DOE/OR/01-2922&D2 March 2023

U.S. Department of Energy
Environmental Management Program DOE/OR/01-2922&D2

Proposed Plan for the Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee

This Proposed Plan describes:

- Residual contamination in groundwater in the K-31/K-33 Area at the East Tennessee Technology Park (ETTP).
- Current and future human health risks from groundwater in the K-31/K-33 Area at ETTP.
- Remedial action alternatives evaluated in the *Remedial Investigation/Feasibility Study Report for the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2893&D2).
- The preferred remedial action alternative for groundwater in the K-31/K-33 Area at ETTP as monitored natural attenuation.
- How to participate in selecting or modifying the preferred remedial action alternative, including a public meeting on *month/day/year* and a 45-day public comment period beginning on *month/day/year* and ending on *month/day/year*.
- Where to get more information.

YOUR OPINION IS INVITED

The U.S. Department of Energy (DOE) invites you to express your opinion of the presented remedial alternatives and the preferred alternative for K-31/K-33 Area groundwater at the East Tennessee Technology Park. You are encouraged to read the *Remedial Investigation/Feasibility Study Report for the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* for more detailed background and technical information. A comment form is attached to this Proposed Plan, but you are not restricted to this form. Decision makers will consider any comments received before the end of the public comment period.

Community involvement is critical to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, cleanup process. DOE has established a 45-day public comment period, during which time local residents and interested parties can express their views and concerns on this Proposed Plan. DOE will schedule a public meeting to discuss remedial action alternatives and to address questions and concerns the public may have.

This document has been reviewed and confirmed to be UNCLASSIFIED and contains no UCNI.
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Date: 02/20/2023
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1. INTRODUCTION

This Proposed Plan presents the U.S. Department of Energy's (DOE's) preferred remedial action alternative for K-31/K-33 Area groundwater at the East Tennessee Technology Park (ETTP), located on the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee (Figure 1). The preferred alternative is monitored natural attenuation (MNA), which is a groundwater remediation approach that relies on natural processes to decrease or attenuate concentrations of contaminants in groundwater. MNA was selected to address chromium and nickel contamination in K-31/K-33 Area groundwater. Although chromium and nickel have been detected above drinking water standards, overall concentrations have exhibited a downward trend since monitoring began in the late 1980s, and there are no current exposure pathways that affect human health or the environment.

The purposes of this Proposed Plan are to describe the remedial action alternatives analyzed, identify the preferred remedial action alternative, explain the rationale for the preferred remedial action alternative, and solicit public involvement. Additional information on the descriptions and evaluation of the remedial action alternatives can be found in the *Remedial Investigation/Feasibility Study Report for the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2893&D2; Remedial Investigation [RI]/Feasibility Study [FS]).

This Proposed Plan is a document that DOE, as the lead agency, is required to issue to fulfill public participation requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 117(a), as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 United States Code Section 9601 et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300.430[f][2]).

Remediation efforts on the ORR are governed by the *Federal Facility Agreement for the Oak Ridge Reservation* (DOE/OR-1014; Federal Facility Agreement [FFA]). DOE is the lead agency for this Proposed Plan. The U.S. Environmental Protection Agency (EPA) Region 4 and the State of Tennessee's Tennessee Department of Environment and Conservation (TDEC) support issuance of this Proposed Plan. In accordance with the *DOE Secretarial Policy Statement on the National Environmental Policy Act* (DOE 1994), National Environmental Policy Act of 1969 (NEPA) values have been incorporated into the CERCLA documentation prepared for this project.

2. SCOPE OF PROPOSED REMEDIAL ACTION

For the purpose of evaluating and remediating groundwater, DOE has divided the ETTP site into three areas: K-31/K-33 Area, Main Plant Area, and Zone 1. This Proposed Plan addresses groundwater in the K-31/K-33 Area only (Figure 2). Groundwater in the other portions of ETTP will be addressed in separate CERCLA decision documents. The K-31/K-33 Area is west of the Main Plant Area at ETTP and is separated

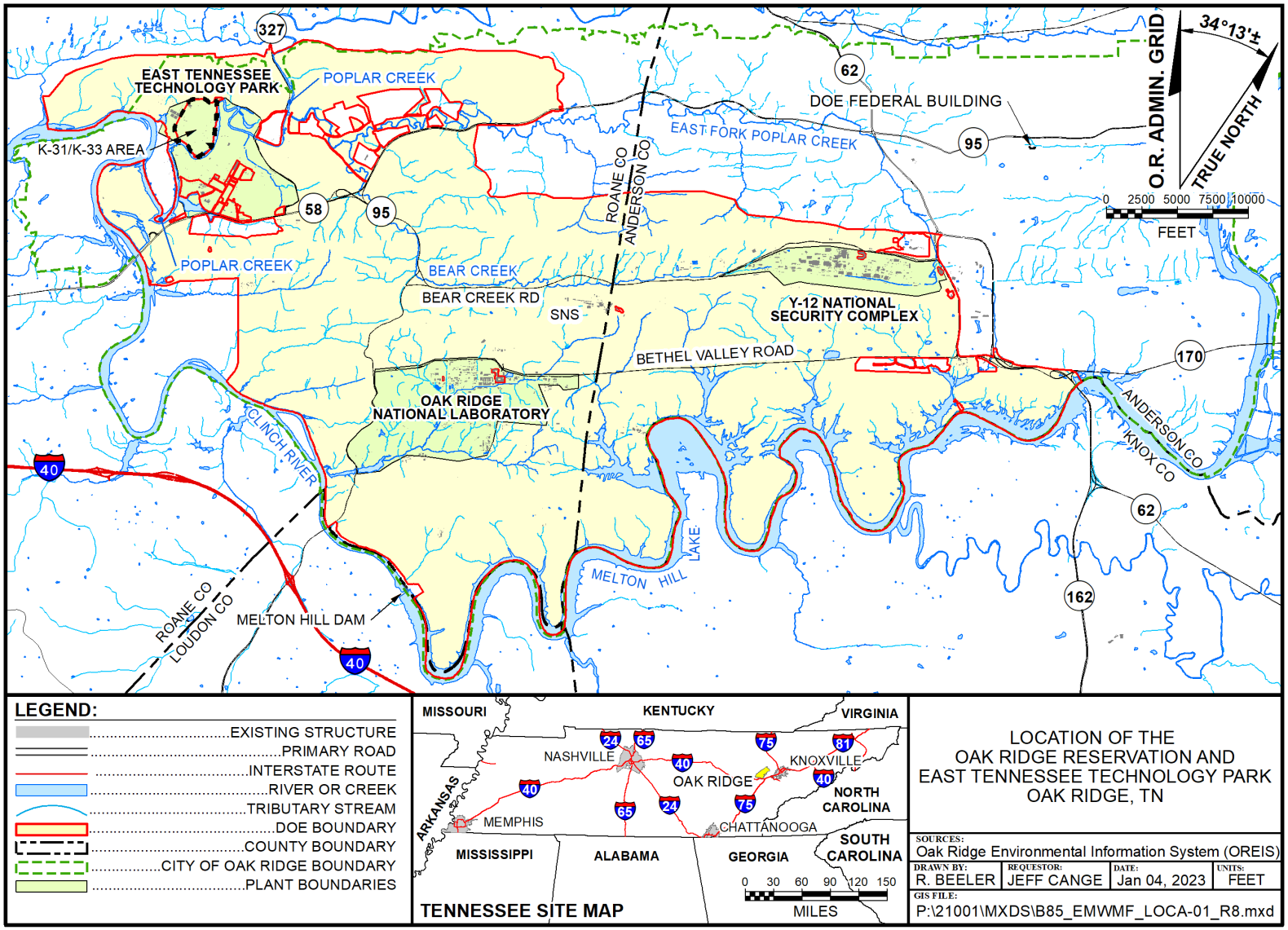

Figure 1. Location of the ORR and ETTP.

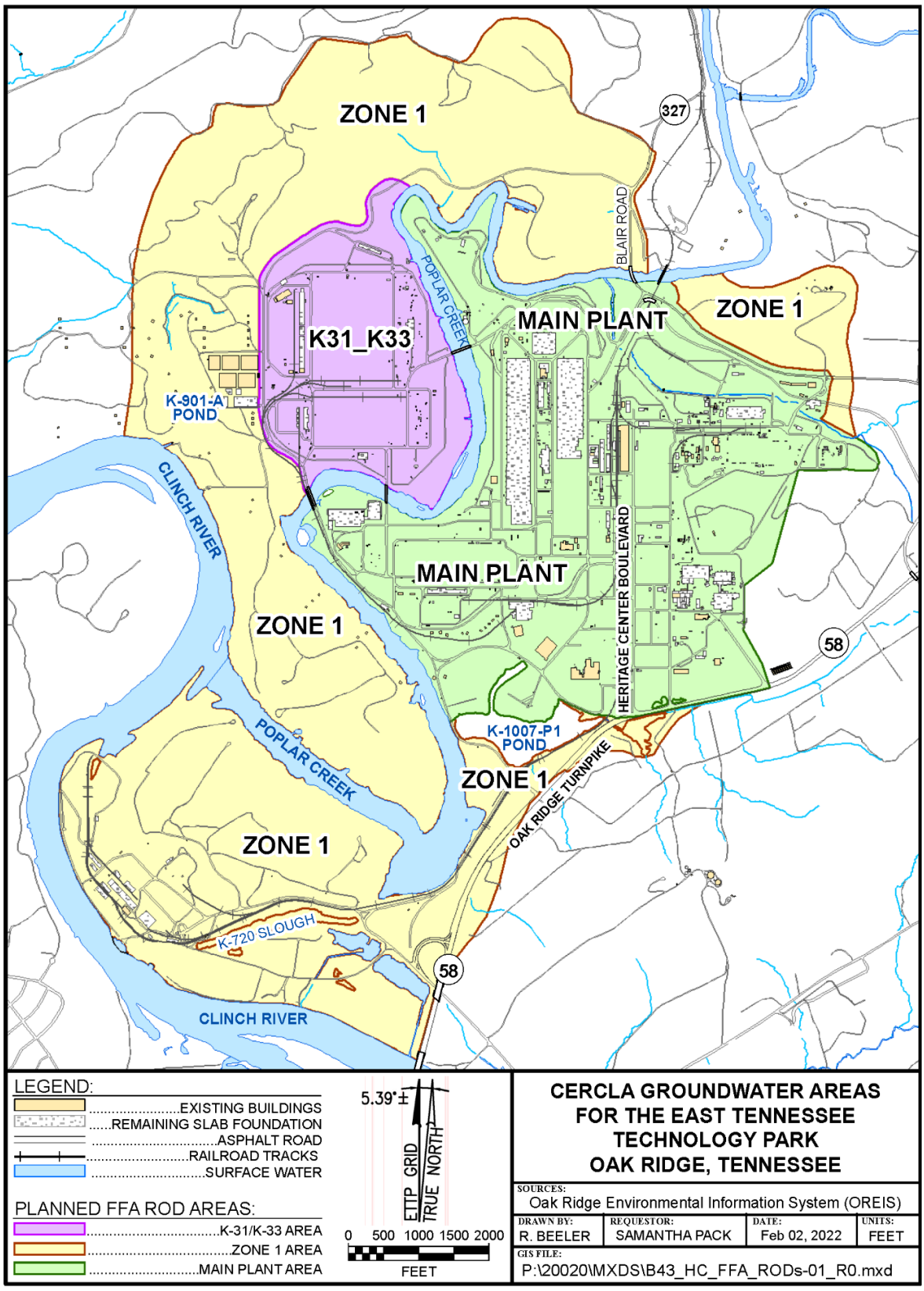

Figure 2. CERCLA groundwater areas at ETTP.

from the Main Plant Area by Poplar Creek. It is bounded to the north and west by the Zone 1 area. The scope of the remedial action is limited to groundwater, which extends from the surface of the water table in the unconsolidated geologic zone down into and through the underlying bedrock zone.

Groundwater sampling results in recent samples (June 2021) from unconsolidated and bedrock wells have identified low levels of contamination (just above the maximum contaminant levels [MCLs] for nickel or chromium) in two monitoring wells along the eastern side of the K-31/K-33 Area. The contaminated groundwater was detected in an overburden well that is screened at a depth of 26 to 36 ft below ground surface and a bedrock well screened at a depth of 35 to 55 ft below ground surface.

Groundwater sampling in the area previously identified other contaminants above their respective MCLs, including the metals antimony, arsenic, beryllium, and lead, as well as the radiological parameter gross alpha activity. Concentrations of these other contaminants have been below the MCL in recent samples, but they will continue to be evaluated as part of the MNA remedy.

2.1 SITE BACKGROUND

2.1.1 Site Overview

The 34,465-acre DOE ORR is located within and adjacent to the corporate limits of the city of Oak Ridge, Tennessee, in Roane and Anderson Counties (Figure 1). The ORR is bounded to the east, south, and west by the Clinch River and on the north by the developed portion of the city of Oak Ridge. Three major industrial research and production facilities that originally were constructed as part of the World War II-era Manhattan Project—ETTP, formerly the K-25 Site and Oak Ridge Gaseous Diffusion Plant; Oak Ridge National Laboratory, formerly X-10; and the Y-12 National Security Complex (Y-12)—are located on the ORR.

ETTP occupies approximately 5000 acres of the ORR. Areas potentially impacted by site activities account for roughly 2200 of the 5000 acres. The original mission of ETTP was to enrich uranium using the gaseous diffusion process. From 1945 until 1964, ETTP produced highly enriched uranium for use in nuclear weapons. After 1964, operations focused on producing low-enriched uranium for fabrication into fuel elements for commercial and research nuclear reactors.

2.1.2 Site History and Status

ETTP's principal mission was to enrich uranium. Enrichment activities ceased in 1987, and demolition of all buildings covered under CERCLA was completed in 2020. ETTP is currently being cleaned up to allow for reuse of the land and remaining infrastructure. Oak Ridge National Laboratory historically has performed, and continues to perform, a variety of research and development activities, including use of research-scale nuclear reactors for DOE. Y-12 has served several missions, including uranium enrichment, lithium refining, nuclear weapons component manufacturing, and weapons disassembly. Y-12 still has continuing missions in some of these areas. Historical operations on the ORR have led to soil, surface water, sediment, groundwater, and buildings contamination. Consequently, the ORR, including all of ETTP, was placed on the CERCLA National Priorities List in 1989.

At the peak of operations in the 1950s and early 1960s, there were five process buildings—K-25, K-27, K-29, K-31, and K-33—that housed the gaseous diffusion equipment used for the enrichment process. Once the production of highly enriched uranium ceased in 1964, the K-25 and K-27 process buildings were shut down. The K-29, K-31, and K-33 buildings continued to produce low enriched uranium until 1985.

