Chromium Project Update

for

Northern New Mexico Citizens' Advisory Board Meeting

November 15, 2016

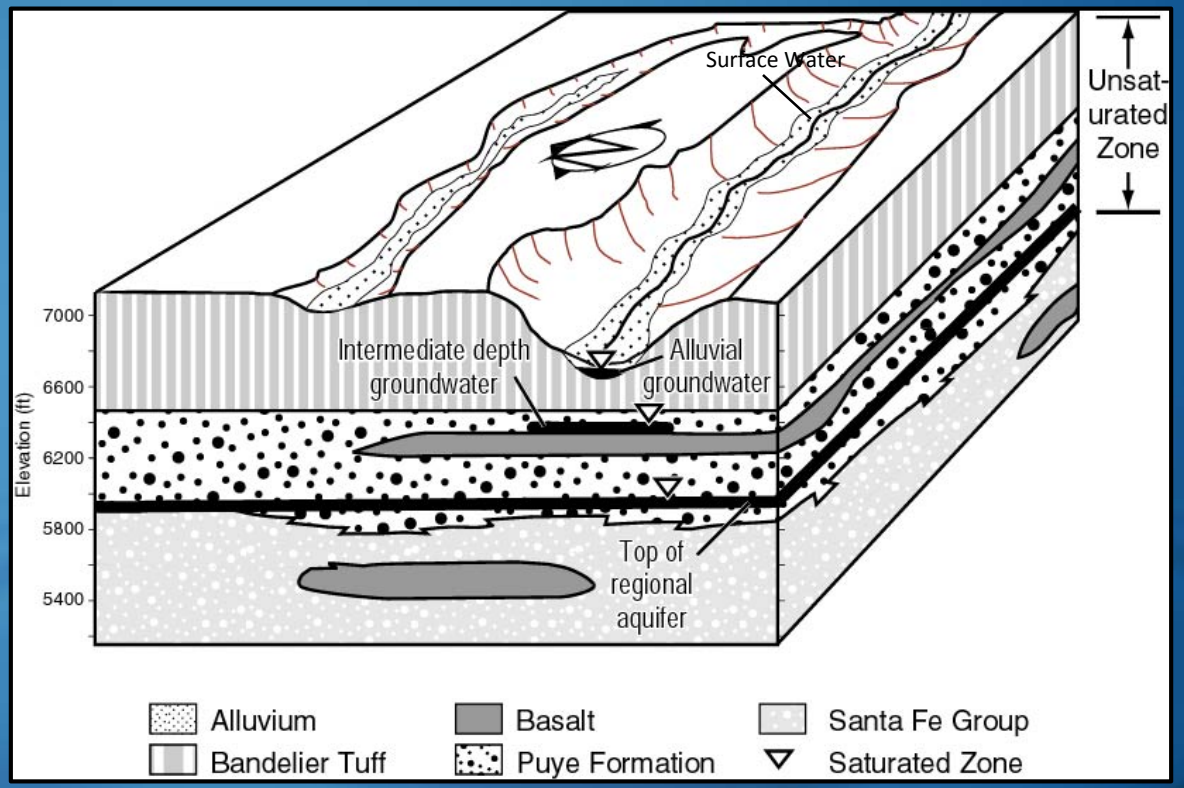
LA-UR-16-28737

Chromium Project Status

- Conceptual model refresher
- Installation of injection wells and piping
- Monitoring data from injection wells
  - Monitoring Update
- Status of Interim Measure
  - Permits
  - Infrastructure and Operations
  - Startup of extraction-injection loop near boundary
- Status of Plume-Center Characterization Activities

Groundwater Occurrences

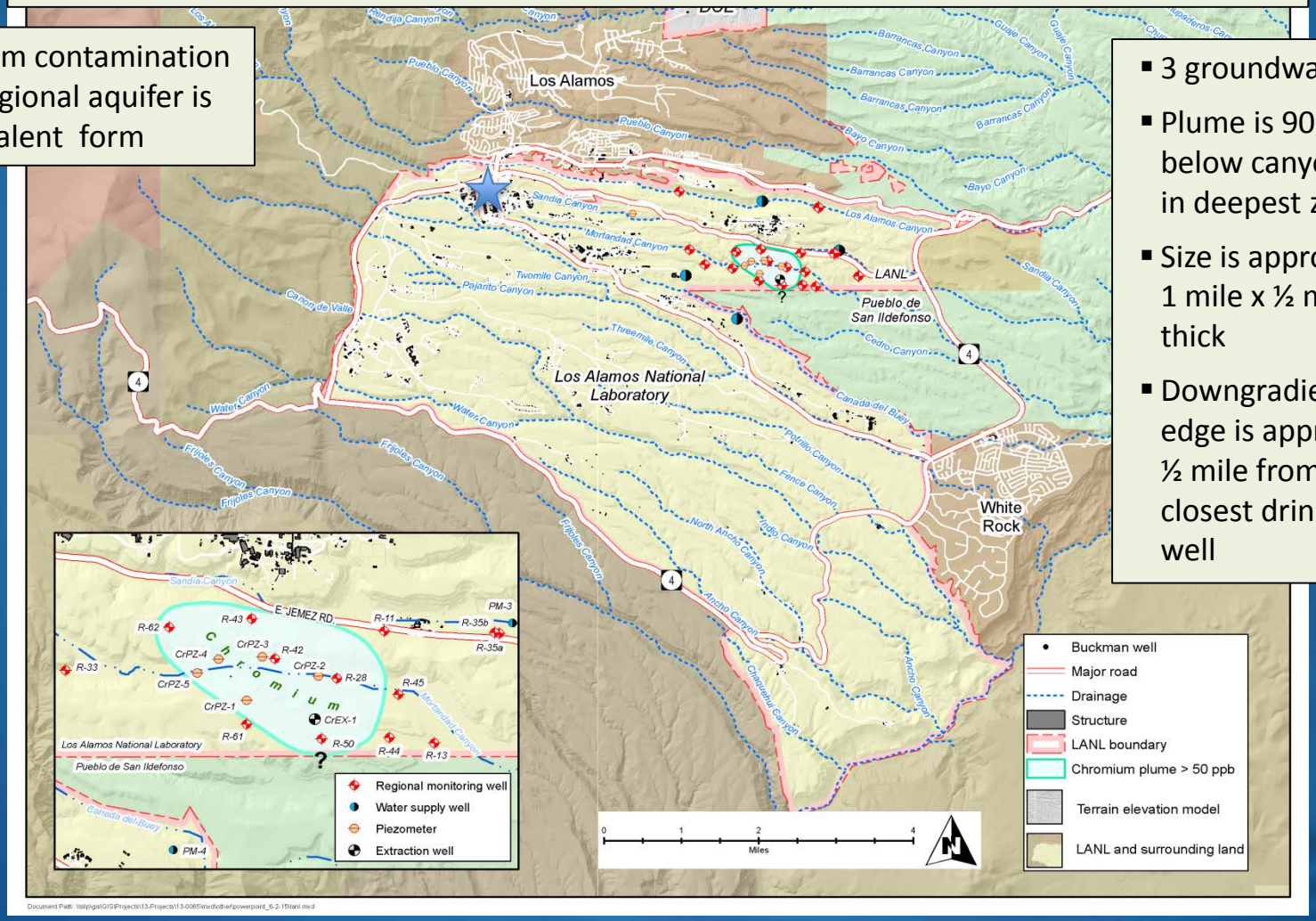
- Alluvial groundwater occurs generally 20-40 ft below ground surface (bgs). Recharged by snowmelt, stormwater, and effluent
- Perched-intermediate groundwater known to occur predominantly beneath wet canyons generally 150-800 ft bgs
- Deep or regional groundwater generally occurs from 800-1200 ft bgs
- Hydrologic connection known to exist between the three zones



Chromium Plume Location

- Potassium dichromate used in cooling towers at a Laboratory power plant
- Up to 72,000 kg released from 1956-72 in hexavalent form [Cr(VI)]

