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*Date:* March 29, 2005
*Refer To:* ER2005-0184

Mr. John Young
Permits management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

**SUBJECT: DRILLING SCOPE FOR CALENDAR YEAR 2005**

Dear Mr. Young:

This letter documents agreements made between NMED and DOE/LANL during recent meetings and phone conversations about the scope of groundwater well-construction and well-decommissioning activities in calendar year 2005. Planned well-construction activities in 2005 include installation of seven regional aquifer wells, installation of five intermediate-depth perched-zone wells, and plugging and abandonment of four old test wells that do not meet current well-construction standards. The work described below will be conducted consistent with the requirements of the March 1, 2005 Consent Order and will satisfy part of the requirements for groundwater investigations in submitted or planned Canyons work plans.

New regional well installations will include R-3 in Pueblo Canyon, R-16a in White Rock (Canada del Buey), R-17 in Pajarito Canyon, R-24 at former TA-10 in Bayo Canyon, R-27 in Water Canyon, and a pair of regional wells, R-10 and R-10a, in Sandia Canyon on San Ildefonso Pueblo land. New well R-16a will replace the upper screen in R-16 that is blocked by drill casing. New intermediate-depth perched zone wells will be installed at LAOI-3.2a, LAOI-7, and LADP-5 in Los Alamos Canyon and at R-23i in Pajarito Canyon. The LADP-5 intermediate well will be installed in lieu of intermediate well LAOI-1.5 described in the Los Alamos and Pueblo Canyon Intermediate and Regional Groundwater Work Plan. At TA-16, well CDV-16-2(i)r will target the uppermost intermediate perched groundwater to replace the original well CDV-2(i) which was dry. Attachment 1 to this letter lists the locations, planned depths, number of well screens, characterization goals, and data requirements for these planned regional and intermediate wells. Attachment 2 is a map showing the planned well locations and anticipated stratigraphy. In addition to the installation of new wells, old test wells TW-1, TW-1A, TW-3, and TW-4 will be plugged and abandoned in accordance with requirements of sections IV.B.1.b.iv and v and X.D (Well Abandonment) in the Consent Order.

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Please provide a written response indicating your approval for the calendar year 2005 well construction and well decommissioning activities as described in this letter. For wells in the Los Alamos and Pueblo Canyon watershed (R-3, LAO-3.2a, LAO-7, LADP-5), please also address your approval in your comments to the Los Alamos and Pueblo Canyon Intermediate and Regional Groundwater Work Plan. For R-17 and R-23i in Pajarito Canyon, please also include your approval of these wells in your comments on the Pajarito Canyon Work Plan. If you have any questions, please contact Danny Katzman at (505) 667-6333 or Tom Whitacre at (505) 665-5042.

Sincerely,

David McInroy, Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,

Mathew Johansen
Groundwater Program Compliance Manager
National Nuclear Security Administration
Los Alamos Site Office

DM/DG/DK/ds

Enclosures:

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D. Gregory, LASO, MS A316
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B. Rich, ADO, MS A104
C. Voorhees, NMED-OB

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-3 | Regional Well R-16a | Regional R-17 |
|---|---|---|---|
| Primary Purpose | Determine the zone(s) within the regional aquifer that contain the contaminants (nitrate, perchlorate, and tritium) that have been detected in O-1<br>Assess the contaminant transport pathways from surface sources to the regional aquifer.<br>Measure the hydrologic parameters and water quality in saturated zone(s). | R-16a will replace screen 1 in R-16, which is blocked by drill casing that that could not be extracted during well construction. The original purpose of R-16 was determine water table and vertical gradients for the regional aquifer near the Rio Grande and to serve as a monitoring point between TA-54 and the Rio Grande. It also was intended to determine relationship between regional water table and springs in White Rock Canyon. | R-17 will provide information on perched and regional aquifer groundwater in the poorly-characterized west-central part of the Lab. It is located on a bench above Pajarito Canyon near the confluence with Twomile Canyon and upstream of the flood retention structure. This location is down stream of release sites in TAs-3, -6, -58, -59, -62, and –69. |
| Projected Depth | 1500 ft; penetrate approximately 800 ft below regional water table. Top of screen in O-1 is at 1017 ft bgs and bottom of screen is at 2477 ft bgs. The screen intervals in R-3 will examine water quality entering the upper part of louvers at O-1. | 700 feet; screen 1 in R-16 was placed from 641 ft to 649 ft. Static water level in R-16 is at 642 ft. | 1350 ft; 250 feet below the top of the regional aquifer. |
| Geology | Characterize clay/zeolite alteration that affects pre-Puye rocks in this area and resolve stratigraphic uncertainties presented by poor cuttings quality at O-1. | Geology of the vadose zone at this location is known from R-16. | To determine the extent of thick Cerro Toledo deposits in the central part of LANL, to determine the presence and character of Cerros del Rio (?) dacitic lavas, and the thickness and character of the Puye Formation. These data are needed to refine the 3-D geologic model, which is critical for identifying geologic controls on groundwater pathways |
| Hydrology | Determine hydraulic gradient, hydraulic conductivity, and flow direction in the regional aquifer upgradient of O-1, if feasible, with other wells. | Define the top of the regional water table near White Rock Canyon.<br>Determine source of springs in White Rock Canyon.<br>Determine relationship of regional water table to Rio Grande.<br>Define vertical gradients near the Rio Grande. | To identify the presence of perched intermediate saturated zones in order to evaluate groundwater pathways and interconnections between the surface and deep groundwater in Pajarito Canyon.<br>To measure the water table elevation in the regional aquifer.<br>To provide aquifer characteristics, and chemistry data for improving the regional flow and transport model. |
| Geochemistry | Evaluate hydrochemistry and contaminant distributions (nitrate, perchlorate, and tritium) in productive zones within the regional aquifer along the screened section in O-1. | Determine water quality at the water table. No contaminants have been detected in screens 2, 3, or 4 of R-16.<br>Compare water quality at top of regional aquifer to water quality at nearby springs. | R-17 will provide water-quality data downgradient of release sites in the upper parts of the watershed and upgradient of TA-18. Upper Pajarito Canyon contains HE-contaminated springs and the probable source of contaminants is TA-15. However, it is unlikely we would see the contaminants from TA-15 in R-17, unless the water table map is not accurate in this location. |
| Vadose Zone Sampling | Collect vadose zone core and analyze for anions, metals, radionuclides, and stable isotopes.<br>Collect water samples if perched water is encountered during drilling. | The vadose zone was sampled while drilling R-16; no additional samples are necessary. | Collect vadose zone core and analyze for anions, metals, radionuclides, and stable isotopes.<br>Collect water samples if perched water is encountered during drilling. |
| Core Needs | Collect core samples in a separate corehole from surface to core refusal, or a maximum depth 300 ft, for contaminant, metal, and anion analyses. | No core will be collected. | Core will be collected in the upper 300 feet in a separate corehole near the canyon bottom and tested for moisture content, anions, stable isotopes, barium, HE, and |

