U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

ENVIRONMENTAL MANAGEMENT CLEANUP FORUM

Protecting Water Quality: Hexavalent Chromium Plume

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February 9, 2023

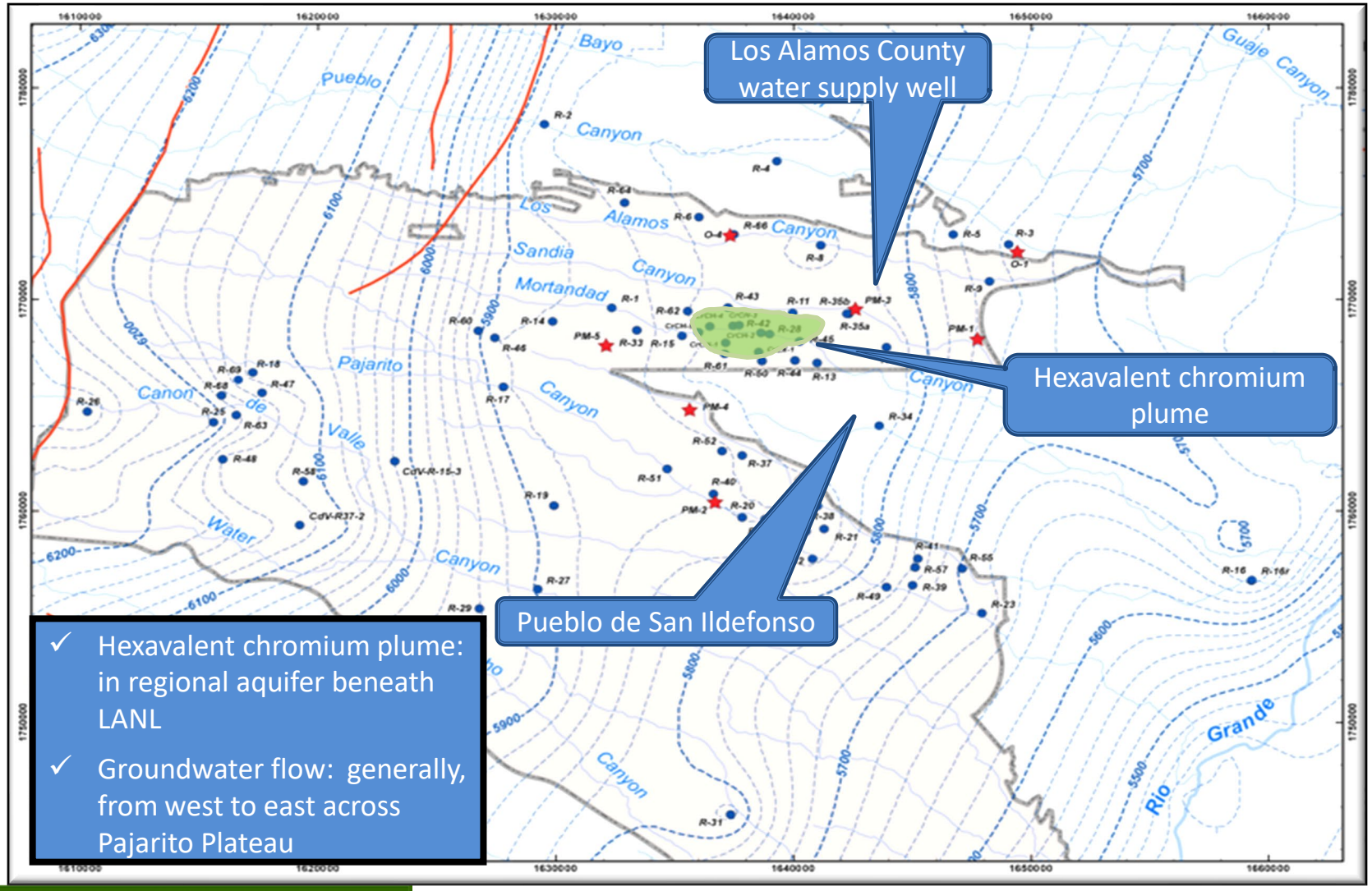
ENVIRONMENTAL MANAGEMENT
SAFETY ❖ PERFORMANCE ❖ CLEANUP ❖ CLOSURE

N3B Los Alamos

Los Alamos Legacy Cleanup

