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Hydrogeologic Site Atlas, LAUR-09-3763.
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UNCLASSIFIED

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Conceptual Models of Vadose Zone Vadose Zone
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Groundwater Level Status Report for 2010
Los Alamos National Laboratory
The four most recent reports in this unclassified series are LA-14331-PR, LA-14358-PR, and LA-14397-PR, LA-14416-PR.

Edited by Hector Hinojosa, Group IRM-CAS.
Groundwater Level Status Report for 2010
Los Alamos National Laboratory

Richard J. Koch
Sarah Schmeer
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March 2011

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- 18-BG-1
- 18-MW-8
- 18-MW-9
- 18-MW-11
- 18-MW-18
- 3MAO-2
- 39-UM-3
- 39-DM-6
- APCO-1
- CDBO-1
- CDBO-2
- CDBO-3
- CDBO-4
- CDBO-5
- CDBO-6
- CDBO-7
- CDBO-8
- CDBO-9
- CDV-16-02655
- CDV-16-02656
- CDV-16-02657
- CDV-16-02658
- CDV-16-02659
- CDV-16-611921
- CDV-16-611923
- CDV-16-611925
- CDV-16-611929
- CDV-16-611930
- CDV-16-611931
- CDV-16-611938
- FCO-1
- FLC-16-25278
- FLC-16-25279
- FLC-16-25280
- LAO-B
- LAO-0.3
- LAO-0.6
- LAO-1
- LAO-1.6G
- LAO-1.8
- LAO-2
- LAO-3A
- LAO-4.5C
- LAO-5
- LAO-6
- LAO-6A

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5.29
5.44
5.42
5.34
5.32
5.31
5.30
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5.23
5.22
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5.10
5.08
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Groundwater Level Status Report for 2010
Los Alamos National Laboratory

by
Richard J. Koch and Sarah Schmeer

Abstract
The status of groundwater level monitoring at Los Alamos National Laboratory in 2010 is provided in this report. This report summarizes groundwater level data for 194 monitoring wells, including 63 regional aquifer wells (including 10 regional/intermediate wells), 34 intermediate wells, 97 alluvial wells, and 12 water supply wells. Pressure transducers were installed in 162 monitoring wells for continuous monitoring of groundwater levels. Time-series hydrographs of groundwater level data are presented along with pertinent construction and location information for each well. The report also summarizes the groundwater temperatures recorded in intermediate and regional aquifer monitoring wells and seasonal responses to snowmelt runoff observed in intermediate wells.

1.0 Introduction
This report presents and describes groundwater level data obtained by Los Alamos National Laboratory (LANL) during Fiscal Year (FY) 2010 to provide regulatory compliance and to provide other programs at LANL with groundwater level data as a resource for groundwater modeling and data assessment. The Groundwater Level Monitoring (GWLM) Project was instituted in 2005 to meet New Mexico Environment Department Compliance Order on Consent (Consent Order) requirements to collect groundwater level data.

During 2010, 63 regional aquifer monitoring wells containing 106 regional aquifer screens, 30 intermediate wells, and 10 intermediate/regional monitoring wells comprising 57 intermediate screens, 97 alluvial wells, and 12 Los Alamos County (LAC) water supply wells were monitored for groundwater levels. Ten of the multiple completion regional aquifer wells monitored one or more intermediate zones; however, at least one intermediate zone was dry in seven of these wells. Six of the multiple completion regional aquifer wells also monitored intermediate groundwater levels.

Pressure transducers were installed in 61 regional aquifer wells and 30 intermediate wells; periodic manual measurements were obtained from four intermediate wells, which are typically dry and are monitored annually. Transducers were installed in 92 alluvial wells during 2010 and five alluvial wells were monitored with periodic manual measurements. Transducers have been installed in all 12 LAC water supply wells through the cooperation and efforts of the LAC Utilities Department personnel.

This report includes groundwater level data obtained during FY 2010 (October 1, 2009, through September 30, 2010) and, where available, historical data and data obtained after September 30, 2010. The groundwater level data are presented in time-series hydrographs to provide a comprehensive representation of the groundwater level characteristics, to the extent possible with available data. For the alluvial wells, the first hydrograph for each well represents the entire period of record, while the second hydrograph represents the most recent two or three years of data to provide better representation of recent and seasonal changes.
2.0 Description of Groundwater Level Data

The GWLM Project at LANL is conducted under the Quality Assurance Project Plan (QAPP) for Groundwater Level Monitoring (LANL 2006) to assure the quality of groundwater level data. The QAPP contains the work processes and the data quality objectives utilized in the GWLM Project.

Groundwater level data were collected during 2010 according to the criteria outlined in the 2010 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2010). Two types of groundwater level data were collected:

- manual groundwater level measurements were obtained in monitoring wells, supply wells, and boreholes and
- pressure transducers were used to measure groundwater levels in monitoring wells and supply wells.

Manual groundwater level measurements were obtained according to Environmental Program Directorate (EPD) standard operating procedure (SOP) 5223 (formerly ENV-SOP-202), Manual Groundwater Level Measurements. Transducer measurements were obtained according to EPD SOP 5227 (formerly ENV-SOP-201), Pressure Transducer Installation, Removal, and Maintenance, and EPD SOP 5226 (formerly ENV-WQH-SOP-064), Westbay® Pressure Transducer Installation, Removal, and Maintenance. Groundwater level data obtained both manually and with pressure transducers were reviewed and validated according to EPD SOP 5230 (formerly ENV-WQH-SOP-062), Groundwater Level Data Processing, Review, and Validation.

Wells installed with pressure transducers had measurements collected at least hourly. Where possible, manual groundwater level measurements were obtained at least semi-annually to provide quality control for the transducer measurements. In the following sections, both manual measurements and transducer measurements are shown on the time-series hydrographs. Because hourly transducer measurements are too voluminous to reproduce for most hydrographs, mean daily groundwater levels are shown on most hydrographs in this report. Some monitoring wells have significant drawdown when pumped during sampling events. Because pumping of the monitoring wells for sampling usually occurs over several hours, the mean daily water level value will not usually portray the full amount of drawdown experienced during pumping of a well. For this reason, mean daily water level data are not usually appropriate for determining well characteristics such as specific capacity, etc.

Transducers that measure pressure head in wells typically have a measurement precision of ±0.1% of the full-scale measurement capability. Thus, typical measurement accuracy for a 100-psi transducer is 0.23 ft, and for a 500-psi transducer is 1.2 ft. The higher-pressure-rated transducers are required in the deeper Westbay® installations where higher water pressures are encountered. Most shallow wells and deep wells not installed with the Westbay® sampling system are equipped with 30-psi transducers, with a measurement accuracy of 0.07 ft. A few of the shallow alluvial wells are equipped with 15-psi transducers. Manual groundwater level measurements typically have an accuracy of approximately 0.1 ft per 100 ft of measurement (0.1%).

From 2000 through 2004, groundwater level data obtained during groundwater sampling of Westbay® wells was from a 1000-psi-rated transducer that had an accuracy of about ±2.3 ft. In 2005 new sampling transducers with a 500-psi rating were obtained, which have an accuracy of about 1.2 ft. The higher accuracy of the new Westbay® sampling transducers is the cause for the apparent water level shift for sampling water levels in mid 2005, as observed on many of the accompanying hydrographs for Westbay® wells. Similarly, the apparent scatter of sampling water levels on hydrographs from Westbay® wells is the result of the higher-pressure-rated and less accurate transducers that are used for sampling.

In the following sections, acronyms used to describe groundwater level data include...
3.0 Groundwater Level Data from Regional Aquifer Wells

Figure 3-1 shows the locations of the regional aquifer monitoring wells and water supply wells in the vicinity of LANL. Table 3-1 lists the regional aquifer monitoring wells that were monitored for groundwater levels in 2010. Screen intervals and port depths for each well are shown in subsequent sections.

The Appendix B table lists the mean annual water level for 2010 for each well screen located at the top of the regional aquifer. Figure 3-1 also shows the mean annual regional aquifer groundwater elevation for monitoring wells and the mean annual non-pumping water level for supply wells. Appendix C Table C-1 summarizes the transient responses observed in monitoring wells that result from supply well pumping at Los Alamos.

In the following sections reference is made to the barometric efficiency of some monitoring wells. Barometric efficiency is defined as the ratio of the water level change observed in a well divided by the concurrent atmospheric pressure change, expressed as a percentage. For a given change in atmospheric pressure, if the water in a well responds by an equal amount, the well is said to have 100% barometric efficiency; however, this type of response by the water in the well can occur only when the aquifer adjacent to the well does not experience the atmospheric pressure change. Thus, a well with a 100% barometric efficiency is installed into an aquifer that does not experience the atmospheric pressure fluctuations.
Figure 3-1. Regional aquifer monitoring wells and supply wells.
Groundwater Level Status Report

-

March 2011

Table 3 1 L oca f ion I nf ormaf ion f or
Well Name

CdV-R-15-3
CdV-R-37-2
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-10a
R-11
R-13
R-14
R-15
R-16
R-16r
R-17
R-18
R-19
R-20
R-21
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R-27
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R-35a
R-35b
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R-37
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R-40
R-41
R-42
R-43
R-44
R-45
R-46
R-48
R-49
R-50
R-51
R-52
R-53
R-54
R-55
R-56
R-57
R-60
Test Well 3
Test Well DT-10
Test Well DT-5A
Test Well DT-9

LA-14437-PR

Date
Completed

9/24/2000
8/1/2003
3/12/2004
10/28/2003
6/21/2010
1/6/2004
6/19/2001
1214/2004
2/26/2001
4/22/2002
10/18/1999
10/5/2005
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1/5/2009
3/19/2009
8/27/2008
10/17/2008
1/15/2009
1/24/2009
212612009
9/26/2009
6/1/2009
2/13/2010
2/8/2010
4/5/2010
3/29/2010
1/29/2010
8/25/2010
7/19/2010
6/8/2010
10/18/2010
11/20/1949
3/13/1960
1/25/1960
2/19/1960

Completed
Depth (ft)

Reg1ona IAqui"fer Mom"tormg Wells
Easting (ft)

1675.0
1587.3
1080.1
943.3
1006.8
840.0
884.0
1252.0
977.0
850.0
758.0
1079.0
706.0
901.7
1029.4
1315.6
1030.6
1276.7
631.4
1140.9
1405.0
1877.4
1353.3
941.4
1472.9
886.3
861.0
1934.7
1479.0
878.7
980.3
1191.8
1171.8
1077.7
1002.0
1126.0
920.7
1086.2
872.2
803.7
1068.8
853.4
875.6
895.0
997.1
973.5
990.4
1016.0
1016.0
1383.8
1540.0
949.3
1217.5
1046.1
1128.7
1001.9
936.0
1021.0
1078.8
1013.8
1360.9
815.0
1408.0
1819.5
1501.0

5

1623221.00
1619218.96
1632354.13
1629519.57
1649037.61
1639287.98
1646707.00
1636011.02
1631666.00
1641139.01
1648236.50
1653465.92
1653411.63
1639959.31
1640991.66
1629855.01
1635308.60
1659283.61
1659289.39
1627795.96
1617254.37
1629918.40
1637835.40
1641284.17
1645324.40
1647913.60
1643554.46
1615178.42
1610267.23
1629230.52
1638988.73
1626779.91
1626287.74
1637353.80
1640797.67
1633401.71
1643595.82
1642326.53
1642234.75
1643907.07
1637828.13
1640998.66
1644995.98
1636628.23
1645217.12
1637709.96
1637236.21
1640061.34
1640249.62
1627433.85
1615977.33
1643900.90
1638666.13
1634685.79
1636988.93
1640109.61
1638803.48
1647083.52
1640507.31
1645109.00
1626734.38
1637727.50
1628988.50
1625310.00
1628993.62

Northing (ft)

1762349.20
1759327.28
1769600.84
1778281.56
1772598.75
1776530.28
1773063.00
1773884.07
1773653.00
1772554.62
1770847.10
1764766.46
1764782.29
1769353.57
1766994.17
1768953.12
1768272.50
1756710.97
1756730.68
1765861.23
1766545.47
1760252.10
1759694.51
1759143.06
1757111.10
1755165.37
1777591.35
1764060.50
1764721.12
1756296.28
1768358.57
1755383.32
1753921.18
1745648.40
1757730.25
1768532.65
1764028.77
1769310.85
1769322.98
1767736.64
1762616.71
1760235.07
1756488.99
1760801.14
1757745.55
1768775.73
1769614.70
1767109.85
1768017.72
1768183.02
1762436.24
1756401.85
1767087.32
1761983.36
1762825.71
1759860.57
1759602.87
1757272.15
1759044.73
1757337.71
1768514.75
1773138.12
1754448.75
1754789.37
1751492.62

Surface
8evation (ft)

7258.90
7330.60
6881.21
6770.38
6395.88
6577.49
6472.60
6995.80
6779.20
6544.74
6382.80
6362.31
6363.74
6673.72
6673.05
7062.08
6820.00
6256.87
6256.97
6921.51
7404.83
7066.30
6694.35
6656.24
6650.50
6527.75
6547.38
7516.10
7641.69
6713.72
6728.61
7100.75
7073.84
6362.50
6637.63
6853.33
6629.99
6623.06
6625.21
6591.37
6870.59
6668.58
6580.86
6719.24
6660.53
6759.02
6732.65
6714.91
6704.02
7213.33
7486.78
6584.54
6904.11
6762.17
6883.04
6689.98
6679.85
6533.86
6780.88
6648.04
7228.17
6626.90
7019.90
7143.86
6935.00


3.1 CdV-R-15-3

Location: CdV-R-15-3 is located on a mesa between upper Three-Mile Canyon and Cañon de Valle within the Cañon de Valle watershed.

Completion Type: Multiple completion, three screens in intermediate vadose zones, three screens in regional zones.

Period of Record: Westbay® installed September 17, 2000; transducers installed March 1, 2001; intermittent data to August 2, 2010, when the transducers were removed in preparation for Westbay® system removal and well testing. The transducers were removed for several months in 2009 to rebuild the cables.

Remarks: The three intermediate screens have been dry since well installation. A transducer was never installed at screen 2. Transducers monitoring dry screens 1 and 3 were removed in January 2006. Regional screens 4 and 5 have similar heads; screen 6 head is 35 ft lower. Westbay® monitoring port MP6B has not been operational since the system was installed (Kopp et al. 2002, p. 38). Six ft of water appeared in the screen 3 sump at port MP3C October 2006; sump water still present in 2010. Screens 4 and 5 do not indicate a water level response to atmospheric pressure fluctuations; screen 6 indicates a 30% response to atmospheric pressure.

<table>
<thead>
<tr>
<th>Measurement and Sampling Ports in CDV-R-15-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note: CdV-R-15-3 Brass Cap Ground Elevation: 7258.9 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports
3.2 CdV-R-37-2

Location: CdV-R-37-2 is located on a mesa between Cañon de Valle and Water Canyon at Technical Area (TA) 37 in the Water Canyon watershed.

Completion Type: Multiple completion, one screen in an intermediate vadose zone, three screens in regional zones.

Period of Record: Westbay® installed October 8, 2001; transducers installed August 8, 2003; data to August 09, 2010, when the transducers were removed in preparation for Westbay® system removal and well testing.

Remarks: The intermediate screen has been dry since well installation; the transducer at this screen was removed in January 2006. The three regional screens have similar heads that show downward gradient of about 1 ft between each screen. The screens do not indicate a water level response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Geo Port</th>
<th>Geo Unit Code</th>
<th>Port Depth (ft)</th>
<th>Port Elev (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>914.4</td>
<td>939.6</td>
<td>6416.2</td>
<td>6391.1</td>
<td>25.1</td>
<td>I</td>
<td>Tp</td>
<td>MP1A 934.9</td>
<td>6395.7</td>
<td>4.8</td>
<td>Within Screen (Dry)</td>
</tr>
<tr>
<td>2</td>
<td>7186.7</td>
<td>1213.6</td>
<td>6141.9</td>
<td>6116.8</td>
<td>25.1</td>
<td>RT</td>
<td>Tt</td>
<td>MP2A 1205.7</td>
<td>6124.9</td>
<td>8.1</td>
<td>Within Screen</td>
</tr>
<tr>
<td>3</td>
<td>1215.7</td>
<td>6116.4</td>
<td>6138.5</td>
<td>6139.6</td>
<td>13.2</td>
<td>MP3A 1365.9</td>
<td>5971.3</td>
<td>17.9</td>
<td>Within Screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1649.3</td>
<td>5761.3</td>
<td>5774.6</td>
<td>6.7</td>
<td>RD</td>
<td>PP4 1565.0</td>
<td>5774.6</td>
<td>0.5</td>
<td>Base of Screen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: CDV-R-37-2 Brass Cap Ground Elevation: 7330.6 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
3.3 R-1

Location: R-1 is located in Mortandad Canyon about 220 ft west of former monitoring well TW-8.
Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 28 ft below the water table.
Remarks: R-1 was completed to a depth of 1080.1 ft, about 80 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer has no immediate response to atmospheric pressure fluctuations. The aquifer indicates a seasonal response to supply well pumping and primarily responds to pumping at PM-5 and possibly to PM-4.

R-1 Construction Information

<table>
<thead>
<tr>
<th>Screen Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Zone</th>
<th>Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1031.1</td>
<td>1057.4</td>
<td>5850.1</td>
<td>5823.8</td>
<td>26.3</td>
<td>1027.7</td>
<td>5853.5</td>
<td>1057.4</td>
<td>5823.8</td>
<td>1080.1</td>
<td>22.7</td>
<td>69.7</td>
<td>RT</td>
</tr>
</tbody>
</table>

Note: R-1 Brass Cap Ground Elevation: 6881.21 ft; all measurements are from this elevation
3.4 R-2

Location: R-2 is located in middle Pueblo Canyon between former monitoring wells TW-4 and TW-2.
Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 5 ft below the water table.
Remarks: R-2 was completed to a depth of 943.3 ft, about 50 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer has no immediate response to atmospheric pressure fluctuations. The well shows a continuous water level decline but does not indicate a seasonal response to supply well pumping or an apparent response to pumping of any specific supply well.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Depth to Sump (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>906.4</td>
<td>929.6</td>
<td>5874</td>
<td>5860.8</td>
<td>23.2</td>
<td>917.0</td>
<td>5853.4</td>
<td>929.6</td>
<td>5840.8</td>
<td>943.3</td>
<td>13.7</td>
<td>42.1</td>
<td>RT</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: R-2 Brass Cap Ground Elevation: 6770.38 ft; all measurements are from this elevation
3.5 R-3

Location: R-3 is located in lower Pueblo Canyon about 0.5 mi east of monitor well R-5 and about 500 ft northwest of supply well O-1.

Completion Type: Single completion in the regional aquifer. The top of the screen is about 315 ft below the water table.

Period of Record: Well completed May 2010, transducer installed October 12, transducer data through 2010.

Remarks: R-3 was completed to a depth of 1077.7 ft, about 415 ft into the regional aquifer. The well responds to pumping at PM-1.

### R-3 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Bottom Well Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>974.5</td>
<td>995.0</td>
<td>5421.4</td>
<td>5400.9</td>
<td>20.5</td>
<td>905.0</td>
<td>5430.1</td>
<td>995.0</td>
<td>1006.8</td>
<td>11.8</td>
<td>RT</td>
<td>Tsf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6395.88 ft; all measurements are from this elevation

![Graph showing groundwater level status](image-url)
3.6 R-4

Location: R-4 is located in Pueblo Canyon near the new LAC Sewage Treatment Plant.
Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about
49 ft below the piezometric water table in a confined zone.
Period of Record: Well completed September 2003, transducer installed January 2005, data through
2010. The transducer failed in January 2008 and was replaced in March 2008.
Remarks: R-4 was completed to a depth of 840 ft, about 90 ft into the regional aquifer. The well is
100% barometrically efficient; the aquifer has no immediate response to atmospheric
pressure fluctuations. The aquifer indicates a seasonal response to supply well pumping and
appears to respond primarily to pumping PM-3, and possibly to pumping at O-4 and the
Guaje well field.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>792.9</td>
<td>816</td>
<td>5784.6</td>
<td>5761.5</td>
<td>23.1</td>
<td>787.5</td>
<td>5790.0</td>
<td>816.0</td>
<td>5761.5</td>
<td>840.0</td>
<td>24.0</td>
<td>73.7</td>
<td>RT</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: R-4 Brass Cap Ground Elevation: 6577.49 ft; all measurements are from this elevation

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R-4 Construction Information

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R-4 Graph

---

LA-14437-PR
3.7 R-5

Location: R-5 is located in lower Pueblo Canyon about 0.5 mi upstream of supply well O-1.
Completion Type: Multiple completion, two screens in intermediate zones, two screens in regional zones.
Remarks: Screen 1 has been dry since well installation, although there is about 3 ft of water above port MP1B in the sump below screen 1. The screen 2 intermediate groundwater level is about 5 ft below the bottom of screen 1. The two regional screens have heads about 10 to 15 ft apart. The water level at the top of the regional aquifer at screen 3 declined below port MP3A in 2001; samples are collected and groundwater levels are monitored from port MP3B. The aquifer at screen 4 responds primarily to supply well pumping at PM-1, but screen 3 apparently shows little or no response. The R-5 regional aquifer screens do not indicate a response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elevation (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>329.4</td>
<td>331.5</td>
<td>6146.2</td>
<td>6141.1</td>
<td>5.1</td>
<td>I</td>
<td>Tp</td>
<td>PP1</td>
<td>334.9</td>
<td>6137.7</td>
<td>-3.4</td>
<td>9.9</td>
<td>Below Screen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>350.4</td>
<td>6122.2</td>
<td>-18.9</td>
<td>54.7</td>
<td>Below Screen, 3 ft of water</td>
</tr>
<tr>
<td>2</td>
<td>372.8</td>
<td>398.8</td>
<td>6099.8</td>
<td>6083.8</td>
<td>18.0</td>
<td>I</td>
<td>Tp</td>
<td>PP2</td>
<td>388.8</td>
<td>6083.8</td>
<td>4.8</td>
<td>0.0</td>
<td>Below Screen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>394.4</td>
<td>6078.2</td>
<td>-5.6</td>
<td>18.2</td>
<td>Below Screen</td>
</tr>
<tr>
<td>3</td>
<td>676.9</td>
<td>720.3</td>
<td>5795.3</td>
<td>5792.3</td>
<td>43.4</td>
<td>RT</td>
<td>Tsf</td>
<td>MP3A</td>
<td>665.1</td>
<td>5777.5</td>
<td>25.2</td>
<td>0.0</td>
<td>Below Screen, Port Dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>719.6</td>
<td>5754.0</td>
<td>1.7</td>
<td>0.0</td>
<td>Below Screen, Port sampled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>724.3</td>
<td>5748.8</td>
<td>-3.7</td>
<td>10.7</td>
<td>Below Screen</td>
</tr>
<tr>
<td>4</td>
<td>858.7</td>
<td>863.7</td>
<td>5613.9</td>
<td>5609.9</td>
<td>5.0</td>
<td>RD</td>
<td>Tsf</td>
<td>MP4A</td>
<td>866.3</td>
<td>5606.3</td>
<td>-2.6</td>
<td>7.5</td>
<td>Below Screen</td>
</tr>
</tbody>
</table>

Note: R-5 Brass Cap Ground Elevation: 6472.9 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports
3.8 R-6

Location: R-6 is located at the east end of DP Mesa between DP Canyon and Los Alamos Canyon.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 44 ft below the water table.


Remarks: R-6 was completed to a depth of 1252 ft, about 100 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer has no immediate response to atmospheric pressure fluctuations.

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### R-6 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1205.0</td>
<td>1228.0</td>
<td>5760.8</td>
<td>5747.8</td>
<td>23.0</td>
<td>1197.66</td>
<td>5787.8</td>
<td>1228.0</td>
<td>5787.8</td>
<td>1252.0</td>
<td>24.0</td>
<td>73.7</td>
<td>RT</td>
<td>TF</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6995.80 ft; all measurements are from this elevation.
3.9 R-7

Location: R-7 is located in middle Los Alamos Canyon about 1 mi upstream of supply well O-4.

Completion Type: Multiple completion, two screens in intermediate zones, one screen at the top of the regional aquifer.


Remarks: Initial transducer data from MP1A are not valid because transducer apparently did not connect properly to port. Port MP1A at intermediate screen 1 went dry during sampling on December 18, 2003. Pressure data from port MP1B located in the sump have indicated 3 to 4 ft of water present above the port but about 7 ft below screen 1 since 2005. The screen 2 intermediate screen has been dry since well installation but port MP2B indicates about 1 ft of water in the sump above the port since mid 2008. The regional aquifer at R-7 screen 3 does not indicate a response to atmospheric pressure fluctuations and does not show a seasonal water level response to supply well pumping or a response to pumping any of the water supply wells, but shows a relatively constant water level decline of about 0.6 ft/yr.

### R-7 Construction and Port Data

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elevation (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Comment</th>
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<tbody>
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<td>I</td>
<td>Tp</td>
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<td>1.2 Within screen - Screen dry</td>
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<td>Tp</td>
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<td>MP3C</td>
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<td>5852.0</td>
<td>-8.9 Below screen</td>
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</tr>
</tbody>
</table>

Note: R-7 Brass Cap Ground Elevation: 6779.2 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
**R-7 Screen 1**

- Screen 1 GW
- Screen 1 Transducer

MP1A went dry during sampling

Port MP1A Elevation: 6401.2 ft

**R-7 Screen 3**

- Screen 3 GW
- Screen 3 Transducer

Port 3A Elevation: 5884.1 ft
3.10 R-8

Location: R-8 is located in middle Los Alamos Canyon about 0.75 mi downstream of the confluence with DP Canyon and supply well O-4.
Completion Type: Multiple completion, two screens in the regional aquifer. The top of screen 1 is about 13 ft below the water table.
Remarks: Screens are 66 ft apart, head in screen 2 about 20 ft lower than screen 1. The groundwater does not indicate a response to atmospheric pressure fluctuations, but the groundwater at both screens responds to pumping supply well PM-3.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elevation (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Comment</th>
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<td>Tp</td>
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<td>711.1</td>
<td>5833.64</td>
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<td>34.3</td>
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<td>PP1</td>
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<td>RD</td>
<td>Tp</td>
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</table>

Note: R-8 Brass Cap Ground Elevation: 5544.74 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
3.11 R-9

Location: R-9 is located in Los Alamos Canyon near the eastern LANL boundary.
Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.
Remarks: R-9 was completed to a depth of 758 ft, about 70 ft into the regional aquifer. The well is 100% barometrically efficient; the groundwater has no immediate response to atmospheric pressure fluctuations. However, the aquifer indicates a delayed 65% response to atmospheric pressure.

<table>
<thead>
<tr>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>756</td>
<td>9.5</td>
<td>28.7</td>
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</tr>
</tbody>
</table>

Note: R-9 Brass Cap Ground Elevation: 6382.8; all depths are from this elevation
3.12 R-10

Location: R-10 is located in lower Sandia Canyon on San Ildefonso land east of the LANL boundary.
Completion Type: Dual completion in two deeper zones within the regional aquifer. Baski packer and dual valve sampling system with single submersible pump installed in May 2006.
Remarks: R-10 screen 1 is 174 ft deeper than the screen at R-10a; due to relatively low hydraulic conductivity of the formation between these screens, the head at R-10 screen 1 is 30 ft lower than at R-10a. The screen 2 water level gage tube was inoperable until repaired in February 2008; water level data for R-10 screen 2 in 2006 and 2007 are not available. The groundwater at R-10 screens exhibit a barometric efficiency of about 45%. The regional aquifer at both screens responds to pumping at supply well PM-1.

---

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Packer/ Sump (ft)</th>
<th>Top of Packer/ Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<th>Geo Unit Code</th>
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<tbody>
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<td>906.2</td>
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</tr>
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<td>RD</td>
<td>Tsf</td>
<td></td>
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</table>

Note: R-10 Brass Cap Ground Elevation: 6362.31 ft; all measurements are from this elevation.

---

LA-14437-PR 20
3.13 R-10a

Location: R-10a is located in lower Sandia Canyon on San Ildefonso land east of the LANL boundary about 55 ft west of R-10.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 66 ft below the water table.


Remarks: The R-10a water level is about 30 ft higher than at R-10 screen 1. The groundwater at R-10a shows an immediate 58% response to atmospheric pressure fluctuations for a well barometric efficiency of 42%. There is no apparent response to supply well pumping at R-10a.

### R-10a Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<tr>
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<td>RT</td>
<td>Tsf</td>
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</tbody>
</table>

Note: Brass Cap Ground Elevation: 5363.74 ft; all measurements are from this elevation

---

![Graph showing R-10a groundwater level changes](image-url)
3.14 R-11

Location: R-11 is located in middle Sandia Canyon about 0.5 mi upstream of supply well PM-3.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 17 ft below the water table.

Period of Record: Transducer installed May 4, 2005; data through 2010.

Remarks: R-11 was completed in 2004 to a depth of 901.7 ft, about 66 ft into the regional aquifer. The well is 100% barometrically efficient; the groundwater has no immediate response to atmospheric pressure fluctuations. The aquifer at R-11 exhibits a seasonal response to supply well pumping but does not indicate a direct response to any specific supply well.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<tbody>
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<td>5795.8</td>
<td>901.7</td>
<td>23.8</td>
<td>RT</td>
<td>Tp</td>
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</tbody>
</table>

Note: R-11 Brass Cap Ground Elevation: 5873.72 ft; all measurements are from this elevation

[Graph showing groundwater levels over time for R-11]
3.15 R-12 (Regional)

Monitoring well R-12 was recompleted as a dual screen intermediate monitoring well in December 2007. Refer to Section 4 for recent R-12 intermediate groundwater level status.

Location: R-12 is located in lower Sandia Canyon near State Route (SR) 4 and supply well PM-1.

Completion Type: Multiple completion, two screens in intermediate zones, one screen at the top of the regional aquifer until September 2006. Well recompleted as two intermediate screens on December 13, 2007, when regional screen 3 was plugged and abandoned.