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# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-3 | Regional Well R-16a | Regional R-17 |
|---|---|---|---|
| | Cuttings will be used to determine lithology and stratigraphy below core refusal depth. | | radionuclides. Cuttings will be collected every 5 feet in the regional aquifer well to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization. |
| Regional Aquifer Sampling | Collect screening water samples during drilling at the top of the regional aquifer.<br>Install well screens to collect water quality data for the regional aquifer. | Collect screening water samples during drilling at the top of the regional aquifer<br>Install well screen to collect water quality data for the regional aquifer water table. | Collect screening water samples during drilling at the top of the regional aquifer.<br>Install 2 well screens to collect water quality data for the regional aquifer. |
| Hydraulic Testing | Conduct slug test, single-step pumping test, or injection/straddle packer test in the screen completely below the regional water table. | Hydraulic testing was completed in screens 2, 3, and 4. Hydraulic testing can not be conducted in screens that straddle the regional water table. | Conduct slug test, single-step pumping test, or injection/straddle packer test in the screen completely below the regional water table. |
| Geophysical Testing | In regional aquifer bore hole, run full array of contract geophysical logs to characterize moisture distribution and identify perched groundwater in the vadose zone and to characterize the hydraulic properties of saturated rocks in the regional aquifer. These logs will also be used select well screen depth. The suite and timing of geophysical logging will depend on bore hole conditions.<br>In core hole and regional aquifer bore hole, LANL's bore hole video camera will be used when open hole conditions allow logging. | R-16 was cased down to 760 ft. Laboratory bore hole video camera, gamma, and induction tools to be used when open hole conditions in the vadose zone are favorable for logging. | In regional aquifer bore hole, run full array of contract geophysical logs to characterize moisture distribution and identify perched groundwater in the vadose zone and to characterize the hydraulic properties of saturated rocks in the regional aquifer. These logs will also be used select well screen depth. The suite and timing of geophysical logging will depend on bore hole conditions.<br>In core hole and regional aquifer bore hole, LANL's bore hole video camera will be used when open hole conditions allow logging. |
| Number of Well Screens | Up to 3 screens at locations selected based on productive zones in the regional aquifer. | One in the Puye Formation at the top of the regional zone of saturation. | Up to 2 screens in the regional aquifer: one in the lavas near the water table, one in the Totavi, and one in the Santa Fe. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-27 | Regional Well R-10 | Regional Well R-10a |
|---|---|---|---|
| Primary Purpose | Provide information about water quality in intermediate perched zones and in the regional aquifer downgradient of TAs-11, -16, and 49. The location for R-27 in the Hydrogeologic Workplan was at the confluence of Cañon de Valle and Water Canyon to detect HE from TA-16 sources. However, that location is technically infeasible, and it abuts sensitive spotted owl habitat. After several visits, including with NMED, the well was moved to its current location about 1 mile below the confluence of Cañon de Valle and Water Canyon. | R-10 is the deeper well in a pair of wells in lower Sandia Canyon, on San Ildefonso Pueblo intended to bound the extent of contaminants detected in R-12 and to further refine the understanding of the effects of pumping in the Buckman well field. The R-10 well pair will also test the conceptual model of contaminant transport from lower Pueblo Canyon to springs in the vicinity of White Rock.<br>R-10 is primarily a hydrology well and penetrates to depths sufficient to identify hydraulic responses to pumping at Buckman well field.<br>The Hydrogeologic Workplan included R-10 in upper Sandia Canyon to provide information about water quality in intermediate perched zones and in the regional aquifer downgradient of potential sources in Sandia Canyon. With the installation of wells in areas proximal to upper Sandia Canyon, no further hydrogeologic characterization of the regional aquifer is required in this area. The proposed location of R-10 has been moved to lower Sandia Canyon on San Ildefonso Pueblo land and it's designation changed to R-10. | R-10a is the shallower of a pair of wells in lower Sandia Canyon, on San Ildefonso Pueblo intended to bound the extent of contaminants detected in R-12 and to further refine the understanding of the effects of pumping in the Buckman well field. R-10a is primarily a monitoring well designed to collect water quality data near the top of the regional aquifer. |
| Projected Depth | R-27 will be drilled to approximately 1100 ft, penetrating 300 feet into the regional aquifer targeting more permeable sedimentary rocks below the lavas expected at the water table. If the drilling conditions are to difficult to reach this depth, the borehole will be drilled to far enough below the water table to install a single screen. | Approximately 1165 ft, approximately 500 feet into the regional aquifer targeting the high permeability units that may be preferential flow pathways. | 765 ft, approximately 100 feet below the top of the regional aquifer. |
| Geology | Determine if the lavas that are present are Cerros del Rio basalts or Tschicoma dacites.<br>Determine the presence and character of the Puye Formation.<br>Measure the thickness of the Cerro Toledo deposits. | To determine the stratigraphy in an area where no other data exist<br>Corroborate stratigraphy with what was observed in R-16 and R-12. | To determine the stratigraphy in an area where no other data exist<br>Corroborate stratigraphy with what was observed in R-16 and R-12. |
| Hydrology | To provide aquifer characteristics and water chemistry down gradient of firing and test sites, for improving the regional flow and transport model.<br>To measure the permeability of the regional aquifer at this location. | Determine if perched intermediate water zones exist in basalts of the vadose zone and what the quality of the water is.<br>Determine depth to regional groundwater in a poorly characterized area.<br>Determine the relationship of the water table to springs in White Rock Canyon.<br>Measure water quality in the regional aquifer.<br>Test the hypothesized flow path from Pueblo Canyon to the springs near White Rock.<br>Evaluate the influence of the Buckman well field on flow | Determine if perched intermediate water zones exist in basalts of the vadose zone and what the quality of the water is.<br>Determine depth to regional groundwater in a poorly characterized area.<br>Determine the relationship of the water table to springs in White Rock Canyon.<br>Measure water quality in the regional aquifer.<br>Test the hypothesized flow path from Pueblo Canyon to the springs near White Rock.<br>Evaluate the influence of the Buckman well field on flow |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-27 | Regional Well R-10 | Regional Well R-10a |
|---|---|---|---|
| | | directions, velocity, and contaminant transport. | directions, velocity, and contaminant transport. |
| Geochemistry | Water from the regional aquifer should be analyzed for the standard suite of analyses, HE, and plutonium. It is a likely candidate for C-14 analyses to measure the age of water at this location (pending a regional aquifer age dating plan, to be developed) | Determine water quality associated with high permeability zones in the deeper part of the regional aquifer. However, drilling to 500 feet below the regional aquifer water table will likely require drilling muds, so obtaining representative water samples is considered an secondary objective. Samples will be analyzed for tritium and other constituents that are not affected by residual drilling mud. | Determine water quality at the regional aquifer water table. |
| Vadose Zone Sampling | This is an area where surface water derived from Cañon de Valle and Water Canyon infiltrates the canyon floor. It important to determine if contaminants from upgradient sources are infiltrating the vadose zone beneath this wet canyon system. Core should be collected in the upper portion of the borehole and tested for moisture, anions, stable isotopes, barium, HE and radionuclide suite.<br>Collect water samples if perched water is encountered during drilling. | Cuttings will be collected every 5 feet to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization.<br>Collect water samples if perched water is encountered during drilling. | Cuttings will be collected every 5 feet to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization.<br>Collect water samples if perched water is encountered during drilling. |
| Core Needs | Core will be collected in a separate corehole to a depth of 300 ft and tested for moisture, anions, stable isotopes, barium, HE and radionuclide suite.<br>Cuttings will be collected every 5 feet in the regional aquifer well to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization. | No core will be collected. | No core will be collected. |
| Regional Aquifer Sampling | Collect screening water samples during drilling at the top of the regional aquifer.<br>Install well screen to collect water quality data for the regional aquifer. | Collect screening water samples during drilling at the top of the regional aquifer<br>Install well screens to collect water quality data for the deep screens. | Collect screening water samples during drilling at the top of the regional aquifer.<br>Install well screen to collect water quality data near the regional water table. |
| Hydraulic Testing | The well should be completed with a single screen in the regional aquifer, placed in the uppermost permeable rock unit. The permeability of the screen interval at this location will be estimated by hydrologic testing. Conduct slug test, single-step pumping test, or injection/straddle packer test in the screen completely below the regional water table. | Conduct slug test, single-step pumping test, or injection/straddle packer test in each of the screens. | Conduct slug test, single-step pumping test, or injection/straddle packer test in the screen completely below the regional water table. |
| Geophysical Testing | In regional aquifer bore hole, run full array of contract geophysical logs to characterize moisture distribution and identify perched groundwater in the vadose zone and to characterize the hydraulic properties of saturated rocks in the regional aquifer. These logs will also be used to select the well | A full array of contract geophysical logs to characterize moisture distribution and identify perched groundwater in the vadose zone and to characterize the hydraulic properties of saturated rocks in the regional aquifer. These logs will also be used to select well screen depths. The suite and timing of | Laboratory borehole video camera to be used when open hole conditions in the vadose zone are favorable for logging. The Laboratory induction tool will be used to identifying potential zones of perched groundwater. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-27 | Regional Well R-10 | Regional Well R-10a |
|---|---|---|---|
| | screen depth. The suite and timing of geophysical logging will depend on bore hole conditions.<br>In core hole and regional aquifer bore hole, LANL's bore hole video camera will be used when open hole conditions allow logging. | geophysical logging will depend on bore hole conditions. | |
| Number of Well Screens | One screen will be fully submerged in Tschicoma (?) lava near the top of the regional aquifer. If the lavas near the top of the aquifer have very low permeability, a second screen may be installed in more permeable rocks of the underlying sedimentary rock units. | Two regional aquifer well screens will target high permeability units that may be preferential flow paths. If possible, the upper screen will be located about 225 ft below the regional water table and the lower screen will be located about 450 ft below the water table. | One screen will be fully submerged just below the regional water table. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

| | Regional Well R-24 | Intermediate Well LAOI-3.2a | Intermediate Well LAOI-7 |
|---|---|---|---|
| Primary Purpose | R-24 is being installed to determine if perched intermediate water occurs beneath Bayo Canyon and to determine the water quality at the top of the regional aquifer. The Compliance Order on Consent includes a requirement to place a well in the regional aquifer in Bayo Canyon, at or near the site of former TA-10. This well will be designated R-24. The original R-24 site, located west of the Pajarito fault near Water Canyon, is no longer needed for hydrologic characterization. | The LAOI-3.2 well was installed in Feb. 2005 to provide information about potential impacts to the vadose zone downgradient of SWMUs at TA-21, TA-2, and TA-53. In particular, LAOI-3.2 was designed to investigate impacts to the vadose zone from releases of radioactive liquid effluent from the 21-011(k) outfall.<br>LAOI-3.2 was originally planned to be 300 ft deep to investigate the occurrence of possible perched water identified in the Puye Formation by a borehole video taken during the drilling of O-4. However, during coring operations, an upper perched zone was encountered from 140 to 163.5 ft (TD) in the Guaje Pumice Bed and the LAOI-3.2 well was installed.<br>LAOI-3.2a is a new well at the same location that will be drilled to the original target horizon in the Puye Formation to determine if a second perched groundwater zone is present in the. This well will help define the lateral extent of the deeper perched groundwater found in the Puye Formation at wells O-4 and R-6i. | The primary purpose of LAOI-7 is to define the western extent of perched groundwater found in basalt at R-9/R-9i. LAOI-7 will also help define the eastern extent of contaminant migration through the vadose zone in Los Alamos Canyon.<br>LAOI-7 is located near the R-8 well, between wells LAOI-4.5 and LAOI-6. LAOI-7 was originally proposed in the Los Alamos-Pueblo Canyon RFI Work Plan and is required by the NMED Order on Consent.<br>LAOI-7 will be cored to collect samples for contaminant and moisture profiles. A well will be installed if perched water is encountered; otherwise, LAOI-7 will be backfilled. |
| Projected Depth | 840 ft, about 100 feet into the regional aquifer. | LAOI-3.2a will be sited within 50 ft of LAOI-3.2, near the confluence of DP and Los Alamos Canyons. Based on depth of the perched zones at R-6i and O-4, the target depth is 300 ft or the top of Cerros del Rio basalt, whichever is encountered first.<br>LAOI-3.2a will be drilled without core to 160 ft. Core will be collected from 160 to TD, or refusal, to satisfy the original investigation objectives of determining the extent of vertical migration of contaminants through the vadose zone. | The target depth should extend through the Cerros del Rio basalt and 20 feet into the Puye Formation, a target depth of 350 ft, or to refusal. |
| Geology | To further refine the edge of the Cerros del Rio basalt field<br>Further evaluate the distribution of the pumiceous unit of the Puye Formation<br>Refine the dip, thickness, and distribution of the Miocene basalt | Little new geologic information will be gained because of the proximity of LAOI-3.2a to other deep wells; however, LAOI-3.2a will confirm stratigraphic contacts identified in the TW-3 and O-4 lithologic logs. | Little new geologic information will be gained because of the proximity of LAOI-7 to other deep wells; however, LAOI-7 will confirm stratigraphic contacts identified in the R-8 and R-9 lithologic logs. |
| Hydrology | Determine if perched intermediate water zones exist and what the quality of the water is.<br>Determine the regional aquifer water level and measure water quality in the regional aquifer. | LAOI-3.2a will identify the occurrences of perched intermediate groundwater in the Puye Formation, if present. | Define the western extent of perched groundwater found in basalt at R-9/R-9i, but absent in R-8.<br>Define the eastern extent of contaminant migration through the vadose zone in Los Alamos Canyon<br>R-8 had a perched zone in the Guaje Pumice Bed, but it drained before it could be sampled. Determine if an upper perched water (i.e., above the basalt) occurs at the LAOI-7 location. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