Drill Rig for Chromium Monitoring Well
Location: Mortandad Canyon

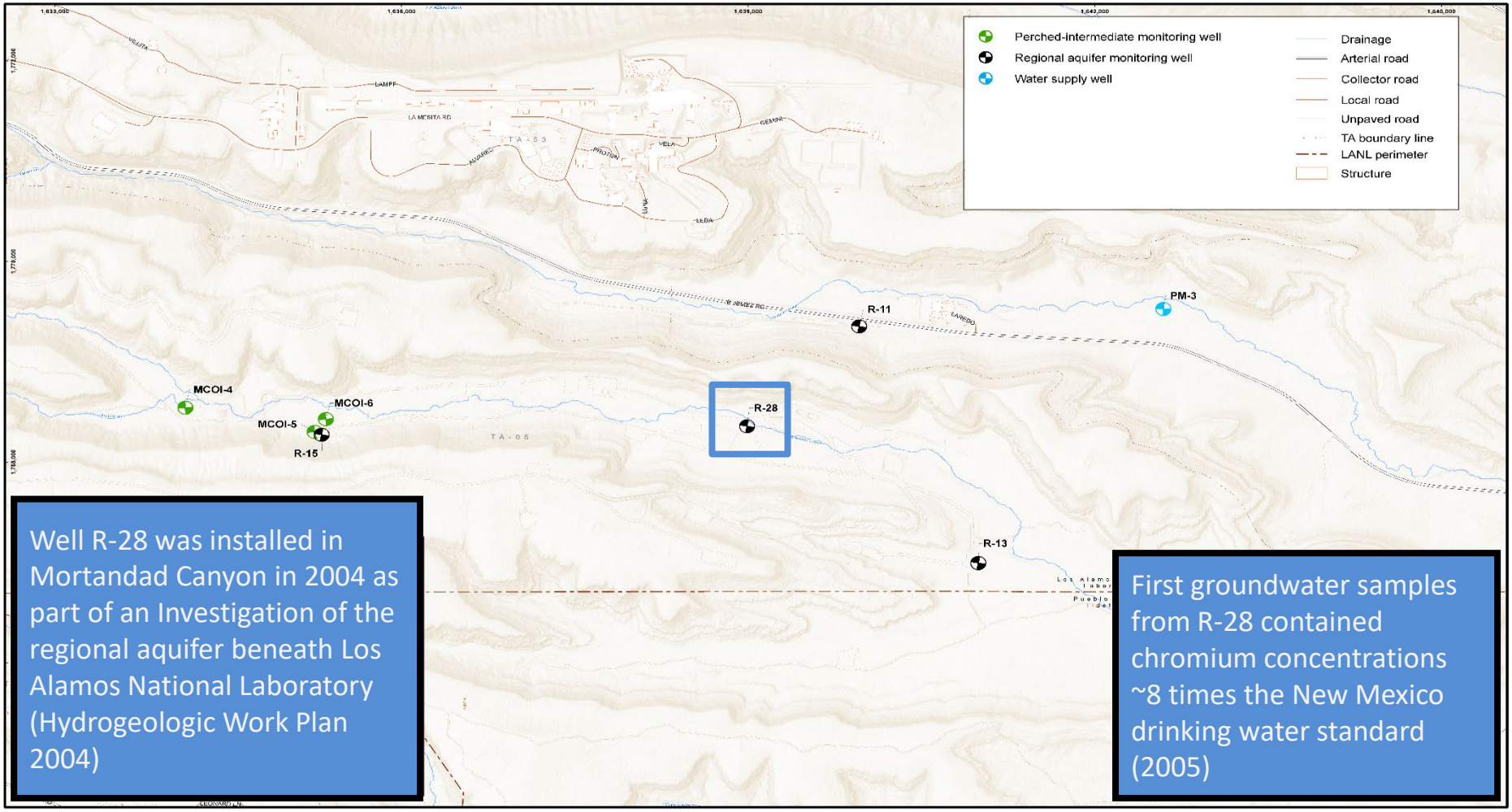
Protecting Los Alamos County & Pueblo de San Ildefonso



- ✓ Hexavalent chromium plume: in regional aquifer beneath LANL
- ✓ Groundwater flow: generally, from west to east across Pajarito Plateau

NOTE: Hexavalent Chromium plume not to scale.