Secondary missions at ETTP, beginning in the 1970s and continuing untill plant shutdown, included research on new technologies for uranium enrichment, such as gas centrifuge and laser isotope separation. In 1985, because of a decline in the demand for low enriched uranium, DOE placed ETTP in standby mode. ETTP was shut down permanently in 1987. Currently, DOE activities at ETTP include environmental cleanup and reindustrialization efforts. Portions of ETTP are used for non-DOE industrial activities.

ETTP operations resulted in a legacy of inactive and contaminated facilities, waste disposal areas, and contaminated media, including the following:

- Buildings
- Buried waste

- Buried tanks
- Underground waste lines
- Scrap and debris
- Contaminated surface and subsurface soil
- Contaminated surface water and sediment
- Contaminated groundwater

The initial environmental investigations at ETTP were completed in the late 1980s to meet the requirements of the Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984. After the ORR was listed on the National Priorities List, environmental work at ETTP was driven by CERCLA requirements. The first set of key CERCLA decisions addressed single-project, higher risk, early actions to remove primary sources of contamination or address primary release mechanisms. In addition, buildings have been demolished under CERCLA removal authority. The early actions and facility demolition are complete.

The second set of key decisions at ETTP addressed soil, buried waste, and subsurface structures. ETTP was divided into two geographical areas to support the evaluation and follow-on remediation of these media: Zone 1, consisting of approximately 1,400 acres outside the original fence line of the main processing/industrial area; and Zone 2, the processing/industrial area inside the original fence line. Historically, Zone 1 was mostly undeveloped, but portions were used for industrial purposes (e.g., power generation) and limited waste disposal. Zone 2 is the Main Plant Production Area associated with uranium enrichment and supporting operations, as well as waste treatment and disposal.

Characterization and remedial actions for soil, buried waste, and subsurface structures in Zone 1 were implemented under the *Record of Decision for Interim Actions in Zone 1, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-1997&D2; Zone 1 Interim Record of Decision [IROD]). Remedial actions in Zone 2 are conducted in accordance with the *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, Oak Ridge, Tennessee* (DOE/OR/01-2161&D2; Zone 2 Record of Decision [ROD]). Remedial actions under the Zone 1 IROD and Zone 2 ROD were based on the protection of both human health and underlying groundwater, but neither ROD included actions that extend below the water table (or below the top of bedrock).

The *Amendment to the Record of Decision for Interim Actions in Zone 1 for Final Soil Actions, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2817&D3) added protection of ecological receptors in the terrestrial environment, given that much of Zone 1 is essentially undeveloped and, thus, a viable ecological habitat. The amendment also added protection of recreational receptors, as much of the undeveloped area is managed as a conservation easement by the Tennessee Wildlife Resources Agency. All of the Zone 1 remedial actions are complete. Remedial actions in Zone 2 are in progress and planned to be completed in 2024.

The remaining CERCLA decisions at ETTP will address contamination in groundwater, surface water, and sediment in the ponds, wetlands, and perennial streams in Zones 1 and 2. These decisions will include protection of ecological receptors in aquatic environments (i.e., ponds, streams) as appropriate. CERCLA decisions for the sediment in Poplar Creek, which borders the eastern and southern edges of the K-31/K-33 Area, were addressed in the *Record of Decision for the Clinch River/Poplar Creek Operable Unit, Oak Ridge, Tennessee* (DOE/OR/02-1547&D3). A future ROD will be issued for surface water in Poplar Creek (and the Clinch River) upon completion of the CERCLA-driven cleanup work in the ORR.

CERCLA decisions for groundwater at ETTP will be based on the three geographical areas described above:

- Main Plant Area groundwater IROD (followed by a subsequent final decision document)
- K-31/K-33 Area groundwater ROD
- Zone 1 groundwater ROD

The CERCLA decision for surface water, sediment, and aquatic ecological receptors at ETTP (exclusive of Poplar Creek) will be addressed in the following decision:

- Remaining Ecology/Surface Water/Sediment Final ROD

The anticipated end uses in the K-31/K-33 Area are industrial, which is consistent with the Covenant Deferral Request transferring the land to the Community Reuse Organization of East Tennessee. Currently, the K-31 area is being leased as a support facility to the Y-12 Uranium Processing Facility construction project, and the K-33 footprint has been sold to Kairos Power who plans to use it for a nuclear energy demonstration reactor.

Future use of the groundwater in the K-31/K-33 Area is improbable and would require prior approval from DOE, EPA, and TDEC before implementation. Groundwater would be of limited use to future site developers due to the complex geology, the availability of the nearby Clinch River as a water source, and the availability of the existing municipal water supply. Future residential use of the K-31/K-33 Area is prohibited through land use controls (LUCs) established under the Zone 2 ROD.

2.1.3 Site Characteristics

The K-31/K-33 Area was located in the northwestern portion of ETTP. The K-31/K-33 Area occupied approximately 200 acres bounded by Poplar Creek on the east and south, the K-901-A Holding Pond to the west, and Black Oak Ridge to the north. The area included the former locations of Buildings K-31 and K-33, which enriched uranium using the gaseous diffusion process (Figure 3). The area also included ancillary or support facilities (e.g., electrical switchyards and Recirculating Cooling Water facilities), as well as an extensive underground utility network.

Building K-31 began operation in 1951. Building K-33 was the last gaseous diffusion process building constructed at ETTP and began operations in 1954. All enrichment operations were discontinued in 1985, and Buildings K-31 and K-33 were shut down. Between 1998 and 2005, the process equipment was removed under the *Action Memorandum for Equipment Removal and Building Decontamination for Buildings K-29, K-31, and K-33, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/02-1646&D1). Demolition of Buildings K-31 and K-33 was completed in 2015 under the *Action Memorandum for the Remaining Facilities Demolition Project at East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2049&D2). The soil in the K-31/K-33 Area was evaluated and remediated, as required, under the Zone 2 ROD.

The K-31/K-33 Area was transferred to the Community Reuse Organization of East Tennessee, and a portion subsequently was leased by Consolidated Nuclear Security, LLC in 2018 for use as an equipment staging area in support of the Uranium Processing Facility at the National Nuclear Security Administration's Y-12 facility. The property transfer was completed in accordance with approved Covenant Deferral Requests under CERCLA Section 120(h). The deed transferring the property to the Community Reuse Organization of East Tennessee contains restrictions for the K-31/K-33 Area that limit development of the property to industrial, commercial, or recreational uses and prohibit the extraction, consumption, exposure, or use, in any way, of the groundwater. The deed also restricts disturbances of the soil on the property of more than 10 ft below ground level.

Monitoring of groundwater quality in the K-31/K-33 Area has been ongoing since 1989 in 21 groundwater monitoring wells. As required by EPA and TDEC, groundwater sampling results are evaluated against Safe Drinking Water Act of 1974 (SDWA) MCLs. In the past 5 years, antimony, arsenic, beryllium, chromium, lead, and nickel have exhibited concentrations that exceeded their respective MCLs. In addition, of the radiological parameters analyzed in groundwater, gross alpha activity was detected above its MCL.

Historically, suspended solids in the groundwater samples (measured and reported as turbidity values) have impacted the results of the unfiltered groundwater samples from the K-31/K-33 Area wells. The turbidity data have shown that, oftentimes, there was an increase in the reported constituent concentrations corresponding to increased levels of turbidity in the samples. This relationship was further substantiated by the absence of MCL exceedances in the corresponding filtered samples (filtered samples, collected at the same time as unfiltered samples, are produced by passing the groundwater through a 40-micron filter before filling the sample jars). Following installation of dedicated low-flow sampling pumps in 2019, using an EPA-approved method to limit turbidity in groundwater samples the number of constituents that exceed MCLs was significantly reduced. In the most recent, groundwater sampling event (June 2021), MCL

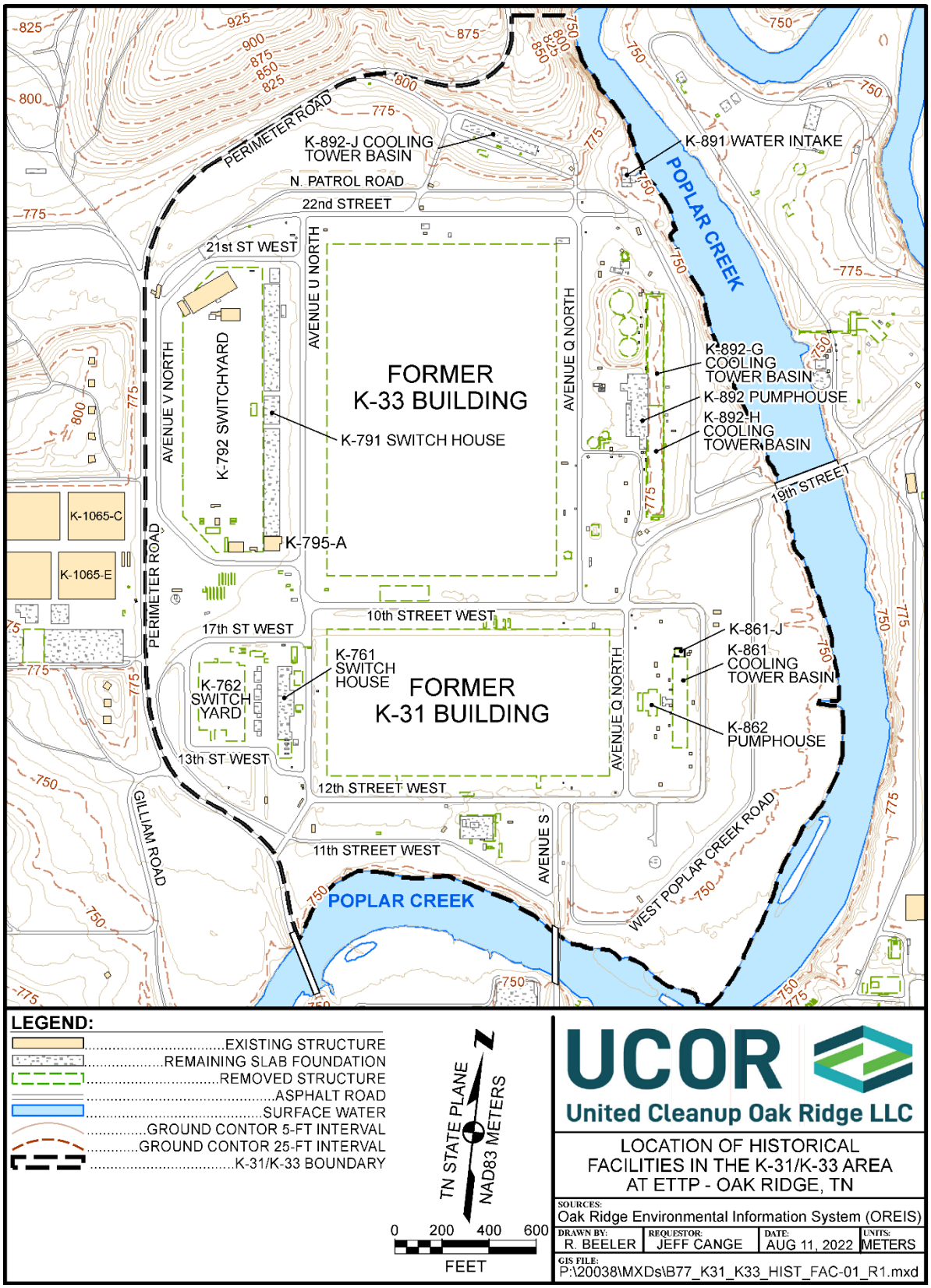

Figure 3. K-31/K-33 Area, circa 2000.

exceedances were detected in samples from only 2 of the 20 wells that were sampled—BRW-030 (chromium) and UNW-083 (nickel). Figure 4 shows the locations of the two wells with the June 2021 MCL exceedances.

Potential releases of chromium and nickel in the K-31/K-33 Area occurred from leaks in the Recirculating Cooling Water piping and firewater system, leaks in the cooling tower basins, mist from the cooling water towers, and flushing of the firewater system hydrants. The Recirculating Cooling Water system and the firewater system used a corrosion-inhibitor additive that contained hexavalent chromium. Based on historical concentrations of nickel observed in the cooling tower basin sediments, the Recirculating Cooling Water also was a potential source for nickel due to the wide-scale use of nickel in the process piping and equipment. The cooling tower basins were demolished between 1994 and 1996.

Soils and subsurface infrastructure (e.g., Recirculating Cooling Water basins) were evaluated as required under the Zone 2 ROD and were determined to require no further action following completion of demolition activities. These evaluations, completed between 2007 and 2015, did not identify any areas that could be considered an ongoing or future source of groundwater contamination.

3. SUMMARY OF SITE RISKS

A baseline human health risk assessment was performed for exposures to groundwater as part of the K-31/K-33 Area RI/FS. Although the Zone 1 IROD and Zone 2 ROD include LUCs that prohibit the use of groundwater as a source of potable water at ETTP, the CERCLA process requires a quantitative evaluation of risks related to potential exposures to groundwater through a variety of pathways, including use of groundwater as a potable water supply.

The risk assessment evaluated exposures for two potential receptors: a future industrial worker; and, as required by EPA, a hypothetical future resident (the Zone 1 IROD and Zone 2 ROD also prohibit residential development of ETTP). In both cases, the risk assessment assumed these receptors would use the groundwater as a potable drinking water source. In addition to ingesting groundwater, both receptors also are potentially exposed to groundwater contaminants via dermal exposure and inhalation of volatiles. The calculated exposure point concentrations representing the 95% upper confidence limit (UCL) on the mean value were developed using all wells at the K-31/K-33 Area.

Results from the risk assessment identified hexavalent chromium as the principal contributor to an estimated increased lifetime cancer risk (ILCR) that exceeds the 1E-04 target risk threshold for both the industrial worker receptor and the hypothetical residential receptor. Estimated ILCRs were 2E-04 for the industrial worker and 1E-03 for the hypothetical resident. In addition, the UCLs exceeded the MCL for chromium and nickel.

An evaluation also was performed looking at the wells individually. The metals aluminum, arsenic, beryllium, cadmium, cobalt, hexavalent chromium, fluoride, iron, lithium, manganese, selenium, thallium, uranium, and vanadium were identified as contaminants of concern (COCs) in one or more of the individual wells because COC-specific hazard indices were greater than 1 or the metals contributed to a hazard index greater than 1 for a similar target organ/critical effect for a hypothetical resident. A subset of the metals (arsenic, cobalt, manganese, thallium, and vanadium) was identified as COCs in one or more wells for industrial workers.

In addition to the risk assessment results, groundwater data (including data from dedicated, low-flow sampling pumps starting in 2019) and evaluation of process knowledge from the K-31/K-33 Area indicate chromium and nickel have been the most commonly occurring constituents, with concentrations exceeding MCLs. As a result, chromium (including both total chromium and hexavalent chromium) and nickel are considered to be the primary COCs for groundwater in the K-31/K-33 Area.

