



# New Mexico Environment Department

## Chromium Plume Update

Radioactive & Hazardous Materials Committee

Aug. 23, 2019



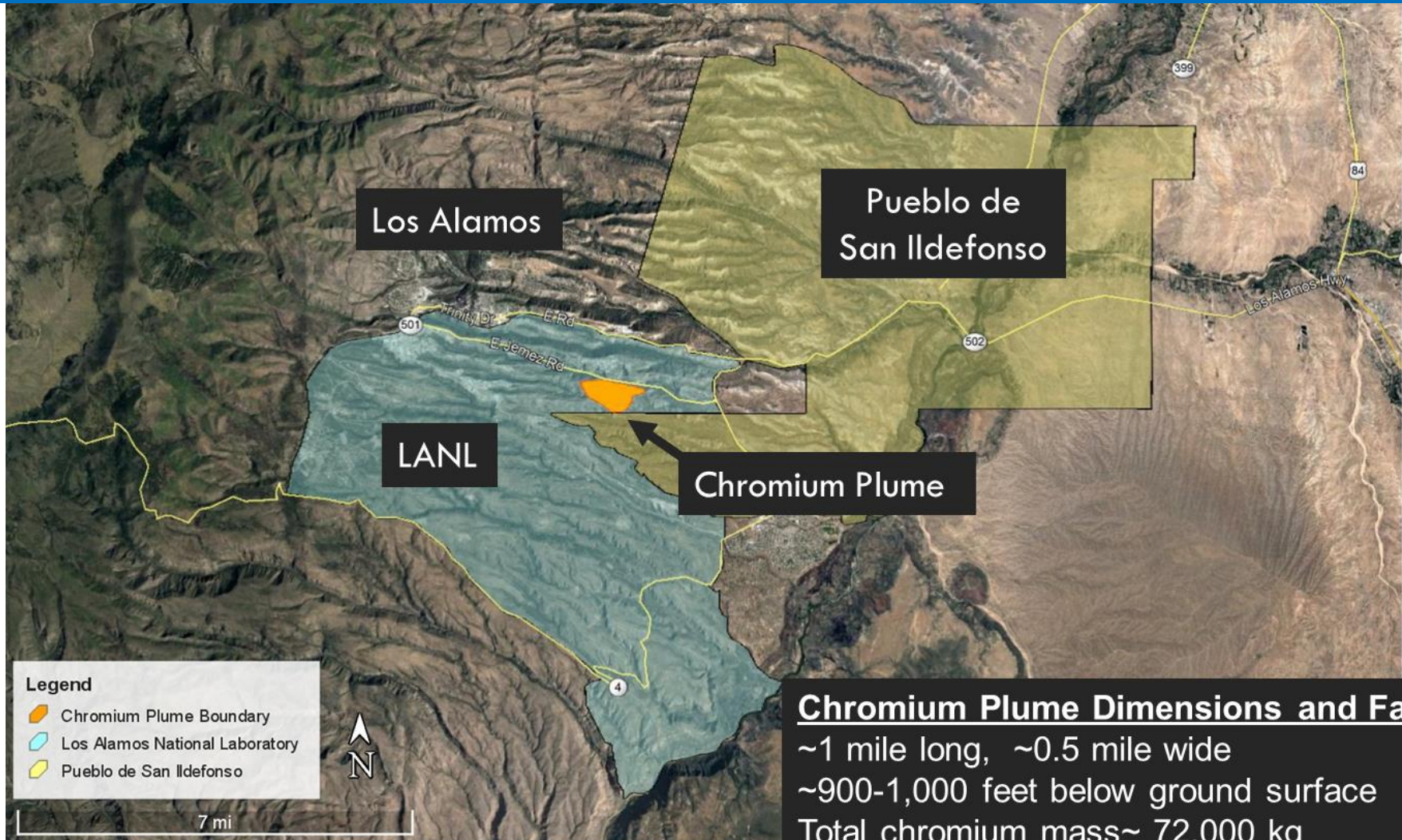


# Topics for Discussion

- ❑ Overview
- ❑ Regulatory framework
- ❑ Summary of the work performed to date
- ❑ Overview of the Interim Measure (IM) to control chromium plume migration
- ❑ Overview of pilot-scale amendments testing as potential remedial solutions for chromium
- ❑ Uncertainties to be addressed prior to the Corrective Measures Evaluation (CME)



