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Floodplain and Wetland Assessment for Chromium Remediation in Sandia and Mortandad Canyons, Los Alamos National Laboratory (*Draft*)

N3B Los Alamos

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1.0 INTRODUCTION

This floodplain and wetland assessment was prepared in accordance with 10 Code of Federal Regulations (CFR) Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." According to 10 CFR Part 1022, a floodplain is defined as "the lowlands adjoining inland and coastal waters and relatively flat areas and flood prone areas of offshore islands" and has a 1 in 100 chance of being equaled or exceeded by a flood event in any 1-year period. A wetland is defined as "an area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, and similar areas."

Per Executive Order 14030, "Climate-Related Financial Risk," the Federal Flood Risk Management Standard (FFRMS) was reinstated. The FFRMS provides three approaches or options for federal agencies to establish flood hazard areas. The climate informed science approach (CISA) requires federal agencies to "use the best available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science" (FEMA 2015). Furthermore, for areas vulnerable to riverine flood hazards, federal agencies must "account for changes in riverine conditions due to current and future changes in climate and other factors (e.g., land use) by applying state-of-the art science in a manner appropriate to policies, practices, criticality, and consequences (risk)."

In regard to the best available and actionable data and methods that could be used to forecast flood hazard areas under future climate changes and other factors, the currently implemented base floodplain extent model at Los Alamos National Laboratory (LANL) (LANL 2001) complies with the CISA described in the FFRMS in the following ways:

- The digital elevation model (i.e., topography) used in the base floodplain extent model is of a resolution equal to or superior to other publicly available data sources.
- The empirically measured rainfall intensity data used are still the best available and actionable data for use in determining flood hazard areas.
- The watershed hydrologic parameterization methods used are the best available and are typical of current watershed modeling efforts.
- The model results were validated using observed data from stream gages located throughout LANL.
- The model was developed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) and River Analysis System (HEC-RAS), which the Federal Emergency Management Agency (FEMA) has approved for use in flood hazard mapping.
- Future projections of extreme precipitation events in the region do not indicate a clear and actionable trend and/or are not of a temporal and spatial resolution that could inform a watershed-scale, event-based hydrologic model.
- Flooding-related impacts from changes in land use are limited within the Pajarito Plateau watershed.
- The base floodplain extent map was modeled using watershed hydrologic parameters representative of post-fire conditions.

The U.S. Department of Energy Environmental Management Los Alamos Field Office (EM-LA) has prepared this floodplain and wetland assessment to evaluate the potential impacts of the proposed actions on the floodplains and wetland within the project area, to identify alternatives to the proposed actions, and to allow for meaningful public comment.

1.1 Background

1.1.1 Floodplains and Wetland Descriptions

The Sandia Wetland is located at the head of Sandia Canyon. The wetland is primarily sustained via effluent discharged from the Sanitary Effluent Reclamation Facility (National Pollutant Discharge Elimination System [NPDES] Permit No. NM002835; permitted outfalls 001 and 03A199) at LANL. At the terminus of the wetland, a grade control structure maintains high groundwater levels and prevents further migration of a headcut into the wetland from the Sandia Canyon floodplain (Figure 1). Vegetation within the wetland primarily consists of broadleaf cattail, narrow-leaf cottonwood, Siberian elm, sedges, and rushes. The wetland area is approximately 3.65 acres (N3B 2019).

The Sandia Wetland drains into Sandia Canyon creating a perennial segment of the waterway until the confluence with Sigma Canyon (LANL 2021). The infiltrated water below Sandia Canyon percolates through a heterogeneous and complex vadose zone before reaching the regional aquifer underlying both lower Sandia and Mortandad Canyons. The upper Sandia and Mortandad Canyon floodplains are largely undeveloped with a single dirt road providing access to the Sandia Wetland, monitoring wells, and stormwater-monitoring infrastructure. Vegetation within the upper Sandia and Mortandad Canyon floodplains includes Douglas fir, ponderosa pine, box elder, and narrow-leaf cottonwood.