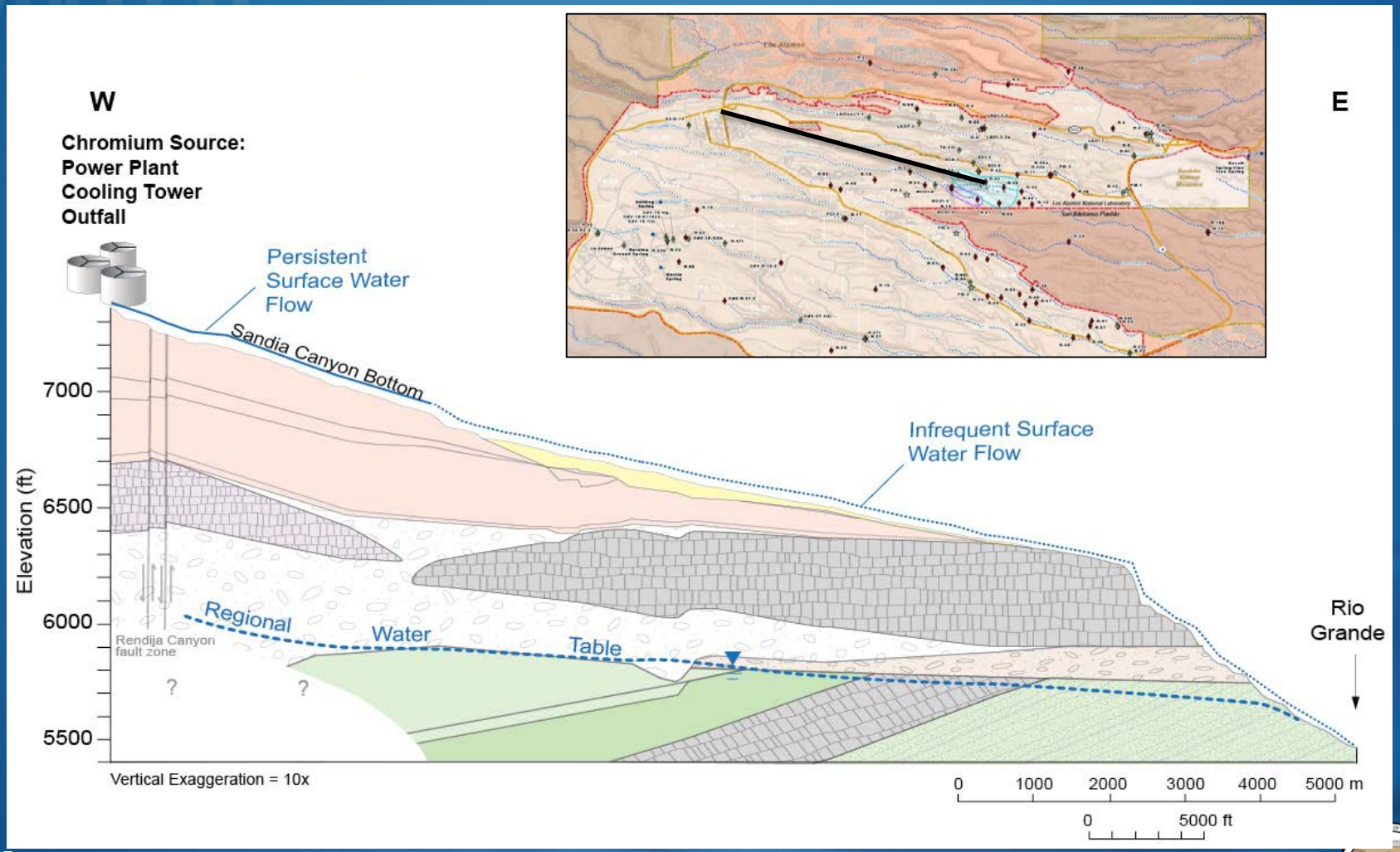
Chromium contamination in the regional aquifer is in hexavalent form



- 3 groundwater zones
- Plume is 900-1,000 ft below canyon bottom in deepest zone
- Size is approximately 1 mile x ½ mile x <50 ft thick
- Downgradient plume edge is approximately ½ mile from the closest drinking water well

Chromium Fate and Transport

Conceptual Model of chromium transport in the Subsurface



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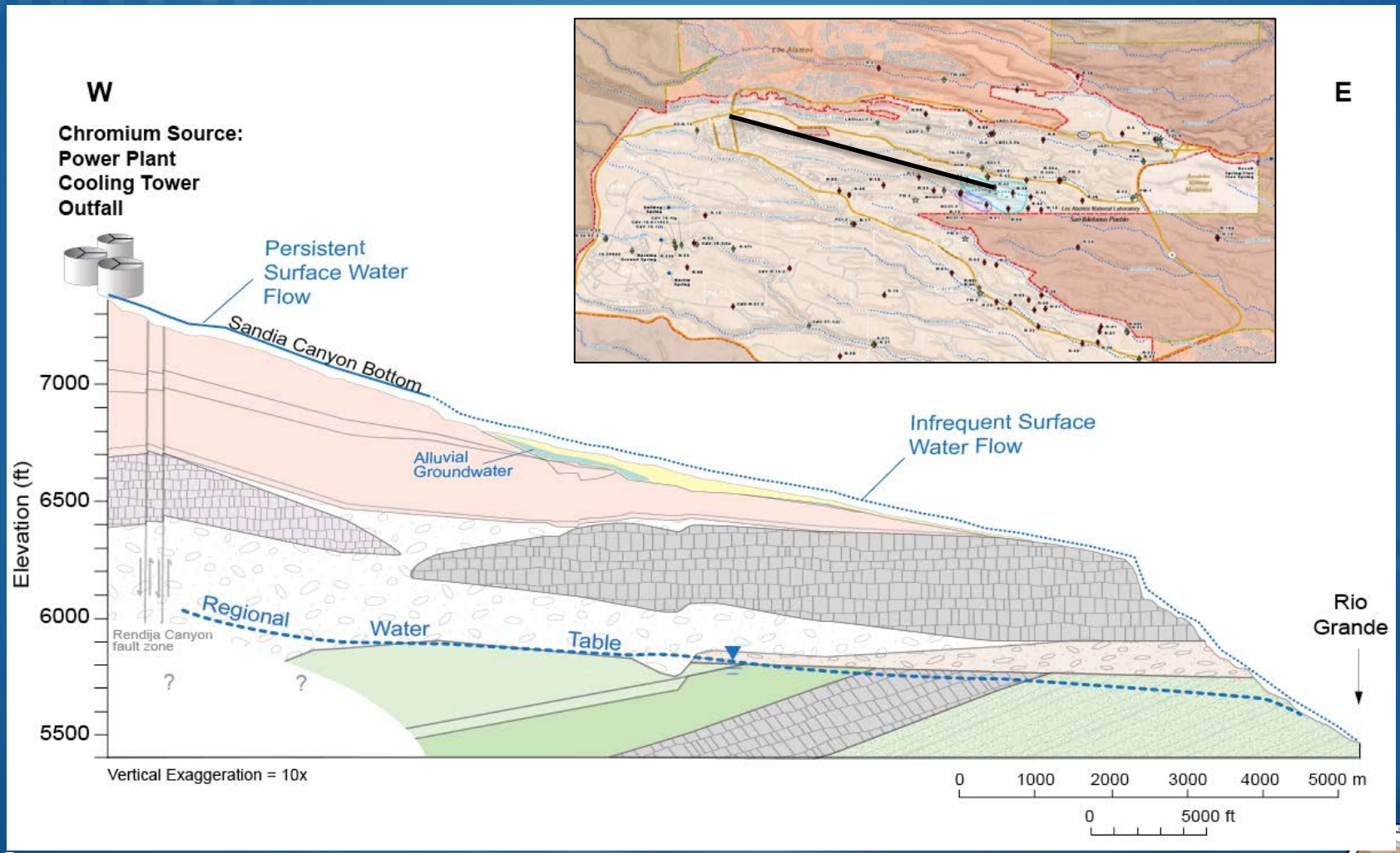

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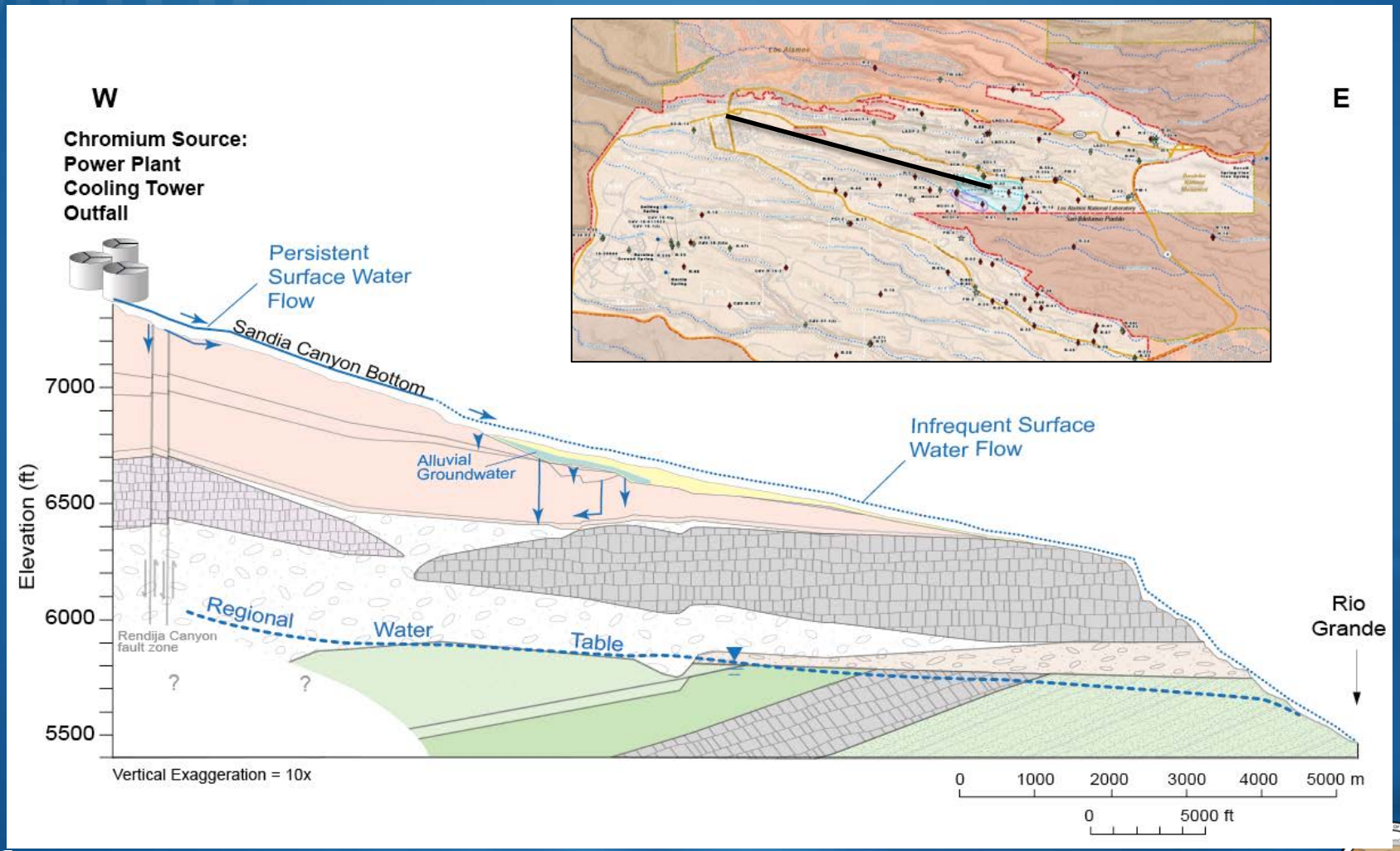