# Site Location and History



**Chromium Plume Dimensions and Facts**  
~1 mile long, ~0.5 mile wide  
~900-1,000 feet below ground surface  
Total chromium mass~ 72,000 kg  
Chromium is in hexavalent Cr(VI) form



# Site History / Background

- ❑ Estimated 72,000 kg of hexavalent chromium were present in cooling tower water discharged from TA-3 during 1956-1972
- ❑ Chromium contamination in groundwater was first discovered in December 2005
- ❑ The chromium plume in the regional aquifer is:
  - ❑ Approximately 1 mile long and 0.5 mile wide
  - ❑ Present at approximately 900-1000 ft below ground surface
  - ❑ Present within the first 100 feet of the water table



# Regulatory Framework

- ❑ The Corrective Action for the chromium plume is conducted under the 2016 Compliance Order on Consent (Consent Order).
- ❑ The chromium plume is identified as a priority campaign under Appendix B of the Consent Order.
- ❑ Federal Fiscal Year (FFY) 2018: 5 of the 13 milestones were associated with the Chromium IM and Characterization Campaign
  - ❑ Four were completed and one was granted an extension
- ❑ FFY 2019: 6 of the 20 milestones are associated with Chromium IM and the Characterization Campaign
  - ❑ Four were complete, one was granted an extension, and one is due in September 2019
- ❑ Chromium Corrective Measures Evaluation (CME) Report submission: Estimated 2021, pending monitoring well results



# Chromium Plume Control Interim Measure

- IM – controlling migration of chromium plume boundary
  
- IM wells installed
  - 5 chromium extraction wells
  
  - 5 injection wells (treated water)
  
- R-70 – additional characterization and performance monitoring well completed in May 2019