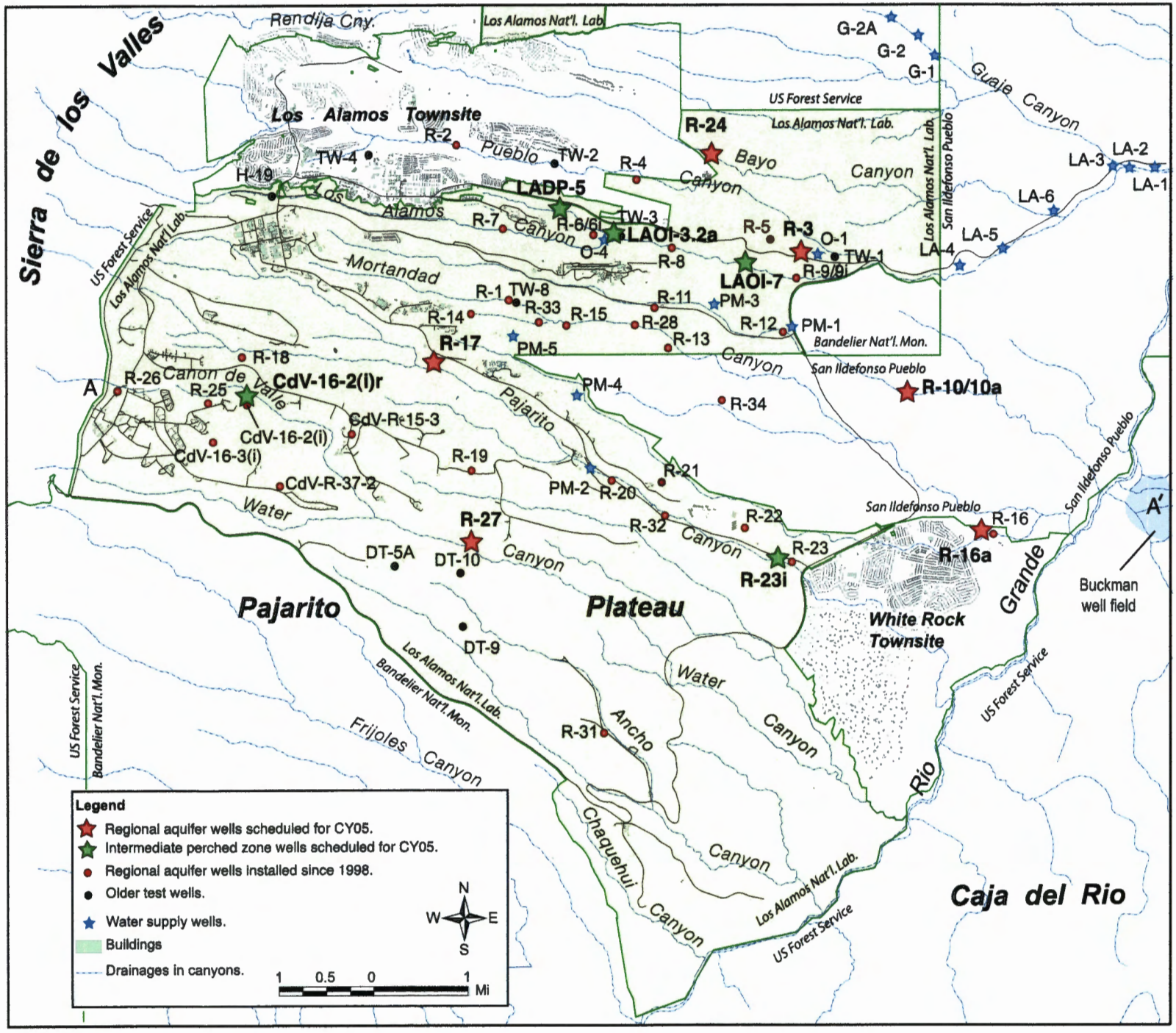
| | Regional Well R-24 | Intermediate Well LAOI-3.2a | Intermediate Well LAOI-7 |
|---|---|---|---|
| Geochemistry | Perched water (if present) and regional aquifer will be analyzed for Sr-90, the primary contaminant of concern at the former TA-10. | Core from LAOI-3.2 and LAOI-3.2a will constrain the location and rate of percolation from the vadose zone to the regional aquifer by determining the vertical distribution of moisture and contaminants. | The proposed location of LAOI-7 is near the downstream limit of alluvial groundwater that contains strontium-90. Contaminant profiles in core will determine the vertical extent of contaminant migration through the vadose zone. Analyze tritium migration pathway indicated by the presence of tritium in the R-9i perched zones. |
| Vadose Zone Sampling | There was a large inventory of Sr-90 released from septic tanks serving the TA-10 radiochemistry lab. The lab was producing lanthanide and Sr-90 was a by-product. The FUSRAP program removed contaminated soil and left a marker warning not to dig. Subsequently, near-surface Sr-90 soil contamination was defined by 93 boreholes | Core will be collected and analyze for moisture, anions, metals, radionuclides, and stable isotopes.<br>Water samples will be collected from perched water encountered beneath the Guaje Pumice Bed during drilling. | Core will be collected and analyze for moisture, anions, metals, radionuclides, and stable isotopes.<br>Collect water samples if perched water is encountered during drilling and install a well screened at the perched water interval. |
| Core Needs | A corehole will be cored 300 feet, or refusal. The core will be analyzed to measure moisture and contaminant profiles for Sr-90. | Core samples will be collected from 160 ft to core refusal (target 300 ft or top of basalt, whichever is encountered first) for moisture and contaminant analyses.<br>Cuttings (every 5 ft) will be used to determine stratigraphy and lithology below core refusal depth. | Continuous core will be collected to the target depth of 350 feet, or refusal. Analyze core for metals, anions, radionuclides, and moisture content.<br>Cuttings (every 5 ft) will be used to determine stratigraphy and lithology below core refusal depth. |
| Regional Aquifer Sampling | Collect screening water samples during drilling at the top of the regional aquifer<br>Install a fully-submerged well screen to collect water quality data near the top of the regional aquifer. | Not applicable | Not applicable |
| Hydraulic Testing | Conduct slug test, single-step pumping test, or injection/straddle packer test in the screened interval. | Pump and/or slug tests will be conducted if the well screen is completely below the perched water table. | Pump and/or slug tests will be conducted if the well screen is completely below the perched water table. |
| Geophysical Testing | In regional aquifer bore hole, run full array of contract geophysical logs to characterize moisture distribution and identify perched groundwater in the vadose zone and to characterize the hydraulic properties of saturated rocks in the regional aquifer. These logs will also be used to select the well screen depth. The suite and timing of geophysical logging will depend on bore hole conditions.<br>In core hole and regional aquifer bore hole, LANL's bore hole video camera will be used when open hole conditions allow logging. | The Laboratory's suite of tools (borehole video camera, gamma, and induction logs) will be used when borehole conditions are favorable for logging. | The Laboratory's suite of tools (borehole video camera, gamma, and induction logs) will be used when borehole conditions are favorable for logging. |
| Number of Well Screens | One screen near the top of the regional aquifer. | A single well screen will be installed if perched intermediate groundwater is encountered in the Puye Formation at LAOI-3.2a. A well has already been installed at LAOI-3.2 for perched water found in the Guaje Pumice Bed. | One screen if perched intermediate groundwater is encountered. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