Ecological risk associated with groundwater contamination was not quantitatively evaluated for the K-31/K-33 Area RI/FS. There are no ponds, springs, or perennial streams in the formerly industrialized, upland portion of the area that might receive discharging groundwater and provide habitat for ecological receptors. A spring and seep survey along the banks of Poplar Creek, completed by the U.S. Geological Survey in 1995, identified several minor seeps in the southern and southeastern portions of the K-31/K-33 Area. These seeps were primarily

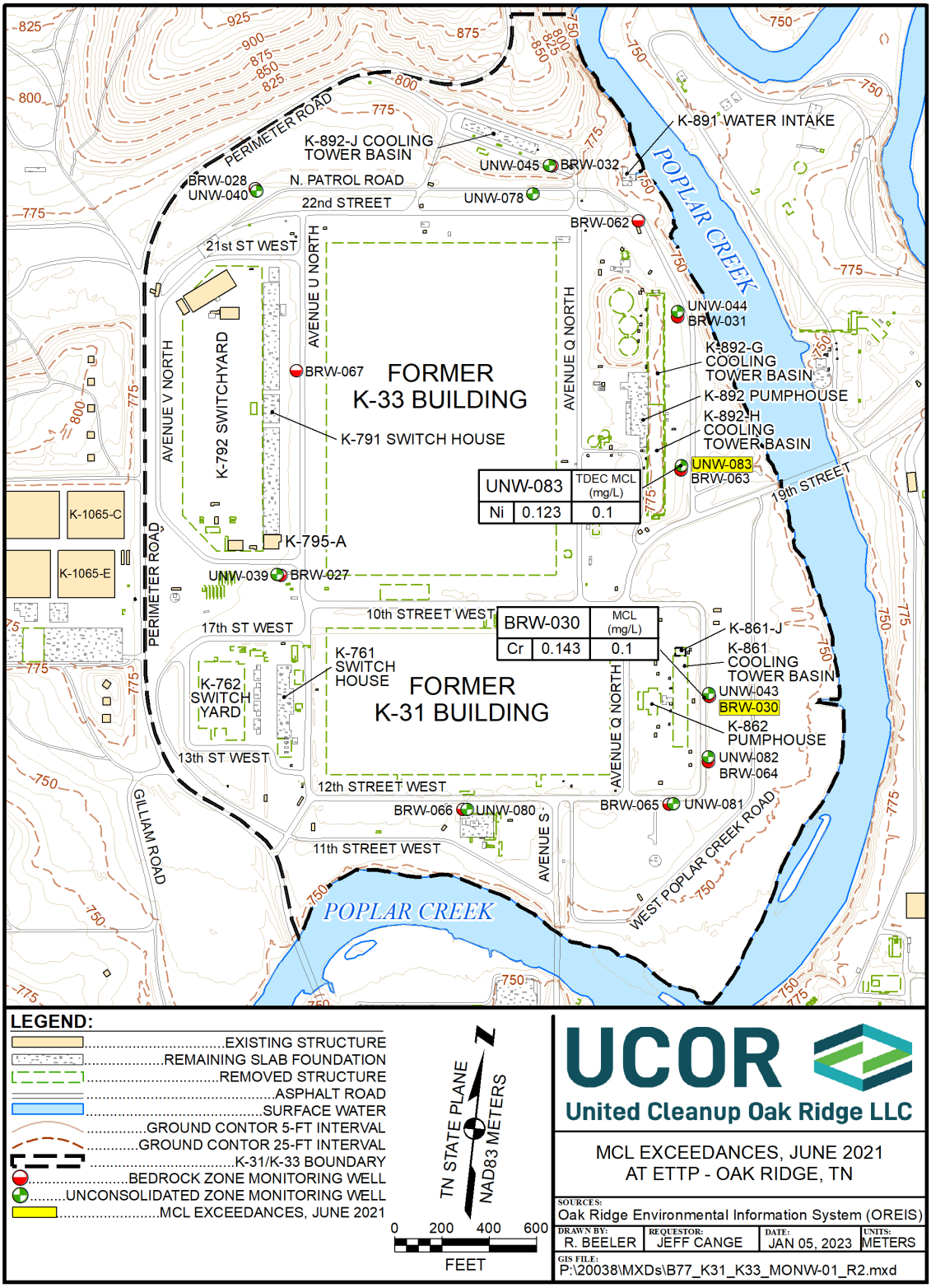

Figure 4. Monitoring wells with MCL exceedances based on June 2021 sampling.

wet-weather conveyances with low, intermittent flow rates and are also unlikely to provide appreciable habitat value. Based on these conditions, groundwater is not associated with a complete exposure pathway for ecological receptors in the K-31/K-33 Area.

It is DOE's current judgment that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4. REMEDIAL ACTION OBJECTIVES

EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004) defines remedial action objectives (RAOs) as "medium-specific or operable-unit specific goals for protecting human health and the environment." According to the NCP (40 CFR 300.430[e][2][i]), RAOs should specify the media involved, COCs, potential exposure pathways, and remediation goals.

The RAOs for groundwater are as follows:

- Restore groundwater to drinking water standards (federal and state).
- Prevent exposure of humans, including industrial and construction workers, via dermal contact, ingestion, and/or inhalation to groundwater containing COCs above protective levels and prevent on-site consumption of groundwater above MCLs or applicable state groundwater criteria that are applicable or relevant and appropriate requirements (ARARs).
- Prevent adverse impacts to surface water quality from migration of contaminated groundwater that could result in exceedances of applicable state or federal ambient water quality standards or impairing the usefulness of the surface water for its classified use.

The CERCLA NCP requires federal SDWA MCLs and non-zero MCL goals (MCLGs) be attained for all remedial actions for groundwaters that are current or potential sources of drinking water, where the MCLs/non-zero MCLGs are relevant and appropriate under the circumstances of the release (40 CFR 300.430[e][2][i][B]-[C]).

TDEC 0400-40-03-.07(4)(b) designates all groundwater in the state as General Use Groundwater (except for groundwater that has been specifically designated otherwise); thus, this General Use Groundwater designation would apply to groundwater on the ORR. Groundwater designated as General Use must meet the state's numeric Water Quality Criteria under TDEC 0400-40-03-.03(1)(j) and (k) for surface waters classified as a Domestic Water Supply and must contain no other constituents that pose an unreasonable risk to public health or the environment (TDEC 0400-40-03-.08[2]). Water Quality Criteria set out in TDEC 0400-40-03-.03(1)(j) reflect the SDWA MCLs (see Table 1).

5. SUMMARY OF REMEDIAL ALTERNATIVES

Three remedial alternatives were developed and evaluated in the K-31/K-33 RI/FS:

- Alternative 1: No action
- Alternative 2: MNA and LUCs (DOE's preferred alternative)
- Alternative 3: Pump and Treat, MNA, and LUCs

The scope of the groundwater remedial action for the K-31/K-33 Area is based on the distribution and magnitude of groundwater contamination in the area. The focus is on locations where sampling over the past 5 years (2017–2022) has identified contamination above MCLs, primarily chromium and nickel.

There are 21 monitoring wells at the site, as shown in Figure 5, but 1 of the wells has been dry since the 1990s. Samples from nine of these wells have not had an MCL exceedance over the past 5 years. The remaining 11 wells are associated with intermittent MCL exceedances and will be the focus of monitoring and evaluation activities under Alternative 2. For Alternative 3, four wells with more persistent MCL exceedances are considered to be candidates for potential treatment (Figure 6).

Table 2 summarizes the major components, cost, and estimated time to achieve RAOs for each remedial action alternative. Alternatives 2 and 3 include additional components, such as performance monitoring and Five-Year Reviews (FYRs). These remedial action alternatives are described more fully in the RI/FS.

Table 1. Numeric criteria for K-31/K-33 Area groundwater

	TDEC MCL[a]	
Chemical	**Value**	**Unit**
Alpha activity	15	pCi/L
Antimony	0.006	mg/L
Arsenic	0.010	mg/L
Beryllium	0.004	mg/L
Chromium (total)	0.1	mg/L
Lead	0.005[b,c]	mg/L
Nickel	0.1[d]	mg/L

[a]TDEC MCLs are listed in TDEC 0400-45-01. All federal non-zero MCL goals (MCLGs) are equivalent to their respective MCLs and are, therefore, not listed on this table. Currently, all federal MCLs are exactly the same as the TDEC MCLs; therefore, the federal MCLs are not listed here.
[b]Lead and copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, then water systems must take additional steps.
[c]In addition to the MCL/treatment technique under the State's Safe Drinking Water Act of 1974 program (TDEC 0400-45-01), Tennessee also has a lead groundwater quality criterion of 0.005 mg/L for domestic water supply (TDEC 0400-40-03-.03).
[d]The U.S. Environmental Protection Agency has deleted both the MCL and the MCLG for nickel from the Code of Federal Regulations, which was vacated by a court ruling. Tennessee has retained the nickel MCL in its current regulations.

MCL = maximum contaminant level
TDEC = Tennessee Department of Environment and Conservation

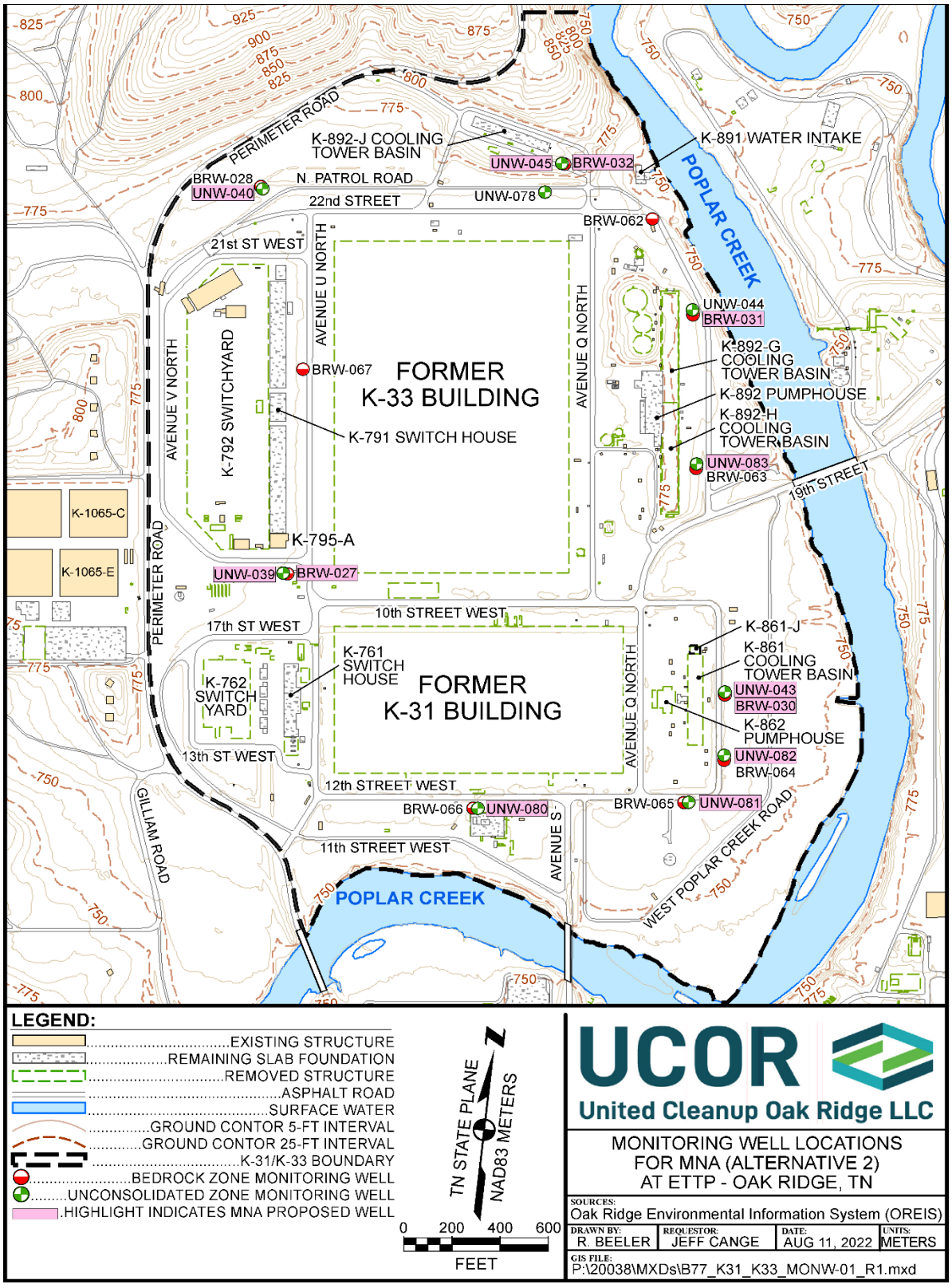

Figure 5. Monitoring well locations for MNA (Alternative 2).

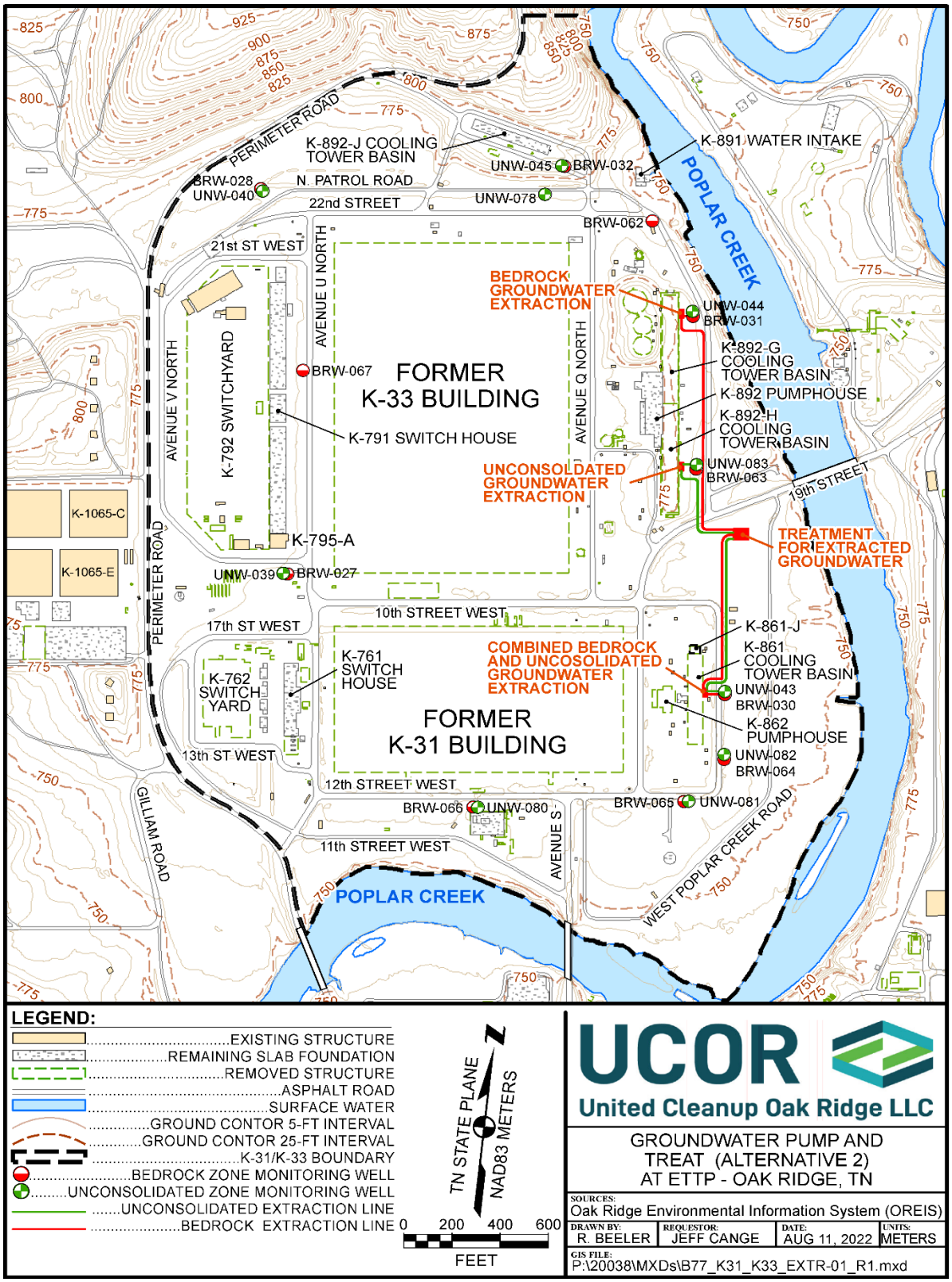

Figure 6. Groundwater pump and treat layout (Alternative 3).