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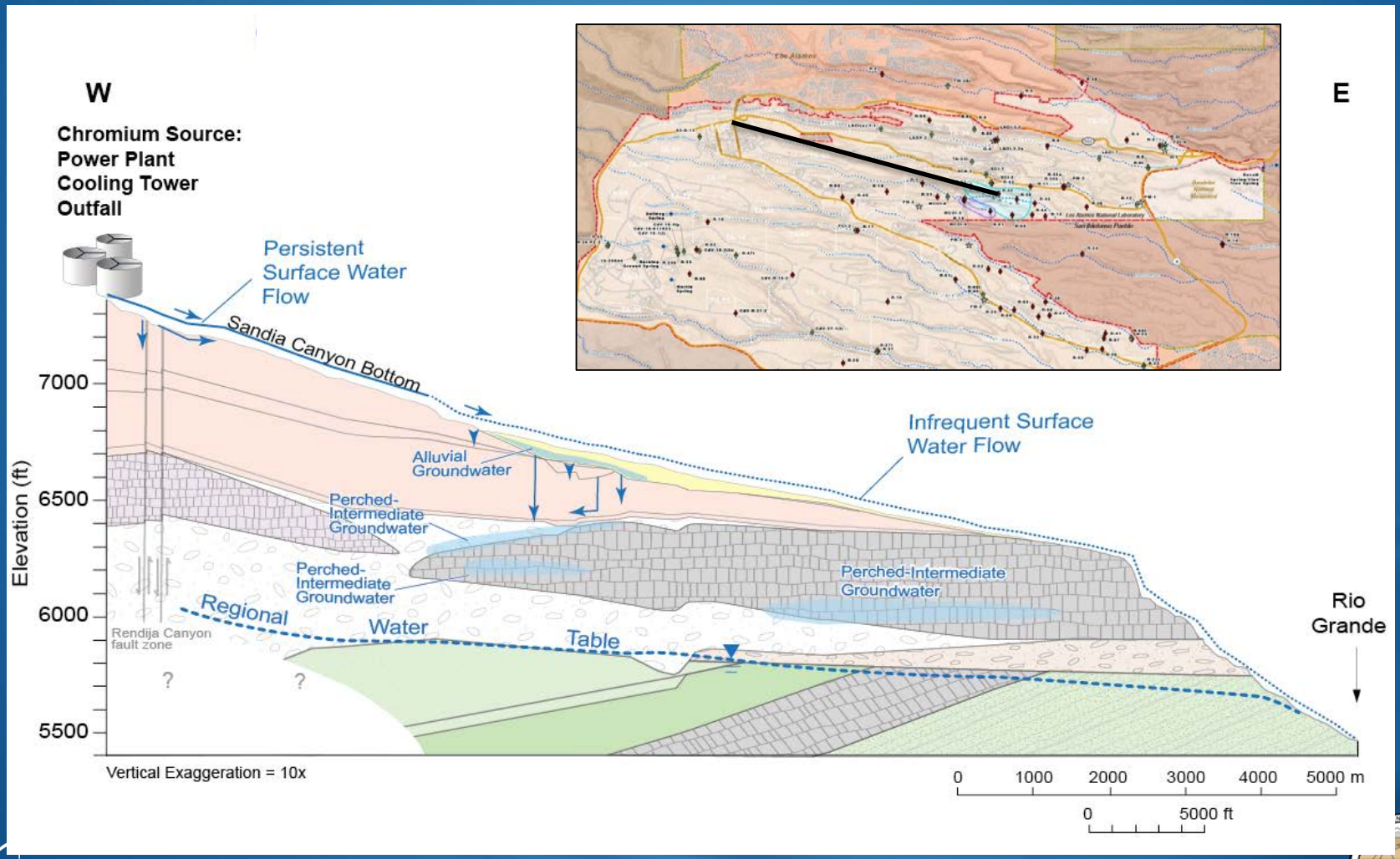

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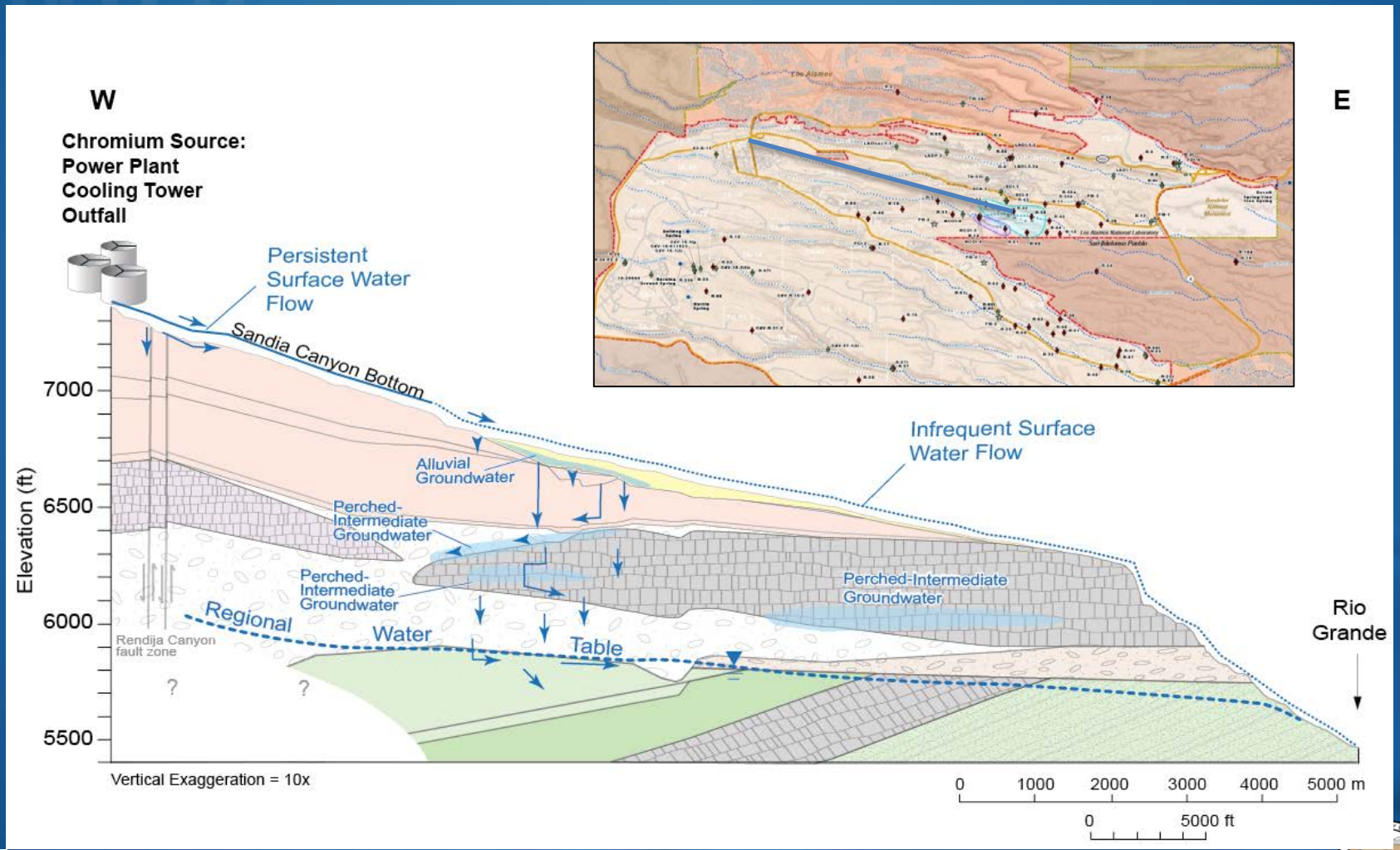

