DOE/EA-1779

Finding of No Significant Impact
and
Environmental Assessment
Proposed Changes to the
Sanitary Biosolids Land Application Program
on the Oak Ridge Reservation,
Oak Ridge, Tennessee

January 2012

U.S. Department of Energy
Oak Ridge Office
P.O. Box 2001
Oak Ridge, TN 37830

FINDING OF NO SIGNIFICANT IMPACT

PROPOSED CHANGES TO THE SANITARY BIOSOLIDS LAND APPLICATION PROGRAM ON THE OAK RIDGE RESERVATION, OAK RIDGE, TENNESSEE

AGENCY: U.S. DEPARTMENT OF ENERGY

ACTION: FINDING OF NO SIGNIFICANT IMPACT

SUMMARY: The U.S. Department of Energy (DOE) has completed an environmental assessment (DOE/EA-1779) that evaluates impacts of proposed changes in the sanitary biosolids land application program on the DOE Oak Ridge Reservation (ORR), Oak Ridge, Tennessee. Changes to the application setbacks and to the biosolids radiological guidelines, as well as elimination of the lifetime loading limit in tons/acre are proposed. Application setbacks would be amended to conform to the Environmental Protection Agency (EPA) biosolids regulations (40 *CFR* Part 503), the Tennessee Department of Environment and Conservation (TDEC) guidance for land application of biosolids, and best management practices derived from formal site investigations. Application would be conducted without an arbitrary lifetime loading limit, but according to the agronomic loading rates calculated for each application site as required in the EPA biosolids regulations. Radiological loading on the sites would be controlled using biosolids guidelines calculated based on site usage of 50 years. Based on the results of the analysis reported in the EA, DOE has determined that the proposed action is not a major federal action that would significantly affect the quality of the human environment within the context of the National Environmental Policy Act of 1969 (NEPA). Therefore, preparation of an environmental impact statement (EIS) is not required, and DOE is issuing this Finding of No Significant Impact (FONSI).

PUBLIC AVAILABILITY OF EA AND FONSI: The EA and FONSI may be reviewed and copies obtained by visiting:

U.S. Department of Energy
DOE Information Center
475 Oak Ridge Turnpike
Oak Ridge, Tennessee 37830
Phone: (865) 241-4780

FURTHER INFORMATION ON THE NEPA PROCESS: Further information on the NEPA process and DOE NEPA regulations may be obtained from

Mr. Gary Hartman
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P.O. Box 2001
Oak Ridge, Tennessee 37831
Phone: (865) 576-0273

BACKGROUND: Land application is included in the EPA policy on municipal treated sludge, biosolids, which was formally articulated in June 1984 (EPA 1984, 49 *Federal Register* [*FR*] 24358), as an example of beneficial use. This beneficial use, or recycling, of biosolids to the land is in keeping with the objectives of Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (EO 2007), for acquisition of green products and services, and for cost effective waste prevention and recycling programs. Further, it provides an example of the goal of Executive Order 13352, *Facilitation of Cooperative Conservation* (EO 2004), for protection of the environment through collaboration between federal, state, and local government. Treated municipal sludge that meets the requirements for land application is treated to a higher quality than sludge disposed to a landfill.

Since 1983, with the approval of EPA, TDEC, and the DOE, biosolids from the City of Oak Ridge (COR) Publicly Owned Treatment Works (POTW) have been applied as a beneficial soil amendment to sites on the Oak Ridge Reservation (ORR). Two environmental assessments were completed on this program, one in 1996 (DOE/EA-1042) and one in 2003 (DOE/EA-1356), that recommended the use of the existing application sites.

Biosolids, when land applied, are exempted from the definition of solid waste according to Title 40 *Code of Federal Regulations (CFR)*, Part 261.4 and are not regulated as a Resource Conservation Recovery Act (RCRA) hazardous waste or a radiological waste. Biosolids are regulated by the EPA under *Standards for the Use or Disposal of Sewage Sludge*, Title 40 *CFR* Part 503, promulgated under section 405(d) and (e) of the Clean Water Act (CWA), 33 United States Code (U.S.C.) 1345(d), (e), as amended by the Water Quality Act of 1987. Section 405(d) of the CWA requires the EPA to identify and regulate toxic pollutants that may be present in biosolids at levels of concern for public health and the environment. Currently, the toxic pollutants regulated under EPA 40 *CFR* Part 503 are metals and pathogens. Analysis results for biosolids and application site soils indicate that concentrations of heavy metals and pathogens are below regulatory limits for concentration and cumulative site loading.

The proposed action consists of three changes to the current biosolids land application program: (1) Elimination of the lifetime loading limit of 50 tons/acre for each site, (2) Revision to the radionuclide guideline levels for biosolids to reflect a 50 year usage period, and (3) Reduction of the protective boundaries associated with sensitive areas on the sites from 500 ft for surface water and 50 ft for potential channels to groundwater to boundaries that conform to EPA regulations, TDEC guidelines, and best management practices derived from site surveys.

ALTERNATIVES: The no-action alternative was considered in accordance with DOE NEPA regulations (10 *CFR* 1021) to provide a baseline for comparison with the proposed action and alternatives. If no action is taken, the city of Oak Ridge could utilize the following options: (1) continue to observe the current setbacks and program lifetime with a significant loss of acreage available to the program, 65% on the Scarboro site alone, and program cessation within five to

seven years, (2) the city could leave the ORR and freely distribute or sell biosolids to members of the public as long as EPA 40 *CFR* Part 503 Class A biosolids regulations are met, and (3) the city could leave the ORR and disposition the biosolids at a suitable landfill with subsequent loss of opportunity for beneficial reuse. As a consequence, future opportunities for DOE to encourage and further recycling and beneficial reuse of biosolids will be curtailed.

ENVIRONMENTAL IMPACTS:

Socioeconomics

Changes in personnel and infrastructure for the city and the program would not be required to implement the proposed changes.

Environmental Justice

Potential impacts from the proposed action would be minor and would be restricted to the ORR. All of the biosolids application sites are located on the ORR, with no site situated directly adjacent to any minority community. Application setbacks and no mow zones help ensure that migration of contaminants offsite through groundwater does not occur. Thus, minority or low-income populations in the Oak Ridge area would not be disproportionately affected.

Land Use

Impacts to the ORR land use would be positive, as the available sites could be more efficiently utilized for a longer time frame. The remaining years of useage for the sites would increase from five to seven years to approximately thirty years.

Cultural Resources

In compliance with Section 106 of the National Historic Preservation Act, the DOE consulted with the Tennessee State Historic Preservation Officer (SHPO) during the public review phase for DOE/EA-1779 regarding potential impacts to archaeological, historic, and cultural resources on the ORR as a result of the proposed actions. The SHPO determined that there are no national register or historic places listed or eligible properties that would be affected by the proposed action.

Geology and Soils

Land application of biosolids is prohibited near sensitive geological areas such as rock outcrops and sinkholes. Both positive and potentially negative impacts to soils result from the biosolids land application program. In addition to the nutrients derived from the biosolids, soils receive heavy metals and radionuclides in trace quantities. Monitoring of specific soil constituents is performed regularly as prescribed by EPA and TDEC to protect human health and the environment. Future additional monitoring will include quarterly analysis for radionuclides in the biosolids and site soil sampling for constituents that will include organics. Therefore, significant adverse affects would not be expected.

Water Resources

Without the implementation of the stringent land management practices specified by EPA, TDEC, DOE, and the COR, pathogenic, chemical, and radiological contaminants in biosolids

could be transported to streams, ponds, and wetlands on the ORR. These contaminants could adversely affect aquatic organisms and ultimately man through bioaccumulation in the food chain and contamination of the water sources used to obtain drinking water. Management practices used to minimize the potential for significant impacts include eliminating application during high wind, precipitation, or extreme cold events; establishment of minimum setbacks from federal and state waterways; prohibition against application in wetlands and floodplain areas; prohibition against application at a rate exceeding the nitrogen requirements of the site vegetation; prohibition against storage of biosolids on the sites between applications; and maintenance of a 33 foot no mow zone surrounding all surface water and areas with potential channels to groundwater. Further, studies conducted by the EPA established that metals applied to the surface within the prescribed regulatory limits result in minimal impact to groundwater due to the strong tendency of the metals to bind with the upper few centimeters of a clay column. Continuation of the program under the proposed action would not be expected to adversely impact ORR or offsite water resources.

Air Quality

Air dispersion modeling was performed during the 2003 EA (DOE/EA-1356) which simulated the on-site exposure of an individual present on an application site downwind during application. The maximum exposure of this individual breathing the biosolids as they are applied for 260 operational days per year, 8 hours each day, is 0.00008 mrem/yr. This figure was considered negligible with little potential for adverse affects. As the operational parameters used in the 2003 modeling remain the same for the current application program, no significant adverse impacts to air quality are expected from the proposed action.

Ecological Resources

The ORR consists of predominantly forest habitat with some sparse urban and agricultural land. Since 1983, the biosolids application sites have been maintained as field habitats that mimic, in many ways, agricultural fields. The sites are dominated by grassy plant species such as fescue and orchard grass. With continuing maintenance through bi-annual mowing, habitats and plants will change very little over the life of the biosolids program. The mowing and the vehicular traffic required to spread biosolids could potentially impact vertebrate habitats through disruption to field nests. Maintenance of a 33 foot no mow zone, around all surface water and potential channels to groundwater, and attempting to avoid most of the breeding season (May to August) for the biannual mowing, act to minimize the impact on wildlife. According to the surveys conducted under the proposed action, the application sites do not provide potential habitat for listed plant species. The plant survey completed during the 2003 EA (DOE/EA-1356) did not identify any listed plant species. Habitats in adjacent areas, such as forests and ridges, may provide potential habitat. These adjacent areas would have only minimal impacts from the biosolids program at the forest or ridge boundary, as no direct application to these areas will be conducted. DOE routinely and frequently consults with TDEC and the Tennessee Wildlife Resources Agency (TWRA) to ensure that protected species and habitat are not adversely impacted by the biosolids program and other DOE actions on the ORR. Therefore, no significant impacts to ecological resources are expected from the proposed action.

Occupational and Public Health and Safety

Radiological: Workers, transients, and potential future onsite farmers may be exposed to radionuclides in biosolids through inhalation and ingestion. During the 2003 EA (DOE/EA-1356), the radionuclide monitoring guidelines for soil and sludge were developed at a maximum

onsite resident/farmer exposure level of 10 mrem/yr. This modeling level was considered conservative when compared to the Nuclear Regulatory Commission radionuclide clean-up criteria of 25 mrem/yr. The health risk analysis conducted during the 2003 EA (DOE/EA-1356) concluded that the combined chemical and radiological risks to workers would be minimal and within the EPA value for excess lifetime cancer risk (10-4). Offsite, the public exposure to radionuclides in the biosolids applied on the ORR would continue to be extremely low as shown by the air dispersion modeling conducted for an onsite worker (0.00008 mrem/yr). As the proposed action does not change the dose modeling level, no additional risk of adverse affects to biosolids workers and the public should be incurred.

Nonradiological: With improper management, worker and public health could be adversely affected by accumulation of heavy metals and pathogens in the soil, which in turn are accumulated in food and water. Because the historically conservative metal loading levels of the program and the pathogen concentration levels have been less than EPA and TDEC limits established to protect human health, chemical contaminants in receiving soils have remained below acceptable levels. Levels of organics detected in the biosolids and site soils to date do not indicate adverse exposure potential. No adverse impact to workers or the public from exposure to nonradiological constituents should be expected.

DETERMINATION: Based on the findings of DOE/EA-1779, DOE has determined that the proposed changes to the sanitary biosolids land application program on the Oak Ridge Reservation, Oak Ridge, Tennessee, do not constitute a major federal action that would significantly affect the quality of the human environment within the context of the National Environmental Policy Act. Therefore, preparation of an environmental impact statement is not required.

Issued at Oak Ridge, Tennessee, this 13 day of FEB 2012.

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Oak Ridge Office
Oak Ridge, Tennessee

DOE/EA-1779

Environmental Assessment
Proposed Changes to the
Sanitary Biosolids Land Application Program
on the Oak Ridge Reservation,
Oak Ridge, Tennessee

January 2012

U.S. Department of Energy
Oak Ridge Office
Oak Ridge, Tennessee

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CONTENTS

FIGURES

TABLES

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ACRONYMS

ANA	Aquatic Natural Area
BA	biological assessment
BEA	U.S. Bureau of Economic Analysis
BJC	Bechtel Jacobs Company LLC
CDM	CDM Federal Services Incorporated
CFR	*Code of Federal Regulations*
the City	City of Oak Ridge
CWA	Clean Water Act
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EA	environmental assessment
EAD	environmental assessment determination
EFPC	East Fork Poplar Creek
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERB	emergency response boundary
ETTP	East Tennessee Technology Park
FBI	Federal Bureau of Investigation
FONSI	Finding of No Significant Impact
IES	Institute of Education Services
ISCORS	Interagency Steering Committee on Radiation Standards
LAA	land application approval
MSL	mean sea level
NEPA	National Environmental Policy Act of 1969
NORM	naturally occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	National Resources Conservation Service
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORNERP	Oak Ridge National Environmental Research Park
POTW	publicly-owned treatment work
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity (computer code)
ROI	region of influence
SAIC	Science Application International Corporation
SAMAB	Southern Appalachian Man and the Biosphere
SHPO	State Historic Preservation Officer
TDEC	Tennessee Department of Environment and Conservation
TENORM	technologically enhanced naturally occurring radioactive materials
TWRA	Tennessee Wildlife Resources Agency
TWRC	Tennessee Wildlife Resources Commission
UCL95	95% upper confidence limit
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USC	United States Code
USCB	United States Census Bureau
USFA	United States Fire Administration
Y-12	Y-12 National Security Complex

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EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) proposes to amend the protective boundaries, setbacks for surface water features, and areas with potential channels to groundwater from the self-imposed 500-ft and 50-ft requirements to new ones, which have been assigned to each protected area based upon U.S. Environmental Protection Agency (EPA) regulations, Tennessee Department of Environment and Conservation (TDEC) guidance, and best management practices derived from formal site investigations. This change shall bring the Sanitary Biosolids Land Application Program into conformity with the requirements set forth by the EPA under provisions of the Clean Water Act (CWA): Title 40, *Code of Federal Regulations (CFR)*, Part 503, *Standards for the Use or Disposal of Sewage Sludge*; and by the TDEC Division of Water Pollution Control, *Guidelines for the Land Application and Surface Disposal of Biosolids*. (TDEC 2011)

The DOE proposes to eliminate the current lifetime loading limit of 50 tons/acre, while continuing to comply with the agronomic rate for each application site and the pollutant concentration values specified in Tables 1, 2, and 3 of 40 *CFR* Part 503.13. These tables present, respectively, the maximum allowable pollutant concentrations, cumulative pollutant loading rates, and monthly average pollutant concentrations. They are restated in the City of Oak Ridge (the City) publicly-owned treatment works (POTW) National Pollutant Discharge Elimination System (NPDES) permits, numbers TN0024155 and TN0078051. These changes are necessary to maximize usage of the available land.

The DOE proposes to revise the guidance levels for radionuclide concentrations in the City municipal sludge/biosolids, in order to ensure that the potential radionuclide deposition on the land application sites is rigorously monitored.

The Sanitary Biosolids Land Application Program on the Oak Ridge Reservation (ORR) was established in 1983 as a joint venture between the City and the DOE to promote beneficial reuse of biosolids from the City on open hayfields and reforestation plots on the ORR. Currently, six (6) of the original sites are actively used in the program. Biosolids application activities were suspended in 2006, when the City POTW initiated changes to the solids management process. While the changes, currently ongoing, will allow the City POTW to produce Class B sludge with 20% to 25% solids, the proposed actions for this environmental assessment (EA) are intended to address application of Class A (essentially free of pathogens) or Class B (contains detectable levels of pathogens) sludge of varying percent solids content.

Formal wetlands and listed species investigations were conducted in support of the proposed actions. The proposed protective boundaries were based on the recommendations from the investigations, the regulations from 40 *CFR* Part 503, and the TDEC 2011 guidelines. The proposed setbacks range from a minimum of 10 m (33 ft), as required in 40 *CFR* Part 503, to a maximum of 30.5 m (100 ft), as recommended by TDEC, depending upon the nature of the sensitive area and the slope of the terrain.

The proposed action provides additional acreage for land application and extends the lifetime of the program. Rigorous monitoring and control of the application process will be unchanged with adherence to the agronomic loading limits and the cumulative pollutant loading limits mandated in the EPA 40 *CFR* Part 503 regulations, under which the City is self-implementing. The lifetime loading limit, derived from the 1983 (Burris, 1983) and 1989 (Harris, 1989) TDEC land application approval (LAA) letters, was specified in the previous EA, DOE/EA-1042, *Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation*, completed for this program. As the EPA 40 *CFR* Part 503 regulations do not specify a total tonnage limit, the lifetime loading limit has been eliminated. Continued oversight will be provided by the designated DOE contractor and through current and updated LAAs granted by the TDEC Division of Water Pollution Control.

The “no action” alternative would arbitrarily limit the lifetime of the Biosolids Program and result in insufficient application capacity.

The proposed action should not result in any increased risk due to metals, radionuclides, or organics loading in the soils at the application sites. Reducing the existing buffer zones to 10 m (33 ft) and 30.5 m (100 ft) and eliminating the lifetime loading limit should not adversely affect the soils, given the stringent biosolids monitoring required by EPA 40 *CFR* Part 503 and the maintenance of vegetative, no-mow, buffers around each sensitive area. Nitrogen loading to the soils will also remain unaffected by the changes in the proposed action, as it will continue to be limited by the agronomic application rate, updated with each biosolids sampling event, which accounts for the nitrogen from past applications, available nitrogen in the biosolids, and the plant requirements of the individual sites. Amending existing setbacks would not affect jobs, income or infrastructure, and thus transportation would not be impacted. The estimated twice-daily trips to the field on application days would have a negligible effect on local traffic. Land use will not be affected since the proposed action will continue use of ORR lands already in use since 1983 for biosolids application. Finally, only a small risk of human health and safety impact may be incurred as a result of biosolids transportation, but any spills can be easily remediated with negligible risk to workers or the public.

1. INTRODUCTION

The U.S. Department of Energy (DOE) proposes to modify the current land application boundaries, setbacks, and to eliminate the 50 ton/acre lifetime loading limit. The current setbacks for ponds and potential channels to groundwater are 500 ft and 50 ft, respectively. The proposed modification will amend setbacks so as to conform to the regulatory requirements set forth by the U.S. Environmental Protection Agency (EPA) in Title 40 Part 503 of the *Code of Federal Regulations* (*CFR*), *Standards for the Use or Disposal of Sewage Sludge*; the Tennessee Department of Environment and Conservation's (TDEC) guidelines for the land application of biosolids (*Guidelines for the Land Application and Surface Disposal of Biosolids*, TDEC 2011); and the recommendations from the site investigations. If, as a result of this environmental assessment (EA), potentially significant impacts are found to result from the change in setbacks and elimination of the physical loading limit, then an environmental impact statement will be prepared, which will detail the impacts from such actions. If not, the DOE will issue a Finding of No Significant Impact (FONSI) and implement the proposed action.

1.1 PURPOSE AND NEED FOR AGENCY ACTION

The DOE and the City of Oak Ridge (the City) participate jointly in the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation (ORR). The program allows for the beneficial reuse of sanitary sewage sludge from the City on open hayfields and reforestation plots on the ORR.

On February 10, 2010, the DOE issued an environmental assessment determination (EAD) for proposed changes to the Biosolids Program at the ORR. The EAD proposes: (1) modifications to the application setbacks and radiological monitoring program, (2) recognition of the City as self-implementing under 40 *CFR* Part 503, and (3) re-evaluation of the wetland and endangered species status. The EAD cites informal survey information gathered as the basis for new formal surveys. The previous wetlands and endangered species surveys were conducted in 1996 and 1997, respectively. In May 2010, a wetlands survey and a listed species survey were performed and used for evaluation in this EA. This EA evaluates environmental impacts of biosolids application to the six (6) active sites: Scarboro, Upper Hayfield #1, Upper Hayfield #2, High Pasture, Rogers, and Watson Road. Figure 1 depicts the biosolids application sites and the location of the East Tennessee Technology Park (ETTP), Y-12 National Security Complex (Y-12), and the Oak Ridge National Laboratory (ORNL), with respect to Bear Creek Road, Bethel Valley Road, and the Oak Ridge Turnpike.

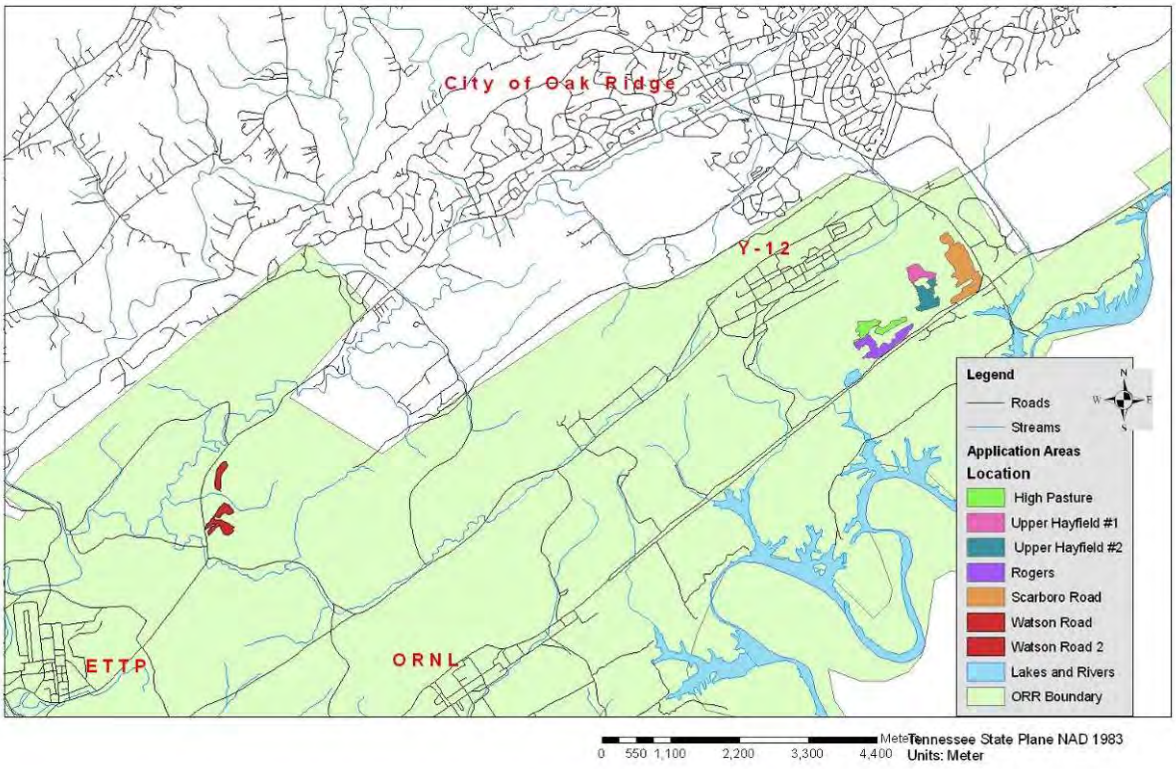


Fig.1. Location of the biosolids application sites with respect to the ETTP, Y-12, and ORNL Facilities within the region.

1.2 BACKGROUND

The City owns and operates a publicly-owned treatment works (POTW), which accepts waste from industrial, residential, and commercial sources. Under a land-license agreement with DOE, the City has been applying municipal biosolids as a beneficial soil amendment on the ORR since 1983. The DOE contributes approximately 20% of the influent to the POTW directly from the Y-12 Site, with lesser amounts from the ETTP through the Rarity Ridge treatment plant, and from the ORNL through tanker delivery of sludge. All significant industrial generators are required by Oak Ridge City Ordinance Number 5-09 (City Code) to obtain an industrial discharge permit (IDP) from the City, which prescribes discharge limits and monitoring/reporting requirements. Land application of biosolids was suspended in 2006 when the POTW was no longer able to produce either a Class A or Class B product suitable for application due to a process change implemented at the facility. The City expects to produce a Class B solids product in the near future (Sect. 1.3).

The Biosolids Land Application Program will also retain the ability to land apply liquid amendments should the need arise, which will utilize a truck-mounted water cannon (sprayer) for application.

The EPA 40 *CFR* Part 503 regulations recognize the following categories of municipal biosolids that may be land-applied. These categories are based largely upon the level of pathogens present in the biosolids:

- Class A biosolids, which are essentially free of pathogens prior to land application; referred to as Exceptional Quality biosolids in the TDEC 2011 guidelines.
- Class B biosolids that may have low levels of pathogens, which rapidly die off when applied to soils.

Both Class A and Class B biosolids must not exceed the concentrations specified in Tables 1 and 3 of 40 *CFR* Part 503. The ORR Biosolids Application Program may apply either class of biosolids at each of the six application sites.

Table 1 summarizes the National Environmental Policy Act of 1969 (NEPA) actions associated with the Biosolids Program.

Table 1. Summary of previous NEPA actions relevant to the ORR Biosolids Land Application Program

NEPA action	Date	Description
DOE/EA-1042	1996	Evaluated the effects of raising the lifetime sludge application from 22 tons/acre to 50 tons/acre and changing the limit for radiological concentrations from 2 times background to a risk-based dose limit of 4 mrem/yr.
DOE/EA-1356	2003	Evaluated increasing the permissible radiological dose from 4 mrem/yr to 10 mrem/yr.

1.3 SOLIDS HANDLING

The City owns and operates a wastewater treatment plant that processes 30 million gal a day near Turtle Park, alongside East Fork Poplar Creek in Oak Ridge, Tennessee. This plant receives wastewater directly from the City and Y-12. A second wastewater treatment facility owned and operated by the City is the Rarity Ridge Plant. It receives wastewater directly from the ETTP, formerly known as K-25, as well as the Rarity Ridge residential development. Sludge is then hauled from the Rarity Ridge plant, and from the ORNL, to the Turtle Park Plant. The sludge from both City POTWs and the ORNL are processed and disposed via the Turtle Park Plant.

Prior to 2001, the City used an anaerobic sludge treatment process resulting in a liquid product, which was land-applied via a truck-mounted sprayer. During the summer of 2001, the City sought unsuccessfully to convert their process to one that would produce Class A sludge with 50% to 60% solids content. The conversion of the anaerobic digesters into aerobic holding tanks began at this time. The POTW is currently developing a standard-activated sludge process, in which biosolids from both the primary and secondary sedimentation basins are fed into aerobic holding tanks, and then pumped into a belt press system. The goal is to produce Class B biosolids with 20% to 25% solids content, which will then be transported to one of the six active application sites (Table 2), and applied as a soil conditioner using a standard-size discharge manure spreader.

All of the tanks formerly used for anaerobic treatment have now been converted to aerobic digesters. A drum thickener has been installed to dewater the digested sludge. Currently, the City handles approximately 27,000 gal per day (gpd) of waste-activated sludge, at a concentration of approximately 1% solids. Another 10,000 gpd of primary sludge is pumped to the sludge handling facility. The primary sludge is approximately 2.5% solids.

Each of the four (4) aerobic digesters has a capacity of approximately 400,000 gal. The hydraulic residence time in the primary digester is slightly more than eleven (11) days. The primary digester has decanting capabilities. The sludge being transferred passes through a rotating drum thickener. This drum

thickener has the capability of thickening the sludge to a higher solids content that can be easily aerated in the later units. Therefore, it will be operated with a solids concentration of 3% to 5%. If the thickener is operated at only 3%, the solids residence time in the next digester unit would be more than 23 days, discounting volatile matter destruction. With volatile solids reduction occurring in the process, the total solids residence time in digestion is more than 250 days, assuming the digesters are operated at 100% capacity.

The digested solids are dewatered by means of a belt press. The solids concentration exiting the press should be in the range of 20%–25% solids. It is anticipated that the volatile matter destruction of the digestion process will be on the order of 40%. It is anticipated that the resulting Class B solids will be land-applied by a farm manure spreader pulled by a tractor. Considering the capacity of the digestion tanks, adequate storage is available for inclement weather conditions during which land application is on hold. It is estimated that up to 2600 lb of dry solids could be land-applied on an average day. Again, the Biosolids Program will retain the flexibility to land apply liquid product should the need arise.

1.4 OAK RIDGE RESERVATION BIOSOLIDS LAND APPLICATION SITES

The biosolids land application sites are located on the ORR in Oak Ridge, Tennessee. Five of the active sites are in the vicinity of Bethel Valley Road, while the remaining active site, Watson Road, is located on Highway 95, near the Horizon Center. Figures 2 through 5 depict the location of each active application site. The gross acreage for each site ranges from 27 acres (10.93 ha) to 117 acres (47.37 ha), with a total of 329 acres (133 ha). Table 2 presents the six application sites and their gross acreage values.

Table 2. ORR biosolids active land application sites gross acreage

Site	Acres (Ac)	Hectares (ha)
Upper Hayfield #1	30	12.15
Upper Hayfield #2	27	10.93
High Pasture	46	18.62
Watson Road	117	47.37
Scarboro	77	31.17
Rogers	32	12.96

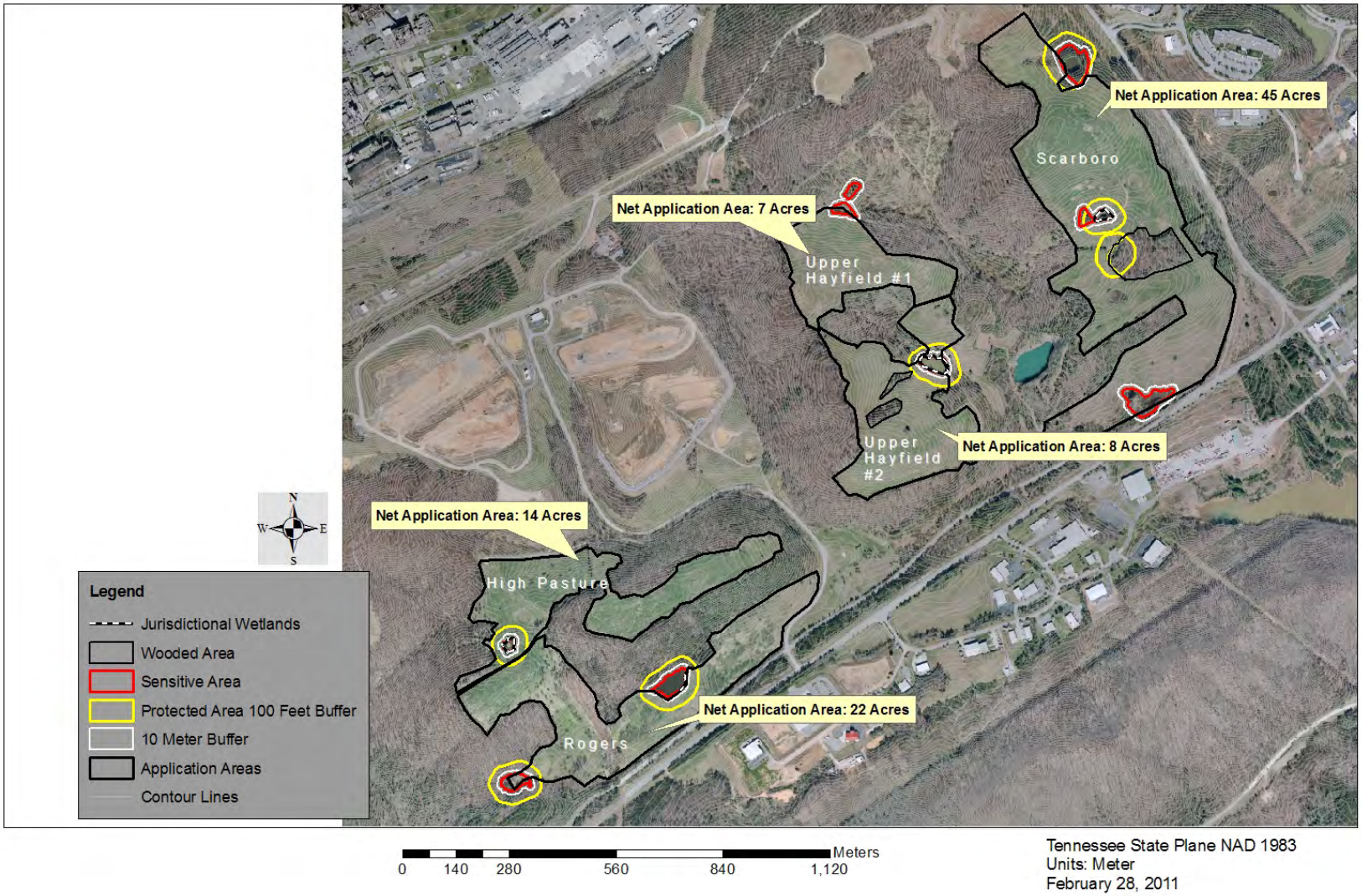
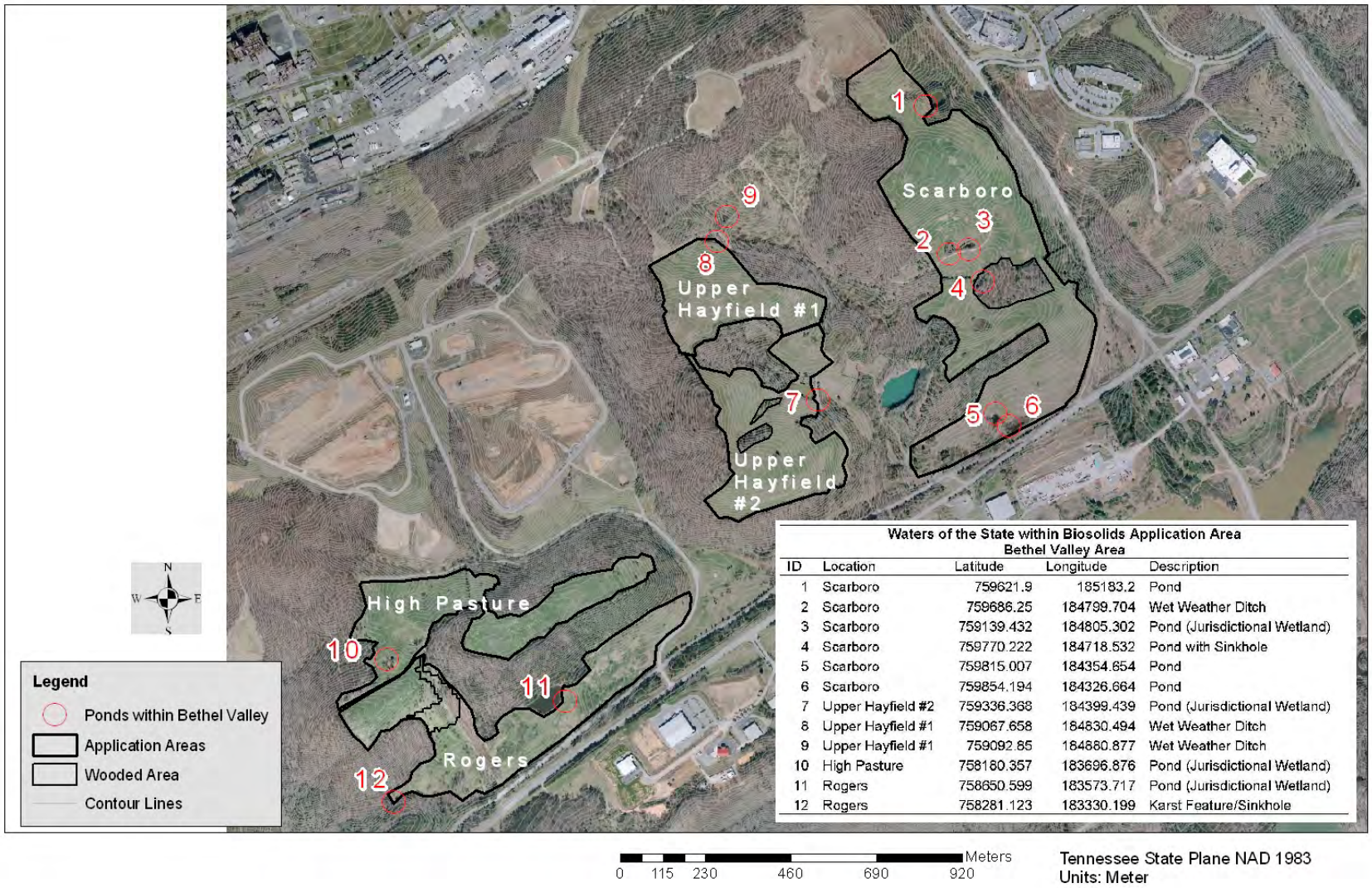


Fig. 2. Bethel Valley biosolids applications sites with proposed setbacks.



Waters of the State within Biosolids Application Area
Bethel Valley Area

ID	Location	Latitude	Longitude	Description
1	Scarboro	759621.9	185183.2	Pond
2	Scarboro	759686.25	184799.704	Wet Weather Ditch
3	Scarboro	759139.432	184805.302	Pond (Jurisdictional Wetland)
4	Scarboro	759770.222	184718.532	Pond with Sinkhole
5	Scarboro	759815.007	184354.654	Pond
6	Scarboro	759854.194	184326.664	Pond
7	Upper Hayfield #2	759336.368	184399.439	Pond (Jurisdictional Wetland)
8	Upper Hayfield #1	759067.658	184830.494	Wet Weather Ditch
9	Upper Hayfield #1	759092.85	184680.877	Wet Weather Ditch
10	High Pasture	758180.357	183696.876	Pond (Jurisdictional Wetland)
11	Rogers	758650.599	183573.717	Pond (Jurisdictional Wetland)
12	Rogers	758281.123	183330.199	Karst Feature/Sinkhole

Fig. 3. Bethel Valley Area application sites waters of the state.

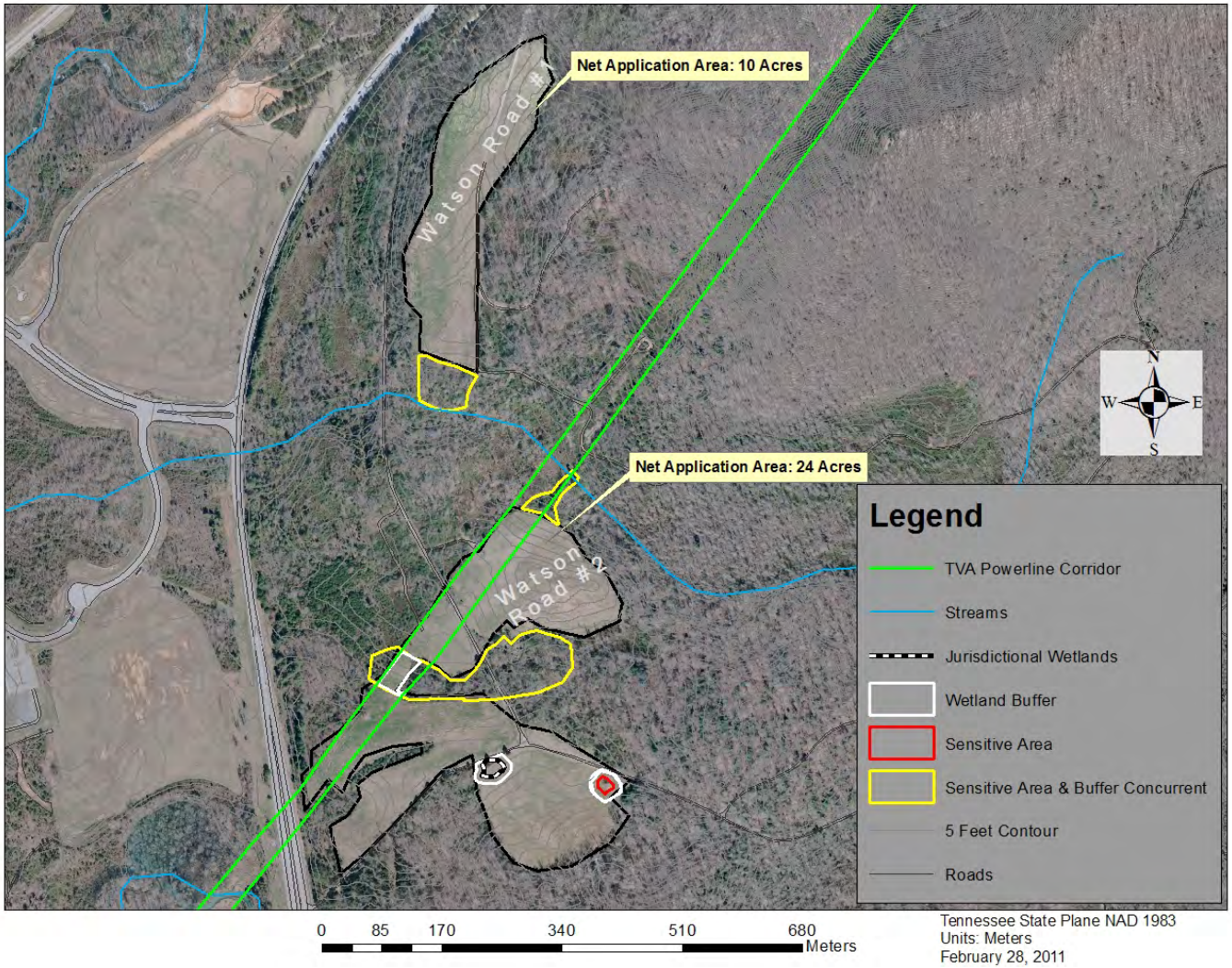


Fig. 4. Watson Road biosolids application site with proposed setbacks.

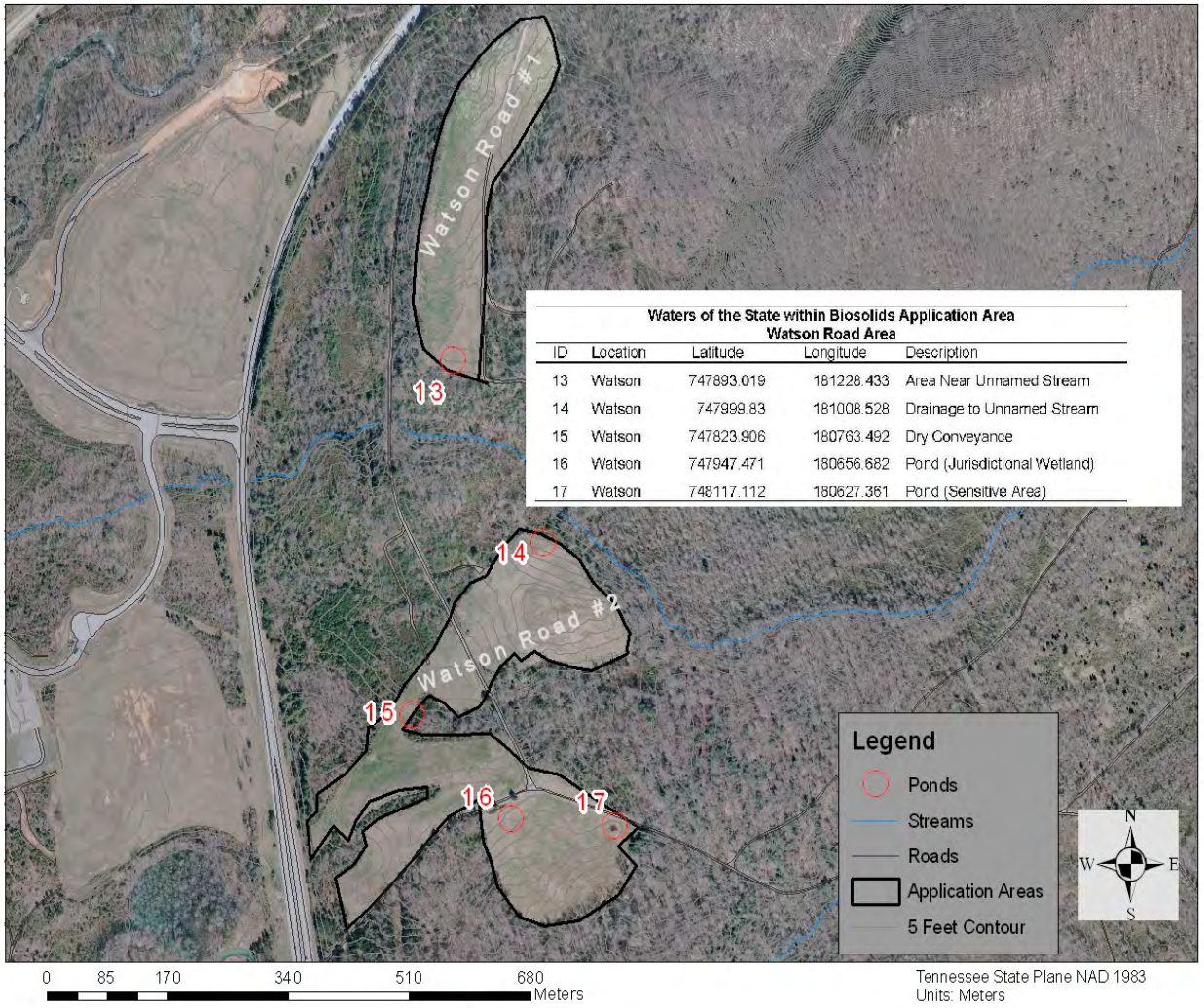


Fig. 5. Watson Road application site waters of the state.

The net acreage values provided in Figs. 2 and 4, and the maps in Appendix C, were calculated after excluding the sensitive areas and sloped areas greater than 8%. These values may change with regard to slope at the discretion of TDEC.

Each of the six active sites received some biosolids application prior to 2006. The amount applied was previously limited by a physical lifetime loading limit derived from the 1983 (Burris, 1983) and 1989 (Harris, 1989) TDEC land application approval (LAA) letters. Under the current program, this lifetime loading limit is not required, but a calculated nitrogen loading limit is used to ensure that excess nitrogen does not accumulate and potentially cause a hazard to the environment. The intent is to provide just enough nitrogen that can be used by the site vegetation, thus preventing nitrogen contamination to surface water or groundwater. This is accomplished by means of calculating the agronomic loading rate, or the amount of biosolids that can be added annually, to maintain a net nitrogen load of zero. Updated with each biosolids analysis, this calculation incorporates the amount of nitrogen in the biosolids produced by the City, the residual nitrogen from previous applications, and the nitrogen requirements of the vegetation. Appendix A, *ORR Biosolids Land Application Program Characterization Data*, presents historical data, site parameters, and the formulas used for agronomic calculations. Additionally, the program will continue to comply with the cumulative pollutant loading rates specified in Table 2 and the maximum concentration values specified in Tables 1 and 3 of 40 *CFR* 503.13. These requirements are also included in the sludge management sections of the City's National Pollutant Discharge Elimination System (NPDES) permits, numbers TN0024155 and TN0078051.

1.5 CONSTITUENTS IN BIOSOLIDS

The characteristics of the biosolids produced by the City are presented in Tables 3 through 7. They tabulate the concentrations of inorganic chemicals, heavy metals, organic chemicals, and radionuclides in the City of Oak Ridge biosolids. Biosolids land application site profiles are provided in Tables 8 through 13 and Tables A.7 through A.12 in Appendix A. Tables 8 through 13, 20 through 25, and A.7 through A.12 present the cumulative loading levels of ten (10) heavy metals for the application sites through 2011, and compares them with the 40 *CFR* Part 503.13(b)(2) cumulative loading limits. The cumulative loading levels are well below the required limits.

The City issues permit limits to industrial users based upon effluent discharge limits to East Fork Poplar Creek (EFPC), the biosolids land application contaminant restrictions listed in existing permits, and agreements with EPA, TDEC, and DOE. Industrial discharge limits are developed using these restrictions, the contaminant removal efficiency of the POTW, and the needs of the industrial user petitioning to discharge to the city sanitary sewer system. At a minimum, the acceptance of contaminants prior to treatment at the POTW must not cause the POTW to exceed contaminant limitations on the effluent discharge to EFPC or on the biosolids land application sites.

No federal standards exist for radioactivity in biosolids. However, prior to 1999, the TDEC, the City, and DOE developed conservative concentration guidelines culminating in the identification of a number of radionuclides and activity levels based upon a 4-mrem/yr dose rate for a person living on-site (DOE/EA-1042, *Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation*). This was still too conservative, and in 1999, the City petitioned TDEC, and was subsequently granted permission, to increase the radionuclide land application loading criterion to 10 mrem/yr. An EA (*Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation*, DOE/EA-1356) was conducted in 2003 to evaluate potential impacts to human health and the environment for the proposed 10-mrem/yr criterion and a FONSI was issued in February 2003. This criterion is consistent with the 10-mrem/yr standard for protection of the public and the environment from airborne radionuclide releases that is recommended in the 1989 EPA regulations, 40 *CFR* Part 61, *National Emission Standards for Hazardous Air Pollutants*.

Table 3. Inorganic parameters and analytical levels in City of Oak Ridge biosolids (1996–2010)

Analyte	Sampling frequency	1996 (mg/kg dry wgt) max	1997 (mg/kg dry wgt) max	1998 (mg/kg dry wgt) max	1999 (mg/kg dry wgt) max	2000 (mg/kg dry wgt) max	2001 (mg/kg dry wgt) max	2002 (mg/kg dry wgt) max	2003 (mg/kg dry wgt) Max	2004 (mg/kg dry wgt) max	2005 (mg/kg dry wgt) max	2006 (mg/kg dry wgt) max	2010 (mg/kg dry wgt) max
Ammonia (as N)	3/year	28,672	43,000	33,000	41,000	33,000	28,000	680	20,000	15,590	13,700	424	27,500
Manganese	3/year	1,345	1,900	1,400	1,100	880	000	1,200	1,665	1,520	1,430	1,690	479*
Nitrate (as N)	3/year	250	220	920	1,000	380	230	6.9	549	920	790	61.3	26,200
Nitrite (as N)	3/year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		1,080
Organic nitrogen	3/year	64,400	86,000	52,000	62,000	92,000	55,000	35,000	85,000	97,410	43,980	16,080	80,200
pH	3/year	8	8	8.4	7.9	7.2	10.2	9.0	7.0	7.3	6.0	6.3	5.7*
Potassium	Daily	5,510	7,100	4,600	6,000	3,500	5,000	1,500	4,261	3,270	2,540	1,590	1,370*
Phosphorus	3/year	31,800	48,000	32,000	47,000	35,000	7,000	37,000	9,600	32,400	23,800	39,600	17,800*
Total Kjedahl Nitrogen	3/year	89,100	120,000	87,000	97,000	93,000	83,000	35,000	99,000	113,000	57,680	16,500	108,000
Total Nitrogen	3/year	89,350	120,140	87,190	98,000	93,300	83,030	35,002	98,178	113,010	57,748.7	16,924	111,000
Total solids %	Daily	3.9%	3.6%	3.2%	3.2%	3.0%	56.7%	66.9%	4.1%	19.5%	3.1%	23.6%	1.65%
Volatile solids (% of TS)	Daily	63%	63%	64%	63%	64%	65%	48%	82%	68%	52%	79%	

Source: City of Oak Ridge
NA = Not Available
TS = total solids
* These results collected in 2009.