First Samples at R-28



Well R-28 was installed in Mortandad Canyon in 2004 as part of an Investigation of the regional aquifer beneath Los Alamos National Laboratory (Hydrogeologic Work Plan 2004)

First groundwater samples from R-28 contained chromium concentrations ~8 times the New Mexico drinking water standard (2005)

DOE & NMED Response

Key Questions

1. Where did the hexavalent chromium come from?
2. How was the hexavalent chromium transported to the regional aquifer?
3. How extensive is it?
4. Is it impacting water supply wells or migrating off-site?
5. What actions need to be taken?

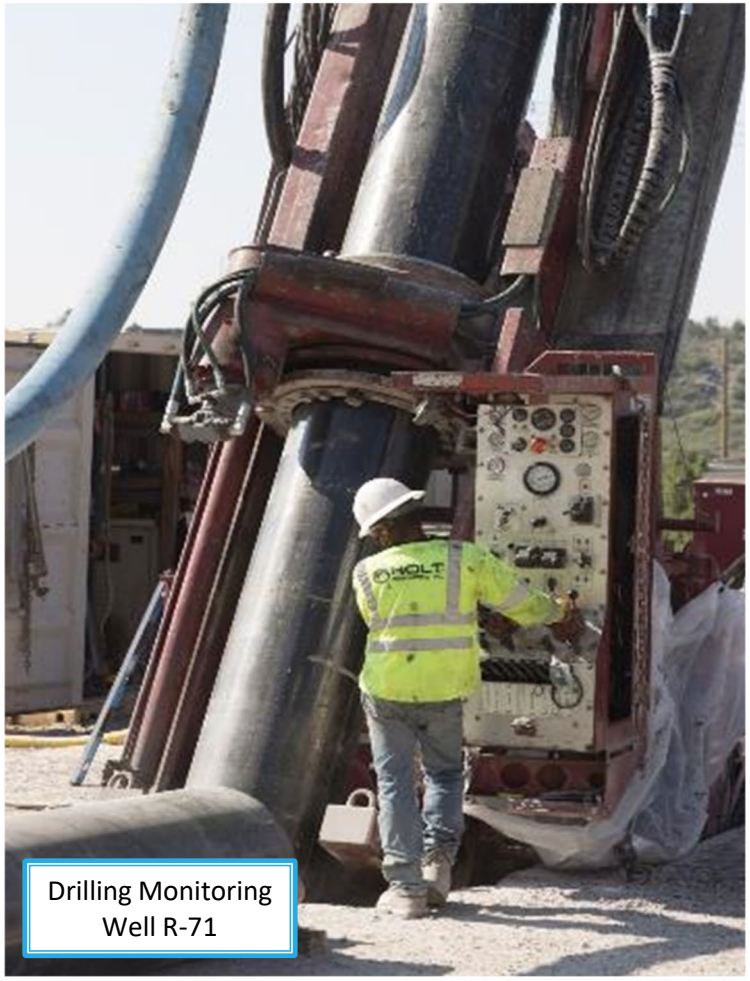
Consent Order Campaign

Campaign Name: Chromium Interim Measures and Characterization Campaign

Campaign Primary Objectives:

1. Prevent migration of hexavalent chromium plume beyond LANL boundary
2. Perform studies and testing to obtain data to determine final remedy
3. Recommend final remedy to NMED (called “Corrective Measures Evaluation” in Consent Order)