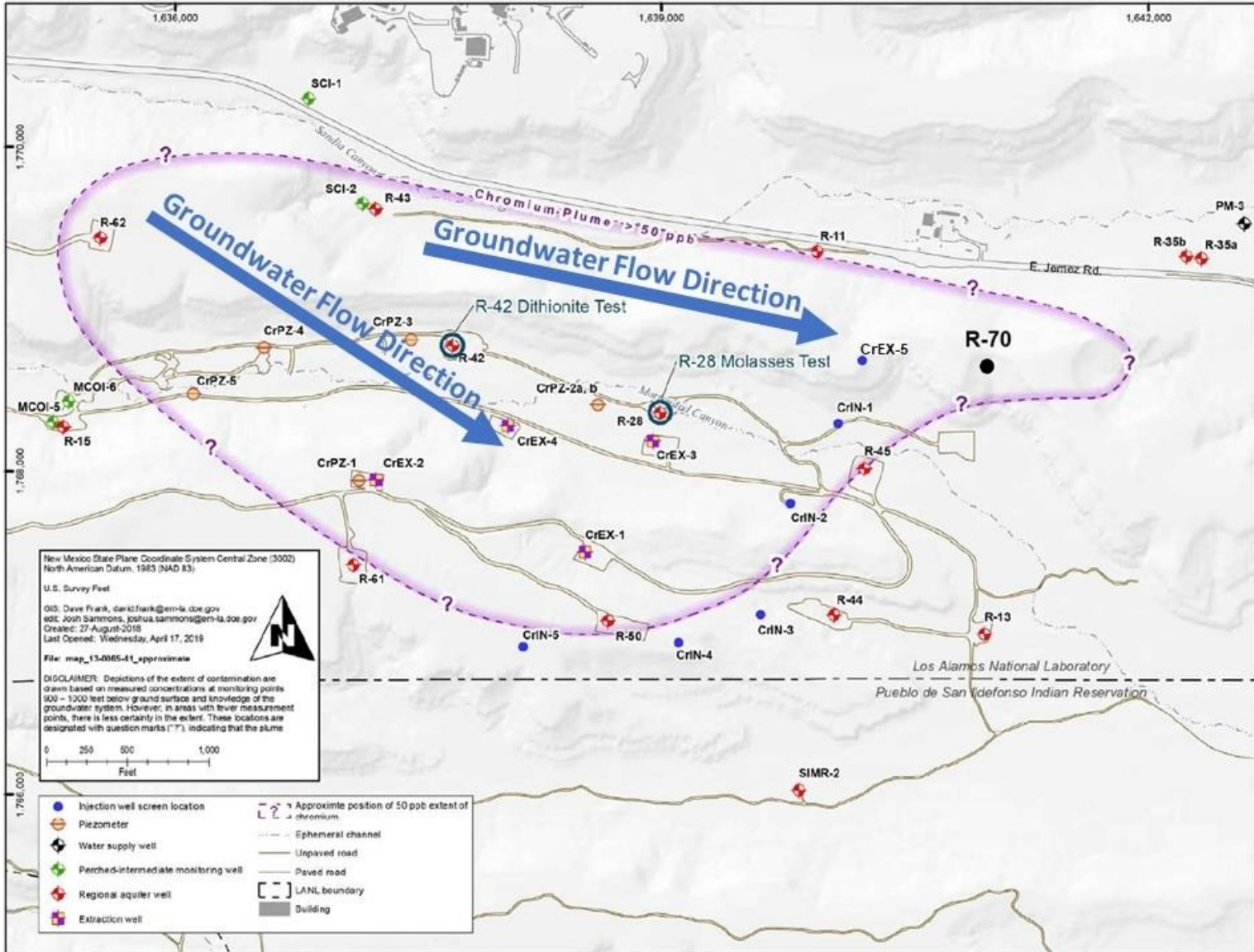


# Chromium Plume Subsurface Investigations

- ❑ Wells and piezometers installed
  - ❑ 19 regional monitoring wells/screens
  - ❑ 4 perched-intermediate monitoring wells
  - ❑ 6 piezometers