Lower Sandia and Mortandad Canyons are considerably more developed. Lower Sandia Canyon converges on East Jemez Road, a major commuter artery to LANL. Both lower Sandia and Mortandad Canyons have numerous well pads interspersed throughout the canyon bottoms. In Mortandad Canyon, a network of dirt roads provide access to this infrastructure. Vegetation within the lower sections of these canyons are more xeric with sparse ponderosa pine, piñon, and juniper canopy interspersed with bunchgrasses and shrubs.

1.1.2 Chromium Contamination

From 1956 to 1972, water used in power plant cooling towers at LANL was treated with potassium dichromate, a corrosion inhibitor. The resulting effluent was discharged into Sandia Canyon (Vesselinov et al. 2013). The historical releases have resulted in hexavalent chromium [Cr(VI)] contamination in the groundwater underlying Sandia and Mortandad Canyons. Since 2005, an ongoing investigation of the Cr(VI) plume has indicated Cr(VI) concentrations within the regional aquifer in excess of 50 ppb, the New Mexico groundwater standard. Beginning in 2015, an interim measure was implemented to impede potential plume migration into adjacent Pueblo de San Ildefonso property and further characterize the nature and extent of contamination in preparation for a final remedy.

EM-LA is proposing to use adaptive site management (ASM) to select and implement options to further remediate Cr(VI) contamination in Sandia and Mortandad Canyons. The goal of ASM is to create a framework of structured and continuous planning, implementation, and monitoring that accommodates new information and changing site conditions to develop effective and efficient cleanup strategies. Remediation under ASM addresses what is known while acknowledging uncertainty. It includes plans to collect the necessary information to improve understanding of plume dynamics and achieve a final remedy for the site. This approach allows work to proceed in some areas while additional data collection and testing of responses is conducted to determine the appropriate remediation strategies in remaining areas.

2.0 PROJECT DESCRIPTION

2.1 Adaptive Site Management

ASM is a dynamic and flexible management approach intended to efficiently characterize contamination, optimize remediation strategies, and limit risk. Central to ASM is the conceptual site model (CSM), which provides an evolving representation of the site. The CSM is constantly being refined as data are gathered and uncertainties are informed. The CSM illustrates where there are data gaps and allows EM-LA to prioritize resources to improve understanding of the plume and efficaciously remedy the contamination.

Because ASM relies on monitoring of evolving conditions to inform optimal remediation strategies, a suite of options are being proposed. ASM will provide the framework for determining which options are implemented. The following four remediation options are being analyzed. Any combination of these options may ultimately be implemented.

- Mass removal via expanded treatment
- Mass removal with land application
- Mass removal via in-situ treatment
- Monitored natural attenuation

2.1.1 Mass Removal via Expanded Treatment

Under the mass removal via expanded treatment option, EM-LA would extract contaminated water from the regional aquifer, pump the water to a treatment facility, remove Cr(VI) from the water, pump the treated water to injection wells, and then inject the treated water back into the regional aquifer. The efficacy of remediation efforts would be monitored via an array of wells and piezometers installed throughout the project area.

As part of this option, EM-LA would construct a 10,000 ft^2 Cr(VI) treatment facility. The treatment system will consist of an ion-exchange treatment system with pre-filtration, associated piping, flow controls, and programmable logic controls and monitoring. The treatment facility will include contactors, ion-exchange vessels, an electrical room, a control room, feed tanks, injection pumps, an electrical supply connection, and a bathroom with a septic system.