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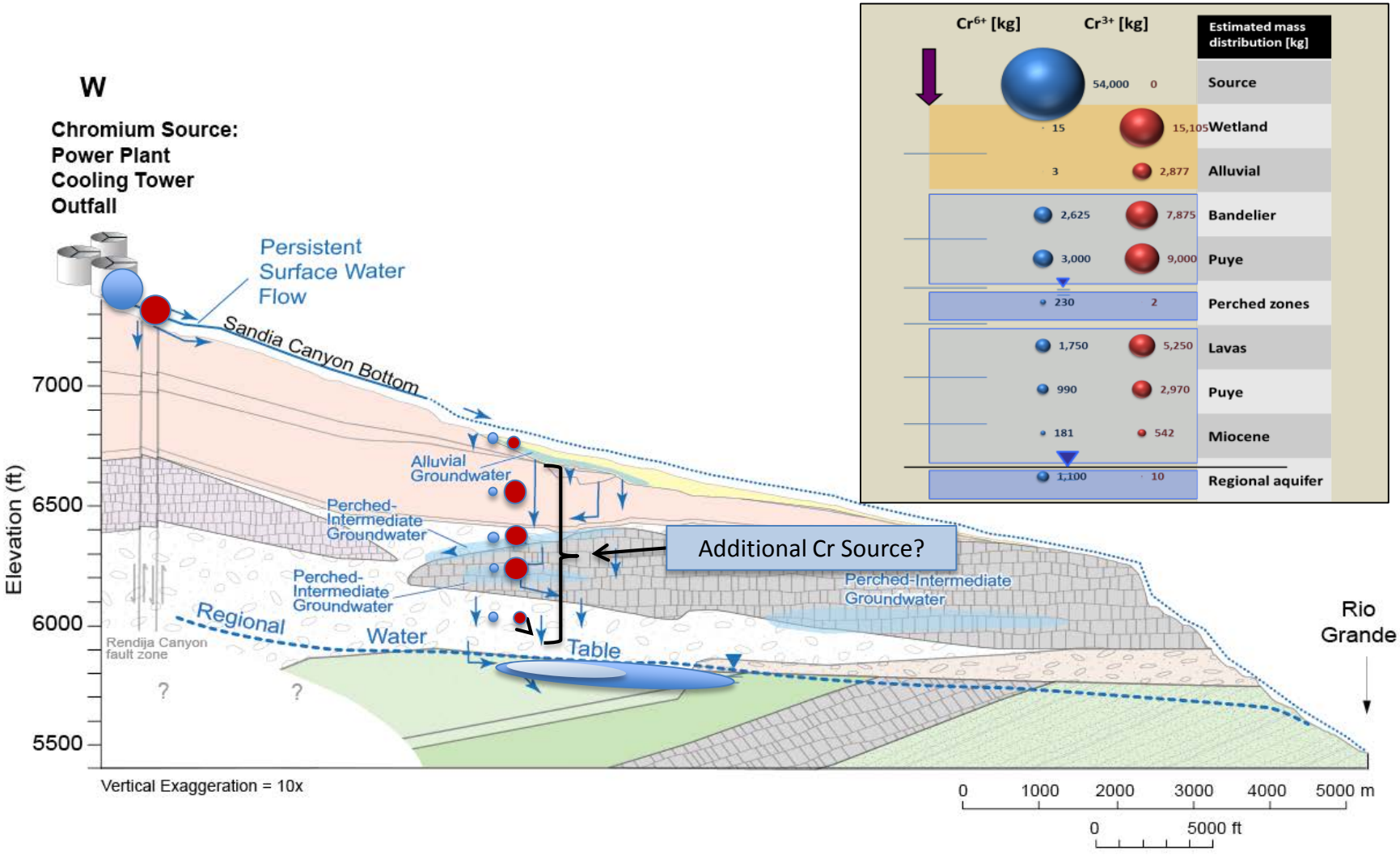
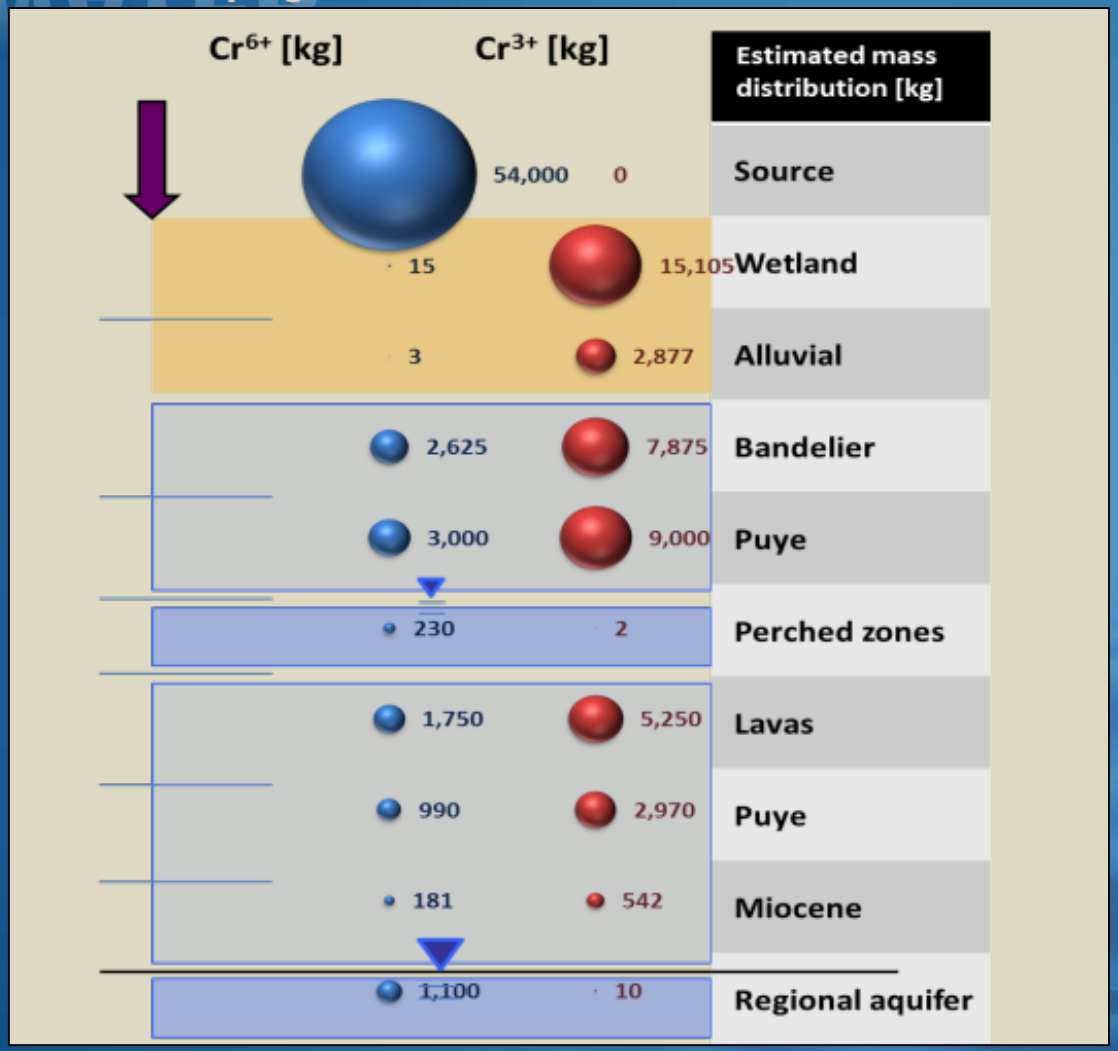
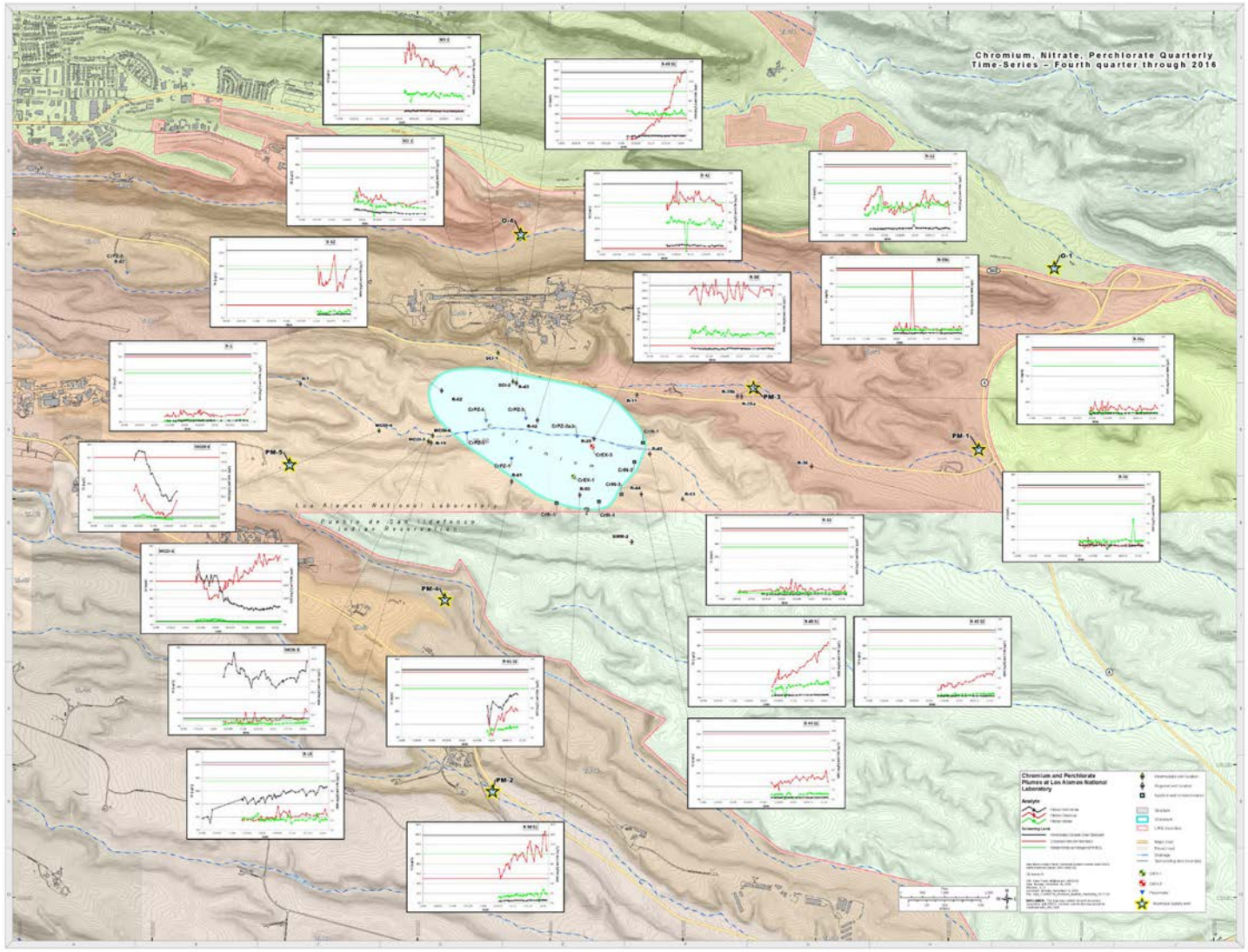