Period of Record: Westbay® installed March 21, 2000, transducers installed December 14, 2000, intermittent data to September 21, 2006, when transducers were removed for removal of the Westbay® system for well rehabilitation. No regional aquifer water level data after 2006. Transducers were reinstalled at intermediate screens 1 and 2 on December 13, 2007; data through 2010.

Remarks: In December 2007, screen 3 was abandoned and a Baski packer with dual pump sampling system was installed at the two intermediate screens. The regional aquifer at screen 3 did not exhibit a seasonal response to supply well pumping, or a response to pumping of any specific supply well, including nearby supply well PM-1. There is no immediate response to atmospheric pressure fluctuations at any screen.

### R-12 Former Westbay Port Data

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
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<td>Tb4</td>
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<td>-0.6</td>
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<td>PP3C</td>
<td>827.2</td>
<td>5672.4</td>
<td>11.8</td>
<td>Within screen</td>
</tr>
</tbody>
</table>

Brass Cap Elevation: 5499.6 ft; all measurements are from this elevation; MP = measurement port; PP = pumping port

![R-12 Regional Screen](image)
3.16 R-13

Location: R-13 is located in lower Mortandad Canyon near the LANL boundary.
Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 120 ft below the water table.
Remarks: R-13 was completed to a depth of 1029.4 ft, about 200 ft into the regional aquifer. The well is 100% barometrically efficient; the groundwater has no immediate response to atmospheric pressure fluctuations. However, the aquifer indicates a delayed 30% response to atmospheric pressure. R-13 exhibits a seasonal response to supply well pumping and responds primarily to pumping at PM-4 (McLin 2006) and possibly to PM-2 and PM-5, but apparently does not respond significantly to pumping at nearby supply well PM-3.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>958.3</td>
<td>1018.7</td>
<td>5714.8</td>
<td>5654.4</td>
<td>80.4</td>
<td>933.0</td>
<td>5740.1</td>
<td>1018.7</td>
<td>5654.4</td>
<td>1029.4</td>
<td>10.7</td>
<td>RT</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: R-13 Brass Cap Ground Elevation: 6673.05 ft; all measurements are from this elevation.
3.17 R-14

Location: R-14 is located in upper Ten Site Canyon about 0.5 mi upgradient of supply well PM-5.
Completion Type: Formerly multiple completion, two screens in the regional aquifer; recompleted in February 2008 to single screen at the top of the regional aquifer when screen 2 was plugged and abandoned. The top of screen 1 is about 20 ft below the water table.
Remarks: Screens were formerly 53 ft apart; heads between screens were within 0.5 ft of each other.

The aquifer shows no response to atmospheric pressure fluctuations. The aquifer at R-14 responds primarily to pumping supply well PM-5. After removal of the Westbay® system, an error in the Westbay® pipe tally resulted in correction of all Westbay® derived water level data downward by 3.3 ft.

R-14 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Depth (ft)</th>
<th>Pump Elev (ft)</th>
<th>Top of Packer/Plug (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1200.6</td>
<td>1233.2</td>
<td>5881.48</td>
<td>5828.88</td>
<td>52.6</td>
<td>1198.0</td>
<td>5864.1</td>
<td>1244.7</td>
<td>11.5</td>
<td>36.0</td>
<td>RT</td>
<td>Tp</td>
</tr>
<tr>
<td>2</td>
<td>1288.9</td>
<td>1293.1</td>
<td>5775.58</td>
<td>5768.98</td>
<td>66</td>
<td>Screen 2 Plugged and Abandoned 2008</td>
<td>RD</td>
<td>Tp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: R-14 brass cap elevation 7062.08 ft; all measurements from this elevation.
3.18 R-15

Location: R-15 is located in lower Mortandad Canyon downstream of the sediment traps.
Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.
Remarks: R-15 was completed in 1999 to a depth of 1030.6 ft, about 140 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The aquifer at R-15 responds to pumping supply wells PM-4 and PM-5.
3.19 R-16

Location: R-16 is located northeast of White Rock in lower Cañada del Buey near the confluence with lower Mortandad Canyon.

Completion Type: Multiple completion, four screens in the regional aquifer, screen 1 is blocked by casing and is not usable.

Period of Record: Westbay® installed December 14, 2002, transducers installed June 16, 2005, transducer data to July 12, 2006, when the Westbay® system was removed for additional screen development. The Westbay® system was reinstalled and transducers were reinstalled October 18, 2006. Westbay® transducer data extend to April 15, 2009, when the Westbay® system was removed for well rehabilitation and conversion. A single submersible pump with dual valve Baski sampling system was installed on October 14, 2009, to monitor screens 2 and 4; screen 3 not monitored after April 15, 2009 (LANL 2009). Groundwater level data from the dual screen sampling system are available from October 14, 2009, through 2010.

Remarks: Screens 2 and 3 are about 144 ft apart with a head difference of over 80 ft. Screens 3 and 4 are 215 ft apart and have a head difference of about 11 ft. The aquifer response to atmospheric pressure declines downward from screen 2 to screen 4, from 68% at screen 2 to 57% at screen 4.

---

### R-16 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Packer/ Sump Bottom (ft)</th>
<th>Packer Bottom Depth (ft)</th>
<th>Bottom of Sump Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>541.0</td>
<td>548.6</td>
<td>5615.9</td>
<td>5610.9</td>
<td>7.6</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>RD</td>
<td>1d</td>
<td>Screen usable</td>
</tr>
<tr>
<td>2</td>
<td>863.4</td>
<td>870.9</td>
<td>5393.5</td>
<td>5360.0</td>
<td>7.5</td>
<td>872.8</td>
<td>5384.1</td>
<td>870.9</td>
<td>5369.0</td>
<td>881.2</td>
<td>885.0</td>
<td>5476.0</td>
<td>10.3</td>
<td>RD</td>
<td>1d</td>
<td>Upper zone</td>
</tr>
<tr>
<td>3</td>
<td>814.8</td>
<td>1022.4</td>
<td>5242.1</td>
<td>5204.5</td>
<td>7.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>RD</td>
<td>1d</td>
<td>Screen sealed-off</td>
</tr>
<tr>
<td>4</td>
<td>1237.0</td>
<td>1244.6</td>
<td>5019.9</td>
<td>5012.3</td>
<td>7.6</td>
<td>1224.8</td>
<td>5022.3</td>
<td>1244.8</td>
<td>5012.3</td>
<td>1228.7</td>
<td>1233.0</td>
<td>4980.2</td>
<td>32.1</td>
<td>RD</td>
<td>1d</td>
<td>Lower zone</td>
</tr>
</tbody>
</table>

Brass Cap Elevation: 5259.87 ft; all measurements are from this elevation.
3.20  **R-16r**

**Location:** R-16r is located northeast of White Rock adjacent to R-16 in lower Cañada del Buey near the confluence with lower Mortandad Canyon.

**Completion Type:** Single completion at the top of the regional aquifer. R-16r provides data for the top of the regional aquifer in place of R-16 screen 1, which is blocked by casing and not useable. The top of the screen is about 35 ft below the water table.

**Period of Record:** Well completed October 11, 2005, transducers installed February 21, 2006, data through 2010.

**Remarks:** R-16r water level at the top of the regional aquifer about 50 ft higher than the water level at R-16 screen 2, which is 250 ft lower than the R-16r screen. The well is 90% barometrically efficient; the aquifer indicates a 10% delayed response to atmospheric pressure.

### **R-16r Construction Information**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (Gal)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600.0</td>
<td>617.6</td>
<td>5657.0</td>
<td>5639.4</td>
<td>17.6</td>
<td>596.6</td>
<td>5660.4</td>
<td>617.6</td>
<td>5639.4</td>
<td>631.4</td>
<td>13.8</td>
<td>11.2</td>
<td>RT</td>
<td>Tpt</td>
</tr>
</tbody>
</table>

*Note: Brass Cap Ground Elevation: 6256.97 ft; all measurements are from this elevation*

---

**Graph:**

- **R-16r**
  - Manual
  - Transducer

**Legend:**

- Groundwater Elevation (ft)
- Date (10/1/05 to 10/1/10)

---

**LA-14437-PR**

**Page:** 29
3.21 R-17

Location: R-17 is located in middle Pajarito Canyon below the confluence with Two-Mile Canyon and about 1 mi southwest of supply well PM-5.

Completion Type: Dual completion within the regional aquifer with a Baski dual valve system and single submersible pump. The top of screen 1 is located about 20 ft below the water table. The screens are 44 ft apart.


Remarks: R-17 was completed to a depth of 1140.9 ft, about 100 ft into the regional aquifer. Screen 1 is 100% barometrically efficient; the aquifer does not show a response to atmospheric pressure fluctuations. Screen 2 is 90% barometrically efficient. Both screens show a seasonal response to supply well pumping; screen 2 shows a response to pumping supply wells PM-2, PM-4, and PM-5.

### R-17 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Depth (ft)</th>
<th>Pump Elev (ft)</th>
<th>Depth to Top of Packer (ft)</th>
<th>Sump Elev (ft)</th>
<th>Top of Sump Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1067.0</td>
<td>1080.0</td>
<td>5884.5</td>
<td>5841.5</td>
<td>23.0</td>
<td>1089.6</td>
<td>5831.9</td>
<td>1101.2</td>
<td>5822.4</td>
<td>1101.2</td>
<td>21.1</td>
<td>66.1</td>
<td>RT</td>
<td>Tpf</td>
</tr>
<tr>
<td>2</td>
<td>1124.0</td>
<td>1134.0</td>
<td>5797.5</td>
<td>5787.5</td>
<td>10.0</td>
<td>1128.6</td>
<td>5792.9</td>
<td>1134.0</td>
<td>5787.5</td>
<td>1140.9</td>
<td>6.9</td>
<td>21.8</td>
<td>RD</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Eleva!Jon: 6921.51 ft; all measurements are from this elevation.

**Graph:**

- Screen 1 Manual: ◇ Screen 1 Transducer: ----
- Screen 2 Manual: □ Screen 2 Transducer: ----

**Legend:**

- Groundwater Elevation (ft)
- Date: 1/1/06, 7/2/06, 1/1/07, 7/2/07, 1/1/08, 7/2/08, 12/31/08, 7/2/09, 1/1/10, 7/2/10, 1/1/11
3.22 R-18

Location: R-18 is located on a mesa at TA-14 between Pajarito Canyon and Cañon de Valle, about 3000 ft northeast of R-25.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 70 ft below the water table.


Remarks: R-18 was completed to a depth of 1405 ft, about 118 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not indicate a response to atmospheric pressure fluctuations. There is no apparent response to supply well pumping.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (ft³)</th>
<th>Hydro Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1368.0</td>
<td>1398.0</td>
<td>6046.8</td>
<td>6023.8</td>
<td>23.0</td>
<td>1353.0</td>
<td>6041.8</td>
<td>1381.0</td>
<td>6023.8</td>
<td>1405</td>
<td>24.0</td>
<td>75.1</td>
<td>RT</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 7404.83 ft; all measurements are from this elevation.
3.23 R-19

Location: R-19 is located on a mesa south of Three-Mile Canyon about 1.2 mi west of supply well PM-2.

Completion Type: Multiple completion, two screens in intermediate zones, and five screens in the regional aquifer. Screen 3 straddles the regional water table.

Period of Record: Westbay installed September 11, 2000, transducers installed June 04, 2002, equipment problems occurred within two weeks. Transducers reinstalled December 10, 2004; transducer data to June 25, 2007, when the transducer string cable failed. Cable rebuilt and transducers reinstalled January 10, 2008; data are available intermittently through 2010.

Remarks: Screen 1 has been dry since Westbay installation. Screen 3 at the top of the regional aquifer does not show a response to atmospheric pressure fluctuations, but the deeper screens 4 through 7 indicate 40% to 50% response. The deeper screens (4 through 7) in the regional aquifer respond to supply well pumping at PM-2 and PM-4, and possibly to PM-5.

<table>
<thead>
<tr>
<th>R-19 Construction Information and Port Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

Note: R-19 Brass Cap Ground Elevation, 7086.3 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
### 3.24 R-20

Location: R-20 is located in lower Pajarito Canyon about 1300 ft east of supply well PM-2.

Completion Type: Multiple completion, originally three screens in the regional aquifer. Screen 3 was plugged and abandoned November 2007, leaving two screens in the regional aquifer. The top of screen 1 is about 76 ft below the regional water table. The recompleted well incorporates two packers, one below screen 1 and one above screen 2 to minimize purge volumes.

Period of Record: Westbay® installed January 18, 2003, transducers installed March 26, 2003, intermittent transducer data to June 1, 2006, when the Westbay® system was removed. No water level data in the last half of 2006 and in 2007 during well rehabilitation. Transducers installed at screens 1 and 2 in May 2008; data through 2010.

Remarks: A dual pump Baski sampling system with two packers between screens 1 and 2 installed May 2008 (LANL January 2008). Screen 1 shows no response to atmospheric pressure fluctuations. Screen 3 responded to supply well pumping at PM-2 and PM-4. The shallower screens 1 and 2 show a muted response to supply well pumping.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top/Bottom Packer Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>904.6</td>
<td>912.2</td>
<td>5784.8</td>
<td>5782.2</td>
<td>7.6</td>
<td>908.43</td>
<td>5785.9</td>
<td>918.7</td>
<td>5782.2</td>
<td>918.7</td>
<td>6.5</td>
<td>5.3</td>
<td>RT</td>
<td>Th4</td>
</tr>
<tr>
<td>2</td>
<td>1147.1</td>
<td>1154.7</td>
<td>5547.3</td>
<td>5539.7</td>
<td>7.6</td>
<td>1141.7</td>
<td>5552.6</td>
<td>1133.8</td>
<td>5539.7</td>
<td>1183.5</td>
<td>28.8</td>
<td>23.8</td>
<td>RD</td>
<td>Tpp</td>
</tr>
<tr>
<td>3</td>
<td>1338.9</td>
<td>1335.5</td>
<td>5365.0</td>
<td>5357.5</td>
<td>7.7</td>
<td>Screen 3 plugged and abandoned November 2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: R-20 Brass Cap Ground Elevation: 6694.35 ft; all measurements are from this elevation.
3.25 R-21

Location: R-21 is located in Cañada del Buey north of TA-54 and between Material Disposal Area (MDA) L and MDA G. R-21 is 780 ft east of R-56, 1130 ft south of R-38, and 1500 ft north of R-32.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 87 ft below the water table.


Remarks: R-21 installed to a depth of 941.4 ft, about 140 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The well responds to pumping of PM-2, PM-4, and possibly another well or combination of wells.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>888.8</td>
<td>906.8</td>
<td>5767.4</td>
<td>5749.4</td>
<td>18.0</td>
<td>861.0</td>
<td>5795.2</td>
<td>906.8</td>
<td>5749.4</td>
<td>941.4</td>
<td>34.6</td>
<td>192.4</td>
<td>RT</td>
</tr>
</tbody>
</table>

Note: R-21 Brass Cap Ground Elevation: 6656.24 ft; all measurements are from this elevation

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R-21 Construction Information

---

R-21 Graph

- Manual
- Transducer

Water level after casing installation

Groundwater Elevation (ft)

Date

10/1/02 10/1/03 9/30/04 9/30/05 10/1/06 10/1/07 9/30/08 9/30/09 10/1/10

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3.26 R-22

Location: R-22 is located at the east end of Mesita del Buey, east of TA-54. R-22 is about 310 ft southeast of R-57, 640 ft south of R-41, and 700 ft northeast of R-39.

Completion Type: Multiple completion, five screens in the regional aquifer. Screen 1 straddles the regional water table.

Period of Record: Westbay® installed December 11, 2000, transducers installed March 26, 2003, intermittent transducer data to April 13, 2009, when the transducers were removed in preparation for removing the Westbay® system.

Remarks: Screens 1 and 2 have similar head values about 6 ft apart. Screens 3, 4, and 5 have similar heads within 6 ft of each other, but about 50 ft lower than screens 1 and 2. Screens 4 and 5 have nearly identical head values. The R-22 screens do not show an immediate response to atmospheric pressure fluctuations, but show a delayed response ranging from 20% to 95%. The deeper aquifer at R-22 screens 3, 4, and 5 shows an apparent small seasonal response to supply well pumping. The Westbay® system was removed on May 3, 2009, for well rehabilitation (LANL 2009).

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elevation (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>872.3</td>
<td>914.2</td>
<td>5778.2</td>
<td>5730.3</td>
<td>41.9</td>
<td>RT</td>
<td>Tb4</td>
<td>MP1A</td>
<td>907.1</td>
<td>5743.4</td>
<td>7.1</td>
<td></td>
<td>Within Screen</td>
</tr>
<tr>
<td>2</td>
<td>947.0</td>
<td>988.9</td>
<td>5703.5</td>
<td>5661.6</td>
<td>41.6</td>
<td>RD</td>
<td>Tb4</td>
<td>MP2B</td>
<td>962.8</td>
<td>5687.7</td>
<td>29.1</td>
<td></td>
<td>Within Screen</td>
</tr>
<tr>
<td>3</td>
<td>1272.2</td>
<td>1278.9</td>
<td>5378.3</td>
<td>5371.6</td>
<td>6.7</td>
<td>RD</td>
<td>Tpf</td>
<td>MP3A</td>
<td>1273.5</td>
<td>5377.0</td>
<td>5.4</td>
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<td>Within Screen</td>
</tr>
<tr>
<td>4</td>
<td>1378.2</td>
<td>1384.0</td>
<td>5272.3</td>
<td>5266.6</td>
<td>6.7</td>
<td>RD</td>
<td>Tb</td>
<td>MP4A</td>
<td>1378.0</td>
<td>5272.6</td>
<td>6.9</td>
<td></td>
<td>Above Screen</td>
</tr>
<tr>
<td>5</td>
<td>1447.3</td>
<td>1452.3</td>
<td>5203.2</td>
<td>5198.2</td>
<td>5.0</td>
<td>RD</td>
<td>Tpf</td>
<td>MP5A</td>
<td>1448.2</td>
<td>5202.3</td>
<td>4.1</td>
<td></td>
<td>Within Screen</td>
</tr>
</tbody>
</table>

Note: R-22 Brass Cap Ground Elevation: 8650.5 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
3.27 R-23

Location: R-23 is located in lower Pajarito Canyon near SR-4 and the eastern LANL boundary.

Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.


Remarks: R-23 was installed to a depth of 886.3 ft, about 60 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer has no immediate response to atmospheric pressure fluctuations, however, the aquifer has a delayed response to atmospheric pressure. The aquifer at R-23 shows no apparent response to pumping the PM well field or the Buckman well field, but exhibits a steady water level decline of about 0.3 ft/yr.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>873.2</td>
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<td>688.3</td>
<td>13.1</td>
<td>41.0</td>
<td>RT</td>
<td>TaF</td>
</tr>
</tbody>
</table>

Note: R-23 Brass Cap Ground Elevation: 6527.75 ft; all measurements are from this elevation.
3.28 R-24

Location: R-24 is located in Bayo Canyon north of the former Bayo Sewage Treatment Plant.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is in a confined zone about 110 ft below the water table.


Remarks: R-24 installed to a depth of 861 ft, about 150 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The aquifer at R-24 responds primarily to pumping at supply well PM-3 located 1.5 mi south in Sandia Canyon, but may also respond to pumping the Guaje well field and supply well O-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
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<th>Geo Unit Code</th>
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<tbody>
<tr>
<td>1</td>
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<td>Tef</td>
<td></td>
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</table>

Note: R-24 Brass Cap Ground Elevation: 6547.38 ft; all measurements are from this elevation.
3.29 R-25

Location: R-25 is located at TA-16 within the Cañon de Valle watershed. R-25 is about 50 ft east of R-25b, 100 ft east of R-25c, 370 ft south of CdV-16-1(i), and 425 ft southwest of CdV-16-4p.

Completion Type: Multiple completion, four screens in intermediate zones, and five screens in the regional aquifer. Screens 3 and 9 were damaged during installation and are not reliable for water level monitoring. Screen 5 straddles the regional water table.


Remarks: Recurring problems with the transducer cables from 2001 to 2005 caused loss of data. The transducer cables were rebuilt in 2005. Screens 1 and 2 are in upper intermediate zones. Screen 3 has always been dry; screen 4 appears to be in a separate intermediate zone. The water level at screen 5, the top of the regional aquifer, declines significantly during low flow sampling and recovers slowly. There is no significant response to atmospheric pressure at any of the screens. Intermediate screens 1, 2, and perhaps 4 responded to snowmelt runoff in 2005, 2007, 2008, and 2010; see Appendix D for more information. The regional aquifer screens do not indicate an apparent response to supply well pumping. The intermediate groundwater at screens 1, 2, and 4 and the sump water at screen 3 responded to drilling and installation of adjacent well R-25c (replacement for R-25 screen 3) in August 2008 (LANL September 2008). Screen 2 responded during drilling of nearby well CDV-16-4p.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port Depth (ft)</th>
<th>Port Elev (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Sump Vol above Port (ft)</th>
<th>Sump Vol Total (ft)</th>
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<td>Cbo</td>
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<td>6451.5</td>
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<td>Within Screen</td>
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<tr>
<td>5</td>
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<td>1304.7</td>
<td>6221.4</td>
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<td>Tpf</td>
<td>1260.4</td>
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<tr>
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<td>Tpf</td>
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<tr>
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<td>Tpf</td>
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<td>Tpf</td>
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<td>5510.1</td>
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<td>17.4</td>
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</tr>
</tbody>
</table>

Note: R-25 Brass Cap Ground Elevation: 7516.1 ft; all measurements are from this elevation.

MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.
3.30 R-26

Location: R-26 is located at the western LANL boundary near Cañon de Valle.

Completion Type: Multiple completion, screen 1 is in an intermediate zone, and screen 2 is within the regional aquifer. The top of screen 2 is about 319 ft below the regional water table.

Period of Record: Westbay® installed July 18, 2004, transducers installed July 29, 2005, transducer data to August 13, 2010, when the transducers were removed in preparation for removal of the Westbay® system. When the Westbay® removal was delayed, the transducers were reinstalled December 16, 2010.

Remarks: Screen 2 is in a tight zone and/or improperly completed zone. Sampling attempts at MP2A caused plugging of the port and sampler with bentonite; the transducers were installed in the B ports on November 3, 2005; water level data from screen 2 at port MP2B appear valid with some questions as to validity pending additional data and review. There is no apparent response to supply well pumping at R-26.

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### R-26 Construction and Port Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elevation (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6989.9</td>
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<td>Qct</td>
<td>MP1A</td>
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<td>6982.4</td>
<td>10.6</td>
<td>Within Screen</td>
<td></td>
</tr>
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<td></td>
<td>PP1</td>
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<td>6977.0</td>
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</tr>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>MP1B</td>
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</tr>
<tr>
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</tr>
<tr>
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<td></td>
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<td></td>
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<td></td>
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<td>PP2</td>
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<td>Within Screen</td>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td>MP2B</td>
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<td>7.0</td>
<td>Within Screen</td>
<td></td>
</tr>
</tbody>
</table>

Note: R-26 Brass Cap Ground Elevation: 7841.69 ft; all measurements are from this elevation; MP = Monitor Port; PP = Pump Port; Monitor Ports shown in bold are instrumented ports.

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### R-26 Screen 1 Intermediate

- Screen 1 GW
- Screen 1 Transducer

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LA-14437-PR 45
3.31 R-27

Location: R-27 is located in middle Water Canyon about 0.35 mi north of DT-10 and about 0.75 mi south of R-19.

Completion Type: Single completion at the top of the regional aquifer in Puye fanglomerates. The top of the screen is about 36 ft below the water table.


Remarks: R-27 is installed to a depth of 878.7 ft, about 60 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not show a response to atmospheric pressure fluctuations. The aquifer at R-27 may show a small seasonal response to supply well pumping at PM-2, but the general water level trend does not correlate with supply well pumping.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>852.0</td>
<td>826.0</td>
<td>5981.7</td>
<td>5838.7</td>
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<td>678.7</td>
<td>3.7</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6713.72 ft; all measurements are from this elevation

R-27 Construction Information

R-27

Date

Groundwater Elevation (ft)

10/1/05 4/1/06 10/1/06 4/1/07 4/1/05 9/30/08 4/1/09 10/1/09 4/1/10 10/1/10

LA-14437-PR 47
3.32 R-28

Location: R-28 is located in middle/lower Mortandad Canyon between and about 1300 ft from both R-42 and R-45 and about 1300 ft north of R-50.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 43 ft below the water table.


Remarks: R-28 installed to a depth of 980.3 ft, about 100 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. R-28 exhibits a seasonal response to supply well pumping and responds primarily to pumping at PM-4 and PM-2 and possibly to PM-5, but apparently does not respond significantly to pumping at nearby supply well PM-3.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>22.2</td>
<td>68.2</td>
<td>RT</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: R-28 Brass Cap Ground Elevation: 6728.61 ft; all measurements are from this elevation.
3.33 R-29

Location: R-29 is located at TA-49 east of MDA AB and about 0.3 mi northeast of Test Well DT-5A and 0.3 mi north of R-30.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 17 ft below the water table.


Remarks: R-29 installed to a depth of 1191.8 ft, about 39 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The tested specific capacity of R-29 was 0.62 gpm/ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Bottom of Well Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<tbody>
<tr>
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<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 7100.75 ft, all measurements are from this elevation

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R-29 Construction Information

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R-29 Construction Information

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R-29

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LA-14437-PR
49
3.34 R-30

Location: R-30 is located at TA-49 east of MDA AB and about 0.25 mi southeast of Test Well DT-5A and 0.3 mi south of R-29.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen is about 14 ft below the water table.


Remarks: R-30 installed to a depth of 1171.8 ft, about 46 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The tested specific capacity of R-30 was 2.04 gpm/ft.
3.35 R-31

Location: R-31 is located in the southern part of LANL in the north Ancho Canyon tributary.
Completion Type: Multiple completion, one screen in an intermediate zone, and four screens in the regional aquifer. The intermediate screen 1 has been dry since Westbay® installation.
Period of Record: Westbay® installed April 7, 2000, transducers installed May 4, 2000, transducer data through 2010.
Remarks: Screen 5 has the highest head values, followed by screen 4 and screen 2; screen 3 has the lowest head values. Port MP2A was dry after Westbay® installation; port MP2B is used to collect samples and groundwater level data. Screens 2 and 3 have 80% and 100% response to atmospheric pressure fluctuations, respectively, while screens 3 and 4 have about 45% response. Screens 4 and 5 show seasonal responses to supply well pumping that coincide with the non-pumping water levels at PM-2.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elev (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
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<td>PP1</td>
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<td>MP5A</td>
<td>1011.3</td>
<td>5351.2</td>
<td>5.8</td>
<td>Below screen</td>
</tr>
</tbody>
</table>

Brass Cap Elevation: 6362.5 ft; all measurements are from this elevation.
MP = measurement port; PP = pumping port

Note: Screen 1 is dry
3.36 R-32

Location: R-32 is located in lower Pajarito Canyon about 1 mi east of supply well PM-2 and south of TA-54 between MDA L and MDA G. R-32 is about 0.25 mi south of R-56.

Completion Type: Multiple completion, three screens in the regional aquifer until September 2007 when screens 2 and 3 were plugged and abandoned. Screen 1 is about 90 ft below the water table.

Period of Record: Westbay® installed December 14, 2002, transducers installed January 21, 2003, transducer data through August 2007. The Westbay® system was removed on September 18, 2007, and the well was rehabilitated to a single completion well at screen 1 in September 2007. A submersible pump was installed in November 2007 and a transducer was installed at screen 1 in February 2008; transducer data through 2010.

Remarks: Screens 2 and 3 had nearly identical head values and responded to pumping supply wells PM-2 and PM-4. Screen 1 apparently responded to long-term pumping of PM-4 in 2003, but vaguely to test pumping PM-2 in 2004 and PM-4 in 2005. Screens 2 and 3 responded to the PM-2 aquifer test in January 2003 (McLin 2005), to the PM-4 aquifer test in January 2005 (McLin 2006), and to PM-4 pumping in June 2006 and July 2007.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>897.5</td>
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<td>Tp4</td>
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<td>934.9</td>
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<td>5702.7</td>
<td>3.1</td>
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<td>Screen plugged and abandoned Sept 2007</td>
<td>934.9</td>
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<td>Screen plugged and abandoned Sept 2007</td>
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<td>Tp4</td>
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<tr>
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<td>5657.0</td>
<td>7.7</td>
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<td>972.9</td>
<td>57.5</td>
<td>RD</td>
<td>Tp4</td>
</tr>
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Note: R-32 Brass Cap Ground Elevation: 6637.63 ft; all measurements are from this elevation
3.37 R-33

Location: R-33 is located in lower Ten Site Canyon about 1500 ft northeast of supply well PM-5.
Completion Type: Dual screen completion in the regional aquifer.
Remarks: R-33 screen 1 installed about 12 ft below the regional water table at a depth of 1018.5 ft, and screen 2 within the regional aquifer to a depth of 1126 ft, about 140 ft into the regional aquifer. Transducer equipment problems occurred from February 2005 until October 2006 when transducers and packer equipment became operational. The original transducer equipment was removed from the well on November 8, 2007, in preparation for removing the Barcad sampling system from the well. A dual valve Baski sampling system was installed July 2008 (LANL August 2008). The water level at screen 2 responds primarily to pumping of supply well PM-5 but also to pumping at PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top/Bottom Packer Length (ft)</th>
<th>Top/Bottom Packer Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (Gal)</th>
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<th>Geo Unit Code</th>
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<tr>
<td>1</td>
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<td>2</td>
<td>1112.4</td>
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</tr>
</tbody>
</table>

Note: R-33 Brass Cap Ground Elevation: 6853.33 ft; all measurements are from this elevation; APV = access port valve.
3.38 R-34

Location: R-34 is located in Cedro Canyon on San Ildefonso land east of LANL.

Completion Type: Single completion in the regional aquifer. The top of the screen is about 90 ft below the water table.