  - ❑ 5 extraction wells
    - ❑ CrEX-1, CrEX-2, CrEX-3, CrEX-4, CrEX-5
  - ❑ 5 injection wells
    - ❑ CrIN-1, CrIN-2, CrIN-3, CrIN-4, CrIN-5



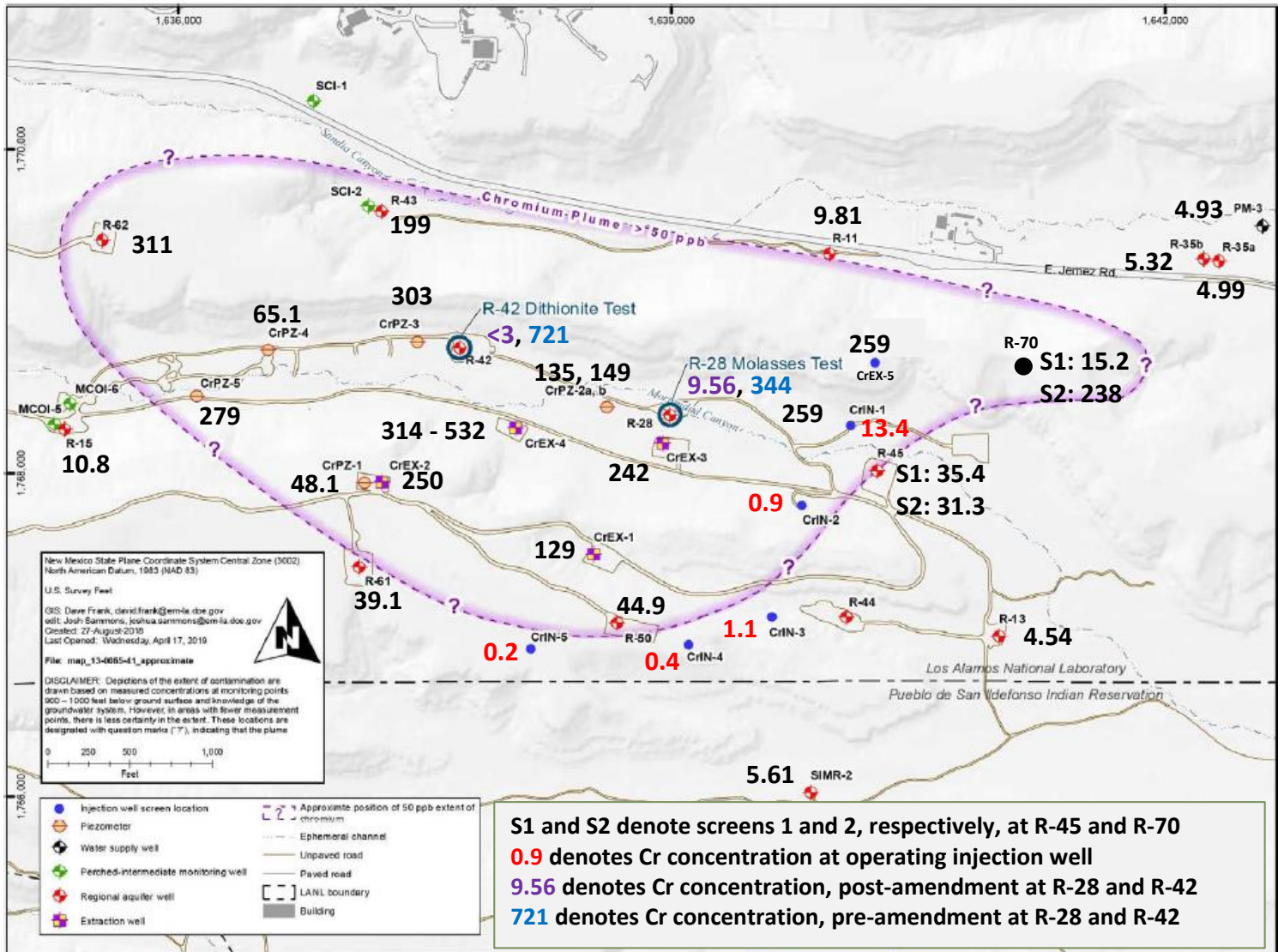
# Chromium Plume: Groundwater Monitoring Network