Distribution of CrVI and CrIII

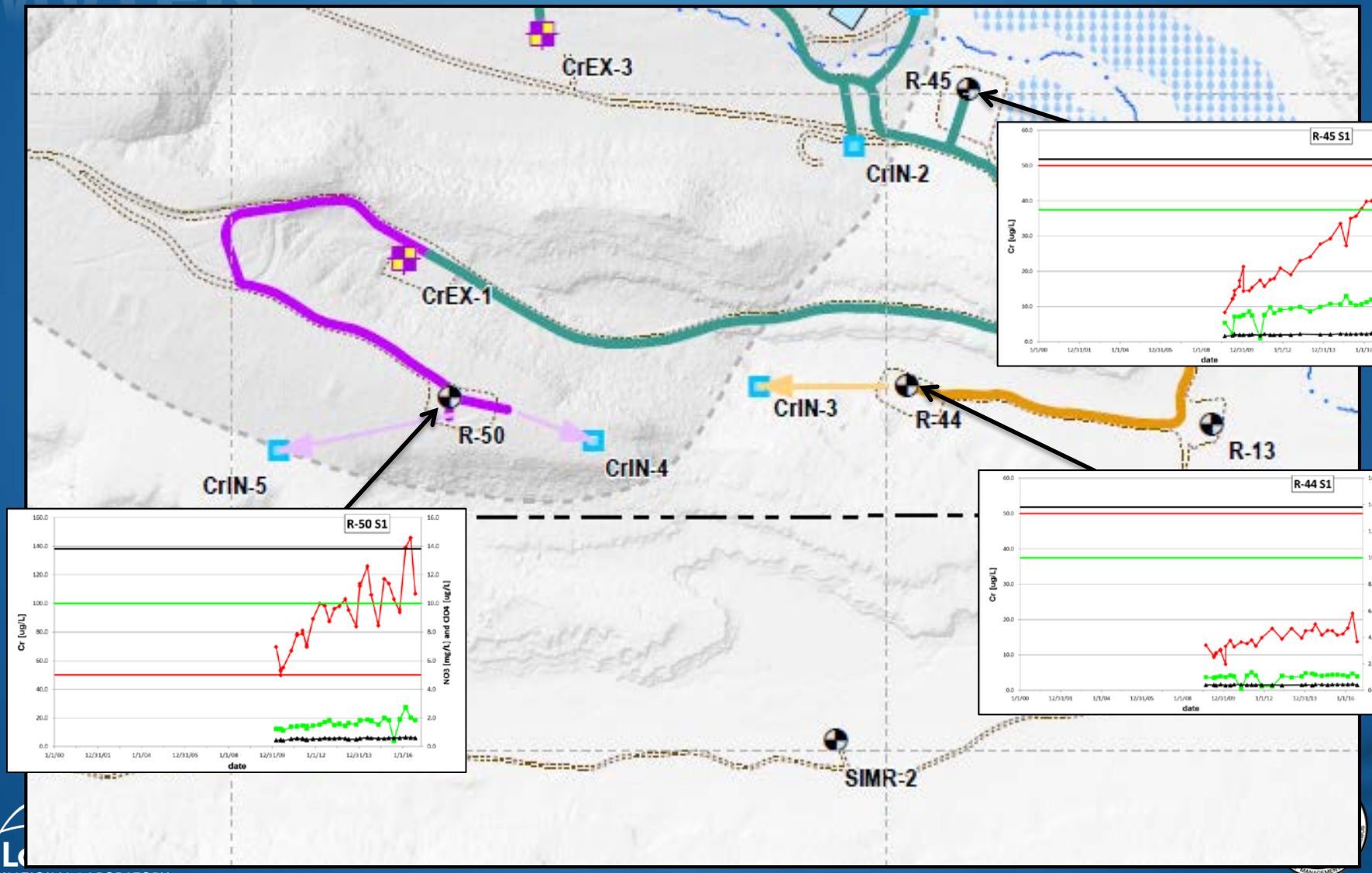


- Natural processes have converted much CrVI to stable, non-toxic CrIII
- Important to understand distribution and form of chromium to guide remedial actions

Monitoring


Chromium, Nitrate, Perchlorate Quarterly Time-Series – Fourth quarter through 2016
PM-1
PM-2
PM-3
PM-4
PM-5
O-1
O-4
Chromium and Perchlorate Plumes at Los Alamos National Laboratory

Trends at Plume Edge Wells

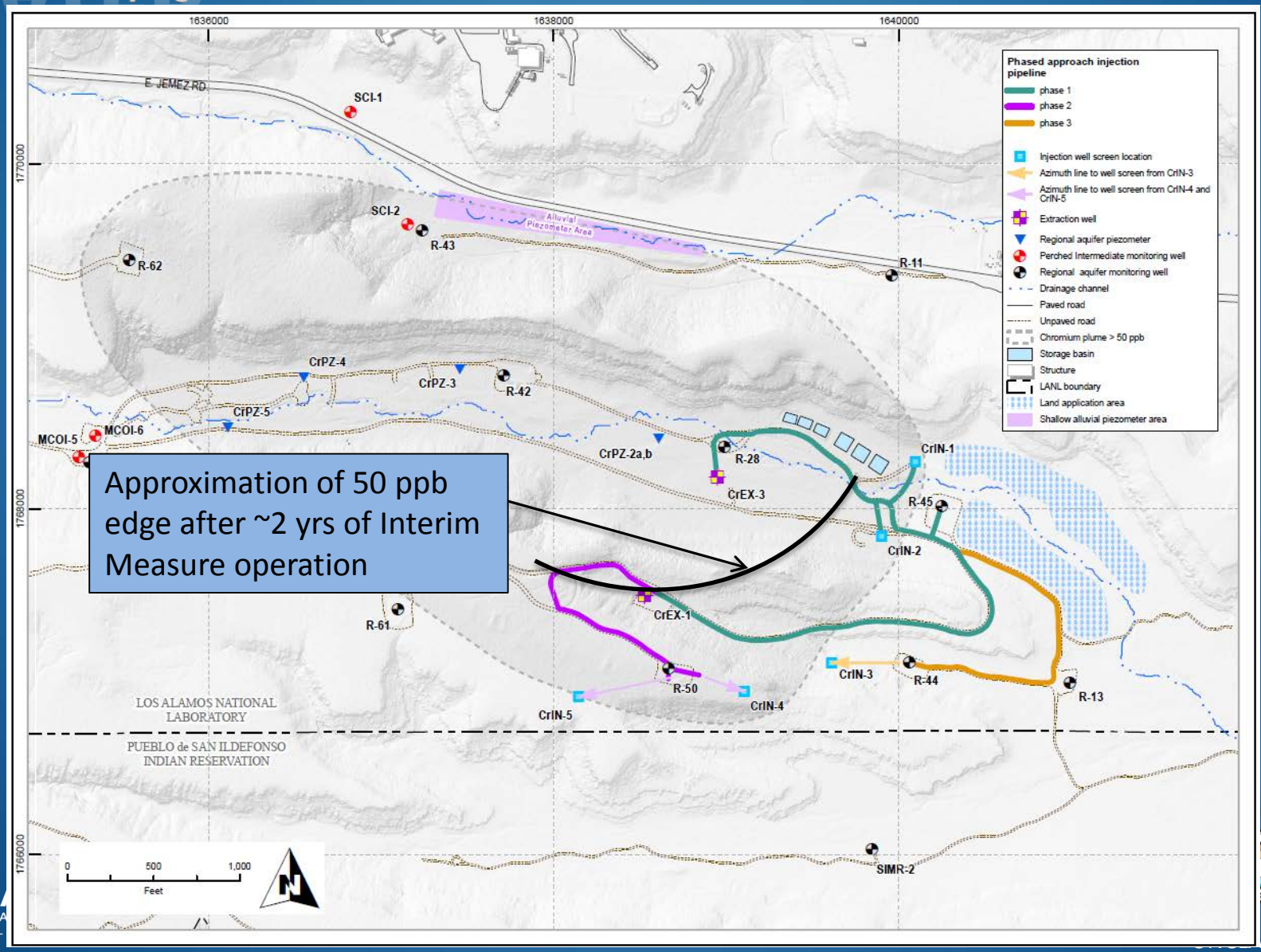


Interim Measure

Goal is to control plume migration and maintain plume edge within Laboratory boundary