Remarks: R-34 installed at the top of the regional aquifer at a depth of 920.7 ft, about 110 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. R-34 exhibits a seasonal response to supply well pumping but does not indicate a response to any specific supply well. The average annual water decline has been about 0.55 ft/yr.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5723.4</td>
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<td>5748.4</td>
<td>906.6</td>
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<td>44.1</td>
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<td>1pp</td>
</tr>
</tbody>
</table>

Note: R-34 Brass Cap Ground Elevation: 8629.99 ft; all measurements are from this elevation.

R-34 Construction Information

R-34

Groundwater Level Status Report March 2011

LA-14437-PR 55
3.39 R-35a

Location: R-35a is located in Sandia Canyon about 340 ft southwest of supply well PM-3.

Completion Type: Single completion in the regional aquifer. The top of the screen is about 220 ft below the water table at the same elevation as the top of the PM-3 screen.

Period of Record: Well completed June 2007, transducer installed August 3, 2007; water level data through 2010.

Remarks: R-35a installed at a depth of 1082.2 ft, about 290 ft into the regional aquifer. R-35a responds primarily to pumping supply well PM-3, about 3 to 4 ft daily, but also shows a response to pumping supply well O-4. When the well was completed, the static water level at R-35a was about 7 ft lower than nearby monitoring well R-35b, which is screened at the top of the aquifer.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<tbody>
<tr>
<td>1</td>
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<td>48.1</td>
<td>988.0</td>
<td>3924.8</td>
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<td>1086.2</td>
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<td>75.1</td>
<td>RD</td>
<td>Tsfu</td>
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</tbody>
</table>

Note: Brass Cap Ground Elevation: 6623.06 ft; all measurements are from this elevation.

Note: Hydrograph shows mean daily values

LA-14437-PR 56
3.40 R-35b

Location: R-35b is located in Sandia Canyon about 90 ft west of R-35a and about 400 ft southwest of supply well PM-3.

Completion Type: Single completion at the top of the regional aquifer. The top of the screen was about 37 ft below the water table when the well was installed.

Period of Record: Well completed July 2007, transducer installed August 3, 2007; water level data through 2010.

Remarks: R-35b installed near the top of the regional aquifer at a depth of 872.2 ft, about 80 ft into the regional aquifer. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. R-35b does not indicate a response to pumping of nearby well PM-3 or to any specific supply well, but indicates a relatively continual decline of about 0.5 ft/yr in response to supply well pumping.

R-35b Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>825.4</td>
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<td>5792.5</td>
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<td>5776.7</td>
<td>872.2</td>
<td>23.1</td>
<td>74.1</td>
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</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6625.21 ft; all measurements are from this elevation

R-35b

- Manual
- Transducer
3.41 R-36

Location: R-36 is located in lower Sandia Canyon about 2200 ft southeast of supply well PM-3.

Completion Type: Single completion at the top of the regional aquifer.

Period of Record: Well completed February 2008, transducer installed March 31, 2008; water level data through 2010.

Remarks: R-36 installed near the top of the regional aquifer to a depth of 803.7 ft; top of screen is about 17 ft below the regional water table. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. Available water level data indicate that R-36 does not appear to respond to supply well pumping at nearby wells PM-1 and PM-3, but indicate a relatively continual decline of about 0.5 ft/yr in response to supply well pumping.

### R-36 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>6826.6</td>
<td>780.9</td>
<td>5801.5</td>
<td>803.7</td>
<td>13.9</td>
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<td>RT</td>
<td>Tsfu</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6591.37 ft; all measurements are from this elevation.
3.42 R-37

Location: R-37 is located at TA-54 on an unnamed mesa between Cañada del Buey and the south fork of Cañada del Buey. R-37 is about 3000 ft southeast of supply well PM-4, 2500 ft northeast of supply well PM-2, and about 1100 ft east of MDA J.

Completion Type: Dual completion in a perched intermediate zone and in the top of the regional aquifer. A Baski dual pump sampling system was installed on November 11, 2009, but due to a problem with the Bennett pump, the system was removed on December 14, 2009, and reinstalled on December 16, 2009.

Period of Record: Well completed June 2009, transducers installed November 12, 2009, and again on December 17, 2009; water level data through 2010.

Remarks: The top of screen 2 is about 12 ft below the regional water table. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The regional aquifer at R-37 screen 2 responds to supply well pumping at nearby well PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Packer/ Sump Bottom (ft)</th>
<th>Depth to bottom of Packer (ft)</th>
<th>Sump Length (ft)</th>
<th>Bottom Well Elev (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>I</td>
<td>Tpf</td>
</tr>
<tr>
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<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6870.59 ft; all measurements are from this elevation.
### 3.43 R-38

**Location:** R-38 is located in middle Cañada del Buey northeast of MDA L and about 960 ft northeast of R-53.

**Completion Type:** Single completion at the top of the regional aquifer in Cerros del Rio basalt.

**Period of Record:** Well completed December 2008, transducer installed March 25, 2009; data through 2010.

**Remarks:** R-38 installed near the top of the regional aquifer to a depth of 853 ft; top of screen is about 10 ft below the regional water table. The well is 100% barometrically efficient; however, the aquifer has a delayed response to atmospheric pressure fluctuations. Available data indicate that R-38 shows a small response to pumping at supply well PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Bottom Well Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

**Note:** Brass Cap Ground Elevation: 6668.58 ft; all measurements are from this elevation.

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**Graph:**

- **Legend:** Manual, Transducer
- **Groundwater Elevation:**
  - 5855 ft
  - 5856 ft
  - 5857 ft
  - 5858 ft
  - 5859 ft
  - 5860 ft

- **Date:**
  - 10/1/08
  - 12/31/08
  - 4/1/09
  - 7/1/09
  - 10/1/09
  - 12/31/09
  - 4/1/10
  - 7/2/10
  - 10/1/10
  - 12/31/10

---

**LA-14437-PR 61**
3.44 R-39

Location: R-39 is located in lower Pajarito Canyon southeast and downgradient of TA-54 MDA G. R-38 is about 700 ft southwest of monitoring well R-22, 850 ft south of R-57, and 1100 ft east of R-49.

Completion Type: Single completion at the top of the regional aquifer in Cerros del Rio basalt.


Remarks: R-39 installed near the top of the regional aquifer to a depth of 875.6 ft; top of the screen is about 30 ft below the regional water table. The well is 80% barometrically efficient; the aquifer indicates a partial response to atmospheric pressure fluctuations. The R-39 screen overlaps the lower 4 ft of R-57 screen 1 and is 36 ft above R-57 screen 2; R-39 water level is 5 ft lower than R-57 screen 1 and 3 ft higher than R-57 screen 2. The groundwater at R-39 responded during drilling R-57 and responds to pumping R-57 screen 2. The water level at R-39 is about 2 ft higher than at R-49 screen 2, which shows similar responses to R-57 screen 2 pumping.
3.45  R-40

Location: R-40 is located in lower Pajarito Canyon east of TA-18, 400 ft north of supply well PM-2 and about 0.25 mi south of MDA J.

Completion Type: Three screens in two piezometers; one intermediate 3-in.-ID PVC piezometer screen (R-40i) and two 5-in.-ID stainless steel screens (R-40) with the upper screen in an intermediate zone and the lower screen at the top of the regional aquifer.

Period of Record: Well completed January 2009. Transducers installed at all three screens August 27, 2009; data through 2010. A temporary transducer was installed at the R-40 upper screen from February 11 to March 3, 2009, to monitor the slow recovery of the lower intermediate zone after attempting an aquifer test.

Remarks: Screen R-40i and the upper R-40 screen are completed in intermediate perched zones within the Cerros del Rio basalt. The lower R-40 screen is installed in Puye fanglomerates near the top of the regional aquifer to a depth of 895 ft; the lower R-40 screen straddles the regional water table. The regional aquifer indicates a response to pumping supply wells PM-2 and PM-4.

---

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<tr>
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<td>870.0</td>
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<td>25.0</td>
<td>96.5</td>
<td>RT</td>
<td>Tpf</td>
<td>5&quot; ID SS Casing</td>
</tr>
</tbody>
</table>

Note: BRASS CAP GROUND ELEVATION: 6719.24 ft; all measurements are from this elevation.

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Graph showing groundwater levels with dates and transducer data for R-40 and R-40i.
Groundwater Level Status Report

March 2011

Note scale change for R-40 Screen 1 hydrograph
3.46 R-41

Location: R-41 is located about 100 ft east of MDA G at TA-54 and about 420 ft northeast of R-57 and 650 ft north of monitoring well R-22.

Completion Type: Dual completion in a dry zone and at the top of the regional aquifer in Santa Fe Group sediments.


Remarks: Screen 1 has been dry since installation. Screen 2 is installed near the top of the regional aquifer to a depth of 997.1 ft; the top of the screen is about 4 ft below the regional water table. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuation. The water level at R-41 is about 50 ft lower than at R-22 screen 1 and R-57 screen 1 and about 50 ft lower than at R-57 screen 2. The R-41 water level is similar to the water level at R-22 screen 3. The aquifer at R-41 showed no apparent response to pumping at nearby well R-57. Available data do not indicate a response at R-41 to supply well pumping.

### R-41 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Packer (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>7.2</td>
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<td>Taf</td>
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<td>5685.5</td>
<td>9.7</td>
<td>978.1</td>
<td>5682.0</td>
<td>975.0</td>
<td>5666.5</td>
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<td>22.1</td>
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<td>RT</td>
<td>Taf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 5660.93 ft; all measurements are from this elevation.

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**R-41**

- Screen 2 Manual
- Screen 2 Transducer

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R-41 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Packer (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
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<th>Geo Unit Code</th>
</tr>
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<td>9.7</td>
<td>978.1</td>
<td>5682.0</td>
<td>975.0</td>
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</tr>
</tbody>
</table>
3.47 R-42

Location: R-42 is located in lower Mortandad Canyon between R-15 and R-28. R-42 is about 970 ft southeast of R-43 (located in Sandia Canyon) and 0.25 mi west of R-28.

Completion Type: Single completion within the regional aquifer in Santa Fe Group sediments.


Remarks: R-42 installed in the regional aquifer to a depth of 973.5 ft. The top of the screen is about 12 ft below the water table. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The aquifer indicates a response to pumping supply well PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Top Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
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<td>Tsfu</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6759.02 ft; all measurements are from this elevation.

R-42 Construction Information

LA-14437-PR
3.48 R-43

Location: R-43 is located in middle Sandia Canyon about 970 ft northwest of R-42.
Completion Type: Dual completion within the regional aquifer. The top of screen 1 is about 10 ft below the water table.
Remarks: R-43 installed in the regional aquifer to a depth of 990 ft, about 95 ft into the aquifer. A Baski packer with dual valve, single submersible pump sampling system was installed June 8, 2009. The screens are 44.5 ft apart with a head difference of about 1 ft. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The aquifer indicates a response to pumping supply well PM-4.
3.49 R-44

Location: R-44 is located in lower Mortandad Canyon about 925 ft west of R-13, 940 ft south of R-45, and 0.25 mi east of R-50.

Completion Type: Dual screen completion within the regional aquifer.

Period of Record: Well completed January 2009; transducers installed July 8, 2009; data through 2010.

Remarks: R-44 installed in the regional aquifer to a depth of 1016 ft, about 110 ft into the aquifer. The screens are 80 ft apart. Both screens exhibit a response to pumping supply well PM-4; however, screen 2 shows more response than screen 1. During pumping PM-4, the head difference between screens was about 0.25 ft; however, with PM-4 shut down, the head difference declines. The well is 100% barometrically efficient; however, the aquifer shows a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top/Bottom of Packer (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L.)</th>
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Note: Brass Cap Ground Elevation: 6714.81 ft; all measurements are from this elevation.
3.50 R-45

Location: R-45 is located in lower Mortandad Canyon about 925 ft north of R-44 and 1285 ft east of R-28.

Completion Type: Dual screen completion within the regional aquifer.


Remarks: R-45 installed in the regional aquifer to a depth of 1016 ft, about 147 ft into the aquifer. The screens are 85 ft apart. Both screens exhibit a response to pumping supply well PM-4; however, screen 2 shows more response than screen 1. During pumping PM-4 in 2009, the head difference between screens was about 0.10 ft; however with PM-4 shut down, the head difference declines to 0.05 ft or less. The well is 100% barometrically efficient; however, the aquifer shows a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top/Bottom of Packer (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
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Note: Brass Cap Ground Elevation: 6704.02 ft; all measurements are from this elevation.
3.51 R-46

Location: R-46 is located on a mesa between Mortandad Canyon and Pajarito Canyon about 800 ft east (downgradient) of MDA C and R-60, and 4700 ft west (upgradient) of supply well PM-5.

Completion Type: Single completion at the top of the regional aquifer. The screen is located about 12 ft below the water table.


Remarks: R-46 installed in the regional aquifer to a depth of 1382.2 ft. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The groundwater responds to pumping supply wells PM-4 and PM-5.

### R-46 Construction Information

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<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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Note: Brass Cap Ground Elevation: 7213.33 ft; all measurements are from this elevation.

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LA-14437-PR
3.52 R-48

Location: R-48 is located at the east side of TA-10 about 1800 ft south of R-25. R-48 was formerly borehole CdV-16-3i, which was deepened and completed in the regional aquifer.

Completion Type: Single completion at the top of the regional aquifer. The screen is located about 147 ft below the water table in Tschicoma dacite.


Remarks: R-48 installed in the regional aquifer to a depth of 1540 ft. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations.

### R-48 Construction Information

<table>
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<tr>
<th>Screen</th>
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<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
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<td>R1</td>
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Note: Brass Cap Ground Elevation: 7486.78 ft; all measurements are from this elevation.
3.53 R-49

Location: R-49 is located in lower Pajarito Canyon south of TA-54 and MDA G and about 1100 ft west of R-39. R-49 is 1550 ft southwest of R-57.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 50 ft apart. The upper screen is located in basalt about 35 ft below the water table and the lower screen is in Puye Totavi lentil sediments.

Period of Record: Well completed June 2009, transducers installed August 20, 2009, groundwater level data through 2010.

Remarks: R-49 installed in the regional aquifer to a depth of 949.3 ft. A Baski dual valve sampling system was installed in August 2009. The well is 100% barometrically efficient; the aquifer does not immediately respond to atmospheric pressure fluctuations; however, the groundwater shows a delayed response to atmospheric pressure fluctuations. The groundwater at R-49 screen 2 responds to pumping supply wells PM-4 and PM-5 and responded to drilling activities at R-57 and pumping at R-57 screen 2.

### R-49 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Packer/ Sump Depth (ft)</th>
<th>Top of Packer/ Sump Elev (ft)</th>
<th>Bottom of Packer/ Sump Depth (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
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<td>125.8</td>
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</tbody>
</table>

Note: Brass Cap Ground Elevation: 6584.54 ft; all measurements are from this elevation.
3.54 R-50

Location: R-50 is located on a mesa south of Mortandad Canyon near the boundary with San Ildefonso Pueblo. R-50 is about 0.25 mi west of R-44 and 0.25 mi south of R-28.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 98 ft apart. The upper screen is located in Puye fanglomerates about 10 ft below the water table.


Remarks: R-50 installed in the regional aquifer to a depth of 1217.5 ft. A dual valve Baski sampling system was installed in May 2010. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The groundwater at R-50 responds to pumping supply well PM-4. The groundwater at the lower screen contains significant volumes of gas, which requires pumping screen 2 at a reduced rate during purging and sampling.
3.55 R-51

Location: R-51 is located in middle Pajarito Canyon west of TA-18. R-51 is about 0.55 mi south of supply well PM-4, 0.48 mi northwest of supply well PM-02, and 0.43 mi northwest and upstream of R-40.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 105.7 ft apart. Both screens are located in Puye fanglomerates; the upper screen is about 25 ft below the water table.


Remarks: R-51 installed in the regional aquifer to a depth of 1046.1 ft. A dual valve Baski sampling system was installed in May 2010. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The groundwater responds to pumping supply wells PM-2 and PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top/Bottom Packer Depth (ft)</th>
<th>Top/Bottom of Packer Elev (ft)</th>
<th>Depth to LIC Top (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<td>RD</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6762.17 ft; all measurements are from this elevation.
3.56 R-52

Location: R-52 is located at TA-54 on an unnamed mesa between Cañada del Buey and the south fork of Cañada del Buey. The well is about 500 ft northeast of MDA J, 850 ft northwest of R-37 and 0.45 mi southeast of supply well PM-4.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 51.3 ft apart. A dual valve Baski system was installed July 17, 2010.


Remarks: R-51 installed in the regional aquifer to a depth of 1128.7 ft. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. The groundwater responds to pumping nearby supply well PM-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
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<th>APV Elev (ft)</th>
<th>Top / Bottom of Packer Elev (ft)</th>
<th>Top / Bottom of Packer Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
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<td>RD</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6883.04 ft; all measurements are from this elevation.

Diagram: Graph showing groundwater elevation from 4/1/10 to 11/30/10 with data points for Screen 1 and Screen 2.
3.57 R-53

Location: R-53 is located in the south fork of Cañada del Buey about 400 ft northeast of MDA at TA-54. R-53 is about 950 ft west of R-38, 1370 ft northwest of R-21, and 1330 ft east of R-54.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 100.5 ft apart. A dual valve Baski system was installed July 07, 2010.


Remarks: R-53 installed in the regional aquifer to a depth of 1001.9 ft. The upper screen is located in Puye fanglomerates about 20 ft below the Cerros del Rio basalt and 19 ft below the water table; the lower screen is also in Puye fanglomerates but there does not appear to be hydraulic communication between screens. Preliminary data indicate that screen 1 is about 80% barometrically efficient and screen 2 is about 50% barometrically efficient. The groundwater at screen 2 responds to supply pumping at PM-4.
3.58 R-54

Location: R-54 is located in lower Pajarito Canyon about 985 ft east of R-20 and 2250 east of PM-2. R-54 is about 0.5 mi northwest of R-32 and 0.25 mi west of R-53.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 75 ft apart. Screen 1 is located in the Cerros del Rio basalt and screen 2 is located in Puye fanglomerates; the upper screen is about 13 ft below the water table.


Remarks: R-54 installed in the regional aquifer to a depth of 936 ft. A dual valve Baski sampling system was installed in May 2010. The well is 100% barometrically efficient; the aquifer does not respond to atmospheric pressure fluctuations. Note that screen 2 has a higher head than screen 1 except when supply well PM-2 is pumping. Screen 2 responds to pumping at PM-2 and PM-4.

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**R-54 Construction Information**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
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<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top/Bottom of Packer Depth (ft)</th>
<th>Top of Packer Depth (ft)</th>
<th>Top of Packer Elev (ft)</th>
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<th>Sump Bottom Elev (ft)</th>
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<td>5803.9</td>
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<td>11.0</td>
<td>11.2</td>
<td>RD</td>
<td>Tp4</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6676.85 ft; all measurements are from this elevation.
3.59 R-55

Location: R-55 is located in lower Cañada del Buey about 0.4 mi east of MDA G at TA-54. R-55 is about 1975 ft east of R-47 and 1760 ft east-northeast of R-22.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 114 ft apart.

- Screen 1 is located in Puyc fanglomerates and screen 2 is located in the Chamita Formation; the upper screen is about 25 ft below the water table.


Remarks: R-55 installed in the regional aquifer to a depth of 1021 ft. A dual valve Baski sampling system was installed January 18, 2011. The head difference between screens is about 2.8 ft.

---

### R-55 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Top / Bottom of Packer Elev (ft)</th>
<th>Top / Bottom of Packer Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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<tr>
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<td>RT</td>
<td>Tpf</td>
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<tr>
<td>2</td>
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<td>1015.4</td>
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<td>5518.5</td>
<td>21.0</td>
<td>992.2</td>
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<td>950.0</td>
<td>5583.8</td>
<td>1021.0</td>
<td>5.6</td>
<td>5.7</td>
<td>RD</td>
<td>Tch</td>
</tr>
</tbody>
</table>

Note: Bratt Cap Ground Elevation: 6533.86 ft; all measurements are from this elevation.

---

### Graph: R-55 Screens 1 and 2 on 01/19/2011

- **Screen 1**
- **Screen 2**
- **Ops**

Note very short time scale.

---

LA-14437-PR 79
3.60 R-56

Location: R-56 is located on Mesita del Buey at TA-54 between MDA L and MDA G. R-56 is about 550 ft southeast of MDA L and about 0.25 mi northwest of MDA G. R-56 is about 780 ft west of R-21 and 900 ft southeast of R-53.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 81 ft apart. Both screens are located in dacitic gravels within the Puye fanglomerates; the upper screen is about 25 ft below the water table.


Remarks: R-56 installed in the regional aquifer to a depth of 1078 ft. A dual valve Baski sampling system was installed January 15, 2011. The head difference between screens in August 2010 was about 4 ft and, in January 2011, was about 2.7 ft.

<table>
<thead>
<tr>
<th>R-56 Construction Information</th>
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<tbody>
<tr>
<td>Screen</td>
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<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6780.86 ft; all measurements are from this elevation.

Note very short time scale.

LA-14437-PR 80
3.61 R-57

Location: R-57 is located east of TA-54 MDA G about 420 ft south of R-41 and 300 ft northwest of R-22. R-57 is about 850 ft north of R-39 and 1550 ft northeast of R-49.

Completion Type: Dual completion, two screens in the regional aquifer. The screens are 41 ft apart.

Screen 1 is located in the Cerros del Rio basalt and screen 2 is located in Puye Totavi lentil sediments; the upper screen is about 20 ft below the water table.


Remarks: R-57 installed in the regional aquifer to a depth of 1013.8 ft; the head separation between screens is about 8 ft. A dual valve Baski sampling system was installed December 16, 2010. R-57 screen 1 is at the approximate same elevation as nearby well R-41 screen 1, which is dry. The top of R-57 screen 2 is about 10 ft below the bottom of R-41 screen 2; however, the water level at R-41 screen 2 is about 50 ft lower than the R-57 screen 2 water level. The R-57 screen 1 water level is similar to that at R-22 screen 1; R-57 screen 2 water level is similar to that at R-22 screen 2 and about 50 ft higher than the groundwater at R-22 screen 3. R-49 screen 1 and R-57 screen 1 are at similar elevations but the water level at R-49 screen 1 is about 12 ft higher than R-57 screen 1. The lower screens at R-57 and R-49 are at equivalent elevations, and the groundwater levels are similar.

---

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Screen APV Elev (ft)</th>
<th>Screen APV of Top Sump Elev (ft)</th>
<th>Top/Bottom of Packer Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gallons)</th>
<th>Hydro Geo Zone Code</th>
<th>Geo Unit Code</th>
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<tr>
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<td>RT</td>
<td>704</td>
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<tr>
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<td>22.1</td>
<td>RD</td>
<td>704</td>
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</tbody>
</table>

Note: Brass Cap Ground Elevation: 6648.04 ft; all measurements are from this elevation

---

Graph showing groundwater level changes from 6/1/10 to 1/30/11 with marked dates and screen elevations.

---

LA-14437-PR
3.62 R-60

Location: R-60 is located on a mesa between Mortandad Canyon and Pajarito Canyon about 100 ft east of MDA C and about 770 ft northwest of R-46.

Completion Type: Single completion at the top of the regional aquifer. The screen is located in the Pujo fanglomerates about 10 ft below the water table.


Remarks: R-60 installed in the regional aquifer to a depth of 1360.9 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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</table>

Note: Brass Cap Ground Elevation: 7228.17 ft; all measurements are from this elevation.
3.63 R-63

Location: R-63 is located at TA-16 near the Burning Grounds. R-63 is located adjacent to and on the same pad as CDV-16-2(i)r; R-63 is about 1000 ft east of intermediate well CDV-16-4ip and about 1500 ft east of R-25.

Completion Type: Single completion at the top of the regional aquifer. The screen is located in Puye fanglomerates.

Period of Record: Well completed January 2011, pending transducer installation.

Remarks: R-63 installed in the regional aquifer to a depth of 1387 ft. Construction data pending.

### R-63 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
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<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
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<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
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<tr>
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<td></td>
<td></td>
<td>RT</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: not yet surveyed; all measurements are from ground surface.
3.64 Test Well 1

Location: TW-1 was located in lower Pueblo Canyon downstream of supply well O-1. TW-1 was plugged and abandoned in March 2010.

Completion Type: Single completion within the regional aquifer. The top of the screen was about 120 ft below the water table in 2006.

Period of Record: Well completed January 1950, transducer installed January 23, 1992, intermittent water level data to February 6, 2006, when the transducer was removed in preparation for well plugging and abandonment.

Remarks: TW-1 installed in the regional aquifer at a depth of 642 ft, about 100 ft into the regional aquifer. Water level in TW-1 was recharged locally by surface water from Pueblo Canyon (Koch and Rogers 2003) and did not correlate with the water level of surrounding regional aquifer wells. Test Well 1 was plugged and abandoned March 23, 2010 (LANL April 2010).

<table>
<thead>
<tr>
<th>TW-1 Construction Information</th>
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<tbody>
<tr>
<td>Screen</td>
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<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Note: TW-1 Ground Elevation: 6369.19 ft; all measurements are from this elevation.
3.65 Test Well 2

Location: TW-2 was located in middle Pueblo Canyon. TW-2 was plugged and abandoned in February 2010.

Completion Type: Single completion at the top of the regional aquifer.


Remarks: TW-2 was completed at the top of the regional aquifer at a depth of 834 ft, about 35 ft into the regional aquifer. The transducer failed in November 2000, transducer data since then are questionable. A manual measurement attempt in March 2005 resulted in the measurement tape stuck in the well. Thus, transducer water level data since November 2000 are not valid with respect to elevation, but are shown for reference and character information only. TW-2 was plugged and abandoned February 8, 2010 (LANL March 2010).

### TW-2 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
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Note: Test Well 2 Ground Elevation: 6648.06 ft; all measurements are from this elevation.
3.66 Test Well 3

Location: TW-3 is located in middle Los Alamos Canyon at the confluence with DP Canyon.
Completion Type: Single completion at the top of the regional aquifer.
Remarks: TW-3 completed at the top of the regional aquifer at a depth of 815 ft, about 30 ft into the regional aquifer. Transducer removed February 9, 2006, in preparation for well plugging and abandonment. The well was re-opened and sampled in July 2009 and January 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
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<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
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<td>0.0</td>
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<td>Tpt</td>
<td></td>
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</tbody>
</table>

Note: Ground Elevation: 6626.9 ft; all measurements are from this elevation.

---

TW-3 Construction Information

---

TW-3

- Manual
- Transducer

Groundwater Elevation (ft)

Date

1/92 1/93 1/94 1/95 1/96 1/97 1/98 1/99 1/00 1/01 1/02 1/03 1/04 1/05 1/06 1/07 1/08 1/09 1/10
3.67 Test Well 4

Location: TW-4 was located in upper Pueblo Canyon east of Acid Canyon and about 1 mi west of R-2.

Completion Type: Single completion at the top of the regional aquifer.

Period of Record: Well drilled in 1950, transducer installed June 1993 but problems occurred with the transducer equipment. Transducer reinstalled July 1997, intermittent data to February 8, 2006.

Remarks: Completed at the top of the regional aquifer to a depth of 1205 ft, about 30 ft into the regional aquifer. Transducer removed February 8, 2006, in preparation for well plugging and abandonment. TW-4 was plugged and abandoned May 3, 2010 (LANL July 2010). The groundwater level measurement before plugging was reported to be 6076.56 ft, but the accuracy of the measurement is questionable.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Depth to Top of Intake Elev (ft)</th>
<th>Depth to Top of Sump Elev (ft)</th>
<th>Top of Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<td>0.0</td>
<td>RT</td>
</tr>
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</table>

Note: TW-4 Ground Elevation: 7244.66 ft; all measurements are from this elevation.

TW-4

- Manual
- Transducer

Groundwater Level Status Report

March 2011

LA-14437-PR 87
3.68 Test Well 8

Location: TW-8 was located in middle Mortandad Canyon about 220 ft east of R-1, which was drilled to replace TW-8.

Completion Type: Single completion at the top of the regional aquifer. The screen straddled the water table.

Period of Record: Well drilled in 1960, transducer installed June 1993, transducer data to March 1997. Transducer reinstalled January 2000; intermittent data to June 19, 2008, when the transducer was removed. Several manual measurements were obtained in June and July 2009 during preparations for plugging and abandonment.

Remarks: TW-8 was completed at the top of the regional aquifer at a depth of 1065 ft, about 70 ft into the regional aquifer. The well was nearly 100% barometrically efficient; the aquifer had no response to atmospheric pressure fluctuations. The aquifer indicated a seasonal response to supply well pumping and primarily responded to pumping PM-5 and possibly to pumping PM-4. The well was plugged and abandoned on August 13, 2009.

### TW-8 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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</thead>
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<tr>
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<td>Tpf</td>
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</tbody>
</table>

Note: Ground Elevation 6873.5 ft; all measurements are from this elevation
3.69 Test Well DT-5A

Location: DT-5A is located at TA-49 near the southern boundary of LANL. DT-5A is about 1300 ft northwest of R-30 and 1600 ft west-southwest of R-29.
Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.
Remarks: DT-5A completed at the top of the regional aquifer at a depth of 1819.5 ft, about 650 ft into the regional aquifer. The long screen encompasses Tb4 basalt and Tp fanglomerates. The well is 100% barometrically efficient; the aquifer does not respond immediately to atmospheric pressure fluctuations but shows a delayed response. The long-term water level shows a decline of about 0.2 ft/yr, likely in response to supply well pumping.