# Chromium Plume: Concentrations in Groundwater



S1 and S2 denote screens 1 and 2, respectively, at R-45 and R-70  
 0.9 denotes Cr concentration at operating injection well  
 9.56 denotes Cr concentration, post-amendment at R-28 and R-42  
 721 denotes Cr concentration, pre-amendment at R-28 and R-42

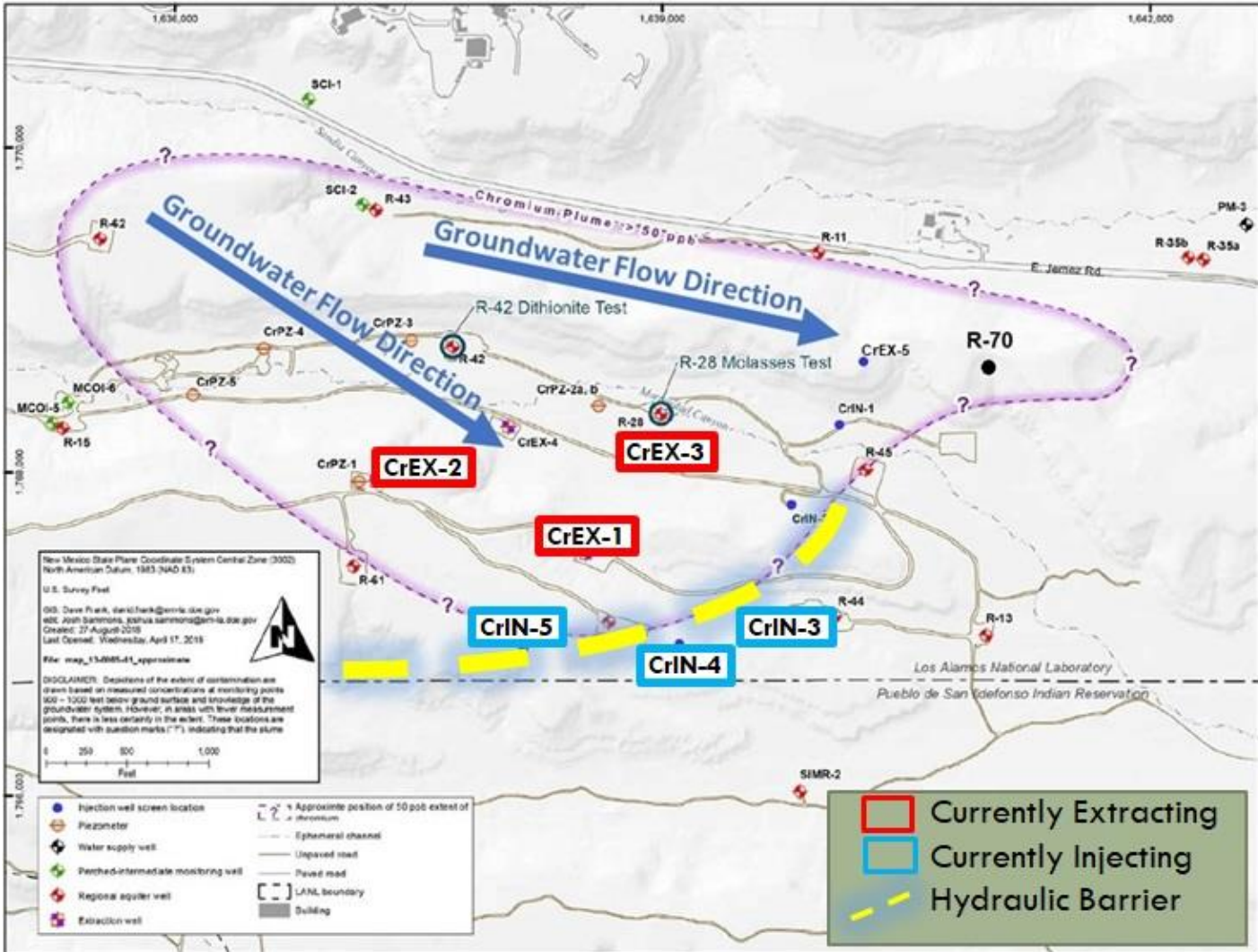


# IM Work Plan Implementation

- ❑ IM has been continuously operating at the southern boundary of the plume for approximately one year.
- ❑ Monitoring results indicate that IM is meeting the objective in the southern portion of the chromium plume.
- ❑ IM at the eastern boundary is ready for operations, but waiting on emergency authorization from the Office of the State Engineer.