In addition to the new treatment facility, this option also includes designs for the following:

- 15 extraction wells with piping network to treatment facility
- 15 injection wells with piping network from treatment facility
- 15 monitoring wells
- 20 shallow piezometers in the source area (i.e., Sandia Wetland and Sandia Canyon)
- 10 piezometers in the deep vadose zone in Mortandad Canyon
- Roads and wells pads as needed

2.1.2 Mass Removal with Land Application

The mass removal with land application option uses the same treatment facility processes and treatment options as the mass removal via expanded treatment option, except treated water would not be injected back into the regional aquifer. Treated water would be stored in existing synthetically lined storage basins in Mortandad Canyon, then conveyed through an existing system of basin pumps and piping for disposition by any of the following methods: (1) irrigation-type sprinklers using an array of sprinkler heads, (2) mechanical evaporators, or (3) 3000- to 10,000-gal. water trucks with high-pressure sprayers. Use of the irrigation system and/or mechanical evaporators would be prioritized over the use of water trucks to minimize vehicle traffic.

The land-application method will only occur in permitted areas per an NPDES land permit (Figure 2) and only up to land application–allowable/permitted limits (currently 350,000 gal./day).

2.1.3 Mass Removal via In-situ Treatment

The mass removal via in-situ treatment option would use in-situ treatment to address Cr(VI)-contaminated groundwater. In-situ treatment involves injecting reducing agents in untreated water and relying on chemical processes (e.g., sodium dithionite amendments) to immobilize and detoxify contaminants within soil or groundwater without removing them from the ground. In-situ treatment would be used to target source area contamination in Sandia Canyon as well as groundwater contamination beneath Mortandad Canyon.

2.1.4 Monitored Natural Attenuation

The monitored natural attenuation (MNA) option relies on natural physical, chemical, or biological processes to reduce concentrations, toxicity, or mobility of chromium and incorporates regular monitoring to verify that MNA is working. In the case of chromium, attenuation occurs via the reduction of mobile Cr(VI) to insoluble trivalent chromium [Cr(III)]. EM-LA would consider MNA when contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe, compared with more active methods.

The new treatment facility will not be installed within the 100-yr floodplain or Sandia Wetland. As practicable, all other infrastructure (e.g., wells, well pads, piping, roads) will not be installed within the 100-yr floodplain or Sandia Wetland. Where infrastructure is installed in the 100-yr floodplain and/or Sandia Wetland, the nature and extent of the floodplain hazard are not expected to change.

3.0 FLOODPLAIN AND WETLAND IMPACTS

3.1 Short-Term Impacts

Ground disturbance from the proposed action may result in short-term negative direct and indirect effects to the floodplains and wetland within the project area. The following best management practices will be used to mitigate these impacts:

- Disturbed areas will be revegetated using an appropriate native seed mix.
- Erosion and sediment control measures will be installed during construction.
- Heavy equipment will not be used within the wetland.

Additionally, controls will be put in place to ensure hazardous materials, chemicals, fuels, and/or oils do not directly or indirectly negatively impact the floodplains and wetland within the project area. These controls include the following:

- Permanent equipment staging areas will not be located within the floodplains or wetland.
- All equipment will be refueled at least 100 ft from the floodplains and wetland.
- Hazardous materials, chemicals, fuels, and oils will not be stored within the floodplains or wetland.
- If any spillage occurs, all contaminated soil will immediately be containerized and relocated.
- Portable generators, compressors, and other fuel-driven equipment will be staged on bermed plastic sheeting as a form of secondary containment. Construction equipment (e.g., graders, dozers, excavators, etc.) and light vehicles will not be subject to this restriction.

3.2 Long-Term Impacts

Although infrastructure will not be installed within the floodplains and/or wetland where a practicable alternative exists, some infrastructure may be permanently installed within the floodplains and/or wetland (e.g., well pad, road, piping, piezometers, etc.). These developments have the potential to have a long-term adverse impact on floodplains and the wetland within the project area. To mitigate these direct and/or indirect effects, the following best management practices will be used:

- Support structures, such as the treatment facility, personnel trailers, storage tanks, or permanent laydown yards will not be installed within the floodplains or wetland.
- Project staff will remove all trash and debris (e.g., construction material) from the floodplains and wetland after project completion.
- Well pads and roads will be reinforced to minimize erosion and/or flooding following project completion.
- Any proposed excavation within the Sandia Wetland will require an additional wetland assessment to determine the potential impacts of that proposed action on the Sandia Wetland.