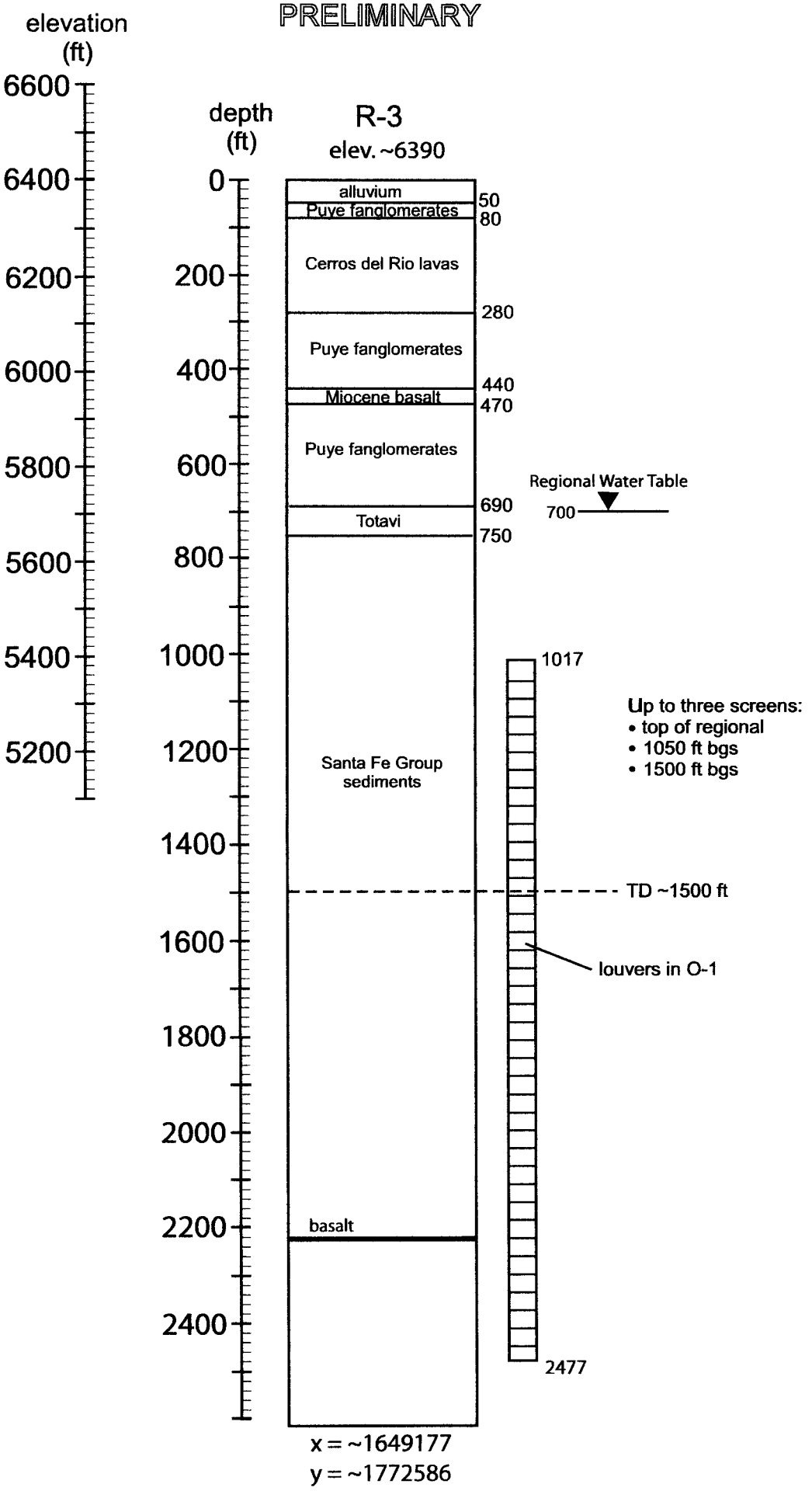
| | Intermediate Well LADP-5 | Intermediate Well R-23i | Intermediate Well CDV-16-2(i)r |
|---|---|---|---|
| Primary Purpose | LADP-5 is located in DP Canyon and is designed to determine the western extent of tritium-, nitrate-, and perchlorate-bearing perched groundwater that was recently discovered in R-6i.<br>At NMED's request, LADP-5 replaces intermediate well LAOI-1.5 in upper Los Alamos. | Well R-23i is being installed to sample possible intermediate perched groundwater encountered while drilling the R-23 regional aquifer well. The possible perched groundwater was detected outside the drill casing at a depth of ~470 feet in the Cerros del Rio basalts. However, the depth and thickness of the perched zone are very uncertain. | Re-drill CDV-16-2(i) due to dry hole conditions at well screens. Contractor to attempt recovery of casing for a limited period and DOE will recycle casing if successfully recovered. Re-drill replacement hole at offset distance to TD 900 feet.<br>Limited access to site. Requires security escort for crew. |
| Projected Depth | Approximately 650 ft. | R-23i will be drilled to the uppermost perched groundwater zone encountered. The maximum depth for R-23i will be 700 feet, the base of the lowermost of the interflow deposits within the basalt that could host perched groundwater. | Approximately 900 feet. |
| Geology | Due to the proximity to LADP-4 and R-6i, the geology at the site is sufficiently known. | Due to the proximity to R-23, the geology at the site is sufficiently known. | Due to the proximity to well CDV-16-2(i), the geology at the site is sufficiently known. |
| Hydrology | Determine if perched intermediate water zones exist and what the quality of the water is. | Determine if perched intermediate water zones exist and what the quality of the water is. | Install a well in the uppermost intermediate perched water zone. |
| Geochemistry | Determine water quality in perched intermediate zones (if present).<br>Core from LADP-5 will constrain the location and rate of percolation in the vadose zone from the former 0-11(k) outfall by determining the vertical distribution of moisture and contaminants. | Determine water quality in perched intermediate zones (if present). | Determine water quality in uppermost intermediate perched zone. |
| Vadose Zone Sampling | Core will be collected and analyze for moisture, anions, metals, radionuclides, and stable isotopes.<br>Water samples will be collected from perched water encountered beneath the Guaje Pumice Bed during drilling. | Cuttings will be collected every 5 feet to identify geologic contacts, describe rock characteristics, and provide samples for additional geologic characterization.<br>Collect water samples if perched water is encountered during drilling. | Not applicable. |
| Core Needs | Continuous core will be collected to a target depth of 350 feet, if possible. Analyze core for metals, anions, radionuclides, and moisture content.<br>Cuttings (every 5 ft) will be used to determine stratigraphy and lithology below core refusal depth. | No core will be collected. | Not applicable. |
| Regional Aquifer Sampling | Not applicable. | Collect screening water samples during drilling if perched water is encountered.<br>Install well screens to collect water quality data for the | Not applicable. |

# Attachment 1
# Preliminary Data Needs Matrix for CY05 Characterization Wells

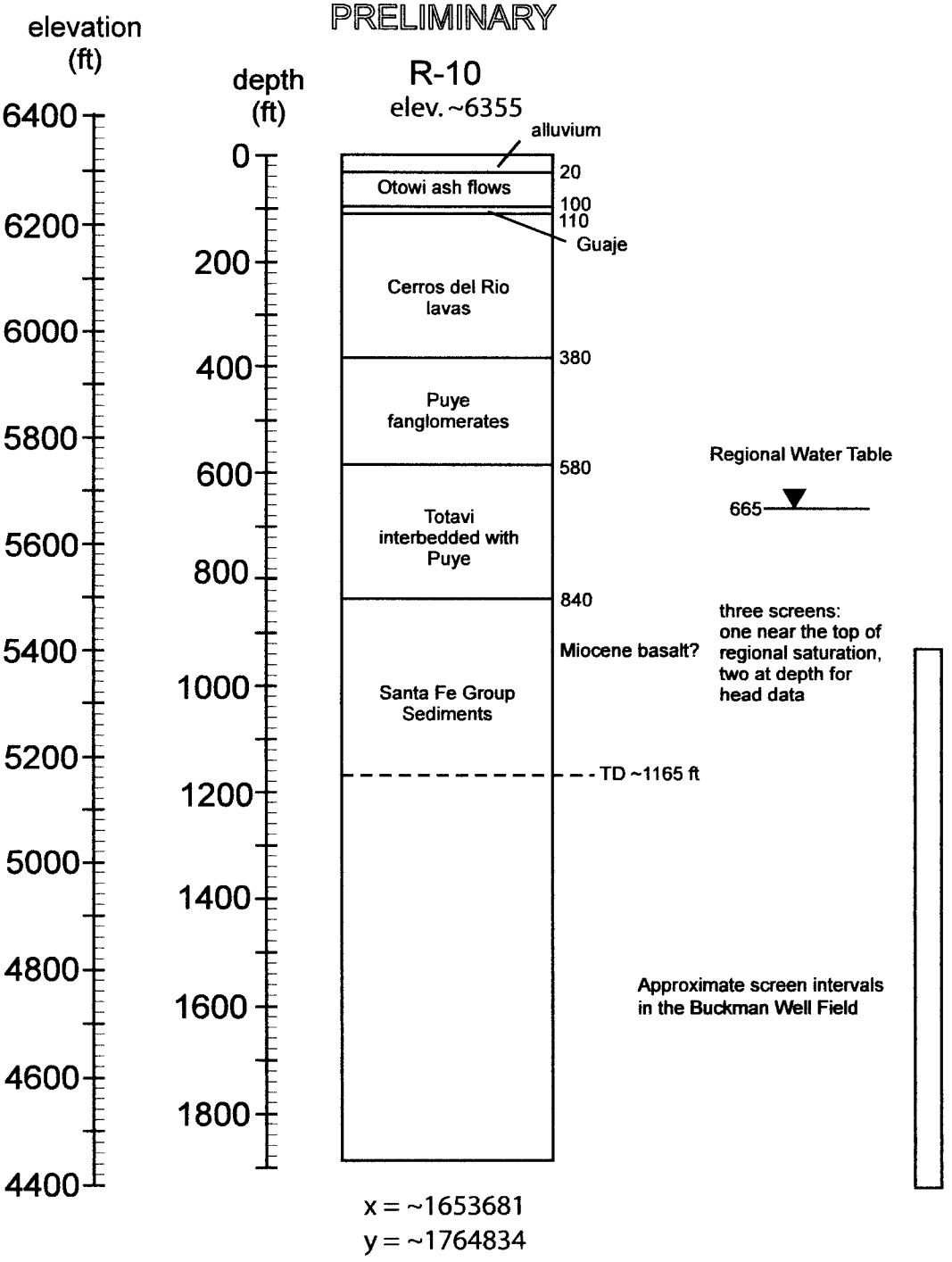
| | Intermediate Well LADP-5 | Intermediate Well R-23i | Intermediate Well CDV-16-2(i)r |
|---|---|---|---|
| | | intermediate perched water zone. | |
| Hydraulic Testing | Pump and/or slug tests will be conducted if the well screen is completely below the perched water table. | Pump and/or slug tests will be conducted if the well screen is completely below the perched water table. | Pump and/or slug tests will be conducted if the well screen is completely below the perched water table. |
| Geophysical Testing | Geophysical logs will be limited to induction and gamma logs. The borehole video will be used to identify perched zones. | Geophysical logs will be limited to induction and gamma logs. The borehole video will be used to identify perched zones. | Geophysical logs will be limited to induction and gamma logs. The borehole video will be used to identify perched zones. |
| Number of Well Screens | One screen if perched intermediate groundwater is encountered. | One screen if perched intermediate groundwater is encountered. | One screen if perched intermediate groundwater is encountered. |