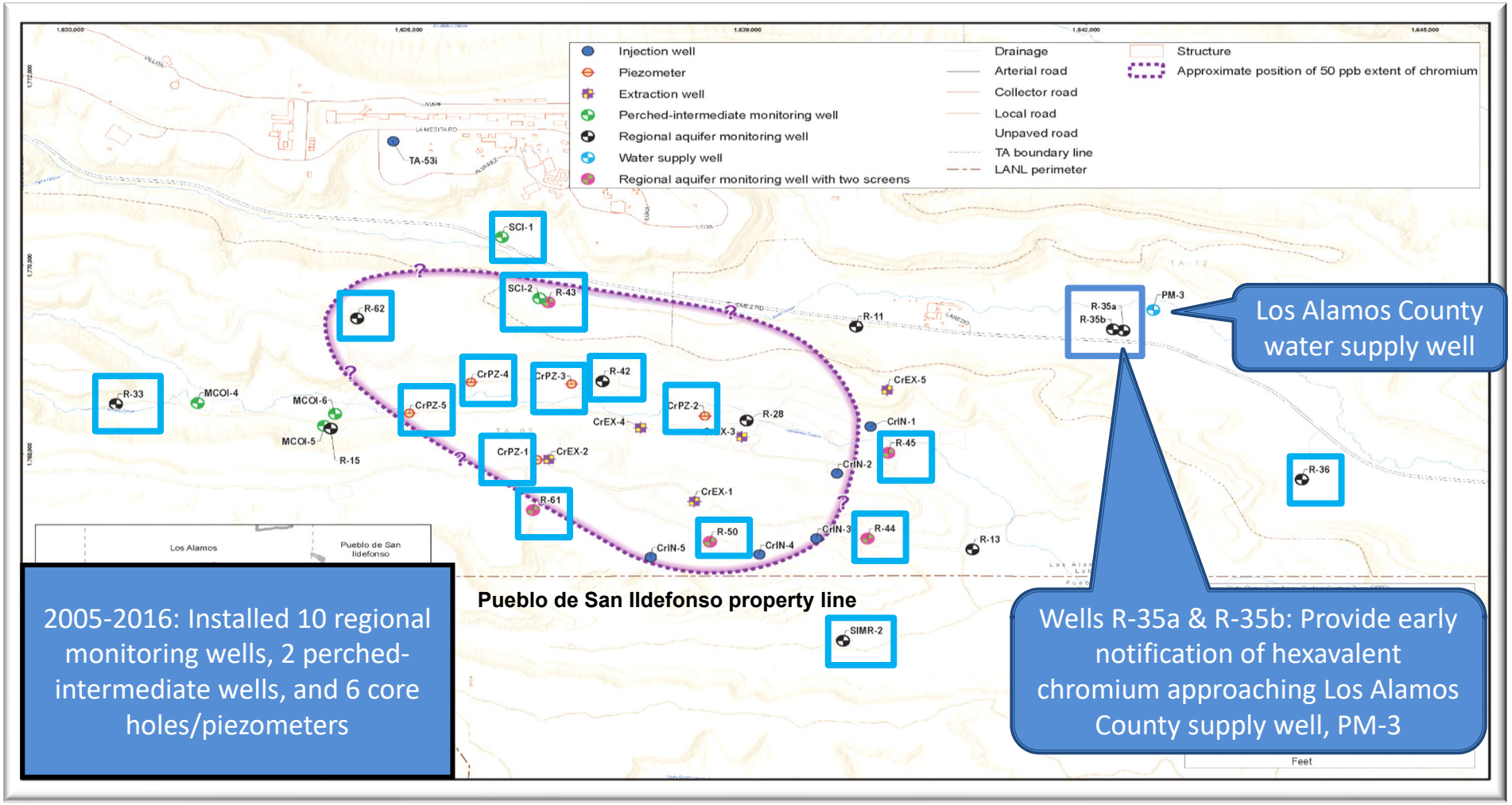
Drill Rig



Drilling Monitoring Well R-71

Drilling Monitoring Well R-62

Data Generation: Wells to Understand Nature & Extent



Interim Measures for Hexavalent Chromium Plume Control

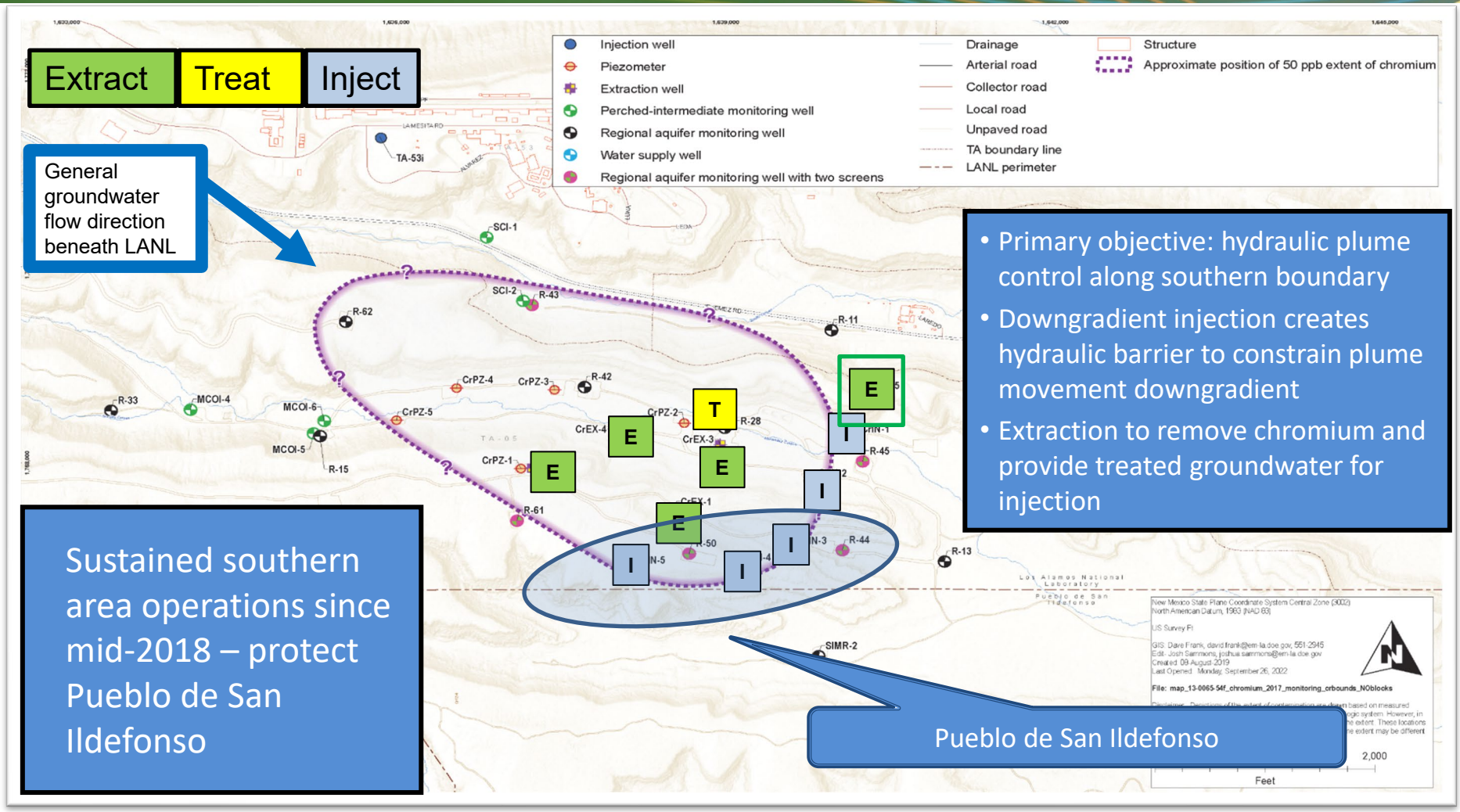
Process:

1. Extract contaminated groundwater
2. Treat contaminated groundwater near point of extraction
3. Inject treated (clean) groundwater along downgradient side of plume

Purpose:

1. Create hydraulic barrier to prevent further migration of plume
2. Inject treated (clean) water to avoid unnecessary consumption of limited resource and adhere to New Mexico Office of the State Engineer (OSE) authorization

