

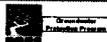
* LANL needs to consider looking for perched groundwater near Otowi-4 (add to workplan scope) (what is happening to water near confluence with DP Canyon? liquid releases from TA-21?) (between O-4 + TW-3)

* TW-3 needs to be P+A'ed as part of the work plan

General

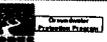
Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan
12/23/03

Patrick Longmire and Kelly Bitner

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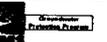
Work Plan Goals

- Further define the extent of contamination in perched intermediate groundwater at well R-9I and in the regional aquifer at supply well Otowi (O)-1;
- Evaluate the presence and uncertainties of other contaminants known to have been released in the upper reaches of Los Alamos Canyon and Pueblo Canyon; and
- Evaluate the transport pathways that have resulted in the presence of contaminants in water supply well O-1 and in investigation wells R-9 and R-9I.

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Document Trail

- Nov 1995: "Task/Site Work Plan for Operable Unit 1049: Los Alamos Canyon and Pueblo Canyon"
- March 1997: Notice of Deficiency (NOD) on the submitted work plan
- April, 1997: Response to the NOD
- June 1997: NMED approved the work plan
- February, 2002: "Los Alamos and Pueblo Canyons Work Plan Addendum, Surface Water and Alluvial Groundwater Sampling and Analysis Plan"
- May, 2002: NMED approved the addendum

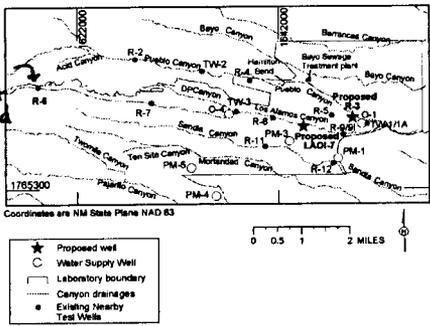
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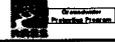
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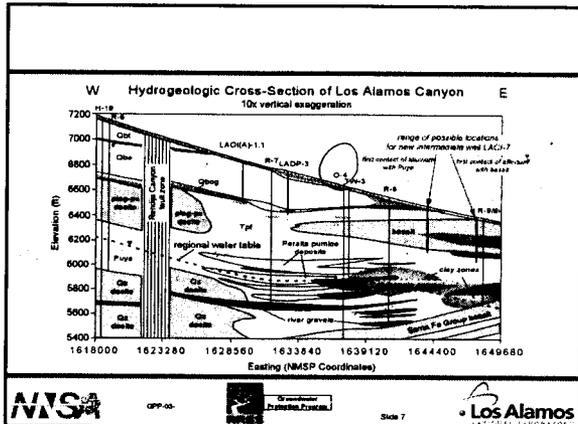
R-6 is not yet installed


Technical Objectives	
Groundwater Addendum Objectives	How Addressed
Determine nature and extent of potential contamination within the regional aquifer downstream of the Acid Canyon and Pueblo Canyon confluence in Pueblo Canyon.	R-2 was drilled in October 2003. R-3 is proposed in this work plan addendum to be installed near Otow-1.
Determine nature and extent of potential contamination within the regional aquifer immediately north of TA-73 in Pueblo Canyon.	R-4 was drilled in August 2003.
Determine nature and extent of contamination within the Cerro del Rio basal/Puye Formation between wells R-8 and R-9.	Well LAOI-7, as proposed in this work plan addendum, is located between wells R-8 and R-9. The information from wells R-8 and R-9 are sufficient for regional aquifer characterization.
Determine background/baseline water chemistry for Los Alamos Canyon and Pueblo Canyon.	Wells R-26 and R-7 serve as background wells for the Laboratory including Los Alamos Canyon and Pueblo Canyon.

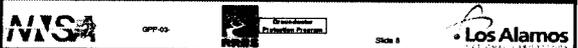






Background

- Los Alamos Canyon and Pueblo Canyon have received effluents from the Laboratory since the early 1940s discharged from former TA-1, TA-2, TA-21, TA-41, TA-43, and TA-53.
- Effluents have contained contaminants, including nitrate, perchlorate, tritium, cesium-137, strontium-90, americium-241, and several isotopes of uranium and plutonium
- Active outfalls discharging to Los Alamos Canyon and Pueblo Canyon include outfalls at TA-43, TA-53, and the Los Alamos Medical Center.
- Bayo Wastewater Treatment Plant a municipal facility actively discharges treated effluent to Pueblo Canyon.



Perched and Regional Water Quality

- R-9i showed 69.4 to 246 pCi/L tritium in two screens set in perched zones within the Cerros del Rio basalt at depths of 199 and 279 ft
- R-7, has not shown contamination in the regional aquifer. Perched groundwater at 378 ft bgs contained 2.55 to 3.38 pCi/L tritium during characterization sampling
- R-9 contained 4.84 to 14.68 pCi/L tritium in regional aquifer groundwater at 741 ft. Perched groundwater at 279 ft during the drilling of R-9 contained 0.0484 mg/L dissolved uranium; subsequent sampling well R-9i has shown dissolved concentrations of uranium less than 0.001 mg/L.