Table 4. Concentrations of heavy metal levels in City of Oak Ridge biosolids (1996–2000) versus 40 *CFR* Part 503.13 limits

Heavy metal	40 *CFR* Part 503.13 limits	1996 (mg/kg) mean	1996 (mg/kg) max	1997 (mg/kg) mean	1997 (mg/kg) max	1998 (mg/kg) mean	1998 (mg/kg) max	1999 (mg/kg) mean	1999 (mg/kg) max	2000 (mg/kg) mean	2000 (mg/kg) Max
Arsenic	**75**	6.71	12.80	2.53	7.50	2.4	4.3	2.7	4.7	2.1	3.8
Cadmium	**85**	9.92	19.40	3.60	5.20	3.1	4.8	3.4	3.8	3.1	4.5
Copper	**4,300**	361.70	520.00	430.80	570.00	479.2	700.0	484.4	570.0	510.8	620.0
Lead	**840**	32.52	74.00	38.00	74.60	33.6	63.0	36.6	43.0	36.2	48.0
Mercury	**57**	2.16	8.20	12.00	20.00	11.0	16.0	10.6	19.0	6.0	11.0
Molybdenum	**75**	23.00	54.00	7.00	13.00	10.1	21.0	15.8	21.0	13.9	26.0
Nickel	**420**	26.23	39.70	28.20	42.00	33.5	100.0	25.5	47.0	63.1	100.0
Selenium	**100**	10.29	18.20	1.70	301.00	3.1	7.0	8.6	14.0	8.4	15.0
Zinc	**7,500**	887.00	1,610.00	1,404.00	1,910.00	1,209.0	1,600.0	1,150.0	1,400.0	1,039.0	1,600.0

Source: City of Oak Ridge; all values on dry-weight basis

Table 5. Concentrations of heavy metal levels in City of Oak Ridge biosolids (2001-2009) versus 40 *CFR* Part 503.13 limits

Heavy metal	40 *CFR* Part 503.13 limits	2001 (mg/kg) mean	2001 (mg/kg) max	2002 (mg/kg) mean	2002 (mg/kg) max	2003 (mg/kg) mean	2003 (mg/kg) max	2004 (mg/kg) mean	2004 (mg/kg) max	2005 (mg/kg) mean	2005 (mg/kg) max	2009 (mg/kg)
Arsenic	**75**	2.6	7.7	0.4	0.8	2.8	4.6	6.0	9.5	5.4	7.0	8.08
Cadmium	**85**	3.4	5.2	3.9	9.5	1.4	1.9	1.0	1.3	0.8	1.4	0.729
Copper	**4,300**	584.4	680.0	418.0	610.0	710.4	869.0	725.5	843.0	632.0	768.0	381
Lead	**840**	46.9	63.0	18.2	26.0	40.4	52.2	25.9	34.6	30.1	37.4	15.1
Mercury	**57**	6.2	12.0	1.5	3.3	4.7	6.6	4.4	5.2	5.2	6.1	1.37
Molybdenum	**75**	14.7	20.0	3.5	7.9	9.4	14.2	18.5	29.8	31.1	38.9	9.48
Nickel	**420**	166.7	410.0	66.4	98.0	44.7	88.5	21.1	35.5	22.2	26.8	16.6
Selenium	**100**	7.6	12.0	9.7	18.0	12.4	29.0	9.6	13.2	4.8	5.1	8.54
Zinc	**7,500**	1,116.7	1,500.0	602.0	920.0	940.8	1,062.0	852.3	1,070.0	826.5	1,020.0	743

Source: City of Oak Ridge; all values on dry-weight basis

Table 6. NPDES organic parameters and concentrations of organic constituents in City of Oak Ridge biosolids

Analyte	Sampling frequency	1996 (mg/kg dry wt) max	1997 (mg/kg dry wt) max	1998 (mg/kg dry wt) max	1999 (mg/kg dry wt) max	2000 (mg/kg dry wt) max	2001 (mg/kg dry wt) max	2002 (mg/kg dry wt) max	2003 (mg/kg dry wt) max	2004 (mg/kg dry wt) max	2005 (mg/kg dry wt) max	2006 (mg/kg dry wt) max	2009 (mg/kg dry wt) Max
Aldrin	Annually	0.025	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
Chlordane	Annually	2.7	1.3	0.34	3.80	6.70	0.95	18.00	3.60	2.12	U	U	U
DDD	Annually	U	0.071	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
DDE	Annually	0.01	0.023	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
DDT	Annually	U	0.0071	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
Dieldrin	Annually	0.099	0.061	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
Heptachlor	Annually	U	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
Lindane (gamma-BHC)	Annually	U	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
PCBs	Annually	U	U	U	7.70	NA	19.0	35.00	0.46	1.10	U	U	U
Toxaphene	Annually	U	U	U	7.70	13	19.0	35.00	7.10	4.24	U	U	U
Trichloroethene	Annually	U	U	U	0.038	0.17	0.24	0.44	0.005	0.05	U	U	U
Benzo(a)pyrene	Annually	U	1.0	U	13	11	NA	U	NA	NA	NA	NA	U
Dimethylnitrosamine (n-nitroso-di-methylamine)	Annually	U	U	U	13	11	NA	NA	NA	NA	NA	NA	U
Hexachlorobenzene	Annually	U	U	U	13	11	0.24	0.44	0.005	0.05	U	U	U
Hexachlorobutadiene	Annually	U	U	U	13	11	NA	NA	NA	NA	NA	NA	U

Source: City of Oak Ridge
U = Undetected
NA = Not Available

Table 7. Concentrations of radionuclides in City of Oak Ridge biosolids (1997–2011)

Radionuclide	Planning level[1]	Proposed guideline[2]	1997 (pCi/g) mean	1997 (pCi/g) mean	1998 (pCi/g) mean	1998 (pCi/g) max	1999 (pCi/g) mean	1999 (pCi/g) max	2000 (pCi/g) mean	2000 (pCi/g) max	2001 (pCi/g) mean	2001 (pCi/g) max	2002 (pCi/g) mean	2002 (pCi/g) max	2010 - 2011 (pCi/g)[3] mean	2010 - 2011 (pCi/g)[3] max
^{241}Am		23													0.0508	0.08
^{7}Be	NA		1.70	6.15	1.30	2.69	1.08	1.89	0.72	1.09	0.18	0.55	0.142	0.214	NA	NA
^{134}Cs		110													U	U
^{137}Cs	43.6	25	0.31	0.85	0.36	0.69	2.07	4.17	1.88	3.8	1.47	3.68	0.064	0.143	0.297	1.06
^{60}Co	10.7	25	0.51	8.96	0.52	1.17	0.51	0.80	0.48	0.81	0.57	1.38	0.0868	0.15	U	U
^{152}Eu		24													0.532	1.72
^{154}Eu		18													U	U
^{155}Eu		5,500													0.102	0.48
^{131}I	NA		21.60	86.20	9.46	32.60	8.52	44.80	5.70	40.10	34.58	127.82	6.967	16.029	NA	NA
^{210}Pb		15													0.966	3.263
^{54}Mn		650													U	U
^{237}Np		4.3													0.0258	0.07
^{238}Pu		32													0.01	0.04
$^{239/240}$Pu		24													0.0483	0.11
^{40}K	120.0	16	6.19	8.08	6.04	9.27	5.86	7.24	5.67	10.43	3.68	6.46	0.803	1.211	< Bkg[4]	
^{226}Ra		0.32													< Bkg[4]	
^{228}Ra	20.7	23	1.01	1.42	0.97	1.51	0.84	1.36	0.62	0.99	0.13	0.31	0.156	0.26	< Bkg[4]	
^{90}Sr		16													0.617	1.28
^{99}Tc		102													0.168	0.98
^{228}Th		34													< Bkg[4]	
^{229}Th		4.3													0.0425	0.11
^{230}Th		43													< Bkg[4]	
^{232}Th		4.3													< Bkg[4]	
$^{233/234}$U		280													2.215	3.444
^{235}U	157.0	63	0.35	0.71	0.33	0.83	0.36	0.73	ND	ND	NA	NA	NA	NA	0.26	0.37
^{238}U	459.5	350	8.00	24.20	10.60	21.90	7.62	15.70	2.58	6.20	NA	NA	NA	NA	1.655	3.184

Source: City of Oak Ridge; all values pCi/g on a dry weight basis
U = undetected NA = Not Available

[1]Planning level based on 10-year application at 5 tons/acre/year with dose limit of 4-mrem/year (DOE/EA-1042)
[2]Sludge guidelines from Table B.1.
[3]Values corrected for soil background levels that are provided in DOE/OR/01-2105&D1 *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee,* 2003. Values represent monthly composite samples collected from June 2011 through May 2011.
[4]< Bkg: while detected, the mean for this radionuclide is below the mean of the soil background level

Table 8. Upper Hayfield #1 site profile information

General site information	
Land application site name	Upper Hayfield #1
Gross acres	30
Application area in acres	7
Application area in hectares	2.84
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	None
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre *(Source: Code 590 Nutrient Management, National Resources Conservation Service [NRCS], 2003)*

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.38	41	0.9%
Cadmium	0.61	39	1.6%
Chromium	10.43	-	-
Copper	63.63	1,500	4.2%
Lead	6.9	300	2.3%
Mercury	1.27	17	7.5%
Molybdenum	1.80	-	-
Nickel	6.77	420	1.6%
Selenium	0.84	100	0.8%
Zinc	165.73	2,800	5.9%

Table 9. Upper Hayfield #2 site profile information

General site information	
Land application site name	Upper Hayfield #2
Gross acres	27
Application area in acres	8
Application area in hectares	3.24
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth Requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.37	41	0.9%
Cadmium	0.62	39	1.6%
Chromium	10.09	-	
Copper	54.59	1,500	3.6%
Lead	6.36	300	2.1%
Mercury	1.17	17	6.9%
Molybdenum	1.09	-	
Nickel	5.23	420	1.2%
Selenium	2.21	100	2.2%
Zinc	155.68	2,800	5.6%

Table 10. High Pasture site profile information

General site information	
Land application site name	High Pasture
Gross acres	46
Application area in acres	14
Application area in hectares	5.67
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels			
Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.51	41	1.3%
Cadmium	0.89	39	2.3%
Chromium	12.49	-	-
Copper	83.93	1,500	5.6%
Lead	7.32	300	2.4%
Mercury	1.08	17	6.4%
Molybdenum	1.54	-	-
Nickel	10.86	420	2.6%
Selenium	2.80	100	2.8%
Zinc	187.96	2,800	6.7%

Table 11. Rogers site profile information

General site information	
Land application site name	Rogers
Gross acres	32
Application area in acres	22
Application area in hectares	8.91
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland); Karst feature (functional wetland)
Vegetation	Orchard Grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical loading levels			
Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.41	41	0.7%
Cadmium	0.65	39	1.7%
Chromium	18.81	-	-
Copper	52.77	1,500	3.5%
Lead	10.93	300	3.6%
Mercury	1.20	17	7.1%
Molybdenum	3.31	-	-
Nickel	6.04	420	1.4%
Selenium	0.62	100	0.6%
Zinc	147.17	2,800	5.3%

Table 12. Scarboro site profile information

General site information	
Land application site name	Scarboro
Gross acres	77
Application area in acres	45
Application area in hectares	18.23
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels			
Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.27	41	0.7%
Cadmium	0.47	39	1.2%
Chromium	7.47	-	-
Copper	33.32	1,500	2.2%
Lead	4.24	300	1.4%
Mercury	0.76	17	4.4%
Molybdenum	0.82	-	-
Nickel	3.09	420	0.7%
Selenium	1.83	100	1.8%
Zinc	102.34	2,800	3.7%

Table 13. Watson Road site profile information

General site information	
Land application site name	Watson Road
Gross acres	117
Application area in acres	34
Application area in hectares	13.77
Soil type	Armuchee (silt loam, moderately deep shale) and Colbert (silty clay loam)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.36	41	0.9%
Cadmium	0.57	39	1.4%
Chromium	8.78	-	-
Copper	44.91	1,500	3.0%
Lead	5.5	300	1.8%
Mercury	0.71	17	4.2%
Molybdenum	0.85	-	-
Nickel	4.34	420	1.0%
Selenium	2.20	100	2.2%
Zinc	120.62	2,800	4.3%

Biosolids may contain technologically enhanced naturally occurring radioactive material (TENORM), which is naturally occurring radioactive material (NORM) that has been concentrated and radionuclides formed as a result of cosmic ray interactions, and human-made radionuclides. NORM consists primarily of material with isotopes belonging to the primordial series and ^{40}K. NORM originates in the earth's crust and underlying mantle and enters sanitary sewers primarily from the surrounding soil and water. Sources of man-made contributions to sanitary sewers are from licensed discharge from DOE facilities, discharge from the Nuclear Regulatory Commission (NRC) licensees, and from others such as medical laboratories.

In an early investigation, the EPA determined from surveys that the four radionuclides most frequently found in sewage sludge are ^{131}I, ^{226}Ra, ^{241}Am, and ^{137}Cs (EPA 1986, *Radioactivity of Municipal Sludge*). In the 2003 Interagency Steering Committee on Radiation Standards (ISCORS) survey of 313 POTW distributed around the country that had the greatest potential to receive waste from NRC licensees and in areas of higher levels of NORM, a total of forty-five radionuclides were detected, with eight radionuclides detected in more than 200 samples: ^{7}Be, ^{214}Bi, ^{131}I, ^{40}K, ^{212}Pb, ^{214}Pb, ^{226}Ra, and ^{228}Ra (ISCORS-2003-02; NUREG-1775; EPA 832-R-03-002; DOE/EH-0669, *ISCORS Assessment of Radioactivity in Sewage Sludge: Radiological Survey Results and Analysis*). In the ISCORS survey, half of the samples were analyzed by the Oak Ridge Institute of Science and Education in Oak Ridge, TN under contract to NRC, and the other half were analyzed by the EPA's National Air and Radiation Environmental Laboratory. The survey data revealed that the samples contained primarily TENORM such as radium. As a result of this survey, ISCORS concluded that despite some high activity values, a widespread problem of elevated radionuclide levels in biosolids does not exist and that while estimated doses to potentially exposed individuals generally do not require radiation protection measures, the dose to limited POTW workers and on-site residents above the protective standards could occur. The Association of Metropolitan Sewerage Agencies also conducted a survey of 55 POTWs that produced similar results to those generated by the ISCORS survey (Bastian et al., 2005).

Under the proposed action, DOE further refines the radionuclide concentration guidelines to reflect a 50-year program life cycle (Sect. 2.1). Table B.1 in Appendix B presents the radionuclides that will be monitored under the Biosolids Program, and the concentration guidelines based on a 50-year program life cycle. The guidelines reflect the conceptual, worst-case exposure scenario of a person residing on the actual application site, eating food and drinking water, with exposure to the radionuclides that have been land-applied from the City biosolids. In reality, the active application sites are isolated from members of the public, and access to the Bethel Valley Road site is controlled through ORR security due to proximity to the Y-12 Site.

From June 2010 through May 2011, the City biosolids were monitored monthly for the Table B.1 radionuclides. The resulting data were evaluated against the proposed guidelines using the sum of the fractions approach. The statistical summary is presented in Table A.6 in Appendix A. Monitoring continued on a quarterly basis, with the first quarterly sample collected in November 2011. Refer to Appendix A for a detailed discussion of the statistical evaluation.

The ^{232}Th soil and sludge guidelines have been revised in the proposed action using the modeling approach employed for the other radionuclides. They have been calculated following the methodology outlined in the previous environmental assessment (DOE/EA-1356) for use of RESidual RADioactivity (RESRAD) 6.0 for modeling the soil concentration that provides 10 mrem/yr dose and for calculating the sludge concentration that would meet the soil concentration limit after 50 years of application at a maximum application rate of 7 dry tons per acre per year and mixing into the top 0.15 m of the soil. An affected area of 200,000 m^2 was assumed. The calculated corresponding risk of carcinogenic morbidity was 1.18E-04.

The following radionuclides have not been included in the proposed guidelines in Table B.1 of Appendix B:

- ^{131}I: This radionuclide will be monitored through the daily gamma screening performed by the City.
- ^{214}Bi: This radionuclide indicates the presence of ^{226}Ra, which is included in the proposed guidelines.
- ^{7}Be: This radionuclide has a short half-life (53 days) and is produced continually by cosmic ray interactions with nitrogen and oxygen in the earth's atmosphere.
- ^{231}Pa: This radionuclide cannot be measured with adequate sensitivity by the typical commercial laboratory method. It will be evaluated in terms of the proposed guideline by assuming secular equilibrium with ^{235}U.
- ^{152}Gd: This radionuclide is a low-energy alpha emitter that cannot be measured by the typical commercial laboratory method.

1.6 RELEVANT REGULATORY DRIVERS

Municipal biosolids are not regulated as a Resource Conservation and Recovery Act (RCRA) waste, or as a radiological waste, but are regulated under the provisions of 40 *CFR* Part 503 of the Clean Water Act (CWA). In these regulations, the EPA established standards for biosolids use and disposal, including risk-based, metal-loading criteria for the receiving soil. Until 2001, the City applied biosolids to the ORR, under EPA permit number TNL0024155. In a letter dated July 24, 2001 (Dominy 2001), the EPA Region 4 notified the City that individual sludge-only permits would not be renewed and declared its intent to prepare a general permit. However, the general sludge-only permit was not developed and the EPA Region 4 now considers the City to be self-implementing under 40 *CFR* Part 503. The requirements specified in 40 *CFR* Part 503 are incorporated by reference in the sludge management sections of the City's NPDES permits, numbers TN0024155 and TN0078051, issued by TDEC.

When the City has generated sludge suitable for land application, a formal request to TDEC will be submitted for LAA. This new approval will replace the 1983 (Burris, 1983) and 1989 (Harris, 1989) letter approvals under which the Biosolids Program is currently operating. This new approval will reflect the revised TDEC guidance for biosolids management found in *Guidelines for the Land Application and Surface Disposal of Biosolids* (TDEC 2011). Neither the TDEC approvals nor the guidelines are enforceable; however, as stated in the February 2011 guidelines (page 4): "These guidelines are not to be construed as State Regulations…," and "Tennessee is not a delegated state to administer the Biosolids Program. Therefore, U.S. EPA-Region is the permitting authority and is the legal authority to enforce the provisions of the Part 503 regulation." [Although not included in the original source, it is assumed that U.S. EPA Region 4 is intended.] Although they are unenforceable, the TDEC guidance and LAAs are carefully considered and incorporated into the Biosolids Program. Table 14 presents a summary of the relevant regulatory drivers for the ORR Sanitary Biosolids Land Application Program.

Table 14. Summary of the relevant regulatory drivers affecting the Sanitary Biosolids Land Application Program

Relevant agency/regulatory driver	Implementation	Relevant documents
EPA	• Regulates municipal biosolids disposal under the CWA. • Recognizes the City as a self-implementing entity.	• EPA 40 *CFR* Part 503
DOE	• Issues the land use license for non-federal use of property. • Originally signed 1995, currently set to expire 10/2015.	• U.S. Department of Energy License for Non-Federal Use of Property REORDOER-3-01-0703, Supplemental Agreement No. 3, March 17, 2011
NPDES	• Establishes effluent limits and monitoring requirements for discharging treated municipal wastewater from Outfall 001 to receiving water of EFPC at mile 8.3. • Establishes effluent limits and monitoring requirements for discharging treated municipal wastewater from Outfall 001 to receiving waters of the Clinch River at mile 12.85.	• NPDES Permit No. TN0024155 for the Oak Ridge Sewage Treatment Plant (valid through 08/31/2013) • NPDES Permit number TN0078051 for the Rarity Ridge Waste Water Treatment Plant (valid through 08/31/2013)
TDEC	• Issues guidelines for the land application of biosolids in Tennessee. • Does not regulate Biosolids Program. • Issues approval letter for application on the sites.	• *Guidelines for the Land Application and Surface Disposal of Biosolids*, (TDEC 2011) • Approval letter from TDEC Division of Water Pollution Control (May 8, 1989), for application of biosolids to ORR sites

1.7 SCOPE OF THE ANALYSIS

This EA evaluates the impact of decreasing the setbacks for ponds and potential channels to groundwater from 500 ft for ponds and 50 ft for potential channels to groundwater and eliminating the 50 ton/acre lifetime biosolids loading limit to conform to the EPA 40 *CFR* Part 503 regulations, versus no action.

The process of converting from a liquid to a solid is not addressed in this document because it was previously assessed in an earlier EA (DOE/EA-1042) and found not to have significant impact upon the ORR.

This EA conforms to the requirements of the Council on Environmental Quality regulations (40 *CFR* Parts 1500-1508) implementing the NEPA and DOE NEPA *Implementing Procedures* (10 *CFR* Part 1021).

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to change the setback for ponds and potential channels to groundwater in the Biosolids Land Application Program to conform to the EPA regulations of 40 *CFR* Part 503, as well as those requirements specified in the TDEC guidance for the land application of biosolids (TDEC 2011). The new setbacks are summarized in Table 15 and the action is discussed in detail in Sect. 4.1.

Table 15. Summary of setbacks (buffers) for protected areas on the ORR biosolids land application sites

Map feature number*	Site name	Protected area (type of wetland if applicable)	Latitude	Longitude	Setback
1	Scarboro	Pond (functional)	35º 59′ 5″	-84º 13′ 40″	30.5 m (100 ft) upgradient; 10 m (33 ft) downgradient
2	Scarboro	Wet weather ditch (functional)	35º 58′ 54″	-84º 13′ 37″	10 m (33 ft)
3	Scarboro	Pond (jurisdictional)	35º 59′ 9″	-84º 13′ 42″	30.5 m (100 ft)
4	Scarboro	Pond with sinkhole (functional)	35º 59′ 22″	-84º 13′ 45″	30.5 m (100 ft)
5	Scarboro	Pond	35º 58′ 23″	-84º 13′ 62″	10 m (33 ft)
6	Scarboro	Pond	35º 58′ 58″	-84º 13′ 67″	10 m (33 ft)
7	Upper Hayfield #2	Pond (jurisdictional)	35º 58′ 56″	-84º 14′ 0″	30.5 m (100 ft)
8	Upper Hayfield #1	Wet weather ditch	35º 59′ 23″	-84º 14′ 03″	10 m (33 ft)
9	Upper Hayfield #1	Wet weather ditch	35º 59′ 43″	-84º 14′ 96″	10 m (33 ft)
10	High Pasture	Pond (jurisdictional)	35º 58′ 34″	-84º 14′ 45″	30.5 m (100 ft)
11	Rogers	Pond (jurisdictional)	35º 58′ 45″	-84º 14′ 29″	30.5 m (100 ft)
12	Rogers	Karst feature with sinkhole	35º 58′ 35″	-84º 14′ 75″	30.5 m (100 ft)
13	Watson Road	Area near unnamed stream	35º 57′ 65″	-84º 21′ 80″	30.5 m (100 ft)
14	Watson Road	Drainage to unnamed stream	35º 57′ 27″	-84º 21′ 94″	30.5 m (100 ft)
15	Watson Road	Dry conveyance	35º 57′ 95″	-84º 21′ 61″	30.5 m (100 ft)
16	Watson Road	Pond (jurisdictional)	35º 57′ 1″	-84º 21′ 35″	10 m (33 ft)
17	Watson Road	Pond (functional)	35º 57′ 0″	-84º 21′ 36″	10 m (33 ft)

*Feature numbers refer to Figs. 3 and 5 from Sect. 1.4 and the Appendix C maps.

DOE proposes to eliminate the physical loading limit of 50 tons/acre that was derived from the TDEC 1983 (Burris, 1983) and 1989 (Harris, 1989) LAA letters. Continued adherence to the cumulative pollutant loading limits and maximum ceiling values specified in 40 *CFR* Part 503, Tables 1, 2, and 3, and the agronomic rates calculated for each site will ensure that land application of biosolids on the ORR does not pose a threat to human health or the environment. The cumulative loading levels through 2006

for each site are presented in Tables 20 through 25 in Sect. 4 of this EA. The concentration values observed for constituents in the City biosolids are presented in Appendix A.

DOE proposes to revise the concentration guidance levels for radionuclides in biosolids. (See Table B.1 in Appendix B.) The current guidance levels for site soils and the City biosolids were developed using the RESRAD 6.0 Software Program and a 10^{-4} (1 in 10,000) risk level for excess cancer. These guidance levels were evaluated in the documents DOE-EA/1042 and DOE-EA/1356. The risk level was conservatively adopted from the EPA regulatory limits for carcinogens in land-applied sludge, although radionuclides are not currently addressed in the regulations. The existing sludge concentration guidance levels were calculated assuming a 20-year program lifespan. The DOE proposes to retain the site soil concentration guidance levels and to revise the sludge concentration guidance levels to reflect a 50-year program lifespan. This will ensure that the radionuclide loading levels are monitored as rigorously as the non-radiological constituents without dependence on a physical lifetime loading limit. The limits for the site soils and the biosolids are summarized in Appendix B, Table B.1.

2.2 NO ACTION

The “no action” alternative provides an environmental baseline against which impacts of the proposed action can be compared. Under the “no action” alternative, the currently observed setbacks of 500 ft for ponds and 50 ft for potential channels to groundwater would not be changed. Similarly, the 50 ton/acre biosolids lifetime limit would continue to be in effect. Observing the 500-ft setback will result in the virtual elimination of the Scarboro site and considerably reduce the capacity of the Upper Hayfield #1 and Upper Hayfield #2 sites. The Biosolids Application Program would continue with essentially three fully functional sites and one greatly diminished one. For example, it is estimated that the available acreage on the Scarboro Road site would drop by 65%. Observing the 50 ton/acre lifetime loading limit for each site would result in program cessation within approximately five to seven years, depending on the site.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 LAND USE

The six biosolids application sites under consideration for this EA reside within the ORR. Five of the sites—Scarboro, Upper Hayfield #1, Upper Hayfield #2, High Pasture, and Rogers—are located within the Y-12 emergency response boundary (ERB) near Bethel Valley Road. The sixth site, Watson Road, is located within the ETTP ERB on Highway 95. The Bethel Valley Road sites are located within Anderson County; the Watson Road site within Roane County. Access to these sites is controlled by the respective Plant/Park Shift Superintendant offices for each facility. The sites are accessible to the general public during scheduled Tennessee Wildlife Resources Agency (TWRA) hunting seasons.

3.2 ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL RESOURCES

The DOE *Cultural Resource Management Plan* (DOE/ORO-2085) was developed to identify, assess, and document historic and cultural resources on the ORR. These resources include the New Bethel Baptist Church and Cemetery, George Jones Memorial Baptist Church, Freels Cabin, Bear Creek Road Checking Station, Bethel Valley Road Checking Station, and the Oak Ridge Turnpike Checking Station. Forty-six archaeological sites have been identified on the ORR. Seven DOE-owned structures are listed on the National Register of Historic Places and five of these are on the ORR. Additional potential listings include any buildings or structures directly related to the Manhattan Project (DOE/ORO-2296, *Annual Site Environmental Report 2008*).

3.3 REGIONAL DEMOGRAPHY/SOCIOECONOMICS

In order to provide relevant demographic and socioeconomic information, one must first define the region of influence for the impact analysis for the proposed action. The proposed changes will take place on DOE property located within the ORR. The land application sites are located in both Anderson and Roane counties. Because of the economic and commuter ties of these communities to surrounding areas, Knox County is also included. Thus, Anderson, Roane, and Knox counties define the region of influence for this analysis.

Oak Ridge is located in East Tennessee, approximately 25 miles northwest of Knoxville. Parts of the City lie in both Anderson and Roane counties. The City occupies approximately 85.6 square miles and has approximately 29,330 residents (United States Census Bureau [USCB] 2010). Its largest employment source is federally-funded projects, the City's principle economic activity, and it accounts for one of the biggest employment bases in the Knoxville metropolitan area. The City also has numerous recreational venues and multiple opportunities for outdoor activities.

Environmental justice concerns are addressed in Sects. 3.3.5 and 4.1.2.

3.3.1 Region of Influence

The region of influence (ROI) is defined as the geographic region that is most affected by a proposed action. The ROI for the socioeconomic analysis consists of a three-county area in Tennessee that includes Anderson, Knox, and Roane counties. Approximately 40% of the current ORR workforce resides in Knox County, 29% in Anderson County, 16% in Roane County, and the remaining 15% in other counties outside the ROI.

3.3.2 Demographic and Economic Characteristics

Table 16 summarizes the population data from the 2000 census and the 2010 census for the three counties, and Table 17 summarizes general demographic statistics by age and sex for 2010 (USCB). Population for the ROI has increased 11% over the 10-year period, from 505,272 in 2000 to 561,536 in 2010. Total employment (full-time and part-time) increased by 8%, from 343,970 jobs in 2000 to 371,987 jobs in 2009 (U. S. Bureau of Economic Analysis [BEA], *Economic Statistics*).

The median income in Roane, Anderson, and Knox counties was $39,007, $43,645, and $45,380, respectively, in 2009 (USCB). Per capita personal income in 2009 in the ROI ranged from a low of $30,015 in Roane County to a high of $35,278 in Knox County (BEA).

Unemployment rates for the three counties and the state overall are similar and show a dramatic increase from 2000 to 2011 (Tennessee Department of Labor and Workforce Development).

Table 16. Population and Unemployment Estimates for Knox, Roane, and Anderson counties, TN

Area	2000 Population	2010 Population	2000 Unemployment rate	2011 Unemployment rate
Knox County	382,032	432,226	3.2%	7.7%
Anderson County	71,330	75,129	4.2%	8.8%
Roane County	51,910	54,181	4.4%	8.5%
Total	505,272	561,536		
Tennessee	5,689,283	6,346,105	3.8%	9.8%

Table 17. General demographic characteristics for Roane, Anderson, and Knox counties, Tennessee, 2010 Census

Sex and age	Roane	Anderson	Knox
Male	26,628	35,613	208,785
Female	27,553	38,556	221,234
Under 5 years	2,699	4,423	27,022
5 to 9 years	3,074	4,213	26,253
10 to 14 years	3,447	4,450	26,226
15 to 19 years	3,273	4,687	29,235
20 to 24 years	2,552	3,941	33,632
25 to 34 years	5,261	9,056	56,836
35 to 44 years	6,857	9,736	59,844
45 to 54 years	8,479	11,180	63,800
55 to 59 years	4,330	5,319	28,213
60 to 64 years	4,154	4,640	23,370
65 to 74 years	5,655	6,222	29,443
75 to 84 years	3,219	4,357	18,573
85 years and over	1,181	1,945	7572
Median age (years)	44.9	41.8	37.7
18 years and over	42,896	57,983	334,494
21 years and over	41,153	55,681	314,234
62 years and over	12,550	15,052	67,874
65 years and over	10,055	12,524	55,588
18 years and over			
Male	20,653	27,883	161,616
Female	22,243	30,782	176,120
65 years and over			
Male	4,474	5,554	23,490
Female	5,581	7,510	33,001

*Source: *United States Census Bureau* (USCB)

3.3.3 Population and Housing

Between 2000 and 2010, population growth in the ROI was slightly slower than population growth in the state of Tennessee. The ROI population increased at an average annual rate of 1.1% within this time period, while the state population increased 1.2%, annually. The Anderson County population increased at an average annual rate of only 0.5% within this time frame (USCB).

Knox County is the largest county in the ROI with a population of 432,226 in 2010. Knox County includes the City of Knoxville, the largest city in the ROI. The City of Oak Ridge and the ORR are located in both Roane and Anderson Counties, which had populations of 54,181 and 75,129 in 2010, respectively (USCB).

The 2010 Census documented a total of 255,382 housing units in the ROI. Approximately 9.6% of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Owner-occupied housing units accounted for 61% (USCB). The median values of owner-occupied housing units ranged from $121,600 in Roane County to $155,900 in Knox County and the median contract rent ranged from $578 in Roane County to $695 in Knox County.

According to the 2000 Census, 12.4% of the United States population and 13.5% of the Tennessee population had incomes below the poverty level in year 1999. In this analysis, a low-income population consists of any census tract in which the proportion of individuals below the poverty level exceeds the national average. Within the ROI in 2000, 13.1% of the population in Anderson County had incomes below the poverty level, Knox County had 12.6%, and Roane County had 13.9%. Within the ROI, according to the 2010 Census, 16.5% of the Anderson County, 14.0% of the Knox County, and 12.5% of the Roane County populations had incomes below the poverty level (USCB).

3.3.4 Community Services

Community services in the ROI include public schools, fire response, medical services, and law enforcement. There are six public school districts, with 136 schools that serve the ROI. During the 2009 – 2010 school year, these districts served 76,648 students (Institute of Education Services [IES], *Search for Tennessee Public School districts*). The tri-county ROI includes a total of 81 career and volunteer type fire stations (United States Fire Administration [USFA]), 13 hospitals (USCB) and 14 local law enforcement agencies (USACOPS) employing over 1300 law enforcement officers (police and sheriffs) that serve the regional populations (Federal Bureau of Investigation [FBI], *Police Employee Data*).

3.3.5 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, signed by President Clinton in February 1994, requires each federal agency to formulate a strategy for addressing issues in human health—and the environment—in related programs, policies, planning, and public participation processes, enforcement, and in rulemakings. The White House memorandum accompanying the EO directs federal agencies to "Analyze the environmental effects…of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA" (Clinton, 1994). Pursuant to the EO, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations from the proposed actions included in this EA. Adverse health effects may include bodily impairment, infirmity, illness, or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment. Minorities include individuals classified by the USCB as Black or African American,

American Indian and Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, and Hispanic or Latino, and those classified under two or more races.

For the purposes of this analysis, a minority population consists of any census tract in which minority representation is greater than the national average of 30.7%. The distribution of minority and economically disadvantaged populations changed little between the years 1990 and 2000. See Sect. 4.1.2 for a discussion about a minority population on one of the ORR census tracts.

3.4 GEOLOGY AND SOILS

The ORR lies within the Valley and Ridge Physiographic Province. The Valley and Ridge Province is characterized by steep-sided parallel ridges with broad intervening valleys, generally oriented in a northeast-southwest direction. The ORR lies ~16 km (10 miles) southeast of the Cumberland Mountains and ~113 km (70 miles) northwest of the Blue Ridge Mountains. Elevations on the ORR range from ~230 m (750 ft) above mean sea level (MSL) along the Clinch River to ~385 m (1260 ft) above MSL along the highest ridge tops. The Valley and Ridge Province is part of the southern Appalachian fold and thrust belt. The bedrock stratigraphy of the ORR ranges from Lower Cambrian to Upper Ordovician and consists primarily of rock units of the Rome Formation, the Conasauga Group, the Knox Group, and the Chickamauga Group.

The Upper Hayfield #1, Upper Hayfield #2, High pasture, Rogers, and Scarboro Road application sites have all had thorough hydrogeological evaluations and were found to be suitable for the land application of biosolids by TDEC Division of Solid Waste (Burris, 1983). The Watson Road site underwent a full hydrogeological evaluation and was found to be suitable for the land application of biosolids by TDEC-Division of Wastewater (Harris, 1989). The Upper Hayfield #1, Upper Hayfield #2, High Pasture, Rogers, and Scarboro Road land application sites are located on the southeast side of Chestnut Ridge. The land surface there is hilly with moderate to steep slopes and total relief of up to 200 feet. Chestnut Ridge is strongly dissected with long, deep drain ways, which trend both east-west and north-south.

The direction of surface drainage is quite variable over these sites; however, all the sites drain first into Bethel Valley and subsequently into the Melton Hill Reservoir of the Clinch River, about 1 mile to the southeast. The drainage pattern of the area is generally rectangular. Several sinks or depressions occur on these application sites. The application sites referenced predominantly overlie the Knox with just their southeast portions underlain by Chickamauga.

The Cambrian-Ordovician Knox Group is composed primarily of thick-bedded siliceous or cherty dolomite and interbedded dolomitic limestone. These rocks are generally fine to medium-grained and thinly to massively bedded. Chert occurs in the Knox as irregular beds, lenses, and nodules.

This group generally underlies broad ridges with fairly gentle slopes to the southeast. Thickness of the Knox Group ranges from 900 m (2469 ft) to 1000 m (2743 ft).

Knox dolomite gives rise to dissolution or karst features and sinkholes are common. The Knox Group weathers to form deep residual clay soils, commonly more than 100 feet in thickness. Knox soils resist erosion because of the abundant chert on the surface. The Knox weathers to form generally thick, orange to reddish brown, silty, residual clays with varying amounts of chert fragments and blocks. These soils are mostly Fullerton associations.

The Ordovician Chickamauga Group dominantly comprises limestone sequences with calcareous shales and siltstones. Limestones are generally gray to blue-gray and argillaceous or shaley. Thickness of the Chickamauga can reach 670 m (2208 ft). Some beds of relatively "purse" limestone may occur within the Chickamauga in addition to interbedded calcareous shales of varying thickness. Chert occurs sparsely in the Chickamauga limestone. The surfaces of valleys underlain by this group are irregular, with the more silty and cherty layers underlying low ridges and hills. Sinkholes do occur, but are not as numerous nor as large as those found within the Knox Group. Chickamauga soils are thinner than those derived from the Knox and may be brown to reddish-brown to yellowish in color. The soils may contain limestone "float," particularly in horizons close to the soil-bedrock interface. The Chickamauga soils here are mostly Collegedale and Sequoia associations, but some areas may have Leadvale and Armuchee soil.

Strata in the area generally dip southeastward at about 25°F to 35°F, although dips may vary considerably in some areas due to small local structures, faults, etc. The Copper Creek fault occurs just southeast of the application sites, its trace extending along the upper northwest side of Haw Ridge whereby the Cambrian Rome formation is thrust over the Ordovician Chickamauga limestone. Intense jointing has occurred in the subject area as attested to by the previously mentioned sinkholes and the strongly dissected land surface, the joints probably being related to the Copper Creek fault. No structures are located on these land application sites.

Groundwater moves mainly within a system of solution enlarged joints in the carbonate bedrock. Groundwater movement is probably generally southeastward toward the Clinch River, but locally such flow may be either to the northeast or southwest to the deep drainages which cut through Haw Ridge and Copper Creek fault. Sinks in the area may provide a substantial recharge system for the groundwater reservoir, although some of the sinks appear to be "filling in" with the colluvial sediments wherein percolation would be greatly retarded. One spring occurs just to the northwest of the western most application site, High Pasture; however, this spring is up-gradient from the proposed site and is not affected by land application operations. (Source: *Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation* [DOE/EA-1356], pages 3-4 through 3-6.)

3.5 WATER QUALITY

Surface water is drained from the ORR by a network of small streams that are tributaries of the Clinch River. Generally, the Clinch River tributaries conform to the physiography of the Valley and Ridge Province by paralleling the Clinch for a long distance before crossing a ridge gap to unite with it. The net effect is a trellis pattern that can be seen on a map such as the topographic map of the Oak Ridge area. Each of the three ORR DOE facilities, the ETTP, Y-12, and ORNL, affects a different sub basin of the Clinch River. Drainage from Y-12 enters both Bear Creek and EFPC; ORNL drains into White Oak Creek and several tributaries of the Clinch River; and ETTP drains predominantly into Poplar Creek and Mitchell Branch (DOE/EA-1042). Surface water quality on the ORR is influenced by the geochemistry and soil-water interactions of the sub basins. Water quality is also affected by wastewater discharges, and by groundwater transport of contaminants from land disposal of waste. All effluent discharged from ORR facilities to receiving streams must meet various chemical limits that are specified in the NPDES permits for each site.

The water quality of EFPC is also heavily influenced by activities at Y-12. Discharges from Y-12 at the headwaters and from the Oak Ridge POTW near the middle of the stream's length constitute a large percentage of the stream's mean annual flow. The stream also receives urban and agricultural runoff. Water and sediment in EFPC contain metals, organic chemicals, and radionuclides from past operations at Y-12. These include ammonia, copper, mercury, nitrogen, petroleum-based oils and greases,

perchloroethylene, PCBs, and residual chlorine. Recent actions taken at Y-12 to reduce the input of contaminants to EFPC have shown positive results in water quality improvement. (Source: *Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation* [DOE/EA-1356], pages 3-6.)

3.6 FLOODPLAINS AND WETLANDS

In May 2010, CDM Federal Services Incorporated (CDM) conducted a wetlands survey of the six active biosolids application areas covered in this proposed action. As a result, five jurisdictional and four functional wetlands were identified. The results of this survey are documented in the *Wetlands Walk Over Survey Report of the Biosolids Application Areas* (CDM 2010a) in Appendix C.

The topography of the application areas varies from steep, ridged slopes to relatively flat-lying floodplains. Karst features and rock outcrops are common. The majority of the biosolids application areas are well drained due to the slopes and high relief, but low relief, poorly drained areas are common. The ORR includes a wide variety of habitats. These include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, ponds (both permanent and vernal), streams, wetlands, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and the associated wildlife have received limited human disturbance since 1942. The ORR has also been established as a Wildlife Management Area under a cooperative agreement between the DOE and the TWRA and includes the 20,000-acre Oak Ridge National Environmental Research Park (ORNERP) and several state Natural Areas. In 1989, the ORNERP was designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as one of six units of the Southern Appalachian Biosphere Reserve (SAMAB).

Aquatic habitats on the ORR include small streams, Bear Creek, East Fork Popular Creek, the Clinch River, and several scattered ponds. Several species of fish, reptiles, and amphibians are found in these areas.

All six of the active biosolids application sites are open grassland field areas, surrounded for the most part by woodlands. The sites are devoid of caves, perennial streams, and large bodies of water. Small ponds and vernal ponds occur on all six of the locations. These features provide ecological habitat for amphibians, as well as other wildlife. Two of the application sites, Rogers and Scarboro Road, include rock outcrop features and sinkholes. Boundaries of the application sites are dominated by mature hardwood tree species that provide suitable habitat for a wide variety of plant and animal species.

For the biosolids application sites, three criteria had to be met for an area to be afforded the status of jurisdictional wetland, according to the *Corps of Engineers Wetland Delineation Manual* (Y-87-1):

- Visible signs of wetlands hydrology. (The areas either had standing water at the time of the site visit, or there were physical clues, such as watermarks or channels, that indicated the area was frequently inundated.)
- Wetland-type soil (gleyed or mottled soils), which were compared to color chips for the evaluation.
- Wetland-type vegetation. In the application sites, these species were predominantly herbaceous.

The results of the evaluation are summarized in Table 18 and illustrated in Figs. 3 and 5.

Four functional wetlands were identified that did not meet all three of these criteria, but were considered to perform the same functions of a wetland in that they served as habitat for amphibians, birds, and other wildlife.

Table 18. Jurisdictional and functional wetlands identified on the ORR biosolids land application sites

Map feature number	Site name	Description of area	Type of wetland	Latitude	Longitude
1	Scarboro	Pond	Functional	35° 59′ 5″	-84° 13′ 40″
2	Scarboro	Wet weather ditch	Functional	35° 58′ 54″	-84° 13′ 37″
3	Scarboro	Pond	Jurisdictional	35° 59′ 9″	-84° 13′ 42″
4	Scarboro	Pond with sinkhole	Functional	35° 59′ 22″	-84° 13′ 45″
7	Upper Hayfield #2	Pond	Jurisdictional	35° 58′ 56″	-84° 14′ 0″
10	High Pasture	Pond	Jurisdictional	35° 58′ 34″	-84° 14′ 45″
11	Rogers	Pond	Jurisdictional	35° 58′ 45″	-84° 14′ 29″
16	Watson Road	Pond	Jurisdictional	35° 57′ 1″	-84° 21′ 35″
17	Watson Road	Pond	Functional	35° 57′ 0″	-84° 21′ 36″

3.7 CLIMATE AND AIR QUALITY

The Oak Ridge area is located in a temperate, continental climate. Summers are warm and humid and winters are typically cool. Spring and fall are transitional seasons, normally warm and sunny. Severe weather (e.g., tornadoes or high winds, severe thunderstorms with damaging lighting, extreme temperatures or heavy precipitation) is rare. Average annual rainfall is approximately 140 cm (55 in). The Oak Ridge area has one of the lowest average wind speeds in the United States. Local terrain is the dominant influence on daily wind patterns and contributes to the low average wind speed. Prevailing wind directions are either southwesterly daytime winds or northeasterly nighttime winds. The Oak Ridge area is an attainment area (i.e., within permissible limits) with respect to National Ambient Air Quality Standards for all criteria pollutants (sulfur dioxide, particulate matter, nitrogen dioxide, carbon monoxide, ozone, and lead). (Source: *Environmental Assessment Proposed Changes to the Sanitary Sludge Land Application Program on the Oak Ridge Reservation* [DOE/EA-1356], pages 3-9.)

3.8 ECOLOGICAL RESOURCES

Terrestrial habitats on the ORR include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and associated wildlife have received limited human disturbance since 1942. In 1988, the ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program (SAMAB). The ORR has also been established as a Tennessee Wildlife Management Area under a cooperative agreement between DOE and TWRA and includes the 20,000-acre Oak Ridge National Environmental Research Park and other research park

natural areas (ORNL/TM-2006/110, *Oak Ridge Reservation: Physical Characteristics and Natural Resources*).

3.8.1 Listed Species

A listed species survey of the biosolids application areas was conducted in May 2010 by CDM and documented in a report for DOE in June 2010 (CDM 2010b, *Listed Species Walk Over Survey Report of the Biosolids Application Areas*). The focus of the survey was on state-listed and federally-listed species that may use the subject area and potentially ecologically sensitive habitat areas that support these species. The survey found that the ORR biosolids application sites provide suitable habitat for eleven listed species, including five birds (cerulean warbler, northern harrier, sharp-shinned hawk, vesper sparrow, yellow-bellied sapsucker), four mammals (gray bat, Indiana bat, southeastern shrew, and meadow jumping mouse), one salamander (four-toed salamander) and one fish (Tennessee dace). The gray bat and Indiana bat are federally-endangered species and are discussed below (see Sect. 4.8.1).

The ORR contains a wide diversity of quality wildlife habitats. Habitats include hardwood forest, mixed forest, forest edge, field, wetland, riparian, and shrub. Many of the wildlife species, such as the white-tailed deer (*Odocoileus virginianus*), are ubiquitous and can be found in almost any habitat, although they may show a preference for a certain type. Other species, such as the blue grosbeak (*Passerina caerulea*) or yellow-breasted chat (*Icteria virens*), are to be found only in specific habitat types while yet others require large tracts of unbroken forest (e.g., pileated woodpecker [*Dryocopus pileatus*]).

Hunting on the ORR occurs for wild turkey (*Meleagris gallopavo*), white-tailed deer, and Canada goose (*Branta canadensis*). Public deer, goose, and turkey hunts on the ORR are managed by the TWRA. These are the only hunting activities allowed on the ORR (Giffen, 2010).

Aquatic habitats on the ORR include small streams, Bear Creek, East Fork Poplar Creek, the Clinch River, and several scattered ponds. Several species of fish, reptiles, and amphibians are found in these areas. Muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) are found close to aquatic areas. The muskrat prefers open terrain where aquatic vegetation and dense growths of riparian grasses, sedges, and rushes exist, and beavers are found in locations where there are trees for food and for building dams and lodges. Mink (*Mustela vison*) and raccoon (*Procyon lotor*) are found in aquatic habitats but range into forest and field areas. Large mammals visit aquatic areas to drink water.

Most of the wildlife species observed during the surveys are those typical of the ORR.

Birds observed include woodpeckers (common flicker [*Colaptes auratus*], downy woodpecker [*Picoides pubescens*], hairy woodpecker [*Picoides villosus*], pileated woodpecker [*Dryocopus pileatus*], and red-bellied woodpecker [*Melanerpes carolinus*]), hawks (red-shouldered [*Buteo lineatus*] and red-tailed [*Buteo jamaicensis*]), sparrows (American tree [*Spizella arborea*], chipping [*Spizella passerina*], field [*Spizella pusilla*], song [*Melospiza melodia*], and white-throated [*Zonotrichia albicollis*]), vultures (black [*Coragyps atratus*] and turkey [*Cathartes aura*]), thrushes (eastern bluebird [*Sialia sialis*], and flycatchers eastern phoebe [*Sayornis phoebe*], and eastern wood pewee [*Contopus virens*]). Common birds of forest and forest edges identified include crow (*Corvus brachyrhynchos*), robin (*Turdus migratorius*), gnatcatcher (*Polioptila caerulea*), jay (*Cyanocitta cristata*), cardinal (*Cardinalis cardinalis*), thrasher (*Toxostoma rufum*), chickadee (*Poecile caronlinensis*), wren (*Thryothorus ludovicianus*), mockingbird (*Mimus polyglottos*), titmouse (*Baeolophus bicolor*), towhee (*Pipilo erythrophthalmus*), and turkey (*Meleagris gallopavo*). Other bird species noted during the surveys were American kestrel (*Falco sparverius*), belted kingfisher (*Ceryle alcyon*), black-crowned night heron (*Nycticorax nycticorax*), cedar waxwing (*Bombycilla cedrorum*), European starling (*Sturnus vulgaris*), killdeer (*Charadrius vociferous*), mourning dove (*Zenaida macroura*), and pine warbler (*Dendroica pinus*).

Mammals observed during the surveys included eastern chipmunk (*Tamias striatus*), eastern gray squirrel (*Sciurus carolinensis*), northern raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Amphibians observed during the surveys were bull frog (*Rana catesbeiana*), chorus frogs (*Pseudacris triseriata*), eastern newts (*Notophthalmus viridescens*), and spring peepers (*Pseudacris crucifer*).

3.8.2 Plants

All six of the sites are fields that are mowed bi-annually: generally once in late May and once in late August. These fields do not provide potential habitat for listed plant species. A plant survey was conducted as part of the previously completed biosolids application EA and no listed plant species were identified (DOE/EA-1356). In addition, no listed species were identified during the recent surveys. Habitats in adjacent areas, such as forests and ridges, may provide the potential for listed plants to exist. These adjacent areas would be protected from impact from the biosolids application with the maintenance of a buffer between the fields of application and the surrounding habitats.

3.8.3 Vertebrates

Three sources were consulted for the survey in Appendix D, including the Tennessee Natural Heritage Program, the ORR species of concern list (Table D.1 in Appendix D), and the TWRA. These sources were consulted in concert with the ecological surveys to make determinations regarding ecologically sensitive areas. Information from the ORR was checked for species of ORR concern that may be impacted by the proposed biosolids application. Lastly, the TWRA and Tennessee Wildlife Resources Commission (TWRC) Wildlife in Need of Management database were consulted to make sure all species listed as in need of management have been considered.

Biosolids application can have either favorable or detrimental effects on vertebrate habitat, depending on the species. Application requires that vehicular access be maintained (DOE/EA-1356). For the six study areas, this means they are mowed on an annual basis to prevent the development of woody plant species. Mowing maintains the areas in pastureland or hayfield condition, dominated by grassy plant species such as fescue and orchard grass. This habitat, although limited in value to many listed species (i.e., forest-dependent species), would be beneficial to others (i.e., species dependent on open field habitats).

4. POTENTIAL ENVIRONMENTAL IMPACTS

4.1 PROPOSED ACTION – SETBACK AMENDMENT

As described in Sect. 2.1, the proposed action amends the current 500-ft application setback around waters of the state and the 50-ft setback for potential channels to groundwater, to reflect current regulatory requirements, as set forth in EPA 40 *CFR* Part 503, while also applying recommendations provided in the current TDEC biosolids application guidance (TDEC 2011). Additionally, the proposed action eliminates the 50 ton/acre biosolids lifetime loading limit previously imposed on the program.

Figures 1–5 in this report present the biosolids application areas and the relevant surface water features and areas of concern identified in the most recent wetlands survey and listed species survey, conducted in May 2010 (CDM 2010a and 2010b). These surveys are provided in full, respectively, in Appendix C and Appendix D. Prior to 2006, the application process included the use of truck-mounted water cannons applying sludge with low percent solids content to the sites. The proposed action takes into account several changes to the program upon resumption of biosolids land application activities:

- As described in Sect. 1.3, the City's POTW has undergone a conversion from an anaerobic processing system to an aerobic system, and is expected to produce a Class B material.
- The upgraded system will produce a product with 20% to 25% solids content that will be applied with a standard-sized manure spreader, although the program retains the ability to apply product of varying percent solids content.

In accordance with 40 *CFR* Part 503, for each sensitive area identified by either the wetlands survey or the listed species survey, the Biosolids Program will maintain a minimum 10 m (33 ft) buffer zone inside of which no application or mowing will take place. The results of these two surveys in conjunction with the recommendations set forth in the TDEC biosolids land application guidance (TDEC 2011) were used to establish in some cases, larger setbacks of 30.5 m (100 ft) to provide additional protection of certain areas. Figures 2 and 4 present the proposed setbacks surrounding areas of concern identified by the wetlands survey and the listed species survey. Each application site is summarized below and Table 19 presents a summary of the relevant protected areas with their recommended buffer zones. More information regarding the identification of sensitive areas can be found in the respective survey reports.

The surveys identified, evaluated, and numbered the features (ponds, wetlands, wet weather ditches, sensitive habitats, and karst features) on the biosolids application areas. In the following sections, designated setbacks refer to Figs. 2 and 4, and feature numbers refer to those listed on Figs. 3 and 5.

Scarboro

As shown in Fig. 3, there are six surface water features of significance on the Scarboro site, including three ponds, one pond with a sinkhole, one wet weather ditch, and one jurisdictional wetland. Feature 1 is a pond. The relatively steep slope up-gradient from the feature, however, will necessitate a 30.5-m (100 ft) protective setback and the minimum 10-m setback down-gradient from the pond. Feature 2, a wet weather drainage ditch, was given a minimum 10-m (33 ft) setback since it had no additional special considerations necessitating a larger area. Feature 3, a pond, was afforded a 30.5-m (100 ft) setback since it is a jurisdictional wetland. Feature 4, a pond with a sinkhole, resides at the edge of a small wooded area, a habitat for breeding amphibians and other species. For this reason, it was given a 30.5-m (100 ft) setback. Features 5 and 6, because of their proximity to one another, are defined as one sensitive area with a 10-m (33 ft) setback surrounding both ponds as a unit.

Upper Hayfield #1

Features 8 and 9, from Fig. 3, that are located on the Upper Hayfield #1 site are described as wet weather ditches, meaning they occasionally have standing water during periods of, or immediately following, rain events. They each have a 10-m (33 ft) setback.

Upper Hayfield #2

Feature 7 on the Upper Hayfield #2 site is a pond identified as a jurisdictional wetland, and has a 30.5-m (100 ft) setback since it is located in terrain with a moderately steep slope of 8%–15%.

High Pasture

Feature 10 on the High Pasture site is a pond identified as a jurisdictional wetland, and has a 30.5-m (100 ft) setback since it is located in terrain with a moderately steep slope of 8%–15%.

Rogers

Feature 11 on the Rogers site is a pond with a small jurisdictional wetland identified along the southeast border. It has been assigned a 30.5-m (100 ft) setback due to slopes to the north in excess of 15%. Feature 12 is a karst feature/sinkhole that also has a 30.5-m (100 ft) setback. It is defined as a functional wetland, which the wetlands walk over survey recommended be afforded the same measure of protection as that of a jurisdictional wetland due to the moderate to steep slopes surrounding it.

Watson Road

The Watson Road area feature numbers discussed below refer to those listed in Fig. 5, and designated setbacks are depicted on Fig. 4.

Feature 13 is an area near an unnamed stream. Because the designated sensitive area is sufficiently far (>100 ft) from the stream, the buffer boundary runs concurrently and is as protective or more than the 30.5-m (100 ft) setback. Feature 14 is an area of drainage to the unnamed stream and similarly has a sensitive area boundary sufficiently large that it runs concurrently with its setback boundary. Feature 15 is a dry conveyance, meaning that it is dry for most of the year but can convey water in a rain event. Feature 16 is a pond identified as a jurisdictional wetland. Due to the relatively flat slope in this area, Feature 16 is designated with a 10-m (33 ft) setback, except to the west where the boundary extends beyond 33 ft to a wooded area. Feature 17 is a pond (functional wetland) with a 10-m (33 ft) setback.

Table 19. Summary of setbacks for protected areas on the ORR biosolids land application sites

Map feature number*	Site name	Protected area (type of wetland if applicable)	Latitude	Longitude	Setback
1	Scarboro	Pond (functional)	35º 59′ 5″	-84º 13′ 40″	30.5 m (100 ft) upgradient; 10 m (33 ft) downgradient
2	Scarboro	Wet weather ditch (functional)	35º 58′ 54″	-84º 13′ 37″	10 m (33 ft)
3	Scarboro	Pond (jurisdictional)	35º 59′ 9″	-84º 13′ 42″	30.5 m (100 ft)
4	Scarboro	Pond with sinkhole (functional)	35º 59′ 22″	-84º 13′ 45″	30.5 m (100 ft)
5	Scarboro	Pond	35º 58′ 23″	-84º 13′ 62″	10 m (33 ft)
6	Scarboro	Pond	35º 58′ 58″	-84º 13′ 67″	10 m (33 ft)
7	Upper Hayfield #2	Pond (jurisdictional)	35º 58′ 56″	-84º 14′ 0″	30.5 m (100 ft)
8	Upper Hayfield #1	Wet weather ditch	35º 59′ 23″	-84º 14′ 03″	10 m (33 ft)
9	Upper Hayfield #1	Wet weather ditch	35º 59′ 43″	-84º 14′ 96″	10 m (33 ft)
10	High Pasture	Pond (jurisdictional)	35º 58′ 34″	-84º 14′ 45″	30.5 m (100 ft)
11	Rogers	Pond (jurisdictional)	35º 58′ 45″	-84º 14′ 29″	30.5 m (100 ft)
12	Rogers	Karst feature with sinkhole	35º 58′ 35″	-84º 14′ 75″	30.5 m (100 ft)
13	Watson Road	Area near unnamed stream	35º 57′ 65″	-84º 21′ 80″	30.5 m (100 ft)
14	Watson Road	Drainage to unnamed stream	35º 57′ 27″	-84º 21′ 94″	30.5 m (100 ft)
15	Watson Road	Dry conveyance	35º 57′ 95″	-84º 21′ 61″	30.5 m (100 ft)
16	Watson Road	Pond (jurisdictional)	35º 57′ 1″	-84º 21′ 35″	10 m (33 ft)
17	Watson Road	Pond (functional)	35º 57′ 0″	-84º 21′ 36″	10 m (33 ft)

*Feature numbers refer to Figs. 3 and 5 from Sect. 1.4 and the Appendix C maps.

Summation

While the source of the 500-ft setback previously assigned to surface water features (DOE/EA-1356) is uncertain, it is assumed that it was assigned to be conservatively protective, as the majority of the biosolids product at that time was a liquid, applied with a water cannon. A vegetative cover, or no-mow zone, was not established. For reference, the 2001 TDEC guidelines (*Guidelines for the Land Application and Surface Disposal of Biosolids)* specify a 200-ft setback for spray application. Again, a vegetative cover was not included in the recommendations. However, the 2011 TDEC guidelines do recommend the presence of a vegetative cover, as well as specify a 100-ft setback upgradient of the surface water features for sloped application areas, and 33-ft downgradient, for all forms of product. In this proposed action, DOE will designate a vegetative cover, no-mow or maintenance zone, of approximately 10 m (33 ft) around surface water and sensitive habitats identified in the surveys. The vegetative cover areas will not be marked in the field, unless they coincide with the setbacks, to avoid creating a mowing hazard.

The 2011 TDEC guidance does not distinguish between a liquid or solid product in its recommendations. While the majority of the biosolids product that is the subject of this proposed action is expected to be

solid, the program will consider product of varying percent solid content for land application. For low percent solids product, special care will be taken to avoid conditions that would increase the potential for contamination of surface water features, such as windy or high precipitation conditions. Additionally, biosolids will not be stored on the sites prior to application.

The proposed setback amendments reflect the results of the surveys, conform to the requirements of 40 *CFR* Part 503, and follow the recommendations set forth in the TDEC guidance for land disposal of biosolids (TDEC 2011). For surface water features, they reflect whether an application is made up-gradient or down-gradient of a surface water feature and address the slope of the terrain adjacent to a given feature. Additionally, the presence of a buffer zone with a vegetative cover serves to further minimize the potential for runoff to any waters of the state. The cumulative effect of these recommended administrative and engineered controls, when applied to the appropriate field conditions, will be setbacks that are protective of the environment and the public.