2018: Hydraulic Control Along Southern Boundary



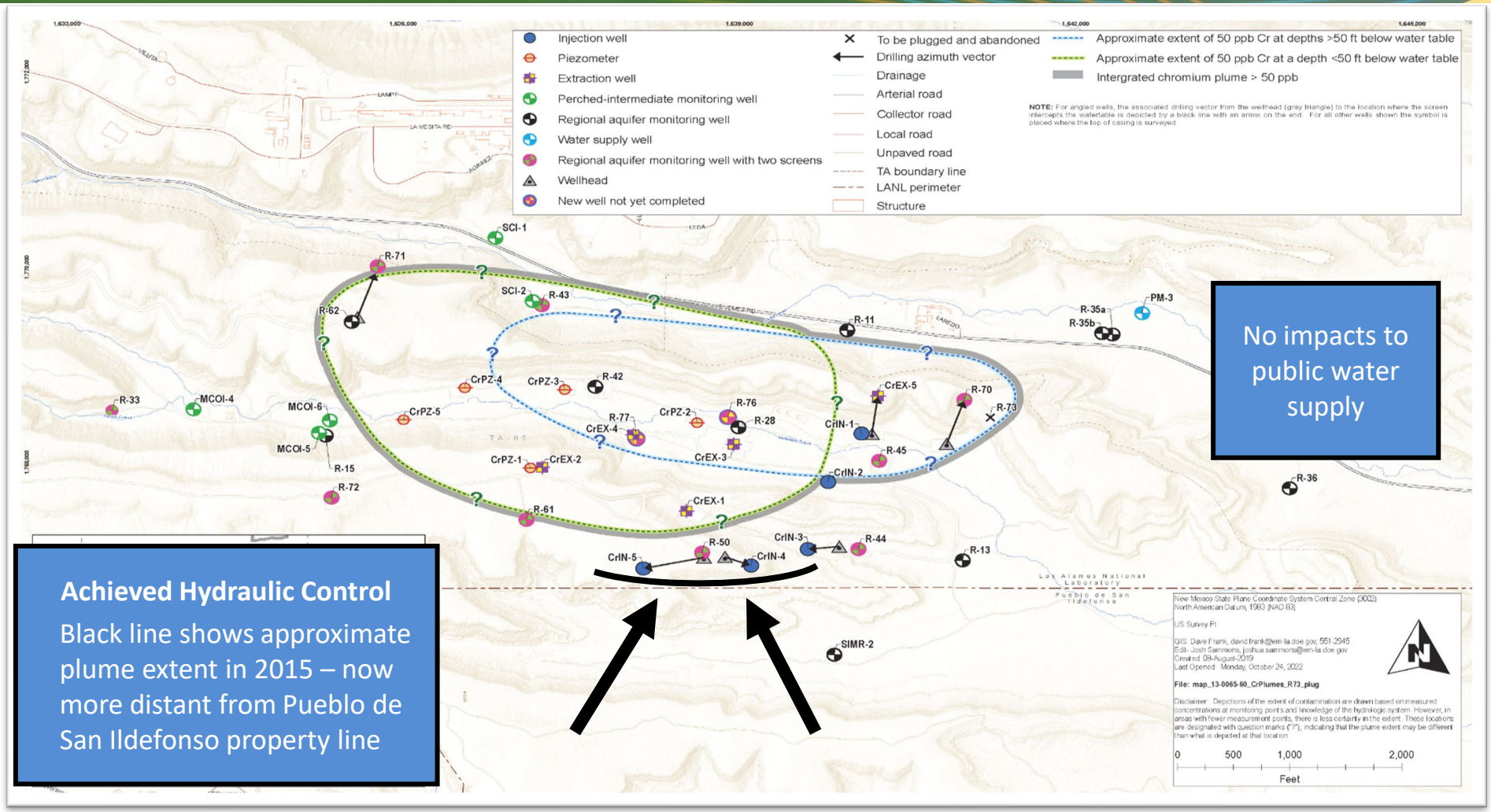
- Primary objective: hydraulic plume control along southern boundary
- Downgradient injection creates hydraulic barrier to constrain plume movement downgradient
- Extraction to remove chromium and provide treated groundwater for injection