The land application of treated water within portions of the 100-yr floodplain within Mortandad Canyon is anticipated to have a long-term positive impact by enhancing native plant growth and stabilizing soils.

No effects to life and property associated with floodplain disturbance are anticipated. No effects to the survival, quality, and function of the Sandia Wetland are anticipated.

3.3 Regulatory Compliance

EM-LA requires all project work to be reviewed by subject matter experts (SMEs) via their Project Planning and Regulatory Review system. This system allows for the early identification of all institutional, state, and/or federal requirements relevant to the project. In coordination with SMEs, the project management team ensures compliance with all applicable regulations. Identified regulatory requirements include the following:

- The project area includes habitat for federally listed threatened and endangered species. The proposed action will comply with the Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory (LANL 2022), or EM-LA will further consult with the U.S. Fish and Wildlife Service to ensure compliance with the Endangered Species Act.
- To comply with the Migratory Bird Treaty Act, vegetation will not be removed during the peak bird-nesting season (May 15 through July 15) unless a biological resources SME conducts a nest

check to ensure no active nests will be disturbed. Bollards and empty pipes will be capped, so birds are not caught inside.

- Work that may result in any discharge into Waters of the United States will require a permit under Sections 401 and/or 404 of the Clean Water Act.
- The land application of extracted groundwater will comply with the associated NPDES permit.
- As required, stormwater pollution prevention plans will be developed to ensure coverage under the U.S. Environmental Protection Agency's Construction General Permit for stormwater discharges.

4.0 ALTERNATIVES

Alternatives to the proposed action that were considered but not evaluated included (1) alternative project locations and (2) alternative actions.

Because chromium contamination is located within Sandia Wetland and underlies Sandia and Mortandad Canyon floodplains, remediation of the contamination will necessarily require project activities to be centered on these areas. Where practicable, disturbance to the floodplains and/or wetland in the project area will be avoided under the proposed action.

EM-LA solicited public feedback on alternative actions during the National Environmental Policy Act scoping period that occurred during the summer of 2023. Alternative actions that meet the project objectives and do not impact the floodplains and wetland in the project area were not identified.

A no-action alternative was previously evaluated during the planning of the chromium plume control interim measure (LANL 2015). "No action" does not necessarily mean doing nothing but involves maintaining or continuing the existing status or condition. Under the no-action alternative, EM-LA would control plume migration and maintain chromium contamination concentrations within the LANL boundary while continuing to evaluate long-term corrective action remedies, including options for chromium mass removal. The no-action alternative was not selected because it would not meet the objective of both chromium mass removal and contaminant source control.

5.0 CONCLUSIONS

Implementation of the proposed action will provide the flexibility required to actively manage Cr(VI) contamination in the source area and regional aquifer and will respond to evolving conditions. The proposed action will allow EM-LA to impede plume migration off of LANL property, while remediating Cr(VI) contamination within Sandia and Mortandad Canyons. The project will minimize long-term, adverse impacts to the floodplains and wetland in the project area through the implementation of best management practices, including erosion and sediment controls. Most impacts will conclude upon completion of construction activities. The proposed project will not significantly modify the existing structure and function of floodplains and wetland within the project area. EM-LA anticipates the project will not adversely impact natural and beneficial floodplain and wetland values.