4.1.1 Regional Demography/Socioeconomics

The proposed action would not result in a net change in employment since the proposed actions will not require any net change in personnel to operate the existing Biosolids Land Application Program.

4.1.2 Environmental Justice

As discussed in Sect. 3.3.5 regarding 1994 EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, federal agencies must achieve environmental justice by identifying and addressing, disproportionately high and adverse human health or environmental effects of activities on minority and low-income populations. Adverse health effects may include bodily impairment, infirmity, illness or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Environmental justice impacts occur if minority or low-income populations incur adverse effects due to a particular action, in this case the proposed action, where a minority population is defined as any census tract in which minority representation is greater than the national average of 30.7%. Thirteen of the census tracts within the ROI currently include a minority population (not white alone, or in combination) greater than the national average of 30.7% (USCB, 2010). No federally-recognized Native American group lives within 50 miles of the ORR.

The Sanitary Biosolids Land Application Program operations are conducted on the ORR near Y-12 and the ETTP. The only minority community located in close proximity to active application operations is the Scarboro Community. This African-American community is located within 2 miles of the active ORR land application sites near Y-12. Located in east Oak Ridge, it is bounded to the west by East Fork Ridge and to the east by Pine Ridge. It is a small urban community of approximately 650 individuals that is located approximately 457 m (1500 ft) northwest of Y-12 along the ORR boundary. The community occupies an area of approximately 101 ha (250 acres). Land in the Scarboro Community was cleared and divided into lots ranging in size from approximately 0.1 to 0.20 ha (0.25 to 0.5 acre). The Scarboro Community Center Park and various churches and small businesses are also located in the Scarboro Community.

No adverse impacts, either health or environmental, to minority or low-income populations are expected as a result of implementing the proposed action described in this EA. There are no measureable dose or risk impacts to any on-site or off-site receptors resulting from the proposed action. All of the biosolids application sites are located on the ORR and fenced off from the public, and mitigating measures are incorporated, in the form of setbacks, to avoid exposure to wetlands and floodplains. Because the areas in

use are not directly adjacent to any minority community and no off-site contamination is expected, no minority community should encounter any adverse impact as a result of the proposed action.

4.1.3 Archaeological, Cultural, and Historical Resources

In compliance with Sect. 106 of the National Historic Preservation Act (16 U.S.C. 470), the DOE consulted with the State Historic Preservation Officer (SHPO) regarding impact of the original biosolids land application operation in the 1996 EA (DOE/EA-1042). The SHPO response was in agreement with the DOE's determination that the biosolids project would have no effect on properties included on, or eligible for, inclusion on the National Register of Historic Places. Since the Biosolids Program proposed action only uses existing application sites already considered under the 1996 EA determination, no further consultation is necessary since no archaeological, cultural, and historic resources will receive any adverse impact as a result of the application program.

4.1.4 Geology and Soils

The land application of biosolids at the six active sites using amended setbacks is not expected to have any impact on site geology or soils. Setbacks range from 10 m (33 ft) for areas with relatively low slopes, to 30.5 m (100 ft) for areas with moderate to steep slopes, in accordance with TDEC guidance to be protective of soils and groundwater (TDEC 2011). Transport of contaminants from the land application of biosolids to groundwater is extremely unlikely unless channels or fissures exist in the soil matrix. For this reason, biosolids application is not permitted near rock outcrops, sinkholes, or other geologic features that would lend themselves to act as channels to groundwater.

The application sites are located near Chestnut Ridge, and are underlain by siliceous dolostones of the Knox Group, consisting of silica-rich carbonate rocks. When weathered, they form silty clay soils rich in chert, and are resistant to erosion. Karst features are present in the region in the form of outcrops, small caves, and small conduits. The majority of fractures and solution cavities in the region occur in shallow bedrock and decrease with depth (> 100 ft), resulting in the majority of water transported via karst features being discharged to local surface water features within the ORR boundary.

Actual walkdowns of the application sites conducted during the wetlands survey (Appendix C) revealed that the sites have some karst features including perennial streams and outcrops. Two of the locations (Rogers and Scarboro) include rock outcrop features and sinkholes. While the nature of groundwater transport through karst topography can be difficult to predict, off-site contamination from application activities is not expected due to the setbacks afforded karst features observed in the field, and the presence of regolith overlying the bedrock where application is allowed.

Inorganic compounds, heavy metals, and other trace parameters in the biosolids site soils were evaluated as a part of a previous EA (DOE/EA-1042) and were found to have no significant impact.

Eliminating the lifetime loading limit will have no adverse effect, as the cumulative metals loading limits prescribed in 40 *CFR* Part 503 will still be observed, thereby protecting the public and environment from potential adverse impacts. Cumulative loading levels of ten heavy metals are tracked as a part of the program to ensure that they are below the cumulative heavy metals loading limits required by 40 *CFR* Part 503. Tables 20–25 present the cumulative heavy metal loading levels through 11/07/2011 for each site and compare them to those concentration ceiling values in 40 *CFR* Part 503, Table 1. As one can see, the actual loading levels are well below EPA limits.

Table 20. Heavy metal loading levels for the Upper Hayfield #1 site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.38	41	0.9%
Cadmium	0.61	39	1.6%
Chromium	10.43	-	NA
Copper	63.63	1,500	4.2%
Lead	6.9	300	2.3%
Mercury	1.27	17	7.5%
Molybdenum	1.80	-	NA
Nickel	6.77	420	1.6%
Selenium	0.84	100	0.8%
Zinc	165.73	2,800	5.9%

NA = Not Available

Table 21. Heavy metal loading levels for the Upper Hayfield #2 site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.37	41	0.9%
Cadmium	0.62	39	1.6%
Chromium	10.09	-	NA
Copper	54.59	1,500	3.6%
Lead	6.36	300	2.1%
Mercury	1.17	17	6.9%
Molybdenum	1.09	-	NA
Nickel	5.23	420	1.2%
Selenium	2.21	100	2.2%
Zinc	155.68	2,800	5.6%

NA = Not Available

Table 22. Heavy metal loading levels for the High Pasture site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.51	41	1.3%
Cadmium	0.89	39	2.3%
Chromium	12.49	-	NA
Copper	83.93	1,500	5.6%
Lead	7.32	300	2.4%
Mercury	1.08	17	6.4%
Molybdenum	1.54	-	NA
Nickel	10.86	420	2.6%
Selenium	2.80	100	2.8%
Zinc	187.96	2,800	6.7%

NA = Not Available

Table 23. Heavy metal loading levels for the Rogers site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.41	41	0.7%
Cadmium	0.65	39	1.7%
Chromium	18.81	-	NA
Copper	52.77	1,500	3.5%
Lead	10.93	300	3.6%
Mercury	1.20	17	7.1%
Molybdenum	3.31	-	NA
Nickel	6.04	420	1.4%
Selenium	0.62	100	0.6%
Zinc	147.17	2,800	5.3%

NA = Not Available

Table 24. Heavy metal loading levels for the Scarboro site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.27	41	0.7%
Cadmium	0.47	39	1.2%
Chromium	7.47	-	NA
Copper	33.32	1,500	2.2%
Lead	4.24	300	1.4%
Mercury	0.76	17	4.4%
Molybdenum	0.82	-	NA
Nickel	3.09	420	0.7%
Selenium	1.83	100	1.8%
Zinc	102.34	2,800	3.7%

NA = Not Available

Table 25. Heavy metal loading levels for the Watson Road site vs. 40 *CFR* Part 503.13 (b)(2) limits

Heavy metal	Cumulative pollutant loading levels as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503.13 Cumulative loading limits (kg/ha)	Percentage of allowable loading attained
Arsenic	0.36	41	0.9%
Cadmium	0.57	39	1.4%
Chromium	8.78	-	NA
Copper	44.91	1,500	3.0%
Lead	5.5	300	1.8%
Mercury	0.71	17	4.2%
Molybdenum	0.85	-	NA
Nickel	4.34	420	1.0%
Selenium	2.20	100	2.2%
Zinc	120.62	2,800	4.3%

NA = Not Available

4.1.5 Water Quality

4.1.5.1 Surface pathway to groundwater

One potential pathway for contaminants to be transported off-site is from the surface to groundwater receptors. In 40 *CFR* Part 503, the concentration limits for contaminants of concern are derived from extensive fate and transport and exposure modeling. This modeling is documented in the *Technical Support Document for Land Application of Sewage Sludge* (EPA 822/R-93-001b). Fourteen exposure pathways were modeled, including migration of metals from the application site to groundwater. The results established that metals applied to the surface within the prescribed regulatory limits result in minimal impact to groundwater due to the strong tendency of the metals to bind with the upper few centimeters of a clay column. Radionuclides of concern in this proposed action are metal species and thus their transport is retarded by the upper few centimeters of the soil column. This retardation and retention of the metals in the upper layer of the soil and the vadose (unsaturated) zone result in minimal impact to the groundwater from contaminants of concern. Groundwater exposure pathways were considered in the original RESRAD modeling that was documented in the previous environmental assessments conducted for the program (DOE/EA-1042, DOE/EA-1356). Pathogens are similarly not considered to pose a threat to groundwater, as research indicates that pathogens from Class B biosolids are degraded through sunlight and attenuation within a short amount of time.

Nitrogen does not pose a threat to groundwater since biosolids applications are limited by the calculated agronomic loading rate, resulting in no excess nitrogen available for transport to groundwater or off-site receptors.

4.1.5.2 Surface pathway to surface water

Pathogenic, chemical, and radiological contaminants in biosolids applied to land may be transported by surface runoff to receiving waters such as streams, ponds, or wetlands. Potential adverse effects from exposure to these contaminants could occur in aquatic organisms in the surface water or in humans or animals drinking the water or consuming food organisms living in the water. Nitrogen or other nutrients in the biosolids could also have potential adverse effects on surface water quality should these nutrients reach excessive levels in the water. Most of the application sites on the ORR have a heavy herbaceous cover and reduction of runoff has been directly related to the density of vegetative cover on the site (DOE/EA-1042). The use of setbacks, heavy vegetative cover, avoidance of excessive slopes, and natural attenuation of the Class B solids will substantially reduce any threat to surface waters on or near active land application sites.

Similar to the groundwater pathway, because the biosolids are applied at a rate determined by the agronomic loading rate, there will not be excess nitrogen available for transport to surface water features either on-site or off-site. Organic compounds resulting from the land application of City biosolids have not been found to accumulate in active land application sites and would not pose a threat to surface and ground waters, given the existing program management practices.

Although some small surface water features are present at a number of sites, no adverse impacts are expected due to the reasons listed above and because setbacks that conform to the regulatory requirements set forth in 40 *CFR* Part 503.1 and the recommendations of the TDEC biosolids application guidance (TDEC 2011) are used to minimize the threat of exposure to contaminants. Additionally, prior to the initial TDEC approval of these sites in 1983 (Burris, 1983), a detailed hydrogeological evaluation of each site was completed that documented the suitability of the sites for the land application of biosolids. Best management practices for biosolids management, as documented in 40 *CFR* Part 503.14, restrict the application of biosolids application during precipitation events or when the ground is frozen or flooded,

thereby minimizing the likelihood of runoff. Avoiding areas with excessive slope (i.e., >15%) also eliminates a major risk factor for runoff to occur.

None of the biosolids application sites are located in wetlands. Jurisdictional and functional wetlands are present within all of the sites, as documented in the most recent wetlands survey conducted as a part of this EA (Tables C.3 and C.4). In consideration of TDEC biosolids land application guidance, a 30.50 m (100 ft) buffer has been established around these wetlands, which will be marked in the field to ensure that biosolids appliers will recognize their borders and not inadvertently apply into the wetlands or too closely to their borders.

The 40 *CFR* Part 503 regulations prohibit the land application of biosolids within any area designated as a floodplain. None of the land application sites are located within a 100-year floodplain.

4.1.5.3 City of Oak Ridge POTW discharge to EFPC

Heavy metal and radionuclide contaminants typically partition to the solid phase that is land-applied, as opposed to the water phase that exits the City of Oak Ridge NPDES discharge point to lower EFPC (TN0024155). This is based upon historical data collected since the program began in 1983 and the fact that most metals and long-lived radionuclides have a higher density and typically weigh more than water. As a conservative measure to simulate worse case environmental impacts from the proposed action, predictive modeling, RESRAD 6.0 modeling, and risk assessment scenarios (DOE/EA-1356) assume 100% of the radionuclides and heavy metals would partition to the solid phase and thus, be land-applied on the ORR. The sludge management sections of the City NPDES permits require adherence to the 40 *CFR* Part 503 limits for heavy metals. Although radionuclide monitoring for treated discharges through the City of Oak Ridge NPDES discharge point is not required by TDEC or EPA, monthly samples of the City biosolids will be analyzed for the radionuclides listed in Table B.1 of Appendix B until the data evaluation indicates that this activity may cease or be conducted at a reduced frequency.

4.1.6 Floodplains and Wetlands

As stated earlier, federal regulatory requirements as presented in 40 *CFR* Part 503, TDEC guidelines (TDEC 2011), and site selection criteria (DOE/EA-1042) specifically prohibit biosolids application in wetlands or 100-year floodplains. During the original hydrogeologic evaluation of the land application sites, floodplains were not identified within any of the active sites. Biosolids application will not take place within a 100-year floodplain, or in any wetland.

As detailed in the wetlands survey conducted in May 2010, five jurisdictional wetlands and four functional wetlands were identified across the six active sites. Jurisdictional wetlands were identified based upon protocols outlined in the *United States Army Corps of Engineers Wetlands Delineation Manual* (Y-87-1). These protocols consider such things as general hydrologic conditions of the area, relative dominance of hydrophilic plants, and soil and sediment characteristics to make a determination. For the biosolids application sites specifically, three criteria had to be met to be afforded the status of jurisdictional wetlands (see also Sect. 3.8):

- Visible signs of wetlands hydrology. (The areas either had standing water at the time of the site visit, or there were physical clues such as watermarks or channels that indicate the area was frequently inundated.)
- Wetland-type soil, gleyed or mottled soils, which were compared to color chips for the evaluation.
- Wetland-type vegetation. In the application sites, these species were predominantly herbaceous.

The results of the evaluation are summarized in Table 18 and illustrated in Figs. 2 through 5.

The four functional wetlands did not meet all three of these criteria in some measure, but were considered to perform the same functions of a wetland in that they served as habitat for amphibians, birds, and other wildlife. Consequently the wetlands survey recommended that these areas be afforded the same degree of protection as the jurisdictional wetlands. Thus, as presented in Table 15, Table 19, and Table C.1, each of the functional wetlands has a minimum 10-m (33 ft) setback established around them.

4.1.7 Climate and Air Quality

No air quality impacts have been identified for the proposed action. Minor odor problems have been reported from a few past biosolids application sites located immediately adjacent to public access highways. Because of the remoteness of most of the six active application sites, no odor problems to the public would be expected. An air dispersion model was performed as a part of the environmental assessment (DOE/EA-1356). The modeling simulates the on-site exposure of a person standing on a biosolids application site, inhaling fugitive radioactive particulates downwind during application.

Results are listed in Table 26.

Table 26. Air dispersion modeling results to an on-site receptor

Radionuclide	Air activity (pCi/m^3)	Dose (mrem/yr)
^{60}Cobalt	8.33×10^{-8}	1.12×10^{-8}
^{137}Cesium	3.23×10^{-8}	7.21×10^{-10}
^{235}Uranium	6.23×10^{-9}	5.35×10^{-7}
^{238}Uranium	7.24×10^{-7}	8.33×10^{-5}

The maximum exposure of an individual breathing the biosolids as they are land-applied 260 operational days per year, 8 hours each day, is 0.00008 mrem/yr. This level is considered to be negligible. As emissions travel off-site, the concentration of radionuclides drops substantially, resulting in an even lower exposure to an off-site individual.

4.1.8 Ecological Resources

The proposed action is not expected to cause adverse impacts to any biota at the application sites. Amended setbacks follow recommendations set forth in TDEC biosolids land application guidance (TDEC 2011) to be protective of water resources and wildlife. Adherence to the cumulative metals loading ceilings in 40 *CFR* Part 503 ensures that the environment will be protected even with the elimination of the 50 ton/acre lifetime loading limit. Some short-term impacts to wildlife would be realized, but would be limited to minimal physical disturbance as a direct result of the application vehicles on the site.

4.1.8.1 Listed species

Impacts to any state or federally-listed species from the proposed action would be minimized through adherence to the application regulations set forth in 40 *CFR* Part 503, the recommendations developed during the listed species survey, and the 2011 TDEC guidance for land application of biosolids.

Vehicular traffic required to spread biosolids could potentially impact vertebrate habitats. Nests established in the grassy areas where biosolids are applied would be subject to disturbance by traffic and biosolids application. Currently tractors mow the fields twice per year, generally in late spring (May) and

late summer (August). The application process used will call for the biosolids to be trucked over to the application sites and dumped at a central location where a front-end loader will then fill the manure spreader. All of these vehicles pose a potential, albeit small, threat to wildlife on the ground through direct contact with them. Tree dwelling species, such as birds, would have little risk of adverse impact from the presence of vehicle traffic on the application sites.

Application of biosolids pose the potential to increase heavy metal concentrations in the soils and thus bioaccumulate in certain biota, such as earthworms that are then eaten by shrews and birds. However, as previously stated, the ORR Biosolids Application Program shall adhere to the conservative heavy metals loading limits set forth in 40 *CFR* Part 503, which will minimize any possibility of adverse effects to biota from heavy metals.

According to the most recent listed species survey report (Appendix D) these fields do not provide potential habitat for listed plant species. A plant survey was conducted as part of the previously completed biosolids application EA and no listed plant species were identified (DOE/EA-1356). Habitats in adjacent areas, such as forests and ridges, may provide the potential for listed plants to exist. These adjacent areas would be protected from impacts from the biosolids application with the maintenance of the proposed buffers between the application fields and the surrounding habitats.

Biosolids application can have either favorable or detrimental effects on vertebrate habitat, depending on the species. Application requires that vehicular access be maintained (DOE/EA-1356). For the six study areas, this means they are mowed twice yearly to prevent the development of woody plant species. Mowing maintains the areas in pastureland or hayfield condition, dominated by grassy plant species such as fescue and orchard grass. This habitat, although limited in value to many listed species (i.e., forest-dependent species), would be beneficial to others (i.e., species dependent on open field habitats).

The ORR biosolids application sites provide suitable habitat for 11 listed species, including five birds (cerulean warbler, northern harrier, sharp-shinned hawk, vesper sparrow, yellow-bellied sapsucker), four mammals (gray bat, Indiana bat, southeastern shrew, and meadow jumping mouse), one salamander (four-toed salamander) and one fish (Tennessee dace).

The gray bat and Indiana bat are federally-endangered and are discussed below. At the request of the U.S. Fish and Wildlife Service, a biological assessment (BA) was performed in 2002 to evaluate the specific impacts of the proposed actions upon the federally endangered gray and Indiana bats, as documented in the 2003 EA (DOE/EA-1356). Many of the conclusions of the BA are still valid. The results of the BA were that neither of these species would be expected to be impacted, if present, due to restrictions regarding the application of biosolids within 500 ft of a U.S. waterway, the extremely low levels of radionuclides found in application site soils and plant tissues that have been observed through program monitoring, and the low occurrence of potential roosting habitat (e.g., caves, exfoliating trees) on the active application sites. Specifically, the BA found that the proposed action would be unlikely to adversely impact the gray bat for the following reasons:

- The absence of caves from the ORR application sites, reducing the likelihood of roosting habitat.
- The absence of large water bodies present on the application sites, reducing the likelihood of foraging habitat.
- The rigorous radionuclide monitoring program in place and the extremely low to non-detectable levels of radionuclides found in application site soils and vegetation, reducing the likelihood of accumulation of radionuclides within insects that consume vegetation and represent a food source for the gray bat (DOE/EA-1356).

- The established buffer zone of 500 ft around existing bodies of water on the application sites prohibiting the application of biosolids, reducing the likelihood of direct or indirect contact with the gray bat, if present.

Because the first three reasons are still valid under the proposed action, a reduced buffer around waters of the state would likely still not adversely impact the gray bat. Besides the gray bat and Indiana bat, two state-listed mammals may use the biosolids application areas. These two species are southeastern shrew and meadow jumping mouse. The southeastern shrew is a species within the Soricidae family that lives in forests near wet areas. Buffering will protect the forest habitats needed for this shrew. The meadow jumping mouse prefers moist grasslands near ponds or streams. Buffering the ponds will protect it from the biosolids application. Similar to the vesper sparrow, impacts to this mouse will be minimized by avoiding mowing operations from May to August to allow completion of the breeding cycle. Impact from machinery used on the fields for the application of the biosolids, maintenance of the fields, etc., would occur; however, impact will be minimized if mowing does not occur during the meadow jumping mouse breeding cycle.

The four-toed salamander prefers vernal ponds and forest habitats for key portions of its life cycle. The ponds on the biosolids application sites will be protected by the proposed buffers. The adjacent woodlands to vernal ponds are important to salamanders, such as the four-toed salamander. Such a pond and woodland habitat occur in the middle of the Scarboro site and thus, this area is also protected by a buffer in the proposed action.

Tennessee dace are reported as living in the unnamed creek adjacent to the Watson Road site (Fig. 4). This unnamed tributary is within the Aquatic Natural Area (ANA) 3 of the ORR. The buffer zone established near this unnamed creek should protect it from the runoff from the biosolids application fields, and protect the habitat of this Tennessee State fish species in need of management.

4.1.8.2 Plants and Habitats

Current habitats are similar to others areas on the ORR that include forest, stream, and pond habitat, with agricultural type uses interspersed. The ORR currently consists of predominantly forest habitat with some sparse urban and agriculture land as shown in ORNL/TM-2006/110. Currently the biosolids application areas are maintained as field habitats that mimic, in many ways, agricultural fields. Surrounding these fields are forest, stream, intermittent stream, wetland, and pond habitats (Figs. 2-5). Since these fields will be maintained to allow for the biosolids application, habitats and plants should change very little over the time period of the biosolids application. In addition, proposed unmowed vegetative buffers as presented in Table 15 will help to limit impacts to sensitive plant habitats. Therefore, no substantial impacts to current habitats or plant species are anticipated with the proposed action.

4.1.8.3 Animals

Animals observed during the walk over survey (see Sect. 3.8.1 and Appendix D) are typical of species observed in similar habitats on the ORR. As is the case with impacts to listed species noted in Sect. 4.1.8.1 above, impacts to non-listed wildlife from the proposed action would be minimized through adherence to the application regulations set forth in 40 *CFR* Part 503, the recommendations developed during the listed species survey, and the 2011 TDEC guidance for land application of biosolids.

As noted in Sect. 4.1.8.1 above, vehicular traffic could potentially impact vertebrate habitats. Nests established in the field areas where biosolids are applied would be subject to disturbance by traffic and biosolids application. Tractors mow the fields twice per year, generally in late spring (May) and late

summer (August). All of these vehicles pose a potential, albeit small, threat to wildlife on the ground through direct contact with them.

Biosolids application can have either favorable or detrimental effects on vertebrate habitat, depending on the species. Application requires that vehicular access be maintained (DOE/EA 1356). For the six study areas, this means they are mowed twice yearly to prevent the development of woody plant species. Mowing maintains the areas in pastureland or hayfield condition, dominated by grassy plant species such as fescue and orchard grass. This habitat, although limited in value to many species (i.e., forest dependent species), would be beneficial to others (i.e., species dependent on open field habitats).

Areas such as ponds, wet weather ditches, sinkholes, areas adjacent to streams, drainages that lead to streams, dry conveyances, and forests will be protected by the proposed setbacks listed in Table 15. By protecting these features, wildlife such as small mammals, bats, birds, frogs, and salamanders dependent on these habitats, and habitats adjacent to these features, would benefit. Impacts to wildlife dependent on the mowed portions of the application sites would be minimized by avoiding mowing operations from May to August to allow for completion of the breeding cycle. Additionally, the initial 33 feet of each setback will not be mowed. Buffering of streams will also help protect fish from the runoff from the biosolids application fields.

No substantial impacts to non-listed wildlife species are anticipated from the proposed action.

4.1.9 Potential Radiological Impacts

As noted earlier, there are no federal standards for biosolids radiological content and land application areas.

Dose-based radionuclide concentration guidelines were developed as a part of the previous EA (DOE/EA 1356) using RESRAD 6.0 modeling and assuming a 20-year program lifecycle. These guidelines, summarized in Appendix B, have been updated to reflect a 50-year program lifecycle. Conservative assumptions such as on-site farmers and pica (soil-eating) child receptors were used. The dose-based radionuclide planning levels were calculated to be protective of human health at a maximum dose of 10 mrem/year to the most exposed (conservative) individual. The 10 mrem/year criterion used is the same as in the *National Emission Standards for Hazardous Substances* regulations at 40 *CFR* Part 61 and lower than the 25 mrem/year limit for land disposal of radioactive wastes in the TDEC rules (TDEC Chapter 1200-2-11-.16, 1988, *Rules of Department of Environment and Conservation Division of Radiological Health*).

The worker exposure to radionuclides scenario would be where a worker is exposed via incidental ingestion and inhalation of particulates while handling biosolids during both treatment and land application operations.

The human health risk analysis from DOE/EA-1356 concludes that the combined chemical and radiological risks to employees exposed to biosolids during the land application process are minimal at 4×10^{-7}, and are within DOE and EPA acceptable risk criteria (i.e., less than 1×10^{-4}). Non-carcinogenic risks were estimated to be < 1, for both the worker and the trespasser, indicating that no adverse effects would be expected from exposure to biosolids or biosolid-amended soils.

Transients could be exposed to the biosolid-amended soils. The combined chemical radiological risks to transients exposed to soil are also minimal at 1×10^{-7} and within the DOE and EPA acceptable risk criteria for excess lifetime cancer risk of $<1 \times 10^{-4}$. Non-carcinogenic risks were estimated to be < 1, for

both the worker and the trespasser, indicating that no adverse effects would be expected from exposure to biosolids or biosolid-amended soils.

Impact to human health for a resident farmer (conservative assumption) due to radiological exposure to 10 mrem/yr dose is within the acceptable risk criteria of 1×10^{-4}.

4.1.10 Transportation

The Biosolids Program will, on a typical day, make two trips to the application areas to deliver and apply biosolids. No unusual traffic conditions are expected that would pose an added risk for transportation. There is, however, ongoing construction on Oak Ridge Turnpike (Highway 95) to widen the road to two lanes in each direction; this impacts transportation to the Watson Road site in the form of slower traffic, due to construction zone speed limits, and interrupted flow of traffic, due to construction activity. In the unlikely event of a transportation-related spill, there would be little potential for contamination with the higher solids content biosolids as they would be relatively easy to contain and recover quickly. If a liquid product were to be spilled, it would have a higher potential for contaminating the environment, but it would be dealt with through the appropriate spill response plan implemented by the City. The notification requirements for a spill of biosolids or petroleum products are specified in *Application of Sanitary Biosolids on the Oak Ridge Reservation, Spill Response Plan, Oak Ridge Tennessee* (Bechtel Jacobs Company LLC [BJC]/OR-1218/R11).

Road Improvements in the Watson Road Area

A road improvement project was undertaken to upgrade the roads serving the Watson Road application site due to their degraded condition. The roads included were: Watson Road, the eastern section of Old County Road, and Salvage Yard Road. These roads were graded to remove any soft sediment buildup, with some areas receiving 2 in. of stone as a stabilizing base before applying a minimum of 6 in. of firmly compacted pug-mix stone over the entire roadways.

The ditches were reworked to improve drainage throughout the area. This included the reshaping and rerouting of some ditches that will not only improve the life of the road, but establish better defined drainage. Four corrugated metal culverts were also added under the road at various locations to aid in directing the drainage. Riprap was placed at all of the culvert outlets and inlets and in many drainage areas to help reduce erosion that could occur during heavy runoff conditions.

Access points into the fields from the roads were established to ensure the safe transition of loaded trucks delivering product into the fields.

Silt fencing and straw bales were used in the road upgrades to control sediment runoff, and the bare areas were seeded to prevent future erosion.

The environmental impact of these road improvements is small. Improved drainage from the ditch modifications, combined with mitigating measures such as riprap placed at the culvert outlets and inlets, will reduce the possibility of erosion on the sites. Overall the road improvement project will improve access to the sites and will not negatively impact any of the designated sensitive areas.

4.1.11 Human Health and Safety

Human health issues of concern are chemical contamination from the biosolids, particularly buildup of heavy metals in the soil, and the survival of residual pathogens (viruses, bacteria, parasites, and some fungi) in the biosolids and soil. The potential health impacts are summarized below.

Heavy metal concentrations in the biosolids are well below the ceiling concentration limits established by EPA in 40 *CFR* Part 503.13(b), Table 1, and the cumulative metal loading for the application sites is below the values in 40 *CFR* 503.13(b), Table 2. As detailed in the human health risk assessment for the biosolids land application sites, the hazard index for toxic (i.e., noncarcinogenic) effects from heavy metals is < 1.0, which is within acceptable limits. For cancer effects, risks to an employee applying the biosolids and risks to a transient on the application site are also below the DOE and EPA acceptable value (DOE/EA-1356).

Activities associated with the transportation of the biosolids will be detailed in future TDEC land application submittals. This will include health and safety training for the operators, and a spill response plan that will be the responsibility of the City.

4.1.12 Accidents

Accidents during transportation to or from the application sites are possible, albeit unlikely. In the unlikely event of a transportation-related spill, the solid product could be easily recovered with minimal chance of posing a risk to the public or the environment from pathogens. Further, since heavy metal levels must meet EPA land application criteria prior to application, they do not pose a threat to humans or the environment, should a spill occur. The trace amount of radionuclides contained within the biosolids would produce a maximum exposure of 0.14 mrem/yr, with an associated risk of 4×10^{-7} to a worker, which is below the acceptable EPA and DOE limitations (DOE/EA-1356).

4.2 NO ACTION

Under this scenario it is assumed that nothing changes from the current program conditions, which have been evaluated in the previous environmental assessments listed in Table 1 of Sect. 1.2. Current setbacks of 500 ft from surface water would be observed, and the lifetime loading limit of 50 tons/acre would remain in effect. The impacts are as follows (Sect. 2.1):

- Due to the large setbacks in the no action scenario, there could be an even lower risk of contaminants migrating to surface water, groundwater, or off-site receptors, although this was not confirmed through soil or surface water testing.
- Total available biosolids application acreage would be decreased, significantly in some cases, such as would be the case for the Scarboro site.
- The lifetime loading limit would arbitrarily limit the program lifetime.

4.3 COMPARISON OF ALTERNATIVES

Table 27 presents the relevant information concerning both alternatives for basis of comparison.

Table 27. Alternatives comparison summary

Action	Summary	Impacts
Proposed Action: Amend current application buffers to conform with 40 *CFR* Part 503 and utilize 2011 TDEC biosolid applications guidance as appropriate; eliminate 50 ton/acre lifetime loading limit	• Protective of waters of the state • Extends program lifetime • Maximizes use of application sites	A small risk of contamination to surface water may exist from the closer proximity of the application area to surface water features. This is mitigated, however, through use of vegetative, no-mow buffer.
No Action: Continue biosolids application with 500-ft setback around waters of the state and 50 ft around potential routes to groundwater; continue with 50 ton/acre lifetime loading limit	• Lowers available application acreage • Eliminates a large portion of one site, Scarboro • Arbitrarily restricts useful life of each site	No increase in health, environmental, and transportation risks. Program has less acreage on which to apply biosolids. Program ceases in near future.

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5. POTENTIAL CUMULATIVE AND LONG-TERM IMPACTS

This section evaluates the impacts from the proposed action and the no action alternative, in combination with other unrelated actions that could result in adverse impact to the environment. Cumulative impact is defined as: "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 *CFR* Part 1508.7, *Protection of the Environment*, "Cumulative Impact") The impact from multiple actions are considered to be cumulative based upon their contribution—however minor—to the proposed action in this EA.

Other actions that could impact the public or the environment could act synergistically with those potential impacts from the proposed action. Thus, any potential impacts from other actions in the area are considered and evaluated on a cumulative basis with the impacts presented in Sect. 4 of this EA.

Projects that would be considered relevant for consideration in cumulative impacts would be the ongoing remediation and decontamination and decommissioning (D&D) projects at Y-12, and the road-widening construction along Highway 95 (Oak Ridge Turnpike), north of the I-40 interchange.

5.1 CUMULATIVE IMPACTS BY RESOURCE AREA

5.1.1 Geology and Soils

The ceiling concentrations for heavy metals (Table 1, 40 *CFR* Part 503), the concentration guidance levels for radionuclides in the biosolids (Table B.1, Appendix B), and the comprehensive monitoring program are designed to prevent future environmental and public impact from biosolids land application on the ORR. The safety factor provided by the concentration guidance levels for radionuclides in biosolids, derived from the TDEC-approved, dose-based approach, ensures protection of the environment.

The proposed action should not result in any increased risk due to metals, radionuclides, or organics loading in the soils at the application sites. As discussed in Sect. 4, reducing the existing buffer zones to 10 m (33 ft) and 30.5 m (100 ft) and eliminating the lifetime loading limit should not adversely affect the soils, given the stringent biosolids monitoring required by EPA 40 *CFR* Part 503 and the maintenance of vegetative, no-mow, buffers around each sensitive area. Nitrogen loading to the soils will also remain unaffected by the changes in the proposed action, as it will continue to be limited by the agronomic application rate, updated with each biosolids sampling event, which accounts for the nitrogen from past applications, available nitrogen in the biosolids, and the plant requirements of the individual sites. No soils will be removed or excavated from the application sites in conjunction with any Y-12-related activities. Additionally, no construction activities are planned for any of these sites and, therefore, no potential cumulative effects from the proposed action are expected.

5.1.2 Water Resources

Implementation of the proposed action would not contribute cumulative adverse impacts to the surface water or groundwater of the ORR or surrounding communities. Section 4 evaluated the potential impacts of the reduced setbacks around surface water features on the application sites and concluded that with the combination of setbacks with vegetative cover, along with identification and protection of special features such as sinkholes, there is no increased risk of surface water or groundwater contamination from constituents in the biosolids product. Radionuclides are bound to the solid matrix of the biosolids and are

not readily released when the material is saturated. Restricting the application rate to meet the nitrogen requirements of the site vegetation protects the ORR waters from potential nitrogen contamination.

The proposed action would not contribute to surface water discharges that could occur from ongoing Y-12 remedial or D&D actions. No groundwater withdrawals are planned as any part of the proposed action. Additionally, there is not expected to be any interaction between the proposed action and any environmental restoration actions involving groundwater recovery or discharge. Since no chemical or radiological impacts to groundwater were identified as a result of the evaluation in Sect. 4, no cumulative impacts would be expected as well.

5.1.3 Ecological Resources

The implementation of the proposed action will have little effect on ecological resources. Wetlands and ecologically sensitive areas identified in the wetlands (Appendix C) and listed species (Appendix D) surveys are protected with ample setbacks, as recommended in the surveys and TDEC guidance (TDEC 2011), to ensure that wetlands and wildlife receive no adverse impacts as a result of biosolids application. Since activities at Y-12 similarly do not impact the wetlands or wildlife at the sites, no cumulative impacts to ecological resources are expected.

5.1.4 Cultural Resources

Since no cultural or historic resources have been identified on the ORR biosolids application sites, implementing the proposed action will not contribute to any cumulative effects on the archaeological resources of the ORR.

5.1.5 Air Quality

In the previous EA developed in 2003 (DOE/EA-1356), an air dispersion model was presented to evaluate the possible impacts from the formation of dust particulates at the point of application. The model simulated an on-site receptor inhaling fugitive radioactive particulates downwind during application.

The maximum exposure of an individual breathing the biosolids as they are land-applied for 260 operation days per year, 8 hours each day is 0.00008 mrem/yr. This corresponds to 0.01% of the total 0.7 mrem/yr off-site exposure received by an individual from cumulative operations conducted on the ORR or any concurrent projects in and around the application sites that have the potential to produce dust emissions (DOE/ASER, *Annual Site Environmental Report*). Thus, the proposed action would not be expected to adversely impact air quality in and around the ORR.

5.1.6 Socioeconomic

Environmental effects from the proposed action on the economy and surrounding communities of the ROI would be non-existent. The impact of amending the existing setbacks would not affect jobs, income, or the infrastructure. Thus, no cumulative impacts are expected as a result of the implementation of the proposed action.

5.1.7 Environmental Justice

As discussed in Sects. 3.3.5 and 4.1.2, no potential effects to environmental justice were identified from the proposed action. Similarly, no other projects are known to have a potential to contribute to cumulative effects.

5.1.8 Transportation

Implementation of the proposed action is not expected to impact the local traffic since there are no known changes to employment expected as a result of this action. As negligible increases in traffic are expected from the twice-daily trips to and from the application areas, no cumulative or long-term impacts to traffic are expected. Because access roads to the ORR biosolids land application sites are restricted from public use, there should be no cumulative impacts for this roadway access.

5.1.9 Land Use

The proposed action would not result in changes to land use because activities would occur on sites that have been in use since 1983 for biosolids land application activities. The net increase in useable acreage due to the proposed action will not affect land use.

5.1.10 Human Health and Safety

No operations included as a part of the proposed action would increase chemical or radiological risk since the processing is essentially similar to what was already being done on the sites. Some additional risk may be involved with increased transportation to and from the application sites, but any potential spills can be easily remediated with little or no risk to the worker, the public, or the environment.

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6. PERMIT AND REGULATORY REQUIREMENTS

Municipal biosolids are not regulated as a RCRA waste or as a radiological waste. Municipal biosolids are included in the solid waste exemption for domestic sewage provided in 40 *CFR* Part 261.4(a), "Identification and Listing of Hazardous Waste, Exclusions."

The EPA regulates the land application of municipal biosolids under *Standards for the Use or Disposal of Sewage Sludge*, 40 *CFR* Part 503, which were promulgated under section 405(d) and (e) of the CWA, 33 United States Code 1345(d), (e), as amended by the Water Quality Act of 1987. In these amendments to section 405 of the CWA, Congress issued a mandate to reduce the potential environmental risks and maximize the beneficial use of biosolids. Accordingly, the EPA established standards for biosolids use and disposal, including risk-based, metal-loading criteria for the receiving soil. As discussed in Sect. 1.3, the City applied biosolids to the ORR under EPA permit number TNL024155 until 2001, when the individual sludge-only permits were discontinued (TDEC 2001, *Guidelines for the Land Application and Surface Disposal of Biosolids*). The EPA Region 4 now considers the City to be self-implementing under 40 *CFR* Part 503.

Section 405(f) (1) of the CWA requires that any NPDES permit issued to a POTW must include conditions to implement the municipal biosolids regulations issued under section 405(d), unless permitted by a state authorized by EPA to administer the Biosolids Land Application Program. As the state of Tennessee is not currently an authorized state, the City NPDES permits, numbers TN0024155 and TN0078051, include implementation provisions in the sludge management sections.

The City received permission to use the application sites on the ORR through a land license agreement with DOE. The current agreement was effective beginning November 1, 2010 and will expire on October 31, 2015.

The TDEC-issued LAA letters to the City in 1983 (Burris, 1983) and 1989 (Harris, 1989). The ten-year period and the five-tons/acre/year application limit specified in the 1989 letter were used by the Sanitary Biosolids Land Application Program to develop the lifetime loading limit for the program of 50 tons/acre, presented for elimination in this proposed action. Establishment of a lifetime loading limit was considered a conservative best management practice, pending further guidance from TDEC. The February 2011 TDEC guidance for biosolids management found in *Guidelines for the Land Application and Surface Disposal of Biosolids*, along with concurrence from the state of Tennessee Biosolids Coordinator, support the elimination of the lifetime loading limit.

As discussed in Sect. 1.3, when the City has generated sludge suitable for land application, a formal request to TDEC will be submitted for LAA. This new approval will replace the 1983 (Burris, 1983) and 1989 (Harris, 1989) letter approvals and will reflect the 2011 TDEC guidance for biosolids management. Neither the TDEC approvals nor the guidelines are enforceable; however, as stated on page 4 of the guidelines: "These guidelines are not to be construed as State Regulations…" and "Tennessee is not a delegated state to administer the Biosolids Program. Therefore, U.S. EPA Region is the permitting authority and is the legal authority to enforce the provisions of the Part 503 regulation." Although they are unenforceable, the TDEC guidance and approval are carefully considered and incorporated into the Biosolids Program.

The City's wastewater treatment plant receives discharges of radionuclides from state-licensed industrial facilities, a local hospital, and the Y-12 facility. There are no regulatory standards that establish acceptable concentrations for radionuclides in municipal biosolids. However, in an effort to ensure that the biosolids remain acceptable for long-term land application, the City established a dose-based

methodology for determining acceptable radionuclide concentrations. The City obtained approval from the TDEC Division of Radiological Health to develop sewer release criteria based on a dose rate of 10 mrem/year (DOE/EA-1356, Appendix A). Using the RESRAD 6.0 computer code, radiological concentration guidelines for the site soils and the biosolids were developed and documented in environmental assessments conducted in 1996 (DOE/EA-1042) and 2003 (DOE/EA-1356). The proposed action modifies these documents to reflect a 50-year program life cycle, establish a list of radionuclides to be monitored in the Biosolids Program, and to establish an independent analysis of the biosolids for these radionuclides.

For the proposed action, no changes to the NPDES permits will be required. All conditions of 40 *CFR* Part 503 will be conducted, as implemented in the permits.

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40 *CFR*. Chap.V, *Council on Environmental Quality*, Pt. 1500, *Purpose, Policy, and Mandate*, Pt. 1501, *NEPA and Agency Planning*, Pt. 1502, *Environmental Impact Statement*, Pt. 1503, *Commenting*, Pt. 1504, *Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory*, Pt. 1505, *NEPA and Agency Decisionmaking*, Pt. 1506, *Other Requirements of NEPA*, Pt. 1507, *Agency Compliance*, and Pt. 1508, *Terminology and Index*, Sec. 1508.7, *Cumulative Impact*.

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APPENDIX A.
ORR BIOSOLIDS LAND APPLICATION PROGRAM CHARACTERIZATION DATA

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A.1 CITY OF OAK RIDGE BIOSOLIDS CHARACTERISTICS

This section discusses the characterization of the biosolids from the City of Oak Ridge POTW, which are being land-applied on the ORR. Biosolids characteristics discussed include constituent inorganic chemicals, heavy metals, organic chemicals, radionuclides, and pathogens as they relate to biosolids.

Inorganic Chemicals

The City of Oak Ridge biosolids will be sampled for classical inorganic chemistry parameters at the frequency specified in the NPDES permit and the TDEC land application guidelines. **Table A.1** presents the maximum levels of each required analyte found in the City's biosolids from 1996 to 2010.

Heavy Metals

Heavy metal sampling and analysis is based upon the total amount of biosolids produced by the POTW on an annual basis. The City currently produces between 500 and 700 metric tons (dry weight) a year. Under the EPA 40 *CFR* Part 503 regulations, amounts greater than 290 metric tons a year require quarterly sampling. **Tables A.2** and **A.3** present the maximum concentration of each heavy metal in the City biosolids, as well as the maximum allowable concentration for each metal for the years 1996–2000, and 2001–2009, respectively. **Tables A.7 through A.11 provide the site profiles and cumulative loading statistics.**

Organic Chemicals

Currently, the City performs annual sampling of the biosolids for organic analytical parameters. **Table A.4** presents the results of selected organic compounds analysis for the City biosolids.

Radionuclides

Because of contributions of natural background radiation, atmospheric deposition, industrial operations, and various medical uses including medical diagnostics, all biosolids contain some radioactive material. **Table A.5** presents the radiological characterization data for the Oak Ridge biosolids from 1997 to 2011. Radiological parameters that are naturally occurring remain fairly constant, while the constituent ^{131}I, a commonly used isotope for medical testing, shows spiking, which is to be expected. All of the constituents remain well below their respective planning levels.

As **Fig. A.1** illustrates, with the exception of ^{131}I, the trend is one of generally level, or decreasing radiological concentration in the biosolids. It is therefore reasonable to expect that if current conservative management practices continue, radiological concentrations on the ORR biosolids sites will remain low. The isotope ^{235}U was either not detected or not reported for the years 2000, 2001, and 2002. The isotope ^{238}U was not reported for the years 2001 and 2003.

Bulk gamma emitters are monitored by the POTW on a daily basis. The ORNL analyzed the biosolids for selected radionuclides (e.g. ^{60}Co, ^{137}Cs, ^{131}I, ^{235}U and ^{238}U) from composite samples on a quarterly basis until 2002, at which time such analysis was suspended. Independent testing of the City biosolids resumed in June 2010. A composite of City sludge at the stage prior to press introduction was prepared from aliquots collected over the course of the month and was analyzed by a commercial laboratory. Monthly samples were collected through May 2011. **Table A.6** presents the statistical evaluation of this data against the proposed guidelines (Table B.1, Appendix B). Based on the acceptable results for the statistical evaluation of the monthly data, monitoring continued on a quarterly basis with the collection of

the first quarterly sample in November 2011. As for the previous composites, the November sample was prepared from aliquots collected over the course of one month.

Table A.6 Statistical Evaluation

The previous environmental assessments developed for the program (DOE/EA-1042, DOE/EA-1356) described the sum of the fractions approach as the method for comparing the radiological data to the sludge guidelines. In the proposed action, the sludge guidelines are based on a fifty year program lifetime.

The monthly data collected between June 2010 and May 2011 was evaluated using the ProUCL 4.1 statistical software developed by the EPA for environmental applications. The 95% upper confidence limit (UCL95) for the arithmetic mean for each radionuclide data set was calculated based on the distribution type. For nonparametric data sets, the UCL95 was selected from the Chebyshev evaluation. Soil background data points for ^{210}Pb, ^{40}K, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, and ^{238}U were taken from DOE/OR/01-2105&D1 *Soil Background Supplemental Data Set for the ETTP*. The entire background data set collected for each radionuclide was used in ProUCL 4.1 to allow two sample Wilcoxon-Mann-Whitney comparison of the sludge mean with the background mean. Where the evaluation indicated that the sludge mean was greater than the background mean, the background mean was subtracted from the sludge UCL95 prior to calculation of the fractional contribution for that radionuclide. The fractional contribution was then calculated as the UCL95 divided by the sludge guideline. Assuming secular equilibrium, the ^{226}Ra background mean was used to evaluate ^{210}Pb and the ^{228}Th background mean to evaluate ^{228}Ra. Assuming secular equilibrium, the ^{235}U UCL95 value was used to evaluate ^{231}Pa, the ^{238}U value to evaluate $^{233/234}$U, and the ^{235}U value to evaluate ^{227}Ac.

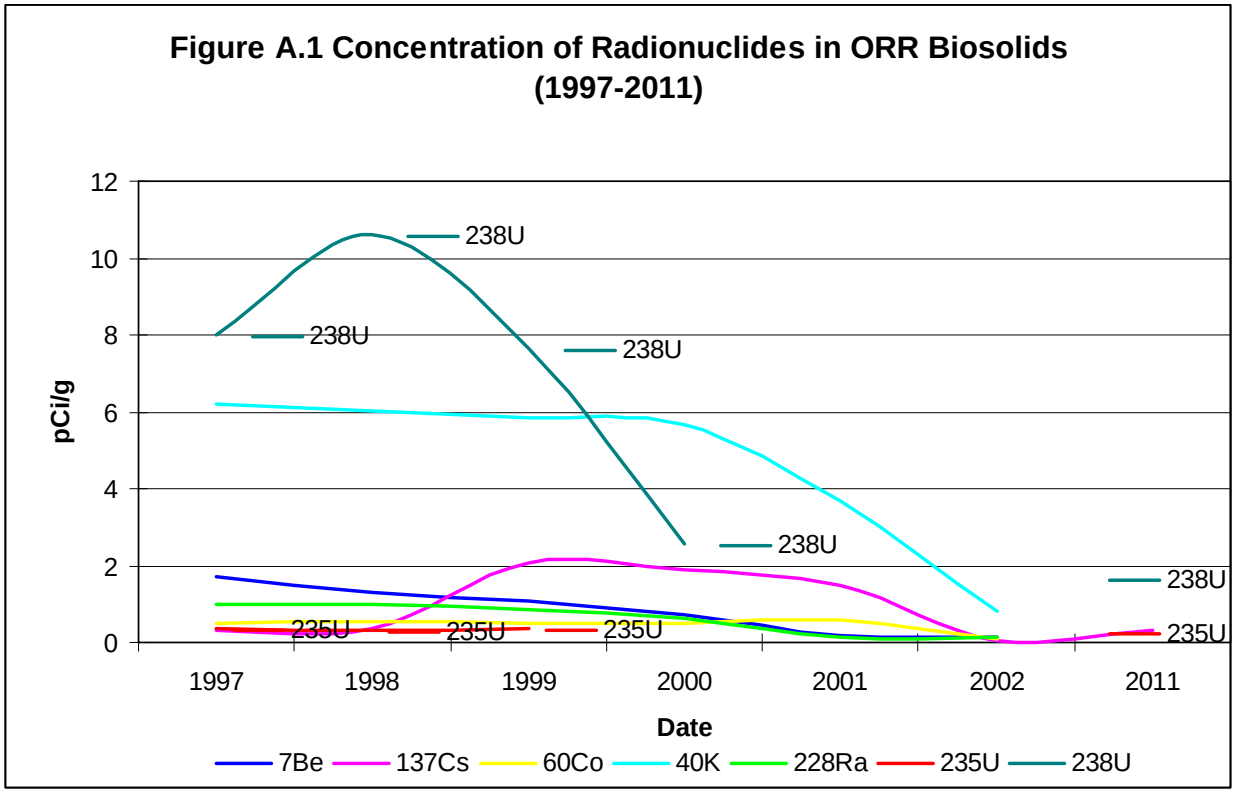
Figure A.1 Concentration of Radionuclides in ORR Biosolids
(1997-2011)
12
10
8
6
4
2
0
pCi/g
238U
238U
238U
238U
238U
235U
235U
235U
235U
1997
1998
1999
2000
2001
2002
2011
Date
7Be
137Cs
60Co
40K
228Ra
235U
238U

Table A.1. Inorganic parameters and analytical levels in City of Oak Ridge biosolids (1996–2010)

Analyte	Sampling frequency	1996 (mg/kg dry wgt) max	1997 (mg/kg dry wgt) max	1998 (mg/kg dry wgt) max	1999 (mg/kg dry wgt) max	2000 (mg/kg dry wgt) max	2001 (mg/kg dry wgt) max	2002 (mg/kg dry wgt) max	2003 (mg/kg dry wgt) max	2004 (mg/kg dry wgt) max	2005 (mg/kg dry wgt) max	2006 (mg/kg dry wgt) max	2010 (mg/kg dry wgt) max
Ammonia (as N)	3/year	28,672	43,000	33,000	41,000	33,000	28,000	680	20,000	15,590	13,700	424	27,500
Manganese	3/year	1345	1900	1400	1100	880	,000	1200	1665	1520	1430	1690	479*
Nitrate (as N)	3/year	250	220	920	1000	380	230	6.9	549	920	790	61.3	26,200
Nitrite (as N)	3/year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		1,080
Organic nitrogen	3/year	64,400	86,000	52,000	62,000	92,000	55,000	35,000	85,000	97,410	43,980	16,080	80,200
pH	3/year	8	8	8.4	7.9	7.2	10.2	9.0	7.0	7.3	6.0	6.3	5.7*
Potassium	Daily	5510	7100	4600	6000	3500	5000	1500	4261	3270	2540	1590	1,370*
Phosphorus	3/year	31,800	48,000	32,000	47,000	35,000	7000	37,000	9600	32,400	23,800	39,600	17,800*
Total Kjedahl Nitrogen	3/year	89,100	120,000	87,000	97,000	93,000	83,000	35,000	99,000	113,000	57680	16,500	108,000
Total Nitrogen	3/year	89,350	120,140	87,190	98,000	93,300	83,030	35,002	98,178	113,010	57,748.7	16,924	111,000
Total solids %	Daily	3.9%	3.6%	3.2%	3.2%	3.0%	56.7%	66.9%	4.1%	19.5%	3.1%	23.6%	1.65%
Volatile solids (% of TS)	Daily	63%	63%	64%	63%	64%	65%	48%	82%	68%	52%	79%	

Source: City of Oak Ridge
NA = Not Available
TS = total solids
* These results collected in 2009.