Sustained southern area operations since mid-2018 – protect Pueblo de San Ildefonso

Interim Measures: Central Treatment Area

Treatment System

2022: Hydraulic Control Along Southern Boundary

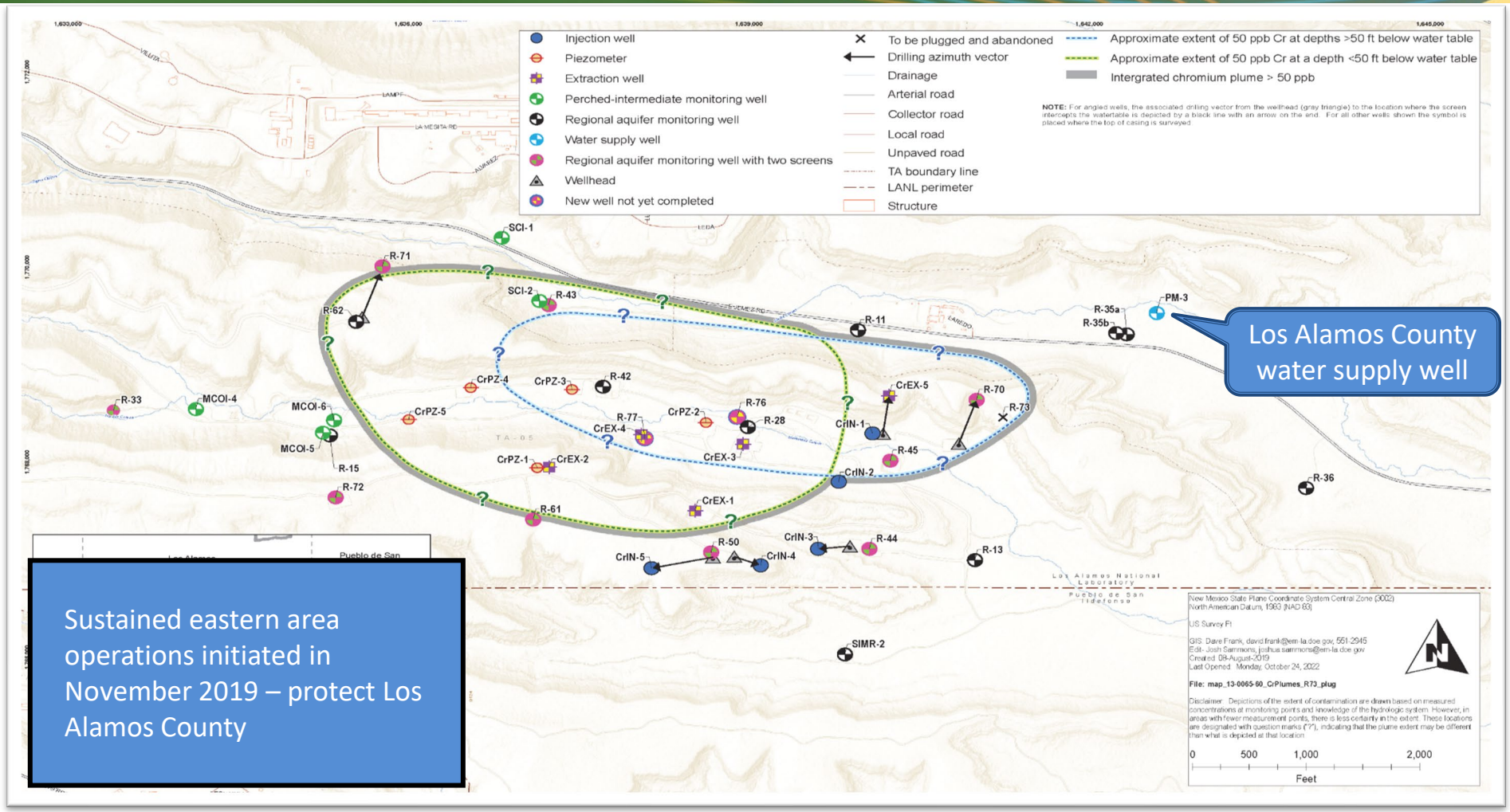


No impacts to public water supply

Achieved Hydraulic Control

Black line shows approximate plume extent in 2015 – now more distant from Pueblo de San Ildefonso property line