Table 2. Summary of remedial action alternatives

Alternative	Description	Cost ($)/Timeframe (years)
Alternative 1: No action	The no-action alternative was included to provide a baseline for comparison to other alternatives, as required by the National Oil and Hazardous Substances Pollution Contingency Plan. Under this alternative, no remediation, monitoring, or LUCs will occur. Future contamination trends will not be evaluated or reported.	Cost: $0 Timeframe: Not applicable
Alternative 2: MNA and LUCs	Alternative 2 relies on naturally occurring processes to attenuate (reduce) the concentration, toxicity, or mobility of contaminants. These processes are closely monitored and evaluated over time to determine progress toward RAOs. LUCs will be implemented to prohibit the use of groundwater and provide notifications to future landowners concerning the presence of contaminated groundwater. The LUCs remain in place until RAOs are achieved. The estimated costs include installing and monitoring additional wells; however, the need for, number, and exact locations of additional wells will be addressed during development of the Remedial Action Work Plan.	Capital cost: $131,000 Total present-worth cost: $1.8 million Annual O&M present-worth cost: $84,000 Timeframe: 15 years
Alternative 3: Pump and treat, MNA, and LUCs	Alternative 3 extracts and treats groundwater with the highest concentrations of chromium and nickel, targeting specific areas with more persistent exceedances of MCLs (Figure 6). MNA will be implemented in areas where monitoring well data have shown lower contaminant concentrations (and only intermittent MCL exceedances). Groundwater will be pumped out of specially constructed extraction wells. A dedicated water treatment plant will be constructed near the extraction wells to treat the extracted groundwater. The treatment process will consist of a bag filter (to remove suspended solids), followed by ion-exchange units that will use two different ion-exchange resins to remove the chromium and nickel. Treated water will be discharged to the Clinch River in accordance with the Clean Water Act and TDEC regulations. MNA and LUCs will be implemented as described with Alternative 2.	Capital cost: $2,355,000 Total present-worth cost: $11.2 million Annual O&M present-worth cost: $882,000 Timeframe: 10 years

Note: Costs represent direct project costs only and do not include all program-level management and overhead burdens.

LUC = land use control
MCL = maximum contaminant level
MNA = monitored natural attenuation
O&M = operations and maintenance
RAO = remedial action objective
TDEC = Tennessee Department of Environment and Conservation

EXPLANATION OF NINE CERCLA EVALUATION CRITERIA

1. **Overall Protection of Human Health and the Environment** addresses whether a remedial action provides overall protection of human health and the environment. This criterion must be met for a remedial alternative to be eligible for selection.

2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether a remedial action meets all of the applicable or relevant and appropriate federal and state environmental requirements or provides grounds for invoking a waiver of the requirements. This criterion must be met for a remedial alternative to be eligible for selection.

3. **Long-term Effectiveness and Permanence** considers the ability of an alternative to protect human health and the environment over time.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment** evaluates an alternative's use of treatment to reduce harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present.

5. **Short-term Effectiveness** refers to potential adverse effects on workers, human health, and the environment during the construction and implementation phases of a remedial action.

6. **Implementability** refers to the technical and administrative feasibility of a remedial action alternative, including the availability of materials and services needed to implement the alternative.

7. **Cost** refers to an evaluation of the capital, operation and maintenance, and monitoring costs for each alternative, including present-worth costs.

8. **State Acceptance** indicates whether the state concurs with the preferred alternative.

The following is applied after comments are received on the Proposed Plan.

9. **Community Acceptance** assesses the general public response to the Proposed Plan following a review of public comments received during the public comment period. The remedial action is selected only after consideration of this criterion.

6. EVALUATION OF REMEDIAL ACTION ALTERNATIVES

CERCLA, Section 121, as amended, specifies statutory requirements for remedial actions. These requirements include protection of human health and the environment, compliance with ARARs, a preference for permanent solutions that incorporate treatment as a principal element to the maximum extent practicable, and cost effectiveness. To assess whether remedial action alternatives meet these requirements, the following nine criteria (EPA/540/G-89/004), identified in the NCP (40 CFR 300.430[f][2]), must be evaluated for each remedial action alternative (Section 300.430[e][9][iii]):

- Threshold criteria:
  - Overall protection of human health and the environment
  - Compliance with ARARs
- Balancing criteria:
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying criteria:
  - State acceptance
  - Community acceptance

The first two criteria are the threshold criteria that relate directly to statutory findings that must be documented in the ROD. The next five criteria, designated the primary balancing criteria, address the performance of the remedial action alternative and verify the remedial action alternative is realistic. The last two modifying criteria are taken into account after public comment is received on the Proposed Plan.

In addition to these evaluation criteria prescribed under CERCLA, DOE policy directs the substantive elements of analysis required under NEPA be incorporated into CERCLA decision documents (DOE 1994). Elements common to both CERCLA and NEPA include protectiveness, compliance with ARARs, long-term effectiveness and permanence, short-term effectiveness, and

cost. Additional NEPA values not specifically included in CERCLA criteria include socioeconomic impacts, environmental justice, and ecological impacts.

The comparative analysis of the three remedial action alternatives is summarized in Table 3 and discussed below.

Table 3. Summary of alternatives evaluation

CERCLA criteria	Alternative 1: No action	Alternative 2: MNA and LUCs	Alternative 3: Pump and treat, MNA, and LUCs
Protection of human health and the environment	○	●	●
Compliance with ARARs	○	●	●
Long-term effectiveness and permanence	N/A	●	●
Reduction of toxicity, mobility, or volume through treatment	N/A	◎	◎
Short-term effectiveness	N/A	●	●
Implementability	N/A	●	◎
Present-worth cost	$0	$1.8 million	$11.2 million
Estimated time to achieve RAOs	N/A	15 years	10 years

Relative ranking: High ● Moderate ◎ Low ○

Rankings are provided as qualitative descriptions of relative compliance with each alternative criterion.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
LUC = land use control
MNA = monitored natural attenuation
N/A = not applicable; criterion was not evaluated because it did not pass the threshold criteria
RAO = remedial action objective

6.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 is not protective of human health and the environment because no action would be taken to reduce or monitor groundwater contamination levels, nor would LUCs exist to prevent exposures to the contaminated groundwater. Alternatives 2 and 3 were both considered to be protective of human health and the environment because groundwater contamination levels would be reduced either through extraction and treatment (Alternative 3) or through closely monitored natural attenuation processes. LUCs would be used to manage risks at the site until the RAOs are achieved under Alternatives 2 and 3.

6.2 COMPLIANCE WITH ARARS

Alternative 1 would not achieve the chemical-specific ARARs, which include all enforceable numerical standards. Alternatives 2 and 3 would be specifically designed and implemented to achieve ARARs.

6.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 was not assessed for this criterion because it did not pass the threshold criteria for protection of human and the environment or compliance with ARARs. For Alternatives 2 and 3, long-term effectiveness and permanence are comparable, as both alternatives result in the permanent removal of contamination. Alternative 3 accomplishes this removal through extraction of contaminated groundwater with aboveground treatment that transfers the

contaminants to treatment media that will be disposed of in compliance with ARARs. Alternative 3 permanently removes contamination from K-31/K-33 Area groundwater.

Alternative 2 relies on naturally occurring attenuation processes, primarily adsorption and precipitation, to transfer contaminants from groundwater onto aquifer matrix materials (soil and bedrock surfaces). Contaminant concentrations are expected to decrease over time until RAOs are achieved, which is estimated to require 15 years for Alternative 2 and 10 years for Alternative 3.

During this time, the progress will be assessed and LUCs will remain in place. The long-term risks associated with both alternatives are considered acceptable, although the risks are slightly higher with Alternative 2 because active treatment is not performed and contaminant levels will take longer to reach MCLs. The detailed analysis of alternatives indicates both Alternatives 2 and 3 are comparable for this criterion.

6.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 1 was not assessed for this criterion because it did not pass the threshold criteria. Alternative 3 uses active treatment with physiochemical treatment processes and natural attenuation, whereas Alternative 2 relies solely on attenuation. Attenuation is generally considered passive treatment. More contaminant mass is expected to be removed from groundwater with Alternative 3, although both alternatives will achieve RAOs. Both alternatives reduce contaminant mass, though Alternative 3 results in treatment residuals (spent ion exchange resins) that will require further management. The detailed analysis of alternatives indicates both Alternatives 2 and 3 are comparable for this criterion.

6.5 SHORT-TERM EFFECTIVENESS

Alternative 1 was not assessed for this criterion because it did not pass the threshold criteria. There are more risks to remediation workers with Alternative 3, as compared to Alternative 2, due to the increased construction activities and need for continuous operation of the treatment plant. Both alternatives can be implemented in a manner that protects the community. The environmental footprint of Alternative 3 is greater than that of Alternative 2 due to the electricity, material, and chemical demands of the treatment system that is expected to operate for 10 years. The detailed analysis of alternatives indicates both Alternatives 2 and 3 are comparable for this criterion.

6.6 IMPLEMENTABILITY

Alternative 1 was not assessed for this criterion because it did not pass the threshold criteria. Alternative 3 has more construction elements than Alternative 2, resulting in potential for greater operational challenges. Existing groundwater extraction systems at the Main Plant Area have resulted in fouling of extraction wells and pipelines, which could also occur at the K-31/K-33 Area. Alternative 3 was judged to be more susceptible to schedule impacts related to potential difficulties in maintaining efficient operation of the groundwater extraction system. Both alternatives can be implemented in a manner that would not limit additional remedial actions, should they be considered necessary in the future. Both alternatives have similar monitoring well requirements, but Alternative 3 requires more monitoring to verify pump-and-treat performance, compliance with surface water discharge requirements, and ongoing evaluation of treatment system performance. Alternative 3 has a greater impact on the future use of the property due to the need of installing pump-and-treat infrastructure (i.e., conveyance piping, treatment system, and utilities). The detailed analysis of alternatives indicated Alternative 2 scored higher than Alternative 3 for this criterion.

6.7 COST

Alternative 1 was not assessed for this criterion because it did not pass the threshold criteria. The capital costs and net present-value costs for Alternative 2 and Alternative 3 are shown in Table 2. Alternative 3 costs are significantly greater than those for Alternative 2 due to the need for construction and operation of extraction wells, a groundwater treatment plant, and related infrastructure. The costs for Alternative 2 include installing and monitoring additional wells to support the MNA evaluation. The need for, number, and exact locations of these additional wells will be addressed during development of the Remedial Design Report, in consultation with TDEC and EPA.

6.8 STATE ACCEPTANCE

State involvement has been solicited throughout the CERCLA-based remedy selection process. TDEC supports the preferred alternative (Alternative 2: MNA and LUCs), and its final concurrence will be solicited following review of all comments received during the public comment period.

6.9 COMMUNITY ACCEPTANCE

Community acceptance will be evaluated after the public comment period for this Proposed Plan.

6.10 ALTERNATIVE COMPARISON SUMMARY

In summary, Alternative 1 fails both threshold criteria—overall protection of human health and the environment, and compliance with ARARs; therefore, it was eliminated from further analysis. Alternatives 2 and 3 both pass the threshold criteria and generally are equivalent for the balancing criteria of long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Alternative 2 is superior for the balancing criteria of implementability and cost, and it is more readily implemented and less expensive to construct and operate. Alternative 2 avoids the operational challenges associated with groundwater extraction systems and its performance is easily monitored using conventional field and laboratory methods.

EPA and TDEC involvement have been solicited throughout the CERCLA-based remedy selection process. EPA and TDEC support the preferred alternative (Alternative 2: MNA and LUCs), and their final concurrence will be solicited following the review of all comments received during the public comment period. Community acceptance will be evaluated after the public comment period for this Proposed Plan.

7. SUMMARY OF PREFERRED ALTERNATIVE

7.1 DESCRIPTION OF THE PREFERRED ALTERNATIVE

Based on comparative analysis results and consideration of all information currently available, DOE has determined that Alternative 2: MNA and LUCs is the preferred remedial action alternative to address contaminated groundwater in the K-31/K-33 Area at ETTP. This alternative is recommended because it will achieve the RAOs within a reasonable timeframe and its performance is easily measured.

Given the relatively low levels of contamination and the absence of current exposures to this contamination, DOE believes MNA and LUCs are a cost-effective approach to cleaning up the groundwater, as required by CERCLA and TDEC regulations. DOE also recognizes the preferred alternative may change in response to public comment, which is being solicited through this Proposed Plan.

The components of Alternative 2 are described below.

7.1.1 MNA

MNA relies on natural processes that reduce or "attenuate" contaminant concentrations in groundwater. These processes may also reduce the toxicity or mobility of the contaminants. Using MNA as the remedial action essentially involves continuous monitoring of groundwater conditions to measure and evaluate progress toward achieving RAOs. The natural processes applicable to chromium, nickel, and inorganic contaminants in groundwater include:

- bio-reactions (biogeochemical reduction)
- abiotic reactions (sorption and geochemical reduction)
- advection and dispersion

EPA and the Interstate Technical and Regulatory Council provide guidance on evaluating site conditions and groundwater monitoring data to verify the attenuation processes are performing as expected and to measure progress toward groundwater cleanup (EPA 2007a, 2007b, 2015; ITRC 2010).