Table A.2. Concentrations of heavy metal levels in City of Oak Ridge biosolids (1996–2000) versus 40 CFR Part 503.13 limits

Heavy metal	40 *CFR* Part 503.13 limits	1996 (mg/kg) mean	1996 (mg/kg) max	1997 (mg/kg) mean	1997 (mg/kg) max	1998 (mg/kg) mean	1998 (mg/kg) max	1999 (mg/kg) mean	1999 (mg/kg) max	2000 (mg/kg) mean	2000 (mg/kg) max
Arsenic	**75**	6.71	12.80	2.53	7.50	2.4	4.3	2.7	4.7	2.1	3.8
Cadmium	**85**	9.92	19.40	3.60	5.20	3.1	4.8	3.4	3.8	3.1	4.5
Copper	**4300**	361.70	520.00	430.80	570.00	479.2	700.0	484.4	570.0	510.8	620.0
Lead	**840**	32.52	74.00	38.00	74.60	33.6	63.0	36.6	43.0	36.2	48.0
Mercury	**57**	2.16	8.20	12.00	20.00	11.0	16.0	10.6	19.0	6.0	11.0
Molybdenum	**75**	23.00	54.00	7.00	13.00	10.1	21.0	15.8	21.0	13.9	26.0
Nickel	**420**	26.23	39.70	28.20	42.00	33.5	100.0	25.5	47.0	63.1	100.0
Selenium	**100**	10.29	18.20	1.70	301.00	3.1	7.0	8.6	14.0	8.4	15.0
Zinc	**7500**	887.00	1610.00	1404.00	1910.00	1209.0	1600.0	1150.0	1400.0	1039.0	1600.0

Source: City of Oak Ridge; all values on dry-weight basis

Table A.3. Concentrations of heavy metal levels in City of Oak Ridge biosolids (2000-2009) versus 40 *CFR* Part 503.13 limits

Heavy metal	40 *CFR* Part 503.13 limits	2001 (mg/kg) mean	2001 (mg/kg) max	2002 (mg/kg) mean	2002 (mg/kg) max	2003 (mg/kg) mean	2003 (mg/kg) max	2004 (mg/kg) mean	2004 (mg/kg) max	2005 (mg/kg) mean	2005 (mg/kg) max	2009 (mg/kg)
Arsenic	**75**	2.6	7.7	0.4	0.8	2.8	4.6	6.0	9.5	5.4	7.0	8.08
Cadmium	**85**	3.4	5.2	3.9	9.5	1.4	1.9	1.0	1.3	0.8	1.4	0.729
Copper	**4300**	584.4	680.0	418.0	610.0	710.4	869.0	725.5	843.0	632.0	768.0	381
Lead	**840**	46.9	63.0	18.2	26.0	40.4	52.2	25.9	34.6	30.1	37.4	15.1
Mercury	**57**	6.2	12.0	1.5	3.3	4.7	6.6	4.4	5.2	5.2	6.1	1.37
Molybdenum	**75**	14.7	20.0	3.5	7.9	9.4	14.2	18.5	29.8	31.1	38.9	9.48
Nickel	**420**	166.7	410.0	66.4	98.0	44.7	88.5	21.1	35.5	22.2	26.8	16.6
Selenium	**100**	7.6	12.0	9.7	18.0	12.4	29.0	9.6	13.2	4.8	5.1	8.54
Zinc	**7500**	1116.7	1500.0	602.0	920.0	940.8	1062.0	852.3	1070.0	826.5	1020.0	743

Source: City of Oak Ridge; all values on dry-weight basis

Table A.4. NPDES organic parameters and concentrations of organic constituents in City of Oak Ridge biosolids

Analyte	Sampling frequency	1996 (mg/kg dry wt) max	1997 (mg/kg dry wt) max	1998 (mg/kg dry wt) max	1999 (mg/kg dry wt) max	2000 (mg/kg dry wt) max	2001 (mg/kg dry wt) max	2002 (mg/kg dry wt) max	2003 (mg/kg dry wt) max	2004 (mg/kg dry wt) max	2005 (mg/kg dry wt) max	2006 (mg/kg dry wt) max	2009 (mg/kg dry wt) Max
Aldrin	Annually	0.025	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
Chlordane	Annually	2.7	1.3	0.34	3.80	6.70	0.95	18.00	3.60	2.12	U	U	U
DDD	Annually	U	0.071	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
DDE	Annually	0.01	0.023	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
DDT	Annually	U	0.0071	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
Dieldrin	Annually	0.099	0.061	U	0.38	0.67	0.95	0.26	0.71	0.21	U	U	U
Heptachlor	Annually	U	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
Lindane (gamma-BHC)	Annually	U	U	U	0.38	0.67	0.95	0.26	0.36	0.21	U	U	U
PCBs	Annually	U	U	U	7.70	NA	19.0	35.00	0.46	1.10	U	U	U
Toxaphene	Annually	U	U	U	7.70	13	19.0	35.00	7.10	4.24	U	U	U
Trichloroethene	Annually	U	U	U	0.038	0.17	0.24	0.44	0.005	0.05	U	U	U
Benzo(a)pyrene	Annually	U	1.0	U	13	11	NA	U	NA	NA	NA	NA	U
Dimethylnitrosamine (n-nitroso-di-methylamine)	Annually	U	U	U	13	11	NA	NA	NA	NA	NA	NA	U
Hexachlorobenzene	Annually	U	U	U	13	11	0.24	0.44	0.005	0.05	U	U	U
Hexachlorobutadiene	Annually	U	U	U	13	11	NA	NA	NA	NA	NA	NA	U

Source: City of Oak Ridge
U = Undetected
NA = Not Available

Table A.5. Concentrations of radionuclides in City of Oak Ridge biosolids (1997–2011)

Radionuclide	Planning level[1]	Proposed guideline[2]	1997 (pCi/g) mean	1997 (pCi/g) mean	1998 (pCi/g) mean	1998 (pCi/g) max	1999 (pCi/g) mean	1999 (pCi/g) max	2000 (pCi/g) mean	2000 (pCi/g) max	2001 (pCi/g) mean	2001 (pCi/g) max	2002 (pCi/g) mean	2002 (pCi/g) max	2010 - 2011 (pCi/g)[3] mean	2010 - 2011 (pCi/g)[3] max
^{241}Am		23													0.0508	0.08
^{7}Be	NA		1.70	6.15	1.30	2.69	1.08	1.89	0.72	1.09	0.18	0.55	0.142	0.214	NA	NA
^{134}Cs		110													U	U
^{137}Cs	43.6	25	0.31	0.85	0.36	0.69	2.07	4.17	1.88	3.8	1.47	3.68	0.064	0.143	0.297	1.06
^{60}Co	10.7	25	0.51	8.96	0.52	1.17	0.51	0.80	0.48	0.81	0.57	1.38	0.0868	0.15	U	U
^{152}Eu		24													0.532	1.72
^{154}Eu		18													U	U
^{155}Eu		5500													0.102	0.48
^{131}I	NA		21.60	86.20	9.46	32.60	8.52	44.80	5.70	40.10	34.58	127.82	6.967	16.029	NA	NA
^{210}Pb		15													0.966	3.263
^{54}Mn		650													U	U
^{237}Np		4.3													0.0258	0.07
^{238}Pu		32													0.01	0.04
$^{239/240}$Pu		24													0.0483	0.11
^{40}K	120.0	16	6.19	8.08	6.04	9.27	5.86	7.24	5.67	10.43	3.68	6.46	0.803	1.211	< Bkg[4]	
^{226}Ra		0.32													< Bkg[4]	
^{228}Ra	20.7	23	1.01	1.42	0.97	1.51	0.84	1.36	0.62	0.99	0.13	0.31	0.156	0.26	< Bkg[4]	
^{90}Sr		16													0.617	1.28
^{99}Tc		102													0.168	0.98
^{228}Th		34													< Bkg[4]	
^{229}Th		4.3													0.0425	0.11
^{230}Th		43													< Bkg[4]	
^{232}Th		4.3													< Bkg[4]	
$^{233/234}$U		280													2.215	3.444
^{235}U	157.0	63	0.35	0.71	0.33	0.83	0.36	0.73	ND	ND	NA	NA	NA	NA	0.26	0.37
^{238}U	459.5	350	8.00	24.20	10.60	21.90	7.62	15.70	2.58	6.20	NA	NA	NA	NA	1.655	3.184

Source: City of Oak Ridge; all values pCi/g on a dry weight basis
U = undetected NA = Not Available

[1]Planning level based on 10 year application at 5 tons/acre/year with dose limit of 4 mrem/year (DOE/EA-1042)
[2]Sludge guidelines from Table B.1.
[3]Values corrected for soil background levels that are provided in DOE/OR/01-2105&D1 *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee,* 2003. Values represent monthly composite samples collected from June 2011 through May 2011.
[4]< Bkg: while detected, the mean for this radionuclide is below the mean of the soil background level

Table A.6. Sum of the Fractions Evaluation for the 2010-2011 Monthly Data

Radionuclide	Sludge Guideline (pCi/g)	UCL95	Distribution	Fraction
^{241}Am	23	0.0882	NP (Chebyshev)	0.00383478
^{134}Cs	110	-0.052	Normal	
^{137}Cs	25	0.477	Normal	0.01908
^{60}Co	25	0.062	Normal	0.00248
^{152}Eu	24	0.886	Gamma	0.03691667
^{154}Eu	18	0.408	NP (Chebyshev)	0.02266667
^{155}Eu	5500	0.232	Normal	4.2182E-05
^{210}Pb	15	1.971	Gamma	0.1314
^{54}Mn	650	0.171	NP (Chebyshev)	0.00026308
^{237}Np	4.3	0.0384	Normal	0.00893023
^{238}Pu	32	0.0215	Normal	0.00067188
$^{230/240}$Pu	24	0.0683	Normal	0.00284583
^{40}K	16	0	Normal	0
^{231}Pa	2.3	0.307		0.13347826
^{226}Ra	0.32	0	Normal	0
^{228}Ra	23	0	Gamma	0
^{90}Sr	16	0.798	Normal	0.049875
^{99}Tc	102	0.43	Normal	0.00421569
^{228}Th	34	0	Normal	0
^{229}Th	4.3	0.0619	Normal	0.01439535
^{230}Th	43	0	Normal	0
^{232}Th	4.3	0	Normal	0
$^{233/234}$U	280	2.599	Normal	0.00928214
^{235}U	63	0.307	Normal	0.00487302
^{238}U	350	2	Normal	0.00571429
^{65}Zn	520	0.0695	Normal	0.00013365
^{3}H	4500	1.437	Normal	0.00031933
^{227}Ac	3.2	0.307		0.0959375
			Sum:	0.54735554

UCL95: 95% upper confidence limit
Sludge guidelines taken from Appendix B, Table B.1
NP: nonparametric

Pathogens

Class A biosolids have pathogen contents that are below detection limits and are therefore suitable for use in home or community gardens. Class B solids have a pathogen content that makes it suitable to be applied in bulk form to agricultural land, forest, reclamation sites, or public sites where physical and temporal buffers exist to provide for natural attenuation and processes to reduce pathogen levels sufficiently within a short amount of time, to prevent adverse impacts to the environment.

Class A or Class B biosolids, with varying percent solids content, may be land-applied on the ORR. The City of Oak Ridge POTW is currently developing a process to produce Class B biosolids. Whether biosolids are applied in liquid or solid form, existing program limits for heavy metals, nitrogen, and radionuclides are all calculated on a dry-weight basis. For this reason, all analytical results, calculations for risk assessment, and RESRAD 6.0 modeling involving biosolids will be done on a dry-weight basis and will cover both liquid or solid materials.

Class B biosolids are well suited for land application on the ORR because the existing access restrictions further support additional time for environmental attenuation. Class A biosolids have fewer restrictions regarding how and where they can be applied, but result in higher treatment costs to meet Class A standards.

A.2 OAK RIDGE RESERVATION LAND APPLICATION SITE CHARACTERISTICS

This section discusses the six ORR sites currently utilized for biosolids application by the City of Oak Ridge. Site profile sheets are provided in Tables **A.6** through **A.11,** which present physical characteristics of the sites, nitrogen-loading, heavy metal, and radionuclide-loading levels. They also present relevant NEPA characteristics, such as threatened and endangered species, wetlands, etc.

The profiles document the vegetation type and nitrogen requirements for each site. The agronomic loading limit takes into account previous applications of biosolids, nitrogen compound levels obtained from analysis of the biosolids, and the nitrogen growth needs of the vegetation found on the application site. The plant-available nitrogen (PAN) is calculated to determine annual vegetation nitrogen needs. The calculation is presented below.

PAN = (MR)(Organic Nitrogen) + (VR)(Ammonia Nitrogen) + Nitrate Nitrogen

Where,

MR = the mineralization rate, which is the rate at which organic nitrogen is released as readily available nitrogen

VR = the volatilization rate, which is the rate at which ammonia nitrogen is released directly to the atmosphere without being utilized by plants.

This calculation is revised as new nitrogen analyses are performed. By using this methodology, all available nitrogen is utilized by the plants to sustain growth, eliminating the threat of excess nitrogen as a potential groundwater contaminant.

Table A.7. Upper Hayfield #1 site profile information

General site information	
Land application site name	Upper Hayfield #1
Gross acres	30
Application area in acres	7
Application area in hectares	2.84
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	None
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre *(Source: Code 590 Nutrient Management, National Resources Conservation Service [NRCS], 2003)*

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.38	41	0.9%
Cadmium	0.61	39	1.6%
Chromium	10.43	-	-
Copper	63.63	1500	4.2%
Lead	6.9	300	2.3%
Mercury	1.27	17	7.5%
Molybdenum	1.80	-	-
Nickel	6.77	420	1.6%
Selenium	0.84	100	0.8%
Zinc	165.73	2800	5.9%

Table A.8. Upper Hayfield #2 site profile information

General site information	
Land application site name	Upper Hayfield #2
Gross acres	27
Application area in acres	8
Application area in hectares	3.24
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth Requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels			
Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.37	41	0.9%
Cadmium	0.62	39	1.6%
Chromium	10.09	-	
Copper	54.59	1500	3.6%
Lead	6.36	300	2.1%
Mercury	1.17	17	6.9%
Molybdenum	1.09	-	
Nickel	5.23	420	1.2%
Selenium	2.21	100	2.2%
Zinc	155.68	2800	5.6%

Table A.9. High Pasture site profile information

General site information	
Land application site name	High Pasture
Gross acres	46
Application area in acres	14
Application area in hectares	5.67
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.51	41	1.3%
Cadmium	0.89	39	2.3%
Chromium	12.49	-	-
Copper	83.93	1500	5.6%
Lead	7.32	300	2.4%
Mercury	1.08	17	6.4%
Molybdenum	1.54	-	-
Nickel	10.86	420	2.6%
Selenium	2.80	100	2.8%
Zinc	187.96	2800	6.7%

Table A.10. Rogers site profile information

General site information	
Land application site name	Rogers
Gross acres	32
Application area in acres	22
Application area in hectares	8.91
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland); Karst feature (functional wetland)
Vegetation	Orchard Grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.41	41	0.7%
Cadmium	0.65	39	1.7%
Chromium	18.81	-	-
Copper	52.77	1500	3.5%
Lead	10.93	300	3.6%
Mercury	1.20	17	7.1%
Molybdenum	3.31	-	-
Nickel	6.04	420	1.4%
Selenium	0.62	100	0.6%
Zinc	147.17	2800	5.3%

Table A.11. Scarboro site profile information

General site information	
Land application site name	Scarboro
Gross acres	77
Application area in acres	45
Application area in hectares	18.23
Soil type	Fullerton association (reddish brown, silty, residual clays w/chert fragments)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management,NRCS, 2003*)

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.27	41	0.7%
Cadmium	0.47	39	1.2%
Chromium	7.47	-	-
Copper	33.32	1500	2.2%
Lead	4.24	300	1.4%
Mercury	0.76	17	4.4%
Molybdenum	0.82	-	-
Nickel	3.09	420	0.7%
Selenium	1.83	100	1.8%
Zinc	102.34	2800	3.7%

Table A.12. Watson Road site profile information

General site information	
Land application site name	Watson Road
Gross acres	117
Application area in acres	34
Application area in hectares	13.77
Soil type	Armuchee (silt loam, moderately deep shale) and Colbert (silty clay loam)
Soil density	1.6 g/cm^3
Threatened and endangered species	None
Designated wetlands on-site	Pond (jurisdictional wetland)
Vegetation	Orchard grass
Vegetation nitrogen growth requirement	120 lb/acre (*Source*: *Code 590 Nutrient Management, NRCS, 2003*)

Calculated site chemical-loading levels

Parameter	Calculated cumulative level as of 11/07/11 (kg/ha, dry wgt)	40 *CFR* Part 503, Table 2 limit (kg/ha)	% Limit
Arsenic	0.36	41	0.9%
Cadmium	0.57	39	1.4%
Chromium	8.78	-	-
Copper	44.91	1500	3.0%
Lead	5.5	300	1.8%
Mercury	0.71	17	4.2%
Molybdenum	0.85	-	-
Nickel	4.34	420	1.0%
Selenium	2.20	100	2.2%
Zinc	120.62	2800	4.3%

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APPENDIX B.
RADIOLOGICAL CONCENTRATION GUIDELINES

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Table B.1. Soil guidelines and sludge limits

Radionuclide	Soil concentration guideline (pCi/g dry wgt)	Sludge limit (pCi/g dry wgt)[a]	Source for soil guideline
^{227}Ac	0.56	3.2	DOE/EA-1042
^{241}Am	7.7	23	DOE/EA-1042
^{60}Co	1.3	25	DOE/EA-1356
^{134}Cs	2.3	110	DOE/EA-1356
^{137}Cs	5.2	25	DOE/EA-1356
^{152}Eu	2.8	24	DOE/EA-1356
^{154}Eu	2.6	18	DOE/EA-1356
^{155}Eu	99.0	5500	DOE/EA-1356
^{3}H	520	4500	DOE/EA-1042
^{40}K	5.5	16	DOE/EA-1042
^{54}Mn	5.4	650	DOE/EA-1356
^{237}Np	1.5	4.3	DOE/EA-1042
^{231}Pa	0.81	2.3	DOE/EA-1042
^{210}Pb	2.5	15	DOE/EA-1042
^{238}Pu	9.1	32	DOE/EA-1042
^{239}Pu/^{240}Pu	8.3	24	DOE/EA-1042
^{226}Ra	0.11	0.32	DOE/EA-1042
^{228}Ra	0.95	23	DOE/EA-1042
^{90}Sr	3.2	16	DOE/EA-1356
^{99}Tc	35.5	102	DOE/EA-1042
^{228}Th	0.66	34	DOE/EA-1042
^{229}Th	1.5	4.3	DOE/EA-1042
^{230}Th	14.8	43	DOE/EA-1042
^{232}Th	1.5	4.3	DOE/EA-1779
^{234}U	98	280	DOE/EA-1356
^{235}U	22	63	DOE/EA-1356
^{238}U	120	350	DOE/EA-1356
^{65}Zn	3.5	520	DOE/EA-1356

[a] Calculated based on 50-year program life cycle

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September 2010 Update

City of Oak Ridge Radionuclide Limits for Land Applied Sludge

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September 13, 2010

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Calculation of Updated Radionuclide Limits for Land-Applied Sludge

The City of Oak Ridge's existing radionuclide limits for land-applied sludge were based on the assumption of a 20-year land application period and an application rate of 4 tons/acre. In this report, the City's limits have been updated to correspond to a 50-year application period at a rate of 7 tons/acre.

The sludge limits are based on: (1) the soil concentration guidelines in Table B.2, (2) the amount of dilution expected on the application site (i.e., mixing of sludge into soil), and (3) the amount of loss that will occur due to radioactive decay during the land application period.

The sludge limits are calculated as follows:

On a per acre basis, the total quantity of a radionuclide, Q_a (pCi), that can be present in the land application site soil at the time residency begins is the soil concentration guideline multiplied by the corresponding soil mass, which is 9.15×10^5 kg (9.15×10^8 g), assuming a mixing depth of 0.15 m and a soil density of 1500 kg/m^3.

$$Q_a = C_{soila}\ (m_{soil})$$

C_{soil} – Concentration limits for radionuclide "a" in soil, (pCi/g)
m_{soil} – mass of soil in top 0.15 m of one acre, (g)

For a given radionuclide, the total activity that can be land-applied, I_a, annually on a per acre basis, assuming a constant input, without exceeding the corresponding soil concentration guideline, can be calculated as follows:

$$I_a = \frac{Q_{a(t)}\lambda}{(1-e^{-\lambda t})}$$

I_a = Annual allowable input quantity (total activity) per acre (pCi/year)
$Q_{a(t)}$ = Quantity (total activity) of radionuclide "a" per acre in top 15 cm at time, t (pCi)
λ = decay constant (years^{-1})
t = time (50 years)

The annual allowable input quantity, I_a, can then be converted to a sludge limit, SL_a, by dividing the quantity by the mass of sludge land-applied on a per acre basis each year (7 dry tons per acre per year or 6.36×10^6 g):

$$SL_a = \frac{I_a}{m_{sludge}}$$

SL_a = Sludge limit for radionuclide "a"
I_a = Annual allowable input quantity
m_{sludge} = Mass of sludge land applied annually (g)

Table B.2. City of Oak Ridge land application sludge limits (September 2010 Update)

Radionuclide	Soil concentration guideline (pCi/g dry wgt)	Sludge limit[a] (pCi/g dry wgt.)	Soil guideline dose basis
^{227}Ac	0.56	3.2	4 mrem/yr
^{241}Am	7.7	23	4 mrem/yr
^{152}Gd	19.6	56	4 mrem/yr
^{3}H	520	4500	4 mrem/yr
^{40}K	5.5	16	4 mrem/yr
^{237}Np	1.5	4.3	4 mrem/yr
^{231}Pa	0.81	2.3	4 mrem/yr
^{210}Pb	2.5	15	4 mrem/yr
^{238}Pu	9.1	32	4 mrem/yr
$^{239/240}$Pu	8.3	24	4 mrem/yr
^{226}Ra	0.11	0.32	4 mrem/yr
^{228}Ra	0.95	23	4 mrem/yr
^{99}Tc	35.5	102	4 mrem/yr
^{228}Th	0.66	34	4 mrem/yr
^{229}Th	1.5	4.3	4 mrem/yr
^{230}Th	14.8	43	4 mrem/yr
^{232}Th[b]	NA[b]	0.97	4 mrem/yr
^{54}Mn	5.4	650	10 mrem/yr
^{60}Co	1.3	25	10 mrem/yr
^{65}Zn	3.5	520	10 mrem/yr
^{90}Sr	3.2	16	10 mrem/yr
^{134}Cs	2.3	110	10 mrem/yr
^{137}Cs	5.2	25	10 mrem/yr
^{152}Eu	2.8	24	10 mrem/yr
^{154}Eu	2.6	18	10 mrem/yr
^{155}Eu	99	5500	10 mrem/yr
^{234}U	98	280	10 mrem/yr
^{235}U	22	63	10 mrem/yr
^{238}U	120	350	10 mrem/yr

[a] Fifty years of land application at an application rate of 7 dry tons per acre

[b] Based on dose source ratio for 50-year application period for on-site resident from *ISCORS Assessment of Radioactivity in Sewage Sludge: Modeling to Assess Radiation Doses* (NUREG-1783, EPA 832-R-03-002A, DOE/EH-0670). The ISCORS dose source ratio was adjusted to reflect an application rate of 7 dry tons per acre per year.

NA = not available

APPENDIX C.
SUMMARY OF SETBACKS, WETLANDS WALK OVER SURVEY REPORT OF THE BIOSOLIDS APPLICATION AREAS (JUNE 2010), AND ORR BIOSOLIDS LAND APPLICATION SITE MAPS

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Table C.1 Summary of setbacks (buffers) for protected areas on the ORR biosolids land application sites

Map feature number*	Site name	Protected area (type of wetland if applicable)	Latitude	Longitude	Setback
1	Scarboro	Pond (functional)	35º 59′ 5″	-84º 13′ 40″	30.5 m (100 ft) upgradient; 10 m (33 ft) downgradient
2	Scarboro	Wet weather ditch (functional)	35º 58′ 54″	-84º 13′ 37″	10 m (33 ft)
3	Scarboro	Pond (jurisdictional)	35º 59′ 9″	-84º 13′ 42″	30.5 m (100 ft)
4	Scarboro	Pond with sinkhole (functional)	35º 59′ 22″	-84º 13′ 45″	30.5 m (100 ft)
5	Scarboro	Pond	35º 58′ 23″	-84º 13′ 62″	10 m (33 ft)
6	Scarboro	Pond	35º 58′ 58″	-84º 13′ 67″	10 m (33 ft)
7	Upper Hayfield #2	Pond (jurisdictional)	35º 58′ 56″	-84º 14′ 0″	30.5 m (100 ft)
8	Upper Hayfield #1	Wet weather ditch	35º 59′ 23″	-84º 14′ 03″	10 m (33 ft)
9	Upper Hayfield #1	Wet weather ditch	35º 59′ 43″	-84º 14′ 96″	10 m (33 ft)
10	High Pasture	Pond (jurisdictional)	35º 58′ 34″	-84º 14′ 45″	30.5 m (100 ft)
11	Rogers	Pond (jurisdictional)	35º 58′ 45″	-84º 14′ 29″	30.5 m (100 ft)
12	Rogers	Karst feature with sinkhole	35º 58′ 35″	-84º 14′ 75″	30.5 m (100 ft)
13	Watson Road	Area near unnamed stream	35º 57′ 65″	-84º 21′ 80″	30.5 m (100 ft)
14	Watson Road	Drainage to unnamed stream	35º 57′ 27″	-84º 21′ 94″	30.5 m (100 ft)
15	Watson Road	Dry conveyance	35º 57′ 95″	-84º 21′ 61″	30.5 m (100 ft)
16	Watson Road	Pond (jurisdictional)	35º 57′ 1″	-84º 21′ 35″	10 m (33 ft)
17	Watson Road	Pond (functional)	35º 57′ 0″	-84º 21′ 36″	10 m (33 ft)

*Feature numbers refer to Figs. 3 and 5 from Sect. 1.4 and the Appendix C maps

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Wetlands Walk Over Survey Report of the Biosolids Application Areas

Date Issued – June, 2010

Prepared by
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Prepared for the
U.S. Department of Energy
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BECHTEL JACOBS COMPANY LLC
Managing the
Environmental Management Activities at the
East Tennessee Technology Park
Y-12 National Security Complex Oak Ridge National Laboratory
Under contract DE-AC05-98OR22700-M198
for the
U.S. DEPARTMENT OF ENERGY

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1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

An Environmental Assessment (EA), DOE/EA-1356 (*Environmental Assessment, Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation*), was issued in February 2003 for the Biosolids program on the Oak Ridge Reservation (ORR) and a FONSI was issued. The Department of Energy (DOE) proposes to modify the Biosolids program, which will result in several changes not analyzed in DOE/EA-1356. The analysis included in DOE/EA-1356 is based on a wetlands survey conducted in 1996 (Science Application International Corporation [SAIC 1996). However, an informal survey conducted in 2009 identified potential additional wetland areas. CDM was contracted to perform a formal wetlands survey for all six active application sites (Table C.2) and an analysis of potential impacts to all wetlands. This information will be included in a new EA to be prepared as directed by the Environmental Assessment Determination (EAD) issued by DOE on February 10, 2010.

Table C.2. Oak Ridge Reservation biosolids land application sites (1996 Survey)

Site name	Gross acreage (ac)	Hectares (ha)
Upper Hayfield #1	30	12.15
Upper Hayfield #2	27	10.93
High Pasture	46	18.62
Watson Road	117	47.37
Scarboro	77	31.17
Rogers	32	12.96

1.2 BACKGROUND

The topography of the application areas varies from steep ridged slopes to relatively flat lying floodplains. Karst features and rock outcrops are common. The majority of the application areas are well drained due to the slopes and high relief, but low relief, poorly drained areas are common. The ORR includes a wide variety of habitats. These include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, ponds (both permanent and vernal), streams, wetlands, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and associated wildlife have received limited human disturbance since 1942. The ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program. The ORR has also been established as a Wildlife Management Area under a cooperative agreement between DOE and the Tennessee Wildlife Resources Agency (TWRA) and includes the 20,000-acre Oak Ridge National Environmental Research Park and several state Natural Areas.

Aquatic habitats on the ORR include small streams, Bear Creek, East Fork Popular Creek, the Clinch River, and several scattered ponds. Several species of fish, reptiles, and amphibians are found in these areas.

All six of the biosolids application sites are open grassland field areas surrounded, for the most part, by woodlands. The sites are devoid of caves, perennial streams, and large bodies of water. Small ponds and vernal ponds occur on all six of the locations. These features provide ecological habitat for amphibians, as well as other wildlife. Two of the locations (Rogers and Scarboro) include rock outcrop features and sinkholes. Boundaries of the application sites are dominated by mature hardwood tree species that provide suitable habitat for a wide variety of plant and animal species.

The Clean Water Act (CWA) prohibits significant discharges of pollutants, including those from municipal sewage sludge, into waters of the state without a permit authorizing these discharges. Under the CWA, 40 *CFR* 503 regulates the disposal of municipal sewage sludge. Unlike many other aspects of the CWA, the state of Tennessee does not enforce the Section 503 requirements directly. Instead, these requirements for the treatment and disposal of sewage sludge are included in the National Pollutant Discharge Elimination System Permits that the state of Tennessee issues to sewage treatment facilities. All activities must be in compliance with the requirements of these regulations and permits. In addition, the state of Tennessee has published guidance for the protection of surface water and wetlands during land application operations (TDEC 2011). The guidance considers the nature of the biosolids, method of application, the slope of the land receiving the biosolids, and proximity of surface water of wetlands.

2. METHODOLOGY

2.1 ECOLOGICAL WALK OVER SURVEYS

Ecological walk over surveys were conducted at the six active sites (High Pasture, Rogers, Upper Hayfield #1, Upper Hayfield #2, Scarboro, and Watson Road) for biosolids application. Aerial maps (figures) of the six proposed locations were developed. These figures include the delineation of potentially ecologically sensitive features with proposed buffers.

Ecological features such as ponds, wetlands, vernal ponds, streams, rock outcrops, sinkholes, fields, and forests were checked on each site. A map of the ORR, depicting 15 ponds and wetlands within the Bethel Valley sludge application areas was used for initial planning. All 15 of these areas were also field checked. Observations were recorded in order to develop the figures showing the ecological features. Surface water bodies were documented on the area maps. Suspected wetlands areas were investigated using protocols outlined in the *United States Army Corps of Engineers Wetlands Delineation Manual* (Y-87-1). Hydrology of the area, relative dominance of hydrophilic plant species, and soil and sediment characteristics were all considered in the wetlands determinations.

For the biosolids area study, key characteristics looked for in the field were:

- Visible signs of the wetlands hydrology (the areas either had standing water at the time of the investigation, or there were physical clues such as watermarks, channels, and so on that indicated that the area was frequently inundated)
- Wetland type soil (gleyed or mottled soils), which were compared to color chips for the evaluation
- Wetland-type vegetation. In the areas in question, these species were predominantly herbaceous.

Potential wetlands must meet all three criteria in order to be afforded the status of jurisdictional wetlands.

2.2 PREVIOUS INVESTIGATIONS

Documents of previous investigations were reviewed, including DOE/EA-1356 with the results of the 1996 Science Applications International Corporation investigation, and the relevant Resource Management Plans for the ORR (ORNL/NERP-7 and -8). These studies identified several wetlands in and near the application areas. All of these areas were included in the 2010 walkover surveys.

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3. OBSERVATIONS

3.1 GENERAL OBSERVATIONS

While there are no major streams that are adjacent to or run through the existing land application sites, the ORR biosolids land application sites have a number of small tributaries and streams that exist in wooded areas and boundaries of the active sites. These tributaries are protected by buffer zones that prohibit the land application of biosolids material.

There are a number of ponds, depressions, and other areas of internal drainage. Some of the ponds are old farm ponds. Other ponds were formed when roadbeds blocked wet weather conveyances. Due to the steep slopes across much of the region, very few natural ponds are found in the application areas. Some of the depressions are located in mowed fields, and are otherwise indistinguishable from the surrounding fields. Largely due to the steepness of the slopes in many of the application areas, even the depressed areas are often well drained, or form ephemeral ponds. Only a few (6) of the potential wetlands areas were found to meet all of the criteria of a jurisdictional wetlands (Table C.3). Most of these wetlands areas are associated with small ponds. All of the jurisdictional wetlands noted in this survey are small and isolated wetlands. The locations of these jurisdictional wetlands are documented on the maps. These areas will be marked in the field with flagging to assist both maintenance and application personnel in avoiding these areas.

Table C.3. Jurisdictional wetlands on Oak Ridge Reservation biosolids land application sites (2010 Survey)

Site name	Latitude	Longitude
High Pasture	35º 58′ 34″	-84º 14′ 45″
Rogers	35º 58′ 45″	-84º 14′′ 29″
Upper Hayfield #1 and Upper Hayfield #2	35º 58′ 56″	-84º 14′ 0″
Scarboro	35º 59′ 9″	-84º 13′ 42″
Watson Road	35º 57′ 1″	-84º 21′ 35″

Several other areas did not meet all three criteria for jurisdictional wetlands, but still functioned as wetland areas. It is recommended that these areas receive the same protection afforded to the jurisdictional wetlands. These areas are also marked on the appropriate maps.

3.1 SPECIFIC JURISDICTIONAL WETLAND AREAS

3.1.1 High Pasture (Figs. C.1 and C.2)

- A small wetland well within the application area.
- Completely surrounded by a buffer of briers, small trees, and grasses.
- The slope of the surrounding area is relatively steep (slopes in the 8-15% range to the west), increasing the probability of runoff from biosolids applied upslope from the wetland entering the wetlands.

Fig. C.1. High Pasture Wetlands (35º 58′ 34″, -84º 14′ 45″).

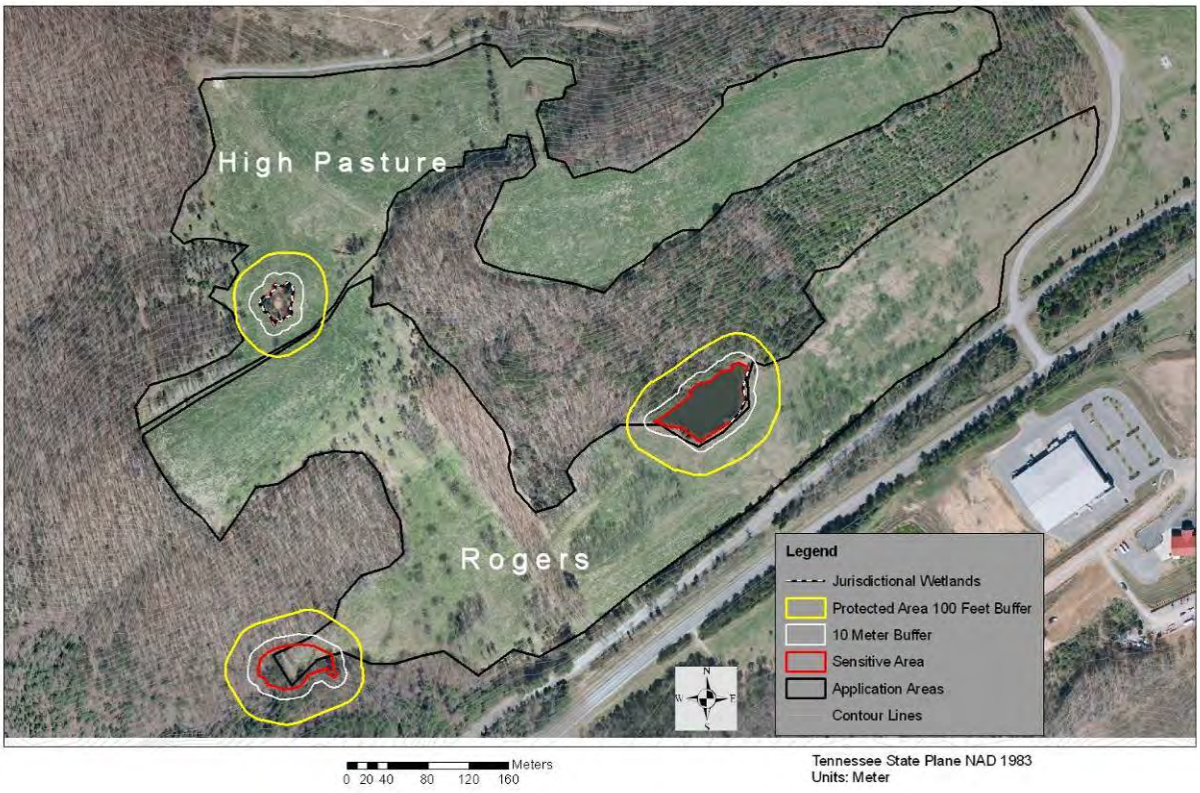

Fig. C.2. High Pasture and Rogers area.

3.1.2 Rogers (Figs. C.2 and C.3)

- A small jurisdictional wetland area associated with a large pond. The pond is located north of, and on the upslope edge of, the application area.
- The wetland skirts the southern and eastern edge of the pond (Fig. C.2), and follows a small stream that drains out of the pond to the east.
- The wetland is unlikely to be seriously impacted by biosolids applied south (down slope) of the pond, although application to the area immediately to the west of the pond increases the probability of runoff entering the pond. The slope in this area is estimated to be in excess of 15% to the northwest of the pond.

Fig. C.3. Rogers wetlands (35º 58′ 45″, -84º 14′ 29″).

3.1.3 Upper Hayfield #1/Upper Hayfield #2 (Figs. C.4 and C.5)

- Small, discontinuous wetland associated with a permanent pond. The wetland is restricted to a thin line around the edges of the pond.
- The pond lies within Upper Hayfield #2.
- Steep slopes surrounding the pond increase the probability of runoff from the application areas entering the pond and wetland if a substantial buffer is not applied. These slopes are estimated to range from 8-15%.

Fig. C.4. Upper Hayfields wetlands (35º 58′ 56″, -84º 14′ 0″).

Fig. C.5. Upper Hayfields wetlands area.

3.1.4 Scarboro (Figs. C.6 and C.7)

- The area noted in Fig. C.6 and the middle of Fig. C.7 is very small, and probably ephemeral.
- This area serves as habitat for several species of amphibians.
- The slopes immediately surrounding this area are moderate (0 – 8% range).

At the time of the investigation, the vegetative buffer was thin, and was less than 10 m.

Fig. C.6. Scarboro wetland (35° 59′ 9″, -84° 13′ 42″).

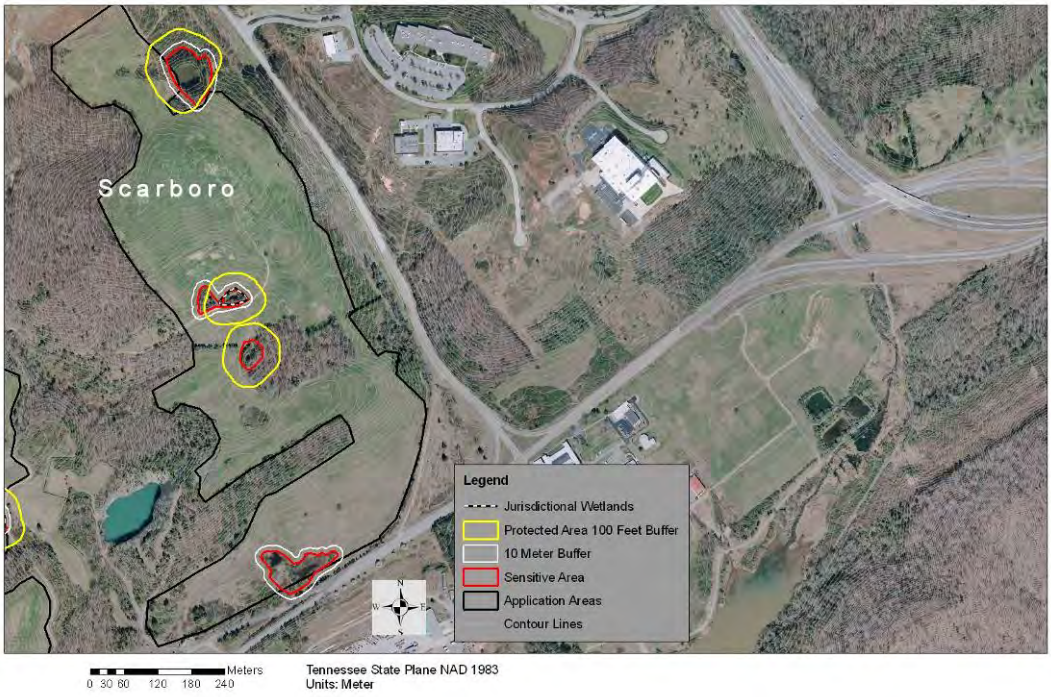

Fig. C.7. Scarboro wetland area.

3.1.5 Watson Road Wetlands (Figs. C.8, C.9 and C.10)

In the Watson Road area, two small areas were noted that met the criteria for jurisdictional wetlands (Figs. C.8 and C.9). These areas are located within the application area fields. Neither area had a vegetative buffer zone at the time of the investigation

3.1.5.1 Watson Road-East Wetlands (Figs. C.8 and C.9)

- The eastern area was very small, and a subsequent site walk showed that it had dried out since the initial inspection.
- At the time of the site walk, there was no apparent vegetative buffer.
- Slopes immediately surrounding the area are very gradual.
- At the time of the initial site walk, this wetland served as habitat for amphibians.
- This area was not identified in the earlier reports.

3.1.5.2 Watson Road-West Wetlands (Figs. C.9 and C.10)

- The western wetland, although small, is larger and deeper than the eastern area.
- At the time of the site walk, there was no apparent vegetative buffer.
- Slopes immediately surrounding the area are very gradual (0 – 8% range).
- At the time of the initial site walk, this wetland served as habitat for amphibians.
- This area was not identified in the earlier reports.

Fig. C.8. Watson Road-eastern wetlands area (35º 57′ 1″, -84º 21′ 35″).

Fig. C.9. Watson Road-western wetlands (35º 57′ 0″, -84º 21′ 36″).

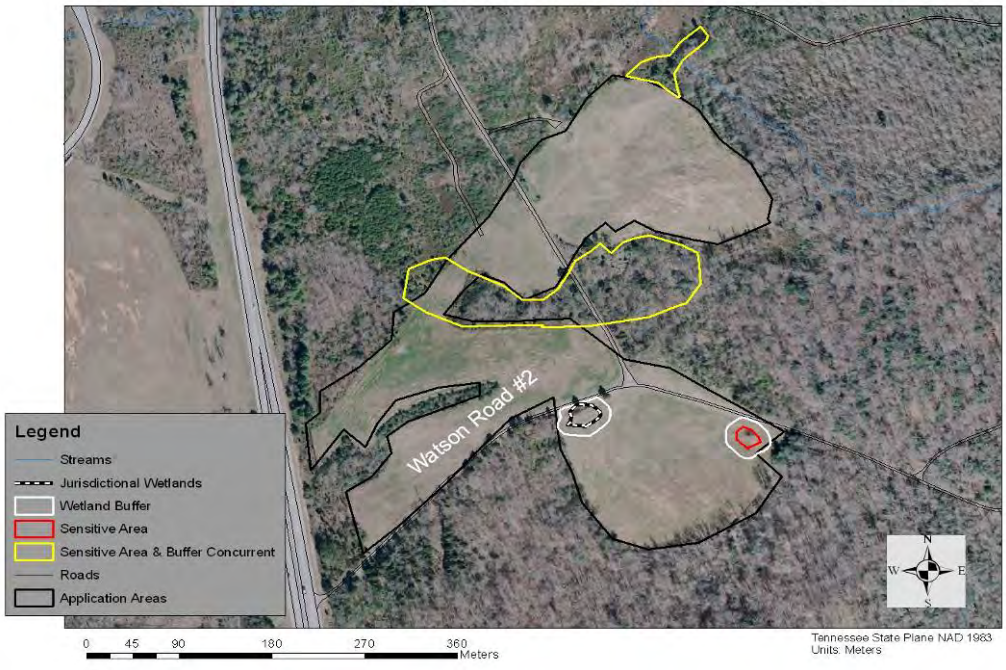

Fig. C.10. Watson Road-west wetlands.

3.2 Functional Wetland Areas

In addition to the jurisdictional wetlands described above, there are several areas that perform the function of wetlands. These areas, while not meeting all of the criteria for jurisdictional wetlands, serve as habitat for amphibians, birds, and other wildlife. Four significant functional wetlands are listed in Table C.4. It is recommended that these four areas be afforded the same degree of protection as the jurisdictional wetlands.

Table C.4. Functional wetlands on ORR biosolids land application sites (2010 Survey)

Site name	Latitude	Longitude
Scarboro	35º 59′ 5″	-84º 13′ 40″
Scarboro	35º 58′ 54″	-84º 13′ 37″
Scarboro	35º 59′22″	-84º 13′ 45″
Watson Road	35º 57′ 0″	-84º 21′ 36″

4. CONCLUSIONS

The biosolids application areas contain both surface water and wetlands areas. These areas are of variable ecological importance, and current conditions, such as vegetative cover or topography, make some areas more suitable than others for the proposed application of biosolids. While many areas (such as the Rogers wetlands area and the northern Scarboro pond) should receive little negative impact from the proposed operations, other areas will continue to need protection, at least at the current levels. The wetlands areas in the Bethel Valley area had been previously identified. However, the two wetlands identified in the Watson Road area had not been identified in the 1996 survey. Maps (Figs. C.1–C.10) depict the sensitive areas (both jurisdictional and functional wetlands), as well as associated buffer zones. All of the wetland areas noted in this survey are presented on these maps.

Many of the areas proposed to receive the biosolids have steep slopes. In some cases, such as the High Pasture, Upper Hayfields #1 and #2, and Scarboro wetlands, the surface water and wetland areas are situated such that runoff of biosolids would be very likely to enter these areas if application occurs to the edge of the buffer zone. Figures C.11 and C.12 depict the slopes within the biosolids application areas. Figure C.11 illustrates slopes in the 8-15% range near surface water features, and Rogers has slopes in excess of 15% near one of its ponds.

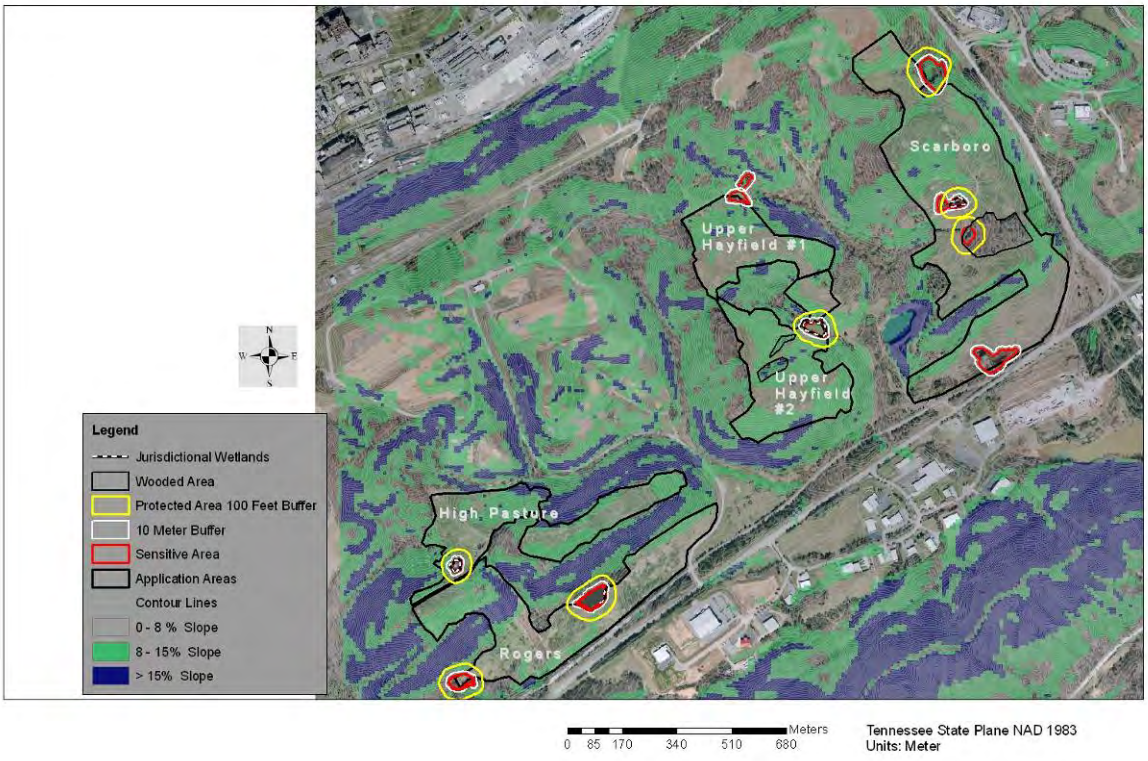

Fig. C.11. Bethel Valley biosolids application area with slopes.

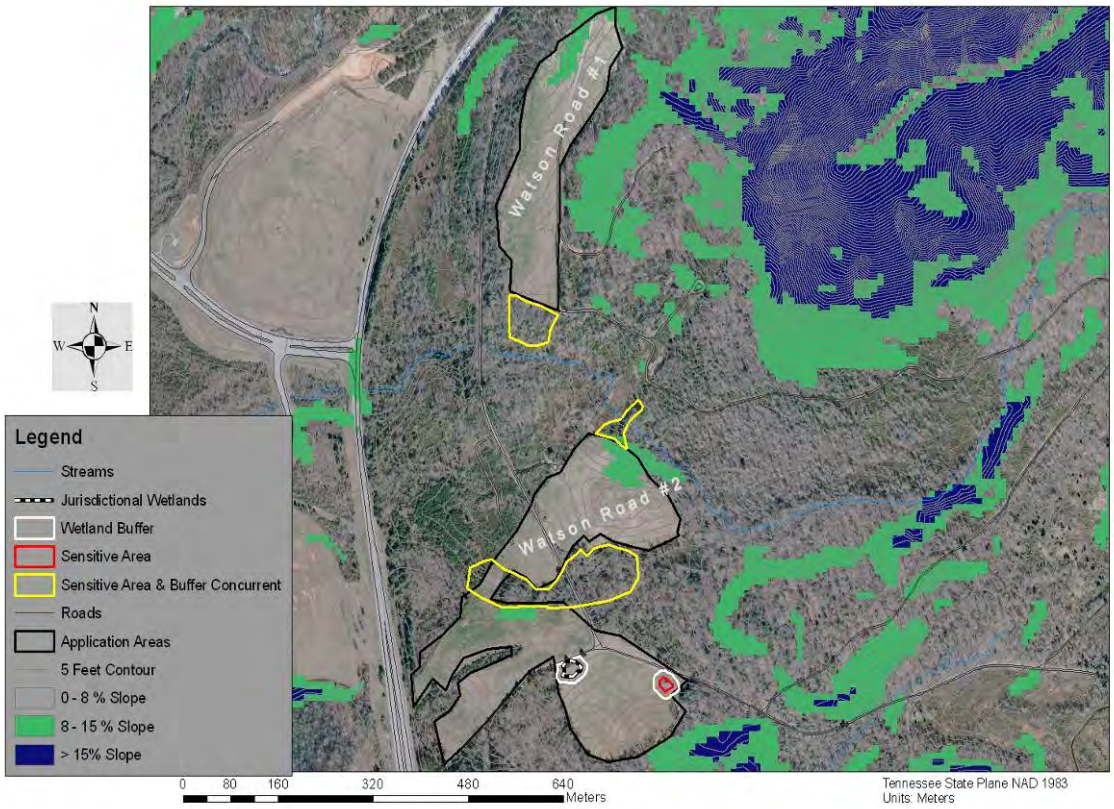

Fig. C.12. Watson Road biosolids application area with slopes

5. RECOMMENDATIONS FOR MITIGATION

Recommendations for mitigation is as follows:

- Clearly delineate buffer areas of the wetlands shown on Figs. C.1-C.3 and C.5-C.10.
- Due to the potential for runoff from biosolids application, buffers greater than 10 m should be considered on areas with steep slopes leading into wetlands areas in the High Pasture, Upper/Lower Hayfields, and Scarboro Road application areas identified in this report.
- A 10-m buffer area is recommended as a no disturbance buffer. Disturbance from mowing, plowing, etc. should be prohibited within the buffer areas. By adopting and maintaining these areas as no disturbance buffer areas, impacts to wetland, creeks, drainages, ponds, and vernal ponds could be limited.