Interim Measures: Eastern Area



Steps: From Interim Measures to Final Remedy

Continue Hydraulic Control of Plume

- Prevent migration of plume beyond LANL boundary
- Obtain data necessary to conduct corrective measures evaluation
- Conduct a corrective measures evaluation

Interim Measures Operations

Status: In Process

Narrow Data Gaps

Identify hexavalent chromium plume extent and data needed for remedy design

Critical Data

Status: In Process

Final Remedy Process

Determine objectives, remedy performance metrics, and an adaptive approach that maintain protection, but recognize uncertainties and technical cleanup challenges

Transition to Remedy

Status: Under Development

Data Gap Resolution: Leading to Final Remedy

Narrow Data Gaps

Identify hexavalent chromium plume extent and data needed for remedy design

Critical Data

Current Focus

- ✓ Lateral and vertical extent of plume, including center depth
  - Identify volume of aquifer requiring treatment to transition to final remedy
- ✓ Plume-scale and local-scale conductivity and concentration profiles
  - Support mass flux evaluation to optimize final remedy (i.e., place wells in zones of high concentrations and flow velocities)
- ✓ Hexavalent chromium mass distribution evaluation
  - Support final remedy design

Recent Direction from Regulator

NMED Hazardous Waste Bureau (HWB)

- September 30, 2022: EM-LA/N3B submitted Chromium Interim Measures and Characterization Work Plan to NMED HWB—an FY22 Appendix B Milestone
- EM-LA awaiting NMED response on Work Plan
- November 21, 2022: NMED HWB directed EM-LA to leave certain injection and extraction wells associated with the Interim Measures, "off-line until further notice"

NMED Ground Water Quality Bureau (GWQB)

- June 6, 2022: EM-LA received Notice of Violation, Los Alamos National Laboratory Underground Injection Control Wells, DP-1835
- September 30, 2022: EM-LA/N3B submitted Regional Aquifer Monitoring Well Action Plan to NMED GWQB
- December 12, 2022: NMED GWQB directed EM-LA to cease injection operations for the Interim Measures

NMED Directive: Cease Injection

NMED letter to EM-LA, dated December 12, 2022

"**By April 1, 2023, the Permittees shall cease all injections authorized under DP-1835 to prevent any potential further migration of chromium contamination**. Cessation shall include all injection activities until the Permittees complete the proposed corrective actions and can definitively prove through qualitative and quantitative analyses, simulations, monitoring well installation, and continued monitoring that further migration is not occurring. Cessation of all injection activities does not inhibit the Permittee from the continued operation of the ion exchange treatment system by utilizing a different treated groundwater disposal option. **The Permittee shall not resume injections until NMED agrees that the Permittee has proven that further migration of the contamination plume will not occur. When the Permittee has provided sufficient evidence NMED will provide written agreement and approval to the Permittees to resume injections**."

NMED Concern: Believes injection is forcing contamination deeper into regional aquifer and resulting in plume migration

Impact of NMED Directive

Alternative to injection is land application -- Presents numerous challenges

1. Loss of hydraulic control
2. EM-LA would need to store water above ground because land application of treated groundwater during freezing temperatures is not authorized under Discharge Permit
3. If land application is pursued, most water does not return to regional aquifer due to evapotranspiration. This approach would also require action with NMED, OSE, Los Alamos County, and the National Nuclear Security Administration Los Alamos Field Office to revisit water rights/how EM-LA is using the water.

Result: Interim Measures extraction and treatment would be reduced to approximately 10% of current capacity, allowing the plume to advance downgradient

EM-LA Approach

1. Perform additional qualitative and quantitative analyses
2. Evaluate different extraction and injection operational scenarios
3. Install additional wells
4. Continue monitoring to evaluate plume movement
5. Move toward proposing a final remedy