### Test Well DT-5A Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
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<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<th>Geo Unit Code</th>
</tr>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

*Note: Brass Cap Elevation 7143.86 ft; all measurements are from this elevation.*
3.70 Test Well DT-9

Location: DT-9 is located at TA-49 near the southern LANL boundary.
Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.
Remarks: DT-9 completed at the top of the regional aquifer at a depth of 1501 ft, about 500 ft into the regional aquifer. The long screen encompasses Tb4 basalt and Tp fanglomerates. The well is 100% barometrically efficient; the aquifer does not respond immediately to atmospheric pressure fluctuations but shows a delayed response. The aquifer shows a long-term decline of about 0.32 ft/yr, likely associated with supply well pumping.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
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<tbody>
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<td>681.0</td>
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<td>0.0</td>
<td>0.0</td>
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<td>Tb4</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation 6935.0 ft; all measurements are from this elevation

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LA-14437-PR 90
3.71 Test Well DT-10

Location: DT-10 is located at TA-49 near the southern LANL boundary. DT-10 is about 1850 ft south of R-27, 2400 ft southeast of R-29, and 2900 ft north of DT-9.

Completion Type: Single completion at the top of the regional aquifer. The screen straddles the water table.


Remarks: DT-10 completed at the top of the regional aquifer at a depth of 1408 ft, about 300 ft into the regional aquifer. The long screen encompasses Tb4 basalt and Tp fanglomerates. The well is about 70% barometrically efficient; the aquifer shows a 30% response to atmospheric pressure fluctuations. The aquifer exhibits a long-term water level decline of about 0.30 ft/yr, likely associated with supply well pumping.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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</thead>
<tbody>
<tr>
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<td>5611.9</td>
<td>329.6</td>
<td>1408.0</td>
<td>5611.9</td>
<td>1408.0</td>
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<td>0.0</td>
<td>RT</td>
<td>10</td>
<td>Tb4</td>
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</tbody>
</table>

Note: Ground Elevation: 7019.90 ft; all depths are from this elevation.
4.0 Groundwater Level Data from Intermediate Wells

Table 4-1 lists the monitoring wells that specifically monitor intermediate groundwater at LANL; the table includes the well name, completed depth, surveyed location coordinates, and the date of completion. Note that R-12 was converted from a three-screen regional/intermediate to a two-screen intermediate monitoring well in December 2007. Table 4-2 lists the well construction information for the intermediate wells and for regional aquifer wells that have intermediate screens. The table includes information for the depth to the top and bottom of screens, screen casing size, geologic formation where the screen is completed, and whether the well/screen contains intermediate groundwater. The hydrographs for intermediate zones in the multiple completion regional aquifer wells are shown in the previous section.

Figure 4-1 shows the locations of the intermediate wells and regional wells that monitor intermediate groundwater. (Note that multiple completion regional wells that do not contain intermediate groundwater, such as CdV-R-15-3, CdV-R-37-2, and R-31, are not shown in Figure 4-1 because the intermediate screens in these wells are dry.) Appendix Table B-2 lists the average annual water levels for each intermediate screen.
<table>
<thead>
<tr>
<th>Well Name</th>
<th>Date Completed</th>
<th>Completed Depth (ft)</th>
<th>Easting (ft)</th>
<th>Northing (ft)</th>
<th>Surface Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-B-13</td>
<td>6/10/2005</td>
<td>32.0</td>
<td>1616691.69</td>
<td>1773317.07</td>
<td>7458.26</td>
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<tr>
<td>16-26644</td>
<td>8/17/2007</td>
<td>150.0</td>
<td>1612087.16</td>
<td>1763729.94</td>
<td>7591.43</td>
</tr>
<tr>
<td>90LP-SE-16-02669</td>
<td>6/10/2005</td>
<td>163.4</td>
<td>1612152.57</td>
<td>1763749.00</td>
<td>7583.26</td>
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<td>BCO-1</td>
<td>11/23/1994</td>
<td>68.0</td>
<td>1640648.74</td>
<td>1778914.70</td>
<td>6641.97</td>
</tr>
<tr>
<td>CdV-16-1(i)</td>
<td>11/9/2003</td>
<td>657.8</td>
<td>1615078.20</td>
<td>1764415.20</td>
<td>7382.17</td>
</tr>
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<td>7/30/2005</td>
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<td>1616673.20</td>
<td>1764194.40</td>
<td>7456.47</td>
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<tr>
<td>CDV-16-4(ip)</td>
<td>8/23/2010</td>
<td>1146.0</td>
<td>1615587.07</td>
<td>1764195.74</td>
<td>7463.91</td>
</tr>
<tr>
<td>CDV-37-1(i)</td>
<td>12/2/2009</td>
<td>657.8</td>
<td>1625923.30</td>
<td>1757986.61</td>
<td>6826.49</td>
</tr>
<tr>
<td>LADP-3</td>
<td>12/17/1993</td>
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<td>1632989.00</td>
<td>1773469.10</td>
<td>6756.70</td>
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<td>1629427.38</td>
<td>1773924.51</td>
<td>6835.20</td>
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<td>1637642.10</td>
<td>1773066.93</td>
<td>6622.60</td>
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<td>1637619.97</td>
<td>1773100.91</td>
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<td>LAOI-7</td>
<td>9/21/2005</td>
<td>264.9</td>
<td>1644788.53</td>
<td>1771584.11</td>
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<td>1768542.01</td>
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<td>1635247.94</td>
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<td>1635345.65</td>
<td>1768428.06</td>
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<td>1614427.59</td>
<td>1762530.55</td>
<td>7516.92</td>
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<td>PCI-2</td>
<td>4/10/2009</td>
<td>633.3</td>
<td>1627648.27</td>
<td>1765872.63</td>
<td>6920.95</td>
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<td>POI-4</td>
<td>5/1/1996</td>
<td>176.5</td>
<td>1649432.46</td>
<td>1772587.08</td>
<td>6372.29</td>
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<tr>
<td>R-3i</td>
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<td>1649196.5</td>
<td>1772592.2</td>
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<td>1635992.34</td>
<td>1773889.89</td>
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<td>1648202.70</td>
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<td>1647424.20</td>
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<td>1647898.02</td>
<td>1755148.04</td>
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<td>1615125.60</td>
<td>1764074.70</td>
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<td>1615073.72</td>
<td>1764083.07</td>
<td>7517.59</td>
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<td>1610201.96</td>
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<td>1757360.90</td>
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<td>R-6i</td>
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<td>309.9</td>
<td>1648208.8</td>
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<td>1771320.08</td>
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Figure 4-1. Intermediate monitoring wells.
<table>
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<tr>
<th>Well Name</th>
<th>Screen Common Name</th>
<th>Screen Material</th>
<th>Top of Screen (ft)</th>
<th>Bottom of Screen (ft)</th>
<th>Screen Diameter (in.)</th>
<th>Geologic Unit</th>
<th>Comment</th>
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<td>03-B-13</td>
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<td>PVC</td>
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<td>Qbt3</td>
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<td>16-26644 Screen #1</td>
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<td>145.0</td>
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<td>PVC</td>
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<td>162.5</td>
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<td>PVC</td>
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<td>67.0</td>
<td>4.00</td>
<td>Tpf</td>
<td>Dry</td>
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<td>Qbo</td>
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<td>80.0</td>
<td>1.50</td>
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<td>CDV-15-3</td>
<td>CDV-15-3 Screen 2</td>
<td>SS304</td>
<td>617.7</td>
<td>624.5</td>
<td>4.50</td>
<td>Qbo</td>
<td>Dry</td>
</tr>
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<td>522.0</td>
<td>5.00</td>
<td>Tpf</td>
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<td>R-25 Screen #2</td>
<td>SS304</td>
<td>882.6</td>
<td>893.4</td>
<td>5.17</td>
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<td>SS304</td>
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</table>

Note: SS = stainless steel, PVC = polyvinyl chloride, Qbo = Otowi Member of the Bandelier Tuff, Tp = Puye Formation, Qbog = Guaje Pumice member of the Bandelier Tuff, Tpf = fluvial facies of the Puye Formation, Tb = undifferentiated basalt, Tb4 = Cerros del Rio Basaltic Rocks; Qbt3 = Unit 3 of the Tshirege Member of the Bandelier Tuff, Tt = Tschicoma Formation (dacite).
Table 4-2. Well Completion Information for Intermediate Wells and Screens (Continued)

<table>
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<th>Well Name</th>
<th>Screen Common Name</th>
<th>Screen Material</th>
<th>Top of Screen (ft)</th>
<th>Bottom of Screen (ft)</th>
<th>Screen Inside Diameter (in.)</th>
<th>Geologic Unit</th>
<th>Comment</th>
</tr>
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<tr>
<td>R-27i</td>
<td>R-27i Screen #1</td>
<td>SS304</td>
<td>619.0</td>
<td>629.0</td>
<td>5.00</td>
<td>Qbt3</td>
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<td>R-31</td>
<td>R-31 Screen #1</td>
<td>SS304</td>
<td>439.1</td>
<td>454.4</td>
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<td>Tb</td>
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<tr>
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<td>R-37 Screen #1</td>
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<td>R-40i</td>
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<tr>
<td>R-41</td>
<td>R-41 Screen #1</td>
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<td>928.0</td>
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<tr>
<td>R-47i</td>
<td>R-47i Screen #1</td>
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<tr>
<td>R-5</td>
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<td>326.4</td>
<td>331.5</td>
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<td>Tp</td>
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</tr>
<tr>
<td>R-5i</td>
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<td>SS304</td>
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<td>388.8</td>
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<td>SS304</td>
<td>510.0</td>
<td>530.0</td>
<td>5.00</td>
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<tr>
<td>R-6i</td>
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<td>SS304</td>
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<tr>
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<td>R-7 Screen #1</td>
<td>SS304</td>
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<td>Dry</td>
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<tr>
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<td>R-7 Screen #2</td>
<td>SS304</td>
<td>730.4</td>
<td>746.4</td>
<td>4.50</td>
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<td>Dry</td>
</tr>
<tr>
<td>R-6i</td>
<td>R-6i Screen #2</td>
<td>SS304</td>
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<td>199.6</td>
<td>5.00</td>
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<tr>
<td>SCI-1</td>
<td>SCI-1 Screen #1</td>
<td>PVC</td>
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<td>near R-43</td>
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<td>TA-53i</td>
<td>TA-53i Screen #1</td>
<td>SS304</td>
<td>600.0</td>
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<td>5.00</td>
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<tr>
<td>Test Well 1A</td>
<td>TW-1A Screen #1</td>
<td>CS</td>
<td>215.0</td>
<td>225.0</td>
<td>6.00</td>
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<td>P&amp;A 2010</td>
</tr>
<tr>
<td>Test Well 2A</td>
<td>TW-2A Screen #1a</td>
<td>CS</td>
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<td>133.0</td>
<td>6.00</td>
<td>Tp</td>
<td>P&amp;A 2010</td>
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<tr>
<td>TW-2Ar</td>
<td>TW-2Ar Screen #1</td>
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<td>102.0</td>
<td>112.0</td>
<td>4.88</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: SS = stainless steel, PVC = polyvinyl chloride, Qbo = Otowi Member of the Bandelier Tuff, Tp = Puye Formation, Qbog = Guaje Pumice member of the Bandelier Tuff, Tpf = fluvial facies of the Puye Formation, Tb = undifferentiated basalt, Tb4 = Cerros del Rio Basaltic Rocks; Qbt3 = Unit 3 of the Tshirege Member of the Bandelier Tuff, Tt = Tschicoma Formation (dacite); P&A = plugged and abandoned.

The following sections include additional port and construction information for single and multiple completion intermediate wells at LANL. Time-series groundwater level data are shown for each well.
4.1 03-B-13

Location: 03-B-13 is located at TA-3 behind building SM-30.
Completion Type: Single completion in an intermediate perched zone in Unit 3 of the Bandelier Tuff. The wellhead is completed below ground surface with a waterproof well cap flush with an asphalt roadway.


Remarks: The surface completion was reworked in 2007. Surface water enters the well protective cover at times and may enter the well.

### 03-B-13 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.50</td>
<td>31.5</td>
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<td>7426.8</td>
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<td>None</td>
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<td>7426.8</td>
<td>32.0</td>
<td>0.5</td>
<td>0.3</td>
<td>I</td>
<td>Qbt3</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7458.26 ft; all depths from this elevation.
4.2 16-26644

Location: 16-26644 is located at TA-16 southeast and downgradient of the 90LP Pond and about 70 ft west of well 90LP-SE-16-02669.

Completion Type: Single completion in an intermediate zone in Unit 3 of the Bandelier Tuff.

Period of Record: Well drilled in August 2007, periodic manual measurements through 2009. A dedicated Bennett pump and transducer were installed in January 2010; data through 2010.

Remarks: The well has contained water when checked since completion of drilling, but several nearby boreholes and wells to a similar depth are dry. The groundwater appears to respond to precipitation and nearby runoff events.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>145.0</td>
<td>7461.4</td>
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<td>144.4</td>
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<td>150.0</td>
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<td>3.1</td>
<td>Qtb3</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7591.43 ft; all measurements are from this elevation.

16-26644 Construction Information

![Graph showing groundwater elevation over time with manual and transducer data points.](image-url)
4.3 90LP-SE-16-02669

Location: 90LP-SE-16-02669 is located at TA-16 downgradient of the 90LP Pond. 90LP-SE-16-02669 is about 70 ft east-northeast of 16-26644.

Completion Type: Single completion in an intermediate zone in Unit 3 of the Bandelier Tuff.

Period of Record: Well drilled in March 1998, periodic measurements through 2010.

Remarks: The borehole contained water at the completion of drilling, but since completion of the well, water has not been present in the well; the well was last checked April 29, 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Geo Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>None</td>
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<td>163.4</td>
<td>0.4</td>
<td>0.2</td>
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</tr>
</tbody>
</table>

Note: Ground Elevation: 7583.26 ft; all measurements are from this elevation.
4.4 CdV-16-1(i)

Location: CdV-16-1(i) is located at TA-16 downgradient of the TA-6-280 outfall and about 360 ft north of intermediate well R-25b and R-25 and about 550 ft northwest of CDV-16-4ip.

Completion Type: Single completion in an intermediate zone. The screen is located at similar depth as R-25 screen 1 and R-25b.


Remarks: Well completed in an intermediate zone in the Otowi Member of the Tshirege Formation; the water level is about 50 ft above the top of the screen. The screen is at a similar elevation as R-25b and R-25 screen 1; the bottom of the screen is about 105 ft higher than the top of the screen at CDV-16-4ip. The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The intermediate groundwater rose in response to snowmelt runoff in the spring of 2007, 2008, and 2010 and responded to drilling activities at R-25b and R-35c in 2008.

### CDV-16-1(i) Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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</table>

Note: Ground Elevation: 7382.17 ft; all measurements are from this elevation.
4.5 CdV-16-2(i)r

Location: CdV-16-2(i)r is located at TA-16 downgradient of the TA-6-260 outfall and about 1450 ft east of R-25.

Completion Type: Single completion in intermediate zone in the Puye Formation.


Remarks: Well replaces CdV-16-2(i). The water level is about 20 ft above bottom of screen. The well is about 90% barometrically efficient. The groundwater did not indicate a response to snowmelt runoff in 2007 but may have shown a small response to snowmelt runoff in the spring of 2008 and 2010. Nearby dry well CdV-16-2(i) was plugged and abandoned in July 2009 (LANL August 2009b). The groundwater level at CdV-16-2(i)r began to recover on July 9, 2009, when pressure grouting activities commenced during plugging of the nearby well; the water level recovered about 1.3 ft after CdV-16-2(i) was plugged.

CDV-16-2(i)r Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Screen Intake Depth (ft)</th>
<th>Screen Inake Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<th>Hydro Unit Code</th>
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<td>1</td>
<td>Tpf</td>
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</table>

Note: Ground Elevation: 7453.67 ft; all measurements are from this elevation

LA-14437-PR 101
### 4.6 CDV-16-4ip

**Location:** CdV-16-2(i)r is located at TA-16 downgradient of the TA-66-260 outfall and about 430 ft east of R-25 and 750 ft southeast of CdV-16-1(i).

**Completion Type:** Dual completion in two intermediate zones in the Puye Formation.

**Period of Record:** Well completed August 2010. Temporary transducer installed at screen 1 above a temporary packer December 22, 2010, to monitor drilling activities at R-63. Installation of permanent transducers is pending.

**Remarks:** The upper screen is at a similar elevation as R-25 screen 2 and is 105 ft lower than the screen at CdV-16-1(i). The lower screen is at a similar elevation as R-25 screen 4. The water level at screen 1 is about 11 ft above the top of the screen. Screen 1 is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure changes. Groundwater level data from screen 2 are pending.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>APV Intake Depth (ft)</th>
<th>APV Intake Elev (ft)</th>
<th>Packer Top/Bottom Depth (ft)</th>
<th>Packer Top/Bottom Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Vol (gal.)</th>
<th>Sump Zone Code</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
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<td>6584.7</td>
<td>63.6</td>
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<td>116.0</td>
<td>4.9</td>
<td>5.0</td>
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</tr>
<tr>
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<td>1146.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>Tpf</td>
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</tbody>
</table>

**Note:** Brass Cap Ground Elevation: 7463.91 ft; all measurements are from this elevation.

![CDV-16-4ip Screen 1](chart.png)
4.7 CDV-37-1(i)

Location: CDV-37-1(i) is located in Water Canyon near the confluence with Cañon de Valle and about 0.9 mi west and upstream of R-27i.

Completion Type: Single completion in an intermediate zone in the Puye Formation fanglomerates.


Remarks: A dedicated Bennett submersible pump was installed in January 2010. The screen is located about 4 ft below the level of the perched intermediate groundwater. The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations.

### CDV-37-1(i) Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Depth</th>
<th>Screen Elev</th>
<th>Screen Length</th>
<th>Screen Elev</th>
<th>Pump Intake Depth</th>
<th>Pump Elev</th>
<th>Depth to Top of Sump</th>
<th>Top of Sump Elev</th>
<th>Depth to Sump Bottom</th>
<th>Sump Elev</th>
<th>Sump Elev</th>
<th>Bottom of Well Elev</th>
<th>Hydro Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>647.3</td>
<td>6179.2</td>
<td>6174.0</td>
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<td>657.8</td>
<td>6168.7</td>
<td></td>
<td></td>
<td>6168.7</td>
<td>I</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6826.49 ft; all measurements are from this elevation.

![CDV-37-1(i) Graph](chart.png)
4.8 LADP-3

Location: LADP-3 is located in middle Los Alamos Canyon downgradient of TA-21 and about 0.9 mi upstream of the confluence with DP Canyon.

Completion Type: Single completion in an intermediate zone in the Guaje Pumice bed.


Remarks: No manual measurement available for April 2002 transducer installation, data from April 2002 to November 2003 questionable. The water level declined below the transducer from April 2006 to November 2006 and again from March 2009 to June 2009. The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The groundwater did not indicate a response to snowmelt runoff in 2007, 2008, and 2010. A dedicated Bennett pump was installed in July 2008.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>328</td>
<td>6440.7</td>
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<td>0.0</td>
<td>I</td>
<td>Qbog</td>
</tr>
</tbody>
</table>

Note: LADP-3 Ground Elevation: 9756.7 ft; all measurements are from this elevation

---

The diagram illustrates the groundwater elevation changes over time for LADP-3, showing manual, transducer, and questionable data points. Water level data is questionable without manual measurement from April 2006 to November 2006 and again from March 2009 to June 2009.
4.9 LAOI(a)-1.1

Location: LAOI(a)-1.1 is located in middle Los Alamos Canyon downstream of TA-2 and TA-41.
Completion Type: Single completion in an intermediate zone in the Guaje Pumice bed.
Remarks: The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The groundwater did not indicate a response to snowmelt runoff in 2007, 2008, and 2010. A dedicated Bennett pump was installed July 2008.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>298.2</td>
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<td>305.0</td>
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<td>4.8</td>
<td>8.7</td>
<td>1</td>
<td>Qbog</td>
</tr>
</tbody>
</table>

Note: LAOI(A)-1.1 Ground Elevation: 6835.2 ft; all measurements are from this elevation
4.10 LAOI-3.2

Location: LAOI-3.2 is located in middle Los Alamos Canyon at the confluence with DP Canyon.
Completion Type: Single completion in an intermediate zone in the Guaje Pumice bed.
Remarks: The transducer was removed in October 2005 for pump installation. The transducer was reinstalled in November 2005. The water level declined below the level of the transducer for a time during pumping of the well in December 2005. The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The groundwater did not indicate a response to snowmelt runoff in 2007, 2008, and 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>153.3</td>
<td>162.8</td>
<td>6469.3</td>
<td>6459.8</td>
<td>9.5</td>
<td>159.3</td>
<td>6463.3</td>
<td>162.8</td>
<td>6459.8</td>
<td>165</td>
<td>2.2</td>
<td>1.5</td>
<td>I</td>
<td>Qbog</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6622.6 ft; all measurements are from this elevation.

Water level temporarily below transducer during 2 pumping events.

Manual
Transducer

Date
6/1/05
6/1/06
6/1/07
6/1/08
6/1/09
6/1/10

Groundwater Elevation (ft)
4.11 LAOI-3.2a

Location: LAOI-3.2a is located in middle Los Alamos Canyon near the confluence with DP Canyon and about 50 ft northwest of LAOI-3.2.
Completion Type: Single completion in an intermediate zone in Puye fanglomerate.
Period of Record: Well completed in January 2006. Transducer installed August 2006; transducer data through 2010.
Remarks: The water level is about 6 ft above the bottom of the screen. The well is 100% barometrically efficient, the groundwater does not respond to atmospheric pressure fluctuations. The groundwater did not indicate a response to snowmelt runoff in 2007, 2008, and 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>181.4</td>
<td>191</td>
<td>6443.0</td>
<td>6433.4</td>
<td>9.6</td>
<td>188</td>
<td>6435.4</td>
<td>191.0</td>
<td>6433.4</td>
<td>191.4</td>
<td>0.4</td>
<td>0.6</td>
<td>I</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6624.43 ft; all measurements are from this elevation

LAOI-3.2a

- Manual
- Transducer
4.12 LAOI-7

Location: LAOI-7 is located in middle Los Alamos Canyon about 0.75 mi upstream of R-9i.
Completion Type: Single completion in an intermediate zone in Cerros del Rio basalt.
Remarks: The well has an estimated 18% barometric efficiency (Kleinfelder 2006a); the groundwater shows a delayed, partial response to atmospheric pressure fluctuations. The groundwater rose about 11 ft in response to snowmelt runoff in 2007, about 5 ft in 2008, and about 5 ft in 2010.

### LAOI-7 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>240.0</td>
<td>259.6</td>
<td>6218.4</td>
<td>6198.8</td>
<td>19.6</td>
<td>240.0</td>
<td>6218.4</td>
<td>259.6</td>
<td>6198.8</td>
<td>254.9</td>
<td>5.3</td>
<td>7.4</td>
<td>Fb4</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6458.35 ft; all measurements are from this elevation

---

![Graph of LAOI-7 data](image)
4.13 MCOBT-4.4

Location: MCOBT-4.4 was located in lower Mortandad Canyon near the confluence with Ten Site Canyon.

Completion Type: Single completion at the base of the Puye Formation fanglomerate member and the top of Cerros del Rio basalt.

Period of Record: Well completed in June 2001, transducer installed July 2002, data to June 19, 2008, when the transducer was removed and monitoring ceased due to lack of measureable water.

Remarks: MCOl-4 was located about 70 ft west of MCOBT-4.4; the water level at MCOBT-4.4 declined after the installation of MCOl-4. The bottom of the transducer gage tube was located above the pump and about 1.2 ft above the bottom of the screen. The water level declined below the gage tube for portions of 2006 and most of 2007 and 2008. The water level remained near the bottom of the screen after 2006. MCOBT-4.4 was plugged and abandoned in July 2009 (LANL September 2009b).

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>485.4</td>
<td>524.0</td>
<td>6350.8</td>
<td>6312.2</td>
<td>38.6</td>
<td>534</td>
<td>6312.2</td>
<td>524.0</td>
<td>6312.2</td>
<td>545.0</td>
<td>21.0</td>
<td>64.5</td>
<td>I</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6836.18 ft; all measurements are from this elevation. Well plugged and abandoned 7/29/09.
4.14 MCOI-1

Location: MCOI-1 is located adjacent to upper Mortandad Canyon below the confluence with Effluent Canyon.

Completion Type: Single completion in the Puye Formation.


Remarks: MCOI-1 was dry when completed and has not contained water during periodic checks. Soundings for water throughout 2006 and 2007 have been dry with a total depth of about 814 ft below ground surface, encountering sand at total depth. This total depth is above the screen; thus it appears that the well screen in the 1-in.-diameter PVC may have parted from the tubing or has been somehow damaged, potentially rendering the well inoperative.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>815.0</td>
<td>825.5</td>
<td>6291.2</td>
<td>6280.8</td>
<td>10.5</td>
<td>None</td>
<td>None</td>
<td>825.5</td>
<td>6280.8</td>
<td>825.5</td>
<td>0.1</td>
<td>0.0</td>
<td>I</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7106.20 ft; all measurements are from this elevation.
4.15 MCOI-4

Location: MCOI-4 is located in lower Mortandad Canyon near the confluence with Ten Site Canyon and was about 70 ft upstream of MCOBT-4.4.

Completion Type: Single completion at the base of the Puye Formation fanglomerate member and the top of Cerros del Rio basalt.


Remarks: From 2006 to 2009, the water level in MCOI-4 was 2 to 3 ft higher than in adjacent well MCOBT-4.4 and relatively constant about 1 ft above the bottom of the screen. During plugging operations at MCOBT-4.4 from July 15 to 17, 2009, the water level at MCOI-4 rose about 1 ft and then declined over the next two weeks. The water level in the sump fluctuates indicating that the sump is not competent.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>499.0</td>
<td>522.0</td>
<td>6338.2</td>
<td>6315.2</td>
<td>23.0</td>
<td>524.0</td>
<td>6313.2</td>
<td>522.0</td>
<td>6315.2</td>
<td>525.7</td>
<td>3.7</td>
<td>11.6</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6837.20 ft; all measurements are from this elevation.
4.16 MCOI-5

Location: MCOI-5 is located in lower Mortandad Canyon about 70 ft northwest of regional aquifer well R-15.

Completion Type: Single completion in Cerros del Rio basalt.


Remarks: The transducer was removed for bailing sampling in 2005. A dedicated submersible pump was installed March 2006. The intermediate groundwater has a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Zone Code</th>
<th>Hydro Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>689.0</td>
<td>6130.7</td>
<td>699.0</td>
<td>6120.7</td>
<td>666.0</td>
<td>6123.7</td>
<td>699.0</td>
<td>6120.7</td>
<td>702.7</td>
<td>3.7</td>
<td>11.6</td>
<td>1</td>
<td>Tb4</td>
</tr>
</tbody>
</table>

Note: Brass cap elevation: 6819.70 ft; all measurements are from this elevation.

MCOI-5

Date

10/1/04 10/1/05 10/1/06 10/1/07 9/30/08 10/1/09 10/1/10

Groundwater Elevation (ft)

6142 6140 6138 6136 6134 6132 6130 6128

Manual
Transducer
4.17 MCOI-6
Location: MCOI-6 is located in lower Mortandad Canyon about 160 ft northeast of MCOI-5.
Completion Type: Single completion in Cerros del Río basalt.
Remarks: The groundwater level is about 20 ft above the top of the screen and 17 to 18 ft higher than at MCOI-5. The intermediate groundwater has a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>686.0</td>
<td>708.3</td>
<td>6125.1</td>
<td>6102.8</td>
<td>22.3</td>
<td>689.0</td>
<td>6122.1</td>
<td>708.3</td>
<td>6102.8</td>
<td>713.2</td>
<td>4.9</td>
<td>15.3</td>
<td>I</td>
<td>T64</td>
</tr>
</tbody>
</table>

Note: Brass cap elevation: 6611.10 ft; all measurements are from this elevation

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**MCOI-6 Construction Information**

![Graph showing groundwater levels over time]
4.18 MCOI-8

Location: MCOI-8 is located in lower Mortandad Canyon above the confluence with Ten Site Canyon.
Completion Type: Single completion in Cerros del Rio basalt.
Remarks: Since well completion, water has been measured in the sump of the well; thus data are not valid groundwater level data.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>665.0</td>
<td>675.0</td>
<td>6194.2</td>
<td>6184.2</td>
<td>10.0</td>
<td>None</td>
<td>None</td>
<td>675.0</td>
<td>6184.2</td>
<td>670.0</td>
<td>3.6</td>
<td>11.4</td>
<td>1</td>
<td>1b4</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6659.20 ft; all measurements are from this elevation.

Note: Data are not valid groundwater level data: water present in sump.
4.19 MSC-16-02665

Location: MSC-16-02665 is located at TA-16 at the head of Martin Spring Canyon (S-Site Canyon) about 1500 ft west of R-48 and about 700 ft northwest of Martin Spring.

Completion Type: Single completion in Unit 3 of the Bandelier tuff.

Period of Record: Well completed October 1997, no transducer has been installed, periodic manual measurements through April 2010.

Remarks: MSC-16-02665 has usually been dry; water has been observed in the well after heavy precipitation periods and snowmelt runoff (LANL 2003, p. 4-58). The well was dry when checked in the spring of 2005, 2006, 2007, 2008, 2009, and 2010.

MSC-16-02665 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top of Screen Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>93.5</td>
<td>123.5</td>
<td>7432.4</td>
<td>7393.4</td>
<td>30.0</td>
<td>None</td>
<td>None</td>
<td>123.5</td>
<td>7393.4</td>
<td>124.0</td>
<td>0.5</td>
<td>0.3</td>
<td>I</td>
<td>Qbt3</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7516.92 ft; all measurements are from this elevation.

MSC-16-02665

- Manual
- Transducer
- Bottom of Screen

LA-14437-PR

March 2011
4.20 PCI-2

Location: PCI-2 is located in middle Pajarito Canyon about 150 ft west and upstream of R-17.
Completion Type: Single completion in the Puye fanglomerates and about 35 ft above Tschicoma dacite (LANL September 2009c).
Period of Record: Well completed April 2009, transducer installed June 26, 2009; data through 2010.
Remarks: The well is 100% barometrically efficient; however, the aquifer exhibits a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (Gal.)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>512.0</td>
<td>522.0</td>
<td>6409.0</td>
<td>6399.0</td>
<td>10.0</td>
<td>529.3</td>
<td>6391.7</td>
<td>522.0</td>
<td>6399.0</td>
<td>533.3</td>
<td>11.3</td>
<td>2.9</td>
<td>I</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6920.95 ft; all measurements are from this elevation.
4.21 POl-4

Location: POl-4 is located in lower Pueblo Canyon about 800 ft upstream of TW-1 and about 370 ft north of supply well O-1.