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6. REFERENCES

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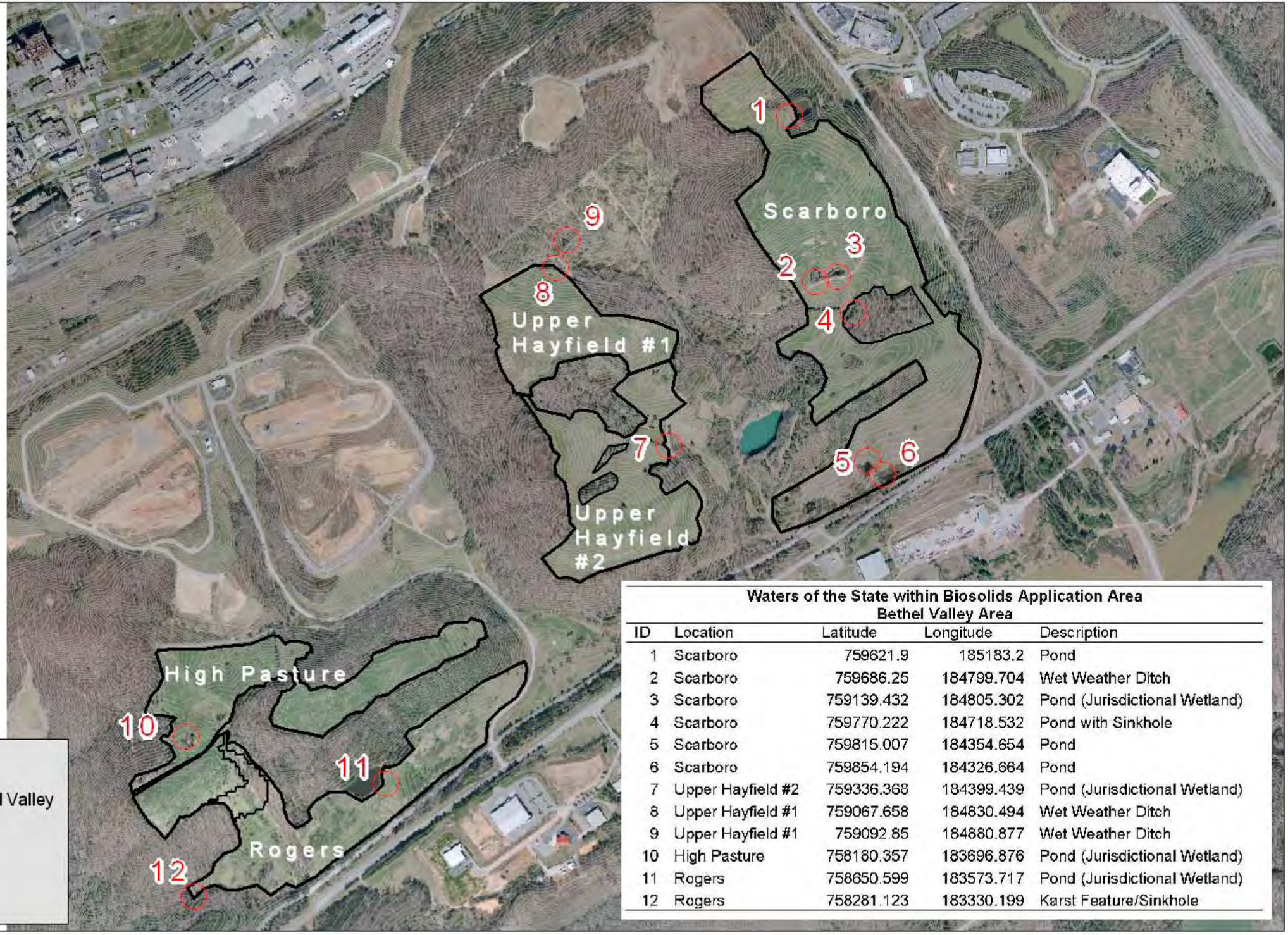
Figure C.13 Bethel Valley Biosolids Application Sites with Proposed Buffers

Figure C.14 Bethel Valley Biosolids Application Sites - Waters of the State



Waters of the State within Biosolids Application Area
Bethel Valley Area

ID	Location	Latitude	Longitude	Description
1	Scarboro	759621.9	185183.2	Pond
2	Scarboro	759686.25	184799.704	Wet Weather Ditch
3	Scarboro	759139.432	184805.302	Pond (Jurisdictional Wetland)
4	Scarboro	759770.222	184718.532	Pond with Sinkhole
5	Scarboro	759815.007	184354.654	Pond
6	Scarboro	759854.194	184326.664	Pond
7	Upper Hayfield #2	759336.368	184399.439	Pond (Jurisdictional Wetland)
8	Upper Hayfield #1	759067.658	184830.494	Wet Weather Ditch
9	Upper Hayfield #1	759092.85	184880.877	Wet Weather Ditch
10	High Pasture	758180.357	183696.876	Pond (Jurisdictional Wetland)
11	Rogers	758650.599	183573.717	Pond (Jurisdictional Wetland)
12	Rogers	758281.123	183330.199	Karst Feature/Sinkhole

Figure C.15 Bethel Valley Biosolids Application Sites with Slope Indicator

Figure C.16 Watson Road Biosolids Application Site Areas with Proposed Buffers

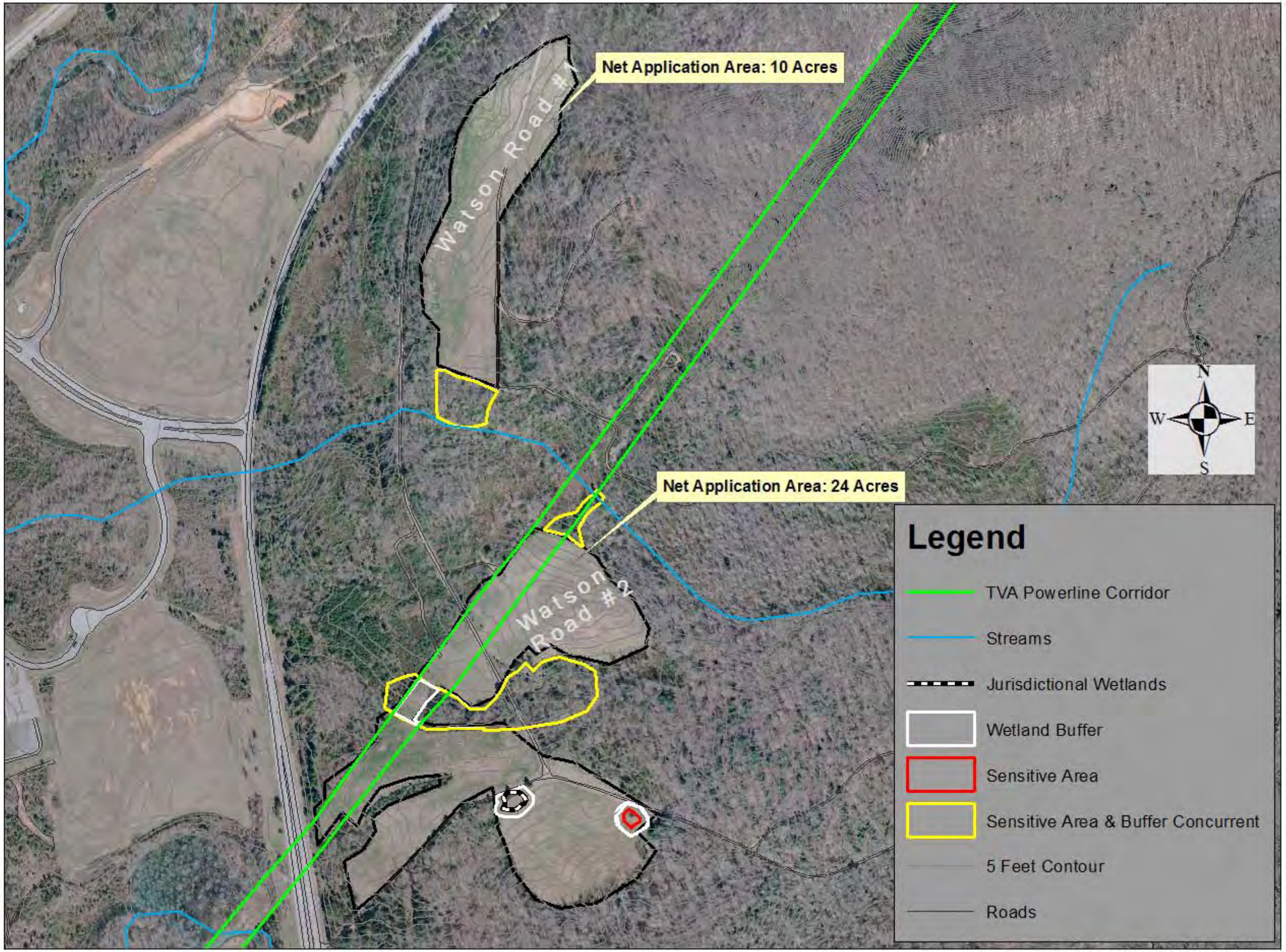
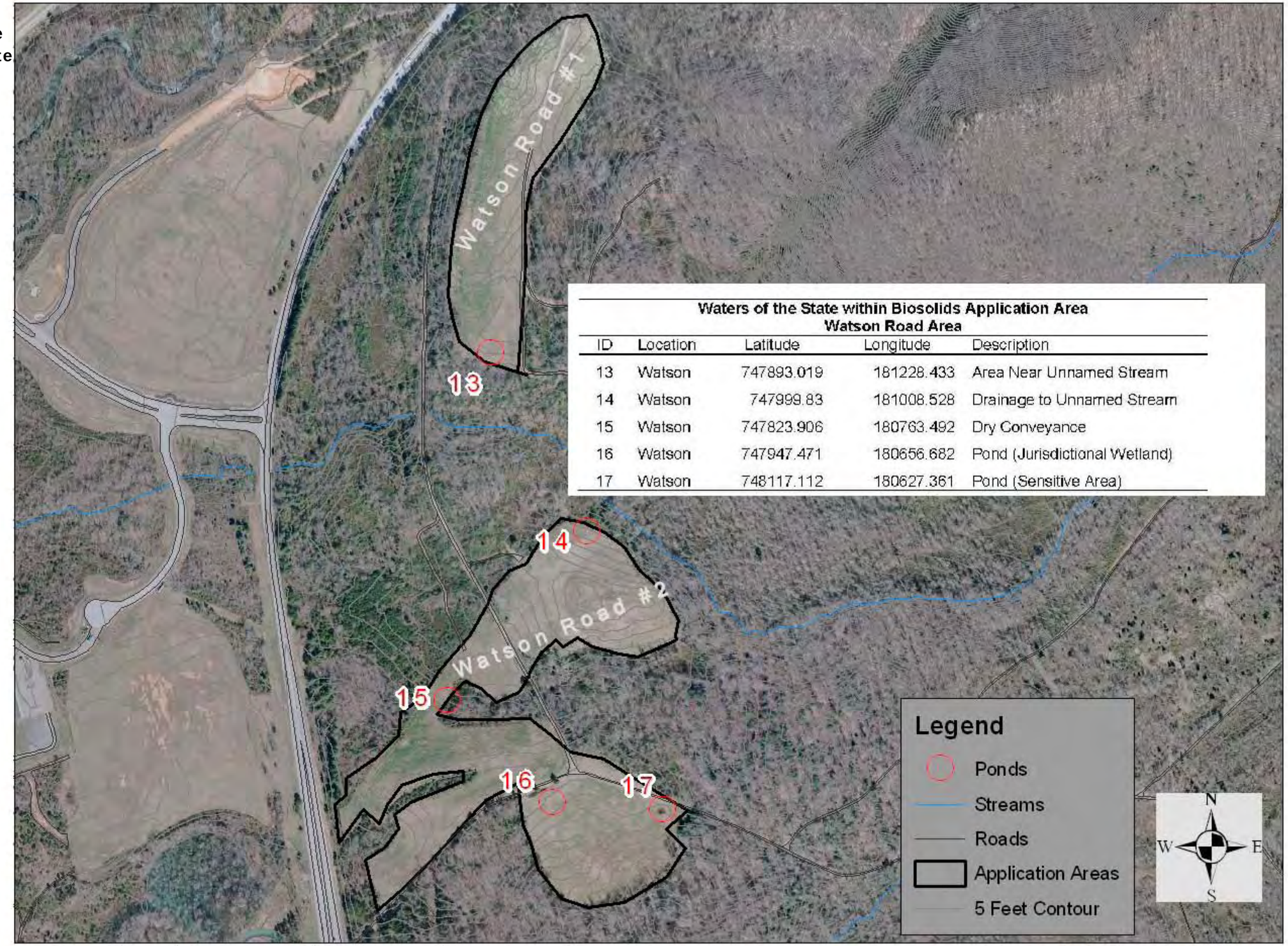


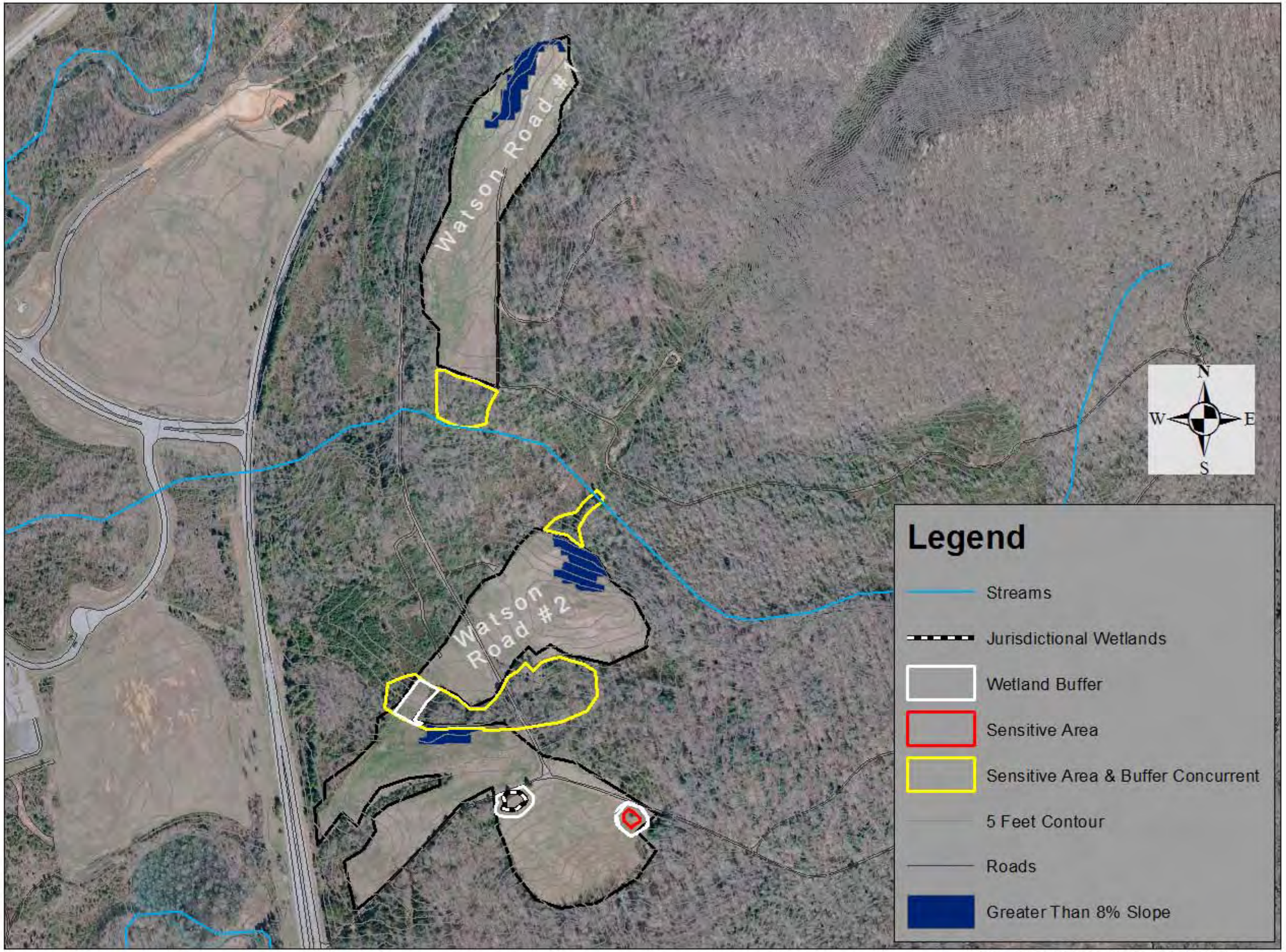
Figure C.17 Watson Road Biosolids Application Site Areas - Waters of the State



Waters of the State within Biosolids Application Area
Watson Road Area

ID	Location	Latitude	Longitude	Description
13	Watson	747893.019	181228.433	Area Near Unnamed Stream
14	Watson	747999.83	181008.528	Drainage to Unnamed Stream
15	Watson	747823.906	180763.492	Dry Conveyance
16	Watson	747947.471	180656.682	Pond (Jurisdictional Wetland)
17	Watson	748117.112	180627.361	Pond (Sensitive Area)

Figure C.18 Watson Road Biosolids Application Site Areas with Slope Indicator



APPENDIX D.
ORR ANIMAL SPECIES OF SPECIAL CONCERN AND LISTED SPECIES WALK OVER SURVEY REPORT OF THE BIOSOLIDS LAND APPLICATIONS AREAS (JUNE 2010), AND APPLICATION SITE MAPS

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The following list identifies sensitive wildlife species found on the Oak Ridge Reservation. Some of these (e.g., anhinga) have been seen only once or a few times; others (e.g., sharp-shinned hawk, southeastern shrew) are comparatively common and widespread on the reservation. (Updated April 2010.)

Table D.1. Animal species of special concern reported from the Oak Ridge Reservation [a]

Scientific name	Common name	Status [b]		
		Federal	State	PIF [c]
Fish				
Phoxinus tennesseensis	Tennessee dace		NM	
Amphibians and Reptiles				
Cryptobranchus alleganiensis	Hellbender	MC	NM	
Hemidactylium scutatum	four-toed salamander		NM	
Birds				
DARTERS				
Anhinga anhinga	Anhinga		NM	
BITTERNS & HERONS				
Ardea alba	great egret		NM	
Egretta caerulea	little blue heron		NM	
Egretta thula	snowy egret		NM	
KITES, HAWKS, EAGLES, & allies				
Haliaeetus leucocephalus	bald eagle	[d]	NM	
Circus cyaneus	northern harrier		NM	
Accipiter striatus	sharp-shinned hawk		NM	
Buteo platypterus	broad-winged hawk			RI
FALCONS				
Falco peregrinus	peregrine falcon	[e]	E	RI
GROUSE, TURKEY, & QUAIL				
Bonasa umbellus	ruffed grouse			RI
Colinus virginianus	northern bobwhite			RI
RAILS, GALLINULES, & COOTS				
Gallinula chloropus	common moorhen		NM	
OWLS				
Aegolius acadicus	northern saw-whet owl	MC	T	RI
Tyto alba	barn owl		NM	
GOATSUCKERS				
Caprimulgus carolinensis	chuck-will's-widow			RI
Caprimulgus vociferus	whip-poor-will			RI
SWIFTS				
Chaetura pelagica	chimney swift			RI

Table D.1. Animal species of special concern reported from the Oak Ridge Reservation [a] (cont.)

Scientific name	Common name	Status [b]		
		Federal	State	PIF [c]
KINGFISHERS				
Ceryle alcyon	belted kingfisher			RI
WOODPECKERS				
Melanerpes erythrocephalus	red-headed woodpecker			RI
Sphyrapicus varius	yellow-bellied sapsucker	MC	NM	
Picoides pubescens	downy woodpecker			RI
Colaptes auratus	northern flicker			RI
TYRANT FLYCATCHERS				
Contopus cooperi	olive-sided flycatcher		NM	RI
Contopus virens	eastern wood-pewee			RI
Empidonax traillii	willow flycatcher			RI
Empidonax virescens	Acadian flycatcher			RI
SWALLOWS				
Progne subis	purple martin			RI
TITMICE & CHICKADEES				
Poecile carolinensis	Carolina chickadee			RI
NUTHATCHES				
Sitta pusilla	brown-headed nuthatch			RI
KINGLETS, GNATCATCHERS, & THRUSHES				
Hylocichla mustelina	wood thrush			RI
THRASHERS & MOCKINGBIRDS				
Toxostoma rufum	brown thrasher			RI
SHRIKES				
Lanius ludovicianus	loggerhead shrike	MC	NM	RI
VIREOS				
Vireo flavifrons	yellow-throated vireo			RI
WOOD WARBLERS				
Vermivora chrysoptera	golden-winged warbler	MC	NM	RI
Vermivora pinus	blue-winged warbler			RI
Dendroica cerulea	cerulean warbler		NM	RI
Dendroica discolor	prairie warbler			RI
Dendroica fusca	blackburnian warbler			RI
Mniotilta varia	black-and-white warbler			RI
Helmitheros vermivorum	worm-eating warbler			RI
Seiurus motacilla	Louisiana waterthrush			RI
Oporornis formosus	Kentucky warbler			RI
Wilsonia canadensis	Canada warbler			RI

Table D.1. Animal species of special concern reported from the Oak Ridge Reservation [a] (cont.)

Scientific name	Common name	Status [b]		
		Federal	State	PIF [c]
Wilsonia citrina	hooded warbler			RI
Icteria virens	yellow-breasted chat			RI
TANAGERS				
Piranga olivacea	scarlet tanager			RI
Piranga rubra	summer tanager			RI
CARDINALS, GROSBEAKS, & allies				
Passerina cyanea	indigo bunting			RI
TOWHEES, SPARROWS, & allies				
Pipilo erythrophthalmus	eastern towhee			RI
Spizella pusilla	field sparrow			RI
Ammodramus savannarum	grasshopper sparrow			RI
Pooecetes gramineus	vesper sparrow		NM	
BLACKBIRDS & allies				
Sturnella magna	eastern meadowlark			RI
Mammals				
Myotis grisescens	gray bat	E	E	
Sorex longirostris	southeastern shrew		NM	
Zapus hudsonius	meadow jumping mouse		NM	

[a] Land and surface waters of the ORR exclusive of the Clinch River, which borders the ORR.
[b] E = endangered, T = threatened, MC = species of management concern, NM = in need of management, RI = regional importance
[c] Partners in Flight (PIF)
[d] The bald eagle was federally delisted effective August 8, 2007.
[e] The peregrine falcon was federally delisted effective August 25, 1999.

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Listed Species Walk Over Survey Report of the Biosolids Application Areas

Date Issued—June 2010

Prepared by
CDM Federal Services Inc.
Oak Ridge, Tennessee 37830
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BECHTEL JACOBS COMPANY LLC

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1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

An Environmental Assessment (EA), DOE/EA-1356, was issued in February 2003 for the Biosolids program on the Oak Ridge Reservation (ORR) and a finding of No Significant Impact (FONSI) was issued. The Department of Energy (DOE) proposes to modify the Biosolids program, which will result in several changes not analyzed in DOE/EA-1356. CDM was contracted to perform a formal listed species survey for all six active application sites (Table D.2). This information will be included in a new EA to be prepared as directed by the Environmental Assessment Determination (EAD) issued by DOE on February 10, 2010.

Table D.2. Oak Ridge Reservation biosolids land application sites (1996 Survey)

Site name	Gross acreage (ac)	Hectares (ha)
Upper Hayfield #1	30	12.15
Upper Hayfield #2	27	10.93
High Pasture	46	18.62
Watson Road	117	47.37
Scarboro	77	31.17
Rogers	32	12.96

1.2 PURPOSE OF LISTED SPECIES WALK OVER SURVEYS

The purpose of this report is to document observations made during walk over surveys conducted between March 30 and April 2, 2010 on the six active land application sites included in the Biosolids Program. The focus of the surveys was on state-listed and federally-listed species that may use the subject area and potentially ecologically sensitive habitat areas that support these species.

This report assumes that nutrient, heavy metal, and radionuclide loading will be limited to ensure the protection of all ecological receptors. The report includes the following sections: Introduction and Background (Sect. 1), Methodology (Sect. 2), Observations and Database Consultation (Sect. 3), Conclusions (Sect. 4), Recommendations (Sect. 5), and References (Sect. 6).

1.3 BACKGROUND

Terrestrial habitats on the ORR include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and associated wildlife have received limited human disturbance since 1942. In 1988 the ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program. The ORR has also been established as a Wildlife Management Area under a cooperative agreement between DOE and the Tennessee Wildlife Resources Agency (TWRA) and includes the 20,000-acre Oak Ridge National Environmental Research Park and several state Natural Areas.

The ORR contains a wide diversity of quality wildlife habitats. Habitats include hardwood forest, mixed forest, forest edge, field, wetland, riparian, and shrub. Many of the wildlife species, such as the white-tailed deer (*Odocoileus virginianus*), are ubiquitous and can be found in almost any habitat, although they may show a preference for a certain type. Other species, such as the blue grosbeak (*passerina caerulea*) or yellow-breasted chat (*Icteria virens*), are to be found only in specific habitat types, while yet others require large tracts of unbroken forest (e.g., pileated woodpecker [*Dryocopus pileatus*]).

Hunting on the ORR occurs for wild turkey (*Meleagris gallopavo*), white-tailed deer, and Canada goose (*Branta canadensis*). Public deer, goose, and turkey hunts on the ORR are managed by the TWRA. These are the only hunting activities allowed on the ORR (Neil Giffen, March 26, 2010, ORNL, personal communication).

Aquatic habitats on the ORR include small streams, Bear Creek, East Fork Poplar Creek, the Clinch River, and several scattered ponds. Several species of fish, reptiles, and amphibians are found in these areas. Muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) are found close to aquatic areas. The muskrat prefers open terrain where aquatic vegetation and dense growths of riparian grasses, sedges, and rushes exist, and beavers are found in locations where there are trees for food and for building dams and lodges. Mink (*Mustela vison*) and raccoon (*Procyon lotor*) are found in aquatic habitats, but range into forest and field areas. Large mammals visit aquatic areas to drink water.

All six of the active application sites within the Biosolids Program are open grassland field areas surrounded, for the most part, by woodlands. The sites are devoid of caves, perennial streams, and large bodies of water. Small ponds and vernal ponds occur on all six of the locations. These features provide ecological habitat for amphibians, as well as other wildlife. Two of the locations (Rogers and Scarboro) include rock outcrop features and sinkholes. Boundaries of the application sites are dominated by mature hardwood tree species that provide suitable habitat for a wide variety of plant and animal species.

2. METHODOLOGY

2.1 ECOLOGICAL WALK OVER SURVEYS

Ecological walk over surveys were conducted at the six active application sites (High Pasture, Rogers, Upper Hayfield #1, Upper Hayfield #2, Scarboro, and Watson Road). Aerial map figures (i.e., Figs. D.1-D.6, shown at the end of this appendix) of the six sites were developed. These figures include the delineation of potentially ecologically sensitive features, proposed buffer areas that may be considered in the EA, and surface slope information.

Ecological features such as ponds, wetlands, vernal ponds, streams, rock outcrops, sinkholes, fields, and forests were checked on each site. Previously identified ponds at the sites were also field checked. Observations were recorded in order to develop the figures showing the ecological features. Wildlife species encountered during the walk over surveys were also noted.

2.2 DATABASE CONSULTATION OF LISTED AND RARE WILDLIFE SPECIES

Three different databases for listed and rare species were consulted in concert with the ecological walk over surveys. The Tennessee Natural Heritage Program Rare Species Observations for Anderson County and Roane County was checked for state and federally listed species that might use the habitats in and around the biosolids application areas (Tennessee Natural Heritage 2009). Species lists and observation record information from the ORR, including information on federally-listed, state-listed, and Partners in Flight (PIF) species of regional importance (i.e., ORR species of special concern) were checked for species of ORR concern that may be impacted by the biosolids application (Rarewildlifelist 2010). Last, the Tennessee Wildlife Resources Commission (TWRC) wildlife in need of management list (Proclamation No. 00-14) was consulted to make sure all species listed as in need of management have been considered.

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3. OBSERVATIONS AND DATABASE CONSULTATION

General observations from the walk over surveys are discussed in Sect. 3.1. Endangered, threatened, wildlife in need of management, and ORR special concern species are discussed in Sect. 3.2. Within this section the results of the database consultation are also discussed.

The ecological walk over surveys resulted in a number of areas being noted and mapped as ecological features to be considered for buffering from biosolids application. These areas are discussed in Sects. 3.3 and 3.4. Consultation with three databases of listed species revealed a number of listed species, along with their associated habitats, as worthy for consideration of protection from the application of biosolids.

3.1 GENERAL OBSERVATIONS

Most of the wildlife species observed during the walk over surveys are those typical of the ORR.

Birds observed include woodpeckers (common flicker [*Colaptes auratus*], downy woodpecker [*Picoides pubescens*], hairy woodpecker [*Picoides villosus*], pileated woodpecker [*Dryocopus pileatus*], and red-bellied woodpecker [*Melanerpes carolinus*]), hawks (red-shouldered [*Buteo lineatus*] and red-tailed [*Buteo jamaicensis*]), sparrows (American tree [*Spizella arborea*], chipping [*Spizella passerina*], field [*Spizella pusilla*], song [*Melospiza melodia*], and white-throated [*Zonotrichia albicollis*]), vultures (black [*Coragyps atratus*] and turkey [*Cathartes aura*]), and thrushes (eastern bluebird [*Sialia sialis*], eastern phoebe [*Sayornis phoebe*], and eastern wood pewee [*Contopus virens*]). Common birds of forest and forest edges identified include crow (*Corvus brachyrhynchos*), robin (*Turdus migratorius*), gnatcatcher (*Polioptila caerulea*), jay (*Cyanocitta cristata*), cardinal (*Cardinalis cardinalis*), thrasher (*Toxostoma rufum*), chickadee (*Poecile carolinensis*), wren (*Thryothorus ludovicianus*), mockingbird (*Mimus polyglottos*), titmouse (*Baeolophus bicolor*), towhee (*Pipilo erythrophthalmus*), and turkey (*Meleagris gallopavo*). Other bird species noted during the surveys were American kestrel (*Falco sparverius*), belted kingfisher (*Ceryle alcyon*), black-crowned night heron (*Nycticorax nycticorax*), cedar waxwing (*Bombycilla cedrorum*), European starling (*Sturnus vulgaris*), killdeer (*Charadrius vociferous*), mourning dove (*Zenaida macroura*), and pine warbler (*Dendroica pinus*).

Mammals observed during the surveys included eastern chipmunk (*Tamias striatus*), eastern gray squirrel (*Sciurus carolinensis*), northern raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Amphibians observed during the surveys were bull frog (*Lithobates catesbeianus*), chorus frogs (*Pseudacris triseriata*), eastern newts (*Notophthalmus viridescens*), and spring peepers (*Pseudacris crucifer*).

3.2 THREATENED, ENDANGERED, AND WILDLIFE SPECIES IN NEED OF MANAGEMENT

A number of surveys have been completed previously on the ORR prior to the walk over surveys documented in this report. Some of these are listed below.

1996–Survey of protected terrestrial vertebrates on the ORR (Mitchell et al. 1996).

1997–Threatened and Endangered Species Survey was conducted by TN & Associates, Inc., of the biosolids application areas on the ORR in the spring and summer of 1997 (TN & Associates, 1997). The objective of the study was to survey six active and one inactive biosolids application sites in search of federally and state-listed threatened and endangered plant species and vertebrate habitat.

2003–The 2003 Environmental Assessment (EA) included a summary of previously completed surveys along with the results of plant and animal surveys that were conducted by grouping the listed species known to occur on the ORR (or for which there is habitat) according to their environmental requirements (e.g., water and light availability). Potential listed habitat on the biosolids application sites was categorized according to physical gradients, the resulting intersection of potential habitat and protected species guided the surveys. Plant species were actively searched in the early spring and late summer growing seasons (DOE/EA-1356).

3.2.1 Plants

All six of the sites are fields that are mowed bi-annually. These fields do not provide potential habitat for listed plant species. A plant survey was conducted as part of the previously completed biosolids application EA and no listed plant species were identified (DOE/EA-1356). In addition, no listed species were identified during the walk over surveys. Habitats in adjacent areas, such as forests and ridges, may provide the potential for listed plants to exist. These adjacent areas would be protected from impacts from the biosolids application with the maintenance of a buffer between the fields of application and the surrounding habitats.

3.2.2 Vertebrates

As stated earlier, three sources were consulted, including the Tennessee Natural Heritage Program, the ORR species of concern list, and the Tennessee Wildlife Resources Agency (TWRA). These sources were consulted in concert with the ecological walkover surveys to make determinations regarding ecologically sensitive areas. Information from the ORR (Rarewildlifelist 2010) was checked for species of ORR concern that may be impacted by the proposed biosolids application. Last, the TWRC wildlife in need of management list (Proclamation No. 00-14) was consulted to make sure all species listed as in need of management have been considered.

3.2.2.1 Species Considered But Eliminated

After the walk over surveys and consultation with the above referenced databases, eight species listed with the state of Tennessee as “in need of management” that were thought as possibly present in the vicinity of the biosolids application area, were eliminated from further consideration and concern. The ORR Wildlife Coordinator checked this list and confirmed that they are not expected to be present on the ORR for the reasons provided in Table D.3 (Neil R. Giffen, April 13, 2010, ORNL, personal communication).

Table D.3. Tennessee State listed species that were considered and then eliminated

Species	Genus Species	Rationale	State status
Swainson's warbler	*Limnothlypis swainsonii*	No records on the ORR	**In need of management**
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*	Listed as in the area in 1964, but not documented on the ORR. No records in more recent studies from 1996 to the present.	**In need of management**
Eastern wood rat	*Neotoma floridana*	No records on the ORR	**In need of management**
Woodland jumping mouse	*Napaeozapus insignis*	Listed on an undated historical list. No records in more recent studies from 1996 to the present.	**In need of management**
Cinereus shrew	*Sorex cinereus*	Listed on an undated historical list. No records in more recent studies from 1996 to the present.	**In need of management**
Long-tailed shrew	*Sorex dispar*	Listed on an undated historical list. No records in more recent studies from 1996 to the present.	**In need of management**
Smoky shrew	*Sorex fumeus*	Listed on an undated historical list. No records in more recent studies from 1996 to the present.	**In need of management**
Southern bog lemming	*Synaptomys cooperi*	Listed on an undated historical list. No records in more recent studies from 1996 to the present.	**In need of management**

Source: Tennessee Natural Heritage (July 2009) and the ORR wildlife list (Rarewildlifelist 2010).

3.2.2.2 Federal and Tennessee State Listed Species

There are a total of eleven federal- and state-listed species that could occur in the vicinity of the biosolids application areas (Table D.3). These species are listed on the Tennessee Natural Heritage Program Rare Species Observations for Anderson County and Roane County and have been documented to be present on the ORR (Tennessee Natural Heritage 2009). The state-listed species are also listed on TWRC wildlife in need of management list (Proclamation No. 00-13).

Habitat for all of these species potentially occurs in the vicinity of the biosolids application areas. The one possible exception to this is the Indiana bat. There are no records of the Indiana bat being identified on the ORR since the 1950s. However, the United States Fish and Wildlife Service (USFWS) requires the protection of Indiana bat habitat because the ORR area is within the historic range of the species. Trees that may serve as potential roosts (i.e., trees 6 inches diameter at breast height or larger with exfoliating bark, cracks, or crevices) may be removed between October 15 and March 31. If potential roost trees are to be removed outside of that window, two nights of mist netting are required to confirm the absence of Indiana bats (Neil R. Giffen, April 13, 2010, ORNL personal communication).

The list provided in Table D.3 is updated from the list provided in DOE/EA-1356. The updated list is based on current field observations of the biosolids application areas, habitats located in the vicinity of the biosolids application areas, all available records and observations for the ORR, and a current check of the databases mentioned previously.

The application sites offer potentially suitable habitats to five state-listed bird species: the cerulean warbler, northern harrier, sharp-shinned hawk, vesper sparrow, and yellow-bellied sapsucker (Table D.3). Cerulean warblers are potential forest breeders on the ORR and have been documented as present during breeding bird surveys on the ORR. The northern harrier is a wintering species and has been observed from time to time foraging in the Freel's Bend area of the ORR (Neil R. Giffen, April 27, 2010, ORNL, personal communication). Sharp-shinned hawks are a year-round resident of the ORR and are a forest breeder. These hawks usually feed along the edges of forests and fields. The ORR is at the edge of the northern boundary of the vesper sparrow's wintering range and the southern extent of its breeding range. Vesper sparrows have been identified on the ORR in the past and have the potential to use the biosolids application areas. Yellow-bellied sapsuckers are a fairly common wintering woodpecker and use forest and forest edge habitats.

In addition to the listed Indiana bat and birds which were discussed previously, there are three mammals (gray bat, meadow jumping mouse, and southeastern shrew), one salamander (four-toed salamander), and one fish (Tennessee dace) which may use the biosolids application areas or habitats nearby. The gray bat has been documented on the ORR, foraging along the Clinch River. There is a slight possibility that this bat could forage along the water courses that are near the biosolids application sites. The meadow jumping mouse and the southeastern shrew have been identified on the ORR. The jumping mouse prefers moist grasslands near ponds or streams, while the southeastern shrew prefers forest and forests near wet areas. The four-toed salamander requires vernal ponds and woodlands, but will wander from time to time from these habitats. This salamander has been documented in 1996 south of the Watson Road location and in 2009 on Chestnut Ridge on the Bear Creek Valley side (Neil R. Giffen, April 27, 2010, ORNL, personal communication). Tennessee dace is a small fish that has been documented in the unnamed creek near the Watson Road area (Figs. D.4, D.5, and D.6). This unnamed tributary creek is documented in the 1993 Resource Management Plan for the ORR as within the Aquatic Natural Area (ANA) 3 of the ORR (ORNL 1993). This unnamed creek eventually flows to the north into lower East Fork Poplar Creek.

Table D.4. Federal- and Tennessee State-listed species that could be present in the vicinity of the proposed biosolids application areas

Species	Genus species	State and federal status	Notes
Cerulean warbler	*Dendroica cerulean*	Tennessee in need of management	Documented on the ORR
Northern harrier	*Circus cyaneus*	Tennessee in need of management	Documented on the ORR
Sharp-shinned hawk	*Accipiter striatus*	Tennessee in need of management	Documented on the ORR
Vesper sparrow	*Pooecetes gramineus*	Tennessee in need of management	Documented on the ORR
Yellow-bellied sapsucker	*Sphyrapicus varius*	Tennessee in need of management	Documented on the ORR
Four-toed salamander	*Hemidactylium scutatum*	Tennessee in need of management	Documented on the ORR
Gray bat	*Myotis grisescens*	Federally endangered	Forage along water courses
Indiana bat	*Myotis sodalis*	Federally endangered	Not documented since the 1950s on ORR, but habitat protected because within historic range of species
Meadow jumping mouse	*Zapus hudsonius*	Tennessee in need of management	Documented on the ORR
Southeastern shrew	*Sorex longirostris*	Tennessee in need of management	Documented on the ORR
Tennessee dace	*Phoxinus tennesseensis*	Tennessee in need of management	It is documented that Tennessee dace are in the unnamed tributary near the Watson Road application areas within Aquatic Natural Area (ANA) 3 of the ORR.

3.2.2.3 ORR Special Concern Species

Partners-In-Flight notes a number of birds as being of regional importance. Table D.5 lists these ORR species of special concern that are potential breeders or year-round residents of the biosolids application areas. Many of the species listed in Table D.5 are dependent or partially dependent on the forested habitats that are near or adjacent to all of the biosolids application areas. Many others are dependent or partially dependent on the field habitats that would be used for biosolids application.

3.3 BETHEL VALLEY AREAS ECOLOGICAL FEATURES

The entire Bethel Valley area is shown in Figs. D.1, D.2, and D.3. Figure D.1 shows the locations of ecologically sensitive areas with proposed buffer zones, Fig. D.2 identifies the waters of the state within the application sites, and Fig. D.3 presents quantitative information regarding slopes at the sites. The Bethel Valley area includes five of the six biosolids application sites: High Pasture, Rogers, Upper Hayfield #1, Upper Hayfield #2, and Scarboro. Ecologically sensitive features are described below.

3.3.1 High Pasture (Fig. D.2, Location 10)

This area contains a very small pond with wetlands and frog egg masses, surrounded by steep slopes to the southwest of the parcel. Chorus frogs and peepers were heard at this pond.

3.3.2 Rogers (Fig. D.2)

Throughout are planted walnuts (*Juglans nigra*) and a large grove of sycamore (*Platanus occidentalis*) trees that bisect the area in a north-south direction.

- (Location 11) One fairly large pond on the northern edge of the eastern portion of the area. The pond receives drainage from the west and north and then has a discharge to the east.
- (Location 12) Drainage feature into a rock outcrop and sinkhole in the extreme western portion of the Rogers area. Drainage comes into the sinkhole from the south and, for the most part, from the large field to the east. Chorus frogs and peepers were heard in this area.

3.3.3 Upper Hayfield #1 (Fig. D.2)

This field includes a couple of low spots in the southern portion and comes within a few feet of a pond that straddles the Hayfield #1 and #2.

- (Location 8) In the northeast corner there is a drainage feature that does not hold water all of the time.
- (Location 9) Across the road from the drainage feature and to the north is a pond surrounded by trees and shrubs. This pond appears to fluctuate quite a bit, depending on rainfall.

3.3.4 Upper Hayfield #2 (Fig. D.2, Location 7)

Adjacent to the northeast portion of this field is a pond. This pond borders the gravel road to the east with grass, shrubs, and trees surrounding the pond, and steep slopes to the south.

Table D.5. This table identifies birds that are listed for regional importance by Partners in Flight, listed as species of special concern on the ORR, and either are potential breeders or year-round residents of the biosolids application areas (source: PIF 2010).

Common name	Scientific name
Acadian flycatcher	*Empidonax virescens*
belted kingfisher	*Ceryle alcyon*
black-and-white warbler	*Mniotilta varia*
blue-winged warbler	*Vermivora pinus*
broad-winged hawk	*Buteo platypterus*
brown thrasher	*Toxostoma rufum*
Carolina chickadee	*Poecile carolinensis*
cerulean warbler	*Dendroica cerulea*
chimney swift	*Chaetura pelagica*
chuck-will's-widow	*Caprimulgus carolinensis*
downy woodpecker	*Picoides pubescens*
eastern meadowlark	*Sturnella magna*
eastern towhee	*Pipilo erythrophthalmus*
eastern wood-pewee	*Contopus virens*
field sparrow	*Spizella pusilla*
grasshopper sparrow	*Ammodramus savannarum*
hooded warbler	*Wilsonia citrina*
indigo bunting	*Passerina cyanea*
Kentucky warbler	*Oporornis formosus*
Louisiana waterthrush	*Seiurus motacilla*
northern bobwhite	*Colinus virginianus*
northern flicker	*Colaptes auratus*
prairie warbler	*Dendroica discolor*
purple martin	*Progne subis*
whip-poor-will	*Caprimulgus vociferus*
red-headed woodpecker	*Melanerpes erythrocephalus*
scarlet tanager	*Piranga olivacea*
summer tanager	*Piranga rubra*
willow flycatcher	*Empidonax traillii*
wood thrush	*Hylocichla mustelina*
worm-eating warbler	*Helmitheros vermivorus*
yellow-breasted chat	*Icteria virens*
yellow-throated vireo	*Vireo flavifrons*

3.3.5 Scarboro (Fig. D.2)

This is the largest of the active application sites.

- (Location 1) Pond to the north surrounded by fairly steep slopes and loblolly pines (*Pinus taeda*). Remnants of a former homestead were also noted.
- (Locations 2 & 3) A pond/wetland area near the center of the Scarboro area. Egg masses, frogs, and newts were present in the pond.
- (Location 4) One vernal pond in the south central portion of the site. This pond is surrounded by cedars and hardwoods, is adjacent to a sinkhole and is part of a rock outcrop feature that continues to the east and encompasses a woodlot to the east. Chorus frogs and peepers were heard and seen in the pond. This vernal pond/woodland provides habitat for variety of salamanders, frogs, and listed birds.
- (Locations 5 & 6) In the extreme southern portion of the field is an east-west oriented segment of the Scarboro area. The west border includes some old field-type habitat. In the center of this portion of the area are two ponds. The northern of the two is a typical pond with cleared field up to the edge, along with some trees and shrubs. This pond is connected to another pond just to the south via a drainage line. The southern most of the two ponds appears to be a pond with a level that fluctuates with rainfall runoff. This pond contained frog egg masses, and chorus frogs and peepers were heard.

3.4 WATSON ROAD AREA

The Watson Road area is shown in Figs. D.4, D.5, and D.6 and depict the ecologically sensitive areas, details regarding identified waters of the state, and regional slope information, respectively. This area includes one field area to the north and then a series of connected fields to the south.

3.4.1 Watson Road Northern Field (Fig. D.5, Location 13)

This area is adjacent to an unnamed stream to the south. This stream is reported to contain Tennessee dace. This dace is a Tennessee fish species “in need of management.”

3.4.2 Watson Road Southern Field (Fig. D.5)

Four ecologically sensitive areas were identified on the southern fields of the Watson Road site and are discussed below.

- In the northeast corner (Location 14), there is a drainage that feeds into an unnamed stream. Tennessee dace, a Tennessee species “in need of management” is thought to inhabit the stream. Chorus frogs, peepers, birds, as well as signs of other wildlife, were seen in this area.
- There is an east-west drainage system that bisects the area (Location 15). This system drains the wooded areas to the east and continues through a culvert under a gravel road, continues through another wooded area westward, and then finally crosses a narrow portion of the field as the drainage continues west.
- A small vernal pond (Location 16) is located in the south central portion of the southern Watson Road area. This pond contained many egg masses of three different species of frogs.
- A small vernal pond (Location 17, eastern marginal wetland) is located in the southeastern corner of the area. At the time of the walk over survey this pond contained water, along with egg masses of two different species of frogs. At the time of the walk over, tractor and mower tracks were visible within the pond. When field-checked a couple of weeks after the walk over, the pond appeared to be completely dried up.

4. CONCLUSIONS

The ecological walkdowns conducted for the biosolids application areas resulted in identification of ecologically sensitive areas to be considered in the biosolids EA. Section 3.3 identifies those sensitive areas for the application sites located on Bethel Valley Road, and Sect. 3.4 identifies those for the Watson Road application area.

4.1 FEDERAL AND TENNESSEE STATE LISTED SPECIES

All six of the sites are fields that are mowed periodically. These fields do not provide potential habitat for listed plant species. A plant survey was conducted as part of the previously completed biosolids application EA and no listed plant species were identified (DOE/EA-1356). In addition, no listed species were identified during the walk over surveys of March 30-April 2, 2010. Habitats in adjacent areas, such as forests and ridges, may provide the potential for listed plants to exist. These adjacent areas would be protected from impacts from the biosolids application with the maintenance of a buffer between the fields of application and the surrounding habitats.

Biosolids application can have either favorable or detrimental effects on vertebrate habitat, depending on the species. Application requires that vehicular access be maintained (DOE/EA-1356). For all of the six study areas this means that the areas are mowed at least once, and usually twice, each year to prevent the development of woody plant species. Mowing maintains the areas in pastureland or hayfield condition, dominated by grassy plant species such as fescue and orchard grass. This habitat, although limited in value to many listed species (i.e., forest dependent species), would be beneficial to others (i.e., species dependent on open field habitats).

The ORR biosolids application sites provide suitable habitat for eleven listed species, including five birds (cerulean warbler, northern harrier, sharp-shinned hawk, vesper sparrow, yellow-bellied sapsucker), four mammals (gray bat, Indiana bat, southeastern shrew, and meadow jumping mouse), one salamander (four-toed salamander) and one fish (Tennessee dace). (See Table D.3.) The gray bat and Indiana bat are federally endangered and are discussed first below.

At the request of the U.S. Fish and Wildlife Service, a Biological Assessment (BA) was performed in 2002 to evaluate the specific impacts of the proposed actions upon the federally endangered gray and Indiana bats, as documented in DOE/EA-1356. Many of the conclusions of the BA are still valid. The results of the BA were that neither of these species would be expected to be impacted, if present, due to restrictions regarding the application of biosolids within 500 ft of a U.S. Waterway, the extremely low levels of radionuclides found in application site soils and plant tissues that have been observed through program monitoring, and the low occurrence of potential roosting habitat (e.g., caves, exfoliating trees) on the active application sites. Specifically, the BA found that the proposed action would be unlikely to adversely impact the gray bat for the following reasons:

- The absence of caves from the ORR application sites, reducing the likelihood of roosting habitat
- The absence of large water bodies present on the application sites, reducing the likelihood of foraging habitat
- The rigorous radionuclide monitoring program in place and the extremely low to non-detectable levels of radionuclides found in application site soils and vegetation, reducing the likelihood of accumulation of radionuclides within insects that consume vegetation that represent a food source for the gray bat

- The established buffer zone of 500 ft around existing bodies of water on the application sites prohibiting the application of biosolids, reducing the likelihood of direct or indirect contact with biosolids being applied if the gray bat is present.

Because the first three reasons are still valid, a reduced buffer around waters of the state would likely still not adversely impact the gray bat. Besides the gray bat and Indiana bat, two state-listed mammals may use the biosolids application areas. These two species are southeastern shrew and meadow jumping mouse. (See Table D.3.) The southeastern shrew is a species of shrew in the Soricidae family that lives in forests near wet areas. Some level of buffering should be established to protect the forest habitats needed for this shrew. The meadow jumping mouse prefers moist grasslands near ponds or streams. Ponds would be buffered and protected from the biosolids application. Similar to the vesper sparrow, impacts to this mouse could be minimized by avoiding mowing operations from May to August to allow completion of the breeding cycle. Assuming the planned mowing of the fields in the proposed program is the same as proposed in the 2003 EA, mowing would occur in spring and early fall. Impacts from machinery used on the fields for the application of the biosolids, maintenance of the fields, etc. would occur; however, impact could be minimized if mowing did not occur during the meadow jumping mouse breeding cycle.

The four-toed salamander prefers vernal ponds and forest habitats for key portions of its life cycle. The ponds on the biosolids application sites should have protective buffer zones established to protect them from biosolids operations. The adjacent woodlands to vernal ponds are important to salamanders such as the four-toed salamander. Such a pond and woodland habitat occur in the middle of the Scarboro site and is recommended to be buffered from the biosolids application (Fig. D.2, Location 4). Four-toed salamanders tend to wander during different parts of the year. Because of this, limiting mowing to once a year would also be beneficial to this salamander.

Tennessee dace are reported as living in the unnamed creek adjacent to the Watson Road site (Fig. D.4). This unnamed tributary is within the ANA 3 of the ORR (ORNL/NERP-8). Protecting this unnamed creek from the runoff from the biosolids application fields would also protect the habitat of this Tennessee State fish species in need of management.

5. RECOMMENDATIONS FOR MITIGATION

Recommendations for mitigation include:

- Clearly delineate buffer areas to be protective of environmentally sensitive habitats shown on Fig. D.1.
- Monitor nutrient, heavy metal, and radionuclide loading to ensure the protection of ecological receptors.
- Due to the potential for runoff from biosolids application, buffers larger than 10 m should be considered on areas with steep slopes leading into the ecological sensitive areas identified in this report. Minimize mowing of all the proposed biosolids application fields. Limiting mowing to one time a year in late fall or winter would be beneficial to species using the fields and the field edges. May to August would be times most critical to breeding wildlife using the fields.
- A 10-m buffer area is recommended as a no disturbance buffer. Disturbance from mowing, plowing, etc. should be prohibited within the buffer areas. By adopting and maintaining these areas as no disturbance buffer areas, impacts to resident wildlife and listed species habitats (e.g., forest, wetland, creeks, drainages, pond, vernal pond, rock out crops, sinkholes) could be limited. Wildlife species that would benefit from the buffering include birds, mammals, reptiles, amphibians, and fish. Listed species benefiting from the no disturbance buffer include two federally endangered species (Table D.3), nine state in need of management species (Table D.3), and thirty-one ORR species of concern (Table D.4).

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6. REFERENCES

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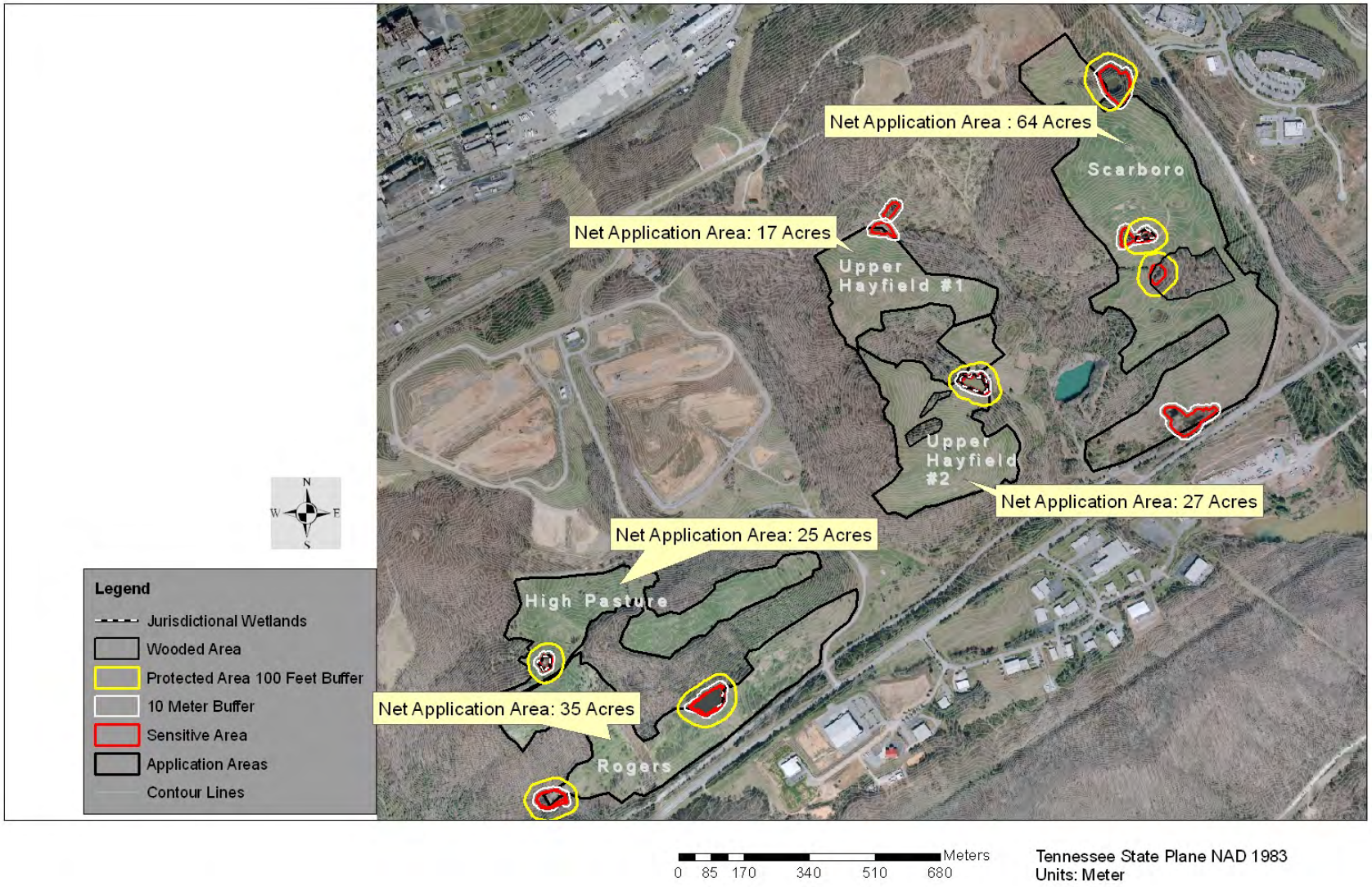
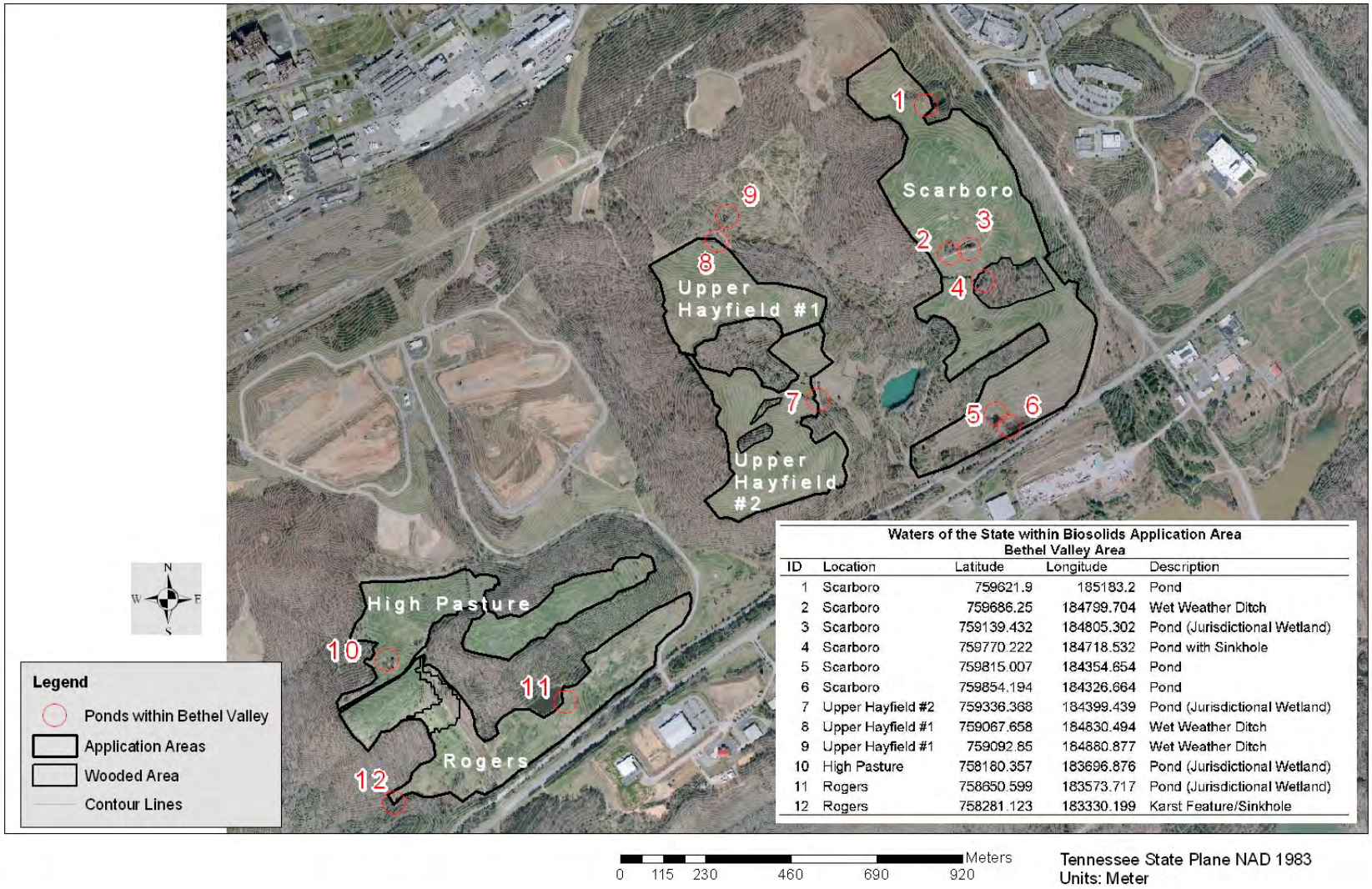


Fig. D.1. Bethel Valley biosolids application sites with proposed buffers.



Waters of the State within Biosolids Application Area
Bethel Valley Area

ID	Location	Latitude	Longitude	Description
1	Scarboro	759621.9	185183.2	Pond
2	Scarboro	759686.25	184799.704	Wet Weather Ditch
3	Scarboro	759139.432	184805.302	Pond (Jurisdictional Wetland)
4	Scarboro	759770.222	184718.532	Pond with Sinkhole
5	Scarboro	759815.007	184354.654	Pond
6	Scarboro	759854.194	184326.664	Pond
7	Upper Hayfield #2	759336.368	184399.439	Pond (Jurisdictional Wetland)
8	Upper Hayfield #1	759067.658	184830.494	Wet Weather Ditch
9	Upper Hayfield #1	759092.85	184860.877	Wet Weather Ditch
10	High Pasture	758180.357	183696.876	Pond (Jurisdictional Wetland)
11	Rogers	758650.599	183573.717	Pond (Jurisdictional Wetland)
12	Rogers	758281.123	183330.199	Karst Feature/Sinkhole

Fig. D.2. Bethel Valley area application sites waters of the state.