Sierra de los Valles
Rendija Cny.
Los Alamos Nat'l. Lab.
G-2A
G-2
G-1
Guaje Canyon
US Forest Service
Los Alamos Townsite
R-2
Pueblo
TW-2
R-4
R-24
Bayo
Canyon
Los Alamos Nat'l. Lab.
San Ildefonso Pueblo
LA-2
LA-3
LA-1
LA-6
LA-5
LA-4
TW-4
H-19
LADP-5
Los Alamos
R-7
Canyon
R-6/6i
TW-3
LAOI-3.2a
R-5
R-3
O-1
TW-1
R-9/9i
O-4
R-8
LAOI-7
Mortandad
R-1
TW-8
R-33
R-15
R-11
PM-3
R-14
R-28
R-12
PM-1
Bandelier Nat'l. Mon.
R-17
PM-5
R-13
R-18
R-26
Canon de Valle
CdV-16-2(i)r
R-25
PM-4
R-34
R-10/10a
Pajarito
CdV-16-2(i)
CdV-R-15-3
CdV-16-3(i)
R-19
R-21
CdV-R-37-2
PM-2
R-20
Water
R-27
R-32
R-22
R-16
R-16a
R-23
R-23i
DT-5A
DT-10
Canyon
Pajarito
Plateau
White Rock
Townsite
Grande
Rio
Buckman
well field
A
A'
DT-9
Los Alamos Nat'l. Lab.
Bandelier Nat'l. Mon.
US Forest Service
Water
Canyon
R-31
Ancho
Frijoles Canyon
Chaquehui Canyon
Caja del Rio
Legend
Regional aquifer wells scheduled for CY05.
Intermediate perched zone wells scheduled for CY05.
Regional aquifer wells installed since 1998.
Older test wells.
Water supply wells.
Buildings
Drainages in canyons.
N
W
E
S
1 0.5 0 1 Mi