Completion Type: Single completion in Cerros del Rio basalt.


Remarks: The well is 100% barometrically efficient; the groundwater displays a delayed response to atmospheric pressure fluctuations. The intermediate groundwater shows a seasonal water level fluctuation, generally lower in the summer and higher in the winter.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Geo Geo Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>159.0</td>
<td>174.0</td>
<td>6213.3</td>
<td>6198.3</td>
<td>15.0</td>
<td>173.0</td>
<td>6199.3</td>
<td>174.0</td>
<td>6198.3</td>
<td>176.5</td>
<td>2.5</td>
<td>6.2</td>
<td>I</td>
<td>Tb4</td>
<td>Tb4</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6372.29 ft; all measurements are from this elevation.
4.22 R-3i

Location: R-3i is located in lower Pueblo Canyon about 240 ft west of intermediate well POI-4 and about 425 ft northwest of supply well 0-1.

Completion Type: Single completion in the Cerros del Rio basalt.


Remarks: The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The groundwater level rises during winter and falls during summer, but did not show a significant response to snowmelt runoff in 2007, 2008, or 2010. The intermediate groundwater appears to show a seasonal water level fluctuation similar to POI-4, but the water level at R-3i is 10 to 15 ft lower than at POI-4. The perched intermediate groundwater at R-3i responded to drilling activities at R-3 in the summer of 2010. When the base of the Cerros del Rio basalt was penetrated at R-3, the groundwater apparently drained into deeper units through the R-3 borehole until the casing was set and the annular seal emplaced at R-3.

R-3i Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>215.2</td>
<td>220</td>
<td>6175.0</td>
<td>6170.2</td>
<td>4.8</td>
<td>217.0</td>
<td>6173.2</td>
<td>220.0</td>
<td>220.34</td>
<td>0.3</td>
<td>0.2</td>
<td>1</td>
<td>Tb4</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6390.15 ft; all measurements are from this elevation.

LA-14437-PR 118
4.23 R-6i

Location: R-6i is located at the eastern extent of DP Mesa near the confluence of DP Canyon and Los Alamos Canyon and adjacent to regional aquifer monitoring well R-6.

Completion Type: Single completion in the Puye Formation fanglomerate member.


Remarks: The well is 100% barometrically efficient; the groundwater does not respond to atmospheric pressure fluctuations. The perched intermediate groundwater did not respond to snowmelt runoff in 2007, 2008, or 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Geo Zone Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>602.0</td>
<td>612.0</td>
<td>6394.9</td>
<td>6384.9</td>
<td>10.0</td>
<td>600.0</td>
<td>6384.9</td>
<td>612.0</td>
<td>6384.9</td>
<td>615</td>
<td>3.0</td>
<td>9.2</td>
<td>1</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6996.9 ft; all depths are from this elevation.
4.24 R-9i

Location: R-9i is located in Los Alamos Canyon near the eastern LANL boundary and adjacent to R-9.
Completion Type: Dual Westbay® completion; both screens in Cerros del Rio basalt.
Remarks: The screens are about 70 ft apart and the heads in the two intermediate zones are about 110 ft apart. The water level at screen 1 is about 40 ft above the top of the screen; the water level at screen 2 is about 15 ft above the top of the screen. Groundwater at screen 1 appears to be recharged from large runoff events in lower Los Alamos Canyon; the water level responded to snowmelt runoff in 2001, 2005, 2007, 2008, and 2010 and to large storm runoff events in the summer of 2006, while the water level at screen 2 shows a reduced response.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
<th>Port</th>
<th>Port Depth (ft)</th>
<th>Port Elev (ft)</th>
<th>Distance from Bottom of Screen (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>189.1</td>
<td>199.5</td>
<td>6194.1</td>
<td>6183.7</td>
<td>10.4</td>
<td>I</td>
<td>TD4</td>
<td>MP1A</td>
<td>168.8</td>
<td>6184.4</td>
<td>0.7</td>
<td></td>
<td>Within screen</td>
</tr>
<tr>
<td>2</td>
<td>269.6</td>
<td>280.3</td>
<td>6113.6</td>
<td>6102.9</td>
<td>10.7</td>
<td>I</td>
<td>TD4</td>
<td>MP1B</td>
<td>208.8</td>
<td>6173.4</td>
<td>-10.3</td>
<td>29.5</td>
<td>Below screen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PP1</td>
<td>204.1</td>
<td>6197.1</td>
<td>-4.6</td>
<td></td>
<td>Below screen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PP2</td>
<td>284.1</td>
<td>6099.1</td>
<td>-3.8</td>
<td>11.0</td>
<td>Below screen</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation is 6383.2 ft; all measurements are from this elevation;
MP = Monitoring Port, PP = Pumping Port; Ports shown in bold are instrumented with transducers.

GW Sample Screen 1
Transducer Screen 1
GW Sample Screen 2
Transducer Screen 2

LA-14437-PR
4.25 **R-12 (Intermediate)**

Location: R-12 is located in lower Sandia Canyon near SR-4 and supply well PM-1.

Completion Type: Multiple completion, originally two screens in intermediate zones, one screen at the top of the regional aquifer—until September 2006 when the well was recompleted as two intermediate screens; screen 3 was plugged and abandoned on December 13, 2007.

Period of Record: Westbay® system installed March 21, 2000, transducers installed December 14, 2000, intermittent data to September 21, 2006, when transducers were removed for removal of the Westbay® system for well rehabilitation and conversion. No water level data for most of 2007. Transducers were reinstalled at screens 1 and 2 on December 13, 2007; data through 2010.

Remarks: In December 2007, screen 3 was abandoned and a Baski packer with dual pump sampling system was installed at the two intermediate screens. Intermediate screens 1 and 2 have similar head values about 380 ft above the regional aquifer; intermediate screen 2 has a slightly higher head than screen 1. The intermediate screens responded to snowmelt runoff events in Los Alamos Canyon in 2001, 2005, 2008, and 2010; no data available during 2007 and no snowmelt runoff in 2009. The groundwater at screens 1 and 2 show a delayed response to atmospheric pressure fluctuations with a barometric efficiency of about 70%.

---

**R-12 Construction Information**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Screen Top Elev (ft)</th>
<th>Screen Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Packer Sump Depth (ft)</th>
<th>Top of Packer Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Unit Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>459.0</td>
<td>467.6</td>
<td>6040.6</td>
<td>6032.1</td>
<td>6.5</td>
<td>485.0</td>
<td>6034.6</td>
<td>470.7</td>
<td>6029.9</td>
<td>470.7</td>
<td>3.2</td>
<td>10.0</td>
<td>704</td>
</tr>
<tr>
<td>2</td>
<td>504.5</td>
<td>508.0</td>
<td>5995.1</td>
<td>5991.6</td>
<td>3.5</td>
<td>501.0</td>
<td>5998.6</td>
<td>508.0</td>
<td>5991.6</td>
<td>540.8</td>
<td>32.5</td>
<td>102.9</td>
<td>704</td>
</tr>
<tr>
<td>3</td>
<td>801.0</td>
<td>803.0</td>
<td>5698.6</td>
<td>5691.6</td>
<td>88</td>
<td>801.0</td>
<td>5691.6</td>
<td>5600.0</td>
<td>5691.6</td>
<td>5600.0</td>
<td>38</td>
<td>Screen 3 Plugged and Abandoned December 2007...</td>
<td>RT</td>
</tr>
</tbody>
</table>

Brass Cap Elevation: 6499.60 ft; all measurements are from this elevation.

---

**R-12 Intermediate Screens**

- Screen 1 GWMM
- Screen 1 Transducer
- Screen 2 GWMM
- Screen 2 Transducer
4.26 R-23i

Location: R-23i is located in lower Pajarito Canyon near SR-4 and adjacent to regional well R-23.

Completion Type: Multiple completion, three screens, screen 1 is in a 2.1-in.-diameter piezometer and screens 2 and 3 are in a 4-in.-diameter well. A Baski packer and dual pump sampling system was installed at screens 2 and 3 in December 2006. All screens are in Cerros del Rio basalt.

Period of Record: Well completed November 2005; transducers installed at screens 2 and 3 in December 2006, transducer installed at screen 1 March 2009; data through 2010.

Remarks: The water levels at screens 2 and 3 are typically about 9 ft apart; the water level at screen 1 is about 44 ft higher than screen 2. The screen 3 gage tubing through the packer has shown occasional partial plugging, but water levels in the tubing appear to be representative of screen 3. Possible response to snowmelt runoff at screens 2 and 3 in the spring of 2008. Packer inflation problems in 2009 caused loss of screens 2 and 3 groundwater level data. The Baski system was removed from the well in December 2009 to repair the packer system. The repaired system was reinstalled March 2, 2010. During purging of cross flow at screen 3 in March 2010, the screen 3 water level increased with coincident water level fall at screen 2, indicating possible intermittent cross flow between screens 2 and 3, possibly through the formation.

R-23i Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Bottom Depth (ft)</th>
<th>Top Elev (ft)</th>
<th>Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Packer Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Depth (ft)</th>
<th>Sump Volume (Gal.)</th>
<th>Geo Unit Code</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>420.3</td>
<td>420.0</td>
<td>6127.6</td>
<td>6107.9</td>
<td>19.7</td>
<td>420.0</td>
<td>6107.9</td>
<td>425.3</td>
<td>5.3</td>
<td>4.4</td>
<td>1</td>
<td>Tb4</td>
<td>2.1 in. Piez</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>470.2</td>
<td>480.1</td>
<td>6057.7</td>
<td>6047.8</td>
<td>9.9</td>
<td>477.1</td>
<td>6050.8</td>
<td>495.3</td>
<td>6032.5</td>
<td>15.2</td>
<td>12.6</td>
<td>Tb4</td>
<td>4.5 in. well</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>524.0</td>
<td>547.0</td>
<td>6003.9</td>
<td>5980.9</td>
<td>23.0</td>
<td>516.7</td>
<td>6011.2</td>
<td>567.5</td>
<td>550.7</td>
<td>3.7</td>
<td>3.1</td>
<td>Tb4</td>
<td>4.5 in. well</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6527.88 ft; all measurements are from this elevation.

Composite WL before packer inflated
Groundwater Level Status Report

March 2011

R-23i

Screen 1 Manual

Screen 1 Transducer

Groundwater Elevation (ft)

10/1/05 4/1/06 10/1/06 4/1/07 10/1/07 4/1/08 9/30/08 4/1/09 10/1/09 4/1/10 10/1/10

Date

Questionable WL data, possible well issue

Composite WL with packer deflated

LA-14437-PR
4.27 R-25b

Location: R-25b is located at TA-16 about 50 ft west of monitoring well R-25.
Completion Type: Single completion, one screen in the Otowi Member of the Bandelier Tuff at a similar elevation as R-25 screen 1.
Remarks: R-25b is screened adjacent to R-25 screen 1.

### R-25b Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Bottom of Well Elev (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>730.0</td>
<td>770.8</td>
<td>6767.0</td>
<td>6746.2</td>
<td>20.8</td>
<td>770.0</td>
<td>6747.0</td>
<td>770.8</td>
<td>6746.2</td>
<td>782.3</td>
<td>11.5</td>
<td>6734.7</td>
<td>I</td>
<td>Qbo</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 7517.00 ft; all measurements are from this elevation.

![Graph showing groundwater level status for R-25b with manual and transducer data points.](image-url)

LA-14437-PR
4.28 R-25c

Location: R-25c is located at TA-16 about 50 ft west of monitoring well R-25b and about 100 ft west of monitoring well R-25.

Completion Type: Single completion, one screen in the Puye fanglomerates at a similar elevation as R-25 screen 3.


Remarks: R-25c is a replacement for R-25 screen 3. The borehole contained water during drilling, but the well was dry (some water in sump) at completion and did not retain water during attempted slug testing (LANL December 2008). A seismometer was installed at the bottom of the well in September 2010. The sump water was raised to near the bottom of the screen during the seismometer installation.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Elev (ft)</th>
<th>Bottom of Well Elevation (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1039.6</td>
<td>1060.0</td>
<td>6478.0</td>
<td>6457.6</td>
<td>20.4</td>
<td>None</td>
<td>None</td>
<td>1080.6</td>
<td>20.6</td>
<td>6437.0</td>
<td>I</td>
<td>Tpf</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 7517.59 ft; all measurements are from this elevation.
4.29 R-26 PZ-2

Location: R-26 PZ-2 is located at TA-16 about 90 ft southwest of monitoring well R-26.
Completion Type: Dual completion, R-26 PZ-1 is the deeper piezometer and R-26 PZ-2 is the shallower piezometer. Both screens are located in Unit 3 of the Tshirege Member of the Bandelier Tuff.
Period of Record: Piezometer installed October 2003, manual measurements began in April 2009, and transducer installed December 16, 2009; transducer data through 2010. The transducer malfunctioned September 2010 and was replaced October 2010.
Remarks: R-26 PZ-1 has always been dry when checked. The groundwater at R-26 PZ-2 appears to have responded to snowmelt runoff in the spring of 2010.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Bottom Depth (ft)</th>
<th>Top Elev (ft)</th>
<th>Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Bottom of Sump Depth (ft)</th>
<th>Bottom of Sump Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal.)</th>
<th>1 CV Purge Vol (gal.)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PZ-1</td>
<td>230.0</td>
<td>250.0</td>
<td>7409.6</td>
<td>7389.6</td>
<td>20.0</td>
<td>250.0</td>
<td>7389.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>I</td>
<td>Qbt3t</td>
</tr>
<tr>
<td>PZ-2</td>
<td>150.0</td>
<td>180.0</td>
<td>7489.6</td>
<td>7459.6</td>
<td>30.0</td>
<td>185.0</td>
<td>7454.6</td>
<td>5.0</td>
<td>0.8</td>
<td>1.5</td>
<td>I</td>
<td>Qbt3t</td>
</tr>
</tbody>
</table>

Note: R-26 Ground Elevation: 7639.56 ft; all measurements are from this elevation; Top of Casing Elevation: 7641.5 ft.
4.30 R-27i

Location: R-27i is located in Water Canyon near monitoring well R-27.

Completion Type: Single completion in an intermediate perched zone; one screen in the Puye fanglomerates.

Period of Record: Well completed October 2009. Dedicated Bennett pump and transducer installed April 13, 2010; transducer data through 2010.

Remarks: The groundwater level is about 2 ft above the top of the screen. The well is 100% barometrically efficient; the groundwater has no immediate response to atmospheric pressure fluctuations, however, the groundwater shows a delayed response to atmospheric pressure fluctuations.

### R-27i Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Bottom of Well Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>619.0</td>
<td>639.0</td>
<td>6099.0</td>
<td>6089.0</td>
<td>10.0</td>
<td>627.9</td>
<td>6090.1</td>
<td>630.2</td>
<td>6087.8</td>
<td>1.2</td>
<td>1.2</td>
<td>1</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6717.97 ft; all measurements are from this elevation.
4.31 R-47i

Location: R-47i is located at TA-14 downgradient from TA-16 and about 0.5 mi east of well CdV-16-2(i)r and about 0.8 mi northwest of well CdV-R-15-3.

Completion Type: Single completion in an intermediate perched zone; one screen in the Puye fanglomerates.

Period of Record: Well completed November 15, 2009. Dedicated submersible pump and transducer installed December 18, 2009; transducer data through 2010.

Remarks: The groundwater level is about 11 ft above the top of the screen. The well is 100% barometrically efficient; the groundwater has no immediate response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Bottom of Well Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal)</th>
<th>Hydro Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>840.0</td>
<td>860.6</td>
<td>6518.4</td>
<td>6497.8</td>
<td>20.6</td>
<td>860.3</td>
<td>6498.1</td>
<td>855.6</td>
<td>6492.9</td>
<td>4.9</td>
<td>5.0</td>
<td>1</td>
<td>Tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 7358.41ft; all measurements are from this elevation.

---

**R-47i**

- Manual Measurement
- Transducer Measurement

---

LA-14437-PR
4.32 R-55i

Location: R-55i is located in lower Cañada del Buey adjacent to R-55.
Completion Type: Single completion in an intermediate perched zone; one screen in unconsolidated sediments associated with basaltic lava flows of the Cerros del Rio basalts.
Period of Record: Well completed January 2011. Transducer installation is pending.
Remarks: The groundwater level before aquifer testing on January 31, 2011, was 498.0 ft below ground surface at an elevation of 6036.91 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Bottom of Well Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (gal)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>510.0</td>
<td>531.1</td>
<td>6024.9</td>
<td>6003.8</td>
<td>21.1</td>
<td>541.4</td>
<td>5983.5</td>
<td>10.3</td>
<td>10.5</td>
<td>1</td>
<td>10.5</td>
<td>10.5</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground Elevation: 6534.91 ft; all measurements are from this elevation.

R-55i Construction Information

R-55i

<table>
<thead>
<tr>
<th>Date</th>
<th>Groundwater Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/11</td>
<td>6034</td>
</tr>
<tr>
<td>1/8/11</td>
<td>6035</td>
</tr>
<tr>
<td>1/15/11</td>
<td>6036</td>
</tr>
<tr>
<td>1/22/11</td>
<td>6037</td>
</tr>
<tr>
<td>1/29/11</td>
<td>6038</td>
</tr>
<tr>
<td>2/5/11</td>
<td>6039</td>
</tr>
</tbody>
</table>

- Manual Measurement
- Transducer Measurement
4.33 SCI-1

Location: SCI-1 is located in Sandia Canyon between intermediate wells LAO1-3.2 in Los Alamos Canyon to the north and MCO1-6 in Mortandad Canyon to the southwest.

Completion Type: Single completion in the Puye Formation fanglomerate member; the screen is located above the Cerros del Rio basalt.

Period of Record: Well completed October 2006, transducer installed in February 2007, data through 2010.

Remarks: Originally drilled as core hole SCC-1, completed as intermediate well and named SCI-1. The well is immediately 100% barometrically efficient; however the groundwater shows a delayed response to atmospheric pressure fluctuations.
4.34 SCI-2

Location: SCI-2 is located in middle Sandia Canyon adjacent to regional monitoring well R-43.
Completion Type: Single completion in an intermediate perched zone in the Cerros del Rio basalt.
Remarks: The initial groundwater elevation at completion of the well was 6221.4 ft; subsequent measurements have been about 15 ft lower. The well is 100% barometrically efficient, the groundwater does not respond to atmospheric pressure fluctuations; however, the groundwater shows a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>548.0</td>
<td>558.0</td>
<td>6187.7</td>
<td>6167.7</td>
<td>20.0</td>
<td>548.7</td>
<td>6187.0</td>
<td>6167.7</td>
<td>2.0</td>
<td>0.2</td>
<td>6735.70</td>
<td>1</td>
<td>Tb4</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6735.70 ft; all measurements are from this elevation.
4.35 TA-53i

Location: TA-53i is located on Mesita de Los Alamos at TA-53 about 1400 ft northwest of SCI-1.
Completion Type: Single completion in a perched intermediate zone in the Puye fanglomerates just above the Cerros del Rio basalt.
Period of Record: Well completed March 2009, transducer installed June 2009; data through 2010.
Remarks: The well is 100% barometrically efficient, the groundwater has no immediate response to atmospheric pressure fluctuations; however, the aquifer shows a delayed response to atmospheric pressure fluctuations.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600.0</td>
<td>610</td>
<td>6387.2</td>
<td>6377.2</td>
<td>10.0</td>
<td>610.8</td>
<td>6376.4</td>
<td>610.0</td>
<td>6377.2</td>
<td>620.8</td>
<td>10.8</td>
<td>41.7</td>
<td>tpf</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6987.17 ft; all measurements are from this elevation.

---

**Groundwater Elevation (ft)**

- **Manual**
- **Transducer**

**Date**

3/1/09 5/31/09 8/30/09 11/29/09 3/1/10 5/31/10 8/30/10 11/30/10
4.36 Test Well 1A

Location: TW-1A is located in lower Pueblo Canyon adjacent to TW-1.
Completion Type: Single completion in Cerros del Río basalt.
Period of Record: Well completed in 1950, transducer installed June 1993, intermittent data to April 2005 when problems were encountered with equipment and the transducer was removed from the well.
Remarks: The wellhead equipment was removed from the well in February 2006 in preparation for plugging and abandonment of the well. The well was plugged and abandoned March 15, 2010 (LANL April 2010).

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Unit Code</th>
</tr>
</thead>
</table>
| 1      | 215.0                | 225                      | 6154.3              | 6144.3                 | 10.0                   | None                   | None                   | 225.0                  | 6144.3                 | 225            | 0.0         | 0.0           | 1             | Tb4

Note: TW-1A Ground Elevation: 6369.28 ft; all measurements are from this elevation.

Test Well-1A

- Manual
- Transducer

Top of Screen: 6154.3 ft
4.37 Test Well 2A

Location: TW-2A is located in middle Pueblo Canyon adjacent to TW-2.
Completion Type: Single completion in the Puye Formation.
Remarks: Recent pumping of TW-2A when the water level is below 6535 ft has shown slow recovery of the intermediate groundwater. The well was plugged and abandoned February 8, 2010 (LANL March 2010).

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>123.0</td>
<td>133.0</td>
<td>6527.4</td>
<td>6517.4</td>
<td>10.0</td>
<td>130.0</td>
<td>6520.4</td>
<td>133.0</td>
<td>6517.4</td>
<td>133.0</td>
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<td>1</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: TW-2A Ground Elevation: 6650.4 ft; all measurements are from this elevation.

Test Well-2A

- Manual
- Transducer
- Top of Screen
- Bottom of Screen

Date

1/92 1/93 1/94 1/95 1/96 1/97 1/98 1/99 1/00 1/01 1/02 1/03 1/04 1/05 1/06 1/07 1/08 1/09 1/10

LA-14437-PR 134
4.38 TW-2Ar

Location: TW-2Ar is located in middle Pueblo Canyon adjacent to former wells TW-2 and TW-2A.

Completion Type: Single completion in the Puye Formation.

Period of Record: Well completed March 4, 2010, transducer installed June 22, 2010; transducer data through 2010.

Remarks: TW-2Ar is a replacement well for former well TW-2A. The perched intermediate groundwater level is about 3 ft above the top of the screen. The well is 100% barometrically efficient, the groundwater does not indicate an immediate response to atmospheric pressure fluctuations; however, the groundwater shows a delayed response to atmospheric pressure fluctuations.

---

### TW-2Ar Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top of Sump Length (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>102.0</td>
<td>112.0</td>
<td>6549.7</td>
<td>6539.7</td>
<td>10.0</td>
<td>110.2</td>
<td>6541.5</td>
<td>112.0</td>
<td>6539.7</td>
<td>113.9</td>
<td>1.9</td>
<td>Tpf</td>
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</tbody>
</table>

Note: TW-2Ar Brass cap elevation: 6651.67 ft; all measurements are from this elevation.
5.0 Groundwater Level Data from Alluvial Wells

Table 5-1 lists the alluvial wells that were monitored for groundwater levels in 2010. The table provides the well name, date of completion, well depth, surveyed location coordinates, ground surface elevation, and the screen top and bottom depths for each well. Figure 5-1 shows the locations of the wells. In the following alluvial groundwater sections, the first hydrograph for each well represents the entire period of record, while the second hydrograph represents groundwater level data for recent years. Alluvial groundwater levels respond to snowmelt runoff, storm runoff, and, in some canyons, effluent discharges. Some alluvial wells have been historically dry and do not show a seasonal response to precipitation and runoff.

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Date Completed</th>
<th>Depth (ft)</th>
<th>Easting (ft)</th>
<th>Northing (ft)</th>
<th>Surface Elevation (ft)</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-BG-1</td>
<td>08/01/94</td>
<td>35.0</td>
<td>1634152.90</td>
<td>1762575.36</td>
<td>6776.45</td>
<td>10.0</td>
<td>35.0</td>
</tr>
<tr>
<td>18-MW-11</td>
<td>06/11/94</td>
<td>47.0</td>
<td>1636001.69</td>
<td>1761139.83</td>
<td>6740.13</td>
<td>27.0</td>
<td>47.0</td>
</tr>
<tr>
<td>18-MW-18</td>
<td>07/31/95</td>
<td>23.0</td>
<td>1639925.00</td>
<td>1760893.56</td>
<td>6732.91</td>
<td>6.0</td>
<td>21.0</td>
</tr>
<tr>
<td>18-MW-8</td>
<td>08/04/94</td>
<td>37.9</td>
<td>1634714.26</td>
<td>1760658.14</td>
<td>6747.79</td>
<td>8.0</td>
<td>38.0</td>
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<tr>
<td>18-MW-9</td>
<td>07/21/94</td>
<td>21.0</td>
<td>1635949.81</td>
<td>1760893.56</td>
<td>6732.91</td>
<td>6.0</td>
<td>21.0</td>
</tr>
<tr>
<td>3MAO-2</td>
<td>06/04/08</td>
<td>30.0</td>
<td>1633782.48</td>
<td>1760716.45</td>
<td>6759.44</td>
<td>14.7</td>
<td>24.7</td>
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<tr>
<td>APCO-1</td>
<td>08/15/90</td>
<td>19.7</td>
<td>1649209.62</td>
<td>1773020.12</td>
<td>6367.53</td>
<td>4.7</td>
<td>14.7</td>
</tr>
<tr>
<td>CDDBO-1</td>
<td>04/17/85</td>
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<td>1637968.59</td>
<td>1760943.96</td>
<td>6757.60</td>
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<td>13.1</td>
</tr>
<tr>
<td>CDDBO-2</td>
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<td>CDDBO-3</td>
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<td>CDDBO-7</td>
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<td>1763301.00</td>
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<td>39.0</td>
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<tr>
<td>CDDBO-8</td>
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<td>23.0</td>
<td>1639294.00</td>
<td>1762366.00</td>
<td>6722.47</td>
<td>3.0</td>
<td>13.0</td>
</tr>
<tr>
<td>CDDBO-9</td>
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<td>34.0</td>
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<td>29.0</td>
</tr>
<tr>
<td>CDV-16-02655</td>
<td>09/27/97</td>
<td>7.6</td>
<td>1611299.09</td>
<td>1764153.13</td>
<td>7583.70</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>CDV-16-02656</td>
<td>11/05/97</td>
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<td>1613634.46</td>
<td>1764932.79</td>
<td>7443.18</td>
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<td>8.0</td>
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<tr>
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<td>10/10/97</td>
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<td>1613813.19</td>
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<tr>
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</tr>
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<td>12.3</td>
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</tr>
<tr>
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<td>7374.18</td>
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<td>10.0</td>
</tr>
<tr>
<td>CDV-16-02672</td>
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<td>1615492.23</td>
<td>1764529.67</td>
<td>7356.25</td>
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<td>8.0</td>
</tr>
<tr>
<td>FCO-1</td>
<td>08/22/89</td>
<td>12.4</td>
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<td>1751181.06</td>
<td>6510.13</td>
<td>2.4</td>
<td>12.4</td>
</tr>
<tr>
<td>FL-26-25278</td>
<td>10/10/05</td>
<td>3.2</td>
<td>1618820.88</td>
<td>1762605.72</td>
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<td>1.6</td>
<td>3.2</td>
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<tr>
<td>FL-26-25279</td>
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<td>4.3</td>
<td>1617679.48</td>
<td>1762856.43</td>
<td>7309.30</td>
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</tr>
<tr>
<td>FL-26-25280</td>
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</tr>
<tr>
<td>LAO-0.3</td>
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<tr>
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<td>30.8</td>
<td>1636083.42</td>
<td>1772657.83</td>
<td>6658.01</td>
<td>10.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>
Groundwater Level Status Report

March 2011

Screen
Top
Depth
(ft)
8.0

Screen
Bottom
Depth
(ft)
18.0

7.0

32.0

Date
Completed
04/15/69

Completed
Depth (ft)

18.0

1635446.25

Northing (ft)
1772661.37

Surface
Elevation
(ft)
6680.00

LA0-2

02/01/96

32.0

1637607.75

1773095.87

6623.00

LA0-3A

09/14/89

14.7

1637980.87

1773099.75

6609.10

4.7

14.7

LA0-4.5C
LA0-5
LA0-6a

11/01/89
02/15/66
08/01/89

23.3
25.0
14.2

1643547.37
1646202.25
1646221.62

1772076.50
1771424.12
1771344.00

6486.50
6427.10
6424.70

13.3
5.0
4.2

23.3
25.0
14.2

LA0-8

04/28/94

27.2

1615148.80

11.8

26.8

1633435.13

1775170.40
1774809.81

7323.59
7032.42

5.4

10.4

LLA0-1b

07/16/97

10.6
24.2

1659738.70

1772381.65

5850.34

11.3

21.3

LLA0-4

09/30/96

18.1

1671820.23

1774468.01

5515.46

5.2

15.2

MCA-1

01/24/05

5.9

1626586.50

1770410.77

7070.60

2.4

5.4

MCA-5
MCA-8

02/01/05

6.0

1627354.17

86.3
3.1

1641325.48
1623987.80

7053.80
6668.80

1.8
66.0

5.8
81.0

MC0-0.6

09/29/04
02/25/99

1770233.59
1767372.92
1771179.50

7188.28

3.1

MC0-2
MC0-3

11/01/60

9.0

1625919.25

1770135.12

03/01/67

12.0

1627362.50

1770236.75

7136.60
7052.60

1.1
2.0

08/01/90
10/01/60

33.9
46.0

1632036.37
1632466.12

1769697.00
1769538.00

03/01/74
10/01/60

47.0
69.0

1633635.37
1634517.87

60.0
33.0

1635454.87
1632578.31

6827.31
6808.88

MCW8-5

04/01/74
12/06/94

1769012.75
1768509.87
1768440.50
1769484.60

6876.22

17.0

27.0

MCW8-5.58

12/22/94

37.5

1633420.54

1769125.78

6856.89

22.5

32.5

MCW8-6.2A
MCW8-6.5E

12/07/94
12/21/94

45.5
50.0

1633754.49
1633833.36

6848.29

30.5

40.5

MCW8-7.48

12/13/94

70.0

1635287.73

1768968.15
1768583.81
1768407.84

6843.80
6813.07

35.0
45.0

45.0
65.0

MCW8-7.78
MCW8-7A

12/20/94
12/09/94

70.0

1635921.84

1768517.26

6798.97

55.0

65.0

52.0

1634356.62

1768551.02

6831.17

37.0

47.0

MSC-16-06293

01/27/00

7.3

1615809.67

1761331.78

7370.79

2.0

7.0

MSC-16-06294

01/26/00
01/31/00

7.6
6.9

1617848.17

1761298.78

7288.44

2.5

7.3

1618630.67

1761004.78

7257.03

1.5

6.5

MT-2

11/01/88

64.0

1636019.79

1768544.59

6796.20

44.0

64.0

MT-3

11/01/88

74.0

1635980.95

1768657.83

6796.65

44.0

64.0

MT-4

11/01/88

74.0

1636558.75

1768634.37

6783.59

54.0

64.0

PA0-1

10/30/98

13.7

1624165.85

1778988.72

6954.97

5.9

10.9

PA0-2

11/02/98

13.9

1625040.90

1778710.00

6930.98

6.1

11.1

Well Name
LA0-1.8

LAUZ-1

MC0-48
MC0-5
MC0-6
MC0-7
MC0-7.5

MSC-16-06295

Easting (ft)