6.0 REFERENCES

FEMA (Federal Emergency Management Agency), October 2015. “Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input.” (FEMA 2015)

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LANL (Los Alamos National Laboratory), January 2022. “Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory,” Los Alamos National Laboratory document LA-UR-22-20556, Los Alamos, New Mexico. (LANL 2022)

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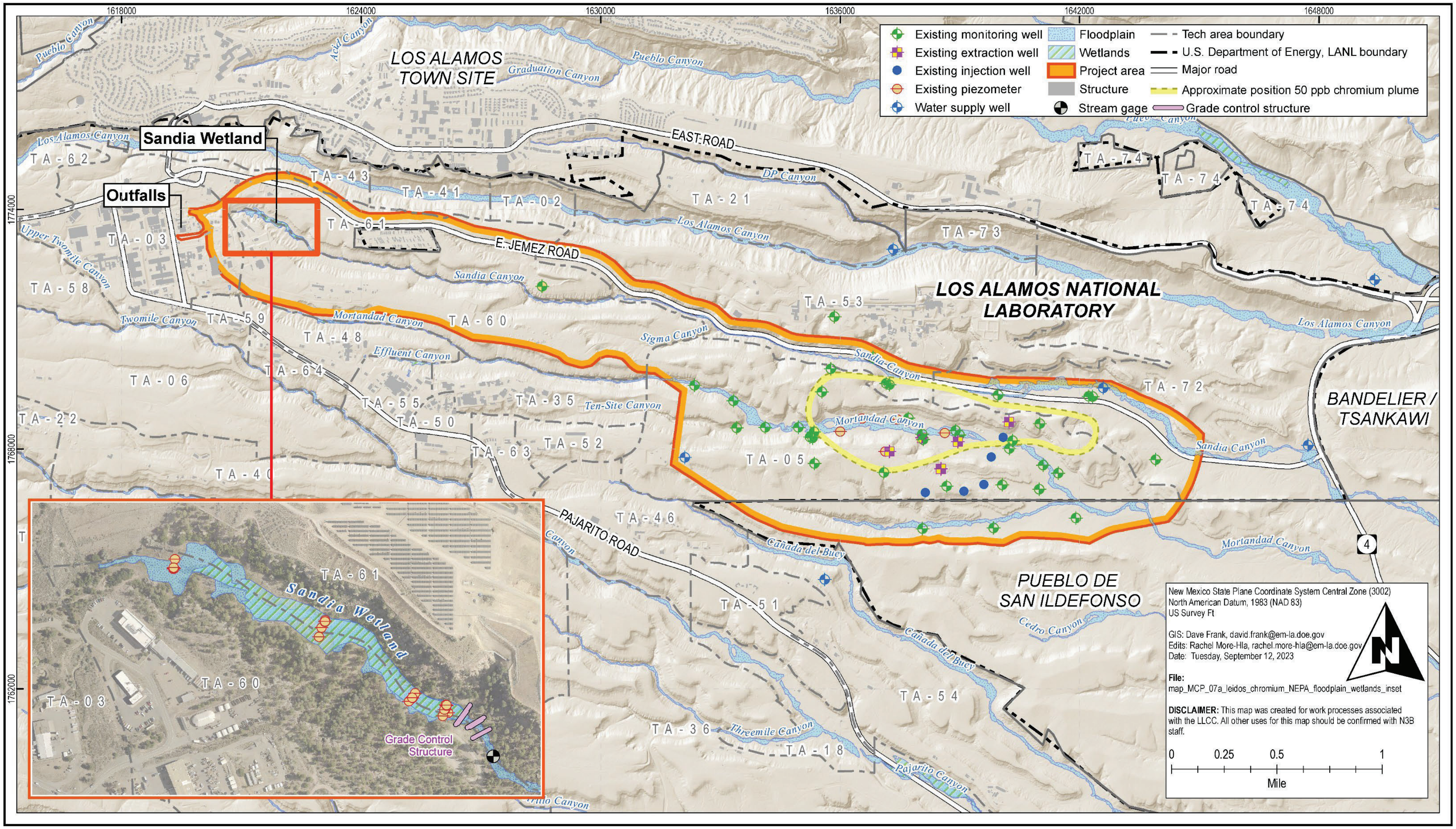

Figure 1 Proposed project area, including Sandia Wetland (inset), Sandia Canyon, and Mortandad Canyon