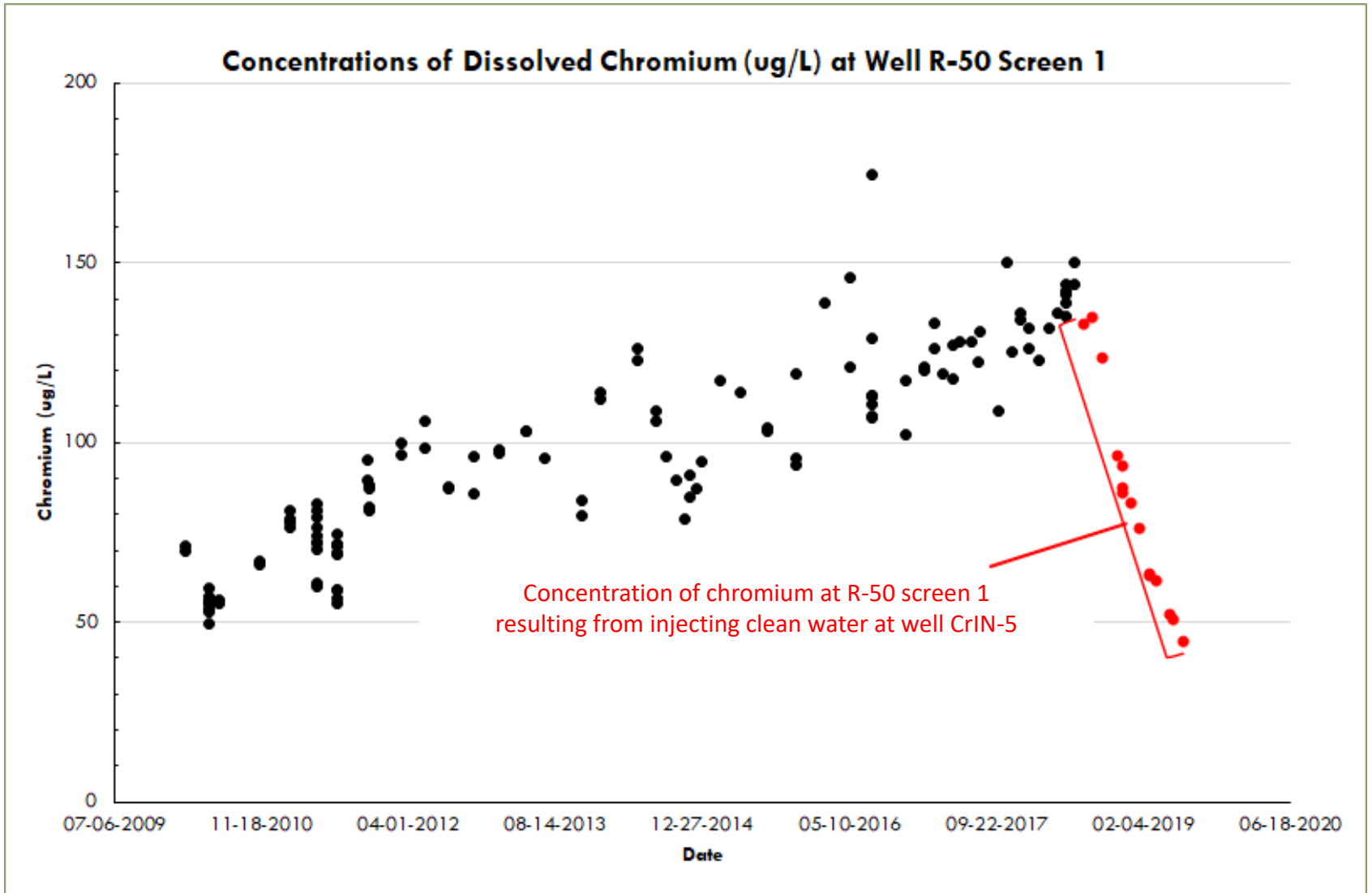


# Interim Measure Wells – Current Status





# Interim Measure Success at Southern Boundary





# Ongoing Chromium Plume Corrective Measures Evaluation (CME) Related Work

- ❑ Refining groundwater numerical model through ongoing data collection
  
- ❑ Amendments resting for in-situ chromium remediation
  - ❑ Conducted at wells R-28 and R-42 – molasses and sodium dithionite deployments (respectively)
  - ❑ Amendments reduce or transform chromium(VI) into chromium(III)
  - ❑ Phase I Progress Report submitted to NMED on July 31, 2018
  - ❑ Phase II Work Plan extension granted in June 2019 and is contingent upon results of Phase I study



# Pilot-Scale Amendments Study for Chromium

- ❑ Results reported by U.S. Department of Energy (DOE) demonstrate both dithionite and molasses can support Cr (VI) reduction in groundwater for at least 2 years.
- ❑ Estimated Cr(VI) immobilized by reduction to Cr(III) after two years: R-42 = 350 grams; R-28 = 150 grams
- ❑ Chromium removed permanently through pump and treat = 58 kilograms
- ❑ Problems with amendments pilot study:
  - ❑ Potential damage to aquifer permeability
  - ❑ Uncertainty regarding the amount of aquifer treated and ability to deliver amendments on a wider scale
  - ❑ Amendments deployment resulted in elevated concentrations of certain constituents (Fe, As, Mn) above NMED tap water screening levels