2.0

9.0
12.0

6886.75

8.9

28.9

6875.66
6849.48

21.0

46.0

27.0
39.0
35.0

47.0
69.0
60.0

PA0-4

07/24/97

9.8

1646090.28

1775098.35

6437.37

2.0

7.0

PCA0-5

05/03/08

30.0

1627159.64

1765953.14

6943.29

14.7

24.7

PCA0-6

06/05/08

20.0

1627610.36

1765888.72

6921.40

8.0

15.0

PCA0-7a

05/30/08

25.0

1636938.56

1760549.16

6711.97

9.7

19.7

PCA0-7b1

05/21/08

60.0

1636831.47

1760490.10

6713.62

44.0

54.0

PCA0-7b2

05127108
05/16/08
06/02/08
06/12/08

PCA0-7c
PCA0-8
PCA0-9

LA-14437-PR

25.0

1636846.45

1760481.06

6713.39

25.0

1636706.72

1760335.39

6714.57

10.0
9.7

20.0
19.7

25.0

1643865.52

1756372.09

6584.45

9.7

19.7

21.0

1645540.81

1755980.24

6558.60

6.0

16.0

137


<table>
<thead>
<tr>
<th>Well Name</th>
<th>Date Completed</th>
<th>Completed Depth (ft)</th>
<th>Easting (ft)</th>
<th>Northing (ft)</th>
<th>Surface Elevation (ft)</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
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<tbody>
<tr>
<td>PC0-2</td>
<td>06/30/85</td>
<td>9.5</td>
<td>1641700.37</td>
<td>1757442.75</td>
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<td>PC0-3</td>
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<td>17.7</td>
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<tr>
<td>SCA-1</td>
<td>08/25/06</td>
<td>2.1</td>
<td>1622482.45</td>
<td>1773264.59</td>
<td>7211.22</td>
<td>1.3</td>
<td>1.9</td>
</tr>
<tr>
<td>SCA-1-DP</td>
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<td>1622482.45</td>
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<td>2.7</td>
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<tr>
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<td>1636114.63</td>
<td>1770283.36</td>
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<td>10.3</td>
<td>15.0</td>
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<tr>
<td>SCA-3</td>
<td>09/09/06</td>
<td>32.6</td>
<td>1637200.62</td>
<td>1769918.81</td>
<td>6723.22</td>
<td>27.6</td>
<td>32.0</td>
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<tr>
<td>SCA-4</td>
<td>09/10/06</td>
<td>42.0</td>
<td>1638260.55</td>
<td>1769567.21</td>
<td>6703.58</td>
<td>37.0</td>
<td>41.5</td>
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<tr>
<td>SCA-5</td>
<td>09/11/06</td>
<td>64.9</td>
<td>1639878.16</td>
<td>1769726.40</td>
<td>6669.02</td>
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<td>1638254.68</td>
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<td>39.9</td>
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<tr>
<td>SCP-1abc</td>
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<td>41.8</td>
<td>1638254.68</td>
<td>1769567.80</td>
<td>6703.65</td>
<td>41.2</td>
<td>41.7</td>
</tr>
<tr>
<td>SCP-1abc</td>
<td>09/12/06</td>
<td>41.8</td>
<td>1638254.68</td>
<td>1769567.80</td>
<td>6703.65</td>
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<tr>
<td>SCP-2a</td>
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<td>1637209.65</td>
<td>1769911.28</td>
<td>6722.95</td>
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<td>SCP-2b</td>
<td>09/12/06</td>
<td>50.1</td>
<td>1637205.05</td>
<td>1769914.53</td>
<td>6723.11</td>
<td>49.5</td>
<td>50.0</td>
</tr>
<tr>
<td>TMO-1</td>
<td>06/09/08</td>
<td>6.5</td>
<td>1626830.56</td>
<td>1766161.13</td>
<td>6945.20</td>
<td>3.5</td>
<td>6.5</td>
</tr>
<tr>
<td>TSCA-6</td>
<td>11/09/04</td>
<td>21.3</td>
<td>1632954.60</td>
<td>1768471.44</td>
<td>6663.20</td>
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<td>20.9</td>
</tr>
<tr>
<td>WCO-1r</td>
<td>12/22/09</td>
<td>16.4</td>
<td>1632736.78</td>
<td>1755106.26</td>
<td>6617.12</td>
<td>6.0</td>
<td>16.0</td>
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<tr>
<td>WCO-2</td>
<td>10/28/89</td>
<td>23.5</td>
<td>1636870.37</td>
<td>1753228.37</td>
<td>6524.57</td>
<td>13.5</td>
<td>23.5</td>
</tr>
<tr>
<td>WCO-3r</td>
<td>12/22/09</td>
<td>10.1</td>
<td>1640114.87</td>
<td>1750476.65</td>
<td>6437.17</td>
<td>4.7</td>
<td>9.7</td>
</tr>
</tbody>
</table>
Figure 5-1. Alluvial wells monitored for groundwater levels in 2010.
5.1 Previously Monitored Alluvial Wells:

The following wells have not been monitored since at least December 2008. For information on these wells, refer to the “Groundwater Level Status Report for 2009.”

<table>
<thead>
<tr>
<th>Previously Monitored Wells</th>
<th>Date Monitoring Ceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-BG-4</td>
<td>12/1/2008</td>
</tr>
<tr>
<td>18-MW-7</td>
<td>12/18/2006</td>
</tr>
<tr>
<td>18-MW-17</td>
<td>9/30/2007</td>
</tr>
<tr>
<td>MCA-3abcdef</td>
<td>11/28/2007</td>
</tr>
<tr>
<td>MCA-4</td>
<td>11/29/2007</td>
</tr>
<tr>
<td>MT-1</td>
<td>11/27/2007</td>
</tr>
<tr>
<td>PCO-1</td>
<td>5/7/2008</td>
</tr>
<tr>
<td>TSWB-6</td>
<td>2/7/2008</td>
</tr>
</tbody>
</table>
5.2 18-BG-1

Location: Lower Pajarito Canyon, about 0.4 mi west of the TA-18 facilities.
Period of Record: August 1, 1994, through November 18, 2010.
Remarks: None.

18-BG-1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Screen Intake Top Depth (ft)</th>
<th>Screen Intake Top Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>35.0</td>
<td>6766.5</td>
<td>6741.5</td>
<td>25.0</td>
<td>35.0</td>
<td>6741.5</td>
<td>35.0</td>
<td>6741.5</td>
<td>85</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Actual groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6776.45 ft; all depths are from this elevation.

March 2011

LA-14437-PR
5.3 18-MW-8

Location: In Three-Mile Canyon above the confluence with Pajarito Canyon, about 0.1 mi west of the TA-18 facilities.

Period of Record: September 15, 1994, through November 18, 2010.

Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.0</td>
<td>38.0</td>
<td>6739.8</td>
<td>6799.8</td>
<td>30.0</td>
<td>30.9</td>
<td>6709.8</td>
<td>30.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>
5.4 18-MW-9

Location: Pajarito Canyon, directly south of the main guard gate to TA-18.
Period of Record: July 21, 1994, through November 18, 2010.
Remarks: Data gap from December 2008 through April 2010 resulted from a succession of malfunctioning transducers.

### 18-MW-9 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.0</td>
<td>21.0</td>
<td>6726.9</td>
<td>6711.9</td>
<td>15.2</td>
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<td>6711.9</td>
<td>21</td>
<td>0.0</td>
<td>0.0</td>
<td>2.0</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6732.91 ft; all depths are from this elevation.
5.5 18-MW-11

Location: Pajarito Canyon, approximately 200 ft north of 18-MW-9 in the TA-18 parking lot.
Period of Record: August 29, 2006, through November 18, 2010.
Remarks: None.

### 18-MW-11 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev. (ft)</th>
<th>Screen Bottom Elev. (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev. (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.0</td>
<td>47.0</td>
<td>6713.1</td>
<td>6693.1</td>
<td>20.0</td>
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<td>6693.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6740.13 ft; all measurements are from this elevation.

---

### Graphs

- **Graph 1:**
  - 18-MW-11
  - Manual Measurement
  - Mean Daily Transducer Measurement
  - Groundwater Elevation (ft)
  - Dates: 12/31/05 to 12/31/10

- **Graph 2:**
  - 18-MW-11
  - Manual Measurement
  - Mean Daily Transducer Measurement
  - Groundwater Elevation (ft)
  - Dates: 1/1/09 to 12/31/10
5.6 18-MW-18

Location: Alluvial well 18-MW-18 is located in Pajarito Canyon, 1000 ft east of 18-MW-17.
Period of Record: July 31, 1995, through November 18, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
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</thead>
<tbody>
<tr>
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<td>23</td>
<td>6642.2</td>
<td>6631.2</td>
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<td>5</td>
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<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6654.7 ft; all depths are from this elevation.
5.7 3MAO-2

Location: In lower Three-Mile Canyon in TA-18, just above the confluence with Pajarito Canyon, on
the south bank of the stream; located roughly half way between 18-BG-4 and 18-MW-18.
Period of Record: June 4, 2008, through November 18, 2010.
Remarks: None.

### 3MAO-2 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
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<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Take Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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</thead>
<tbody>
<tr>
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<td>5.3</td>
<td>13.1</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6759.44 ft; all depths from this elevation.

---

![Graph 1](image1)

![Graph 2](image2)
5.8 39-UM-3

Period of Record: March 9, 2006, through July 2, 2009.
Remarks: Well has historically been dry during quarterly manual measurements. There was no transducer installed in this well. Monitoring was discontinued in August 2009.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (Lt)</th>
<th>Comment</th>
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</thead>
<tbody>
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</tbody>
</table>

Note: Ground elevation is 6394.20 ft; all depths are from this elevation.

39-UM-3 Manual Water Levels

<table>
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<tr>
<td>6/13/2006</td>
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<tr>
<td>9/7/2006</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>3/15/2007</td>
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<tr>
<td>5/10/2007</td>
<td>Dry</td>
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<td>3/31/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>7/2/2009</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.9 39-DM-6

Location: Ancho Canyon, TA-39, approximately 1600 ft north of regional well R-31.

Period of Record: March 9, 2006, through July 2, 2009.

Remarks: Well has historically been dry during quarterly manual measurements. There was no transducer installed in this well. Monitoring was discontinued in August 2009.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
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<td>6334.6</td>
<td>6324.6</td>
<td>10.0</td>
<td>60.0</td>
<td>6324.6</td>
<td>50.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6384.57 ft; all depths are from this elevation.

<table>
<thead>
<tr>
<th>39-DM-6 Manual Water Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>3/9/2006</td>
</tr>
<tr>
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<tr>
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<td>10/15/2008</td>
</tr>
<tr>
<td>3/31/2009</td>
</tr>
<tr>
<td>7/2/2009</td>
</tr>
</tbody>
</table>
5.10 APCO-1

Location: In lower Pueblo Canyon, approximately 0.1 mi north of POI-4 and R-3i.
Period of Record: August 17, 1990, through December 18, 2010.
Remarks: A pressure transducer was installed in APCO-1 from February 17, 1993, through June 17, 1993; from January 11, 1994, through November 9, 1994; and from May 9, 2005, through present.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
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<tbody>
<tr>
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<td>6362.83</td>
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<td>6352.83</td>
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<td>5.0</td>
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<td>Aluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6367.53 ft; all depths are from this elevation
5.11 CDBO-1

Location: Alluvial well CDBO-1 is located in Cañada del Buey, approximately 1320 ft north of regional well R-20.
Period of Record: March 8, 2006, through June 25, 2010.
Remarks: Well has historically been dry during quarterly measurements. There was no transducer installed in this well. Monitoring was discontinued June 25, 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Elevation (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (ft³)</th>
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<td>13.1</td>
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</table>

Note: Ground elevation is 6757.6 ft; all depths are from this elevation.

CDBO-1 Manual Water Levels

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<tr>
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<td>Dry</td>
</tr>
<tr>
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<tr>
<td>6/25/2010</td>
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</tr>
</tbody>
</table>
5.12 CDB0-2

Location: Alluvial well CDB0-2 is located in Cañada del Buey, approximately 260 ft northeast of CDB0-1.

Period of Record: March 8, 2006, through June 25, 2010.

Remarks: Well has historically been dry during quarterly measurements. There was no transducer installed in this well. Monitoring was discontinued June 25, 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
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Note: Ground elevation is 6748.2 ft; all depths are from this elevation.

CDB0-2 Manual Water Levels

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<td>9/5/2006</td>
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</tr>
<tr>
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<td>Dry</td>
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<td>4/1/2008</td>
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<tr>
<td>11/3/2008</td>
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<td>2/3/2009</td>
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<td>8/25/2009</td>
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</tr>
<tr>
<td>6/25/2010</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.13  CDBO-3

Location: Alluvial well CDBO-3 is located in Cañada del Buey, approximately 630 ft northwest of regional well R-21.

Period of Record: December 6, 2005, through June 25, 2010.
Remarks: Well has historically been dry during quarterly measurements. There was no transducer installed in this well. Monitoring was discontinued June 25, 2010.

| Zone | Top Depth (ft) Screen | Top Depth (ft) Screen | Screen Top Elev (ft) Screen Bottom Elev (ft) Screen Length (ft) Pump Intake Depth (ft) Pump Intake Elevation (ft) Depth to Top of Sump (ft) Top of Sump Elevation (ft) Depth to Sump Bottom (ft) Sump Length (ft) Sump Volume (L) Comment |
|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 1    | 4.4                 | 12.4                | 6665.8              | 6657.8              | 8.0                 | 12.4                | 6657.8              | 12.0                | 0.0                 | 0.0                 | Alluvial groundwater |

Note: Ground elevation is 6670.2 ft; all depths are from this elevation.

<table>
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</thead>
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</tr>
<tr>
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</tr>
</tbody>
</table>
5.14 CDBO-4

Location: Alluvial well CDBO-4 is located in Cañada del Buey, approximately 1600 ft north of regional well R-22.

Period of Record: December 7, 2005, through December 2, 2010.

Remarks: Well has historically been dry during quarterly measurements. A transducer was installed in this well January 9, 2009, and has not yet recorded any water in the well.

### CDBO-4 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Pump Length (ft)</th>
<th>Sump Volume (L)</th>
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<td>Alluvial groundwater</td>
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</tr>
</tbody>
</table>

Note: Ground elevation is 6564.5 ft; all depths are from this elevation.

### CDBO-4 Manual Water Levels

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<th>Date</th>
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<td>12/2/2010</td>
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</table>
5.15 CDBO-5

Location: Alluvial well CDBO-5 is located in Cañada del Buey, approximately 0.5 mi west-northwest of CDBO-6.

Period of Record: December 7, 2005, through November 19, 2010.

Remarks: Well has historically been dry during quarterly measurements. A transducer was installed in this well January 12, 2009, and has not yet recorded any water in the well.

CDBO-5 Construction Information

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<th>Zone</th>
<th>Screen Top Depth (ft)</th>
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<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<td>0.0</td>
<td>Alluvial groundwater</td>
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</tbody>
</table>

Note: Ground elevation is 6879.01 ft; all depths are from this elevation.

CDBO-5 Manual Water Levels

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</table>
5.16 CDB0-6

Location: In Cañada del Buey, a branch of Mortandad Canyon, approximately 420 ft east of production well PM-4.

Period of Record: June 1, 1992, through November 19, 2010.

Remarks: A pressure transducer was installed above the pump until April 30, 2007, when the pump was removed from the well. Transducer data before April 30, 2007, do not represent water levels below 6776.83 ft. The dedicated pump was reinstalled November 10, 2009, and the transducer is once again located above the pump.

### CDB0-6 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<td>Alluvial groundwater</td>
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</tbody>
</table>

Note: Ground Elevation: 6817.2 ft; all depths are from this elevation.
5.17 CDBO-7

Location: In Cañada del Buey, a branch of Mortandad Canyon, approximately 0.3 mi southeast of CDBO-6.

Period of Record: June 1, 1992, through December 19, 2010.

Remarks: Initially, a pressure transducer was installed above the well’s bladder pump at an elevation of 6737.14 ft. The transducer was lowered in the well after removal of the pump on April 2, 2007. Data before April 2, 2007, do not represent water levels below 6737.14 ft.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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<td>3.1</td>
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<td>Aluvial groundwater</td>
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</tbody>
</table>

Note: Ground Elevation: 6771.81 ft; all depths are from this elevation
5.18 CDB0-8

Location: Alluvial well CDB0-8 is located in Cañada del Buey, approximately 0.4 mi southeast of CDBO-7.

Period of Record: July 2, 2001, through December 2, 2010.

Remarks: Well has historically been dry during quarterly measurements. A transducer was installed in this well January 9, 2009, and has not yet recorded any water in the well.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
<td>13.0</td>
<td>6719.5</td>
<td>6709.5</td>
<td>10.0</td>
<td>13.0</td>
<td>6709.5</td>
<td>21.0</td>
<td>10.0</td>
<td>6.2</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6722.47 ft; all depths are from this elevation

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/2/2001</td>
<td>Dry</td>
<td>9/10/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>8/22/2001</td>
<td>Dry</td>
<td>1/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>10/18/2001</td>
<td>Dry</td>
<td>2/11/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>4/16/2002</td>
<td>Dry</td>
<td>4/1/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/27/2002</td>
<td>Dry</td>
<td>5/22/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/2002</td>
<td>Dry</td>
<td>7/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>2/19/2003</td>
<td>Dry</td>
<td>8/11/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>12/7/2005</td>
<td>Dry</td>
<td>11/3/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>3/8/2006</td>
<td>Dry</td>
<td>1/12/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>9/7/2006</td>
<td>Dry</td>
<td>4/27/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>10/2/2006</td>
<td>Dry</td>
<td>7/14/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>2/22/2007</td>
<td>Dry</td>
<td>12/14/2009</td>
<td>Dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12/2/2010</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.19 CDBO-9

Location: Alluvial well CDBO-9 is located in Cañada del Buey, approximately 0.7 mi southeast of CDBO-8.

Period of Record: July 2, 2001, through December 2, 2010.

Remarks: Well has historically been dry during quarterly measurements. A transducer was installed in this well January 9, 2009, and has not yet recorded any water in the well.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.0</td>
<td>29.0</td>
<td>6614.0</td>
<td>6604.0</td>
<td>10.0</td>
<td>29.0</td>
<td>6600.0</td>
<td>34.0</td>
<td>5.0</td>
<td>8.1</td>
<td>Alluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6633.0 ft; all depths are from this elevation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/2/2001</td>
<td>Dry</td>
<td>9/10/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>8/22/2001</td>
<td>Dry</td>
<td>1/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>10/18/2001</td>
<td>Dry</td>
<td>2/11/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>4/16/2002</td>
<td>Dry</td>
<td>4/1/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/27/2002</td>
<td>Dry</td>
<td>5/22/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/2002</td>
<td>Dry</td>
<td>7/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>2/19/2003</td>
<td>Dry</td>
<td>8/11/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>12/6/2005</td>
<td>Dry</td>
<td>1/9/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>9/6/2006</td>
<td>Dry</td>
<td>7/14/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>12/8/2006</td>
<td>Dry</td>
<td>12/14/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>3/19/2007</td>
<td>Dry</td>
<td>6/1/2010</td>
<td>Dry</td>
</tr>
<tr>
<td>6/8/2007</td>
<td>Dry</td>
<td>12/2/2010</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.20 CDV-16-02655

Location: Westernmost upper Cañon de Valle in TA-16, approximately 800 ft east of Anchor Ranch Road.


Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.3</td>
<td>7.3</td>
<td>7580.91</td>
<td>7575.91</td>
<td>5.0</td>
<td>7.3</td>
<td>7576.91</td>
<td>7.6</td>
<td>0.3</td>
<td>0.7</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Aluminum cap elevation: 7583.70, Ground Elevation: 7583.21 ft; all depth measurements are from this elevation.

LA-14437-PR 159
5.21 CDV-16-02656

Location: In upper Cañon de Valle at the northern boundary of TA-16.
Remarks: None.

CDV-16-02656 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Intake Sump (ft)</th>
<th>Depth to Sump Elevation (ft)</th>
<th>Depth to Pump Sump Bottom (ft)</th>
<th>Sump Top Elev (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>8.0</td>
<td>7436.90</td>
<td>7436.90</td>
<td>5.0</td>
<td>8.0</td>
<td>7434.69</td>
<td>3.3</td>
<td>0.3</td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Aluminum cap Elevaton: 7443.18 ft; Ground Elevation: 7442.69 ft; all depths are from this elevation.
5.22 CDV-16-02657

Location: Upper Cañon de Valle at northern boundary of TA-16, approximately 200 ft east-southeast of well CDV-16-02656.


Remarks: Transducer began to malfunction around April 21, 2008; replaced October 31, 2008. This well is closed by a manhole cover, and the cable often cannot vent, resulting in mean daily transducer measurements that differ from the corresponding manual measurements. The erratic values possibly come from a compromised sump.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4</td>
<td>5.4</td>
<td>7432.89</td>
<td>7427.85</td>
<td>5.0</td>
<td>5.4</td>
<td>7427.85</td>
<td>5.7</td>
<td>0.3</td>
<td>0.7</td>
<td>161</td>
<td>0.7</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7433.25 ft; all depths are from this elevation.
5.23 CDV-16-02658

Location: Upper Cañon de Valle at northern boundary of TA-16, approximately 200 ft east-southeast of well CDV-16-02657 and approximately 800 ft east-southeast of Burning Ground Spring.

Period of Record: September 15, 1997, through December 10, 2010.

Remarks: None.

CDV-16-02658 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.9</td>
<td>6.9</td>
<td>7373.26</td>
<td>7368.26</td>
<td>5.0</td>
<td>0.9</td>
<td>7358.20</td>
<td>7.2</td>
<td>0.3</td>
<td>0.7</td>
<td></td>
<td>Groundwater</td>
</tr>
</tbody>
</table>
Location: Upper Cañon de Valle at northern boundary of TA-16, approximately 1800 ft east-northeast of well CDV-16-02657.

Period of Record: September 17, 1997, through December 10, 2010.

Remarks: None.

CDV-16-02659 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.7</td>
<td>6.7</td>
<td>7298.32</td>
<td>7293.32</td>
<td>5.0</td>
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<td>7290.32</td>
<td>7.0</td>
<td>0.3</td>
<td>0.7</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Aluminum Cap Elevation: 7300.50 ft, Ground Level: 7300.02; all depths are from this elevation.

LA-14437-PR 163
5.25 CDV-16-611921

Location: Upper Canon de Valle at northern boundary of TA-16, upstream of the Permeable Reactive Barrier (PRB) wall on the south bank.

Period of Record: June 10, 2010, through December 8, 2010.

Remarks: No water in the well since early July 2010.

CDV-16-611921 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Elev (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.3</td>
<td>11.3</td>
<td>7372.6</td>
<td>7367.6</td>
<td>5.0</td>
<td>NA</td>
<td>NA</td>
<td>11.3</td>
<td>7367.6</td>
<td>12.5</td>
<td>1.2</td>
<td>0.7</td>
<td>Artificial groundwater</td>
</tr>
</tbody>
</table>

Note: Monument Marker: 7378.85 ft; all depths are from this elevation.
5.26 CDV-16-611923

Location: Upper Cañon de Valle at northern boundary of TA-16, upstream of the PRB wall on the north bank.
Period of Record: June 10, 2010, through December 8, 2010.
Remarks:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol. (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.2</td>
<td>8.2</td>
<td>7373.6</td>
<td>7368.6</td>
<td>5.0</td>
<td>.8.2</td>
<td>7368.6</td>
<td>6.7</td>
<td>3.5</td>
<td>0.3</td>
<td></td>
<td>Aluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Top of Protective Housing: 7376.81 ft; Top of PVC Casing 7376.43 ft; Ground Level 7373.83 ft; all depths are from this elevation.
5.27 CDV-16-611925

Location: Upper Cañon de Valle at northern boundary of TA-16, in an access tube within the PRB wall on the south bank.

Period of Record: October 14, 2010, through December 8, 2010.

Remarks: Not a well, but an access tube into the PRB. Purpose of this transducer is to ensure that water is being effectively dammed by the PRB and that water is flowing through the conduits within the wall.

<table>
<thead>
<tr>
<th>Date</th>
<th>Manual Measurement</th>
<th>Mean Daily Transducer Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/2/09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/1/09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/31/09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/1/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/31/10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Groundwater Elevation (ft)

7373
7372
7371
7370
7369
7368
5.28 CDV-16-611929

Location: Upper Cañon de Valle at northern boundary of TA-16, downstream of the PRB wall on the south bank.

Period of Record: October 14, 2010, through December 8, 2010.

Remarks: None.

CDV-16-611929 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.0</td>
<td>12.0</td>
<td>7371.4</td>
<td>7366.4</td>
<td>5.0</td>
<td>NA</td>
<td>NA</td>
<td>12.0</td>
<td>7366.4</td>
<td>13.1</td>
<td>1.1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Note: Monument Marker: 7378.38 ft; all depths are from this elevation.

CDV-16-611929

- Manual measurement
- Mean daily transducer measurement
- Bottom of screen
5.29 CDV-16-611930

**Location:** Upper Cañon de Valle at northern boundary of TA-16, downstream of the PRB wall on the south bank.

**Period of Record:** June 10, 2010, through December 8, 2010.

**Remarks:** None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Volume (ft³)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.0</td>
<td>12.0</td>
<td>7370.5</td>
<td>7365.5</td>
<td>5.0</td>
<td>12.0</td>
<td>7365.5</td>
<td>13.0</td>
<td>1.0</td>
<td>0.6</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Monument Marker: 7377.54 ft; all depths are from this elevation.

**CDV-16-611930**

- Manual measurements
- --- Mean daily transducer measurement
- --- Bottom of screen

![Graph showing groundwater level status from 1/1/10 to 12/31/10]
5.30 CDV-16-611931

Location: Upper Cañon de Valle at northern boundary of TA-16, downstream of the PRB wall on the north bank.

Period of Record: June 10, 2010, through October 14, 2010.

Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Top Depth to Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Volume (L)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Screen Length (ft)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>10.0</td>
<td>7369.2</td>
<td>7364.2</td>
<td>5.0</td>
<td>10.0</td>
<td>7364.2</td>
<td>12.0</td>
<td>2.0</td>
<td>1.2</td>
<td>12.0</td>
<td></td>
</tr>
</tbody>
</table>

Note: Monument Marker: 7374.18 ft; all depths are from this elevation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Water Elevation (ft)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/10/2010</td>
<td>7362.01</td>
<td>Sump</td>
</tr>
<tr>
<td>9/3/2010</td>
<td>7361.99</td>
<td>Sump</td>
</tr>
<tr>
<td>10/14/2010</td>
<td>7361.94</td>
<td>Sump</td>
</tr>
</tbody>
</table>
5.31 CDV-16-611938

Location: Upper Cañon de Valle at northern boundary of TA-16, approximately 350 ft downstream of the PRB wall on the south bank.

Period of Record: June 10, 2010, through December 8, 2010.

Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev. (ft)</th>
<th>Screen Bottom Elev. (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev. (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
<td>8.0</td>
<td>7353.3</td>
<td>7348.3</td>
<td>5.0</td>
<td>8.0</td>
<td>7348.2</td>
<td>8.5</td>
<td>0.5</td>
<td>0.3</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground surface: 7356.25 ft; all depths are from this elevation.