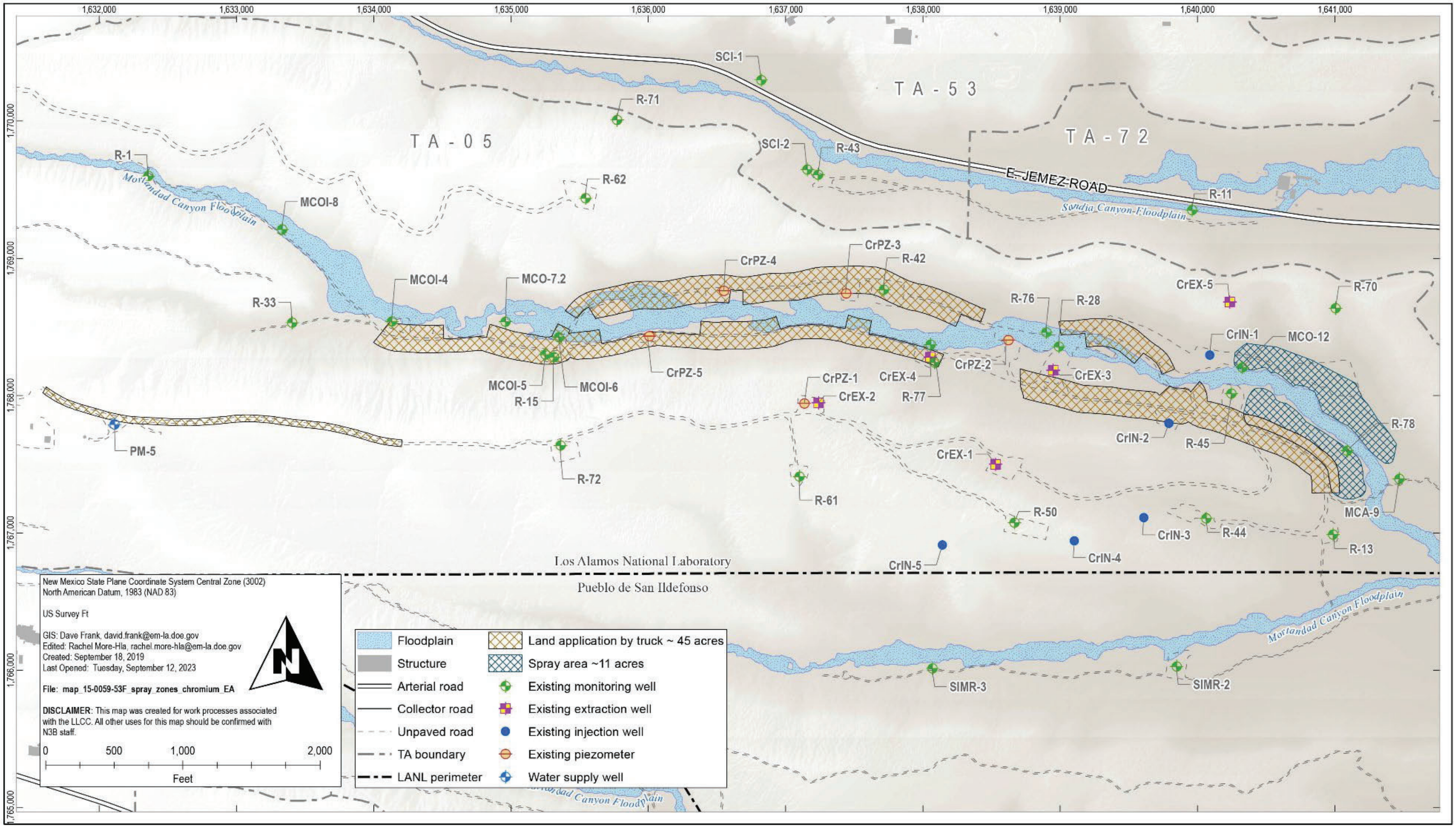

Figure 2 Permitted land-application zones for treated groundwater