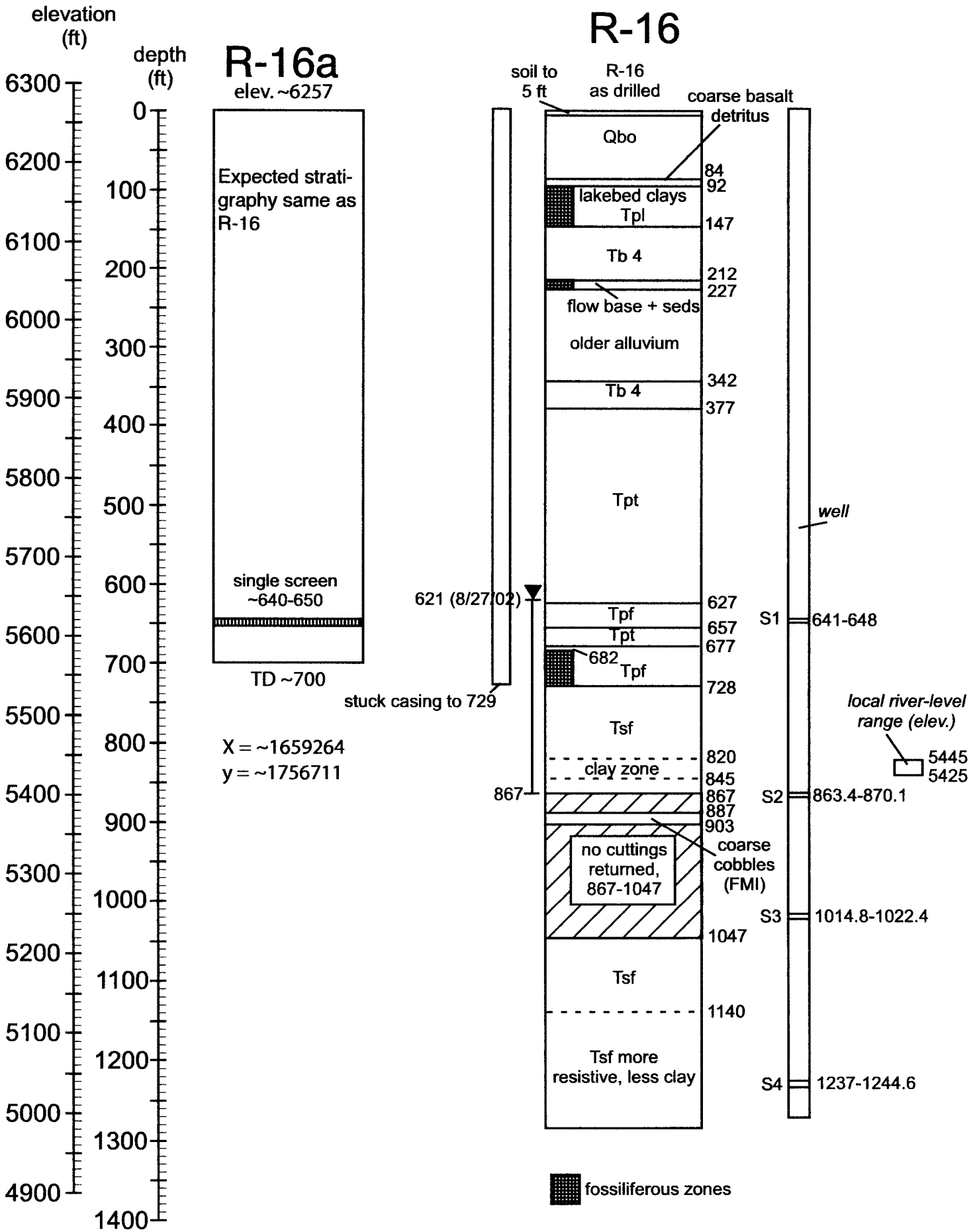
PRELIMINARY

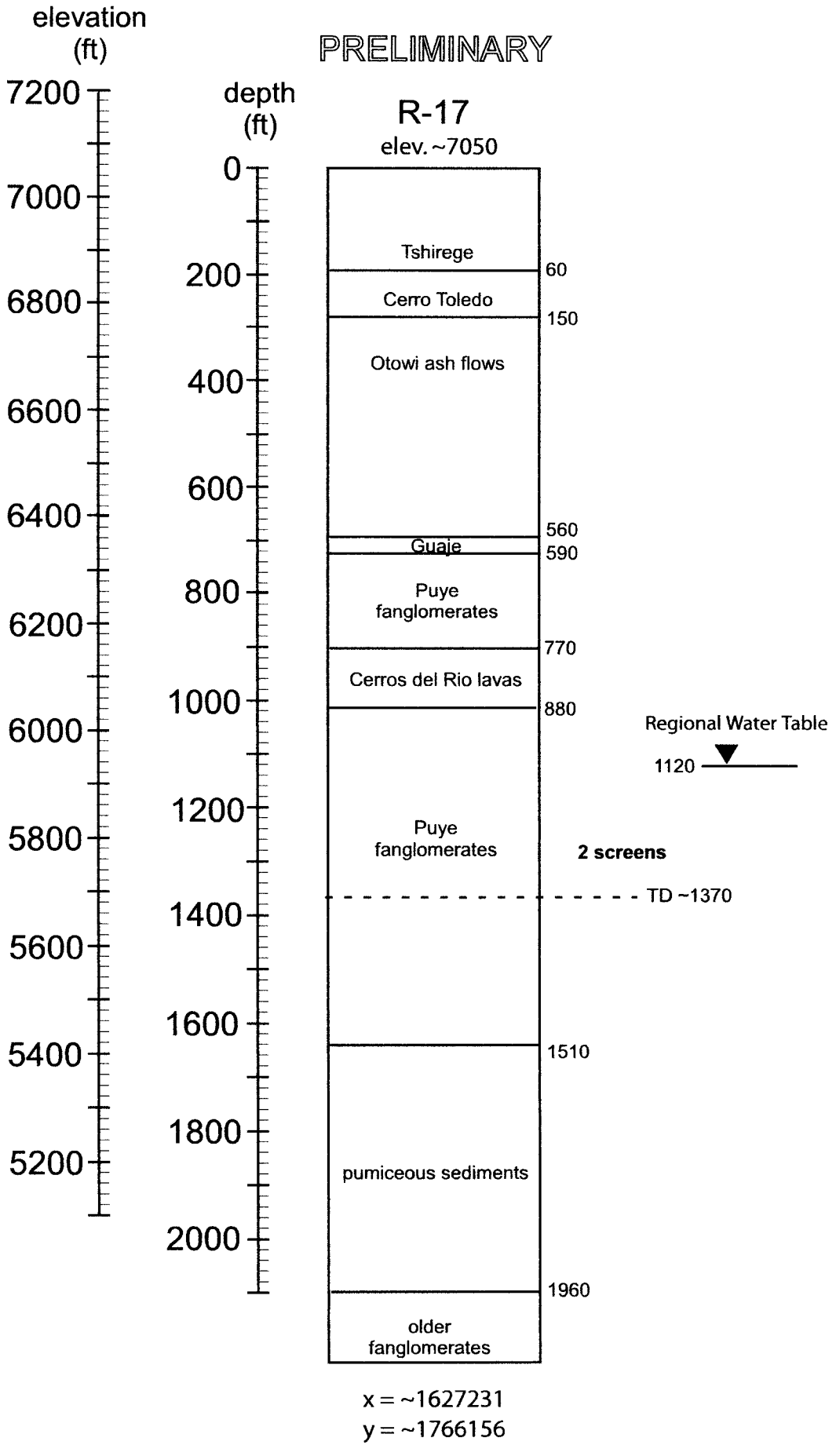


PRELIMINARY

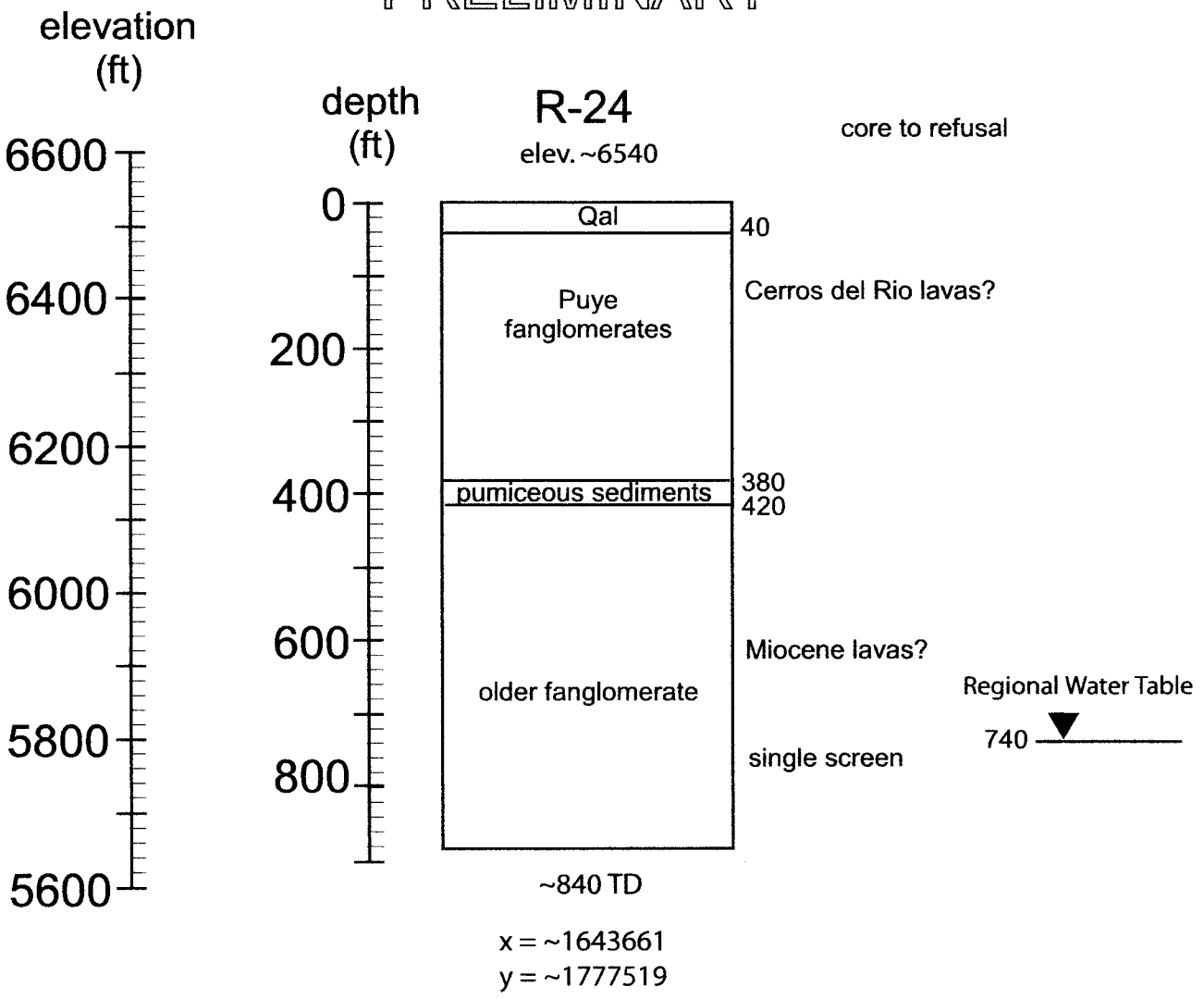


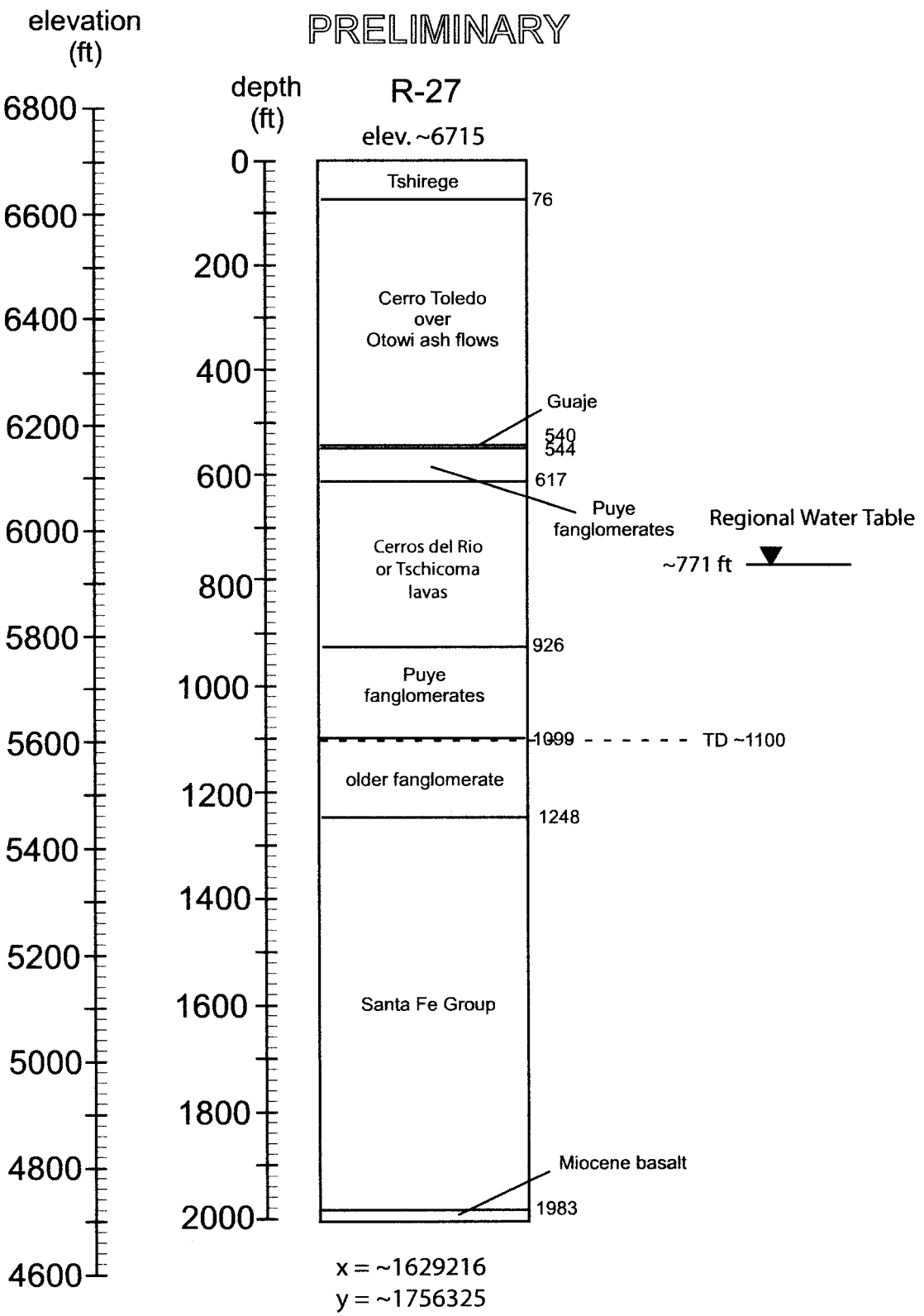

x = ~1653681
y = ~1764834

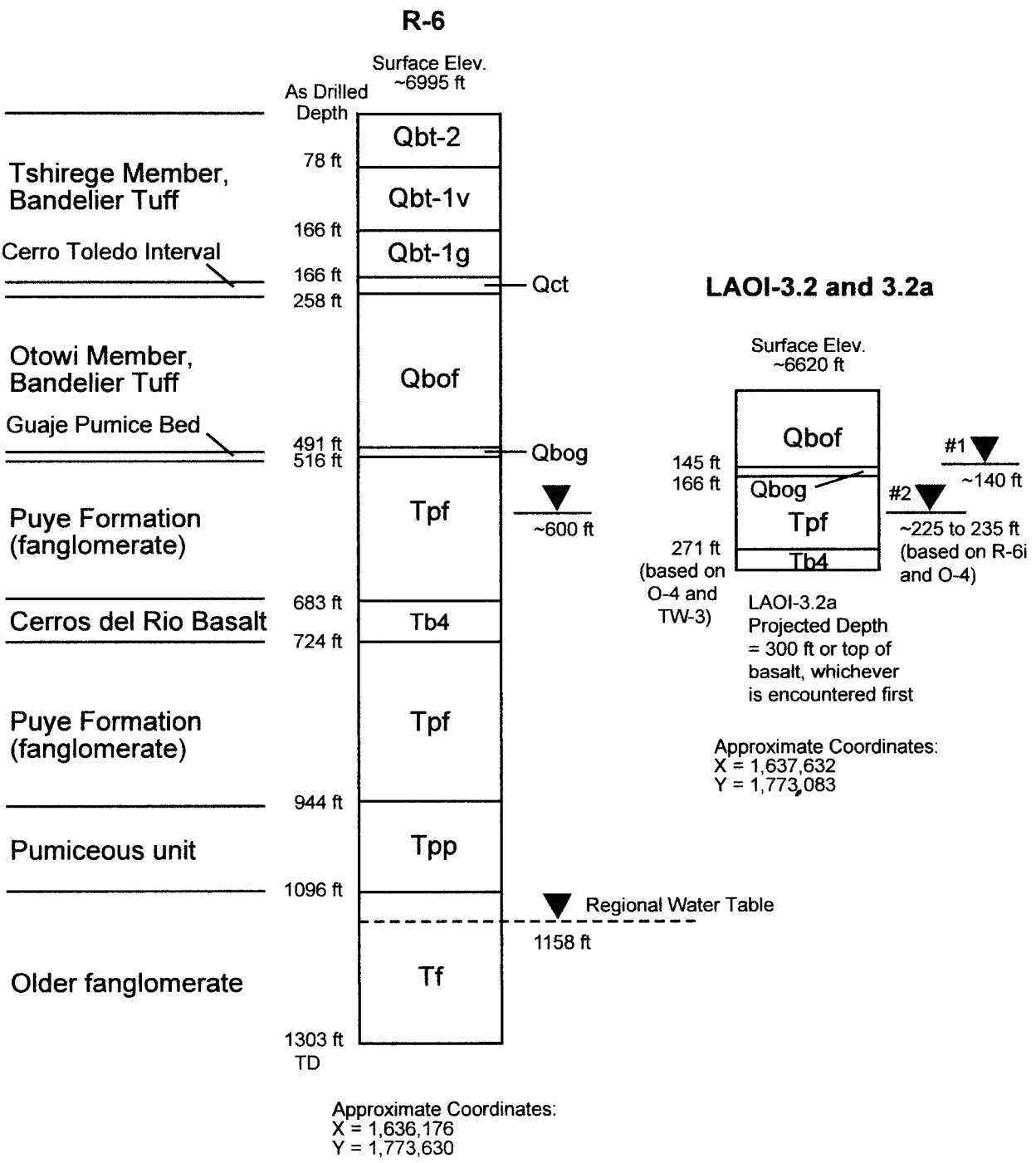

elevation (ft)
depth (ft)
6300
6200
6100
6000
5900
5800
5700
5600
5500
5400
5300
5200
5100
5000
4900
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
R-16a
elev. ~6257
Expected strati-graphy same as R-16
single screen ~640-650
TD ~700
X = ~1659264
y = ~1756711
R-16
soil to 5 ft
R-16 as drilled
coarse basalt detritus
Qbo
84
92
lakebed clays Tpl
147
Tb 4
212
227
flow base + seds
older alluvium
342
Tb 4
377
Tpt
621 (8/27/02)
627
Tpf
657
Tpt
677
682
Tpf
728
stuck casing to 729
Tsf
820
clay zone
845
867
867
887
903
no cuttings returned, 867-1047
coarse cobbles (FMI)
1047
Tsf
1140
Tsf more resistive, less clay
well
S1
641-648
local river-level range (elev.)
5445
5425
S2
863.4-870.1
S3