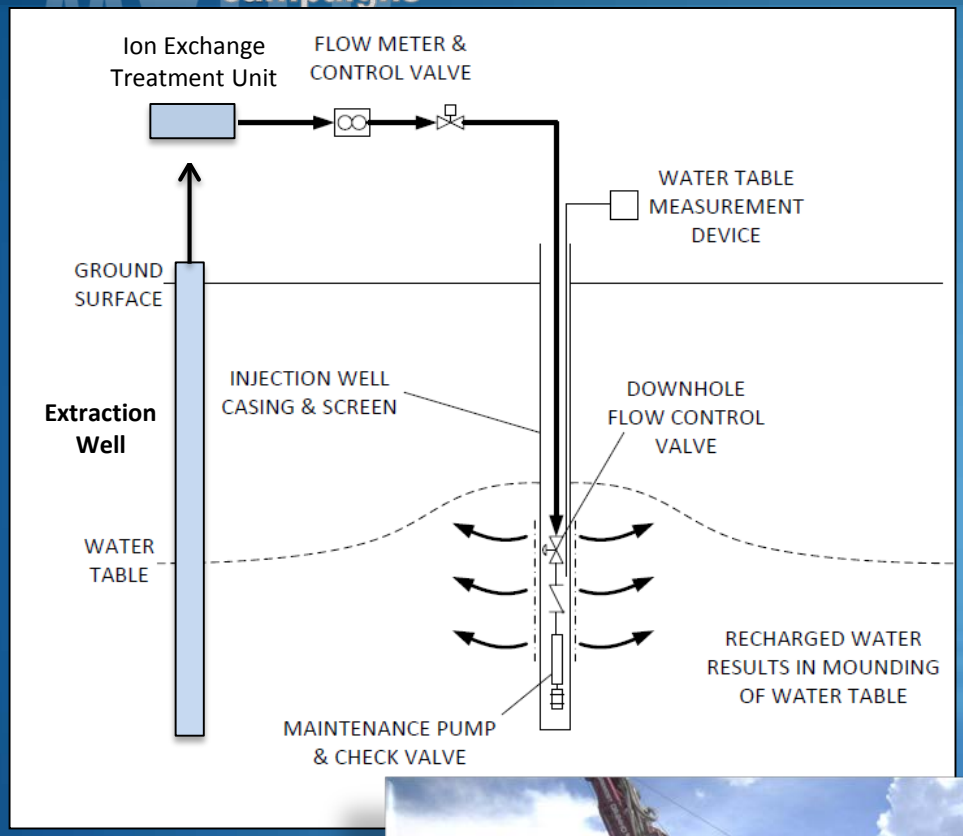
- Hydraulic capture of chromium migration towards Laboratory boundary through extraction and injection
- Pumping from extraction wells
  - CrEX-1 is installed and operational
  - Potential location of CrEX-2 under evaluation
- Contaminated groundwater will be treated at the surface and returned to the aquifer via injection wells
  - Returns clean water back to the aquifer
  - Hydraulic benefit in addition to extraction
  - Cleans downgradient edge of plume

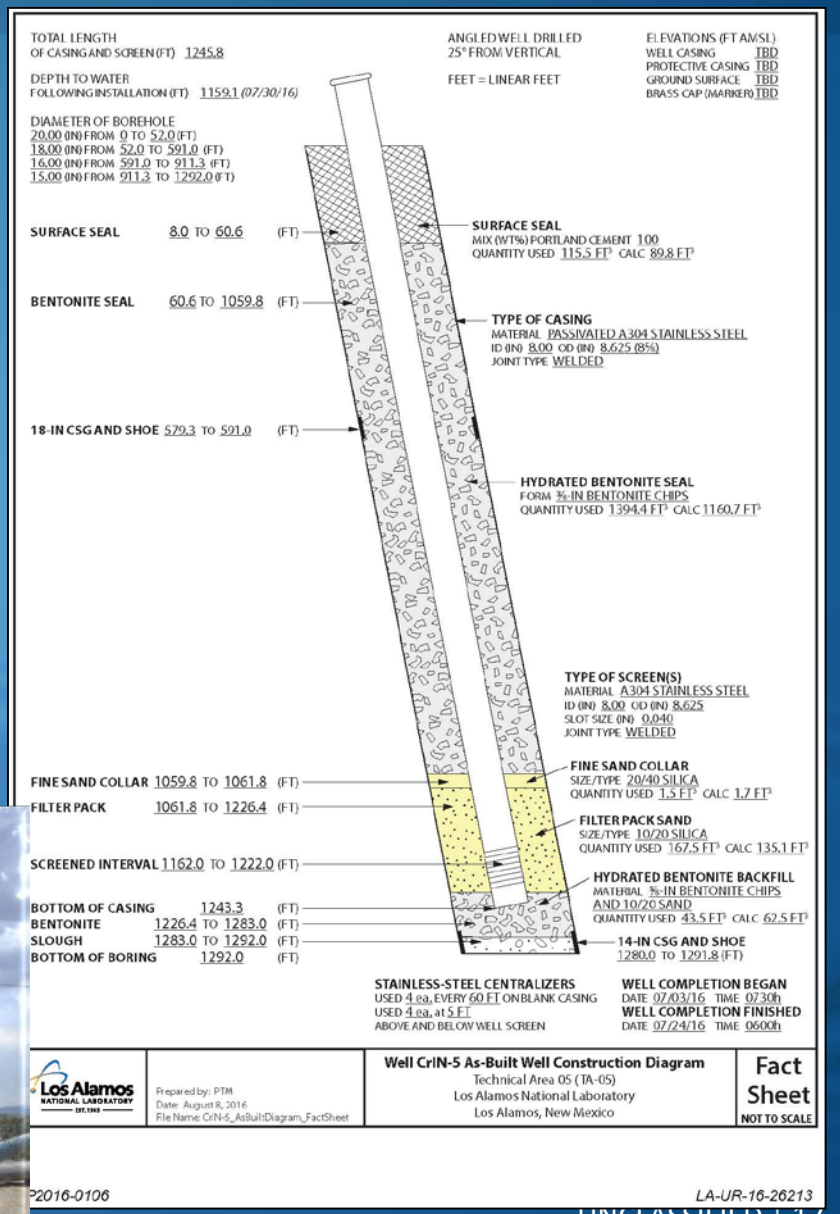
Interim Measure



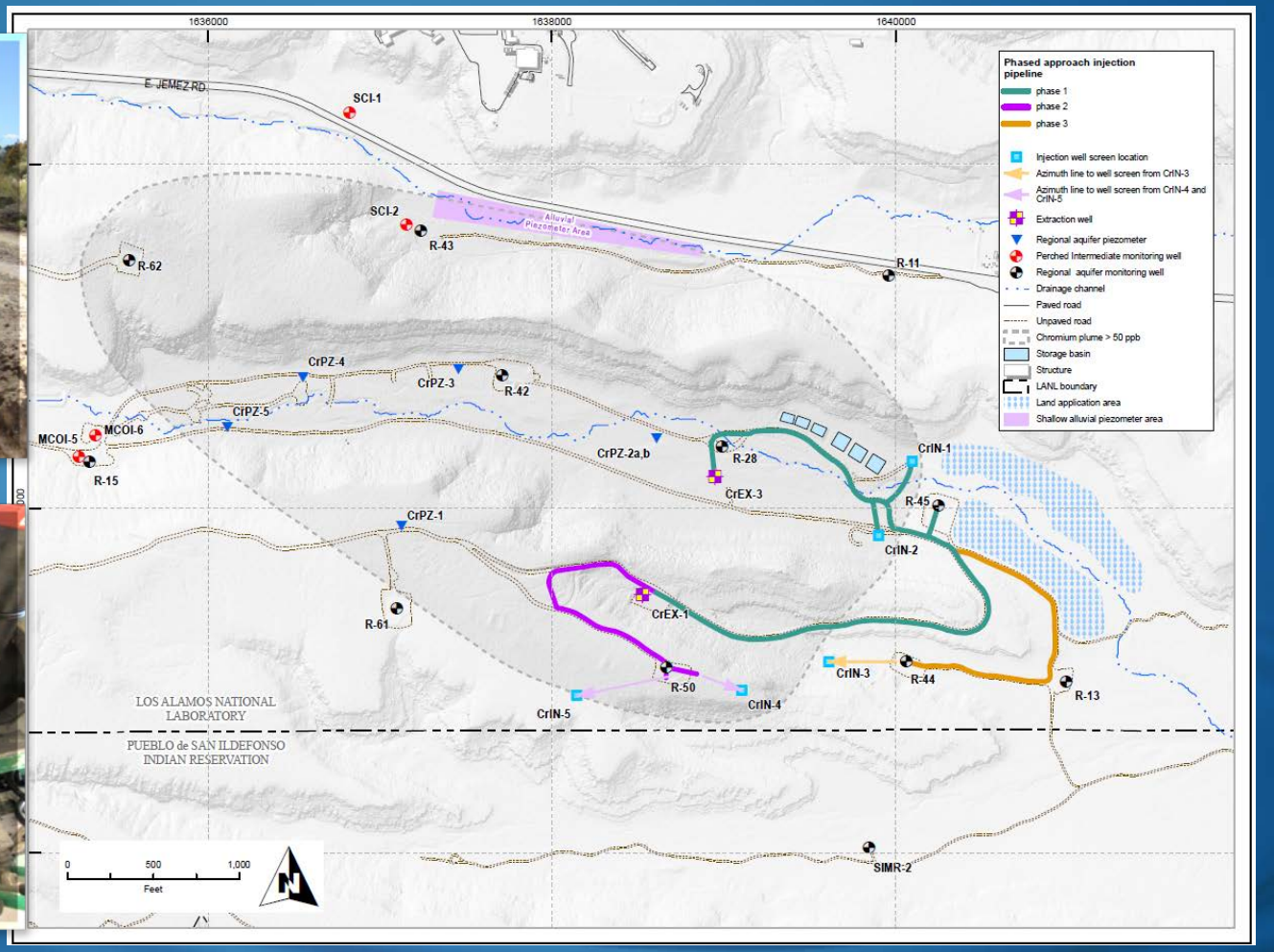
Approximation of 50 ppb edge after ~2 yrs of Interim Measure operation