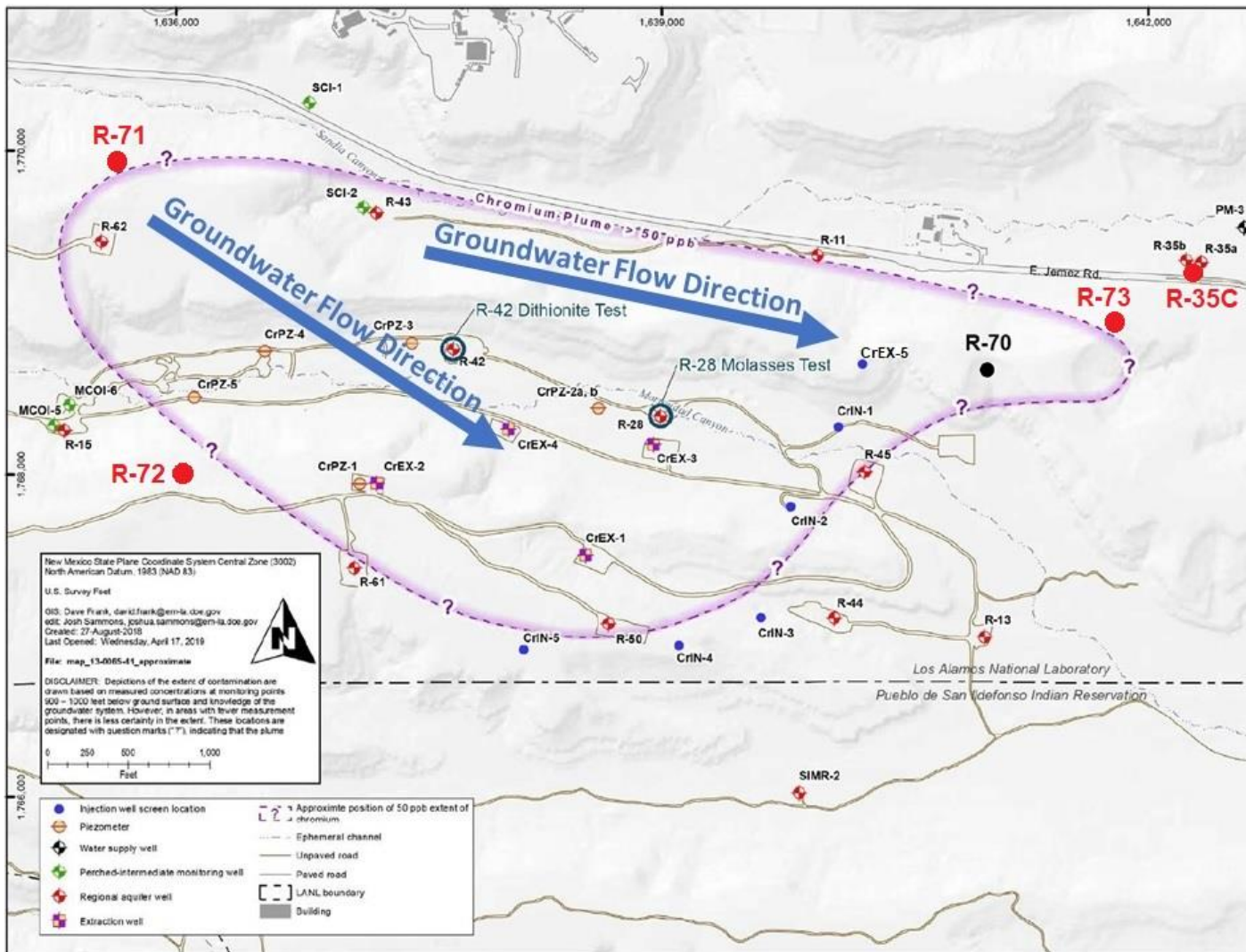


# Chromium Project Team

- ❑ NMED and DOE formed a core team for the chromium project in December 2018.
- ❑ Core team and technical team members include managers and technical staff from NMED, DOE, and DOE contractors.
- ❑ Technical team meets frequently to collaboratively discuss the project status and progress.
- ❑ Technical team recently agreed that three additional regional wells should be installed to further define the extent of plume.
- ❑ NMED sent a letter July 2019 requiring DOE to install two additional wells to define the vertical and lateral in the northeastern portion of the plume due to results from R-70 well.



# Additional Monitoring Wells







# Additional Work Needed for Chromium Plume CME

- ❑ Address remaining uncertainties and data gaps
  - ❑ Horizontal and vertical extent of chromium contamination
    - New monitoring wells
  - ❑ High-chromium flux zones in regional aquifer
    - High-Resolution Site Characterization work
  - ❑ Locations of chromium entry points into vadose zone
  - ❑ Distribution, pathways, and inventory of chromium in vadose zone
  
- ❑ Evaluate and assess best remedial options for chromium
  - ❑ Pump-and-treat
  - ❑ Chemical/biological amendments

# Questions?

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