1014.8-1022.4
S4
1237-1244.6
fossiliferous zones


elevation
(ft)
PRELIMINARY
depth
(ft)
R-17
elev. ~7050
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Tshirege
60
Cerro Toledo
150
Otowi ash flows
560
Guaje
590
Puye
fanglomerates
770
Cerros del Rio lavas
880
Puye
fanglomerates
2 screens
TD ~1370
1510
pumiceous sediments
1960
older
fanglomerates
Regional Water Table
1120
x = ~1627231
y = ~1766156

PRELIMINARY

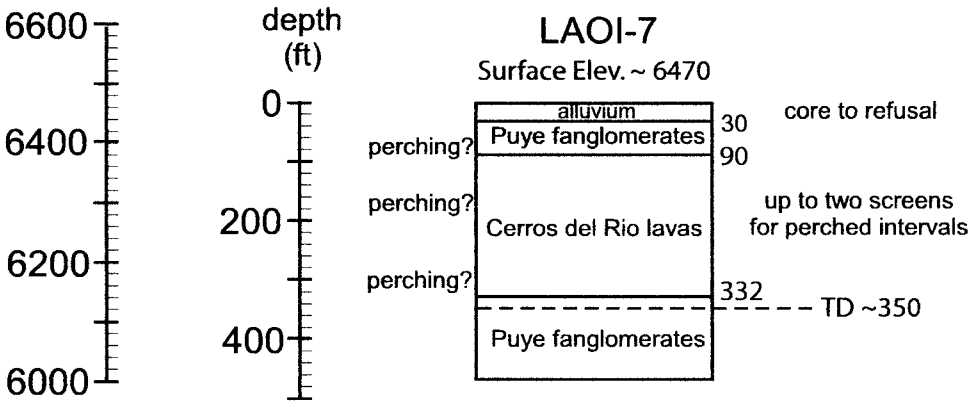



PRELIMINARY
elevation (ft)
depth (ft)
R-27
elev. ~6715
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Tshirege
76
Cerro Toledo over Otowi ash flows
Guaje
540
544
617
Puye fanglomerates
Regional Water Table
~771 ft
Cerros del Rio or Tschicoma lavas
926
Puye fanglomerates
1099
TD ~1100
older fanglomerate
1248
Santa Fe Group
Miocene basalt
1983
x = ~1629216
y = ~1756325



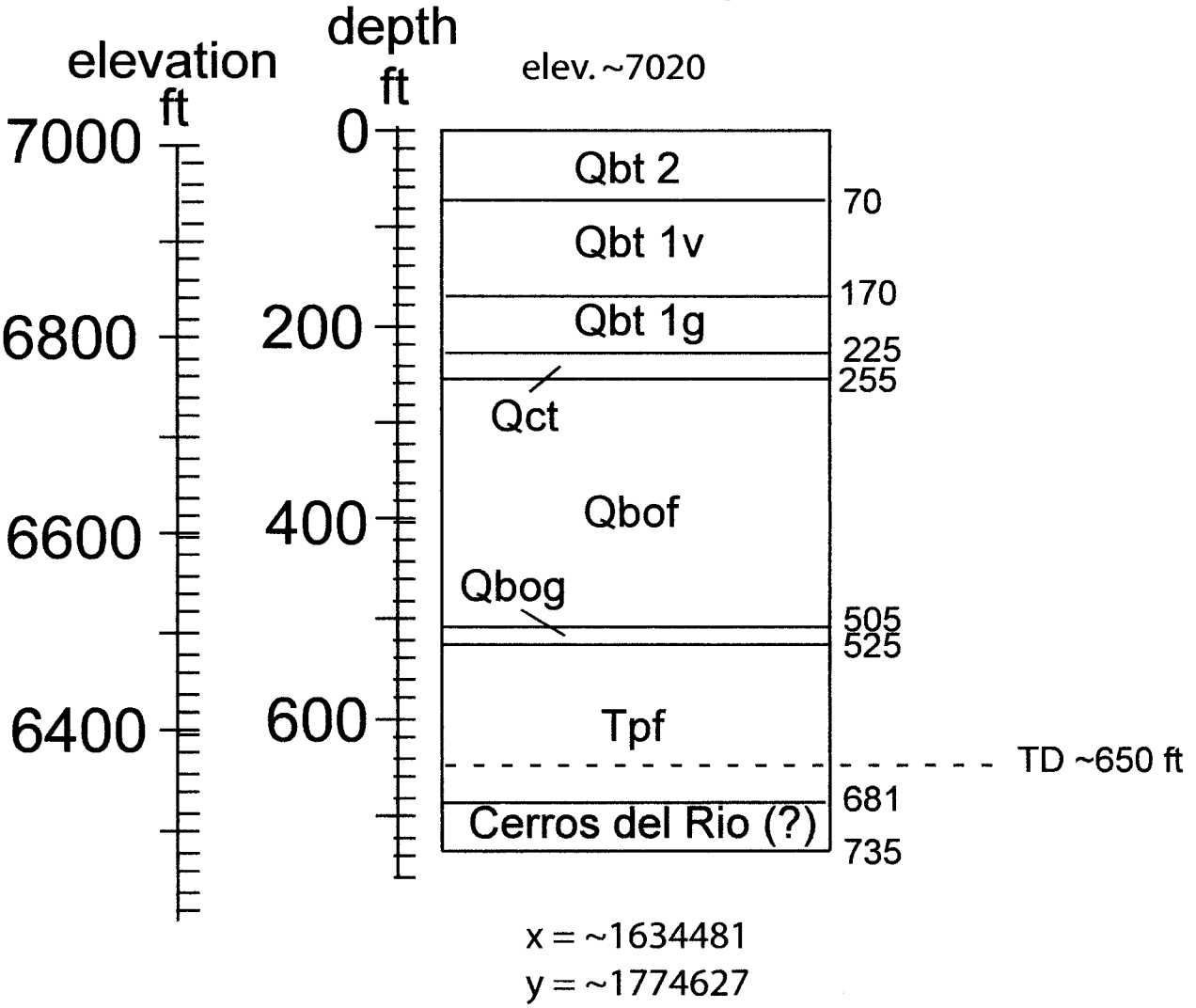

*Note:* Predicted geology based on Otowi-4 geologic log and outcrop data.