A groundwater monitoring program based on the MNA guidance will be used to track remedy performance. Monitoring program design will commence with a tri-party data quality objectives effort that will focus on monitoring locations, the need for installing additional monitoring wells, the frequency of sampling, and the specific constituents to be monitored. The data quality objective will also

address methods for evaluating monitoring data and may include if-then decision statements and contingency actions to help guide the program if future monitoring results indicate the remedy is not performing as expected. The agreed-upon scope for the monitoring program will form the basis of the Remedial Action Work Plan (RAWP) to be prepared following ROD completion.

Potential impacts resulting from the discharge of K-31/K-33 Area groundwater directly into Poplar Creek will be evaluated during implementation of the MNA remedy to satisfy an RAO of protecting surface water. Details concerning the scope of any required surface water monitoring will be defined during development of the RAWP.

Monitoring will begin once EPA and TDEC approve the RAWP. Results will be reported in annual Remediation Effectiveness Reports that DOE prepares as required by the FFA. These annual reports also are submitted for EPA and TDEC review and approval.

Groundwater modeling was used to estimate the timeframe for MNA processes to reduce contaminant concentrations below MCLs. Based on this modeling, MCLs will be achieved in approximately 15 years. Locations with lower levels of contamination are expected to achieve MCLs before this time. Well abandonment (decommissioning) will occur at the end of the project. Wells will be decommissioned via grout placement, with all aboveground well infrastructure removed.

7.1.2 LUCs

LUCs will be implemented in parallel with the MNA action as an additional protective measure to minimize potential exposures to contaminated groundwater. The LUCs will remain in place until RAOs are achieved.

For the K-31/K-33 Area, LUCs prohibit using groundwater for any purpose and may include additional requirements for constructing buildings until groundwater RAOs are achieved. LUCs will be implemented in accordance with the *East Tennessee Technology Park Administrative Watershed Remedial Action Report Comprehensive Monitoring Plan, Oak Ridge, Tennessee* (DOE/OR/01-2477&D4; Remedial Action Report [RAR] Comprehensive Monitoring Plan [CMP]), which includes the LUC Implementation Plan. The LUC Implementation Plan is outlined in Chapter 6 of the RAR CMP, detailed in Appendix D of the RAR CMP, and includes the following applicable LUCs:

- Property Record Restrictions
- Property Record Notices
- Excavation-Penetration Permit Program
- Access controls

The RAR CMP also includes guidelines for transferring property and verifying and reporting LUCs.

7.1.3 FYR

CERCLA requires site conditions be evaluated every 5 years until contamination levels are low enough to allow unlimited use and unrestricted exposures. For the K-31/K-33 Area groundwater remedial action, FYRs will be conducted until groundwater contaminant concentrations are below MCLs. The first review will be prepared 5 years after the ROD is finalized and MNA monitoring activities have begun.

The purpose of the FYR, as stated in EPA's *Comprehensive Five-Year Review Guidance* (EPA 2001), is to evaluate remedy implementation and performance to determine if the remedy is or will be protective of human health and environment. Each FYR includes six components: (1) summary of community involvement, (2) document review, (3) data review and analysis, (4) site inspection, (5) interviews, and (6) protectiveness determination. Information gathered and evaluated for the first five components supports completion of the sixth component, the protectiveness determination for the remedy.

The protectiveness determination is based on answering the following questions:

- Is the remedy functioning as intended?
- Are the exposure assumptions, toxicity data, cleanup levels, and RAOs still valid?
- Has any other information come to light that could call into question the protectiveness of the remedy?

In addition to the protectiveness determination, the FYR will identify any issues affecting remedy performance and will recommend follow-up actions, if needed.

7.2 STATUTORY DETERMINATION

The preferred remedial action alternative meets the statutory requirements of CERCLA Section 121 for: (1) protection of human health and the environment, and (2) compliance with ARARs. The MNA action is cost effective and constitutes a permanent solution to the groundwater contamination problem. Although active treatment measures are not part of the MNA remedy, the natural attenuation processes will achieve the same result; namely, reducing groundwater contamination to meet drinking water standards (MCLs).

8. NATURAL RESOURCE DAMAGES

The proposed remedy for K-31/K-33 Area groundwater is intended to remove contamination from the groundwater and allow its eventual beneficial use. DOE has no plans to leave hazardous substances above health-based levels in groundwater. Conversely, the CERCLA-driven soil cleanup of the K-31/K-33 Area under the Zone 2 ROD was based on a future industrial reuse of the area and was not intended to allow for unrestricted use/unlimited exposures.

Because potentially hazardous substances will remain in K-31/K-33 Area soils, it is recognized by DOE, TDEC, and EPA that Natural Resource Damage claims, in accordance with CERCLA, may be applicable. This document does not address restoration or rehabilitation of any natural resource injuries that may have occurred, or whether any such injuries have occurred. Neither DOE nor TDEC waives any rights or defenses they may have under CERCLA Section 107(1)4(c).

9. COMMITMENT TO LONG-TERM STEWARDSHIP

Areas within the K-31/K-33 Area at ETTP cannot support unrestricted use due to hazardous substances remaining in place after implementation of the selected remedy. Land use restrictions are required as part of this CERCLA action and will be achieved through LUCs that limit use and/or exposure to those areas of the property, including groundwater resources, that are contaminated. DOE is committed to implementing and maintaining LUCs, including institutional controls, to ensure the selected remedy remains protective of human health and the environment.

DOE, EPA, and TDEC have agreed upon a LUC Assurance Plan for the ORR to ensure the ongoing effectiveness of LUCs imposed in remedial actions protect human health and the environment from remaining contamination. The LUC Assurance Plan establishes regular inspection and reporting procedures designed to ensure each required LUC is properly implemented and maintained for as long as it is needed and that it continues to provide the expected level of protection.

10. COMMUNITY PARTICIPATION

DOE, EPA, and TDEC encourage the public to review this document and other relevant documents in the Administrative Record to gain an understanding of the ETTP K-31/K-33 Area and the proposed groundwater cleanup action. A copy of this Proposed Plan, as well as the entire Administrative Record, is located at the DOE Information Center, at the Office of Scientific and Technical Information, 1 Science.gov Way, Oak Ridge, Tennessee, 37830. The center is open Monday through Friday, 8 a.m. to 5 p.m.; the telephone number is (865) 241-4780.

DOE will establish a 45-day public comment period and schedule a public meeting to discuss the preferred alternative and address any questions or concerns from the public. The public meeting will be held at the DOE Information Center (see the previous paragraph for the address).

The public comment period will begin upon regulatory approval of the Proposed Plan, and the dates will be specified in DOE's public notice announcing the availability of the Proposed Plan and the dates for the public comment period. The announcement will include details regarding the public meeting.

DOE also encourages the public to submit comments on the proposed remedial action.

Comments may be provided at the public meeting or via email to OakRidgeEM@orem.doe.gov. Written comments may be addressed to the FFA Project Manager, Oak Ridge Environmental Management, DOE Oak Ridge Operations, Post Office Box 2001, Oak Ridge, Tennessee, 37831. Extensions to the comment period will be granted if requested via email to OakRidgeEM@orem.doe.gov or via written correspondence to the physical address provided above.

DOE will document and respond to comments as part of the ROD that will be issued after the public comment period.

11. REFERENCES

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12. GLOSSARY

Applicable or relevant and appropriate requirement (ARAR) – Those cleanup standards and other substantive requirements, criteria, or limitations promulgated under federal or more stringent state environmental or facility siting laws that are either legally applicable or relevant and appropriate to the hazardous substances, pollutant, contaminant, remedial action, location, or other circumstance found at the CERCLA site.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) – The federal law that establishes, among other requirements, a program for parties (including federal agencies) to identify; investigate; and, if determined necessary, remediate inactive site facilities contaminated with a hazardous substance, pollutant, or contaminant. It is also known as the Superfund law.

Feasibility study (FS) – The step in the CERCLA process in which alternatives for remediation of a contaminated site or of other remediation decisions are developed and evaluated.

Hazard index – The ratio of the level of exposure to an acceptable level of exposure for contaminants that may cause adverse health effects to humans. A cumulative hazard index greater than 1 indicates there may be a concern for adverse health effects. The hazard index is used to assess contaminants that may cause health effects other than cancer. Some contaminants (e.g., uranium, arsenic) can have both carcinogenic and non-carcinogenic effects.

Hazardous and Solid Waste Amendments of 1984 – The federal government's 1984 amendments to RCRA that focused on waste minimization and phasing out land disposal of hazardous waste. In addition to establishing corrective action requirements, the amendments included increased enforcement authority for EPA, more stringent hazardous waste management standards, and a comprehensive underground storage tank program.

Increased lifetime cancer risk (ILCR) – This risk considers the cumulative probability of humans developing cancer as a result of a lifetime of exposure to a particular level of a contaminant, above the normal cancer rates from the natural environment. Cumulative means adding the carcinogenic risk from all contaminants and ways a person can be exposed.

National Environmental Policy Act of 1969 (NEPA) – A federal law that requires federal agencies to consider and evaluate environmental impacts associated with any significant proposed actions or activities. For CERCLA actions undertaken by DOE, any impacts to NEPA values associated with the proposed action are considered along with other factors required to be evaluated.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP is the result of efforts to develop a national response capability and to promote coordination among the hierarchy of responders and contingency plans.

Present-worth – Present-worth costs reflect the quantity of money that would need to be placed in a bank today at a set interest rate, termed the discount rate, to pay for the remedial action over the life of the project. The present-worth approach for cleanup decision-making and comparison of alternatives is recommended by EPA in its cost-estimating guidance for Superfund sites (EPA/540/R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000).

Proposed Plan – The formal document in which the lead agency identifies its preferred alternative for remedial action, explains why this alternative was preferred, and solicits comments from the public.

Record of Decision (ROD) – The formal document in which the lead agency sets forth the selected remedial action and the reasons for its selection.

Remedial investigation (RI) – A CERCLA environmental study that identifies the nature and extent of contamination. The RI also assesses the potential risks associated with the contaminants.

Resource Conservation and Recovery Act of 1976 (RCRA) – A federal law that established, among other requirements, a regulatory system for tracking hazardous waste from the time it is generated until disposal occurs. The law required EPA to promulgate regulations addressing the treatment, storage, and disposal of hazardous wastes that are considered protective of human health and the environment. These regulations (including the State counterparts) may be ARARs for the management of remediation wastes that are also considered hazardous under RCRA.

Superfund Amendments and Reauthorization Act of 1986 (SARA) – The federal law that amended CERCLA on October 17, 1986. SARA promoted permanent remedies for Superfund sites and encouraged the use of innovative treatment technologies, reflecting EPA's experience in administering the complex Superfund program during its first 6 years.

Safe Drinking Water Act of 1974 (SDWA) – The federal law established to protect the quality of public drinking water in the United States. This law focuses on all waters actually or potentially designated for drinking use, whether from aboveground or underground sources.

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13. ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CMP	Comprehensive Monitoring Plan
COC	contaminant of concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
FS	feasibility study
FYR	Five-Year Review
ILCR	increased lifetime cancer risk
IROD	Interim Record of Decision
LUC	land use control
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MNA	monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
ORR	Oak Ridge Reservation
RAO	remedial action objective
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RI	remedial investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act of 1974
TDEC	Tennessee Department of Environment and Conservation
UCL	upper confidence limit
Y-12	Y-12 National Security Complex

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Proposed Plan for the Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee
Public Comment Sheet

The U.S. Department of Energy (DOE) is interested in your comments on the alternatives being considered in this *Proposed Plan for the Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee*, including the preferred remedial action alternative. The mailing address is preprinted on the back of this form. You may use this form to submit your comments. We must receive your comments on or before the close of the public comment period. If you have questions, please contact Mr. Roger Petrie, FFA Project Manager; Oak Ridge Environmental Management; DOE Oak Ridge Operations; P.O. Box 2001, Oak Ridge, Tennessee, 37831; (865) 316-4063.

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Name: _____

Address: _____

City: _____ State/Zip: _____

Phone: _____

MAILING LIST ADDITIONS:

Please add my name to the Environmental Management Program mailing list to receive additional information on the progress at the Oak Ridge Reservation: ☐ Yes ☐ No

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Place
stamp
here

Mr. Roger Petrie, FFA Project Manager
Oak Ridge Environmental Management
DOE Oak Ridge Operations
P.O. Box 2001
Oak Ridge, TN 37831

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United Cleanup Oak Ridge LLC

Comment Resolution Form

Document Number:	Document Title:	
DOE/OR/01-2922&D1	Proposed Plan for the Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee	
Name of Reviewer:	**Organization:**	**Date Comments Transmitted:**
Craig VanTrees	U.S. Environmental Protection Agency Region 4	12/13/22

Comment No.	Sect./Page	Comment	Response
		General	
1.	Guidance	Please ensure all applicable EPA Guidances are followed. All justifications for deviations from the EPA guidances must be documented in the Proposed Plan (PP).	Clarification. DOE prepared this Proposed Plan in accordance with the requirements of CERCLA and followed the relevant guidance documents as appropriate. DOE notes that page i of the ROD guidance contains the following statement: *The document does not, however, substitute for statutes EPA administers nor their implementing regulations, nor is it a regulation itself. Thus, it does not impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the specific circumstances.*
2.	BRW-030 and a Treatability Study:	One groundwater well does not satisfy the first tier (or line of evidence) for monitored natural attenuation (MNA) per the April 1999 Final OSWER Directive *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* OSWER Directive Number 9200.4-17P. Chromium concentrations in well BRW-030 have an increasing trend, opposed to a decreasing trend. Therefore, in the Proposed Plan the DOE presents four mechanisms to satisfy tiers 2 and 3 for MNA as follows: bio-reactions, abiotic reactions, advection, and dispersion. In appendix C of the *Remedial Investigation/Feasibility Study Report for the K- 31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2893&D2) (RI/FS), the DOE details these four mechanisms after acknowledging the chromium trend is increasing in BRW-030. Monitoring data for BRW-030 should be evaluated at the beginning of the Remedial Design Work Plan (RDWP) phase of the project to determine if there is a stable or decreasing trend in contaminant concentration. At that time, if the contaminant trend for BRW-030 is still	Clarification. The overall contamination trends and the number of wells with MCL exceedances in the K-31/K-33 Area have been on a downward trend since monitoring began in the late 1980s. Chromium concentrations in the last two samples collected from BRW-030 were below the MCL. Even when the MCL was exceeded, concentrations have generally been less than twice the MCL. MNA is an appropriate response action given the low levels of contamination, absence of current exposure pathways, and lack of impacts to human health or the environment. As stated in Section 7 of the Proposed Plan, Summary of Preferred Alternative, "A groundwater monitoring program based on the MNA guidance will be used to track remedy performance. Monitoring program design will commence with a tri-party data quality objectives effort that will focus on monitoring locations, the need for installing additional