Injection Wells

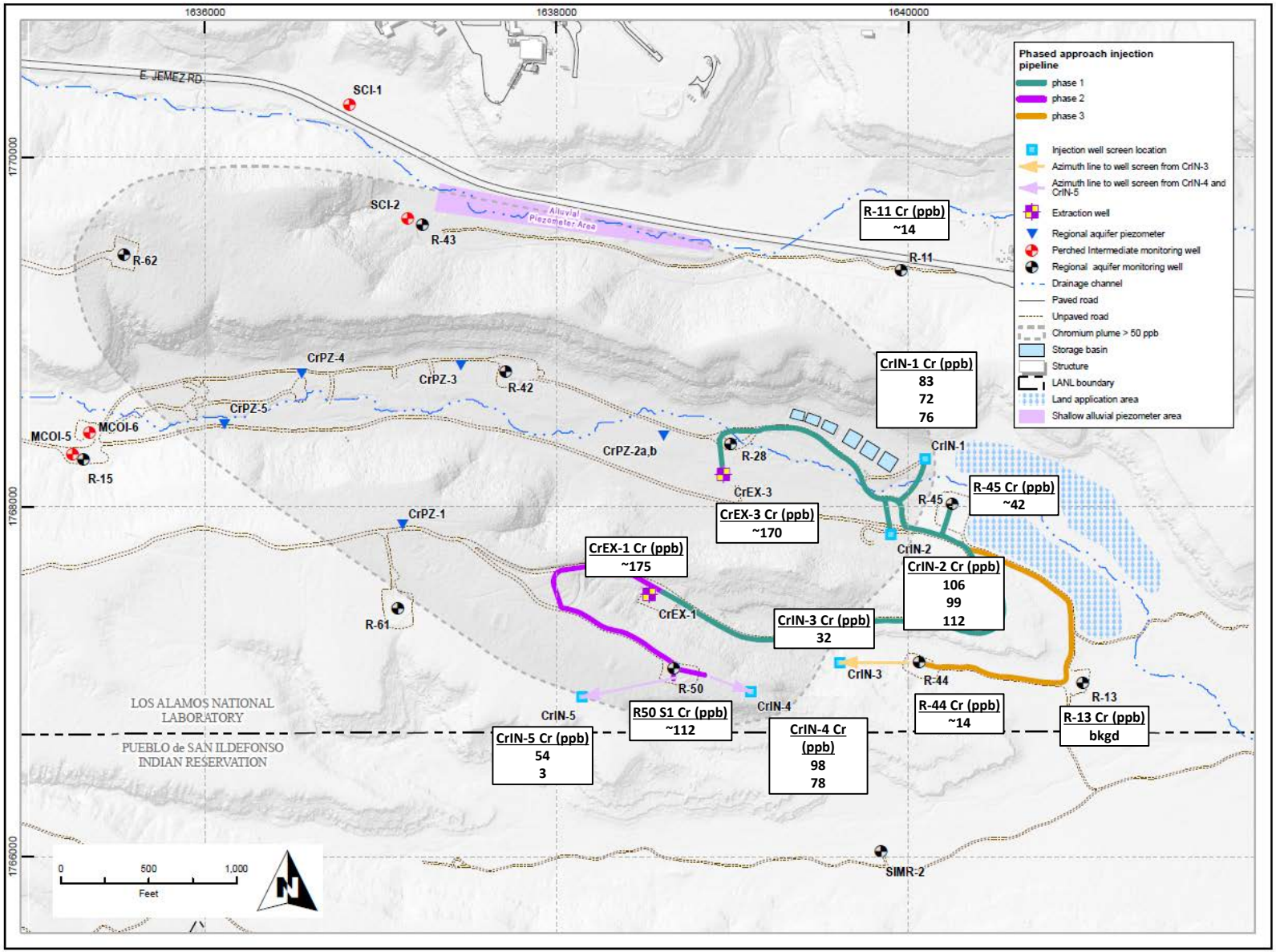




Pipeline Installation



Chromium Concentrations Injection, Extraction and Boundary Monitoring Wells



Status of Interim Measure

Permits

- Discharge Permit DP-1835 for used of injection wells received August 31, 2016
- NM Office of the State Engineer issued an Emergency Authorization (EA) on September 10, 2016 on Joint LAC/DOE application for additional groundwater points of diversion – allows pumping

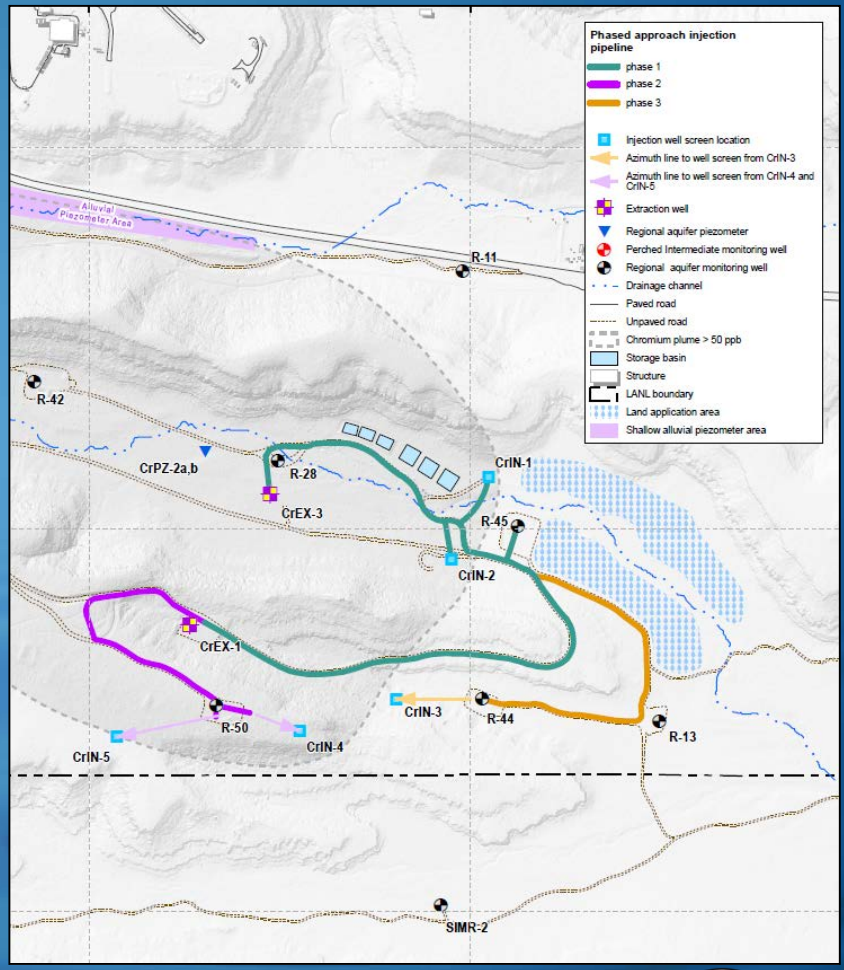
Infrastructure and Operation

- 5 of 6 injection wells installed and instrumented
- Continuous pumping at CrEX-1 since early July, under existing CrEX-1 permit and then under the EA
- Pumping at CrEX-3 began September 12, 2016 after receipt of EA
- To date, all pumped and treated water has been land applied

Status of Interim Measure (cont)

Infrastructure and Operation (cont)

- Phased piping installation (3 phases);
  - Piping installation nearing completion for first phase (Phase 2), the extraction–injection loop near Laboratory boundary (CrEX-1, CrIN-4 and CrIN-5)
  - Installation of remaining two phases anticipated start November 3 and November 28 with target completion by February and March 2017; ties in injection wells CrIN-1, CrIN-2 and CrIN-3 and characterization extraction well CrEX-3