CDV-16-611938

Groundwater Elevation (ft)

- Manual measurement
- Mean daily transducer measurement
- Bottom of screen

Date

1/1/10 2/22/10 4/15/10 6/6/10 7/28/10 9/18/10 11/9/10 12/31/10
5.32 FCO-1

Location: Fence Canyon, approximately 0.1 mi northwest of SR-4.
Period of Record: June 9, 1997, through September 7, 2010.
Remarks: Well has been dry since completion. A transducer was installed January 16, 2008. Well has remained dry since installation. Monitoring was discontinued September 7, 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Top Depth (ft)</th>
<th>Pump Bottom Depth (ft)</th>
<th>Pump Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Top Depth (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.4</td>
<td>12.4</td>
<td>6697.7</td>
<td>6497.7</td>
<td>2.4</td>
<td>6507.7</td>
<td>12.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6510.13 ft; all depths are from this elevation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/9/1997</td>
<td>Dry</td>
<td>9/14/2005</td>
<td>Dry</td>
</tr>
<tr>
<td>10/13/1997</td>
<td>Dry</td>
<td>6/23/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>7/28/1998</td>
<td>Dry</td>
<td>1/24/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/1999</td>
<td>Dry</td>
<td>6/6/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/1999</td>
<td>Dry</td>
<td>9/5/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>3/26/2000</td>
<td>Dry</td>
<td>10/17/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>5/16/2000</td>
<td>Dry</td>
<td>1/16/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/2000</td>
<td>Dry</td>
<td>4/8/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>4/16/2002</td>
<td>Dry</td>
<td>7/16/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/19/2002</td>
<td>Dry</td>
<td>10/7/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>11/13/2002</td>
<td>Dry</td>
<td>4/1/2010</td>
<td>Dry</td>
</tr>
<tr>
<td>2/19/2003</td>
<td>Dry</td>
<td>6/29/2010</td>
<td>Dry</td>
</tr>
<tr>
<td>5/18/2003</td>
<td>Dry</td>
<td>9/7/2010</td>
<td>Dry</td>
</tr>
<tr>
<td>4/7/2004</td>
<td>Dry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.33 FLC-16-25278

Location: Fish Ladder Canyon, approximately 0.1 mi southeast of the TA-16 Burning Grounds.
Period of Record: June 9, 1997, through December 8, 2010.
Remarks: Water levels frequently drop below the screen.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.6</td>
<td>3.2</td>
<td>7270.6</td>
<td>7269.0</td>
<td>1.6</td>
<td>3.2</td>
<td>7259</td>
<td>3.4</td>
<td>0.2</td>
<td>0.12</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7272.20 ft; all measurements are from this elevation.
5.34 FLC-16-25279

Location: Fish Ladder Canyon, approximately 0.2 mi east of FLC-16-25278.
Period of Record: June 9, 1997, through December 8, 2010.
Remarks: Water levels frequently drop below the screen. Bottom of screen is calculated to be at 7304.29 ft, rather than what was originally reported.

### FLC-16-25279 Construction Information

<table>
<thead>
<tr>
<th>Zona</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.7</td>
<td>4.3</td>
<td>7308.60</td>
<td>7305.00</td>
<td>1.6</td>
<td>4.3</td>
<td>7306.5</td>
<td>4.5</td>
<td>7305.5</td>
<td>0.2</td>
<td>0.12</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7309.30 ft; all measurements are from this elevation.

---

**FLC-16-25279**

- Manual Measurement
- Mean Daily Transducer Measurements
- Bottom of Screen

---

**FLC-16-25279**

- Manual Measurement
- Mean Daily Transducer Measurements
- Bottom of Screen

---

LA-14437-PR 173
5.35 FLC-16-25280

Location: Fish Ladder Canyon, approximately 0.2 mi east of FLC-16-25279.
Period of Record: June 9, 1997, through December 8, 2010.
Remarks: Water levels frequently drop below the screen.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.6</td>
<td>4.2</td>
<td>7362.3</td>
<td>7348.7</td>
<td>1.6</td>
<td>4.2</td>
<td>7360.7</td>
<td>4.4</td>
<td>5.2</td>
<td>0.2</td>
<td>0.12</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7352.90 ft; all measurements are from this elevation.

---

**FLC-16-25280**

- Manual Measurement
- Mean Daily Transducer Measurements
- --- Bottom of Screen

---

**FLC-16-25280**

- Manual Measurement
- Mean Daily Transducer Measurements
- --- Bottom of Screen

---
5.36 LAO-B

Location: Upper Los Alamos Canyon, approximately 3000 ft west of the Omega Bridge.
Period of Record: April 28, 1994, through December 14, 2010.
Remarks: None.

### LAO-B Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Sump Top (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.8</td>
<td>26.8</td>
<td>7311.8</td>
<td>7296.8</td>
<td>15.0</td>
<td>25.8</td>
<td>7326.8</td>
<td>27.2</td>
<td>0.4</td>
<td>0.9</td>
<td>0.4</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7323.59 ft; all depths are from this elevation.

![Graph 1](image1.png)

---

![Graph 2](image2.png)
5.37 LAO-0.3

Location: Upper Los Alamos Canyon, approximately 5700 ft east of the Omega Bridge.

Period of Record: June 1, 1994, through December 14, 2010.

Remarks: Transducer readings were not valid from July 7, 2005, through October 12, 2005; the pressure sensor was in the mud at the bottom of the well.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Depth Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.9</td>
<td>10.9</td>
<td>6962.23</td>
<td>6967.23</td>
<td>5.0</td>
<td>10.9</td>
<td>6967.23</td>
<td>11.25</td>
<td>0.35</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: LAO-0.3 Ground elevation is 6968.13 ft; all depths are from this elevation.
5.38 LAO-0.6

Location: Los Alamos Canyon, approximately 7500 ft east of the Omega Bridge.
Period of Record: May 6, 1994, through December 9, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Pump Top Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.0</td>
<td>15.0</td>
<td>6902.34</td>
<td>6897.34</td>
<td>9</td>
<td>13.0</td>
<td>6897.34</td>
<td>13.35</td>
<td>0.35</td>
<td>0.86</td>
<td>0.88</td>
<td></td>
<td></td>
<td>Alluvial Groundwater</td>
</tr>
</tbody>
</table>

Note: Aluminum Cap Elevation: 6910.74 ft; Ground elevation is 6910.34 ft; all depths are from this elevation.

![LAO-0.6 Manual Measurement](image_url)

![LAO-0.6 Mean Daily Transducer Measurement](image_url)
5.39 LAO-1

Location: Los Alamos Canyon, near the eastern border of TA-2.
Period of Record: February 15, 1966, through December 9, 2010.
Remarks: LAO-1 is a 2-in.-diameter well with a dedicated bladder pump. The transducer is sitting on top of the pump. Water levels were below the transducer in December 2008 and January 2009.

### LAO-1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>28</td>
<td>20</td>
<td>28</td>
<td>6806.24</td>
<td>28</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6836.24 ft; all depths are from this elevation.
5.40 LAO-1.6g

Location: Los Alamos Canyon, approximately 400 ft west of the confluence with DP Canyon.
Period of Record: November 22, 1996, through December 9, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.5</td>
<td>25.5</td>
<td>6647.5</td>
<td>6632.5</td>
<td>15.0</td>
<td>6660.0</td>
<td>25.5</td>
<td>6632.6</td>
<td>30.82</td>
<td>5.4</td>
<td>13.2</td>
<td></td>
<td>Alluvial well</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6658.01 ft; all depths are from this elevation.

LA-14437-PR 179
5.41 LAO-1.8

Location: Los Alamos Canyon, approximately 650 ft west of LAO-1.6g.
Period of Record: January 8, 2001, through January 7, 2010.
Remarks: This well frequently runs dry. The total depth of the well has changed over the years as it silts in, and is currently around 6665.6 ft. Monitoring in this well ceased on January 7, 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>18</td>
<td>6672.00</td>
<td>6662.00</td>
<td>18</td>
<td>6662.00</td>
<td>18</td>
<td>6662.00</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6680.00 ft; all depths are from this elevation
5.42 LAO-2

Location: Los Alamos Canyon, approximately 75 ft north of the confluence with DP Canyon.

Period of Record: February 1, 1966, through December 9, 2010.

Remarks. The transducer in this well is installed above the top of the pump with the transducer sensor at 6563.88 ft. Water level elevations below 6563.88 ft are not represented by transducer data.

<table>
<thead>
<tr>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>32</td>
<td>6611</td>
<td>6591</td>
<td>20</td>
<td>32</td>
<td>6591.0</td>
<td>32.0</td>
<td>0</td>
<td>0</td>
<td>Alluvial Groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation is 6623.00 ft; all depths are from this elevation

LAO-2 Construction Information

LAO-2

LAO-2
5.43 LAO-3a

Location: Los Alamos Canyon, approximately 1000 ft east of the confluence with DP Canyon.
Period of Record: September 15, 1989, through December 9, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.7</td>
<td>14.7</td>
<td>6604.4</td>
<td>6594.4</td>
<td>10.0</td>
<td>14.7</td>
<td>6694.4</td>
<td>15</td>
<td>0.3</td>
<td>0.2</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6609.1 ft; all depths are from this elevation.
5.44 LAO-4.5c

Location: Los Alamos Canyon, approximately 1.25 mi east of the confluence with DP Canyon.
Period of Record: November 22, 1989, through December 8, 2010.
Remarks: The transducer is resting on top of the bladder pump; water levels below 6438.34 ft are not recorded by the transducer. This well also tends to run dry.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Top Elev (ft)</th>
<th>Pump Intake Bottom Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.3</td>
<td>23.3</td>
<td>6473.2</td>
<td>6463.2</td>
<td>10.0</td>
<td>23.3</td>
<td>6463.2</td>
<td>23.3</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6486.50 ft; all depths are from this elevation.
5.45 LAO-5

Location: Los Alamos Canyon, approximately 1 mi west of SR-4.

Period of Record: December 14, 2005, through December 8, 2010.

Remarks: LAO-5 was not installed with a pressure transducer and was measured manually on a quarterly schedule. Regular monitoring of the well was discontinued January 9, 2008, and manual water levels are currently only taken for sampling events.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>25.0</td>
<td>6422.1</td>
<td>6402.1</td>
<td>20.0</td>
<td>25.0</td>
<td>6402.1</td>
<td>25.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6402.1</td>
<td>25.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6427.10 ft; all depths are from this elevation.

LAO-5 Manual Water Levels

<table>
<thead>
<tr>
<th>Date</th>
<th>Manual Water Level (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/14/05</td>
<td>Dry</td>
</tr>
<tr>
<td>3/14/06</td>
<td>6409.12</td>
</tr>
<tr>
<td>6/13/06</td>
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</tr>
<tr>
<td>8/2/06</td>
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</tr>
<tr>
<td>8/3/06</td>
<td>Dry</td>
</tr>
<tr>
<td>9/7/06</td>
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</tr>
<tr>
<td>12/8/06</td>
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</tr>
<tr>
<td>3/13/07</td>
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</tr>
<tr>
<td>6/7/07</td>
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</tr>
<tr>
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<td>6415.1</td>
</tr>
<tr>
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<td>6409.23</td>
</tr>
<tr>
<td>1/9/08</td>
<td>6407.6</td>
</tr>
<tr>
<td>9/25/08</td>
<td>6408.08</td>
</tr>
<tr>
<td>1/6/09</td>
<td>Dry</td>
</tr>
<tr>
<td>7/8/09</td>
<td>Dry</td>
</tr>
<tr>
<td>1/7/10</td>
<td>Dry</td>
</tr>
<tr>
<td>4/27/10</td>
<td>6417.11</td>
</tr>
<tr>
<td>9/1/10</td>
<td>6409.38</td>
</tr>
<tr>
<td>12/8/10</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.46 LAO-6

Location: Los Alamos Canyon, approximately 1 mi west of SR-4.
Period of Record: June 26, 1995, through January 28, 2009.
Remarks: Regular monitoring of this well was discontinued January 2, 2008, and manual water levels were obtained for sampling events only. All monitoring of this well was discontinued as of July 28, 2009.

LAO-6 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (ft³)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>16.0</td>
<td>6389.3</td>
<td>6379.3</td>
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<td>6379.3</td>
<td>16.0</td>
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<td>0.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6395.3 ft; all depths are from this elevation

LAO-6 Manual Water Level

<table>
<thead>
<tr>
<th>Date</th>
<th>Manual Water Level (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/26/1995</td>
<td>6413.8</td>
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<tr>
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<td>12/7/1995</td>
<td>6411.7</td>
</tr>
<tr>
<td>3/14/2006</td>
<td>Dry</td>
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<tr>
<td>4/19/2006</td>
<td>Dry</td>
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<tr>
<td>5/13/2006</td>
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<td>7/27/2006</td>
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<tr>
<td>12/8/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>3/13/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>6/7/2007</td>
<td>6411.67</td>
</tr>
<tr>
<td>9/5/2007</td>
<td>Dry</td>
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<tr>
<td>1/9/2008</td>
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<tr>
<td>1/7/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>7/28/2009</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.47 LAO-6a

Location: Los Alamos Canyon, approximately 1 mi west of SR-4.
Period of Record: August 17, 1989, through December 8, 2010.
Remarks: Well is seasonally dry.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.2</td>
<td>14.2</td>
<td>6420.5</td>
<td>6410.5</td>
<td>10.0</td>
<td>6410.5</td>
<td>14.2</td>
<td>6410.5</td>
<td>14.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6424.70 ft; all depths are from this elevation.
5.48 LAUZ-1

Location: DP Canyon, north of TA-21.
Period of Record: August 20, 1997, through November 24, 2010.
Remarks: None.

**LAUZ-1 Construction Information**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.35</td>
<td>10.35</td>
<td>7022.97</td>
<td>7022.97</td>
<td>5.00</td>
<td>15.35</td>
<td>7022.97</td>
<td>10.35</td>
<td>0.20</td>
<td>0.49</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7032.42 ft; all depths are from this elevation.

**Graphs**

- **Graph 1**: Manual Measurement
- **Graph 2**: Mean Daily Transducer Measurement
5.49 LLA0-1b

Location: Lower Los Alamos Canyon, approximately 3000 ft southwest of Totavi on San Ildefonso Pueblo land.

Period of Record: August 27, 1997, through December 7, 2010.

Remarks: Well has mostly remained dry since June 1, 2008, with the exception of a brief rise in June 2009.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.32</td>
<td>21.32</td>
<td>5837.52</td>
<td>5827.52</td>
<td>10.00</td>
<td>21.32</td>
<td>5827.52</td>
<td>24.17</td>
<td>2.85</td>
<td>2.85</td>
<td>7.04</td>
<td>Alluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 5850.34 ft; all measurements are from this elevation.
5.50 LLA0-4

Location: Lower Los Alamos Canyon, approximately 700 ft northwest of the Rio Grande at SR-502 on San Ildefonso Pueblo land.

Period of Record: November 22, 1996, through December 8, 2010.

Remarks: None.

### LLA0-4 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Sump Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.24</td>
<td>15.24</td>
<td>5509.97</td>
<td>5499.97</td>
<td>10.00</td>
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<td>5499.97</td>
<td>18.06</td>
<td>2.85</td>
<td>7.04</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 5515.46 ft; all depths are from this elevation.
5.51 MCA-1

Location: Upper Mortandad Canyon, approximately 700 ft northeast of the TA-50 outfall.
Period of Record: April 20, 2005, through December 3, 2010.
Remarks: None.

### MCA-1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5.4</td>
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<td>7065.2</td>
<td>5.9</td>
<td>0.5</td>
<td>0.1</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7070.6 ft, all depths are from this elevation.

---

**Graphs:**

1. Graph showing groundwater elevation from 4/1/05 to 1/1/10.
2. Graph showing groundwater elevation from 1/1/09 to 12/31/10.
5.52 MCA-5

Location: Upper Mortandad Canyon, approximately 1250 ft downstream of TA-50 outfall.
Period of Record: April 25, 2005, through February 11, 2010.
Remarks: This well is intermittently dry. Monitoring was discontinued February 11, 2010, and moved exclusively to MCO-3.

### MCA-5 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Top (ft)</th>
<th>Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.75</td>
<td>6.75</td>
<td>7052.05</td>
<td>7048.05</td>
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<td>0.04</td>
<td>-</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation JS 7053.8 ft; all depths are from this elevation.

---

**MCA-5**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen

**MCA-5**

- Manual Measurement
- Mean daily Transducer Measurement
- Bottom of Screen

LA-14437-PR 191
5.53 MCA-8

Location: Lower Mortandad Canyon.
Remarks: No valid water level data exist for this well. Water has occurred only in the sump since completion on September 29, 2004. Monitoring was discontinued February 10, 2010.

<table>
<thead>
<tr>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>81</td>
<td>6602.7</td>
<td>6587.7</td>
<td>15</td>
<td>81</td>
<td>6587.7</td>
<td>86.3</td>
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<td>14.4</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Ground elevation is 6668.8 ft; all depths are from this elevation

<table>
<thead>
<tr>
<th>Date</th>
<th>Water Level (ft)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/3/2005</td>
<td>6582.43</td>
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</tr>
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<td>1/4/2006</td>
<td>6583.52</td>
<td>Sump water</td>
</tr>
<tr>
<td>4/13/2006</td>
<td>6584.09</td>
<td>Sump water</td>
</tr>
<tr>
<td>7/18/2006</td>
<td>6584.14</td>
<td>Sump water</td>
</tr>
<tr>
<td>10/30/2006</td>
<td>6584.17</td>
<td>Sump water</td>
</tr>
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<td>9/5/2006</td>
<td>6584.16</td>
<td>Sump water</td>
</tr>
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<td>6584.12</td>
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</tr>
<tr>
<td>4/12/2007</td>
<td>6584.11</td>
<td>Sump water</td>
</tr>
<tr>
<td>7/3/2007</td>
<td>6584.1</td>
<td>Sump water</td>
</tr>
<tr>
<td>11/29/2007</td>
<td>6584.11</td>
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</tr>
<tr>
<td>12/5/2007</td>
<td>6583.94</td>
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<tr>
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<td>6583.99</td>
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<td>6/19/2008</td>
<td>6584.09</td>
<td>Sump water</td>
</tr>
<tr>
<td>8/11/2008</td>
<td>6584.1</td>
<td>Sump water</td>
</tr>
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</tr>
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<td>6584.01</td>
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</tr>
<tr>
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</tr>
<tr>
<td>5/19/2009</td>
<td>6584.13</td>
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</tr>
<tr>
<td>8/25/09</td>
<td>6584.11</td>
<td>Sump water</td>
</tr>
<tr>
<td>11/18/09</td>
<td>6584.11</td>
<td>Sump water</td>
</tr>
<tr>
<td>2/10/10</td>
<td>6583.96</td>
<td>Sump water</td>
</tr>
</tbody>
</table>

LA-14437-PR 192
5.54 MCO-0.6

Period of Record: March 31, 1999, through December 3, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev. (ft)</th>
<th>Screen Bottom Elev. (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev. (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev. (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3.05</td>
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<td>0.05</td>
<td>0.04</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap elevation: 7188.28 ft; Ground elevation: 7187.73 ft; All depths are from this elevation.

LA-14437-PR 193
5.55 MCO-2

Location: Upper Effluent Canyon, approximately 200 ft west of TA-50 outfall.
Period of Record: November 1, 1960, through November 23, 2010.
Remarks: The transducer was sitting on top of the bladder pump in a 2-in.-diameter well at an elevation of 7133.8 ft until April 12, 2007. The pump was removed from the well on April 12, 2007, and the transducer was lowered to a more functional level.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.0</td>
<td>9.0</td>
<td>7134.6</td>
<td>7127.6</td>
<td>7.0</td>
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<td>9.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7136.6 ft; all depths are from this elevation.
5.56 MCO-3

Location: Upper Mortandad Canyon, approximately 1250 ft downstream of TA-50 outfall and 8 ft east of MCA-5.

Period of Record: March 27, 1961, through December 3, 2010.

Remarks: There was no transducer installed in this well until February 11, 2010; continuous monitoring switched from MCA-5 to this well since MCO-3 is the well which is sampled.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.0</td>
<td>12.0</td>
<td>7050.6</td>
<td>7040.6</td>
<td>10.0</td>
<td>12.0</td>
<td>7040.6</td>
<td>12.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7052.6 ft; all depths are from this elevation.
5.57  MCO-4b

Location: Middle Mortandad Canyon, approximately 3000 ft up canyon from sediment traps.
Period of Record: August 21, 1990, through December 2, 2010.
Remarks: Pump was removed for maintenance, and transducer was relocated above pump at that time.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.9</td>
<td>28.9</td>
<td>6877.9</td>
<td>6857.9</td>
<td>20.0</td>
<td>26.9</td>
<td>6857.9</td>
<td>33.6</td>
<td>5.0</td>
<td>5.4</td>
<td>3.1</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6886.75 ft; all depths are from this elevation.
5.58  MCO-5

Location: Middle Mortandad Canyon, approximately 2300 ft up canyon from sediment traps.
Period of Record: October 1, 1960, through December 2, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.0</td>
<td>46.0</td>
<td>6854.66</td>
<td>6829.66</td>
<td>25.0</td>
<td>49.0</td>
<td>7329.00</td>
<td>40.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6975.66 ft; all depths are from this elevation

**MCO-5 Construction Information**

**MCO-5**

- Manual Measurement
- Mean Daily Transducer Measurement

**MCO-5**

- Manual Measurement
- Mean Daily Transducer Measurement

LA-14437-PR 197
5.59 MCO-6

Location: Middle Mortandad Canyon, approximately 0.25 mi east of MCO-5.
Remarks: The transducer was removed from the well October 30, 2007, and replaced February 28, 2008.

### MCO-6 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Screen</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.0</td>
<td>47.0</td>
<td>6822.5</td>
<td>6802.5</td>
<td>20.0</td>
<td>47.0</td>
<td>6802.5</td>
<td>47.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6848.48 ft; all depths are from this elevation.

---

**Graphs**

- **MCO-6**
  - Manual Measurement
  - Mean Daily Transducer Measurement

- **MCO-6**
  - Manual Measurement
  - Mean Daily Transducer Measurement
5.60 MCO-7

Location: Middle Mortandad Canyon, approximately 0.2 mi east of MCO-6.
Period of Record: October 1, 1960, through December 3, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Depth (ft)</th>
<th>Pump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>69</td>
<td>6788.31</td>
<td>6758.31</td>
<td>69</td>
<td>6758.31</td>
<td>69</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6827.31 ft; all depths are from this elevation.

LA-14437-PR 199
5.61  MCO-7.5

Location: Middle Mortandad Canyon, approximately 0.2 mi east of MCO-7.

Period of Record: November 1, 1961, through December 3, 2010.

Remarks: None.

### MCO-7.5 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>60</td>
<td>6773.88</td>
<td>6748.88</td>
<td>25</td>
<td>60</td>
<td>6748.88</td>
<td>60</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6808.88 ft; all depths are from this elevation.

---

![Graph 1](image1.png)

**MCO-7.5**

- Manual Measurement
- Mean Daily Transducer Measurement

---

![Graph 2](image2.png)

**MCO-7.5**

- Manual Measurement
- Mean Daily Transducer Measurement

---

LA-14437-PR 200
5.62 MCWB-5

Location: Middle Mortandad Canyon, up canyon from the sediment traps.

Period of Record: January 9, 1995, through December 2, 2010.

Remarks: Water in the sump is not considered invalid as it appears to respond to groundwater level fluctuations. Transducer hangs above bottom of well; groundwater elevations below 6847 ft are not recorded by the transducer.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.0</td>
<td>27.0</td>
<td>6859.2</td>
<td>6849.2</td>
<td>10.0</td>
<td>27.0</td>
<td>6849.2</td>
<td>32.0</td>
<td>5.0</td>
<td>7.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6876.22 ft; all depths are from this elevation.
5.63 MCWB-5.5b

Location: Middle Mortandad Canyon, up canyon from sediment traps.
Period of Record: January 9, 1995, through December 2, 2010.
Remarks: Water in sump is not invalidated as it appears to represent formation water.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.5</td>
<td>32.5</td>
<td>6834.4</td>
<td>6834.4</td>
<td>10.0</td>
<td>32.5</td>
<td>6824.4</td>
<td>37.5</td>
<td>37.5</td>
<td>5.0</td>
<td>7.0</td>
<td>7.0</td>
<td>Alluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6856.89 ft; all depths are from this elevation.
5.64 MCWB-6.2a

Location: Middle Mortandad Canyon, up canyon from sediment traps.
Period of Record: January 9, 1995, through December 2, 2010.
Remarks: Water in the sump is not invalidated, as it appears to respond to groundwater level fluctuations. Transducer data indicate that the bottom of the well is at 6801.2 ft.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30.5</td>
<td>40.5</td>
<td>6817.8</td>
<td>6807.8</td>
<td>10.0</td>
<td>40.5</td>
<td>6807.8</td>
<td>45.5</td>
<td>5.0</td>
<td>7.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6848.29 ft; all depths are from this elevation.

LA-14437-PR 203
5.65 MCWB-6.5e

Location: Middle Mortandad Canyon, up canyon of the sediment traps.
Period of Record: January 9, 1995, through December 2, 2010.
Remarks: Water in sump is not invalidated, as it appears to respond to groundwater level fluctuations. Water is below transducer from March 23, 2007, to May 4, 2008, and from August 26, 2008, to October 8, 2008.

**MCWB-6.5e Construction Information**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.0</td>
<td>45</td>
<td>6808</td>
<td>6798</td>
<td>10.0</td>
<td>45.0</td>
<td>6798.8</td>
<td>45.3</td>
<td>6798.8</td>
<td>50.0</td>
<td>5.0</td>
<td>70</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6843.80 ft; all depths are from this elevation.

**Graph 1:**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
- Bottom of Well

**Graph 2:**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
- Bottom of Well
5.66 MCWB-7a

Location: Middle Mortandad Canyon, near sediment traps.
Period of Record: January 9, 1995, through December 3, 2010.
Remarks: Water in sump is not invalidated, as it appears to respond to groundwater level fluctuations.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.0</td>
<td>47.0</td>
<td>6794.17</td>
<td>6784.17</td>
<td>10.0</td>
<td>47.0</td>
<td>6784.2</td>
<td>52.0</td>
<td>8.0</td>
<td>7.0</td>
<td>205</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6831.17 ft; all depths are from this elevation.

MCWB-7a Construction Information

MCWB-7a

Date: 1/1/95 4/14/97 7/28/99 11/9/01 2/22/04 6/6/06 9/18/08 12/31/10

Groundwater Elevation (ft)

Date: 1/1/09 5/2/09 9/1/09 12/31/09 5/2/10 9/1/10 12/31/10

Groundwater Elevation (ft)
5.67 MCWB-7.4b

Location: Middle Mortandad Canyon, down canyon from sediment traps.
Period of Record: January 9, 1995, through December 3, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.0</td>
<td>65.0</td>
<td>6768.07</td>
<td>6748.07</td>
<td>20.0</td>
<td>65.0</td>
<td>6748.1</td>
<td>70.0</td>
<td>5.0</td>
<td>7.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6813.07 ft; all depths are from this elevation.
5.68 MCWB-7.7b

Location: Middle Mortandad Canyon, down canyon from sediment traps.
Period of Record: January 9, 1995, through December 3, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevat (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevat (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55.0</td>
<td>65</td>
<td>6744.0</td>
<td>6734.0</td>
<td>10.0</td>
<td>62.0</td>
<td>6734.0</td>
<td>35.0</td>
<td>6744.0</td>
<td>70</td>
<td>5.0</td>
<td>7.0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6798.97 ft, all depths are from this elevation.
5.69 MSC-16-06293

Location: Martin Spring Canyon, about 1600 ft downstream from the Martin Spring outlet.
Period of Record: November 6, 2000, through December 8, 2010.
Remarks: This well periodically runs dry.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.3</td>
<td>7.3</td>
<td>7366.14</td>
<td>7283.14</td>
<td>5.0</td>
<td>7.30</td>
<td>7363.14</td>
<td>7.84</td>
<td>0.54</td>
<td>1.33</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 7370.79 ft; Ground elevation: 7370.44 ft; all depths are from this elevation.
5.70 MSC-16-06294

Location: Martin Spring Canyon, about 1600 ft upstream of the K-site wetlands.
Period of Record: November 6, 2000, through December 8, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.3</td>
<td>5.0</td>
<td>7275.84</td>
<td>7278.84</td>
<td>7.65</td>
<td>7.3</td>
<td>7280.84</td>
<td>7.65</td>
<td>0.35</td>
<td>0.86</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 7288.44; Ground elevation: 7286.14 ft; all depths are from this elevation.
5.71 MSC-16-06295

Location: Martin Spring Canyon, just downstream of the K-site wetlands and north of the TA-11 drop tower.
Period of Record: March 10, 2000, through December 8, 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev. (ft)</th>
<th>Screen Bottom Elev. (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5</td>
<td>6.5</td>
<td>7254.74</td>
<td>7249.74</td>
<td>5.0</td>
<td>6.50</td>
<td>7249.74</td>
<td>6.85</td>
<td>0.35</td>
<td>0.86</td>
<td>Alluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 7257.03 ft; Ground elevation: 7256.24 ft; all depths are from this elevation

MSC-16-06295
• Manual Measurement
--- Mean Daily Transducer Measurement
--- Bottom of Screen

![Graph of Groundwater Level]

MSC-16-06295
• Manual Measurement
--- Mean Daily Transducer Measurement
--- Bottom of Screen

![Graph of Groundwater Level]
5.72 MT-2

Location: Middle Mortandad Canyon, down canyon of sediment traps, approximately 0.12 mi east of MT-1.

Period of Record: November 1, 1988, through December 3, 2010.

Remarks: The transducer was above the pump until April 17, 2007; transducer data before April 17, 2007, do not represent water levels below 6749.3 ft. Transducer was removed from well from November 28, 2007, through August 19, 2008.

**MT-2 Construction Information**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.9</td>
<td>64</td>
<td>6752.2</td>
<td>6732.2</td>
<td>20.0</td>
<td>64.0</td>
<td>64.3</td>
<td>6732.2</td>
<td>64.3</td>
<td>0.3</td>
<td>0.2</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6796.20 ft; all depths are from this elevation.

---

**MT-2:**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen

---

**MT-2:**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
5.73 MT-3

Location: Middle Mortandad Canyon, down canyon of sediment traps, approximately 0.12 mi east of MT-1 and approximately 50 ft north of MT-2.

Period of Record: November 1, 1988, through December 3, 2010.

Remarks: None.

MT-3 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.0</td>
<td>64.0</td>
<td>6752.7</td>
<td>6732.7</td>
<td>20.0</td>
<td>64.0</td>
<td>6732.7</td>
<td>74.0</td>
<td>10.0</td>
<td>10.0</td>
<td>6.2</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6796.65 ft; all depths are from this elevation.

MT-3

- Manual Measurement
- Mean Daily Transducer Measurement
- Top of Pump

Date

Groundwater Elevation (ft)

LA-14437-PR
Groundwater Level Status Report

5.74 MT-4

Location: Middle Mortandad Canyon, down canyon of the sediment traps, approximately 525 ft east of MT-3.