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		increasing, actions to supplement MNA will be needed because bio-reactions, abiotic reactions, advection, and dispersion alone are likely not sufficient to reach cleanup goals in the BRW-030 location. In this case, enhancement of the MNA remedy in localized area(s) will be needed, including a treatability study of *in situ* treatment process as a part of the RDWP and Remedial Design (RD).	monitoring wells, the frequency of sampling, and the specific constituents to be monitored. The data quality objective will also address methods for evaluating monitoring data and may include if-then decision statements and contingency actions to help guide the program if future monitoring results indicate the remedy is not performing as expected. The agreed-upon scope for the monitoring program will form the basis of the Remedial Action Work Plan (RAWP) to be prepared following ROD completion." DOE will continue to monitor and evaluate sampling results from BRW-030 in support of the remedial design and RAWP. Results from this monitoring and evaluation will be shared with EPA and TDEC.
3.	Re-calculating Exposure Point Concentrations:	The EPA requires that Exposure Point Concentrations (EPCs) be re-calculated following EPA guidances (*Determining Groundwater Exposure Point Concentrations, Supplemental Guidance*. OSWER Directive 9283.1-42. February 2014 and *ProUCL Version 5.2.0 Technical and User Guides. Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations*. June 2022) at the beginning of the RDWP phase of the project. Additional monitoring data collected after the RI/FS was completed can be included in the re-calculation. [This comment doesn't impact the proposed plan.] It is unacceptable to calculate EPCs using data from wells outside an area of groundwater contamination or using data that are so old that they are no longer representative of groundwater quality. The text states "The calculated exposure point concentrations representing the 95% upper confidence limit (UCL) on the mean value were developed using all wells at the K-31/K-33 Area." This wording implies that data from wells outside identified locations of recent groundwater contamination were used to determine the EPCs. If the DOE did not follow the EPA's guidance, *Determining Groundwater Exposure Point Concentrations, Supplemental Guidance* (OSWER Directive 9283.1-42) in determining EPCs, the DOE must document why the guidance was not followed and which procedure was used to determine the EPCs that are representative of current groundwater contamination in the "core" or center of the plume. The need for restricting the EPC to the more highly contaminated part of a groundwater plume is based upon a conceptualization of	Clarification. DOE concurs that EPA guidance (EPA 2014) recommends that, for each COPC, the EPC should be based on the lesser of the 95% UCL or MDC calculated based on data collected from the core of a contaminant plume. Additionally, the guidance notes the approach is expected to be appropriate for a majority, but not all, sites. As noted by the reviewer, definable plume conditions are not present at the K-31/K-33 Area. Therefore, as described in the baseline HHRA, an alternative and health-conservative approach was used to calculate EPCs and baseline risks based on unfiltered and filtered datasets via 2 methods: (1) all applicable data available from the combined 20 wells at the K-31/K-33 Area that were collected from sampling rounds that occurred from 2017 through 2021, and (2) datasets determined for individual wells consisting of data collected from 2017 through 2021. SAS statistical software was employed to calculate statistics needed for determining EPCs by emulating algorithms and calculations used by ProUCL Version 5.1.002 (EPA 2015). EPCs determined from both methods of data aggregation were subsequently used to calculate risks for the hypothetical future resident and future industrial worker. Risks calculated based on individual wells are considered to be biased high due to elevated turbidity observed in the earlier sampling rounds and

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		groundwater contamination being in a definable plume. This condition does not seem to apply to the K-31/K-33 area; therefore, some alternative to this typical situation may apply.	the selection of the MDC as the EPC for 13 of the 20 wells due to small datasets. EPA's 2014 EPC guidance provides an approach for calculating the groundwater EPC for use in human health risk assessments; therefore, a recalculation at the beginning of the RDWP phase is not necessary. DOE used a health-conservative EPC calculation approach (i.e., relative to the cited guidance) to K-31/K-33 Area groundwater in the baseline HHRA, given that no discernable plumes are present. Recalculation of EPCs during post-ROD planning and design activities will be performed to provide integral information that will support the preferred alternative. The approach for performing this calculation will be reviewed as part of the DQO process supporting the RAWP.
4.	Referencing of Documents:	All reference documents must be properly cited and included in the reference section of the proposed plan. For example, a baseline human health risk assessment is mentioned on page 8 with no citation. Please review the proposed plan and ensure all documents are properly referenced.	Clarification. The risk assessment mentioned on page 8 was part of the K-31/K-33 Area RI/FS, which is initially cited in the Introduction (Section 1) and properly referenced in the list of references at the end of the document (Section 11). The first sentence of Section 3 has been revised as follows: "A baseline human health risk assessment was performed for exposures to groundwater as part of the K-31/K-33 Area RI/FS."
5.	Collection of additional data:	On December 12, 2022, the DOE confirmed that groundwater sampling at K-31/K-33 is currently conducted on a semi-annual basis. The EPA recommends quarterly collection of data to better address some comments presented in this letter. The monitoring frequency may, upon tri-party agreement, be adjusted at a later time in the project life cycle.	Agree. The semiannual sampling is conducted as part of DOE's Water Resources Restoration Program. DOE will shift the sampling frequency to a quarterly basis beginning in 2023. DOE also agrees that future monitoring frequency and monitoring parameters will be worked out in a tri-party DQO effort in support of the RAWP.
Specific			
1.	Section 1, Introduction, Page 2:	Please revise the text to provide a brief summary description of the remedial alternatives considered in the detailed analysis per Section 3.3.1 (Introduction) of EPA's July 1999 *A Guide to Preparing Superfund*	Clarification. The existing text is consistent with Section 3.3.1 of the ROD guidance. As stated in the guidance document, the purpose of the introduction is to inform and solicit the views of citizens

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		Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (EPA 540-R-98-031) (the EPA Decision Guidance).	on the preferred alternative. The introduction is also intended to inform the public of the function of the proposed plan in the remedy selection process. The additional information identified in the comment is referenced in the introduction and included in later sections of this Proposed Plan.
2.	Section 1, Introduction, Page 2:	Please revise the text to explain the reason for the preference for MNA. The preferred alternative for remedial action is identified as MNA; however, the text does not explain the reason for the preference per the EPA Decision Guidance.	Agree. The first paragraph of the introduction has been revised with the addition of the shaded text shown below: "This Proposed Plan presents the U.S. Department of Energy's (DOE's) preferred remedial action alternative for K-31/K-33 Area groundwater at the East Tennessee Technology Park (ETTP), located on the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee (Figure 1). The preferred alternative is monitored natural attenuation (MNA), which is a groundwater remediation approach that relies on natural processes to decrease or attenuate concentrations of contaminants in groundwater. MNA was selected to address chromium and nickel contamination in K-31/K-33 Area groundwater. Although chromium and nickel have been detected above drinking water standards, overall concentrations have exhibited a downward trend since monitoring began in the late 1980s, and there are no current exposure pathways that affect human health or the environment."
3.	Section 1, Introduction, Page 2:	In the second paragraph, please substitute "follows the requirements of" with "is a document that the DOE is required to issue to fulfill public participation requirements under".	Agree. The second paragraph has been revised as suggested in the comment. The revised text is shown below: "This Proposed Plan is a document that DOE, as the lead agency, is required to issue to fulfill public participation requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 117(a), as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 *United States Code* Section 9601 et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 *Code of Federal Regulations* [*CFR*] 300.430[f][2])."

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4.	Section 2, Scope of Proposed Remedial Action, Page 2:	Please revise the text to discuss the specific depth of groundwater contamination and provide a map and cross section figures so the vertical extent and scope of the problem is clearly presented.	Clarification. Detailed figures and cross-sections of site conditions are provided in the RI/FS and are not necessary to be included in the Proposed Plan. A new paragraph with additional text on the depth of groundwater contamination has been inserted after the first paragraph in Section 2: "Groundwater sampling results in recent samples (June 2021) from unconsolidated and bedrock wells have identified low levels of contamination (just above the maximum contaminant levels [MCLs] for nickel or chromium) in two monitoring wells along the eastern side of the K-31/K-33 Area. The contaminated groundwater was detected in an overburden well that is screened at a depth of 26 to 36 ft below ground surface and a bedrock well screened at a depth of 35 to 55 ft below ground surface."
5.	Section 2, Scope of Proposed Remedial Action, Page 3:	Please revise Figure 1 to include the location of K-31/K-33. Please revise the figure name to appropriately reflect the contents of the figure.	Agree. The K-31/K-33 Area has been identified on revised Figure 1 (which is attached to this table).
6.	Section 2, Scope of Proposed Remedial Action, Pages 2-8:	In addition to chromium (total), hexavalent chromium should be listed as a chemical of concern (COC) since its excess lifetime cancer risk exceeded 1x10-4 (industrial and residential land use scenarios).	Clarification. Section 3 is the most appropriate section to identify hexavalent chromium as a COC. The sixth paragraph in Section 3 has been revised in response to TDEC comment 3. Hexavalent chromium has been added as one of the primary COCs as shown below: "In addition to the risk assessment results, groundwater data (including data from dedicated, low-flow sampling pumps starting in 2019) and evaluation of process knowledge from the K-31/K-33 Area indicate chromium and nickel have been the most commonly occurring constituents, with concentrations exceeding MCLs. As a result, chromium (including both total chromium and hexavalent chromium) and nickel are considered to be the primary COCs for groundwater in the K-31/K-33 Area."

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7.	Section 2, Scope of Proposed Remedial Action, Pages 2-8:	Please revise the text to explain the exceedance of total polychlorinated biphenyls (PCBs). According to the groundwater results summarized in the RI/FS, total PCBs also exceeded its respective National Primary Drinking Water Regulations, Maximum Contaminated Level (MCL) of 0.5 micrograms per liter (µg/L) with a maximum detection limit of 0.774 µg/L.	Clarification. As stated in the RI/FS, PCBs have not been detected in groundwater in the K-31/K-33 Area. The laboratory analytical detection limit of 0.774 µg/L for one sample collected in 2020 exceeds the MCL; however, laboratory results for the preceding sample from this well (BRW-032) with a detection limit well below the MCL (0.0353 µg/L) indicate PCBs were not detected at the lower detection limit at this well. No additional text is needed in this Proposed Plan.
8.	Section 2, Scope of Proposed Remedial Action, Pages 2-8:	Please revise this section where appropriate to describe other sources of groundwater Contaminants of Concern (COCs). Although this section discusses the potential sources of chromium and nickel in groundwater, other sources of groundwater COCs were not discussed. There is also a lack of discussion of the radiological history.	Clarification. As documented in the RI/FS and summarized in this Proposed Plan, chromium (including hexavalent chromium) and nickel are the principal contaminants of concern based on the HHRA and comparison to MCLs. The RI/FS included a discussion of potential sources of other contaminants, including radionuclides. This Proposed Plan is focused on the constituents targeted by the preferred alternative, but performance monitoring for the MNA remedy will include monitoring for additional constituents, including other COCs historically detected in K-31/K-33 Area groundwater. Specific details for this monitoring will be developed during the DQO process and documented in the RAWP.
9.	Section 2, Scope of Proposed Remedial Action, Page 8:	Section 2.1.3 states, “In the past 10 years, antimony, arsenic, beryllium, chromium, lead, and nickel have exhibited concentrations that exceeded their respective MCLs.” It is unclear why a 10-year cutoff was used when discussing any exceedance of the MCLs. According to the RI/FS, the EPCs for all wells were based on data collected from 2017-2021 (five years). Please explain the rationale for using a 10-year cutoff in the PP when a five-year cut-off is used in the RI/FS and revise the text appropriately.	Clarification. The 10-year period was used in some portions of the RI/FS to ensure sufficient data were available for the data trend analyses. However, text for this Proposed Plan has been revised to be consistent with the 5-year period used for calculation of EPCs in the HHRA. The list of constituents with MCL exceedances over the past 5 years is identical to those associated with the 10-year period. The sentence has been revised as follows: “In the past 5 years, antimony, arsenic, beryllium, chromium, lead, and nickel have exhibited concentrations that exceeded their respective MCLs.”

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			A new figure (new Figure 4, which is attached to this table) has been added to Section 2.1.3 to better illustrate the scope of the groundwater contamination problem in the K-31/K-33 Area. The following sentence with a figure callout has been added to the end of the fifth paragraph in Section 2.1.3: "Figure 4 shows the locations of the two wells with the June 2021 MCL exceedances." Note that subsequent figure numbers have changed due to the insertion of new Figure 4.
10.	Section 3, Summary of Site Risks, Pages 8-9:	Please revise this section to distinguish between the terms hazard index and hazard quotient. It states, "The metals cobalt, iron, lithium, manganese, and nickel were identified as COCs in some individual wells based on a hazard index greater than 0.1, when the overall hazard quotient at a well exceeded 1.0, for both the industrial worker and the hypothetical resident." The terms of hazard index and hazard quotient should not be interchanged. The hazard quotient is the ratio of a single substance exposure level over a specified time period to its reference dose from a similar exposure period. The hazard index is the sum of two or more hazard quotients for multiple substances and/or multiple exposure pathways (EPA 1991).	Clarification. The uses of the terms hazard index and hazard quotient were inverted. COCs were identified in individual wells when the overall hazard index exceeded 1 for similar target organs or effects or when the individual hazard quotient exceeded 1. The text in the fourth paragraph in Section 3 has been revised to state: "The metals aluminum, arsenic, beryllium, cadmium, cobalt, hexavalent chromium, fluoride, iron, lithium, manganese, selenium, thallium, uranium, and vanadium were identified as contaminants of concern (COCs) in one or more of the individual wells because COC-specific hazard indices were greater than 1 or the metals contributed to a hazard index greater than 1 for a similar target organ/critical effect for a hypothetical resident. A subset of the metals (arsenic, cobalt, manganese, thallium, and vanadium) was identified as COCs in one or more wells for industrial workers."
11.	Section 3, Summary of Site Risks, Page 9:	Add a statement regarding any prior investigation of surface water near the K-31/K-33 Area and describe the results of monitoring for the identified groundwater COCs in the surface water.	Clarification. As summarized in Section 3.3 of the K-31/K-33 Area RI/FS, surface water sampling in Poplar Creek has been conducted in support of NPDES Permit requirements, including an evaluation of potential impacts to Poplar Creek from stormwater discharges during demolition of the K-31 and K-33 buildings and for the annual Remediation Effectiveness Report. Samples have been analyzed for PCBs, metals, mercury, hexavalent chromium, and gross alpha/gross beta.