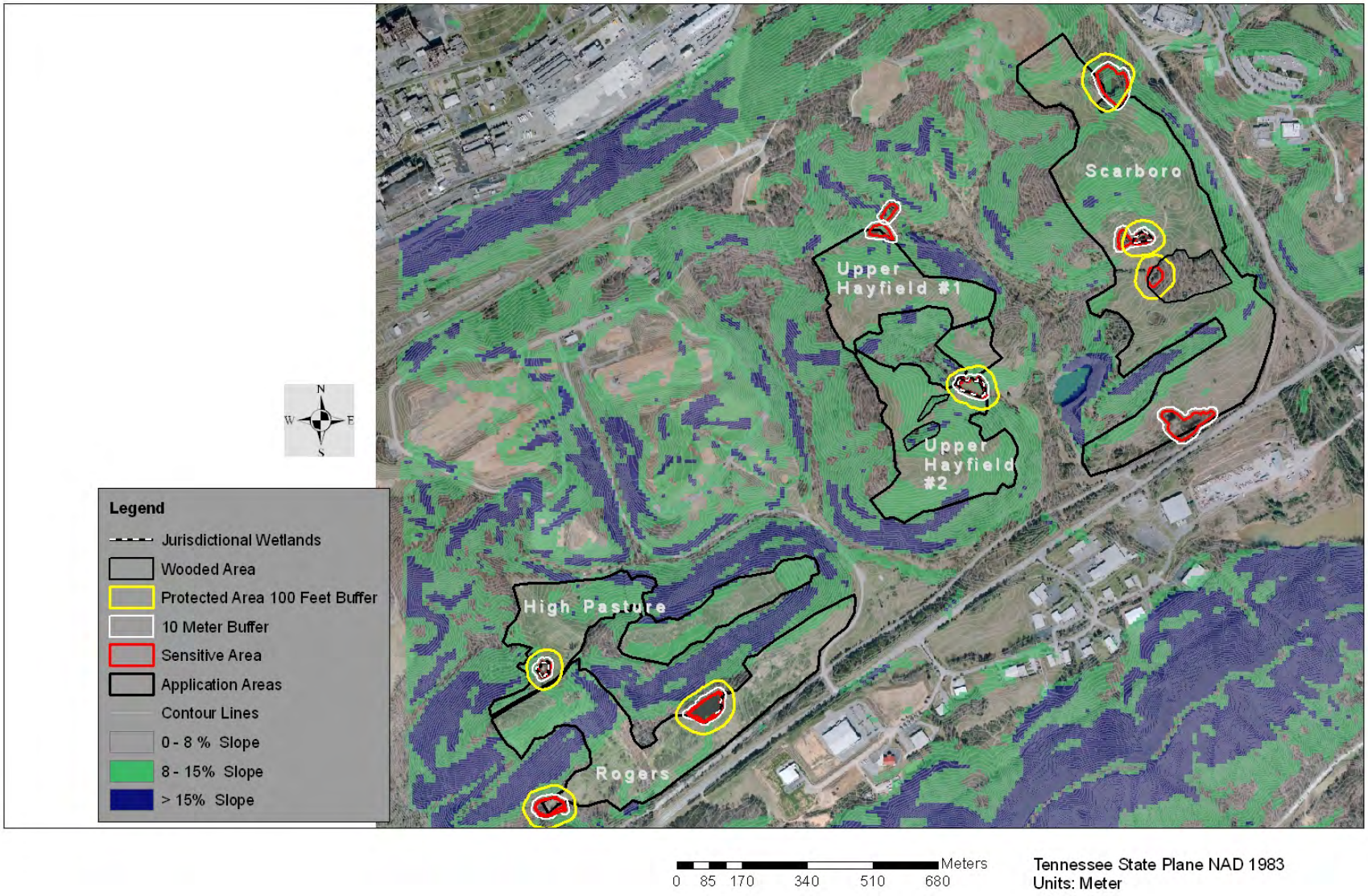


Fig. D.3. Bethel Valley area biosolids application sites with slopes.

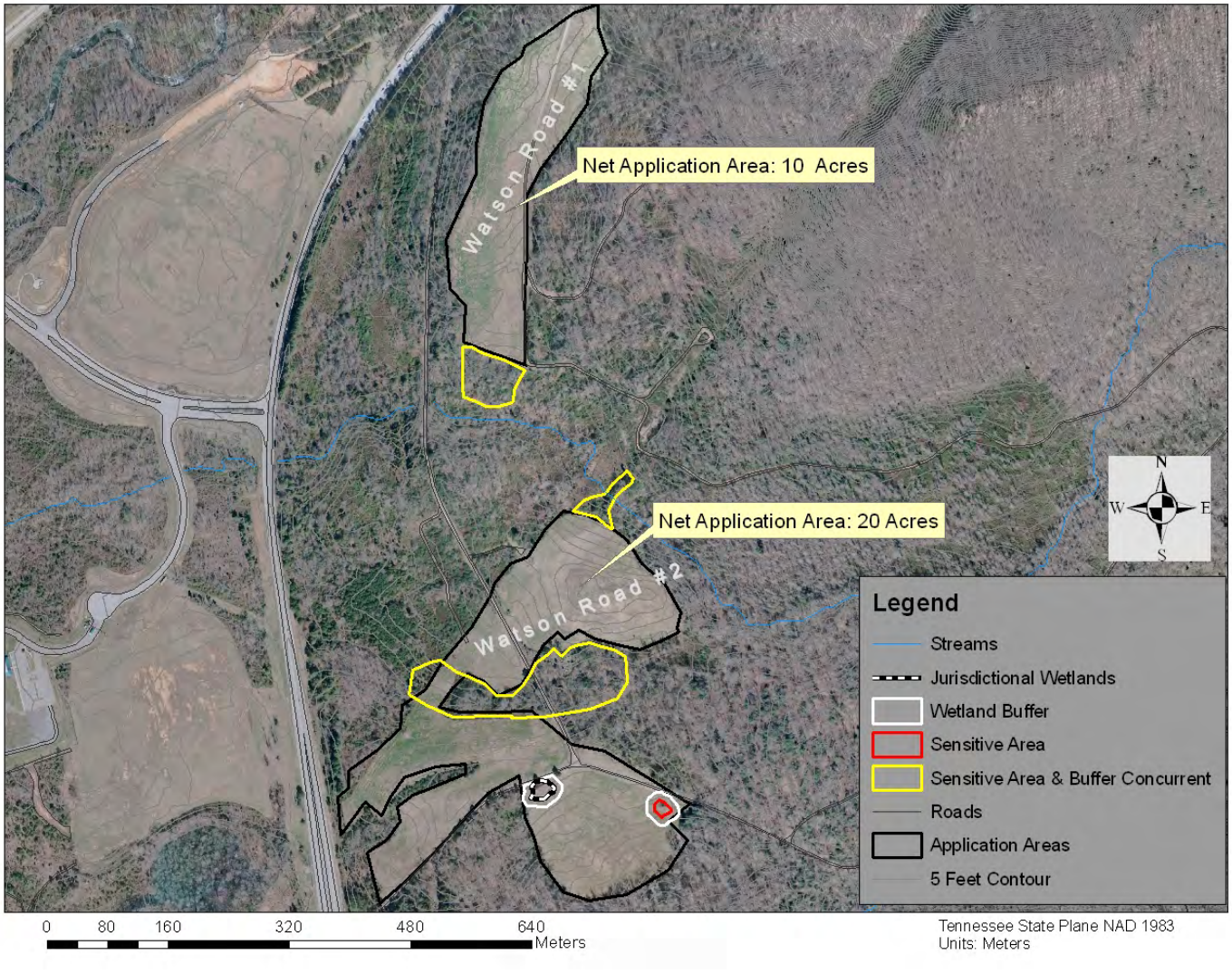


Fig. D.4. Watson Road biosolids application sites with proposed buffers.

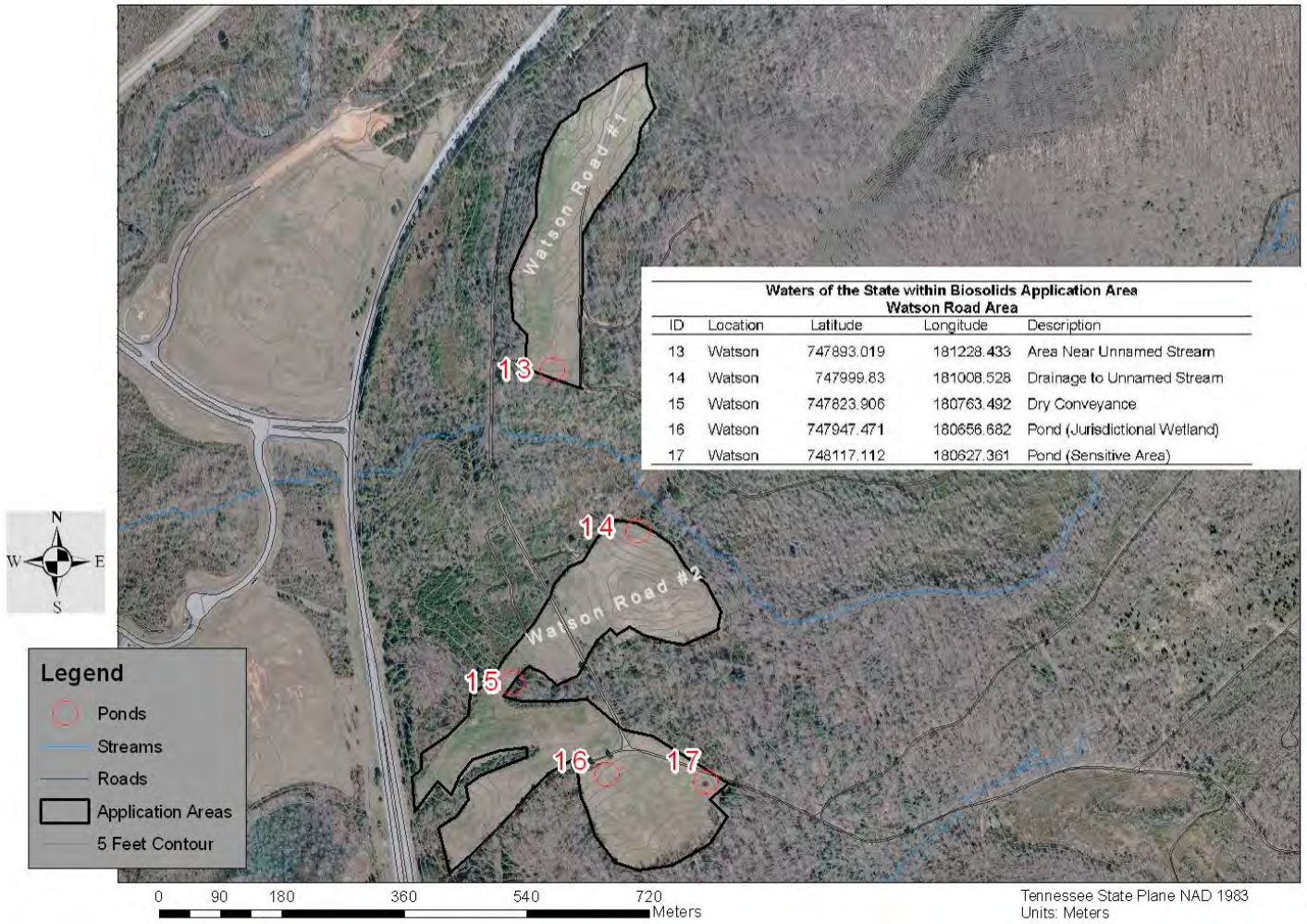


Fig. D.5. Watson Road biosolids application sites waters of the state.

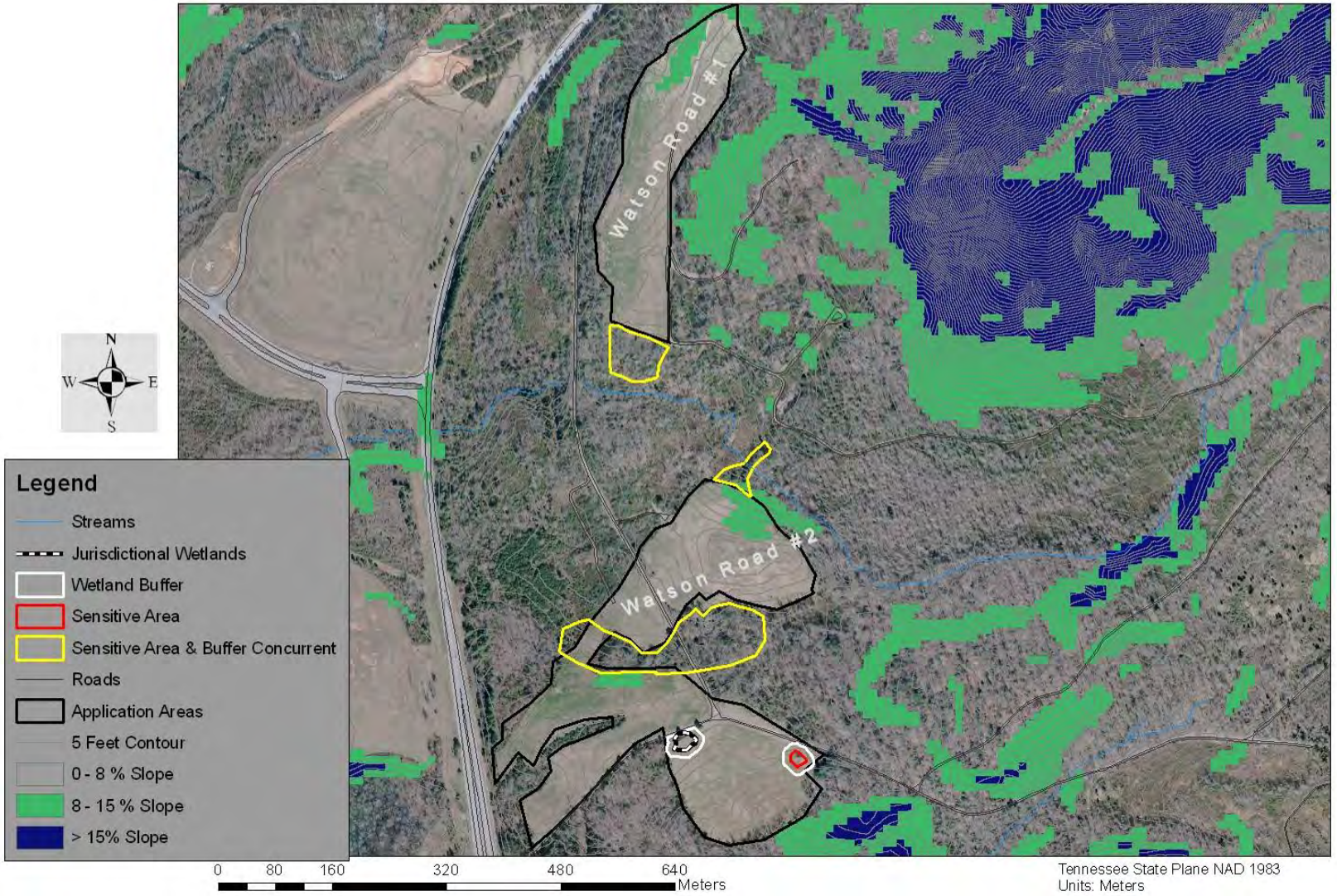


Fig. D.6. Watson Road biosolids application sites with slopes.

APPENDIX E.
STAKEHOLDERS' COMMENTS AND DOE RESPONSES

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July 8, 2011

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

Mr. Gary S. Hartman
Oak Ridge Operations Office
Post Office Box 2001
Oak Ridge, Tennessee, 37831

RE: DOE, SANITARY BIOSOLIDS LAND APPLICATN, OAK RIDGE, ANDERSON COUNTY

Dear Mr. Hartman:

In response to your request, received on Tuesday, July *5,* 2011, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section l 06 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

After considering the documents you submitted, we determine that THERE ARE NO NATIONAL REGISTER OF HISTORIC PLACES LISTED OR ELIGIBLE PROPERTIES AFFECTED BY THIS UNDERTAKING. We have made this determination either because: the undertaking will not alter any characteristics of an identified eligible or listed Historic Property that qualify the property for listing in the National Register, the undertaking will not alter an eligible Historic Property's location, setting or use, the specific location, scope and/or nature of the undertaking precluded affect to Historic Properties, the size and nature of the u ndertaking's area of potential effects p recluded affect to Historic P roperties, or, no National Register listed or eligible Historic Properties exist within the undertaking's area of potential effects. Therefore, we have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. If you are applying for federal funds, license or permit, you should submit this letter as evidence of consultation under Section 106 to the appropriate federal agency, which, in turn, s hould contact us as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to us for comment. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at http://www.tennessee.gov/environment/hist/federal/sectl06.shtm. You may direct questions or comments to Joe Garrison (615) 532-1550-103. This office appreciates your cooperation.

Sincerely,

E. Patrick Mcintyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

August 5, 2011

Mr. Gary Hartman
ORO NEPA Compliance Officer
US Department of Energy
Oak Ridge Office
PO Box 2001
Oak Ridge, TN 37831

Subject: National Environmental Policy Act Environmental Assessment (EA) for the Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation (ORR), Oak Ridge, Tennessee (DOE/EA-1779)

Dear Mr. Hartman:

The Citizens' Advisory Panel (CAP) of the ORR Local Oversight Committee (LOC) has voted to submit the following comments on the subject EA. The LOC Board has not had the opportunity to review this document, so the comments should be regarded as coming from the CAP only.

The CAP recognizes the need for additional acreage and a lifetime extension for the biosolids land application program. This provides a significant benefit for the City of Oak Ridge ("the City"), which faces a greater-than-normal burden for a municipality its size due to the amount and nature of the sewage received from the DOE and NNSA facilities.

However, the EA is a confusing document that includes other studies that might better be integrated into the body of a single EA. It appears to be based primarily on an earlier EA and should have been internally reviewed to ensure that the most recent data were incorporated. Furthermore, because some of the changes could potentially raise the monitoring costs borne by the City, a public meeting is requested so that elected officials and stakeholders can better understand what is being proposed.

Following are issues that we have noted in review of the document:

1. Update Section 1.3 regarding whether the treatment plant in the Clinch River Industrial Park has been taken out of service as planned in 2010.
2. Alternative land uses are not discussed. Some of the sites potentially could be used for new missions or released for private development. Would continued use of a site for biosolids disposal result in future land use restrictions due to accumulation of radionuclides or other contaminants?
3. In Section 1.5 characterization data dates to 2006, and in the case of radionuclides, to 2002 (for uranium isotopes, the most recent data are from 2000). The evaluation should include recently analyzed sludge for all analytes in Tables 3 through 6 and in Table B.2 in order to understand the current contamination profile.
4. There is an error in the title of Table 7: the date range should be until 2002.
5. On page 20 it states that "Appendix B presents the radionuclides that will be monitored under the Biosolids Program, and the concentration guidelines based on a 50-year program life cycle." Which table is applicable, B.1 or B.2? This should be stated in the text.
6. On page 20 a 1986 EPA survey is cited regarding the four radionuclides most frequently found in sewage sludge. This study has been superceded by more recent work and should not be cited.
7. In Section 2.1, the change in setbacks is dramatic, and combined with the elimination of the loading limit, we question whether this would be sufficiently protective of human health and the environment.

In addition, some of the application sites are on karst-forming rocks and would be expected to transmit the more soluble contaminants directly to groundwater.

8. Section 2.2 – DOE should develop and evaluate other alternatives. Were other application sites considered that might have less potential impact on potentially developable sites or that avoided karst-forming bedrock entirely? For example, did DOE consider applying the sewage sludge to the surface of capped landfills?
9. Table 16 should be updated to reflect actual census data for 2010, now available.
10. Appendix A states that independent testing of the City biosolids resumed in June 2010; however this data is not presented in the EA. Furthermore, the use of trends with no sampling data within the past nine years (eleven years for uranium isotopes) cannot be presented as representative of the current contamination of the sludge with respect to radionuclides; industries and other waste sources have likely changed since 2002. Please add a table showing results of the June 2010 monitoring data and include these results in the analysis.
11. Appendix B is generally confusing. Below are comments specific to this appendix.
    a. Why present Table B.1 at all if it has been superceded by B.2?
    b. The first equation on page B-7 is unreadable and should be presented as text, not inserted as a scanned image.
    c. Table B.2 would be easier to compare to Table 7 (and Table B.1) if the radionuclides were presented in alphabetical order.
    d. Proposed revision of guidance levels for radionuclide concentrations in the City municipal sludge (shown in Table B.2) results in the addition of a large number of radionuclides for monthly monitoring. On what basis were these added? Is there any monitoring data that indicate these have been found in the sludge or are there statements from local dischargers that these are likely to be in their waste streams being discharged to the sewer system? It is not clear whether the City will be responsible for carrying out the analyses or whether the analyses are a service from DOE. If the former, there must be an up-front evaluation regarding whether any of these might be excessively costly when performed by an independent lab and if so, the requirement should be balanced against the likelihood of their occurrence. Because the City receives waste from Oak Ridge National Laboratory, there is strong likelihood that they contribute the majority of the more unusual radioisotopes. The City should not be required to bear the burden of unusually high sewage sludge monitoring costs due to impacts by the DOE; in this case DOE should pay for the radionuclide monitoring.

The CAP appreciates the opportunity to comment on the EA, and we look forward to the resolution of our questions. Because this is an important action, DOE should hold a public meeting to explain it and answer the numerous issues that the EA raises.

If you have any questions, please contact the LOC office at (865) 483-1333.

Sincerely,

Norman A. Mulvenon
Chair, LOC Citizens' Advisory Panel

cc: LOC Document Register
LOC Board
LOC CAP
John Owsley, Director, TDEC DOE-O
John Eschenberg, Asst. Manager for EM, DOE ORO
Pat Halsey, FFA Coordinator, DOE ORO EM
Amy Fitzgerald, Government & Public Affairs, City of Oak Ridge
Jeffrey L. Crane, EPA Region 4
Ron Murphree, Chair, ORSSAB

The Oak Ridge Reservation Local Oversight Committee, Inc. (LOC) is a non-profit regional organization that reflects the interests of local communities regarding DOE's environmental management program and the operation of the Oak Ridge Reservation. The Board of Directors of the LOC is composed of the County Mayors/Executives of the seven counties surrounding or downstream of the Oak Ridge Reservation (representing over 600,000 residents), the Mayor of the City of Oak Ridge, the chair of the Oak Ridge Environmental Quality Advisory Board, and the chair of the LOC's Citizens' Advisory Panel (CAP). The CAP makes recommendations to the LOC board, the DOE, and state and federal regulators on technical and other matters of concern to local stakeholders.

Document Title/Number: DOE/EA-1779, Environmental Assessment Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee					Date Comment(s) Sent: 7/21/11	
No.	**Originator of Comment**	**Type M, E, or S**	**Section/ Page**	**Comment(s)**	**Basis for Comment**	**Resolution**
1	Joe Birchfield	M	Executive Summary, Page IX, Last Paragraph, Last Sentence	There is a reference to "through current and updated LAAs granted by the TDEC Division of Water Pollution Control. The last official LAA was 1989, these are typically not utilized any more. Suggest removing reference and replace honoring TDEC-approved land application sites and agreements.	40 CFR 503 Regulations	
2	Joe Birchfield	M	Executive Summary, Page X, First Paragraph, First Sentence	Need to add "lifetime" between insufficient and application and add the following to the end of the sentence "which would end the current application program well before regulatory limits are achieved."	40 CFR 503 Regulations	
3	Joe Birchfield	M	Section 1.1, Page 1, 2nd Paragraph	A reference is made to the scope of the EAD. One of the proposed actions is to eliminate the 50 tons/acre lifetime loading limit from the sites. Was this element discussed in the EAD and if so, it needs to be referenced in this section.	DOE EAD/EA	
4	Joe Birchfield	M	Section 1.2, Table 1, Page 3	A reference is made to the prior 2 EAs and only a FONSI for the latest the EA. Please add a reference to the 1042 EA to the Table.	DOE EA	
5	Joe Birchfield	M	Section 1.5, Page 20, 3rd Paragraph	A reference to the City biosolids will be monitored monthly for radionuclides. This is not the current plan as of the latest working group meeting in June 2011. The statement needs to be modified to reflect the existing and ongoing monitoring which is daily verification by the City of Oak Ridge and monthly independent sample collection and analysis by the TDEC Division of Radiological Health. DOE may choose to perform periodic confirmation monitoring that will be performed on an as needed or pre-determined basis.	Biosolids Working Group discussion	

Document Title/Number: DOE/EA-1779, Environmental Assessment Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee					Date Comment(s) Sent: 7/21/11	
No.	**Originator of Comment**	**Type M, E, or S**	**Section/ Page**	**Comment(s)**	**Basis for Comment**	**Resolution**
6	Joe Birchfield	M	Section 1.5, Page 20, 3rd Paragraph	A reference is made to the frequency of radionuclide monitoring may change depending on the statistical evaluation of the data. As the end of the latest biosolids working group this data had been evaluated and additional monitoring was not recommended. Please remove statement and see comment #5.	Biosolids Working Group discussion	
7	Joe Birchfield	M	Section 1.5, Page 20, bullet list	A statement is made to the removal of the NORM. In the bullet list 6 nuclides are listed but radium-226 and -288 are not included. Please add these radionuclides to the bullet list here.	NORM City of Oak Ridge and Biosolids Working Group Discussion	
8	Joe Birchfield	M	Section 2.1, Table 15, Page 23	Why are some of the setbacks for some ponds 100 ft and others 33 ft. Need to explain the discrepancy in this section or footnote to the table.	DOE EA clarification	
9	Joe Birchfield	M	Section 2.1, Last Paragraph , Page 23	A reference is made to the state of Tennessee Biosolids Coordinator has concurred with this action. Please provide an email or letter reference to the concurrence.	DOE EA clarification	
10	Joe Birchfield	M	Section 2.1, 2nd Paragraph , Page 24	A reference is made to (See Table 7 Section 1.5) for radionuclide guidance levels. Please check the reference to this table, it is a table of historical rad levels not the soil guidance levels.	DOE EA clarification	
11	Joe Birchfield	M	Section 4.1, 3rd Paragraph , 2nd sentence, Page 36	A reference is made to differing setbacks. An explanation needs to be listed as to why this occurs. It appears as if the presence of karst formations and medium to high slopes are the driving factors, please list that here.	DOE EA clarification	
12	Joe Birchfield	M	Section 4.3, Table 27, Proposed Action, Page 51	What about the elimination of NORM radionuclides from the radionuclide guidelines. Should this change not be listed here to reduce any future confusion of whether or not it was fully evaluated under DOE NEPA requirements?	DOE EA Requirements	

Document Title/Number: DOE/EA-1779, Environmental Assessment Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee						Date Comment(s) Sent: 7/21/11
No.	**Originator of Comment**	**Type M, E, or S**	**Section/ Page**	**Comment(s)**	**Basis for Comment**	**Resolution**
13	Joe Birchfield	M	Appendix B, TablesB.1 and B.2	These tables should be updated to include the exclusion of the NORM from further radionuclide monitoring. This includes Ra-226, Ra-228, K-40, etc.	NORM City of Oak Ridge and Biosolids Working Group Discussion	

Mandatory – must provide basis/justification for comment
S = Suggested – things that would improve the document but can be done at later time (basis should describe if needs to be done at next revision)
E = Editorial - things like typographical, editorial, etc. – do not have to provide a basis for these

From: Parr, Patricia Dreyer [parrpd@ornl.gov]
Sent: Tuesday, November 29, 2011 6:48 PM
To: Whaley, Katherine S (5KW)
Subject: EA comment

Katherine-
I have found an error in section 3.8. The last sentence states there are several state natural areas. There are no state natural areas anymore-- DOE cancelled the agreement with TDEC a few years ago. However, there are several Research Park Natural Areas-- and that may be what you are wanting to say. I would simply remove “state” and replace it with “Research Park”. A reference for the Research Park Natural Areas is Parr and Hughes, Oct. 2006. ORNL/TM-2006/110. Oak Ridge Reservation Physical Characteristics and Natural Resources.

3.8 ECOLOGICAL RESOURCES
Terrestrial habitats on the ORR include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and associated wildlife have received limited human disturbance since 1942. In 1988 the ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program (SAMAB). The ORR has also been established as a Wildlife Management Area under a cooperative agreement between DOE and TWRA and includes the 20,000-acre Oak Ridge National Environmental Research Park and several state Natural Areas.

Also- on page 63- under my name, you might include my title “Natural Resources Manager” and leave out Facilities and Operations Directorate.

Thanks-
Pat>
>
>
>
> _____
> UCOR
> URS | CH2M Oak Ridge LLC
> DOE-ORO Prime Contractor at the East Tennessee Technology Park
>
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From: Glass, Ken [KGlass@cortn.org]
Sent: Wednesday, November 23, 2011 1:18 PM
To: Whaley, Katherine S (5KW)
Subject: RE: Biosolids Working Group Meeting: Thursday, December 15th

Katherine,

I have finally read through the latest draft and compared it to the first draft and to the comments table. I don't know if comments are still being solicited but here are mine.

Page 2, line six should read "All *significant* industrial generators…" to be accurate.

Page 21, section 1.6, last sentence of first paragraph. The City's NPDES permit states "The permittee must comply with 40 CFR 503 et seq." Strictly speaking, this is not the same as restating the specific requirements of 40 CFR 503 as the draft EA states.

Concerning page 23, 38, C-3, and in several narratives, the setback for map features 3, 10, and 11 is 100 foot without exception. These three features all have significant areas bounding them that are decidedly down gradient to the water feature and thus deserve only a 10 meter setback coinciding with the vegetative buffer, not a 100 foot setback down slope. For feature 11, there is narrative on page C-13 that supports my assertion; it reads, "the wetland is unlikely to be seriously impacted by biosolids applied south(down slope) of the pond…" Similar statement could have been made of the other two features in regards of applying biosolids down slope of the water.

Page 47, line 3 of section 4.1.8.2 has an extraneous f.

Page 56, line 5 refers to 40 CFR *504*. It should read 40 CFR 503.

Page A-3, under the section "Organic Chemicals", the statement is totally incorrect; nothing in the NPDES permit requires us to ever do organic analysis on the biosolids. However, we do this analysis annually by choice.

Thank you for reconsidering my comments.

Ken Glass
Environmental & Regulatory Compliance Coordinator
Department of Public Works
City of Oak Ridge
Office Phone: (865) 425-1610
Cell Phone: (865) 201-2792

UCOR
URS | CH2M Oak Ridge LLC
DOE-ORO Prime Contractor at the East Tennessee Technology Park

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DOE OVERSIGHT DIVISION
761 EMORY VALLEY ROAD
OAK RIDGE, TENNESSEE 37830-7072

August 8, 2011

Gary S. Hartman
ORO NEPA Compliance Officer
P.O. Box 2001
Oak Ridge, TN 37831

Dear Mr. Hartman

National Environmental Policy Act (NEPA), Environmental Assessment for proposed changes to the Sanitary Biosolids land application program on the Oak Ridge Reservation, Oak Ridge, Tennessee.

The Tennessee Department of Environment and Conservation (TDEC), DOE Oversight Division has reviewed the above subject document in accordance with the NEPA regulations of 40 CFR rts 1500-1505 and 10 CFR Part 1021 as implemented.

General Comments

The three proposed actions, which lay the foundation for operation of a long-term biosolids application program supported by long-term monitoring of pollutant loadings both radiological and non-radiological is consistent with current TDEC guidance. However, the proposed levels of radionuclides in the sludge are inconsistent with the waste disposal practices at the Y-12 industrial landfills.

Additional concerns that arise with the proposed plans that DOE has to address are:

1) The change in setbacks (and buffer areas) for the biosolids application areas. A minimal distance of 33 ft. does not seem adequately protective of water bodies and sensitive areas except where the protected feature is upslope of the land application. In all other instances a 100 ft. setback or buffer is recommended.

2) It would seem imprudent to dispose of any toxic materials on an area such as Chestnut Ridge underlain by a karst aquifer such as exists within the Knox Group Dolomites. Visible or not karst features allowing direct injection of waste into the groundwater system will be both common and pervasive. We acknowledge that sludge application is done on similar terrain statewide; however, Oak Ridge sludge has the potential to contain radionuclides and other contaminants not considered in the 503 regulations.

3)Inspection of the East End Borrow Area located just to the west and upslope of the Scarboro application area, where surface material has been stripped, shows the presence of sinkholes, throats and other dissolution

features. The hydrological evaluations conducted in 1983 and 1989 may not be adequate and applicable to the 2011 state of knowledge regarding recharge of karst aquifers such as exists in the underlying Knox Group dolomites.

4) A review of the exclusion areas mapped within the report suggests that the Karst inventory of the area was limited to sinkholes shown on the USGS topographic map. At a twenty foot contour interval many such features are simply not shown. Groundwater monitoring suitable for karst should be considered.

5) Much of the Spray field area is in the watershed that drains into the Clark Center Recreation Area. If land application of sludge is to continue upstream of public swimming areas, it should include a program for monitoring water and sediment quality.

6) DOE monitoring wells near the disposal fields show sodium concentrations suggesting that groundwater may have been impacted from past land farming of municipal sludge (see GW-187 OREIS). List of reported constituents in sludge is considerably shorter than the list of substances with regulatory limits for sludge application. Radiochemical analysis is dated with last analysis reported as 2002. What is the fate of the pasture grasses grown (including switchgrass, if grown)?

7) 30ug/l total uranium MCL should be included per 40 CFR Parts 9, 141, 142 (FR/volume 65, No. 236/December 7, 2000). Proposed loading should be checked against current promulgated regulations. Also, it is not clear the proposed action fulfills the 40 CFR Part 503.24(n) requirement that aquifers not be contaminated.

8) RCRA subtitle D facilities on the Oak Ridge Reservation that are already capped should be considered as alternative sites for sludge disposal. The landfill caps will act as a transpiration/evaporation zones and allow the sludge to act as a soil amendment. Furthermore, the landfill may act as a buffer to prevent direct injection into underlying karst.

Specific Comments:

In an editorial vein, Figure and Table numbers in Appendices C and D need to be reworked (i.e., given C._ and D._ designations) such that the figures and tables can be referred to and found. In at least one instance in the main document figures in one of the appendices are referred to with only a number (i.e., without appendix designation) causing confusion as to the location of the figure/table. It would also be helpful to list the pertinent sections, figures and tables in the Table of Contents.

Page ix, Executive Summary, Paragraph 6, lines 6-7:
DOE/EA-1042 is included in the References on page 58 and could best be cited here as DOE 1996 (see comments Pg. 58-59).

Page 1, Introduction, lines 5-7:
Should 40 CFR 503 be placed in the References and cited appropriately here?
Should the TDEC Biosolids Guidelines be cited appropriately here?
Also, there was a February 2011 revision of the biosolids guidelines.

Page 2, Background, Paragraph 1, lines 6-7:
Should "Oak Ridge City Ordinance Number 9-91" be included in the References and cited appropriately here?

Page 3, Bullet 1, line 2:
EQ is not in the list Acronyms.
There is a TDEC 2011 revision of the TDEC 2010 guidelines.

Page 3, Table 1, Column 1, Row 3:
Should the FONSI included here be placed in the References?

Page 3, Solids Handling, Paragraph 1, Line 1:
Should mgd be included in the list of Acronyms?

Page 3, Solids Handling, Paragraph 3, Line 3:
Should gpd be included in the list of Acronyms?

Page 4, Table 2, Column Headings:
Should Ac and ha be included in the list of Acronyms?

Page 9, Paragraph 1, Lines 2-3:
Should the 1983 and 1989 TDEC land application approval letters be included in the References?

Page 9, Paragraph 1, Line 16:
TN0024155 and TN0078051 are included in the References. Should they be cited appropriately here (i.e., add date in parentheses after each)?

Page 9, Constituents in Biosolids, Paragraph 3, Lines 4, 6-7, 9, 11-12:
Should the date be included with the citation of DOE/EA-1042? Would it be better to include this reference as DOE 1996 and cite it that way?

DOE/EA-1356 is already included in the References. Should it just be appropriately cited here? Would it be better to include this reference as DOE 2003?

Should the FONSI be included in the References and cited appropriately here?

Should 40 CFR Part 61 be included in the References and cited appropriately here?

NESHAP is not included in the list of Acronyms.

Page 10, Table 3, Column 3, Line 4; Column 1, Last Line:
NA and TS are not included in the list of Acronyms.

Page 12, Table 6, Last Line:
U is not in the list of Acronyms.

Page 13, Table 7, Last 2 Lines:
NA and ND are not in the list of Acronyms.

Page 14, Table 8, First Section of Table, Last Line:
Natural Resources Conservation Services should be included in the References.
NRCS is not in the list of Acronyms.

Page 14, Table 8, Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 15, Table 9 Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 16, Table 10, Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 17, Table 11, Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 18, Table 12, Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 19, Table 13, Second Section of Table, Second Column, Title Heading:
No units are given for dry wgt.

Page 20, Paragraph 4, Lines 5-6:
This statement indicates that 8 radionuclides were found in 200 samples, but only seven are listed here.

Page 20, Paragraph 4, Lines 5-7:
The reference here should be cited more appropriately.

Page 20, Paragraph 4, Line 13:
AMSA is not included in the list of Acronyms.

Page 21, Relevant Regulatory Drivers, Paragraph 1, Line 5:
TNL002415 5 is included in the References and should be cited appropriately here. It might also advisable to list the reference as TDEC 2008a or EPA 2008a in the references.

Also, should the July 2001 EPA letter be included in the References and cited appropriately here?

Page 21, Relevant Regulatory Drivers, Paragraph 1, Lines 9-10:
Should TN0024155 and TN0078051 be cited appropriately here (i.e., citation + date)?

Page 21, Relevant Regulatory Drivers, Paragraph 2, Lines 4-5:
The most recent revision for the guidelines is TDEC 2011.

Page 21, Table 14, Column 3, Row 2:
Should "U.S. Department of Energy License for Non-Federal Use of Property REORDOER-3-01-0703, Supplemental Agreement No. 2, November 1, 2010" be included in the References?

Page 22, Scope of the Analysis, Paragraph 3, Lines1-3:
CEQ is not in the list of Acronyms.

Should 40 CFR Parts 1500-1508 and 10 CFR Part 1021 be included in the References and cited appropriately here?

Page 24, Paragraph 2, Lines 4-5:
DOE-EA/1042 and DOE-EA/1356 are included in the References and should be cited appropriately here.

Page 25, Land Use, Line 6:
PSS is not in the list of Acronyms.

Page 25, Archeological, Cultural and Historical Resources, Lines 1-2:
The Cultural Resources Management Plan is in the References and should be cited appropriately here.

Page 25, Archeological, Cultural and Historical Resources, Lines 8-9:
DOE/OR0-2296 is in the References and should be cited appropriately here.

Page 26, Demographic and Economic, Paragraph 2, Lines 2, 3:
There are references for the U.S. Census Bureau and Bureau of Economic Analysis included in the References. They should be cited appropriately here (i.e., a date included).

Page 28, Population and Housing, Paragraph 1, Lines 3-4:
Is the statement "Anderson County population has increased an average of only 0.4% annually in 2005 (USCB)." necessary? The USCB QuickFacts (http://quickfacts.census.gov/qfd/states/47/47001.html) indicates that between 2000-2010 the Anderson County population increased at a rate of about 5.3%. The isolated fact given for 2005 may be misleading.

Page 28, Population and Housing:
All citations of USCB should be done appropriately (i.e., date included).

Page 28, Community Services:
IES, FBI, THA, and USFA should be cited appropriately. Also, IES, FBI, THA and USFA are not included in the list of Acronyms.

Page 28, Environmental Justice, Line 1:
Executive Order 12898 is included in the References and should be cited appropriately here.

Page 28, Environmental Justice, Lines 4-7:
Should the presidential Memorandum mentioned here be included in the References?

Page 29, Geology and Soils, Paragraph 1, Line 4:
The statement "~3 km (70 miles)" is not correct.

Page 29, Geology and Soils, Paragraph 1, Line 5:
MSL is not included in the list of Acronyms.

Page 29, Geology and Soils, Paragraph 2, Lines 3, 5:
TDEC 1983 and TDEC 1989 are not included in the References.

Page 30, Geology and Soils, Paragraph 3, Lines 8-10:
DOE/EA-1356 is in the References and should just be cited appropriately here.

Page 30, Water Quality, Paragraph 1, Line 8:
DOE 1996 is not in the References.

Page 30, Water Quality, Paragraph 1, Lines 9-10:
Should "Water quality is also affected by wastewater discharges by groundwater transport of contaminants from land disposal of waste." be 'Water quality is also affected by wastewater discharges, ***and*** by groundwater transport of contaminants from land disposal of waste.'

Page 30, Water Quality, Paragraph 2:
The 5 mgd raw water input of Clinch River water near the headwaters of East Fork Poplar Creek for flow maintenance is not really a discharge, but adds considerably to the flow of EFPC.

Page 30, Water Quality, Paragraph 2, Line 7; Page 31, Lines 1-2:
DOE/EA-1356 is in the References and only needs to be cited appropriately here.

Page 31, Floodplains and Wetlands, Paragraph 2, Line 12:
UNESCO is not included in the list of Acronyms.

Page 31, Floodplains and Wetlands, Paragraph 5, Line 2:
The Army Corps of Engineers Wetlands Delineation Manual is in the References and should be cited appropriately here (including date).

Page 32, Climate and Air Quality, Paragraph 1, Lines 10-11:
DOE/EA-1356 is in the References and only needs to be cited appropriately here.

Page 32, Ecological Resources, Paragraph 1, Lines 8-10:
DOE/EA-1356 is in the References and only needs to be cited appropriately here.

Page 33, Listed Species, Paragraph 2, Lines 4:
Passerina caerulea is the currently valid name for the Blue Grosbeak.

Page 33, Listed Species, Paragraph 3, Lines 3-4:
Should the personal communication cited here be placed in the References?

Page 33, Listed Species, Paragraph 4, Line 3:
Ondatra zibethicus is the currently valid name for the muskrat.

Page 33, Listed Species, Paragraph 6, Line 6:

The eastern bluebird is a thrush and not a flycatcher.

Page 34, Listed Species, Paragraph 1, Line 4:
Pseudacris crucifer is the valid name for *Hyla crucifer.*

Page 34, Plants, Line 4:
DOE/EA-1356 should be cited appropriately (i.e., date should be added).

Page 34, Vertebrates, Paragraph 1, Line 6:
TWRC is not included in the list of Acronyms.

Page 34, Vertebrates, Paragraph 2, Line 2:
DOE/EA-1356 should be cited appropriately (i.e., date should be added).

Page 36, Proposed Action – Setback Amendment, Paragraph 1, Line 4:
The most recent revision of the TDEC Guidelines is February 2011.

Page 36, Scarboro, Paragraph 1, Line 4:
What is the slope down gradient of the pond? Does it truly warrant just of 10 m buffer?

Page 36, Scarboro, Paragraph 1, Line 4-6:
It should be made clear here what Feature 2 is (i.e., Wet Weather Ditch). Being a wet weather ditch and dependent on the slope of the land in the vicinity, a significant rainfall event could make a 30.5 m buffer a better choice. Does the wet weather ditch flow into Feature 3 (Jurisdictional Wetland)?

Page 37, Upper Hayfield #1, Paragraph 1:
Where do the wet weather ditches drain to? What is the slope in the vicinity of these features? A 30.5 m buffer may be warranted.

Page 37, Watson Road, Paragraph 2, Lines 6-8:
Areas upslope of Features 16 and 17 should be afforded a 30.5 m buffer, regardless of slope.

Page 38, Summation, Paragraph 1, Lines 1, 4, 5:
DOE/EA-1356 is included in the references and should be cited appropriately here (i.e., date should be included).

TDEC 2001 is included in the References and should be cited appropriately here.

A February 2011 revision of TDEC 2010 is now available.

Page 39, Summation, Paragraph 2, Lines 1-3:
The setbacks do not appear to truly follow the TDEC 2010 recommendations in that some areas not down gradient of a feature are proposed to have 10 m buffers.

Page 39, Environmental Justice, Paragraph 2, Line 5:
The citation for USCB should include the date.

Page 40, Archeological, Cultural, and Historical Resources, Paragraph 1, Line 1:
Should the National Historic Preservation Act be included in the References?

Page 40, Archeological, Cultural, and Historical Resources, Paragraph 1, Line 3:
The citation for DOE/EA-1042 should have the date included.

Page 40, Geology and Soils, Paragraph 1, Line 8:
The citation for DOE/EA-1042 should include the date.

Page 40, Geology and Soils, Paragraph 2, Line 5:
The information discussed here is not in Tables 5-10, but rather in Tables 20-25.

Page 43, Surface Pathway to Groundwater, Paragraph 1, Lines 3-4:

The citation for EPA 922/R-93-001b should include the date.

Page 43, Surface Pathway to Surface Water, Paragraph 3, Line 4:
A February 2011 revision of TDEC 2010 is now available.

Page 44, Surface Pathway to Surface Water, Paragraph 1, Line 3:
The Tables referred to here are actually in Appendix C. The Appendix C Tables need to be re-numbered, such that the Tables could be cited correctly.

Page 44, City of Oak Ridge POTW discharge to EFPC, Paragraph 1, Line 3:
The City of Oak Ridge, NPDES Permit, 2001 is not included in the References.

Page 44, City of Oak Ridge POTW discharge to EFPC, Paragraph 1, Line 7:
The citation for DOE/EA-1356 should include the date.

Page 44, Floodplains and Wetlands, Paragraph 1, Line 2:
A February 2011 revision of TDEC 2010 is now available.

DOE/EA-1042 is in the References and should be cited with the date included.

Page 44, Floodplains and Wetlands, Paragraph 2, Lines 3-4:
This manual is included in the References and its citation here should include the date.

Page 44, Floodplains and Wetlands, Last Line:
There is no Table 6 with this information. A Table 18 (pg. 32) summarizes the functional and jurisdictional wetlands. The only figures of the jurisdictional wetland areas are in Figures 2, 3, and 4 and in Figures in Appendix C.

Page 45, Floodplains and Wetlands, Paragraph 1, Lines 4-5:
No figures showing the functional wetlands and their buffers. At least the figure legends are not labeled as such.

Page 45, Climate and Air Quality, Paragraph 1, Line 5:
DOE/EA-1356 is included in the references and should be cited appropriately here with date.

Page 45, Ecological Resources, Paragraph 1, Lines 2-3:
Do the setbacks follow recommendations set forth in the current TDEC guidance? Table 1 of the 2011 revision of the guidance does not mention that 33 feet is a sufficient buffer down gradient of the application area if the slope is slight. See setback for ponds on Pg. 37, Watson Road.

Page 45, Listed Species, Paragraph 1, Line 3:
This should be updated to reflect the February 2011 revision of the TDEC guidance.

Page 46, Listed Species, Paragraph 3, Line 3; Paragraph 4, Line 2; Paragraph 6, Line 4; Bullet 3, Line 4:
DOE/EA-1356 needs to be cited appropriately with date.

Page 47, Listed Species, Paragraph 3, Line 2:
ANA is not included in the list of Acronyms.

Page 47, Animals, Paragraph 1, Line 5:
TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC guidance.

Page 48, Potential Radiological Impacts, Paragraph 2, Lines 7, 8-9:
Should 40 CFR Part 62 be included in the References?

The TDEC rules should be cited appropriately here with a date.

Page 49, Transportation, Paragraph 1, Lines 10-12:
The document here should be cited appropriately with the date included.

Page 50, Human Health and Safety, Paragraph 2, Line 4:
HI is not included in the list of Acronyms.

Page 51, Table 27, Column 1, Row 1, Line 3:
TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.

Page 52, Paragraph 1, Lines 5-6:
Should 40 CFR Part 1508.7 be included in the References?

Page 53, Ecological Resources, Line 4:
TDEC 2010 needs to be updated to reflect the February 2011 revision of the TDEC Guidance.

Page 53, Air Quality, Paragraph 1, Line 1:
DOE/EA-1356 should be cited appropriately with the date included.

Page 53, Air Quality, Paragraph 2, Line 5:
DOE/ASER should be cited appropriately with the date included.

Page 56, Paragraph 1, Lines 2-3:
Should 40 CFR Part 261.4(a) be included in the References?

Page 56, Paragraph 1, Lines 2-3:
Should 40 CFR Part504 and the CWA be included in the References?

Page 56, Paragraph 3, Lines 4-5:
TN0024155 and TN0078051 are included in the References and should be cited appropriately here with date included.

Page 56, Paragraph 5, Lines 5-7:
TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.

Page 56, Paragraph 6, Line 3:
TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.

Page 57, Paragraph 1, Lines 2, 4:
The citations here should include dates.

Page 58 -59, References:
References in this section should be redone so that the style is consistent. It would be helpful if all documents by an entity (e.g., DOE) were listed as DOE, date, title of document, etc.

Page 58, References, Bastian, R.K:
All authors should be listed for this reference. Bastian, R.K., Bachmaier, J.T., et al. is not in accordance with the American Association for the Advancement of Science Guidance.

Page 58, References, FBI:
The hyperlink given here does not take you to the police data.

Page 59, References, SAMAB:
This reference was not cited in the document.

Page 59, References, TDEC 2001:
The hyperlink given here works, but does not lead to this version of this document.

Page A-5, Figure A.1:
What are the units on the Y-axis?

Page A-8, Figure A.4, Footnote:
U is not included in the list of Acronyms.

Page A-10, Pathogens, Paragraph 1, Lines 1-2:
Is there another purpose to distribute biosolids to the community other than for home gardens?

Page A-10, Oak Ridge Reservation Land Application Site Characteristics, Paragraph 2, Line 4:
PAN is not included in the list of Acronyms.

Page A-10, Oak Ridge Reservation Land Application Site Characteristics, Paragraph 3:
MR and VR are not included in the list of Acronyms.

Page A-11-A-16, Tables A.6 –A.11, Second Section of Table, Column 2 Heading, Line 4:
What are the units for dry wgt?

Page B-7, Equation and parameter explanation following Paragraph 3:
The font used for this information is not clearly readable.

Page B-8,Table B.2, Footnote b:
DSR is not included in the list of Acronyms.

The ISCORS reference should be cited appropriately here with the date included.

Page C-7, Wetlands Walkover:
Should all tables and figures in this report be relabeled C.1, etc. since this is Appendix C?

Page C-7, Introduction:
DOE/EA-1356 is included in the Appendix C References as DOE 2003 and should be cited here accordingly.

Page C-7, Introduction, Lines 4-5:
Is there a reference for the 1996 survey? If so, it should be included in the Appendix C References.

Page C-8, Paragraph 3, Lines 1 & 9-11:
Should the CWA and TDEC 2001 be included in the Appendix C References?

Page C-9, Paragraph 1, Line 2:
Should "Aerial map" be 'Aerial map*s*'?

Page C-9, Paragraph 2, Lines 6-7:
Should the USACE Wetlands Manual be included in the Appendix C References?

Page C-11, Paragraph 2, Line 7:
Should Table 2 be referred to as Table C.2 since it is now in Appendix C?

Page C-12, Figure 1:
Figure 1 and all subsequent figures in Appendix C should be re-designated as Fig. C.1, etc

Page C-20, Functional Wetland Areas, Paragraph 1, Lines 3-5:
Table 3 should be re-designated as Table C.3.
It is indicated here that three significant functional wetlands are listed in the table, but four are present.

Page C-21, Conclusions, Paragraph 1, Lines 7-9:
Only three maps are present in Figures 1-10. None of these maps distinctly indicate the functional wetlands.

Pages C-27-C-32:
These figures need to be re-designated as Figure C.13-Figure C.18 to fit in correctly with the remainder of Appendix C.

Page D-3, Table D-1, Column 1:
Crytobranchus alleganiensis should be Cry*p*tobranchus alleganiensis

Page D-4, Table D-1, Column 1:
Empidonax trailii should be *Empidonax traillii.*
Helmitheros vermivorus should be *Helmitheros vermivor**um**.*

Page D-5, Table D-1, Footnote b:
E, MC, NM, and RI are not included in the list of Acronyms.

Page D-9, Introduction, Paragraph 1, Lines 1 & 4:
DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited as such here.

Page D-9, Introduction:
The Introduction given here is for the wetlands walkover and not the listed species walkover.

Page D-9, Introduction, Paragraph 1, Line 7:
Table 1 needs to be re-designated as Table D.2.

Page D-10, Paragraph 2, Line 4; Paragraph 3, Line 2; Paragraph 4, Line 3:
Passerina caerulea is the currently valid name for the Blue Grosbeak.
Branta Canadensis should be ***Branta ~~C~~canadensis***.
Ondatra zibethicaus is the currently valid name for the muskrat.

Page D-10, Paragraph 3, Lines 3-4:
Shouldn't the personal communication be included in the Appendix D References?

Page D-11, Ecological Walk Over Surveys, Paragraph 1 Line 2:
Figs. 1-6 need to be re-designated as Figs. D.1-D.6.

Page D-11, Database Consultation and Rare Wildlife Species, Paragraph 1, Lines 4-5, 5-6; 7-10:
What are the ORR lists and should they be included in the Appendix D References?
Partners in Flight is included in the Appendix D References and should be cited appropriately here.
Shouldn't the TWRA and TWRC databases be included in the Appendix D References?

Page D-13, General Observations, Paragraph 2, Line 10:
Poecile caronlinensis should be ***Poecile caro~~n~~linensis***.

Page D-13, General Observations, Paragraph 3, Line 3, 4:
Rana catesbeiana should be *Lithobates catesbeianus*.
Hyla crucifer should be Pseudacris crucifer.

Page D-14, Paragraph 1, Line 7:
DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited here as such.

Page D-14, Plants, Paragraph 1, Line 3:
DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited here as such.

Page D-14, Vertebrates, Paragraph 1, Lines 2, 4-5:
GWRA should be ~~G~~TWRA.
What ORR information was checked and should it be included in the Appendix D References?
Should TWRA and TWRC be placed in the Appendix D References and cited appropriately here?

Page D-14, Species Considered But Eliminated, Paragraph 1, Line 5-6:
Table 1 should be Table 2, which should be re-designated as Table D.3.

The personal communication should be included in the Appendix D References.

Page D-15, Table 2, Source:
What is the ORR (April 2010) source and should it be in the Appendix D References?

Page D-16, Paragraph 1, Line 2:
Should the TWRA and TWRC lists be included in the Appendix D References and cited appropriately here?

Page D-16, Paragraph 2, Line 8; Paragraph 4, Lines 5-6; Paragraph 5, Lines 10-11:
The personal communication should be included in the Appendix D References.

Page D-16, Paragraph 3, Line 1; Paragraph 4, Line 2; :
Table 2 should be re-designated as Table D.3.

Page D-16, Paragraph 3, Line 1:
DOE/EA-1356 is in the Appendix D References as DOE 2003 and should be cited as such.

Page D-16, Paragraph 5, Line 12:
Figs. 4, 5, and 6 should be Figs. D.4; D.5; and D.6.

Page D-18, Paragraph 1, Line 3:
Table 3 should be re-designated as Table D.4.

Page D-18, Paragraph 2 and remainder of page:
All Figures mentioned in this Paragraph need to be re-designated as Figure D._.

Page D-19, Table 4, Scientific name:
Wilsonia citrine should be *Wilsonia citrinea.*
Empidonax trailii should be Empidonax traillii.

Page D-20:
All Figures on this page need to be re-designated as D._.

Page D-21, Federal and Tennessee State Listed Species, Paragraph 2, Lines 2-4:
Here it indicates that the biosolids areas are mowed annually. On page 48, Paragraph 2 of the document it indicates that fields are mowed twice annually.

Page D-21, Paragraph 3, Line 4:
Table 2 should be re-designated as Table D.3.

Page D-21, Bullet 3, Line 4:
DOE 2002 is not included in the Appendix D References.

Page D-22, Paragraph 1, Line 4:
Table 2 needs to be re-designated as Table D.3.

Page D-22:
Figures on this page need to be re-designated as Fig. D._.

Page D-23, Bullet 1:
Figure 1 needs to be re-designated as Figure D.1.

Page D-23, Bullet 4, Lines 6-7:
Tables 2 and 3 need to be re-designated as Tables D.3 and D.4.

Page D-25, References, PIF 2010:
PIF is not included in the list of Acronyms.

Page D-27-D-32:
Figures 1-6 need to be re-designated as Figures D.1-D.6.