Perched and Regional Water Quality (cont.)

- ❑ R-8 borehole water sample contained 16 pCi/L tritium and concentrations of perchlorate were less than 0.004 mg/L using ion chromatography
- ❑ R-7, has not shown contamination in the regional aquifer. Perched groundwater at 378 ft bgs contained 2.55 to 3.38 pCi/L tritium during characterization sampling
- ❑ R-2 and R-4 were sampled after development and the analytical results are pending.
- ❑ R-5, sampled during well development and one characterization round. Tritium and nitrate (as nitrogen) were less than 5 pCi/L and 3 mg/L, respectively, in the regional aquifer.

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→ R-7 is considered by LANL to have "background" water quality in the regional aquifer, even though the well is downgradient of LAS operations (3/4 mi. E of Omega well Reactor) and was not intended to be a "background" well.

Perched and Regional Water Quality (cont.)

- ❑ O-1 groundwater samples were collected and analyzed; they contained 1.3 mg/L nitrate (nitrate as nitrogen), 0.00112 to 0.00585 mg/L perchlorate, and 29.06 to 40.23 pCi/L tritium (1.12 - 5.85 ppb ClO₄⁻)
- ❑ TW-1a and TW-1, nitrate and tritium have been detected in wells indicating that these wells have experienced recharge from surface water and alluvial and perched intermediate groundwater for several decades

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→ Tritium + Nitrate are present in both perched + regional groundwater

Proposed Scope

- ❑ Intermediate well, LAOI-7, located between wells R-8 and R-9, to target the Cerros del Rio basalt. Primary purpose of further characterizing the nature and extent of known contaminants in intermediate perched water.
- ❑ Regional aquifer well R-3, located near and upgradient of water supply well O-1 in Pueblo Canyon. The primary purpose of R-3 is to identify the transport pathways that have resulted in the presence of contaminants in O-1.

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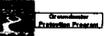
Intermediate Well LAOI-7
(proposed between RB + R9)

- Total depth: 300-400 ft
- Collect core samples from surface to core refusal, or a maximum depth of 320 ft, for contaminant, metal, and anion analyses.
- Conduct slug test and/or injection/straddle packer test in the screen completely within the perched zone
- Collect screening water samples during drilling at the top of the perched intermediate groundwater, if encountered.
- Suite and timing of geophysical logging to depend on borehole conditions.
- Complete well with one screen in the Cerros del Rio basalt or Puye Formation.

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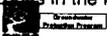
LAOI-7 Caveats

- If perched water is encountered in strata above the Cerros del Rio basalt, that water will be collected and analyzed during drilling to determine presence or absence of contamination.
- If perched water is not encountered above or within the Cerros del Rio basalt, the borehole will be extended 100 ft within the underlying Puye Formation immediately beneath the Cerros del Rio basalt to test for presence of perched water.
- If saturation is not encountered, the borehole will be backfilled.

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Regional Aquifer Well R-3
(upgradient of/near Otowi-1)

- Total depth: 1800 ft; penetrate ~ 800 ft below regional water table.
- Collect core samples from surface to core refusal, or a maximum depth 300 ft, for contaminant, metal, and anion analyses
- Conduct slug test, single-step pumping test, or injection/straddle packer test in the screen completely below the regional water table.
- Collect screening water samples during drilling at the top of the regional aquifer
- Suite and timing of geophysical logging to depend on borehole conditions.
- Complete well with up to 3 screens at locations selected based on productive zones in the regional aquifer.

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→ equivalent zone of saturation to 0-1

Considered, but not Proposed

Regional Well between R-8 and R-9:

- Based on available sampling results, the regional aquifer presently shows the least amount of impact from Laboratory discharges.
- Dilution and adsorption are active processes, thus a significant variation in water chemistry including contaminant concentrations is not expected to occur within the regional aquifer between wells R-8 and R-9.
- An additional R well probably will not reduce uncertainty in contaminant transport and risk analysis based on groundwater monitoring data collected in Los Alamos Canyon.

Considered, but not Proposed (cont)

Background well:

- R-6 was proposed for upper Los Alamos Canyon under the Hydrogeologic Workplan. However, R-26 was recently completed at a location upgradient of Laboratory operations and it will provide high-quality samples for chemical analyses.
- Preliminary results of sampling of well R-26 water indicate background concentrations of analytes are in the expected range.
- The construction of well R-26 also provides a technically defensible basis for establishing background conditions for the regional aquifer.

Schedule

- CY 2005:** Drilling and completing the wells is proposed in this work plan and conducting two quarters of sampling rounds at the wells.
- June 2006:** An investigation report will be prepared following collection and analysis of environmental data and is currently scheduled for delivery to the NMED by June 16, 2006.