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			This monitoring has not identified any impacts to water quality that can be attributed to groundwater discharge from the K-31/K-33 Area.
12.	Section 3, Summary of Site Risks, Page 9:	Please revise the text to discuss if the groundwater to surface water exposure pathway at K-31/K-33 Area will be addressed in the Remaining Ecology/Surface Water/Sediment Final ROD to ensure ecological risks will be sufficiently evaluated. The text states "Ecological risk was not evaluated for the K-31/K-33 Area because the site is an industrial area and groundwater is not an exposure pathway for ecological receptors." However, it is unclear if there is a groundwater to surface water contamination exposure pathway that exists that may impact ecological receptors. For example, one Remedial Action Objective (RAO) for groundwater states "Protect surface water quality by meeting applicable state ambient water quality criteria in surface water where groundwater discharges to surface water"; however, it is unclear if ecological impacts have been evaluated for the groundwater to surface water exposure pathway. It is noted the PP indicates the CERCLA decision for surface water, sediment, and aquatic ecological receptors at East Tennessee Technology Park (ETTP) (exclusive of Poplar Creek) will be addressed in the Remaining Ecology/Surface Water/Sediment Final ROD.	Clarification. The sixth paragraph in Section 3 has been revised, and a new paragraph has been added in Section 7.1.1, as shown below: "Ecological risk associated with groundwater contamination was not quantitatively evaluated for the K-31/K-33 Area RI/FS. There are no ponds, springs, or perennial streams in the formerly industrialized, upland portion of the area that might receive discharging groundwater and provide habitat for ecological receptors. A spring and seep survey along the banks of Poplar Creek, completed by the U.S. Geological Survey in 1995, identified several minor seeps in the southern and southeastern portions of the K-31/K-33 Area. These seeps were primarily wet-weather conveyances with low, intermittent flow rates and are also unlikely to provide appreciable habitat value. Based on these conditions, groundwater is not associated with a complete exposure pathway for ecological receptors in the K-31/K-33 Area." The new paragraph added in Section 7.1.1 states: "Potential impacts resulting from the discharge of K-31/K-33 Area groundwater directly into Poplar Creek will be evaluated during implementation of the MNA remedy to satisfy an RAO of protecting surface water. Details concerning the scope of any required surface water monitoring will be defined during development of the RAWP."
13.	Section 3, Summary of Site Risks, Page 9:	In the fourth full paragraph, the Proposed Plan explains that certain chemicals were not included as COCs because they were not "site-related." Please omit this statement. The site risks and COCs described in the PP should be consistent with the HHRA.	Agree. The statement has been deleted from the sentence.
14.	Section 3, Summary of Site	The risk section of the PP does not conclude with the standard statement and language explaining the basis for taking action per Section 3.3.5 (Summary of Site Risks) of the EPA Decision Guidance. The following standard language explaining the basis for taking action is one example	Agree.

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	Risks, Page 9:	per Section 3.3.5 of the EPA Decision Guidance: *"It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment."* Please revise the text in this section to conclude with the standard statement and language explaining the basis for taking action.	A new paragraph has been added at the end of Section 3 to include the language from Section 3.3.5 of the ROD guidance explaining the basis for taking action, as shown below: "It is DOE's current judgment that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment."
15.	Section 4, RAOs, Page 9:	Revise the RAOs as follows: a. Revise bullet 1 to state "Restore groundwater to drinking water standards." Delete "to the extent practicable," as a technical impracticability waiver has not been sought or approved. b. Combine RAOs 2, 4 and 5 to: "Prevent exposure of humans, including industrial and construction workers, via dermal contact, ingestion, and/or inhalation to groundwater containing COCs above MCLs or state drinking water standards that are ARARs." c. RAO 3 is unclear and doesn't include all the elements typically incorporated into an RAO (contaminants, media, exposure pathway, receptors, and Preliminary Remediation Goals (PRG)/cleanup level). Please revise. For example: *Prevent migration of contaminated groundwater to surface water that could result in exceedances of applicable state or federal ambient water quality standards (ARARs) and*... (tie it back to the risk). Some possible options: *i. …pose an unacceptable risk to human receptors through the ingestion of contaminated organisms.* *ii. Pose an unacceptable risk to ecological organisms.* iii. *Degrade water quality based on its intended use*.	Agree with clarification. a. The first RAO bullet has been revised to state the following: "Restore groundwater to drinking water standards (federal and state)." b. RAOs 2, 4, and 5 have been combined as requested: "Prevent exposure of humans, including industrial and construction workers, via dermal contact, ingestion, and/or inhalation to groundwater containing COCs above protective levels and prevent on-site consumption of groundwater above MCLs or applicable state groundwater criteria that are applicable or relevant and appropriate requirements (ARARs)." c. RAO 3 has been revised as suggested: "Prevent adverse impacts to surface water quality from migration of contaminated groundwater that could result in exceedances of applicable state or federal ambient water quality standards or impairing the usefulness of the surface water for its classified use."
16.	Section 4, Remedial Action Objectives, Page 10:	In Table 1, footnote a, the text in the second sentence mischaracterizes the relationship between the state and federal MCL. The correct relationship is that state requirements are identified as ARARs where they are more stringent than a corresponding federal requirement. Please remove this sentence. EPA does not object to the listing of the TDEC	Agree. The second sentence has been deleted from footnote '[a]' to Table 1.

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		MCLs on Table 1, as TDEC has incorporated federal MCLs into its groundwater protection standards.	
17.	Section 5, Summary of Remedial Alternatives, Page 11:	The alternative recommended as the preferred alternative is not identified at the beginning of this section per Section 5 (Summary of Remedial Alternatives) of the EPA Decision Guidance. Please revise the text to clearly identify the alternative that is recommended as the preferred alternative (i.e., MNA and land use controls [LUCs]).	Agree. The second bullet has been revised to indicate Alternative 2 is the preferred alternative, as shown below: • "Alternative 1: No action • Alternative 2: MNA and LUCs (DOE's preferred alternative) • Alternative 3: Pump and Treat, MNA, and LUCs"
18.	Table 2, Summary of remedial action alternatives, Page 14:	The costs presented for Alternatives 2 and 3 do not provide breakout costs for annual operations and maintenance (O&M) requirements per Section 3.3.7 (Summary of Remedial Alternatives) of the EPA Decision Guidance. Please revise the table to provide the costs for annual O&M requirements for Alternatives 2 and 3 to support a comparative evaluation of primary balancing criteria for costs.	Agree. Annual O&M costs (present worth) have been added to Table 2 (which is attached to this table).
19.	Section 10, Community Participation, Page 20:	This section does not include all of the elements per Section 3.3.10 (Community Participation) of the EPA Decision Guidance. For example, the dates of the comment period, the location of the public meeting, names/phone numbers/addresses (including email address) of the contact person who will receive comments or provide additional information, as well as any citizen advisory boards (CABs) participation. As this is a key milestone for Community Participation, this information should be clearly presented. Please revise the text to include this information.	Clarification. The requested information has been added to Section 10. The revised section is presented below, with new text highlighted: "**10. COMMUNITY PARTICIPATION** DOE, EPA, and TDEC encourage the public to review this document and other relevant documents in the Administrative Record to gain an understanding of the ETTP K-31/K-33 Area and the proposed groundwater cleanup action. A copy of this Proposed Plan, as well as the entire Administrative Record, is located at the DOE Information Center, at the Office of Scientific and Technical Information, 1 Science.gov Way, Oak Ridge, Tennessee, 37830. The center is open Monday through Friday, 8 a.m. to 5 p.m.; the telephone number is (865) 241-4780. DOE will establish a 45-day public comment period and schedule a public meeting to discuss the preferred alternative and address any questions or concerns from the public. The public meeting will be held at the DOE Information Center

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			(see the previous paragraph for the address). The public comment period will begin upon regulatory approval of the Proposed Plan, and the dates will be specified in DOE's public notice announcing the availability of the Proposed Plan and the dates for the public comment period. The announcement will include details regarding the public meeting. DOE also encourages the public to submit comments on the proposed remedial action. Comments may be provided at the public meeting or via email to OakRidgeEM@orem.doe.gov. Written comments may be addressed to the FFA Project Manager, Oak Ridge Environmental Management, DOE Oak Ridge Operations, Post Office Box 2001, Oak Ridge, Tennessee, 37831. Extensions to the comment period will be granted if requested via email to OakRidgeEM@orem.doe.gov or via written correspondence to the physical address provided above. DOE will document and respond to comments as part of the ROD that will be issued after the public comment period."

REFERENCES PROVIDED BY EPA

References

DOE 2022. Remedial Investigation/Feasibility Study Report for the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2893&D2) (RI/FS).

EPA 1991. Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). EPA/540/R-92/003

EPA 1999. A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents. OSWER Directive 9200.1-23P. July 1999.

EPA 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tanks. OSWER Directive 9200.4-17P. April 1999

EPA 2014. Determining Groundwater Exposure Point Concentrations, Supplemental Guidance. OSWER Directive 9283.1-42. February 2014

EPA 2022. ProUCL Version 5.2.0 Technical and User Guides. Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. June 2022

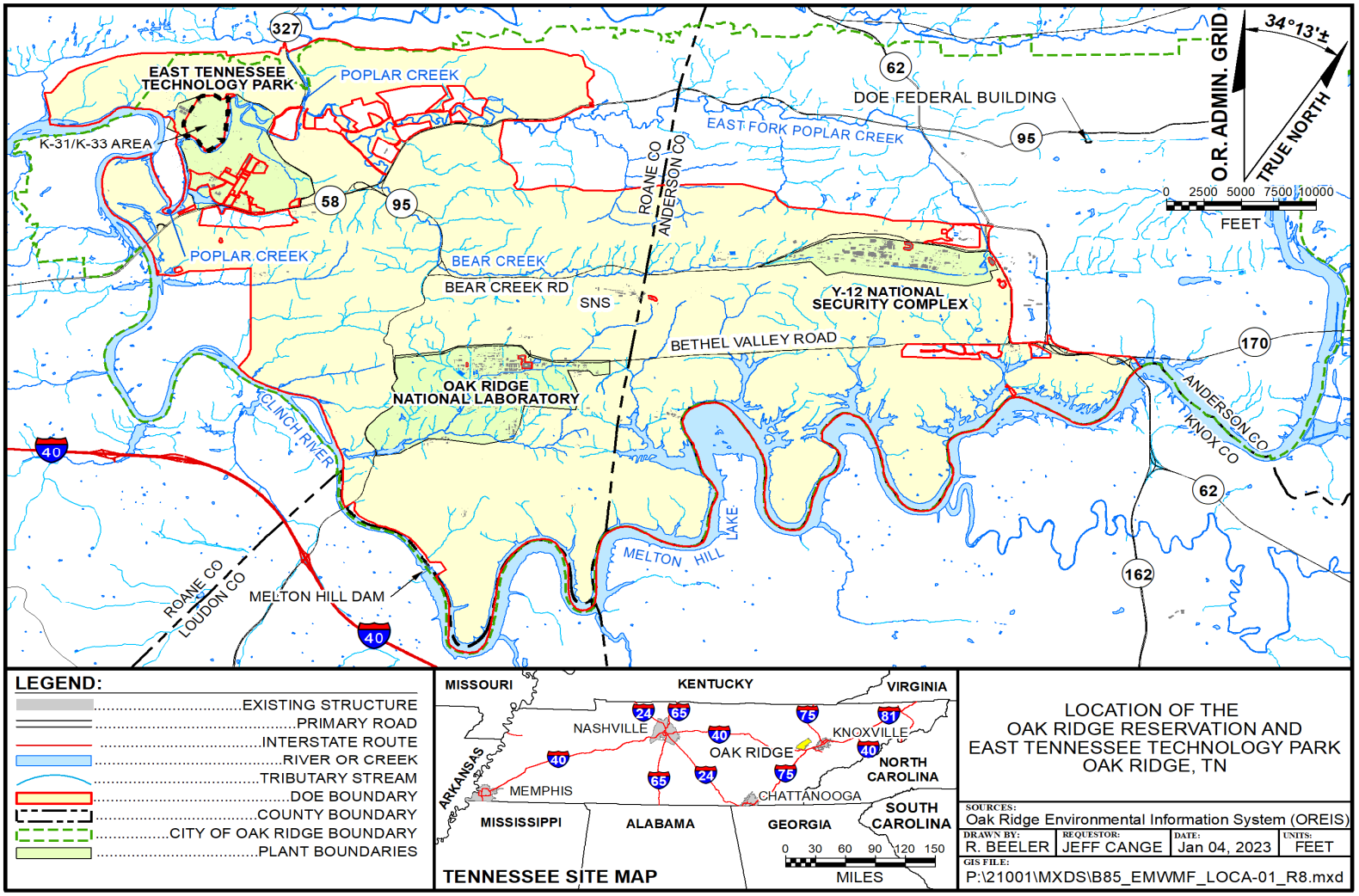

Figure 1. Location of the ORR and ETTP.

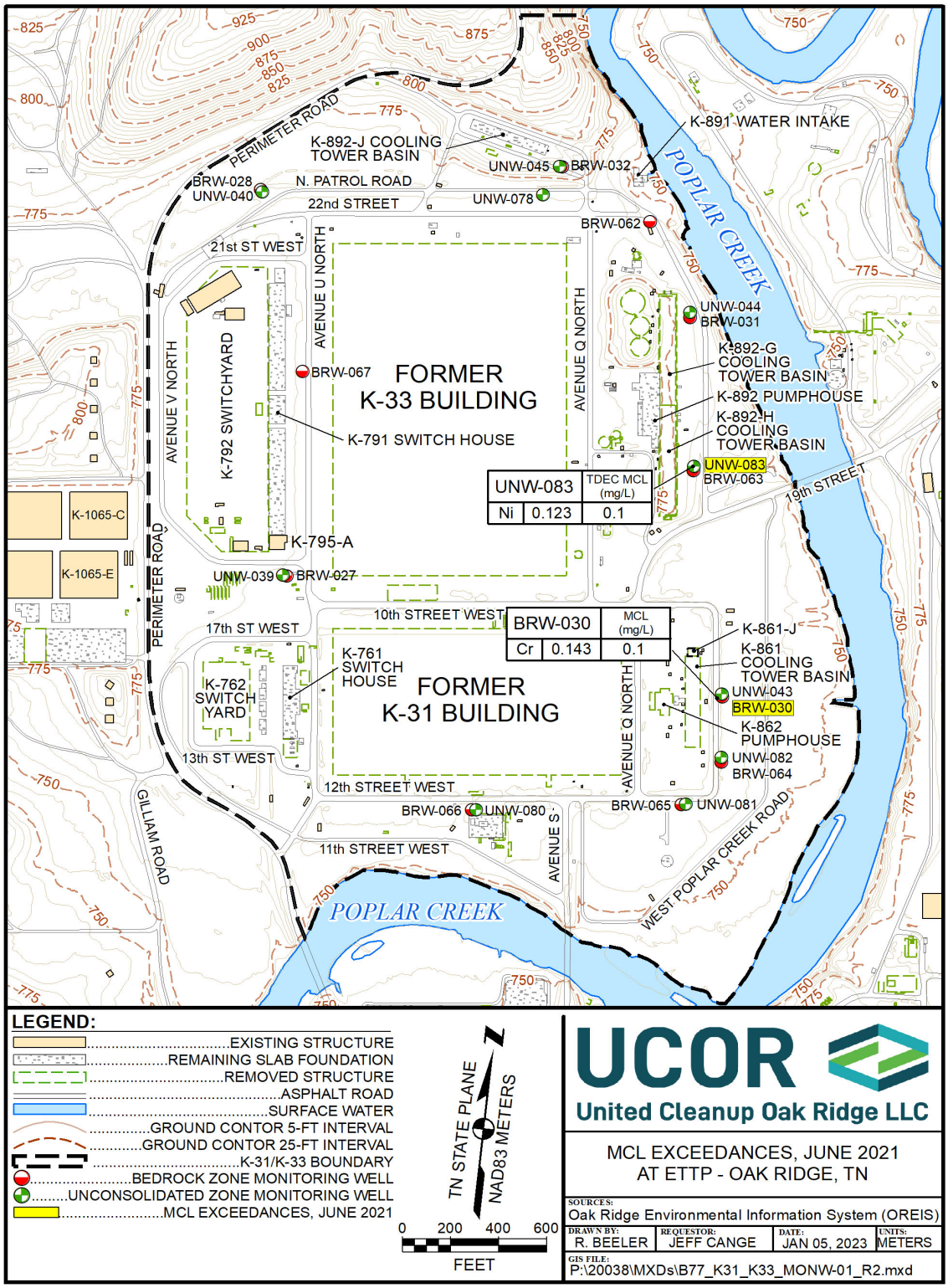

Figure 4. Monitoring wells with MCL exceedances based on June 2021 sampling.