PRELIMINARY



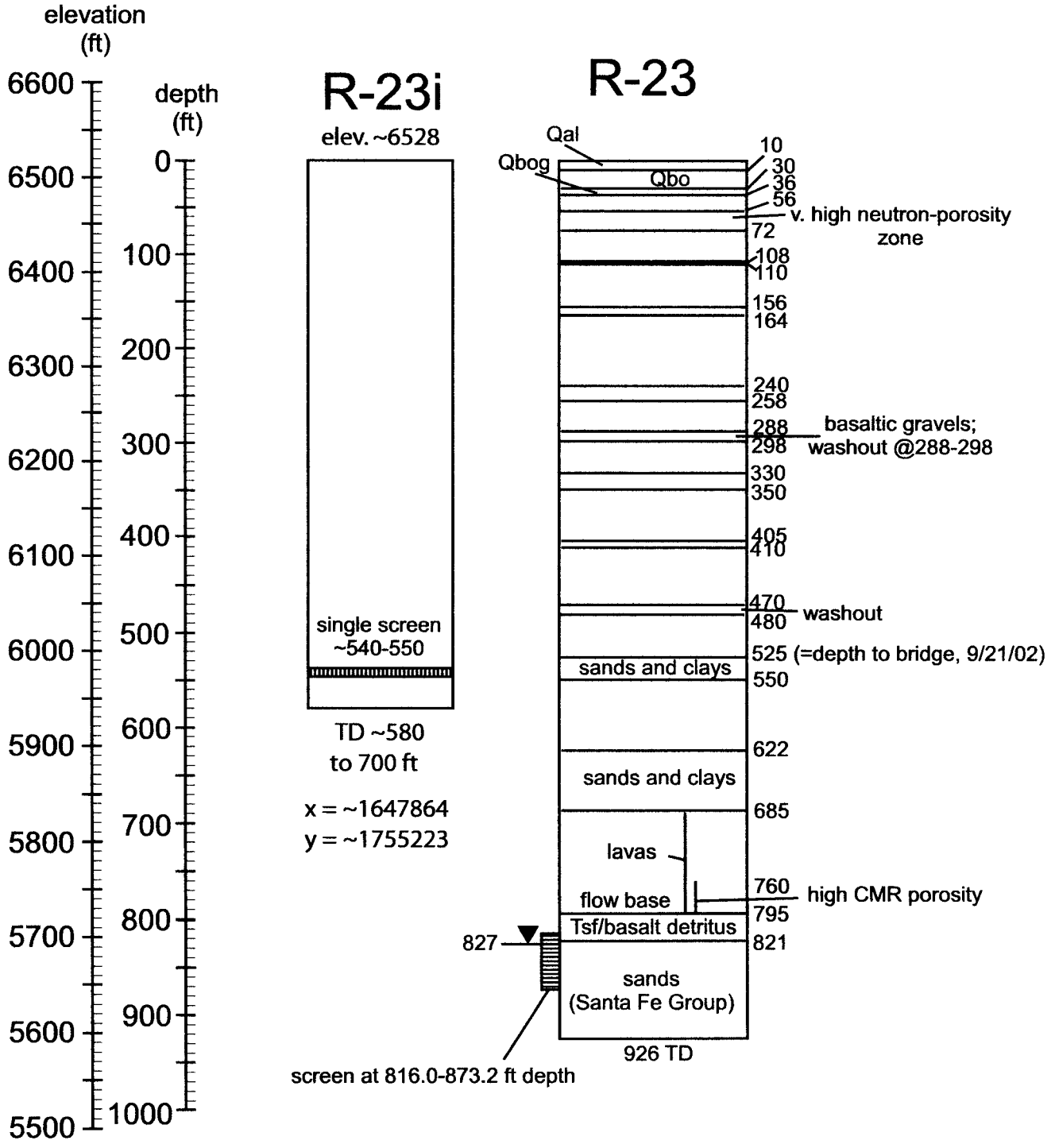
PRELIMINARY

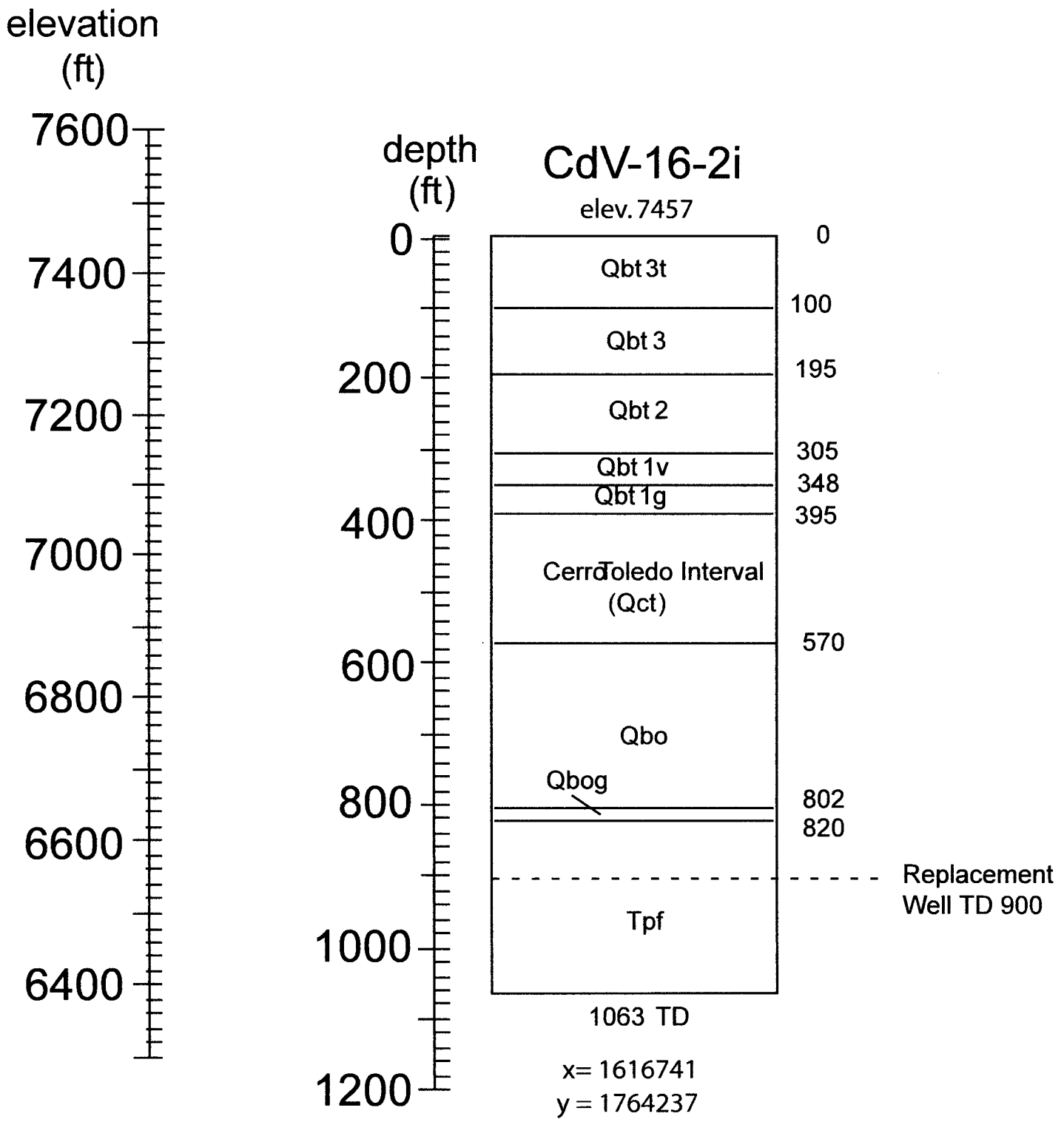
# LADP-5




x = ~1634481

y = ~1774627


elevation (ft)
depth (ft)
6600
6500
6400
6300
6200
6100
6000
5900
5800
5700
5600
5500
0
100
200
300
400
500
600
700
800
900
1000
R-23i
elev. ~6528
single screen ~540-550
TD ~580 to 700 ft
x = ~1647864
y = ~1755223
R-23
Qal
Qbog
Qbo
10
30
36
56
v. high neutron-porosity zone
72
108
110
156
164
240
258
288
298
basaltic gravels; washout @288-298
330
350
405
410
470
480
washout
525 (=depth to bridge, 9/21/02)
sands and clays
550
622
sands and clays
685
lavas
flow base
760
high CMR porosity
795
Tsf/basalt detritus
821
827
sands (Santa Fe Group)
926 TD
screen at 816.0-873.2 ft depth


elevation
(ft)
7600
7400
7200
7000
6800
6600
6400
depth
(ft)
0
200
400
600
800
1000
1200
CdV-16-2i
elev. 7457
Qbt 3t
Qbt 3
Qbt 2
Qbt 1v
Qbt 1g
Cerro Toledo Interval
(Qct)
Qbo
Qbog
Tpf
0
100
195
305
348
395
570
802
820
Replacement
Well TD 900
1063 TD
x= 1616741
y = 1764237