3.4, Page 29: Geology and Soils:
Ordovician is a geologic time *period* and this can be subdivided into *series* and that subdivided into *ages*. If age or *aged (sic)* is to be used as it is in this section, should be as follows: Early Ordovician, Late Ordovician etc., the word age, aged (sic) is unnecessary (USGS, 1978).

The reference to ground water movement in relation to any other karst terrain such as this is in conduits. Worthington et al., 1999, 2000; Davies, 2008, calculate that >94% of the flux in conduits is in conduits in most carbonates (called karst or not). This proposal suggests ground water moves along dissolutionally enlarged joints but the loci of many if not most cave passages (conduits) and channels are controlled by gradients often regardless of the alignment of joints or bedding planes.

The rest of the discussion about the direction of ground water flow fails to mention that most ground water in dipping rocks most often discharges along the strike. There are springs on the dip and scarp slopes of the Knox in Oak Ridge, but the springs in the direction of strike are usually the largest with the longest conduit pathways associated with them, as is the case in other karst terrains (Worthington, 1991).

Average flow path lengths in the direction of strike is many kilometers (Worthington, 1991) so any activity here at this sprayfield might have water-quality implications far downgradient.

4.1.5.1, Page 43: Surface Pathway to Ground Water:
Recharge type has been described in carbonate and karst terrains as *concentrated or dispersed* (ASTM, 1995). Dispersed recharge deserves some additional discussion. Although dispersed suggests non-point, soils on fractured rocks (carbonate and karst) are riddled with *macropores* that will transmit ground water rapidly into the subsurface anywhere (USEPA, 1996).

Recharge in carbonates and karst converges to the more efficient pathway and thus is always some form of concentrated recharge when it reaches the bedrock (or the macropore).

The assumption that sanitary biosolids introduced into the soil will be retarded is questionable for two reasons:

a) Traced velocities in karst, carbonates and many other fractured rocks are (1) rapid enough (mean of 1.7 km/day, 2,877 tests in 43 countries [Worthington et al., 1999]) to transport even some of the largest particle size, so the constituent need not be in solution, merely in suspension, and (2) in between swallets (sinking streams) or other sinkholes, flow will still be convergent via macropores, so even small concentrations can increase when they accumulate and recharge in one concentrated stream.

b) Pathogens are known to migrate rapidly in carbonates and karst, (see website on Walkerton, Ontario enquiry) exactly the opposite to what is stated in the proposal. Models almost never consider macropores that behave just like conduits in the bedrock, so without macropores models often create retardation and attenuation scenarios that in reality may not exist.

One reference (Parr and Hughes, 2006) uses a very misleading reference on the nature of recharge on the ORR - that only ~5% of the precipitation infiltrates. This infiltration number is dramatically contradicted a few hundred meters away from this proposed site, where the number obtained is 53% infiltration (Luxmoore and Huff, 1989). Which value was used in the models? Were macropores incorporated in the models?

Uranium forms soluble complexes with the carbonate and phosphate ion and also can form soluble complexes with humic and fulvic acid (Gascoyne, 1992). Both these anions are present either in the sludge or the soil water. In addition, the sludge contains organic compounds that also could change the behavior of the uranium-series nuclides; thorium is believed to form stronger bonds. This suggests that simple models that assume uranium and any of its daughter products could be adsorbed on the soil may not be tenable.

Even if the uranium or its daughter nuclides are adsorbed the volume and velocity of recharge could physically erode the soil and sludge and transport the whole mass. The mean velocity in conduits or channels in karst and unconfined carbonates is 0.022 m/s, 2 km/day (Worthington, et al., 1999).

Recharge in karst is either dispersed or via sinking streams. If the recharge is via sinking streams there will be essentially no retardation and the sludge and its components would be transported directly to conduits and then far downgradient rapidly. Even away from sink points the soil may have pipes and macropores present and these could provide open pathways for rapidly transporting sludge or soil into conduits.

If you have any questions regarding these comments, please contact Chudi Nwangwa or me at (865) 481-0995.

Sincerely

John A. Owsley, Director

cc Chuck Head, TDEC
Mary Parkman, TDEC
Paul Estil Davis, TDEC

jao1026

References Cited

Gascoyne, M.A., 1992, Geochemistry of the Actinides and their Daughters, (in) Ivanovich, M., amd Harmon, R.S., (eds) Uranium-Series Disequilibrium: Applications to Environmental Problems, p. 34 -61

Luxmoore, R.J., and D.D. Huff., 1989. Water, In D. Johnson and R. I. Van Hook, eds. Analysis of biogeochemical cycling processes in Walker Branch Watershed. Springer-Verlag, New York.

Worthington, S.R.H., 1991, Karst Hydrogeology of the Canadian Rocky Mountains, PhD Thesis, School of Geography and Geology, McMaster University, Hamilton, Ontario, 227 p.

Worthington, S.R.H., Davies, G.J., and Ford, D.C., 1999, Matrix, fracture and channel components of storage and flow in a Paleozoic limestone aquifer, (in) Sasowsky, I.D., and Wicks, C. M.,(eds) Groundwater Flow and Contaminant Transport in Carbonate Aquifers, Balkema, Rotterdam, p. 113-128.

U. S. Environmental Protection Agency, 1996, Guidelines for Wellhead and Springhead Protection Area Delineation in Carbonate Rock EPA904-B-97-003, USEPA Region 4 28 pages plus appendices.

ASTM, 1995, Standard Guide to the Design of Ground Water Monitoring Systems in Karst and Fractured-Rock Aquifers, Vol. 04.09 p. 451-468 (1999 edition) American Society for Testing and Materials, West Conshohocken, PA 19428.

CITY OF
OAK RIDGE

Office of the City Manager

POST OFFICE BOX 1 • OAK RIDGE, TENNESSEE 37831-0001

July 26, 2011

Mr. Gary S. Hartman
ORO NEPA Compliance Officer
U.S. Department of Energy
Oak Ridge Office
P.O. Box 2001
Oak Ridge, TN 37831

Dear Mr. Hartman:

Draft Environmental Assessment on Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation (DOE-EA-1779, June 2011)

I am writing in response to your letter dated June 24, 2011 requesting comments on the subject document. As you know, the City of Oak Ridge has partnered with DOE for more than two decades to promote beneficial use of biosolids on the Oak Ridge Reservation.

The City supports the proposed action set forth in the Draft Environmental Assessment (EA) to provide additional acreage for land application and to extend the lifetime of the program. Rigorous monitoring and control of the application process will continue to be provided by the City, the designated DOE contractor, and through current and updated land application approvals granted by the Tennessee Department of Environment and Conservation Division (TDEC) of Water Pollution Control.

In support of the proposed action, the following changes to the Draft EA are recommended:

1. The Draft Environmental Assessment (EA) identifies 27 radionuclides that it proposes should be monitored monthly. The EA should stipulate that the cost of this monitoring program should be incurred by DOE or its environmental contractor since the source of the man-made radionuclides will most likely be DOE or reservation contractors. Nevertheless, the City of Oak Ridge will continue to support this radiological monitoring effort through the continuation of its 17-year-old gamma spectroscopy screening program which identifies any significant presence of I-131, Cs-137, Co-60, and/or total gamma.

2. Several places in the Draft EA, the land application area is presented as either "gross acreage" or as "net application area in acres", the latter being a much smaller number and quit restrictive. However, in light of a recent joint site visit by staff of the Tennessee

Department of Environment and Conservation and the City of Oak Ridge, there is good reason to believe that the net application areas of at least four of the six sites covered by this Draft EA could be significantly increased with the approval of the State. Since the Biosolids Program could benefit greatly with the addition of useable acreage which, incidentally, is already licensed to the City by DOE for this purpose, the City is requesting the wording of the proposed EA be flexible enough to allow the use of increased net acreage should TDEC indeed approve it.

3. The 100 feet buffer stipulated in the Draft EA for the large pond on the Rogers Site and for the central jurisdictional pond on the Scarboro Site should be reduced to 10 meters (33 feet) for those areas which are down gradient while retaining the 100 feet setback on up slope area; this will keep uniformity with the established criteria set forth in the Draft EA which were derived from the EPA regulations of 40 CFR Part 503 as well as the TDEC *Guidelines for the Land Application and Surface Disposal of Biosolids* (2011).

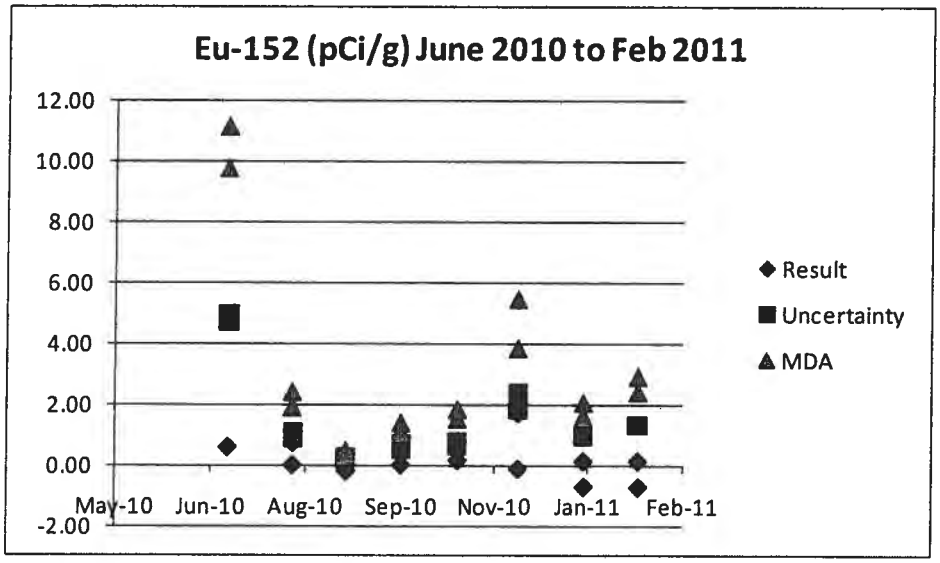
4. Naturally occurring radionuclides that are not technologically enhanced should not be identified as contaminants of concern (i.e., included in the list of radionuclides for which limits are established). There are no industrial, medical or DOE processes contributing to the levels of these radionuclides (e.g., Ra-226, Ra-228, Ac-227, Pa-231, Th-232, Pb-210, K-40, etc.) in the ORWWTP biosolids. These radionuclides are ubiquitous in the environment, and the sources to the treatment plant are human excreta (from food and water consumed) and water and soil that enter the sewer system. The levels of these naturally occurring in the ORWWTP sludge are comparable to the levels that would be present in any municipal sludge (actually lower than in areas where the drinking water source is groundwater) and essentially indistinguishable from the background levels of these radionuclides present in Oak Ridge soils.

5. The sludge limits should all be based on the TDEC approved dose limit of 10 mrem/year. At present, some limits are based on 4 mrem/year and others on 10 mrem. This is true for both naturally occurring and anthropenic radionuclides.

   The purpose of the sludge limit is to ensure the acceptable soil levels on the land application site are not exceeded. For each radionuclide, the limit is calculated based on the assumption that all of the sludge that is land applied over the 50 year life of the site contains the radionuclide at the concentration limit. Therefore, it is the average concentration being land applied over time that is of interest, and short term exceedances do not make the biosolids unacceptable for land application. Therefore, it is recommended that the EA be revised to clarify that a running average is the appropriate point of comparison to the sludge limits, rather than a single measurement or the concentration observed over a relatively short period of time. Furthermore, because the radionuclide concentrations in the biosolids are typically near the detection limits, the counting errors tend to be large and the results highly variable, making comparisons that rely on a single data point unreliable.

Perspective:

The radionuclide levels in the biosolids are generally so low that they are below the detection limits making the counting errors large and the data variable. Therefore, a single measurement viewed alone does not provide meaningful information. For example, in the case of Eu-152 for which the sludge limit is 2.8 pCi/g, the maximum concentration reported in the ORWWTP biosolids over a seven month sampling period was 4.69 pCi/g. The lab qualified this result as "U" meaning it was analyzed for but not detected. The uncertainty reported for this results was 4.94 pCi/g (i.e., 105% of the result), and the reported MDA for the sample was 11.16 pCi/g. The following plot of the Eu-152 data in pCi/g demonstrates that the Eu-152 levels in the biosolids are far below the limit and essentially zero and that the maximum value reported is not meaningful and does not provide an appropriate metric for comparison to the sludge limit.



Perspective on Naturally Occurring Background Radionuclides:

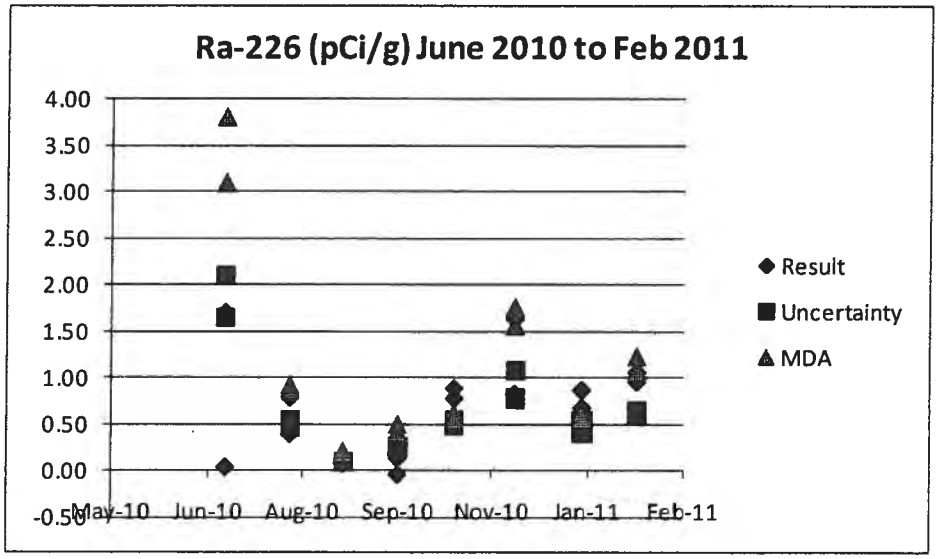
The following are provided as examples. The same conclusions can be drawn for the other naturally occurring radionuclides that are present in the biosolids solely as a result of their presence in the ambient environment (i.e., natural background radionuclides).

K-40: naturally occurring, soil background for K-40 on ORR range from 4.1 to 16.3 pCi/g, The EA establishes a sludge limit of 16 pCi/g. A maximum value of 16.7 was reported for the ORWWTP biosolids over a seven month sampling period. The result has a J qualifier, indicating an "estimated" value, and the reported counting error is 65% of the result (16.8+/- 10.7). A duplicate result for the same sample was 9.97 +/ 10.19.

For perspective on the biosolids concentrations, the level of K-40 in dried fruits ranges from 3 to 10 pCi/g.

Ra-226: naturally occurring, soil background on ORR typically ranges from 0.8 to 1.3 pCi/g. The EA establishes a sludge limit of 0.32. A maximum value of 1.7 pCi/g was reported for the ORWWTP biosolids over a seven month sampling period. This result has a U qualifier, and the counting error is 122% of the result (1.7 +/- 2.09). A duplicate result for the same sample was 0.03 +/- 1.64. The following plot of the Ra-226 values reported for the biosolids in pCi/g) demonstrates that the Ra-226 levels in the biosolids are consistent with soil concentrations in the area.

For perspective on the biosolids concentrations, the cleanup criteria typically used by the EPA, NRC and DOE for Ra-226 is 5 pCi/g, and Ra-226 levels in common fertilizers range from 5 to 33 pCi/g.



Thank you for your consideration of these comments. Feel free to call me at (865) 425-3550 should you have any questions.

Sincerely,

Mark S. Watson
City Manager

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Comment Response Summary for the

Environmental Assessment Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee ***DOE/EA-1779, January 2012****.*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
1	Joe Birchfield	Executive Summary, Page IX, Last Paragraph, Last Sentence	There is a reference to "through current and updated LAAs granted by the TDEC Division of Water Pollution Control. The last official LAA was 1989; these are typically not utilized any more. Suggest removing reference and replace honoring TDEC-approved land application sites and agreements. [Basis for comment - 40 *CFR* 503 Regulations]	We think it is important to identify the specific TDEC approval format. The City of Oak Ridge received a land application approval letter in 2010 for application of a defined batch of treated sludge on the High Pasture and Rogers application sites. Future approvals are expected to follow the same format. The 1989 land application approval letter was used as the basis for the lifetime application limit (total tonnage) cited in the previous environmental assessments for the Biosolids program : DOE/EA-1042 (1996) and DOE/EA-1356 (2003). As the current action proposes to eliminate the lifetime limit, continuity with the history of this format should be maintained.
2	Joe Birchfield	Executive Summary, Page X, First Paragraph, First Sentence	Need to add "lifetime" between insufficient and application and add the following to the end of the sentence "which would end the current application program well before regulatory limits are achieved." [Basis for comment - 40 *CFR* 503 Regulations]	For the Scarboro application site, implementation of the setbacks specified in DOE/EA-1356 (2003) would eliminate the site immediately, as only isolated areas would remain for application. The current statement is intended to convey the urgency behind the proposal.
3	Joe Birchfield	Section 1.1, Page 1, 2nd Paragraph	A reference is made to the scope of the EAD. One of the proposed actions is to eliminate the 50 tons/acre lifetime loading limit from the sites. Was this element discussed in the EAD and if so, it needs to be referenced in this section. [Basis for comment – DOE EAD/EA]	This element, not specifically addressed in the EAD, was covered under the general statement: "DOE proposes to adopt the requirements specified in 40 *CFR* Part 503…" The EPA 40 *CFR* Part 503 regulations do not establish a lifetime loading limit based on total tonnage alone.
4	Joe Birchfield	Section 1.2, Table 1, Page 3	A reference is made to the prior 2 EAs and only a FONSI for the latest the EA. Please add a reference to the 1042 EA to the Table. [Basis for comment – DOE EA]	The FONSI for DOE/EA-1042 was published with the EA by DOE NEPA, whereas the FONSI for DOE/EA-1356 was published as a separate document. The following reference has been added to the reference section: DOE/EA-1356 FONSI. *Finding of no Significant Impact, Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee*, February 2003, U.S. Department of Energy, Oak Ridge Office, Oak Ridge, TN.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				To avoid misleading the reader, the reference to the FONSI documents has been removed from Table 1.
5	Joe Birchfield	Section 1.5, Page 20, 3rd Paragraph	A reference to the City biosolids will be monitored monthly for radionuclides. This is not the current plan as of the latest working group meeting in June 2011. The statement needs to be modified to reflect the existing and ongoing monitoring which is daily verification by the City of Oak Ridge and monthly independent sample collection and analysis by the TDEC Division of Radiological Health. DOE may choose to perform periodic confirmation monitoring that will be performed on an as needed or pre-determined basis. [Basis for comment – Biosolids Working Group discussion]	At the June 23, 2011 meeting of the Biosolids Working Group, the current monthly radionuclide data was discussed, along with the list of radionuclides specified for monitoring in the two previous environmental assessments for the Biosolids program: DOE/EA-1042 (1996) and DOE/EA-1356 (2003). Recommendations for further study were offered. At the meeting of DOE and UCOR on August 10, 2011, it was decided that the independent quantitative monitoring of the radionuclide content in the City of Oak Ridge treated sludge could resume on a quarterly basis.
6	Joe Birchfield	Section 1.5, Page 20, 3rd Paragraph	A reference is made to the frequency of radionuclide monitoring may change depending on the statistical evaluation of the data. As the end of the latest biosolids working group this data had been evaluated and additional monitoring was not recommended. Please remove statement and see comment #5. [Basis for comment – Biosolids Working Group discussion]	See response to Comment #5.
7	Joe Birchfield	Section 1.5, Page 21, bullet list	A statement is made to the removal of the NORM. In the bullet list 6 nuclides are listed but radium-226 and -228 are not included. Please add these radionuclides to the bullet list here. [Basis for comment – NORM City of Oak Ridge and Biosolids Working Group Discussion]	The EPA regards the radionuclides that could be concentrated in municipally treated sludge as TENORM. The text of page 20 has been revised to reflect this definition. The list of radionuclides to be eliminated in the proposed action has been revised as follows: "The following radionuclides have not been included in the proposed guidelines in Table B.1 of Appendix B: • ^{131}I: This radionuclide will be monitored through the daily gamma screening performed by the City. • ^{214}Bi: This radionuclide indicates the presence of ^{226}Ra, which is included in the proposed guidelines. • ^{7}Be: This radionuclide has a short half-life (53 days) and is produced continually by cosmic ray interactions with nitrogen and oxygen in the earth's atmosphere.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				• ^{231}Pa: This radionuclide cannot be measured with adequate sensitivity by the typical commercial laboratory method. It will be evaluated in terms of the proposed guideline by assuming secular equilibrium with ^{235}U. • ^{152}Gd: This radionuclide is a low energy alpha emitter that cannot be measured by the typical commercial laboratory method." If the City of Oak Ridge determines that ^{152}Gd is a concern, method development will be required in order to obtain this analysis from a commercial laboratory. Table A.6 has been added to Appendix A to summarize the statistical evaluation of the June 2010 through May 2011 monthly radiological sampling of the treated sludge. The following text has been added to Section A.1: "**Table A.6 Statistical Evaluation** The previous environmental assessments developed for the program (DOE/EA-1042, DOE/EA-1356) described the sum of the fractions approach as the method for comparing the radiological data to the sludge guidelines. In the proposed action, the sludge guidelines are based on a fifty year program lifetime. The monthly data collected between June 2010 and May 2011 was evaluated using the ProUCL 4.1 statistical software developed by the EPA for environmental applications. The 95% upper confidence limit (UCL95) for the arithmetic mean for each radionuclide data set was calculated based on the distribution type. For nonparametric data sets, the UCL95 was selected from the Chebyshev evaluation. Soil background data points for ^{210}Pb, ^{40}K, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, and ^{238}U were taken from DOE/OR/01-2105&D1 *Soil Background Supplemental Data Set for the ETTP*. The entire background data set collected for each radionuclide was used in ProUCL 4.1 to allow two sample Wilcoxon-Mann-Whitney comparison of the sludge mean with the

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				background mean. Where the evaluation indicated that the sludge mean was greater than the background mean, the background mean was subtracted from the sludge UCL95 prior to calculation of the fractional contribution for that radionuclide. The fractional contribution was then calculated as the UCL95 divided by the sludge guideline. Assuming secular equilibrium, the ^{226}Ra background mean was used to evaluate ^{210}Pb and the ^{228}Th background mean to evaluate ^{228}Ra. Assuming secular equilibrium, the ^{235}U UCL95 value was used to evaluate ^{231}Pa, the ^{238}U value to evaluate $^{233/234}$U, and the ^{235}U value to evaluate ^{227}Ac."
8	Joe Birchfield	Section 2.1, Table 15, Page 23	Why are some of the setbacks for some ponds 100 ft and others 33 ft. Need to explain the discrepancy in this section or footnote to the table. [Basis for comment – DOE EA clarification]	As summarized in Section 2.1, the setbacks in the proposed action are intended to "conform to the EPA regulations of 40 *CFR* Part 503, as well as those requirements specified in the TDEC guidance for the land application of biosolids (TDEC 2011)." In Section 2.1, the reader is referred to Section 4.1 for the detailed discussion of the setbacks. However, in Section 4.1, reference to Appendices C and D, which contain the complete reports for the wetlands and listed species surveys, was not provided. Statements directing the reader to the appendices for further details have been added to the text.
9	Joe Birchfield	Section 2.1, Last Paragraph, Page 23	A reference is made to the state of Tennessee Biosolids Coordinator has concurred with this action. Please provide an email or letter reference to the concurrence. [Basis for comment – DOE EA clarification]	The EPA 40 *CFR* Part 503 regulations do not specify a lifetime limit based on total tonnage. As the Tennessee Biosolids Coordinator's communication served only to restate the requirement and does not provide any additional information in support of the proposed action, the communication has been removed from the text.
10	Joe Birchfield	Section 2.1, 2nd Paragraph, Page 24	A reference is made to (See Table 7 Section 1.5) for radionuclide guidance levels. Please check the reference to this table, it is a table of historical rad levels not the soil guidance levels. [Basis for comment – DOE EA clarification]	The reference has been revised to "(See Table B.1 in Appendix B)".
11	Joe Birchfield	Section 4.1, 3rd Paragraph, 2nd sentence, Page 35	A reference is made to differing setbacks. An explanation needs to be listed as to why this occurs. It appears as if the presence of karst formations and medium to high slopes are the driving factors, please list that here. [Basis for comment – DOE EA clarification]	See response to Comment #8 The following text has been inserted into section 4.1.4 to document the evaluation of the karst features: "The application sites are located near Chestnut Ridge,

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				and are underlain by siliceous dolostones of the Knox Group, consisting of silica-rich carbonate rocks. When weathered, they form silty clay soils rich in chert, and are resistant to erosion. Karst features are present in the region in the form of outcrops, small caves, and small conduits. The majority of fractures and solution cavities in the region occur in shallow bedrock and decrease with depth (> 100 ft), resulting in the majority of water transported via karst features being discharged to local surface water features within the ORR boundary. Actual walkdowns of the application sites conducted during the wetlands survey (Appendix C) revealed that the sites have some karst features including perennial streams and outcrops. Two of the locations (Rogers and Scarboro) include rock outcrop features and sinkholes. While the nature of groundwater transport through karst topography can be difficult to predict, offsite contamination from application activities is not expected due to the setbacks afforded karst features observed in the field, and the presence of regolith overlying the bedrock where application is allowed."
12	Joe Birchfield	Section 4.3, Table 27, Proposed Action, Page 50	What about the elimination of NORM radionuclides from the radionuclide guidelines. Should this change not be listed here to reduce any future confusion of whether or not it was fully evaluated under DOE NEPA requirements? [Basis for comment – DOE EA Requirements]	See response to Comment #7.
13	Joe Birchfield	Appendix B, TablesB.1 and B.2	These tables should be updated to include the exclusion of the NORM from further radionuclide monitoring. This includes Ra-226, Ra-228, K-40, etc. [Basis for comment – NORM City of Oak Ridge and Biosolids Working Group Discussion]	See response to Comment #7.
14	CAP	General Comment	The EA is a confusing document that includes other studies that might better be integrated into the body of a single EA. It appears to be based primarily on an earlier EA and should have been internally reviewed to ensure that the most recent data were incorporated. Furthermore, because some of the changes could potentially raise the monitoring costs borne by the City, a public meeting is requested so that elected officials and stakeholders can better understand what is being proposed.	The proposed action revises existing requirements specified in the previous environmental assessments (DOE/EA-1042 and DOE/EA-1356) that are inconsistent with the EPA 40 *CFR* Part 503 regulations or the TDEC land application guidelines. The proposed action does not impose any additional requirements on the City of Oak Ridge. The Biosolids Working Group will continue to provide the forum for discussion of program requirements. The City

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				of Oak Ridge POTW is represented in this group, which currently meets bi-monthly. Others are welcome to attend.
15	CAP	Section 1.3	Update Section 1.3 regarding whether the treatment plant in the Clinch River Industrial Park has been taken out of service as planned in 2010.	The treatment plant at the Clinch River Industrial Park (CRIP) was taken out of service in 2010. This section has been revised accordingly.
16	CAP	General Comment	Alternative land uses are not discussed. Some of the sites potentially could be used for new missions or released for private development. Would continued use of a site for biosolids disposal result in future land use restrictions due to accumulation of radionuclides or other contaminants?	While a worthwhile discussion, it is not within the scope of this proposed action to analyze alternative land uses. The radionuclide guidelines were established based on the potential dose to a resident farmer and therefore should not preclude release for private development. However, DOE has no plans to change the mission for this land, which has been in use since 1983 for biosolids application.
17	CAP	Section 1.5	In Section 1.5 characterization data dates to 2006, and in the case of radionuclides, to 2002 (for uranium isotopes, the most recent data are from 2000). The evaluation should include recently analyzed sludge for all analytes in Tables 3 through 6 and in Table B.2 in order to understand the current contamination profile.	The cumulative loading information for metals in Tables 8 through 13, 20 through 25, and A.7 through A.12 has been updated through November 7, 2011. The radiological data in Table 7 and Table A.5 has been updated through November 7, 2011. The radiological trend chart in Figure A.1 has been updated through November 7, 2011. Table A.6 has been added to Appendix A to summarize the statistical evaluation of the June 2010 through May 2011 monthly radiological sampling of the treated sludge.
18	CAP	Section 1.5, Table 7	There is an error in the title of Table 7: the date range should be until 2002.	Table 7 in Section 1.5 Constituents in Biosolids has been updated to include the June 2010 through May 2011 monitoring data.
19	CAP	Section 1.5, Page 20	On page 20 it states that "Appendix B presents the radionuclides that will be monitored under the Biosolids Program, and the concentration guidelines based on a 50-year program life cycle." Which table is applicable, B.1 or B.2? This should be stated in the text.	The text has been revised to indicate that Table B.1 from Appendix B provides the formal listing of radionuclides that will be monitored.
20	CAP	Section 1.5, Page 20	On page 20 a 1986 EPA survey is cited regarding the four radionuclides most frequently found in sewage sludge. This study has been superseded by more recent work and should not be cited.	This section was intended to show the historical progression in evaluation of biosolids for radionuclides. It has been revised as follows: "In an early investigation, the EPA determined from surveys that the four radionuclides most frequently found

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				in sewage sludge are ^{131}I, ^{226}Ra, ^{241}Am, and ^{137}Cs (EPA 1986). In the 2003 Interagency Steering Committee on Radiation Standards (ISCORS) survey of 313 POTW distributed around the country that had the greatest potential to receive waste from NRC licensees and in areas of higher levels of NORM, a total of forty-five radionuclides were detected with eight radionuclides detected in more than 200 samples: ^{7}Be, ^{214}Bi, ^{131}I, ^{40}K, ^{212}Pb, ^{214}Pb, ^{226}Ra, and ^{228}Ra (ISCORS-2003-02; NUREG-1775; EPA 832-R-03-002; DOE/EH-0669)…..The survey data revealed that the samples contained primarily TENORM such as radium. As a result of this survey, ISCORS concluded that despite some high activity values, a widespread problem of elevated radionuclide levels in biosolids does not exist and that while estimated doses to potentially exposed individuals generally do not require radiation protection measures, the dose to limited POTW workers and onsite residents above the protective standards could occur. The Association of Metropolitan Sewerage Agencies (AMSA) also conducted a survey of 55 POTWs that produced similar results to those generated by the ISCORS survey (Bastian et al. 2005). "
21	CAP	Section 2.1	In Section 2.1, the change in setbacks is dramatic, and combined with the elimination of the loading limit, we question whether this would be sufficiently protective of human health and the environment. In addition, some of the application sites are on karst-forming rocks and would be expected to transmit the more soluble contaminants directly to groundwater.	The setbacks in the proposed action conform to the EPA regulations (40 *CFR* Part 503) governing land application of biosolids, and to the TDEC requirements (TDEC Guidelines, 2011) which are designed so as to ensure protection of human health and the environment. As an additional protective measure, the proposed action eliminates mowing within the first 10 m of all setbacks. The discussion of karst in Section 4.1.4 has been revised. See response to Comment #11.
22	CAP	Section 2.2	Section 2.2 – DOE should develop and evaluate other alternatives. Were other application sites considered that might have less potential impact on potentially developable sites or that avoided karst-forming bedrock entirely? For example, did DOE consider applying the sewage sludge to the surface of capped landfills?	See the response to Comment #16. Application of the sewage sludge to the Melton Valley capped landfills was considered and rejected in 2010 by the manager of these areas.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
23	CAP	Section 3.3.2, Table 16	Table 16 should be updated to reflect actual census data for 2010, now available.	Section 3.3.2 Demographic and Economic Characteristics and Section 3.3.3 Population and Housing have been updated to reflect the 2010 census data.
24	CAP	Appendix A	Appendix A states that independent testing of the City biosolids resumed in June 2010; however this data is not presented in the EA. Furthermore, the use of trends with no sampling data within the past nine years (eleven years for uranium isotopes) cannot be presented as representative of the current contamination of the sludge with respect to radionuclides; industries and other waste sources have likely changed since 2002. Please add a table showing results of the June 2010 monitoring data and include these results in the analysis.	See the response to Comment #17.
25	CAP	Appendix B	Appendix B is generally confusing. Below are comments specific to this appendix. a) Why present Table B.1 at all if it has been superseded by B.2? b) The first equation on page B-7 is unreadable and should be presented as text, not inserted as a scanned image. c) Table B.2 would be easier to compare to Table 7 (and Table B.1) if the radionuclides were presented in alphabetical order. d) Proposed revision of guidance levels for radionuclide concentrations in the City municipal sludge (shown in Table B.2) results in the addition of a large number of radionuclides for monthly monitoring. On what basis were these added? Is there any monitoring data that indicate these have been found in the sludge or are there statements from local dischargers that these are likely to be in their waste streams being discharged to the sewer system? It is not clear whether the City will be responsible for carrying out the analyses or whether the analyses are a service from DOE. If the former, there must be an up-front evaluation regarding whether any of these might be excessively costly when performed by an independent lab and if so, the requirement should be balanced against the likelihood of their occurrence. Because the City receives waste from Oak Ridge National Laboratory, there is strong likelihood that they contribute the majority of the more unusual radioisotopes. The City should not be required to bear the burden of unusually high sewage sludge monitoring costs due to impacts by the DOE; in this case DOE should pay for	The proposed action revises existing requirements specified in the previous environmental assessments, DOE/EA-1042 (1996) and DOE/EA-1356 (2003), which are inconsistent with the EPA 40 *CFR* Part 503 regulations or the TDEC land application guidelines. The proposed action does not impose any additional requirements on the City of Oak Ridge. Appendix B includes Table B.1, the final listing of the radionuclides to be monitored, and the document providing the revised calculations. Table B.2 is part of the document providing the revised calculations. The first equation on page B-7 has been typed into the text.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			the radionuclide monitoring.	
26	Mark Watson, City of Oak Ridge (COR)	General Comment	The draft EA identifies 27 radionuclides that it purposes should be monitored monthly. The EA should stipulate that the cost of this monitoring program should be incurred by DOE or its environmental contractor since the source of the man-made radionuclides will most likely be DOE or reservation contractors. Nevertheless, the City of Oak Ridge will continue to support this radiological monitoring effort through the continuation of its 17-year-old gamma spectroscopy screening program which identifies any significant presence of I-131, Cs-137, Co-60, and/or total gamma.	The proposed action revises existing requirements specified in the previous environmental assessments, DOE/EA-1042 (1996) and DOE/EA-1356 (2003), which are inconsistent with the EPA 40 *CFR* Part 503 regulations or the TDEC land application guidelines. The proposed action does not impose any additional requirements on the City of Oak Ridge.
27	Mark Watson, COR	General Comment	Several places in the draft EA, the land application area is presented as either "gross acreage" or as "net application area in acres", the latter being a much smaller number and quit restrictive. However, in light of a recent joint site visit by staff of the TDEC and COR, there is good reason to believe that the net application areas of at least four of the six sites covered by this draft EA could be significantly increased with the approval of the State. Since the Biosolids Program could benefit greatly with the addition of useable acreage which, incidentally, is already licensed to the City by DOE for this purpose, the City is requesting the wording of the proposed EA be flexible enough to allow the use of increased net acreage should TDEC indeed approve it.	The following text has been added to Section 1.4 after Figure 5: "The net acreage values provided in Figure 2, Figure 4, and the maps in Appendix C were calculated after excluding the sensitive areas and sloped areas greater than 8%. These values may change with regard to slope at the discretion of TDEC."
28	Mark Watson, COR	General Comment	The 100 feet buffer stipulated in the draft EA for the large pond on the Rogers Site and for the central jurisdictional pond on the Scarboro Site should be reduced to 10 meters (33 feet) for those areas which are down gradient retaining the 100 feet setback on up slope area; this will keep uniformity with the established criteria set forth in the draft EA which were derived from the EPA regulations of 40 *CFR* Part 503 as well as the TDEC *Guidelines for the Land Application and Surface Disposal of Biosolids* (2011).	The drainage and slopes in this area are complicated. It was not possible during the wetlands survey to identify a simple upslope and downslope orientation. Therefore, the larger buffer was established.
29	Mark Watson, City of Oak Ridge (COR)	General Comment	Naturally occurring radionuclides that are not technologically enhanced should not be identified as contaminants of concern (i.e., included in the list of radionuclides for which limits are established). There are no industrial, medical or DOE processes contributing to the levels of these radionuclides (e.g., Ra-226, Ra-228, Ac-227,	The EPA recognizes that NORM radionuclides become concentrated in the biosolids, and should therefore be addressed as TENORM. The text of Section 1.5 following Table 13 has been revised as follows: Biosolids may contain technologically enhanced naturally occurring radioactive material (TENORM), which is

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			Pa-231, Th-232, Pb-210, K-40, etc.) in the ORWWTP biosolids. These radionuclides are ubiquitous in the environment, and the sources to the treatment plant are human excreta (from food and water consumed) and waste and soil that enter the sewer system. The levels of these naturally occurring in the ORWWTP sludge are comparable to the levels that would be present in any municipal sludge (actually lower than in areas where the drinking water source is groundwater) and essentially indistinguishable from the background levels of these radionuclides present in Oak Ridge soils.	naturally occurring radioactive material (NORM) that has been concentrated and radionuclides formed as a result of cosmic ray interactions, and human-made radionuclides. NORM consists primarily of material with isotopes belonging to the primordial series and ^{40}K. NORM originates in the earth's crust and underlying mantle and enters sanitary sewers primarily from the surrounding soil and water. Sources of man-made contributions to sanitary sewers are from licensed discharge from DOE facilities, discharge from the Nuclear Regulatory Commission (NRC) licensees, and from others such as medical laboratories. See the response to Comment #7 for discussion of the method of evaluation.
30	Mark Waston, COR	General Comment	The sludge limits should all be based on the TDEC approved dose limit of 10 mrem/year. At present, some limits are based on 4 mrem/year and others on 10 mrem. This is true for both naturally occurring and anthropenic radionuclides. ***[Additional info provided in the form of text/tables.]***	The proposed action revises existing requirements specified in the previous environmental assessments, DOE/EA-1042 (1996) and DOE/EA-1356 (2003), which are inconsistent with the EPA 40 *CFR* Part 503 regulations or the TDEC land application guidelines. In the DOE/EA-1042 (1996) document, the City of Oak Ridge proposed guidelines based on a 4 mrem/yr dose, whereas in the DOE/EA-1356 (2003) document, the City of Oak Ridge proposed guidelines based on a 10 mrem/yr dose for some of the radionuclides from the DOE/EA-1042, but not for all of the radionuclides specified in DOE/EA-1042 (1996). Additional radionuclides (not specified in DOE/EA-1042) were included in the 2003 document by the City of Oak Ridge. While a laudable goal, reconciling the modeling discrepancies between the two previous documents is not within the scope of the proposed action.
31	John A. Owsley, TDEC	General Comment	….the proposed levels of radionuclides in the sludge are inconsistent with the waste disposal practices as the Y-12 industrial landfills.	The City of Oak Ridge has successfully disposed of treated sludge at the Y-12 Industrial Landfill #5 in the past. Although outside of the scope for the proposed action, it is noted that the proposed guidelines would be acceptable under the current industrial landfill profiles.
32	John A. Owsley, TDEC	General Comment	The change in setbacks (and buffer areas) for the biosolids application areas. A minimal distance of 33 ft. does not seem adequately protective of waste bodies and sensitive	The setbacks in the proposed action conform to the EPA regulations (40 *CFR* Part 503) governing land application of biosolids, and to the TDEC requirements (TDEC

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			areas except where the protected feature is upslope of the land application. In all other instances a 100 ft. setback or buffer is recommended.	Guidelines, 2011) which are designed so as to ensure protection of human health and the environment. As an additional protective measure, the proposed action eliminates mowing within the first 10 m of each setback.
33	John A. Owsley, TDEC	General Comment	It would seem imprudent to dispose of any toxic materials on an area such as Chestnut Ridge underlain by a karst aquifer such as exists within the Knox Group Dolomites. Visible or not karst features allowing direct injection of waste into the groundwater system will be both common and pervasive. We acknowledge that sludge application is done on similar terrain statewide; however, Oak Ridge sludge has the potential to contain radionuclides and other contaminants not considered in the 503 regulations.	It is true that karst features are not uncommon in the application areas, however these sites are TDEC and EPA approved sites with a history of safe application. The following text has been inserted into section 4.1.4 to document the evaluation of the karst features: "The application sites are located near Chestnut Ridge, and are underlain by siliceous dolostones of the Knox Group, consisting of silica-rich carbonate rocks. When weathered, they form silty clay soils rich in chert, and are resistant to erosion. Karst features are present in the region in the form of outcrops, small caves, and small conduits. The majority of fractures and solution cavities in the region occur in shallow bedrock and decrease with depth (> 100 ft), resulting in the majority of water transported via karst features being discharged to local surface water features within the ORR boundary. Actual walkdowns of the application sites conducted during the wetlands survey (Appendix C) revealed that the sites have some karst features including perennial streams and outcrops. Two of the locations (Rogers and Scarboro) include rock outcrop features and sinkholes. While the nature of groundwater transport through karst topography can be difficult to predict, offsite contamination from application activities is not expected due to the setbacks afforded karst features observed in the field, and the presence of regolith overlying the bedrock where application is allowed."
34	John A. Owsley, TDEC	General Comment	Inspection of the East End Borrow Area located just to the west and upslope of the Scarboro application area, where surface material has been stripped, shows the presence of sinkholes, throats, and other dissolution features. The hydrological evaluations conducted in 1983 and 1989 may not be adequate and applicable to the 2011 state of knowledge regarding recharge of karst aquifers such as	The City of Oak Ridge is currently upgrading their sludge treatment system. When completed, they will apply to the TDEC Division of Water Pollution Control for a new land application approval covering all six sites. We are certain that TDEC will evaluate all features of the sites during the application process.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			exists in the underlying Knox Group dolomites.	
35	John A. Owsley, TDEC	General Comment	A review of the exclusion areas mapped within the report suggests that the Karst inventory of the area was limited to sinkholes shown on the USGS topographic map. At a twenty foot contour interval may such features are simply not shown. Groundwater monitoring suitable for karst should be considered.	The inventory of Karst in the proposed action is based upon actual walkover surveys conducted at each site in May, 2010. Any surface karst features with visible water were noted,. Appendix C of the proposed action presents the results of this walkover survey. See response to Comment #33.
36	John A. Owsley, TDEC	General Comment	Much of the Spray field area is in the watershed that drains into the Clark Center Recreation Area. If land application of sludge is to continue upstream of public swimming areas, it would include program for monitoring water and sediment quality.	Land application is conducted in accordance with the EPA 40 *CFR* regulations and the TDEC guidelines so as to avoid the movement of contaminants into the groundwater. Maintaining the proper vegetative cover, observing the application boundaries, allowing dense vegetation to grow up around the sensitive areas, and applying at a rate at or below the agronomic limit, are the major activities that ensure protection of the groundwater. The Y-12 and the ETTP environmental groups monitor the areas surrounding the application sites. UCOR, the current program manager, will ensure that these monitoring groups are kept informed of all land application activities.
37	John A. Owsley, TDEC	General Comment	DOE monitoring wells near the disposal fields show sodium concentrations suggesting that groundwater may have been impacted from past land farming of municipal sludge (see GW-187 OREIS). List of reported constituents in sludge is considerably shorter than the list of substances with regulatory limits for sludge application. Radiochemical analysis is dated with last analysis reported as 2002. What is the fate of the pasture grasses grown (including switchgrass, if grown)?	The GW-187 sampling point is located to the southwest of Roger's Quarry. According to the Y12 water monitoring program, the latest water quality data from wells in this area is 1996. In this data, the sodium and chloride concentrations in the GW-187 well along with other wells along Bethel Valley Road are higher than normally seen. The incidents of highest concentration correlate with the winter months when road salts are applied to Bethel Valley Road. We assume that the reader is referring to the Table B.1 list of radionuclides to be monitored in the biosolids. This list was established in the previous environmental assessments developed for the program (DOE/EA-1042 in 1996, DOE/EA-1356 in 2003) as a best management practice considering the potential sources to the City of Oak Ridge treatment plant. With the exception of the radionuclides to be eliminated in the proposed action,

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				analysis for this list was conducted on a monthly basis from June 2010 through May 2011, and will continue on a quarterly basis beginning in November 2011. Tables 7 and A.5 have been updated to include the recent data. Pasture grasses are mowed, usually twice a year, and left where they fall.
38	John A. Owsley, TDEC	General Comment	30ug/l total uranium MCL should be included per 40 *CFR* Parts 9, 141, 142 (FR/Volume 65, No. 236/December 7, 2000). Proposed loading should be checked against current promulgated regulations. Also, it is not clear the proposed action fulfills the 40 *CFR* Part 503.24(n) requirement that aquifers not be contaminated.	Radionuclides are not included in the list of regulated analytes under EPA *CFR* Part 503 *Standards for the Use or Disposal of Sewage Sludge*. Table B.1 in the proposed action provides a list of radionuclides to be monitored in the biosolids as a best management practice. The monitoring guidelines were developed using RESRAD at a maximum onsite resident/farmer exposure level of 10 mrem/yr. The 10 mrem/yr planning level is extremely conservative considering that the established Nuclear Regulatory Commission (NRC) radionuclide clean-up criteria are 25 mrem/yr. The drinking water exposure pathway was included in the modeling. The EPA regulations and the TDEC guidelines do not require the analysis of application site surface water or sediment. Monitoring of biosolids radionuclide levels, of application rates, of site soil levels, and of site conditions are controls designed to insure that groundwater is not negatively impacted by the biosolids applications. The following text has been added to Section 4.1.5.1: "Groundwater exposure pathways were considered in the original RESRAD modeling which was documented in the previous environmental assessments conducted for the program (DOE/EA-1042, DOE/EA-1356)." 40 *CFR* Part 503.24(n) is included in Subpart C of the regulations which govern the surface disposal of biosolids. The proposed action addresses land application only which is covered under Subpart B of the 40 *CFR* Part 503 regulations.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
39	John A. Owsley, TDEC	General Comment	RCRA subtitle D facilities on the Oak Ridge Reservation that are already capped should be considered as alternative sites for sludge disposal. The landfill caps will act as a transpiration/evaporation zones and allow the sludge to act as a soil amendment. Furthermore, the landfill may act as a buffer to prevent direct injection into underlying karst.	Although outside of the scope for the proposed action, it is noted that application of the sewage sludge to the Melton Valley capped landfills was considered and rejected in 2010 by the manager of these areas.
40	John A. Owsley, TDEC	Appendices C and D	In an editorial vein, Figure and Table numbers in Appendices C and D need to be reworked (i.e., given C._ and D._ designations) such that the figures and tables can be referred to and found. In at least one instance in the main document figures in one of the appendices are referred to with only a number (i.e., without appendix designation) causing confusion as to the location of the figure/table. It would also be helpful to list the pertinent sections, figures and tables in the Table of Contents.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 does specify that the table and figure numbers reflect the appendices designations, all figure and table numbers in Appendix C have been revised to include a leading "C", and all figure and table numbers in Appendix D have been revised to include a leading "D".
41	John A. Owsley, TDEC	Executive Summary, Page ix, Paragraph 6, Lines 6-7	DOE/EA-1042 is included in the Reference on page 58 and could best be cited here as DOE 1996 (see comments Pg. 58-59).	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing for DOE/EA-1042 have not been revised. This is more user-friendly format, especially if there are multiple references from a given source with the same date.
42	John A. Owsley, TDEC	Chapter 1, Page 1, Introduction, Lines 5-7	Should 40 *CFR* 503 be placed in the References and cited appropriately here? Should the TDEC Biosolids Guidelines be cited appropriately here? Also, there was a February 2011 revision of the biosolids guidelines.	The following references have been added to the reference section: 40 *CFR*. Chap.I, *Environmental Protection Agency*, Subchap. C, *Air Programs*, Pt. 61, *National Emission Standards for Hazardous Air Pollutants*, Pt. 261, *Identification and Listing of Hazardous Waste*, Sec. 261.4, *Exclusions*, and Subchap. O, *Effluent Guidelines and Standards*, Pt. 503, *Standards for the Use of Disposal of Sewage Sludge*. Clean Water Act. Pub.L. 84-660, *Federal Water Pollution Control Act*, as amended by Pub.L. 95-217 and Pub.L. 100-4. TDEC 2011. *Guidelines for the Land Application and Surface Disposal of Biosolids*, February 2011, Tennessee Department of Environment and

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				Conservation, Division of Water Pollution Control, Nashville, TN. The TDEC guidelines have been cited as "(TDEC 2011)" in the text. The format for the regulations and public law designations used in the text is in keeping with the requirements of BJC/OR-60, *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000.
43	John A. Owsley, TDEC	Section 1.2, Page 2, Background, Paragraph 1, Lines 6-7	Should "Oak Ridge City Ordinance Number 9-91" be included in the Reference and cited appropriately here?	The ordinance number is incorrect. The sentence has been revised as follows: "All significant industrial generators are required by Oak Ridge City Ordinance Number 5-09 (City Code) to obtain an industrial discharge permit (IDP) from the City, which prescribes discharge limits and monitoring/reporting requirements." The following reference has been added to the reference section: City Code. December 31, 2010. *The Oak Ridge Municipal Code*, Title 18, *Water and Sewers*, Chap. 3, *Sewer Use Ordinance*, prepared by the Municipal Technical Advisory Service Institute for Public Service, The University of Tennessee.
44	John A. Owsley, TDEC	Section 1.2, Page 3, Bullet 1, Line 2	EQ is not in the list of Acronyms. There is a TDEC 2011 revision of the TDEC 2010 guidelines.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies the listing of an acronym if used more than once, EQ has not been added to the acronym section. However, as its presence in the document is of little benefit to the reader, it has been deleted. Bullet 1, line 2 from page 3 has been revised to cite the TDEC 2011 revision.
45	John A. Owsley, TDEC	Section 1.2, Page 3, Table 1, Column 1, Row 3	Should the FONSI included here be placed in the References?	The FONSI for DOE/EA-1042 was published with the EA by DOE NEPA, whereas the FONSI for DOE/EA-1356 was published as a separate document.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				The following reference has been added to the reference section: DOE/EA-1356 FONSI. *Finding of no Significant Impact, Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee*, February 2003, U.S. Department of Energy, Oak Ridge Office, Oak Ridge, TN.
46	John A. Owsley, TDEC	Section 1.3, Page 3, Solids, Handling, Paragraph 1, Line 1	Should mgd be included in the list of Acronyms?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that units of measure should not be included in the acronym list.
47	John A. Owsley, TDEC	Section 1.3, Page 3, Solids Handling, Paragraph 3, Line 3	Should gpd be included in the list of Acronyms?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that units of measure should not be included in the acronym list.
48	John A. Owsley, TDEC	Section 1.4, Page 4, Table 2, Column Headings	Should Ac and ha be included in the list of Acronyms?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that units of measure should not be included in the acronym list.
49	John A. Owsley, TDEC	Section 1.4, Page 9, Paragraph 1, Lines 2-3	Should the 1983 and 1989 TDEC land application approval letters be included in the References?	The following references have been added to reference section. Burris, M.S., November 28, 1983. State of Tennessee Department of Health and Environment, Division of Solid Waste Management, Knoxville, Tennessee, letter to L. Strunk, City of Oak Ridge, Oak Ridge, Tennessee. Harris, N.R., May 8, 1989. State of Tennessee Department of Health and Environment, Division of Water Pollution Control, Knoxville Basin Office, letter to J. Robinson, City of Oak Ridge, Oak Ridge, Tennessee.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
50	John A. Owsley, TDEC	Section 1.4, Page 9, Paragraph 1, Line 16	TN0024155 and TN0078051 are included in the References. Should they be cited appropriately here (i.e., add date in parentheses after each)?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings for the permits have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
51	John A. Owsley, TDEC	Section 1.5, Page 9, Constituents in Biosolids, Paragraph 3, Lines 4, 6-7, 9, 11-12	Should the date be included with the citation of DOE/EA-1042? Would it be better to include this reference as DOE 1996 and cite it that way? DOE/EA-1356 is already included in the References. Should it just be appropriately cited here? Would it be better to include this reference as DOE 2003? Should the FONSI be included in the References and cited appropriately here? Should 40 *CFR* Part 61 be included in the References and cited appropriately here? NESHAP is not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings for the permits have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date. The following reference has been added to the reference section: DOE/EA-1356 FONSI. *Finding of no Significant Impact, Proposed Changes to the Sanitary Biosolids Land Application Program on the Oak Ridge Reservation, Oak Ridge, Tennessee*, February 2003, U.S. Department of Energy, Oak Ridge Office, Oak Ridge, TN. The FONSI for DOE/EA-1042 was published with the EA by DOE NEPA, whereas the FONSI for DOE/EA-1356 was published as a separate document. The following reference has been added to the reference section: 40 *CFR*. Chap.I, *Environmental Protection Agency*, Subchap. C, *Air Programs*, Pt. 61, *National Emission Standards for Hazardous Air Pollutants*, Pt. 261, *Identification and Listing of*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				Hazardous Waste, Sec. 261.4, *Exclusions*, and Subchap. N, *Effluent Guidelines and Standards*, Pt. 503, *Standards for the Use of Disposal of Sewage Sludge*. The acronym NESHAP has been removed from the text, as it was used only once.
52	John A. Owsley, TDEC	Section 1.5, Page 10, Table 3, Column 3, Line 4; Column1, Last Line	NA and TS are not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that acronyms are not added to the Acronym page when defined in the footnotes of a table. These acronyms are defined in the table footnotes (footnotes were added for Tables 20-25).
53	John A. Owsley, TDEC	Section 1.5, Page 12, Table 6, Last Line	U is not in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that acronyms are not added to the Acronym page when defined in the footnotes of a table. This acronym is defined in the table footnotes.
54	John A. Owsley, TDEC	Section 1.5, Page 13, Table 7, Last 2 Lines	NA and ND are not in the list of Acronyms.	For the acronym NA, see response to Comment #52. For the sake of consistency, the acronym ND (not detected) has been replaced with the acronym U (undetected), but is not included on the Acronym page (see response to Comment #53).
55	John A. Owsley, TDEC	Section 1.5, Page 14, Table 8, First Section of Table, Last Line	Natural Resources Conservation Services should be included in the References. NRCS is not on the list of Acronyms.	The following source of information has been added to the reference section: CODE 590. *Nutrient Management*, 2003, Natural Resources Conservation Service, Conservation Practice Standard, U.S. Department of Agriculture, Washington, D.C. The source information provided in Tables 8 through 13 and A.7 through A.12 has been revised to indicate "Code 590 Nutrient Management, NRCS, 2003." The acronym NRCS has been added to the acronym

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				section.
56	John A. Owsley, TDEC	Section 1.5, Page 14, Table 8, Second Section of Table, Section Column, Title Heading	No units are given for dry wgt.	The units for Table 8 and Table 20 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
57	John A. Owsley, TDEC	Section 1.5, Page 15, Table 9, Second Section, Second Column, Title Heading	No units are given for dry wgt.	The units for Table 9 and Table 21 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
58	John A. Owsley, TDEC	Section 1.5, Page 16, Table 10, Second Section, Second Column, Title Heading	No units are given for dry wgt.	The units for Table 10 and Table 22 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
59	John A. Owsley, TDEC	Section 1.5, Page 17, Table 11, Second Section, Second Column, Title Heading	No units are given for dry wgt.	The units for Table 11 and Table 23 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
60	John A. Owsley, TDEC	Section 1.5, Page 18, Table 12, Second Section, Second Column, Title Heading	No units are given for dry wgt.	The units for Table 12 and Table 24 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
61	John A. Owsley, TDEC	Section 1.5, Page 19, Table 13, Second Section, Second Column, Title Heading	No units are given for dry wgt.	The units for Table 13 and Table 25 have been corrected to read "kg/ha, dry wgt." Also, the cumulative loading figures have been revised to be current as of 11/07/11.
62	John A. Owsley, TDEC	Section 1.5, Page 20, Paragraph 5, Lines 5-6	This statement indicates that 8 radionuclides were found in 200 samples, but only 7 are listed here.	See the response to Comment #20

No.	Originator of Comment	Section/ Page	Comment(s)	Response
63	John A. Owsley, TDEC	Section 1.5, Page 20, Paragraph 5, Lines 5-7	The references here should be cited more appropriately	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
64	John A. Owsley, TDEC	Section 1.5, Page 20, Paragraph 5, Line 13	AMSA is not included in the list of Acronyms.	The acronym AMSA has been removed from the text, as the Association of Metropolitan Sewerage Agencies is mentioned only once in the document.
65	John A. Owsley, TDEC	Section 1.6, Page 21, Relevant Regulatory Drivers, Paragraph 1, Line 5	TNL002415 5 is included in the References and should be cited appropriately here. It might also advisable to list the reference as TDEC 2008a or EPA 2008a in the references. Also, should the July 2001 EPA letter be included in the References and cited appropriately here?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings for the permits have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date. The following reference has been added to the references section: Dominy, M.S, July 24, 2001. U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia, letter to B. Giles, City of Oak Ridge, Oak Ridge, Tennessee.
66	John A. Owsley, TDEC	Section 1.6, Page 21, Relevant Regulatory Drivers, Paragraph 1, Lines 9-10	Should TNL0024155 and TN0078051 be cited appropriately here (i.e., citation + date)?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings for the permits have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				These documents are included in the reference section as follows: TN0078051. *Authorization to discharge under the National Pollutant Discharge Elimination System (NPDES)*, 2008, permit, Tennessee Department of Environment and Conservation, Nashville, TN. TN0024155. *Authorization to discharge under the National Pollutant Discharge Elimination System (NPDES)*, 2008, permit, Tennessee Department of Environment and Conservation, Nashville, TN.
67	John A. Owsley, TDEC	Section 1.6, Page 21, Relevant Regulatory Drivers, Paragraph 2, Lines 4-5	The most recent revision for the guidelines is TDEC 2011.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
68	John A. Owsley, TDEC	Section 1.6, Page 22, Table 14, Column 3, Row 2	Should "U.S. Department of Energy License for Non-Federal Use of Property REORDOER-3-01-0703, Supplemental Agreement No. 2, November 1, 2010" be included in the References?	As a third supplemental agreement was executed on March 17, 2011, the following reference has been added to the references section: REORDOER-3-01-0703. *Supplemental Agreement of Outgrant*, March 2011, Real Estate Office, U.S. Department of Energy, Oak Ridge, Tennessee.
69	John A. Owsley, TDEC	Section 1.7, Page 22, Scope of the Analysis, Paragraph 3, Lines 1-3	CEQ is not in the list of Acronyms. Should 40 *CFR* Parts 1500-1508 and 10 *CFR* Part 1021 be included in the References and cited appropriately here?	The acronym CEQ has been removed from the text as it was only used once and does not provide value for the reader. The following references have been added to the reference section: 10 *CFR*. Chap. X, *Department of Energy (General Provisions)*, Pt. 1021, *National Environmental*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				Policy Act Implementing Procedures. 40 *CFR.* Chap.V, *Council on Environmental Quality*, Pt. 1500, *Purpose, Policy, and Mandate*, Pt. 1501, *NEPA and Agency Planning*, Pt. 1502, *Environmental Impact Statement,* Pt. 1503, *Commenting*, Pt. 1504, *Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory*, Pt. 1505, *NEPA and Agency Decisionmaking*, Pt. 1506, *Other Requirements of NEPA*, Pt. 1507, *Agency Compliance*, and Pt. 1508, *Terminology and Index*, Sec. 1508.7, *Cumulative Impact*.
70	John A. Owsley, TDEC	Section 2.1, Page 24, Paragraph 3, Line 4	DOE-EA/1042 and DOE-EA/1356 are included in the References and should be cited appropriately here?	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
71	John A. Owsley, TDEC	Section 3.1, Page 25, Land Use, Line 6	PSS is not in the list of Acronyms.	The acronym PSS has been removed from the text as it was only used once.
72	John A. Owsley, TDEC	Section 3.2, Page 25, Archeological, Cultural and Historical Resources, Lines 1-2	The Cultural Resources Management Plan is in the References and should be cited appropriately here.	In keeping with BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents*, this citation has been amended as follows: "The DOE *Cultural Resource Management Plan* (DOE/ORO-2085) was developed to identify, assess, and document historic and cultural resources on the ORR."
73	John A. Owsley, TDEC	Section 3.2, Page 25, Archeological, Cultural and Historical Resources, Lines 8-9	DOE/ORO-2296 is in the References and should be cited appropriately here.	In keeping with BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents*, this citation has been amended as follows: "Additional potential listings include any buildings or structures directly related to the Manhattan Project (DOE/ORO-2296)."