Table 2. Summary of remedial action alternatives

Alternative	Description	Cost ($)/Timeframe (years)
Alternative 1: No action	The no-action alternative was included to provide a baseline for comparison to other alternatives, as required by the National Oil and Hazardous Substances Pollution Contingency Plan. Under this alternative, no remediation, monitoring, or LUCs will occur. Future contamination trends will not be evaluated or reported.	Cost: $0 Timeframe: Not applicable
Alternative 2: MNA and LUCs	Alternative 2 relies on naturally occurring processes to attenuate (reduce) the concentration, toxicity, or mobility of contaminants. These processes are closely monitored and evaluated over time to determine progress toward RAOs. LUCs will be implemented to prohibit the use of groundwater and provide notifications to future landowners concerning the presence of contaminated groundwater. The LUCs remain in place until RAOs are achieved. The estimated costs include installing and monitoring additional wells; however, the need for, number, and exact locations of additional wells will be addressed during development of the Remedial Action Work Plan.	Capital cost: $131,000 Total present-worth cost: $1.8 million Annual O&M present-worth cost: $84,000 Timeframe: 15 years
Alternative 3: Pump and treat, MNA, and LUCs	Alternative 3 extracts and treats groundwater with the highest concentrations of chromium and nickel, targeting specific areas with more persistent exceedances of MCLs (Figure 6). MNA will be implemented in areas where monitoring well data have shown lower contaminant concentrations (and only intermittent MCL exceedances). Groundwater will be pumped out of specially constructed extraction wells. A dedicated water treatment plant will be constructed near the extraction wells to treat the extracted groundwater. The treatment process will consist of a bag filter (to remove suspended solids), followed by ion-exchange units that will use two different ion-exchange resins to remove the chromium and nickel. Treated water will be discharged to the Clinch River in accordance with the Clean Water Act and TDEC regulations. MNA and LUCs will be implemented as described with Alternative 2.	Capital cost: $2,355,000 Total present-worth cost: $11.2 million Annual O&M present-worth cost: $882,000 Timeframe: 10 years

Note: Costs represent direct project costs only and do not include all program-level management and overhead burdens.

LUC = land use control
MCL = maximum contaminant level
MNA = monitored natural attenuation
O&M = operations and maintenance
RAO = remedial action objective
TDEC = Tennessee Department of Environment and Conservation

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Comment Resolution Form

Document Number:	Document Title:	
DOE/OR/01-2922&D1	Proposed Plan for the Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee	
Name of Reviewer:	**Organization:**	**Date Comments Transmitted:**
Randy C. Young	Tennessee Department of Environment and Conservation	11/08/22

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1	Section 3, Summary of Site Risks, fifth paragraph, page 9	Please identify in this text that the *Final Sitewide Remedial Investigation and Feasibility Study for Residual Contamination at East Tennessee Technology Park (DOE/OR/01-2279&D3)* was never approved. As currently written, it could be perceived by the public that this document is an approved document in this record. This is potentially confusing to the general reader.	Agree with clarification. The fifth paragraph in Section 3 has been deleted in response to EPA comments.
2	Section 3, Summary of Site Risks, fifth paragraph, page 9	All constituents exceeding regulatory limits or human health risk levels in groundwater should be addressed by the proposed remedy though out this document. As was addressed in comment response #1 from DOE to TDEC in TDEC's DOE/OR/01-2893&D1/R1 comments to be incorporated in to the D2 FFS document, DOE has stated previously: "*No COCs have been excluded from the FS based on the HHRA, frequency of MCL exceedances, or magnitude of the concentrations."* • Please evaluate and reword the text in paragraph 5 under section 3 that uses the unapproved "Final Sitewide Remedial Investigation and Feasibility Study for Residual Contamination at ETTP, Oak Ridge, TN Volumes 1 through 3 (DOE/OR/01-2279&D3)" to state that "metals were not analytes of interest in groundwater in the K31/33 Area due to their limited frequency of detection above screening levels."	Agree with clarification. The fifth paragraph in Section 3 has been deleted in response to EPA comments.
3	Section 3, Summary of Site Risks, sixth paragraph, page 9	A baseline human health risk assessment does not differentiate between what COCs should be retained and what COCs should be excluded during site cleanup. The decision to retain COCs should be evaluated using process knowledge to identify which COCs are site related and which COCs are not believed to be attributed to site activities. Please revise this paragraph to state the reasoning for only retaining chromium and nickel as COCs and remove the statement that reads;" the baseline human health risk assessment concluded chromium and nickel are considered to be the primary COCs for groundwater in the K-31/K-33 Area".	Agree. The sixth (now fifth) paragraph has been revised, and hexavalent chromium has been included as a primary COC in response to EPA specific comment 6: "In addition to the risk assessment results, groundwater data (including data from dedicated, low-flow sampling pumps starting in 2019) and evaluation of process knowledge from the K-31/K-33 Area indicate chromium and nickel have been the most commonly occurring constituents, with concentrations exceeding MCLs. As a result, chromium (including both total chromium and hexavalent chromium)

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			and nickel are considered to be the primary COCs for groundwater in the K-31/K-33 Area."
4	Section 3, Summary of Site Risks, last paragraph, page 9	Please remove the portion of the statement that an ecological risk assessment was not conducted because the site is an industrial area. Land use does not prescribe whether an ecological risk assessment needs to be completed. Please provide clarification in the comment response regarding when eco risk will be addressed at this site within the administrative record.	Agree. The statement has been revised as suggested in the comment and in response to EPA specific comment 12: "Ecological risk associated with groundwater contamination was not quantitatively evaluated for the K-31/K-33 Area RI/FS. There are no ponds, springs, or perennial streams in the formerly industrialized, upland portion of the area that might receive discharging groundwater and provide habitat for ecological receptors. A spring and seep survey along the banks of Poplar Creek, completed by the U.S. Geological Survey in 1995, identified several minor seeps in the southern and southeastern portions of the K-31/K-33 Area. These seeps were primarily wet-weather conveyances with low, intermittent flow rates and are also unlikely to provide appreciable habitat value. Based on these conditions, groundwater is not associated with a complete exposure pathway for ecological receptors in the K-31/K-33 Area." DOE agrees land use does not determine whether an ecological risk assessment is required. Land use does, however, have an important impact on the extent of natural habitat available for terrestrial ecological receptors. The planned future land use for Zone 2 is a privately owned industrial property that provides de minimis natural habitat for terrestrial ecological receptors. Zone 2 was, and will remain, industrial property, with future development comprised of buildings, roads, parking lots, and maintained landscaping (e.g., mowed lawns). Given the future land uses in Zone 2, only relatively small, fragmented patches of unmaintained landscape will remain. As such, these areas are qualitatively assessed to include no significant, completed exposure pathways from soil to terrestrial receptors. Neither the Main Plant Area nor the K-31/K-33 Area will provide ecologically significant terrestrial habitats, and the soils do not require further, quantitative evaluation for the protection of ecological receptors.

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			DOE's position on Zone 2 ecological risk was presented in the *Remedial Investigation Work Plan for Remaining Ecology/Surface Water/Sediment at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2912&D2), which was approved by TDEC and EPA in October 2022.
5	Section 4, Remedial Action Objectives, page 9, first bullet	Revise the first RAO bullet to state: "Return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site".	Clarification. The first RAO bullet has been revised in response to EPA specific comment 15, contained in the 02/07/2023 email to DOE, as shown below: "Restore groundwater to drinking water standards (federal and state)."
6	Section 4, Remedial Action Objectives, page 9	Please include an RAO bullet that states "Groundwater contamination should not be allowed to migrate and further contaminate the aquifer or other media (e.g. vapor intrusion into buildings, sediment, surface water, or wetland)."	Clarification. The existing RAOs address migration control through the objectives of restoring groundwater to its beneficial use while preventing exposures to the groundwater (including the vapor intrusion pathway) and protecting surface water quality.
7	Section 4, Remedial Action Objectives, page 9, bullets 2, 4, and 5	RAO bullets 2, 4, and 5 address preventing exposures. As LUCs are interim measures while groundwater remedy is being implemented, please include "until groundwater is returned to beneficial use" to the end of those bullet statements. This intent is referenced in text section 7.1.2 Land Use Controls, but please include this language into these bulleted RAOs specifically as well.	Clarification. In response to comments from EPA, bullets 2, 4, and 5 have been combined into a single RAO, as shown below: "Prevent exposure of humans, including industrial and construction workers, via dermal contact, ingestion, and/or inhalation to groundwater containing COCs above protective levels and prevent on-site consumption of groundwater above MCLs or applicable state groundwater criteria that are applicable or relevant and appropriate requirements (ARARs)."
8	Section 4, Remedial Action Objectives, first paragraph, page 9	Please remove the sentences that discuss the near-term and future end uses in the K-31/K-33 area in this section: *"The anticipated near-term and future end uses in the K-31/K-33 Area are industrial, which is consistent with the Covenant Deferral Request transferring the land to the Community Reuse Organization of East Tennessee. Currently, the K-31 area is being leased as a support facility to the Y-12 Uranium Processing Facility construction project, and the K-33 footprint has been sold*	Agree. The italicized text included in the comment has been removed from Section 4 and added to the end of Section 2.1.2.

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		to Kairos Power who plans to use it for a nuclear energy demonstration reactor. *Future industrial use of the groundwater at ETTP is improbable and would require prior approval from DOE, EPA, and TDEC before implementation. Groundwater would be of limited industrial use due to the complex geology, the availability of the Clinch River immediately adjacent as a water source, and the availability of the existing municipal water supply. Future residential use of the K-31/K-33 Area is prohibited through LUCs established under the Zone 2 ROD."* The end use for the K-31/K-33 area is irrelevant when establishing RAOs for groundwater. All groundwater in the State of Tennessee is considered "General Use Groundwater" 0400-40-03-.07. This information might be better placed in Section 2.1.2 Site History and Status.	
9	Section 4, Remedial Action Objectives, second paragraph, page 9	Please remove the term "industrial use" from the first sentence of this paragraph. Comment 8 above recommends removing or relocating these paragraphs. Please note, regardless of where the paragraphs are relocated, the term "industrial use groundwater" is not a relevant classification under TDEC Rule 0400-40-03 General Water Quality Criteria, and that "industrial use groundwater" terminology should be reworded or removed in all instances where groundwater usage and the required water quality criteria associated with those uses, are being discussed.	Agree. The paragraph has been moved to Section 2.1.2, and the first two sentences have been revised as follows: "Future use of the groundwater in the K-31/K-33 Area is improbable and would require prior approval from DOE, EPA, and TDEC before implementation. Groundwater would be of limited use to future site developers due to the complex geology, the availability of the nearby Clinch River as a water source, and the availability of the existing municipal water supply. Future residential use of the K-31/K-33 Area is prohibited through land use controls (LUCs) established under the Zone 2 ROD."
10	Section 6.2, Compliance with Applicable or Relevant and Appropriate Requirement, First paragraph, page 15	Please revise the sentence to state that Alternative 1 would not achieve the chemical specific ARARs which would include ALL enforceable numerical standards, both EPA MCLs and TN general use water quality criteria.	Agree. The sentence has been revised as follows: "Alternative 1 would not achieve the chemical-specific ARARs, which include all enforceable numerical standards."
11	Section 6.7, Cost, last sentence, page 17	Please change "Remedial Design Report" to "Remedial Design Work Plan".	Clarification. See response to comment 12.

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12	Section 7.1.1, page 18	Please include after paragraph 2 in this section, a discussion regarding the evaluation of the monitoring network and the potential need for installing additional monitoring wells as part of the Remedial Design Work Plan (RDWP) and Remedial Design Report (RDR) stage of the CERCLA process.	Clarification. As stated in Section 7.1.1, the "Monitoring program design will commence with a tri-party data quality objectives effort..." DOE plans for this DQO effort to include an evaluation of the potential need for installing additional monitoring wells. The second sentence in the third paragraph has been revised to add the consideration for additional wells: "Monitoring program design will commence with a tri-party data quality objectives effort that will focus on monitoring locations, the need for installing additional monitoring wells, the frequency of sampling, and the specific constituents to be monitored." Results from the DQO process, including the decision regarding additional wells, will be documented in the Remedial Design Report (RDR). The RDR will present the rationale for selecting the actual wells to be monitored and will include installation details for any additional wells needed. TDEC and EPA will provide input to the RDR through the FFA review and approval protocol.
13	Section 8, Natural Resource Damages, page 19	The first sentence of this paragraph reads: "Hazardous substances above health-based levels will remain onsite if this remedy is implemented." Please define hazardous substances in the context of this statement and elaborate what hazardous substances are intended to be left in groundwater with implementation of this remedy, and for what time frame are they intended to remain?	Clarification. The original language is based on the Annotated Outline for Proposed Plans in the FFA. The paragraph has been revised as follows: "The proposed remedy for K-31/K-33 Area groundwater is intended to remove contamination from the groundwater and allow its eventual beneficial use. DOE has no plans to leave hazardous substances above health-based levels in groundwater. Conversely, the CERCLA-driven soil cleanup of the K-31/K-33 Area under the Zone 2 ROD was based on a future industrial reuse of the area and was not intended to allow for unrestricted use/unlimited exposures. Because potentially hazardous substances will remain in K-31/K-33 Area soils, it is recognized by DOE, TDEC, and EPA that Natural Resource Damage claims, in accordance with CERCLA, may be applicable. This document does not

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			address restoration or rehabilitation of any natural resource injuries that may have occurred, or whether any such injuries have occurred. Neither DOE nor TDEC waives any rights or defenses they may have under CERCLA Section 107(1)4(c)."