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Status of Interim Measure (cont)

Infrastructure and Operation (cont)

- Operation of Phase 2 loop (continuous extraction and injection) scheduled to begin in late November 2016
  - Pump CrEX-1 at 80 gpm
  - Treatment at wellhead with ion exchange
  - Injection directly into CrIN-4 and CrIN-5
- Startup of complete system anticipated spring 2017
- Sixth injection well (CrIN-6) and second plume control extraction well (CrEX-2) to be installed in 2017
- Increase monitoring frequency at key performance monitoring wells along plume edge

Plume-Center Characterization

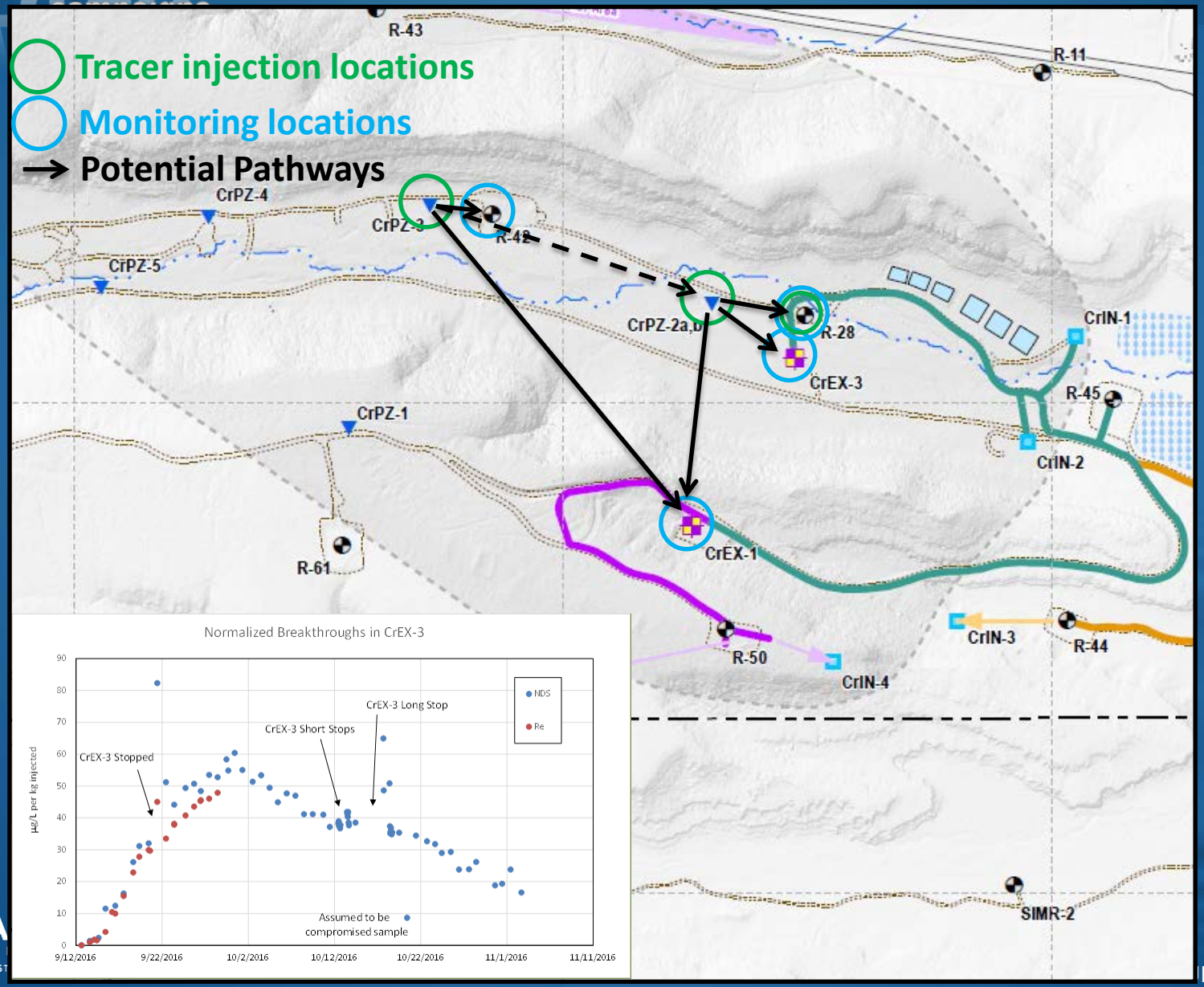
Goal is to characterize aspects of the regional aquifer that directly support development of a final remediation strategy

- Laboratory "bench-scale" studies are underway
  - Evaluate the potential for using bio- or chemical amendments directly within the aquifer to remediate chromium by altering the form from hexavalent to trivalent
- Pumping within the centroid at CrEX-3
  - Evaluate efficacy of source removal as a component of a potential remediation strategy

Plume-Center Characterization (cont)

- Tracer studies include deployment of paired tracers of different molecular sizes into wells/piezometers and monitoring at downgradient locations
  - Evaluate details of aquifer pathways and heterogeneity
  - Will help with understanding where and how the majority of chromium may be migrating
- Sandia Canyon alluvial piezometers
  - Characterize infiltration of surface water (and past chromium releases) for potential remediation strategy that involves flushing the vadose (unsaturated) zone where residual chromium may be present

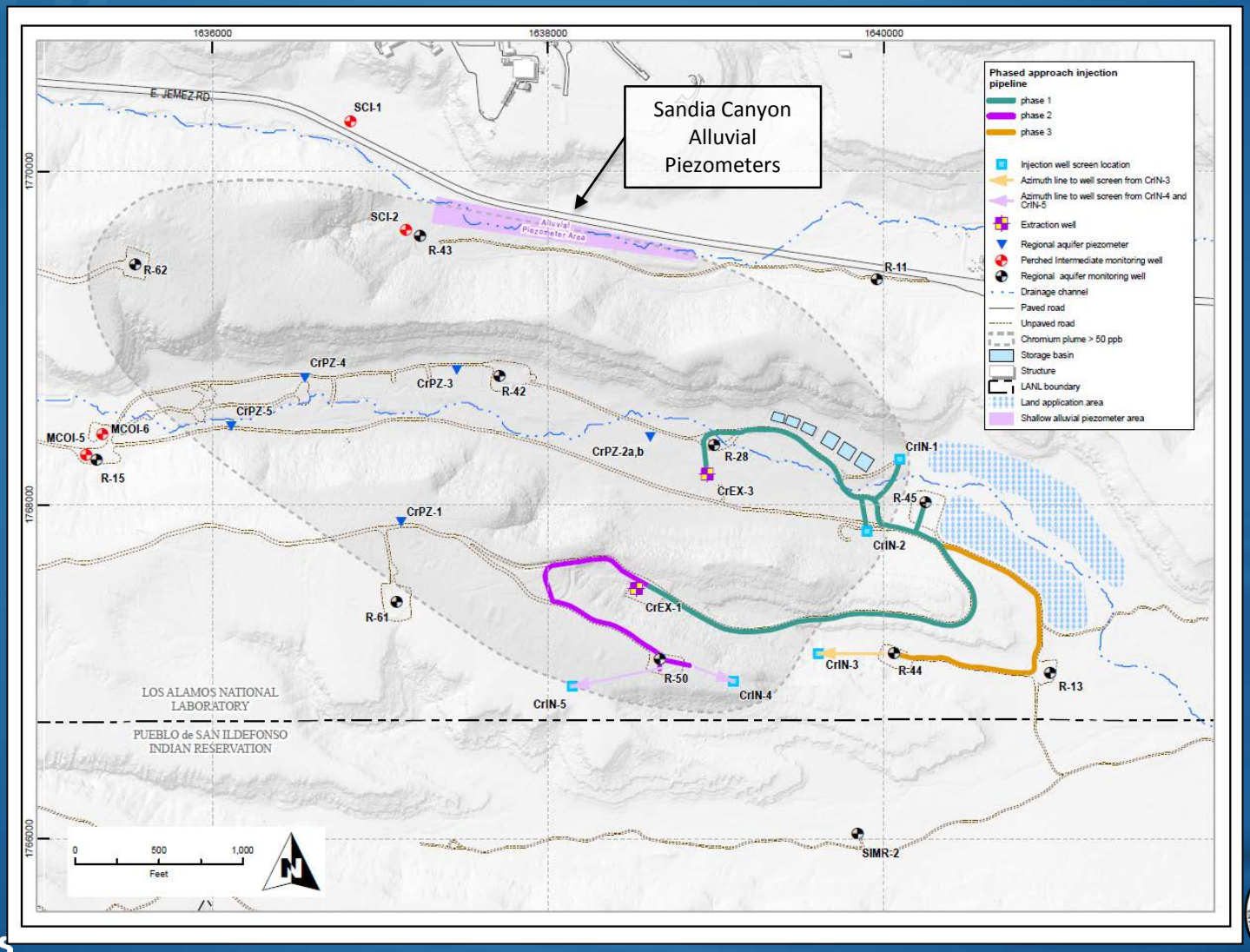
Plume-Center Characterization–Tracer Tests



Plume-Center Characterization – "Bench-Scale" Tests

Studies underway to evaluate potential amendments for remediation within the aquifer

Plume-Center Characterization–Sandia Canyon Alluvial Piezometers



Questions?