No.	Originator of Comment	Section/ Page	Comment(s)	Response
74	John A. Owsley, TDEC	Section 3.3.2, Page 26, Demographic and Economic, Paragraph 2, Lines 2,3	There are references for the U.S. Census Bureau and Bureau of Economic Analysis included in the References. They should be cited appropriately here (i.e., a date included).	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As the dates are included in the sentences with the citations, the citations are in keeping with the requirements of BJC/OR-60.
75	John A. Owsley, TDEC	Section 3.3.3, Page 28, Population and Housing, Paragraph 1, Lines 3-4	Is the statement "Anderson County population has increased an average of only 0.4% annually in 2005 (USCB)." necessary? The USCB Quickfacts (http://quickfacts.census.gov/qfd/states/47/47001.html) indicates that between 2000-2010 the Anderson County population increased at a rate of about 5.3%. The isolated fact given for 2005 may be misleading.	The text has been revised as follows: "Between 2000 and 2010, population growth in the ROI was slightly slower than population growth in the state of Tennessee. The ROI population increased at an average annual rate of 1.1% within this time period, while the state population increased 1.2%, annually. The Anderson County population increased at an average annual rate of only 0.5% within this time frame (USCB)." This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As the dates are included in the sentences with the citations, the citations are in keeping with the requirements of BJC/OR-60.
76	John A. Owsley, TDEC	Section 3.3.3, Page 28, Population and Housing	All citations of USCB should be done appropriately (i.e., date included).	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As the dates are included in the sentences with the citations, the citations are in keeping with the requirements of BJC/OR-60.
77	John A. Owsley, TDEC	Section 3.3.4, Page 28, Community Services	IES, FBI, THA, and USFA should be cited appropriately. Also, IES, FBI, THA, and USFA are not included in the list of Acronyms.	The hospital information included in Section 3.3.4 Community Services has been updated using data from USCB. Therefore, the citation and reference for THA, the Tennessee Hospital Association, has been removed from the text. As the acronyms IES, FBI, and USFA have been used in the references section as well as the text, they have been added to the acronym section.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
78	John A. Owsley, TDEC	Section 3.3.5, Page 28, Environmental Justice, Line 1	Executive Order 12898 is included in the References and should be cited appropriately here.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. The date and the order title are included in the sentence as an embedded citation, an approach in keeping with the requirements of BJC/OR-60.
79	John A. Owsley, TDEC	Section 3.3.5, Page 28, Environmental Justice, Lines 4-7	Should the presidential Memorandum mentioned here be included in the References?	The following reference has been added to the reference section: Clinton, W.J., February 11, 1994. The White House, memorandum accompanying Executive Order 12898 to the heads of all departments and agencies, Washington, D.C.
80	John A. Owsley, TDEC	Section 3.4, Page 29, Geology and Soils, Paragraph 1, Line 4	The statement "~3 km (70 miles)" is not correct.	This sentence has been revised as follows: "The ORR lies ~16 km (10 miles) southeast of the Cumberland Mountains and ~113 km (70 miles) northwest of the Blue Ridge Mountains."
81	John A. Owsley, TDEC	Section 3.4, Page 29, Geology and Soils, Paragraph 1, Line 5	MSL is not included in the list of Acronyms.	MSL has been added to the list of acronyms.
82	John A. Owsley, TDEC	Section 3.4, Page 29, Geology and Soils, Paragraph 2, Lines 3, 5	TDEC 1983 and TDEC 1989 are not included in the References.	The citations for the initial land application approval letters have been revised as follows: "(Burris, 1983)" and "(Harris, 1989)" The following references for the initial land application approval letters have been added to the reference section: Burris, M.S., November 28, 1983. State of Tennessee Department of Health and Environment, Division of Solid Waste Management, Knoxville, Tennessee, letter to L. Strunk, City of Oak Ridge, Oak Ridge, Tennessee. Harris, N.R., May 8, 1989. State of Tennessee Department of Health and Environment, Division of Water Pollution Control, Knoxville Basin Office, letter to J. Robinson, City of Oak Ridge,

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				Oak Ridge, TN.
83	John A. Owsley, TDEC	Section 3.4, Page 30, Geology and Soils, Paragraph 3, Lines 8-10	DOE/EA-1356 is in the References and should just be cited appropriately here.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
84	John A. Owsley, TDEC	Section 3.5, Page 30, Water Quality, Paragraph 1, Line 8	DOE 1996 is not in the References.	This citation has been updated to reference DOE/EA-1042.
85	John A. Owsley, TDEC	Section 3.5, Page 30, Water Quality, Paragraph 1, Lines 9-10	Should "Water quality is also affected by wastewater discharges by groundwater transport of contaminants from land disposal of waste." be 'Water quality is also affected by wastewater discharges, ***and*** by groundwater transport of contaminants from land disposal of waste. '	This sentence has been corrected as follows: “Water quality is also affected by wastewater discharges, and by groundwater transport of contaminants from land disposal of waste.”
86	John A. Owsley, TDEC	Section 3.5, Pages 30-31, Water Quality, Paragraph 2	The 5 mgd raw water input of Clinch River water near the headwaters of East Fork Poplar Creek for flow maintenance is not really a discharge, but adds considerably to the flow of EFPC.	Agreed, but in the paragraph we are referring to all of the discharges from Y-12 to EFPC, not just the flow maintenance water.
87	John A. Owsley, TDEC	Section 3.5, Page 31, Water Quality, Paragraph 2	DOE/EA-1356 is in the References and only needs to be cited appropriately here.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
88	John A. Owsley, TDEC	Section 3.6, Page 31, Floodplains and Wetlands, Paragraph 2, Line 12	UNESCO is not included in the list of Acronyms.	This acronym has been added to the list of acronyms.
89	John A. Owsley,	Section 3.6, Page 31, Floodplains	The Army Corps of Engineers Wetlands Delineation Manual is in the References and should be cited appropriately here	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
	TDEC	and Wetlands, Paragraph 5, Line 2	(including date).	*Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000.
90	John A. Owsley, TDEC	Section 3.7, Page 32, Climate and Air Quality, Paragraph 1, Lines 10-11	DOE/EA-1356 is in the References and only needs to be cited appropriately here.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
91	John A. Owsley, TDEC	Section 3.8, Page 32, Ecological Resources, Paragraph 1, Lines 8-10	DOE/EA-1356 is in the References and only needs to be cited appropriately here.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
92	John A. Owsley, TDEC	Section 3.8.1, Page 33, Listed Species, Paragraph 2, Lines 4	***Passerina caerulea*** is the currently valid name for the Blue Grosbeak.	The name for the Blue Grosbeak has been revised as requested.
93	John A. Owsley, TDEC	Section 3.8.1, Page 33, Listed Species, Paragraph 3, Lines 3-4	Should the personal communication cited here be placed in the References?	The following reference has been added to the reference section: Giffen, N.R., March 26, 2010, ORR Wildlife Coordinator, ORNL, personal communication. This reference has been cited as "(Giffen, 2010)" in the text.
94	John A. Owsley, TDEC	Section 3.8.1, Page 33, Listed Species, Paragraph 4, Line 3	*Ondatra zibethic~~a~~us* is the currently valid name for the muskrat.	The name for the muskrat has been revised to *Ondatra zibethicus.*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
95	John A. Owsley, TDEC	Section 3.8.1, Page 33, Listed Species, Paragraph 6, Line 6	The eastern bluebird is a thrush and not a flycatcher.	The text has been revised as requested.
96	John A. Owsley, TDEC	Section 3.8.1, Page 34, Listed Species, Paragraph 7	*Pseudacris crucifer* is the valid name for *Hyla crucifer*.	The name for the spring peepers has been revised to *Pseudacris crucifer*.
97	John A. Owsley, TDEC	Section 3.8.2, Page 34, Plants, Line 4	DOE/EA-1356 should be cited appropriately (i.e., date should be added).	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
98	John A. Owsley, TDEC	Section 3.8.3, Page 34, Vertebrates, Paragraph 1, Line 6	TWRC is not included in the list of Acronyms.	TWRC has been added to the list of acronyms.
99	John A. Owsley, TDEC	Section 3.8.3, Page 34, Vertebrates, Paragraph 2, Line 2	DOE/EA-1356 should be cited appropriately (i.e., date should be added).	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
100	John A. Owsley, TDEC	Section 4.1, Page 35, Proposed Action - Setback Amendment, Paragraph 1, Line 4	The most recent revision of the TDEC Guidelines is February 2011.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
101	John A. Owsley, TDEC	Section 4.1, Page 35, Scarboro, Paragraph 1,	What is the slope down gradient of the pond? Does it truly warrant just of 10 m buffer?	For reference, the sloped areas in excess of 8% are shaded dark blue in the tabloid sized Figure C.3 in Appendix C. The pond in question is ID #1 from Figure 3 or Figure C.2

No.	Originator of Comment	Section/ Page	Comment(s)	Response
		Line 4		(tabloid size). There are some areas with slope in excess of 8% below the pond. As the direction of flow for application in these areas would be down and away from the pond, the "upgradient" setback of 33 ft specified in the TDEC 2011 (February) guidelines is protective of the environment. As an added protection, the proposed action eliminates mowing within the first 33 ft of any setback. The use of downgradient or upgradient in the Table 1 (page 18) TDEC 2011 guidelines refers to the position of the water body in relation to the area of application. However, in the proposed action, we use the terms to indicate the location of the setback in relation to the water body. We apologize for the confusion. Therefore, for Scarboro area #1, the setback above the pond is 100ft and the setback below the pond is 33 ft.
102	John A. Owsley, TDEC	Section 4.1, Page 35, Scarboro, Paragraph 1, Line 4-6	It should be made clear here what Feature 2 is (i.e., Wet Weather Ditch). Being a wet weather ditch and dependent on the slope of the land in the vicinity, a significant rainfall event could make a 30.5 m buffer a better choice. Does the wet weather ditch flow into Feature 3 (Jurisdictional Wetland)?	This line of text has been revised as follows: "Feature 2, a wet weather drainage ditch, was given a minimum 10-m (33 ft) setback since it had no additional special considerations necessitating a larger area." Flow from the wet weather drainage ditch (Feature 2) into Feature 3 (Jurisdictional Wetland) would not be expected as drainage from Feature 2 is westward into a forested area. Although the survey did not follow the Feature 2 drainage to its terminus, the aerial photos indicate that the drainage tends southwest toward Kerr Hollow Quarry.
103	John A. Owsley, TDEC	Section 4.1, Page 36, Upper Hayfield #1, Paragraph 1	Where do the wet weather ditches drain to? What is the slope in the vicinity of these features? A 30.5 m buffer may be warranted.	The Upper Hayfield #1 wet weather ditches, map features 8 and 9 from Figure 3, drain to the southeast into a shrubby/wooded area that is not part of the application site. Although the survey did not follow Features 8 and 9 to their terminus, the aerial photos indicate that the drainage tends southeast toward Kerr Hollow Quarry.
104	John A. Owsley, TDEC	Section 4.1, Page 36, Watson Road, Paragraph 2, Lines 6-8	Areas upslope of Features 16 and 17 should be afforded a 30.5 m buffer, regardless of slope.	There are no slopes in excess of 8% around these features. The vegetation is not mowed within the 33 ft setback. Application will not occur during conditions when the soil could be saturated or frozen and this area does not have karst features. The TDEC 2011 (February) guidelines state on page 16:

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				"Biosolids can be applied to sites that have sloping topography….In general, slopes exceeding 8% should not receive biosolids application…..Biosolids should not be applied to a sloping area, regardless of degree, where there is reasonable potential/possibility for direct migration of the biosolids into any waters of the state." As there is no reasonable potential for direct mitration into the Features 16 and 17, these areas should not require protection beyond the 33 ft setback required under the TDEC guidelines or the EPA 40 *CFR* Part 503 regulations.
105	John A. Owsley, TDEC	Section 4.1, Page 37, Summation, Paragraph 1, Lines 1, 4, 5	DOE/EA-1356 is included in the references and should be cited appropriately here (i.e., date should be included). TDEC 2001 is included in the References and should be cited appropriately here. A February 2011 revision of TDEC 2010 is now available.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listings have not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date. No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
106	John A. Owsley, TDEC	Section 4.1, Page 37, Summation, Paragraph 2, Lines 1-3	The setbacks do not appear to truly follow the TDEC 2010 recommendations in that some areas not down gradient of a feature are proposed to have 10 m buffers.	The setbacks in the proposed action conform to the EPA regulations (40 *CFR* Part 503) governing land application of biosolids, and to the TDEC requirements (TDEC Guidelines, 2011) which are designed so as to ensure protection of human health and the environment. They were established to ensure that there is no reasonable potential for direct migration into any surface water. They were established after careful field inspections. As an additional protective measure, the proposed action eliminates mowing within the first 10 m of all setbacks.
107	John A. Owsley, TDEC	Section 4.1.2, Page 38, Environmental Justice, Paragraph 2, Line 5	The citation for USCB should include the date.	This sentence has been revised to reflect the 2010 census data as follows: "Thirteen of the census tracts within the ROI currently include a minority population (not white alone, or in combination) greater than the national average of 30.7% (USCB, 2010)."

No.	Originator of Comment	Section/ Page	Comment(s)	Response
108	John A. Owsley, TDEC	Section 4.1.3, Page 39, Archeological, Cultural, and Historical Resources, Paragraph 1, Line 1	Should the National Historic Preservation Act be included in the References?	The following reference has been added to the reference section: 16 U.S.C. 470. *National Historic Preservation Act of 1966*, October 15, 1966, Public Law 89-665; amended December 22, 2006, Public Law 109-453, *United States Code*, Washington, D.C.
109	John A. Owsley, TDEC	Section 4.1.3, Page 39, Archeological, Cultural, and Historical Resources, Paragraph 1, Line 3	The citation for DOE/EA-1042 should have the date included.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
110	John A. Owsley, TDEC	Section 4.1.4, Page 39, Geology and Soils, Paragraph 1, Line 8 (revised version: paragraph 4, line 2)	The citation for DOE/EA-1042 should include the date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
111	John A. Owsley, TDEC	Section 4.1.4, Page 39, Geology and Soils, Paragraph 5, Line 5	The information discussed here is not in Tables 5-10, but rather in Tables 20-25.	The text has been revised to reference Tables 20 through 25.
112	John A. Owsley, TDEC	Section 4.1.5.1, Page 42, Surface Pathway to Groundwater, Paragraph 1, Lines 3-4	The citation for EPA 822/R-93-001b should include the date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date

No.	Originator of Comment	Section/ Page	Comment(s)	Response
113	John A. Owsley, TDEC	Section 4.1.5.2, Page 42, Surface Pathway to Surface Water, Paragraph 3, Line 4	A February 2011 revision of TDEC 2010 is now available.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
114	John A. Owsley, TDEC	Section 4.1.5.2, Page 43, Surface Pathway to Surface Water, Paragraph 1, Line 3	The Tables referred to here are actually in Appendix C. The Appendix C Tables need to be re-numbered, such that the Tables could be cited correctly.	The Appendix C Tables have been renumbered as C.1 through C.4. The text on page 43 has been revised to reference Tables C.3 and C.4.
115	John A. Owsley, TDEC	Section 4.1.5.3, Page 43, City of Oak Ridge POTW discharge to EFPC, Paragraph 1, Line 3	The City of Oak Ridge, NPDES Permit, 2001 is not included in the References.	This incorrect reference has been revised to TN0024155.
116	John A. Owsley, TDEC	Section 4.1.5.3, Page 43, City of Oak Ridge POTW discharge to EFPC, Paragraph 1, Line 7	The citation for DOE/EA-1356 should include the date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
117	John A. Owsley, TDEC	Section 4.1.6, Page 43, Floodplains and Wetlands, Paragraph 1, Line 2	A February 2011 revision of TDEC 2010 is now available. DOE/EA-1042 is in the References and should be cited with the date included.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition. This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000 . As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
118	John A. Owsley, TDEC	Section 4.1.6, Page 43, Floodplains and Wetlands, Paragraph 2, Lines 3-4	This manual is included in the References and its citation here should include the date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
119	John A. Owsley, TDEC	Section 4.1.6, Page 44, Floodplains and Wetlands, Paragraph 2, Lines 4-5	No figures showing the functional wetlands and their buffers. At least the figure legends are not labeled as such.	The last sentence in section 4.1.6 has been revised as follows: "Thus, as presented in Table 15, Table 19, and Table C.1, each of the functional wetlands has a minimum 10-m (33 ft) setback established around them." All of the wetlands noted in the report are included in the figures and the maps. The jurisdictional wetlands (including both functional and purely jurisdictional, i.e., wetlands that meet the letter but not the intent of the regulations) are delineated on the maps with a white and black line. Functional wetlands that are not jurisdictional are listed as sensitive areas, and are marked with a red line.
120	John A. Owsley, TDEC	Section 4.1.6, Page 44, Floodplains and Wetlands, First Line	There is no Table 6 with this information. A Table 18 (pg. 32) summarizes the functional and jurisdictional wetlands. The only figures of the jurisdictional wetland areas are in Figures 2, 3, and 4 and in Figures in Appendix C.	The table reference has been revised to Table 18. The latitude and longitude positions for the wetlands are provided in Figure 3 and Figure 5. Pictorial representations of these areas with their setbacks are provided in Figure 2 and Figure 4. All of these figures are also provided as tabloid sized maps in Appendix C.
121	John A. Owsley, TDEC	Section 4.1.7, Page 44, Climate and Air Quality, Paragraph 1, Line 5	DOE/EA-1356 is included in the references and should be cited appropriately here with date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
122	John A. Owsley,	Section 4.1.8, Page 44,	Do the setbacks follow recommendations set forth in the current TDEC guidance? Table 1 of the 2011 revision of the	See response to Comment #104.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
	TDEC	Ecological Resources, Paragraph 1, Lines 2-3	guidance does not mention that 33 feet is a sufficient buffer down gradient of the application area if the slope is slight. See setback for ponds on Pg. 37, Watson Road.	
123	John A. Owsley, TDEC	Section 4.1.8.1, Page 44, Listed Species, Paragraph 1, Line 3	This should be updated to reflect the February 2011 revision of the TDEC guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
124	John A. Owsley, TDEC	Section 4.1.8.1, Page 45, Listed Species, Paragraph 3, Line 3; Paragraph 4, Line 2; Paragraph 6, Line 4; Bullet 3, Line 4	DOE/EA-1356 needs to be cited appropriately with date.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
125	John A. Owsley, TDEC	Section 4.1.8.1, Page 46, Listed Species, Paragraph 10, Line 2	ANA is not included in the list of Acronyms.	The acronym ANA has been added to the list of acronyms.
126	John A. Owsley, TDEC	Section 4.1.8.3, Page 46, Animals, Paragraph 1, Line 5	TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
127	John A. Owsley, TDEC	Section 4.1.9, Page 47, Potential Radiological Impacts, Paragraph 2, Lines 7, 8-9	Should 40 *CFR* Part 62 be included in the References? The TDEC rules should be cited appropriately here with a date.	The regulation was incorrectly cited as 40 *CFR* Part 62. This has been revised to 40 *CFR* Part 61. The following reference has been added to the reference section: 40 *CFR*. Chap.I, *Environmental Protection Agency*, Subchap. C, *Air Programs*, Pt. 61, *National Emission Standards for Hazardous Air Pollutants*, Pt. 261, *Identification and Listing of Hazardous Waste*, Sec. 261.4, *Exclusions*, and Subchap. O, *Effluent Guidelines and Standards*, Pt. 503, *Standards for the Use of Disposal of Sewage Sludge*.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				The date 1988 has been added to the citation for the 1200-2-11-.16- rule.
128	John A. Owsley, TDEC	Section 4.1.10, Page 48, Transportation, Paragraph 1, Lines 10-12	The document here should be cited appropriately with the date included.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
129	John A. Owsley, TDEC	Section 4.1.11, Page 49, Human Health and Safety, Paragraph 2, Line 4	HI is not included in the list of Acronyms.	This acronym has been removed from the text.
130	John A. Owsley, TDEC	Section 4.3, Page 50, Table 27, Column 1, Row 1, Line 3	TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
131	John A. Owsley, TDEC	Chapter 5, Page 51, Paragraph 1, Lines 5-6	Should 40 *CFR* Part 1508.7 be included in the References?	The following reference has been added to the reference section: 40 *CFR*. Chap.V, *Council on Environmental Quality*, Pt. 1500, *Purpose, Policy, and Mandate*, Pt. 1501, *NEPA and Agency Planning*, Pt. 1502, *Environmental Impact Statement*, Pt. 1503, *Commenting*, Pt. 1504, *Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory*, Pt. 1505, *NEPA and Agency Decisionmaking*, Pt. 1506, *Other Requirements of NEPA*, Pt. 1507, *Agency Compliance*, and Pt. 1508, *Terminology and Index*, Sec. 1508.7, *Cumulative Impact*.
132	John A. Owsley, TDEC	Section 5.1.3, Page 52, Ecological	TDEC 2010 needs to be updated to reflect the February 2011 revision of the TDEC Guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to

No.	Originator of Comment	Section/ Page	Comment(s)	Response
		Resources, Line 4		cite the 2011 edition.
133	John A. Owsley, TDEC	Section 5.1.5, Page 52, Air Quality, Paragraph 1, Line 1	DOE/EA-1356 should be cited appropriately with the date included.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
134	John A. Owsley, TDEC	Section 5.1.5, Page 52, Air Quality, Paragraph 2, Line 5	DOE/ASER should be cited appropriately with the date included.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
135	John A. Owsley, TDEC	Chapter 6, Page 55, Paragraph 1, Lines 2-3	Should 40 *CFR* Part 261.4(a) be included in the References?	The following reference has been added to the reference section: 40 CFR. Chap.I, Environmental Protection Agency, Subchap. C, Air Programs, Pt. 61, National Emission Standards for Hazardous Air Pollutants, Pt. 261, Identification and Listing of Hazardous Waste, Sec. 261.4, Exclusions, and Subchap. O, Effluent Guidelines and Standards, Pt. 503, Standards for the Use of Disposal of Sewage Sludge.
136	John A. Owsley, TDEC	Chapter 6, Page 55, Paragraph 1, Lines 2-3	Should 40 *CFR* Part 503 and the CWA be included in the References?	The following references have been added to the reference section: 40 *CFR*. Chap.I, *Environmental Protection Agency*, Subchap. C, *Air Programs*, Pt. 61, *National Emission Standards for Hazardous Air Pollutants*, Pt. 261, *Identification and Listing of Hazardous Waste*, Sec. 261.4, *Exclusions*, and Subchap. O, *Effluent Guidelines and Standards*, Pt. 503, *Standards for the Use of Disposal of*

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				Sewage Sludge. Clean Water Act. Pub.L. 84-660, *Federal Water Pollution Control Act*, as amended by Pub.L. 95-217 and Pub.L. 100-4.
137	John A. Owsley, TDEC	Chapter 6, Page 55, Paragraph 3, Lines 4-5	TN0024155 and TN0078051 are included in the References and should be cited appropriately here with date included.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
138	John A. Owsley, TDEC	Chapter 6, Page 55, Paragraph 5, Lines 5-7	TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
139	John A. Owsley, TDEC	Chapter 6, Page 55, Paragraph 6, Line 3	TDEC 2010 should be updated to reflect the February 2011 revision of the TDEC Guidance.	No differences were noted between the 2011 and the 2010 editions of the TDEC guidelines. Therefore, all references to the TDEC guidelines in the text have been changed to cite the 2011 edition.
140	John A. Owsley, TDEC	Chapter 6, Page 56, Paragraph 1, Lines 2, 4	The citations here should include dates.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
141	John A. Owsley, TDEC	Chapter 7, Page 57-59, References	References in this section should be redone so that the style is consistent. It would be helpful if all documents by an entity (e.g., DOE) were listed as DOE, date, title of document, etc.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
142	John A. Owsley, TDEC	Chapter 7, Page 57, References, Bastian, R.K.	All authors should be listed for this reference. Bastian, R.K., Bachmaier, J.T., et al. is not in accordance with the American Association for the Advancement of Science Guidance.	This reference has been amended as follows: Bastian, R.K., Bachmaier, J.T, Schmidt, D.W.,Salomon, S.N., Jones, A., Chiu W.A., Setlow, L.W., Wolbarst, A.B., Yu, C., Goodman, J., Lenhart, T., "Radioactive Materials in Biosolids: National survey, dose modeling, and publicly-owned treatment works (POTW) guidance," *Journal of Environmental Quality*, 2005, Volume 34, pp. 67-74. American Society of Agronomy, Madison, WI.
143	John A. Owsley, TDEC	Chapter 7, Page 58, References, FBI	The hyperlink given here does not take you to the police data.	The hyperlink has been updated to http://www2.fbi.gov/ucr/cius2008/police/index.html
144	John A. Owsley, TDEC	Chapter 7, Page 59, References, SAMAB	This reference was not cited in the document.	Citations for this reference have been added to the following sections: Section 3.6 FLOODPLAINS AND WETLANDS "In 1989, the ORNERP was designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as one of six units of the Southern Appalachian Biosphere Reserve (SAMAB). " Section 3.8 ECOLOGICAL RESOURCES "In 1988 the ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program (SAMAB)."
145	John A. Owsley, TDEC	Chapter 7, Page 59, References, TDEC 2001	The hyperlink given here works, but does not lead to this version of this document.	This hyperlink was incorrectly placed with the TDEC 2001 reference. It has been moved to the TDEC 2011 reference listing in Chapter 7.
146	John A. Owsley, TDEC	Appendix A, Page A-5, Figure A.1	What are the units on the Y-axis?	Figure A.1 has been revised to include current data and graph units.
147	John A. Owsley, TDEC	Appendix A, Page A-8, Figure A.4, Footnote	U is not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				60 specifies that acronyms are not added to the Acronym page when defined in the footnotes of a table. This acronym is defined in the table footnotes.
148	John A. Owsley, TDEC	Appendix A, Page A-I0, Pathogens, Paragraph 1, Lines 1-2	Is there another purpose to distribute biosolids to the community other than for home gardens?	This sentence has been revised as follows: "Class A biosolids have pathogen contents that are below detection limits and are therefore suitable for use in home or community gardens."
149	John A. Owsley, TDEC	Appendix A, Page A-10, Oak Ridge Reservation Land Application Site Characteristics, Paragraph 2, Line 4	PAN is not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that acronyms that are only used in the Appendices not be included on the Acronym page. In addition, PAN is defined in the text where it is used.
150	John A. Owsley, TDEC	Appendix A, Page A-10, Oak Ridge Reservation Land Application Site Characteristics, Paragraph 3	MR and VR are not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that acronyms that are only used in the Appendices not be included on the Acronym page. The acronyms MR and VR are defined in the Appendix when it is used and is the only time it occurs.
151	John A. Owsley, TDEC	Appendix A, Page A11-A-16, Tables A.6 –A.11, Second Section of Table, Column 2 Heading, Line 4	What are the units for dry wgt?	The units for the cumulative amounts reported in Tables A.7 through A.12 have been revised to "kg/ha, dry wgt."
152	John A. Owsley, TDEC	Appendix B, Page B-7, Equation and parameter explanation following Paragraph 3	The font used for this information is not clearly readable.	This equation was originally an embedded object. It has been typed into the text as follows: On a per acre basis, the total quantity of a radionuclide, Q_a (pCi), that can be present in the land application site soil at the time residency begins is the soil concentration guideline multiplied by the corresponding soil mass, which is 9.15×10^5 kg (9.15×10^8 g), assuming a mixing depth of 0.15 m and a soil density of 1500 kg/m^3. $Q_a = C_{soila} (m_{soil})$

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				C_{soil} – Concentration limits for radionuclide "a" in soil, (pCi/g) m_{soil} – mass of soil in top 0.15 m of one acre, (g)
153	John A. Owsley, TDEC	Appendix B, Page B-8, Table B.2, Footnote b	DSR is not included in the list of Acronyms. The ISCORS reference should be cited appropriately here with the date included.	The acronym DSR has been removed from the text.
154	John A. Owsley, TDEC	Appendix C, Page C-7, Wetlands Walkover	Should all tables and figures in this report be relabeled C.1, etc. since this is Appendix C?	The Tables have been relabeled as Table C.1 through C.4.
155	John A. Owsley, TDEC	Appendix C, Page C-7, Introduction	DOE/EA-1356 is included in the Appendix C References as DOE 2003 and should be cited here accordingly.	The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
156	John A. Owsley, TDEC	Appendix C, Page C-7, Introduction, Lines 4-5	Is there a reference for the 1996 survey? If so, it should be included in the Appendix C References.	The following reference has been noted on Page C-7 and added to the references in Section 6 of Appendix C: SAIC 1996 *Wetlands Survey of Active and Inactive Sludge Land Application Sites on the U. S. Department of Energy's Oak Ridge Reservation, Oak Ridge, Tennessee*. September.
157	John A. Owsley, TDEC	Appendix C, Page C-8, Paragraph 3, Lines 1 & 9-11	Should the CWA and TDEC 2001 be included in the Appendix C References?	The Appendix C citation has been corrected to "(TDEC 2011)" and the following references added to the reference section of Appendix C: TDEC 2011. *Guidelines for the Land Application and Surface Disposal of Biosolids*, February 2011, Tennessee Department of Environment and Conservation, Division of Water Pollution Control, Nashville, TN. Clean Water Act. Pub.L. 84-660, *Federal Water Pollution Control Act*, as amended by Pub.L. 95-217 and Pub.L. 100-4.
158	John A. Owsley,	Appendix C, Page C-9, Paragraph 1,	Should "Aerial map" be 'Aerial maps'?	The text has been revised to read "Aerial maps".

No.	Originator of Comment	Section/ Page	Comment(s)	Response
	TDEC	Line 2		
159	John A. Owsley, TDEC	Appendix C, Page C-9, Paragraph 2, Lines 6-7	Should the USACE Wetlands Manual be included in the Appendix C References?	The following reference has been added to the Appendix C References: Y-87-1. *Corps of Engineers Wetlands Delineation Manual*, January 1987, Environmental Laboratory, Wetlands Research Program Technical Report, U.S. Army Corps of Engineers, Washington, D.C. URL: http://el.erdc.usace.army.mil/wetlands/pdfs/wlman87.pdf Accessed 01/04/2012.
160	John A. Owsley, TDEC	Appendix C, Page C-11, Paragraph 2, Line 7	Should Table 2 be referred to as Table C.2 since it is now in Appendix C?	The Appendix C tables have been re-designated as Tables C.1 through C.4.
161	John A. Owsley, TDEC	Appendix C, Page C-12, Figure 1	Figure 1 and all subsequent figures in Appendix C should be re-designated as Fig. C.1, etc	The Appendix C figures have been re-designated as Figures C.1 through C.18 (including tabloid sized maps).
162	John A. Owsley, TDEC	Appendix C, Page C-20, Functional Wetland Areas, Paragraph 1, Lines 3-5	Table 3 should be re-designated as Table C.3. It is indicated here that three significant functional wetlands are listed in the table, but four are present.	The Appendix C tables have been re-designated as Tables C.1 through C.4. The text of Appendix C Section 3.2 has been revised as follows: "Four significant functional wetlands are listed in Table C.4. It is recommended that these four areas be afforded the same degree of protection as the jurisdictional wetlands."
163	John A. Owsley, TDEC	Appendix C, Page C-21, Conclusions, Paragraph 1, Lines 7-9	Only three maps are present in Figures 1-10. None of these maps distinctly indicate the functional wetlands.	All of the wetlands noted in the report are included in the maps. The jurisdictional wetlands (including both functional and purely jurisdictional, i.e., wetlands that meet the letter but not the intent of the regulations) are delineated on the maps with a white and black line. Functional wetlands that are not jurisdictional are listed as sensitive areas, and are marked with a red line.
164	John A. Owsley, TDEC	Appendix C, Pages C-27-C-32	These figures need to be re-designated as Figure C.13-Figure C.18 to fit in correctly with the remainder of Appendix C.	The tabloid sized maps have been re-designated as Figures C.13 through C.18.
165	John A. Owsley, TDEC	Appendix D, Page D-3, Table D-l, Column 1	*Crytobranchus alleganiensis* should be Cry***p***tobranchus alleganiensis	The name has been corrected as requested.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
166	John A. Owsley, TDEC	Appendix D, Page D-4, Table D-l, Column	*Empidonax trailii* should be *Empidonax trai**ll**ii*. *Helmitheros vermivorus* should be *Helmitheros vermivor**um***.	These names have been corrected as requested.
167	John A. Owsley, TDEC	Appendix D, Page D-5, Table D-l, Footnote b	E, MC, NM, and RI are not included in the list of Acronyms.	These acronyms, which appear only in Table D.1, are defined in a footnote at the end of the table. They have not been added to the list of Acronyms.
168	John A. Owsley, TDEC	Appendix D, Page D-9, Introduction, Paragraph 1, Lines 1 & 4	DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited as such here.	The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
169	John A. Owsley, TDEC	Appendix D, Page D-9, Introduction	The Introduction given here is for the wetlands walkover and not the listed species walkover.	The introduction to the listed species survey has been amended as follows: "An Environmental Assessment (EA), DOE/EA-1356, was issued in February 2003 for the Biosolids program on the Oak Ridge Reservation (ORR) and a finding of No Significant Impact (FONSI) was issued. The Department of Energy (DOE) proposes to modify the Biosolids program, which will result in several changes not analyzed in DOE/EA-1356. CDM was contracted to perform a formal listed species survey for all six active application sites (Table D.2). This information will be included in a new EA to be prepared as directed by the Environmental Assessment Determination (EAD) issued by DOE on February 10, 2010."
170	John A. Owsley, TDEC	Appendix D, Page D-9, Introduction, Paragraph 1, Line 7	Table 1 needs to be re-designated as Table D.2.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
171	John A. Owsley, TDEC	Appendix D, Page D-10, Paragraph 2, Line 4; Paragraph 3, Line 2; Paragraph 4,	***Passerina caerulea*** is the currently valid name for the Blue Grosbeak. *Branta Canadensis* should be *Branta ~~C~~canadensis.* *Ondatra zibethic~~a~~us* is the currently valid name for the muskrat.	These names have been revised as requested.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
		Line 3		
172	John A. Owsley, TDEC	Appendix D, Page D-10, Paragraph 3, Lines 3-4	Shouldn't the personal communication be included in the Appendix D References?	The following personal communications have been added to the Appendix D References: Neil R. Giffen, March 26, 2010, ORR Wildlife Coordinator, ORNL, personal communication. Neil R. Giffen, April 13, 2010, ORR Wildlife Coordinator, ORNL, personal communication. Neil R. Giffen, April 27, 2010, ORR Wildlife Coordinator, ORNL, personal communication.
173	John A. Owsley, TDEC	Appendix D, Page D-11, Ecological Walk Over Surveys, Paragraph 1, Line 2	Figs. 1-6 need to be re-designated as Figs. D.1-D.6.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
174	John A. Owsley, TDEC	Appendix D, Page D-11, Database Consultation and Rare Wildlife Species, Paragraph 1, Lines 4-5, 5-6; 7-10	What are the ORR lists and should they be included in the Appendix D References? Partners in Flight is included in the Appendix D References and should be cited appropriately here. Shouldn't the TWRA and TWRC databases be included in the Appendix D References?	The following source for the ORR wildlife list has been cited in the Appendix D text and added to the Appendix D References: Rarewildlifelist 2010, Neil R. Giffen, provided August 18, 2010, ORR Wildlife Coordinator, ORNL, personal communication. The wildlife in need of management list was issued by TWRC. Therefore the reference to TWRA has been removed from the text. The following source for the TWRC wildlife list has been added to the Appendix D References. Proclamation No. 00-14. *Tennessee Wildlife Resources Commission Proclamation Wildlife in Need of Management*, Tennessee Wildlife Resources Commission, August 2000.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
175	John A. Owsley, TDEC	Appendix D, Page D-13, General Observations, Paragraph 2, Line 10	*Poecile caronlinensis* should be *Poecile caro~~n~~linensis.*	This name has been revised as requested.
176	John A. Owsley, TDEC	Appendix D, Page D-13, General Observations, Paragraph 3, Lines 3, 4	*Rana catesbeiana* should be *Lithobates catesbeianus.* *Hyla crucifer* should b*e Pseudacris crucifer.*	These names have been revised as requested.
177	John A. Owsley, TDEC	Appendix D, Page D-14, Paragraph 1, Line 7	DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited here as such.	The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
178	John A. Owsley, TDEC	Appendix D, Page D-14, Plants, Paragraph 1, Line 3	DOE/EA-1356 is included in the Appendix D References as DOE 2003 and should be cited here as such.	The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
179	John A. Owsley, TDEC	Appendix D, Page D-14, Vertebrates, Paragraph 1, Lines 2, 4-5	GWRA should be **GT**WRA. What ORR information was checked and should it be included in the Appendix D References? Should TWRA and TWRC be placed in the Appendix D References and cited appropriately here?	The following source for the ORR wildlife list has been cited in the Appendix D text as "Rarewildlifelist 2010" and added to the Appendix D References: Rarewildlifelist 2010, Neil R. Giffen, provided August 18, 2010, ORR Wildlife Coordinator, ORNL, personal communication. The wildlife in need of management list was issued by TWRC. Therefore the reference to TWRA has been removed from the text. The following source for the TWRC wildlife list has been cited in the Appendix D text as "Proclamation No. 00-14" and added to the Appendix

No.	Originator of Comment	Section/ Page	Comment(s)	Response
				D References: Proclamation No. 00-14. *Tennessee Wildlife Resources Commission Proclamation Wildlife in Need of Management*, Tennessee Wildlife Resources Commission, August 2000.
180	John A. Owsley, TDEC	Appendix D, Page D-14, Species Considered But Eliminated, Paragraph 1, Lines 5-6	Table 1 should be Table 2, which should be re-designated as Table D.3. The personal communication should be included in the Appendix D References.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
181	John A. Owsley, TDEC	Appendix D, Page D-15, Table 2, Source	What is the ORR (April 2010) source and should it be in the Appendix D References?	The following source for the ORR wildlife list has been cited in the Appendix D text as "Rarewildlifelist 2010" and added to the Appendix D References: Rarewildlifelist 2010, Neil R. Giffen, provided August 18, 2010, ORR Wildlife Coordinator, ORNL, personal communication.
182	John A. Owsley, TDEC	Appendix D, Page D-16, Paragraph 1, Line 2	Should the TWRA and TWRC lists be included in the Appendix D References and cited appropriately here?	The wildlife in need of management list was issued by TWRC. Therefore the reference to TWRA has been removed from the text. The following source for the TWRC wildlife list has been cited in the Appendix D text as "Proclamation No. 00-14" and added to the Appendix D References: Proclamation No. 00-14. *Tennessee Wildlife Resources Commission Proclamation Wildlife in Need of Management*, Tennessee Wildlife Resources Commission, August 2000.
183	John A. Owsley,	Appendix D, Page D-16, Paragraph	The personal communication should be included in the Appendix D References.	The following personal communications have been added

No.	Originator of Comment	Section/ Page	Comment(s)	Response
	TDEC	2, Line 8; Paragraph 4, Lines 5-6; Paragraph 5, Lines 10-11		to the Appendix D References: Neil R. Giffen, March 26, 2010, ORR Wildlife Coordinator, ORNL, personal communication. Neil R. Giffen, April 13, 2010, ORR Wildlife Coordinator, ORNL, personal communication. Neil R. Giffen, April 27, 2010, ORR Wildlife Coordinator, ORNL, personal communication.
184	John A. Owsley, TDEC	Appendix D, Page D-16, Paragraph 3, Line 1; Paragraph 4, Line 2	Table 2 should be re-designated as Table D.3.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
185	John A. Owsley, TDEC	Appendix D, Page D-16, Paragraph 3, Line 1	DOE/EA-1356 is in the Appendix D References as DOE 2003 and should be cited as such.	The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing has not been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date.
186	John A. Owsley, TDEC	Appendix D, Page D-16, Paragraph 5, Line 12	Figs. 4, 5, and 6 should be Figs. D.4; D.5; and D.6.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
187	John A. Owsley, TDEC	Appendix D, Page D-18, Paragraph 1, Line 3	Table 3 should be re-designated as Table D.4.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
188	John A. Owsley, TDEC	Appendix D, Page D-18, Paragraph 2 and remainder of page	All Figures mentioned in this Paragraph need to be re-designated as Figure D._.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
189	John A. Owsley, TDEC	Appendix D, Page D-19, Table 4, Scientific name	*Wilsonia citrine* should be *Wilsonia citrin**ea**.* *Empidonax trailii should be Empidonax trai**ll**ii.*	These names have been revised as requested.
190	John A. Owsley,	Appendix D, Page D-20	All Figures on this page need to be re-designated as D._.	The Appendix D figures have been re-designated as Figures D.1 through D.6.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
	TDEC			
191	John A. Owsley, TDEC	Appendix D, Page D-21, Federal and Tennessee State Listed Species, Paragraph 2, Lines 2-4	Here it indicates that the biosolids areas are mowed annually. On page 48, Paragraph 2 of the document it indicates that fields are mowed twice annually.	The second sentence in the second paragraph under Section 4.1 of Appendix D has been revised as follows: "For all of the six study areas this means that the areas are mowed at least once, and usually twice, each year to prevent the development of woody plant species."
192	John A. Owsley, TDEC	Appendix D, Page D-21, Paragraph 3, Line 4	Table 2 should be re-designated as Table D.3.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
193	John A. Owsley, TDEC	Appendix D, Page D-21, Bullet 3, Line 4	DOE 2002 is not included in the Appendix D References.	The biological assessment performed in 2002 was published in DOE/EA-1356 which was completed in 2003.
194	John A. Owsley, TDEC	Appendix D, Page D-22, Paragraph 1, Line 4	Table 2 needs to be re-designated as Table D.3.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
195	John A. Owsley, TDEC	Appendix D, Page D-22	Figures on this page need to be re-designated as Fig. D._.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
196	John A. Owsley, TDEC	Appendix D, Page D-23, Bullet 1	Figure 1 needs to be re-designated as Figure D.I.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
197	John A. Owsley, TDEC	Appendix D, Page D-23, Bullet 4, Lines 6-7	Tables 2 and 3 need to be re-designated as Tables D.3 and D.4.	The Appendix D tables have been re-designated as Tables D.1 through D.5.
198	John A. Owsley, TDEC	Appendix D, Page D-25. References. PIF 2010	PIF is not included in the list of Acronyms.	This document has been formatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. BJC/OR-60 specifies that acronyms that are only used in the Appendices not be included on the Acronym page. In addition, PIF is defined in the table footnote.
199	John A. Owsley, TDEC	Appendix D, Page D-27-D-32	Figures 1-6 need to be re-designated as Figures D.l-D.6.	The Appendix D figures have been re-designated as Figures D.1 through D.6.
200	John A. Owsley, TDEC	Section 3.4, Page 29: Geology and Soils	Ordovician is a geologic time *period* and this can be subdivided into *series* and that subdivided into *ages.* If age or *aged (sic)* is to be used as it is in this section, should be as follows: Early Ordovician, Late Ordovician etc., the word	The words "age" and "aged" have been removed from the text. We thank the reader for the thoughtful comments.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			age, aged (sic) is unnecessary (USGS, 1978). The reference to ground water movement in relation to any other karst terrain such as this is in conduits. Worthington et al., 1999, 2000; Davies, 2008, calculate that >94% of the flux in conduits is in conduits in most carbonates (called karst or not). This proposal suggests ground water moves along dissolutionally enlarged joints but the loci of many if not most cave passages (conduits) and channels are controlled by gradients often regardless of the alignment of joints or bedding planes. The rest of the discussion about the direction of ground water flow fails to mention that most ground water in dipping rocks most often discharges along the strike. There are springs on the dip and scarp slopes of the Knox in Oak Ridge, but the springs in the direction of strike are usually the largest with the longest conduit pathways associated with them, as is the case in other karst terrains (Worthington, 1991). Average flow path lengths in the direction of strike is many kilometers (Worthington, 1991) so any activity here at this sprayfield might have water-quality implications far downgradient. ***[A list of references was provided]***	However, as the proposed action is based on the current TDEC land application approvals and the previous environmental assessments developed for the program (DOE/EA-1042 in 1996 and DOE/EA-1356 in 2003), a new hydrological investigation was not performed. Surface features were identified. However, dye tests and other investigations of subsurface flow were not conducted.
201	John A. Owsley, TDEC	Section 4.1.5.1, Page 43, Surface Pathway to Ground Water	Recharge type has been described in carbonate and karst terrains as *concentrated or dispersed* (ASTM, 1995). Dispersed recharge deserves some additional discussion. Although dispersed suggests non-point, soils on fractured rocks (carbonate and karst) are riddled with *macropores* that will transmit ground water rapidly into the subsurface anywhere (USEP A, 1996). Recharge in carbonates and karst converges to the more efficient pathway and thus is always some form of concentrated recharge when it reaches the bedrock (or the macropore). The assumption that sanitary biosolids introduced into the soil will be retarded is questionable for two reasons: a) Traced velocities in karst, carbonates and many other fractured rocks are (1) rapid enough (mean of 1.7 km/day, 2,877 tests in 43 countries [Worthington et al., 1999]) to transport even some of the largest particle size, so the constituent need not be in solution, merely in suspension, and (2) in between swallets (sinking streams) or other sinkholes, flow will still be convergent via	We thank the reader for the thoughtful comment. However, as the proposed action is based on the current TDEC land application approvals and the previous environmental assessments developed for the program (DOE/EA-1042 in 1996 and DOE/EA-1356 in 2003), a new hydrological investigation was not performed. We do not dispute the fact that transport of contaminants can occur along solution channels. The City of Oak Ridge is currently upgrading their sludge treatment system. When completed, they will apply to the TDEC Division of Water Pollution Control for a new land application approval covering all six sites. We are certain that TDEC will evaluate all features of the sites during the application process.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			macropores, so even small concentrations can increase when they accumulate and recharge in one concentrated stream. b) Pathogens are known to migrate rapidly in carbonates and karst, (see website on Walkerton, Ontario enquiry) exactly the opposite to what is stated in the proposal. Models almost never consider macropores that behave just like conduits in the bedrock, so without macropores models often create retardation and attenuation scenarios that in reality may not exist. One reference (Parr and Hughes, 2006) uses a very misleading reference on the nature of recharge on the ORR - that only ~5% of the precipitation infiltrates. This infiltration number is dramatically contradicted a few hundred meters away from this proposed site, where the number obtained is 53% infiltration (Luxmoore and Huff, 1989). Which value was used in the models? Were macropores incorporated in the models? Uranium forms soluble complexes with the carbonate and phosphate ion and also can form soluble complexes with humic and fulvic acid (Gascoyne, 1992). Both these anions are present either in the sludge or the soil water. In addition, the sludge contains organic compounds that also could change the behavior of the uranium-series nuclides; thorium is believed to form stronger bonds. This suggests that simple models that assume uranium and any of its daughter products could be adsorbed on the soil may not be tenable. Even if the uranium or its daughter nuclides are adsorbed the volume and velocity of recharge could physically erode the soil and sludge and transport the whole mass. The mean velocity in conduits or channels in karst and unconfined carbonates is 0.022 m/s, 2 km/day (Worthington, et al., 1999). Recharge in karst is either dispersed or via sinking streams. If the recharge is via sinking streams there will be essentially no retardation and the sludge and its components would be transported directly to conduits and then far downgradient rapidly. Even away from sink points the soil may have pipes and macropores present and these could provide open pathways for rapidly transporting sludge or soil into conduits. ***[A list of references was provided]***	

No.	Originator of Comment	Section/ Page	Comment(s)	Response
202	Patricia Parr, ORNL	Section 3.8, Paragraph 1	I have found an error in section 3.8. The last sentence states there are several state natural areas. There are no state natural areas anymore-- DOE cancelled the agreement with TDEC a few years ago. However, there are several Research Park Natural Areas--and that may be what you are wanting to say. I would simply remove "state" and replace it with "Research Park". A reference for the Research Park Natural Areas is Parr and Hughes, Oct. 2006. ORNL/TM-2006/110. Oak Ridge Reservation Physical Characteristics and Natural Resources. Also- on page 63- under my name, you might include my title "Natural Resources Manager" and leave out Facilities and Operations Directorate.	The final sentence in the first paragraph of Section 3.8 has been revised as follows: "The ORR has also been established as a Tennessee Wildlife Management Area under a cooperative agreement between DOE and TWRA and includes the 20,000-acre Oak Ridge National Environmental Research Park and other Research Park Natural Areas (ORNL/TM-2006/110)." The references in the Appendices have been reformatted according to requirements provided in BJC/OR-60 *Requirements for Bechtel Jacobs Company LLC Documents, Oak Ridge, Tennessee*, as amended by Draft UCOR-4000. As BJC/OR-60 specifies a bibliography type format for the references, the citation and reference listing have been revised. This is a more user-friendly format, especially if there are multiple references from a given source with the same date. The revised reference listing is: ORNL/TM-2006/110. *Oak Ridge Reservation: Physical Characteristics and Natural Resources*, September 2006, Oak Ridge National Laboratory, Oak Ridge, Tennessee. The listing in Section 8, Individuals and Agencies Consulted has been revised as follows: Ms. Pat Parr Natural Resources Manager Oak Ridge National Laboratory P.O. Box 2008 MS6340 Oak Ridge, TN 37831-6340
203	Ken Glass, City of Oak Ridge Sludge Treatment Plant	Section 1.2, Paragraph 1 Section 1.6	Page 2, line six should read "All <u>*significant*</u> industrial generators…" to be accurate. Page 21, section 1.6, last sentence of first paragraph. The City's NPDES permit states "The permittee must comply with 40 *CFR* 503 et seq." Strictly speaking, this is not the same as restating the specific requirements of 40 *CFR* 503	The word "significant" has been inserted into the text as requested. The word "restated" has been replaced by "incorporated by reference" in the text.

No.	Originator of Comment	Section/ Page	Comment(s)	Response
			as the draft EA states.	
		Section 4.1.8.2	Page 46, line 3 of section 4.1.8.2 has an extraneous f.	The lone "f" has been removed from the text.
		Section 6, Paragraph 2	Page 55, line 5 refers to 40 *CFR* 504. It should read 40 *CFR* 503.	The text has been corrected to reference 40 *CFR* 503.
		Appendix A	Page A-3, under the section "Organic Chemicals", the statement is totally incorrect; nothing in the NPDES permit requires us to ever do organic analysis on the biosolids. However, we do this analysis annually by choice.	The text on Page A-3 has been revised as follows: "Currently, the City performs annual sampling of the biosolids for organic analytical parameters. **Table A.4** presents the results of selected organic compounds analysis for the City biosolids."

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