Period of Record: November 1, 1988, through December 3, 2010.

Remarks: Pump was removed December 3, 2010 to enable transducer to record deeper water levels.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54</td>
<td>64</td>
<td>6729.59</td>
<td>6719.59</td>
<td>10</td>
<td>64</td>
<td>6719.59</td>
<td>74</td>
<td>16</td>
<td>8</td>
<td>6729</td>
<td>6719.59</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6783.59 ft; all depths are from this elevation.

MT-4 Construction Information

MT-4

Manual Measurement
Mean Daily Transducer Measurement

MT-4

Manual Measurement
Mean Daily Transducer Measurement
Top of Pump
5.75 PA0-1

Location: Upper Pueblo Canyon, approximately 1000 ft west of the confluence with Acid Canyon.


Remarks: The transducer batteries failed on December 3, 2006, and were replaced on February 27, 2007.

### PA0-1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.89</td>
<td>10.89</td>
<td>6948.91</td>
<td>6943.98</td>
<td>5.00</td>
<td>10.89</td>
<td>6944.08</td>
<td>13.74</td>
<td>2.95</td>
<td>7.04</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6954.97 ft; Ground elevation is 6954.47 ft; all depths are from this elevation.
5.76 PAO-2

Location: Upper Pueblo Canyon, approximately 500 ft east of the Acid Canyon confluence.
Remarks: The water level frequently drops below the screen.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.06</td>
<td>11.06</td>
<td>6914.37</td>
<td>6919.37</td>
<td>5.00</td>
<td>11.06</td>
<td>6919.37</td>
<td>13.91</td>
<td>5919.37</td>
<td>13.91</td>
<td>2.85</td>
<td>7.04</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6930.88 ft; all measurements are from this elevation.
5.77 PAO-4

Location: Lower Pueblo Canyon, approximately 3100 ft southeast of the old LAC Sewage Treatment Plant location.
Period of Record: July 24, 1997, through December 8, 2010.

### PAO-4 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.97</td>
<td>6.97</td>
<td>6435.07</td>
<td>6430.07</td>
<td>5.00</td>
<td>6.97</td>
<td>6430.07</td>
<td>9.82</td>
<td>6.97</td>
<td>6430.07</td>
<td>9.82</td>
<td>7.04</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6437.37 ft; Ground elevation: 6437.04 ft; all depths are from this elevation.

---

[Graphs showing groundwater elevation over time for PAO-4]
5.78 PCA0-5

Location: Middle Pajarito Canyon, adjacent to and on the north side of the stream channel, approximately 100 ft upstream of the flood retention dam.

Period of Record: May 3, 2008, through October 18, 2010.

Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14.7</td>
<td>24.7</td>
<td>6928.6</td>
<td>6918.6</td>
<td>10.0</td>
<td>24.7</td>
<td>6918.6</td>
<td>30.0</td>
<td>5.3</td>
<td>13.1</td>
<td>Alluvial Groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6943.29 ft; all depths from this elevation.
5.79 PCAO-6

Location: Middle Pajarito Canyon, on the south side of the stream channel, approximately 300 ft downstream of the flood retention dam, and approximately 100 ft west of regional well R-17.

Period of Record: June 5, 2008, through October 7, 2010.

Remarks: Well was purged dry during drilling (less than one gallon of water). Until April 2009, water did not rise above the sump. Well remained wet during the summers of 2009 and 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Depth to Top of Sump Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.0</td>
<td>15.0</td>
<td>6913.4</td>
<td>6906.4</td>
<td>7.0</td>
<td>15.0</td>
<td>6906.4</td>
<td>20.0</td>
<td>5.0</td>
<td>12.4</td>
<td>Alluvial Groundwater</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6921.40 ft; all depths from this elevation

---

**Groundwater Level Status Report**

**March 2011**

---

**PCA0-6 Construction Information**

---

**PCA0-6**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
5.80 PCAO-7a

Location: In TA-18 in lower Pajarito Canyon on the north side of Pajarito Road, approximately 100 ft from the TA-18 entrance.
Period of Record: June 12, 2008, through November 18, 2010.
Remarks: None.

### PCAO-7a Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Volume (ft³)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.7</td>
<td>19.7</td>
<td>6702.3</td>
<td>6692.3</td>
<td>10.0</td>
<td>19.7</td>
<td>6692.3</td>
<td>24.7</td>
<td>24.7</td>
<td>5.0</td>
<td>12.4</td>
<td>Alluvial Groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6711.97 ft; all depths are from this elevation.

---

**PCAO-7a Groundwater Elevation Chart**

- **Groundwater Level Status Report**
- **March 2011**

LA-14437-PR 219
5.81 PCAO-7b1

Location: In lower Pajarito Canyon, in TA-18, on the north side of Pajarito Road directly across from the TA-18 entrance. PCAO-7b1 and PCAO-7b2 are approximately 10 ft apart.

Period of Record: May 21, 2008, through November 18, 2010.

Remarks: Well was bailed dry during drilling, and water has not risen above the sump since.

### PCAO-7b1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Elevation Bottom (ft)</th>
<th>Sump Elevation Top (ft)</th>
<th>Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.0</td>
<td>54.0</td>
<td>6659.6</td>
<td>6659.6</td>
<td>54.0</td>
<td>6659.6</td>
<td>59.3</td>
<td>5.3</td>
<td>13.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6713.62 ft; all depths from this elevation.

### PCAO-7b1 Manual Water Levels

<table>
<thead>
<tr>
<th>Date</th>
<th>Water Level (ft)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/21/2008</td>
<td>6656.7</td>
<td>Sump water</td>
</tr>
<tr>
<td>5/28/2008</td>
<td>6657.34</td>
<td>Sump water</td>
</tr>
<tr>
<td>9/9/2008</td>
<td>6653.96</td>
<td>Sump water</td>
</tr>
<tr>
<td>3/3/2009</td>
<td>6653.8c</td>
<td>Sump water</td>
</tr>
<tr>
<td>5/28/2009</td>
<td>6653.93</td>
<td>Sump water</td>
</tr>
<tr>
<td>9/23/2009</td>
<td>6653.95</td>
<td>Sump water</td>
</tr>
<tr>
<td>12/17/2009</td>
<td>6653.93</td>
<td>Sump water</td>
</tr>
<tr>
<td>3/30/2010</td>
<td>6653.86</td>
<td>Sump water</td>
</tr>
<tr>
<td>9/24/2010</td>
<td>6653.86</td>
<td>Sump water</td>
</tr>
<tr>
<td>9/17/2010</td>
<td>6653.96</td>
<td>Sump water</td>
</tr>
<tr>
<td>11/18/2010</td>
<td>6653.86</td>
<td>Sump water</td>
</tr>
</tbody>
</table>
5.82 PCAO-7b2

Location: In lower Pajarito Canyon, in TA-18, on the north side of Pajarito Road directly across from the TA-16 entrance. PCAO-7b1 and PCAO-7b2 are approximately 10 ft apart.

Period of Record: May 27, 2008, through November 18, 2010.

Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>20</td>
<td>6703.4</td>
<td>6693.4</td>
<td>10.0</td>
<td>--</td>
<td>--</td>
<td>23.0</td>
<td>6693.4</td>
<td>25.0</td>
<td>5.0</td>
<td>12.4</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6713.39 ft; all depths are from this elevation.

---

**PCA0-7b2**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of screen

---

**PCA0-7b2**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of screen

---

LA-14437-PR 221
5.83 PCAO-7c

Location: Lower Pajarito Canyon, in TA-18 on the south side of Pajarito Road, approximately 50 ft from the TA-18 entrance.

Period of Record: May 16, 2008, through November 18, 2010.

Remarks: None.

### PCAO-7c Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.7</td>
<td>19.7</td>
<td>6704.9</td>
<td>6684.0</td>
<td>10.0</td>
<td>12.7</td>
<td>6694.9</td>
<td>25.0</td>
<td>5.3</td>
<td>13.1</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6714.37 ft; all depths from this elevation.

---

![Graph](file)

**PCA-7c**

- Manual Measurement
- Mean Daily Transducer Measurement

**Graphs**

- Groundwater Elevation vs Date
- Groundwater Elevation vs Date
5.84 PCAO-8

Location: In lower Pajarito Canyon, on the south side of Pajarito Road in TA-36, approximately a quarter mile west of PCAO-9.
Period of Record: June 2, 2008, through October 7, 2010.
Remarks: None.

### PCAO-8 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.7</td>
<td>19.7</td>
<td>6574.8</td>
<td>6564.8</td>
<td>19.7</td>
<td>6664.8</td>
<td>25.3</td>
<td>5.3</td>
<td>13.7</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6584.45 ft; all depths from this elevation.

---

![Graph 1](chart1.png)

**PCA-8**
- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen

![Graph 2](chart2.png)

**PCA-8**
- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
5.85 PCA0-9

Location: In lower Pajarito Canyon on the south side of Pajarito Road in TA-36, approximately a quarter mile west of the security check point, and a quarter mile east of PCA0-8.

Period of Record: June 12, 2008, through October 7, 2010.

Remarks: None.

### PCA0-9 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Sump Top (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.0</td>
<td>16.0</td>
<td>6552.6</td>
<td>6542.6</td>
<td>10.0</td>
<td>16.0</td>
<td>6542.6</td>
<td>21.0</td>
<td>5.0</td>
<td>12.4</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6558.60 ft; all depths from this elevation

---

LA-14437-PR 224
5.86 PC0-2

Location: In lower Pajarito Canyon on the north side of Pajarito Road, approximately 0.1 mi east of R-32.
Period of Record: June 11, 1985, through October 7, 2010.
Remarks: None.

PC0-2 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5</td>
<td>9.5</td>
<td>6616.8</td>
<td>6608.8</td>
<td>8</td>
<td>9.5</td>
<td>6608.8</td>
<td>9.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6618.3 ft; all depths are from this elevation.

LA-14437-PR
5.87 PCO-3

Location: Lower Pajarito Canyon, approximately 1 mi east of R-32, in wetlands on the south side of Pajarito Road.

Period of Record: June 11, 1985, through December 12, 2010.

Remarks: None.

---

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.7</td>
<td>17.7</td>
<td>6540.6</td>
<td>6528.5</td>
<td>12.0</td>
<td>17.7</td>
<td>6528.6</td>
<td>17.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6546.30 ft; all depths are from this elevation.
5.88 SCA-1 and SCA-1-DP

Location: In upper Sandia Canyon, in the wetlands approximately 350 ft upstream from gaging station E123. SCA-1-DP is located approximately 15 ft west of SCA-1.

Period of Record: October 13, 2006, through November 18, 2010.

Remarks: SCA-1 is a shallow alluvial well located in a wetland. Recent sampling events have moved to temporary drive point well SCA-1-DP due to silting-in of the screen in SCA-1. Continuous water levels are monitored at SCA-1, and manual measurements are taken in conjunction at SCA-1-DP. SCA-1-DP was removed and replaced in the same hole in November 2010.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3</td>
<td>1.9</td>
<td>7209.9</td>
<td>7209.3</td>
<td>0.6</td>
<td>1.9</td>
<td>7209.3</td>
<td>2.1</td>
<td>0.2</td>
<td>0.1</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 7211.22 ft; all depths are from this elevation
**5.89 SCA-2**

Location: Middle Sandia Canyon, approximately 700 ft upstream of gaging station E124.

Period of Record: October 13, 2006, through November 17, 2010.

Remarks: SCA-2 responds to the sewer treatment plant discharge in upper Sandia Canyon. Water levels frequently drop below the screen. From August 22, 2008, though March 11, 2009, the transducer was set too high in the well, not recording water levels below 6735.7 ft, and not matching manual measurements. Transducer has since been lowered to record all water level data.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.3</td>
<td>15.0</td>
<td>6738.8</td>
<td>6734.1</td>
<td>4.7</td>
<td>15.0</td>
<td>6733.8</td>
<td>15.6</td>
<td>0.6</td>
<td>0.4</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Groundwater elevation is 6749.08 ft; all depths are from this elevation.
5.90 SCA-3

Location: Middle Sandia Canyon, approximately 700 ft downstream of gaging station E124.
Period of Record: October 13, 2006, through November 10, 2010.
Remarks: Water rose above the sump for the first time on December 10, 2007. Since then the well has periodically run dry.

SCA-3 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.6</td>
<td>32.0</td>
<td>6695.6</td>
<td>6591.2</td>
<td>4.4</td>
<td>32.0</td>
<td>6691.2</td>
<td>32.6</td>
<td>0.6</td>
<td>4.4</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6723.22 ft; all depths are from this elevation.

SCA-3 Groundwater Level Status Report

LA-14437-PR
5.91 SCA-4

Location: Middle Sandia Canyon, approximately 700 ft downstream from SCA-3.
Period of Record: October 3, 2006, through November 17, 2010.
Remarks: The transducer was installed on October 3, 2006, above the top of the pump at an elevation of 6665.28 ft. The pump was removed on October 31, 2006, to allow more thorough water level monitoring.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.0</td>
<td>41.5</td>
<td>6666.2</td>
<td>6661.7</td>
<td>41.5</td>
<td>6661.7</td>
<td>42.0</td>
<td>6661.7</td>
<td>0.5</td>
<td>3.7</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6703.58 ft; Ground elevation: 6703.20 ft; all depths are from this elevation.
5.92 SCA-5

Location: Middle Sandia Canyon, approximately 550 ft upstream from the firing range at TA-72 and about 325 ft north of R-11.

Period of Record: October 3, 2006, through November 17, 2010.

Remarks: Until spring 2008, the transducer was installed above the pump in the 2-in. casing and the transducer data did not represent water levels below 6608.1 ft. Since spring 2008, the transducer has recorded all water in the well. This well has run dry frequently since installation of the pressure transducer.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55.00</td>
<td>64.4</td>
<td>6614.0</td>
<td>6604.6</td>
<td>9.4</td>
<td>64.4</td>
<td>6604.6</td>
<td>64.9</td>
<td>0.5</td>
<td>0.3</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6669.02 ft; all depths from this elevation.

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**SCA-5 Construction Information**

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**SCA-5**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen

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**SCA-5**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
5.93 SCO-1

Location: Sandia Canyon, approximately 0.1 mi east of R-11.
Period of Record: June 7, 1997, through August 24, 2009.
Remarks: No valid data; well has been dry for every measurement event. There is no transducer installed in this well. Monitoring ceased in August 2009.

### SCO-1 Construction Information

<table>
<thead>
<tr>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.3</td>
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<td>19.3</td>
<td>6599.4</td>
<td>19.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6618.67 ft; all depths are from this elevation

### SCO-1 Manual Water Levels

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/14/1989</td>
<td>Dry</td>
<td>10/18/2005</td>
<td>Dry</td>
</tr>
<tr>
<td>10/13/1997</td>
<td>Dry</td>
<td>3/7/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>7/28/1998</td>
<td>Dry</td>
<td>9/7/2006</td>
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<tr>
<td>8/30/1999</td>
<td>Dry</td>
<td>2/12/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/1999</td>
<td>Dry</td>
<td>3/13/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>3/26/2000</td>
<td>Dry</td>
<td>6/7/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>5/16/2000</td>
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<td>6/12/2007</td>
<td>Dry</td>
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<td>8/30/2000</td>
<td>Dry</td>
<td>9/5/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>10/8/2000</td>
<td>Dry</td>
<td>11/12/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>7/2/2001</td>
<td>Dry</td>
<td>1/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/22/2001</td>
<td>Dry</td>
<td>2/12/2008</td>
<td>Dry</td>
</tr>
<tr>
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<td>Dry</td>
<td>4/3/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>1/27/2002</td>
<td>Dry</td>
<td>5/12/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>4/19/2002</td>
<td>Dry</td>
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</tr>
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<td>Dry</td>
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<td>2/19/2003</td>
<td>Dry</td>
<td>11/3/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>5/18/2003</td>
<td>Dry</td>
<td>2/2/2009</td>
<td>Dry</td>
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<td>6/7/2005</td>
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</tr>
<tr>
<td>6/14/2005</td>
<td>Dry</td>
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<td></td>
</tr>
</tbody>
</table>
5.94 SCO-2

Location: Sandia Canyon, approximately 300 ft west of R-12.
Period of Record: June 9, 1997, through August 24, 2009.
Remarks: No valid data; well has been dry for every measurement event. There is no transducer installed in this well. Monitoring ceased in August 2009.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.4</td>
<td>19.4</td>
<td>6491.3</td>
<td>6481.3</td>
<td>10.0</td>
<td>19.4</td>
<td>6491.3</td>
<td>19.4</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6500.67 ft; all depths are from this elevation

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/16/1989</td>
<td>Dry</td>
<td>10/18/2005</td>
<td>Dry</td>
</tr>
<tr>
<td>10/13/1997</td>
<td>Dry</td>
<td>3/7/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>7/28/1998</td>
<td>Dry</td>
<td>9/7/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/1999</td>
<td>Dry</td>
<td>2/12/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/1999</td>
<td>Dry</td>
<td>3/13/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>3/26/2000</td>
<td>Dry</td>
<td>6/7/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>5/16/2000</td>
<td>Dry</td>
<td>6/12/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/2000</td>
<td>Dry</td>
<td>9/5/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>10/8/2000</td>
<td>Dry</td>
<td>11/12/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>7/2/2001</td>
<td>Dry</td>
<td>1/24/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/22/2001</td>
<td>Dry</td>
<td>2/12/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>10/18/2001</td>
<td>Dry</td>
<td>4/3/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>4/19/2002</td>
<td>Dry</td>
<td>5/12/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/27/2002</td>
<td>Dry</td>
<td>7/22/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>10/27/2002</td>
<td>Dry</td>
<td>8/11/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>2/19/2003</td>
<td>Dry</td>
<td>11/3/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>5/18/2003</td>
<td>Dry</td>
<td>2/2/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>6/14/2005</td>
<td>Dry</td>
<td>8/24/2009</td>
<td>Dry</td>
</tr>
</tbody>
</table>
5.95 SCP-1abc

Location: Middle Sandia Canyon, approximately 5 ft west of SCA-4
Period of Record: October 13, 2006, through November 18, 2010.
Remarks: SCP-1abc is a triple-nested piezometer.

### SCP-1abc Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Bottom of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>37.80</td>
<td>38.3</td>
<td>6665.44</td>
<td>6664.94</td>
<td>0.5</td>
<td>38.3</td>
<td>6664.9</td>
<td>36.4</td>
<td>0.1</td>
<td>0.004</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
<tr>
<td>b</td>
<td>39.4</td>
<td>39.9</td>
<td>6663.84</td>
<td>6663.34</td>
<td>0.5</td>
<td>39.9</td>
<td>6663.34</td>
<td>40.0</td>
<td>0.1</td>
<td>0.004</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
<tr>
<td>c</td>
<td>41.2</td>
<td>41.7</td>
<td>6662.04</td>
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<td>41.7</td>
<td>6661.54</td>
<td>41.8</td>
<td>0.1</td>
<td>0.004</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6703.65 ft; Ground elevation: 6703.24 ft; all depths are from this elevation.

### SCP-1abc Graphs

**Graph 1:**
- 1a Manual Measurement
- 1b Manual Measurement
- 1c Manual Measurement
- 1c Bottom of Screen
- 1a Mean Daily Transducer Measurement
- 1b Mean Daily Transducer Measurement
- 1c Mean Daily Transducer Measurement

**Graph 2:**
- 1a Manual Measurement
- 1b Manual Measurement
- 1c Manual Measurement
- 1c Bottom of Screen (SCP-1c)
- 1a Mean Daily Transducer Measurement
- 1b Mean Daily Transducer Measurement
- 1c Mean Daily Transducer Measurement

Date:
- 10/1/06 5/10/07 12/18/07 7/27/08 3/6/09 10/14/09 5/24/10 12/31/10
- 1/1/09 5/2/09 9/1/09 12/31/09 5/2/10 9/1/10 12/31/10
5.96 SCP-2a

Location: Middle Sandia Canyon, approximately 10 ft east of SCA-3 and 5 ft east of SCP-2b.
Period of Record: October 13, 2006, through November 18, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Screen (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Top (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>44.5</td>
<td>45.0</td>
<td>6678.1</td>
<td>6677.6</td>
<td>0.5</td>
<td>45.0</td>
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<td>0.1</td>
<td>0.02</td>
<td>Alluvial groundwater</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6722.95 ft; Ground elevation: 6722.57 ft; all depths are from this elevation.

SCP-2a Construction Information

SCP-2a

--- Mean Daily Transducer Measurement

SCP-2a and SCP-2b

--- SCP-2a Mean Daily Transducer Measurement
--- SCP-2b Mean Daily Transducer Measurement

Date

Groundwater Elevation (ft)
5.97 SCP-2b

Location: Middle Sandia Canyon, approximately 5 ft east of SCA-3 and 5 ft west of SCP-2a.
Period of Record: October 13, 2006, through November 18, 2010.
Remarks: None.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev. (ft)</th>
<th>Screen Bottom Elev. (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev. (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev. (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2b</td>
<td>49.5</td>
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<td>6672.6</td>
<td>0.5</td>
<td>50.0</td>
<td>6673.1</td>
<td>50.1</td>
<td>0.1</td>
<td>0.02</td>
<td></td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Brass Cap Elevation: 6723.11, Ground Elevation: 6722.57 ft, all depths are from this elevation.
5.98 TMO-1

Location: In lower Two-Mile Canyon, just above the confluence with Pajarito Canyon, approximately 500 ft upstream of PCAO-5 and the flood retention dam.
Period of Record: July 17, 2008, through October 7, 2010.
Remarks: Data from July 17, 2008, through August 9, 2008, were invalidated because transducer was hanging above level of water. The transducer was lowered to the bottom of the well on December 12, 2009.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump Elevation (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Bottom of Sump Elevation (ft)</th>
<th>Sump Elevation Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.5</td>
<td>6.5</td>
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<td>6936.7</td>
<td>3.0</td>
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<td>0.0</td>
<td></td>
<td>0.0</td>
<td>Hand-augered well</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6945.20 ft; all depths from this elevation.
5.99 TSCA-6

Location: Ten Site Canyon, approximately 600 ft west of Mortandad Canyon confluence.
Period of Record: April 18, 2005, through December 2, 2010.
Remarks: This well tends to run dry seasonally, and has been dry since May 2008.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Elevation (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.20</td>
<td>20.9</td>
<td>6847.0</td>
<td>6842.3</td>
<td>4.7</td>
<td>20.9</td>
<td>6842.3</td>
<td>21.3</td>
<td>0.4</td>
<td>0.2</td>
<td>Alluvial groundwater</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6863.2 ft; all depths are from this elevation.

LA-14437-PR
5.100 WCO-1

Location: Water Canyon, near western border of TA-68.

Period of Record: October 31, 1989, through December 20, 2009.

Remarks: This well is usually dry. There are only two records indicating water in well. This well was plugged and abandoned in December 2009. Monitoring has moved to WCO-1r.

### WCO-1 Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.4</td>
<td>34.4</td>
<td>6592.0</td>
<td>6582.0</td>
<td>10.0</td>
<td>34.4</td>
<td>6582.0</td>
<td>34.4</td>
<td>0.0</td>
<td>0.0</td>
<td>7.0</td>
<td></td>
<td>Alluvial groundwaler</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6616.41 ft; all depths are from this elevation.

### WCO-1 Manual Water Levels

<table>
<thead>
<tr>
<th>Date</th>
<th>Groundwater Elevation (ft)</th>
<th>Date</th>
<th>Groundwater Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/31/1989</td>
<td>Dry</td>
<td>6/19/2003</td>
<td>Dry</td>
</tr>
<tr>
<td>11/1/1989</td>
<td>Dry</td>
<td>6/19/2003</td>
<td>Dry</td>
</tr>
<tr>
<td>8/24/1990</td>
<td>Dry</td>
<td>12/22/2005</td>
<td>Dry</td>
</tr>
<tr>
<td>10/13/1997</td>
<td>Dry</td>
<td>6/23/2006</td>
<td>Dry</td>
</tr>
<tr>
<td>7/25/1998</td>
<td>Dry</td>
<td>1/24/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/1999</td>
<td>Dry</td>
<td>6/5/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>11/15/1999</td>
<td>Dry</td>
<td>9/5/2007</td>
<td>Dry</td>
</tr>
<tr>
<td>5/16/2000</td>
<td>Dry</td>
<td>1/16/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/30/2000</td>
<td>Dry</td>
<td>4/8/2001</td>
<td>Dry</td>
</tr>
<tr>
<td>10/8/2001</td>
<td>Dry</td>
<td>4/25/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>7/22/2001</td>
<td>Dry</td>
<td>7/18/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>8/22/2001</td>
<td>Dry</td>
<td>19/7/2008</td>
<td>Dry</td>
</tr>
<tr>
<td>10/18/2001</td>
<td>Dry</td>
<td>2/6/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>8/19/2002</td>
<td>Dry</td>
<td>7/2/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>11/13/2002</td>
<td>Dry</td>
<td>10/7/2009</td>
<td>Dry</td>
</tr>
<tr>
<td>12/19/2003</td>
<td>Dry</td>
<td>12/20/2009</td>
<td>Dry</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6616.41 ft; all depths are from this elevation.
5.101 WCO-1r

Location: Water Canyon, near western border of TA-68, approximately 30 ft northwest of WCO-1.
Period of Record: March 22, 2010, through December 7, 2010.
Remarks: New well drilled to replace WCO-1.

### WCO-1r Construction Information

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.0</td>
<td>16.00</td>
<td>6611.1</td>
<td>6601.1</td>
<td>10.0</td>
<td>16.0</td>
<td>6601.1</td>
<td>16.4</td>
<td>0.4</td>
<td></td>
<td>6617.12</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6617.12 ft; all measurements are from this elevation.

LA-14437-PR 240
5.102 WCO-2

Location: Water Canyon, about 0.9 mi west of gate 9 on SR-4.

Period of Record: October 26, 1989, through December 10, 2010.

Remarks: The transducer malfunctioned on August 23, 2008, and was fixed February 6, 2009. The replacement transducer and/or cable malfunctioned in September 2010 and was replaced December 10, 2010, with a newer transducer and cable.

---

**WC0-2 Construction Information**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elevation (ft)</th>
<th>Screen Bottom Elevation (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elevation (ft)</th>
<th>Depth to Top of Sump (ft)</th>
<th>Top of Sump Elevation (ft)</th>
<th>Depth to Sump Bottom (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.6</td>
<td>23.6</td>
<td>6511.1</td>
<td>6501.1</td>
<td>10.0</td>
<td>23.5</td>
<td>6501.1</td>
<td>23.5</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6524.57 ft; all measurements are from this elevation

---

**Graphs**

**WCO-2**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen

**WCO-2**

- Manual Measurement
- Mean Daily Transducer Measurement
- Bottom of Screen
5.103 WCO-3

Location: Water Canyon, approximately 0.1 mi west of gate 9 on SR-4.
Period of Record: October 25, 1989, through December 20, 2009.
Remarks: Well is typically dry. A transducer was installed January 16, 2008, and never recorded any water in the well. This well was plugged and abandoned in December 2009. Monitoring has moved to WCO-3r.

<table>
<thead>
<tr>
<th>WCO-3 Construction Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6436.43 ft; all depths are from this elevation.

<table>
<thead>
<tr>
<th>WCO-3 Manual Water Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>10/25/1989</td>
</tr>
<tr>
<td>8/24/1990</td>
</tr>
<tr>
<td>6/23/1997</td>
</tr>
<tr>
<td>6/23/1999</td>
</tr>
<tr>
<td>8/30/1999</td>
</tr>
<tr>
<td>11/15/1999</td>
</tr>
<tr>
<td>5/16/2000</td>
</tr>
<tr>
<td>8/30/2000</td>
</tr>
<tr>
<td>10/8/2000</td>
</tr>
<tr>
<td>7/2/2001</td>
</tr>
<tr>
<td>8/22/2001</td>
</tr>
<tr>
<td>10/18/2001</td>
</tr>
<tr>
<td>4/19/2002</td>
</tr>
<tr>
<td>11/13/2002</td>
</tr>
<tr>
<td>2/18/2003</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
5.104 WCO-3r

Location: Water Canyon, approximately 0.1 mi west of gate 9 on SR-4 and 150 ft south of WCO-1.

Period of Record: March 22, 2010, through December 7, 2010.

Remarks: New well installed to replace WCO-3. Water level has thus far not risen above the sump.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.7</td>
<td>9.7</td>
<td>6432.5</td>
<td>6427.5</td>
<td>5.0</td>
<td>9.7</td>
<td>6427.5</td>
<td>10.1</td>
<td>10.1</td>
<td>0.4</td>
<td>0.2</td>
<td></td>
<td>Alluvial groundwater</td>
</tr>
</tbody>
</table>

Note: Ground elevation is 6437.17 ft; all measurements are from this elevation.

WCO-3r Manual Measurements

<table>
<thead>
<tr>
<th>Date</th>
<th>Groundwater Elevation (ft)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/22/2010</td>
<td>6427.17</td>
<td>Water in Sump</td>
</tr>
<tr>
<td>4/1/2010</td>
<td>6427.28</td>
<td>Water in Sump</td>
</tr>
<tr>
<td>6/29/2010</td>
<td>6427.25</td>
<td>Water in Sump</td>
</tr>
<tr>
<td>10/12/2010</td>
<td>6427.30</td>
<td>Water in Sump</td>
</tr>
<tr>
<td>12/7/2010</td>
<td>6427.34</td>
<td>Water in Sump</td>
</tr>
</tbody>
</table>
6.0 Groundwater Level Data from Water Supply Wells

Table 6-1 lists the LAC water supply wells; all supply wells were monitored for groundwater levels in 2010 after transducers were installed at G-1A and O-4. The table provides the well name, date of completion, well depth, surveyed location coordinates, ground surface elevation, and the screen top and bottom depths for each well. See Figure 3-1 for the locations of the wells.

The LANL GWLM Project integrated the water supply wells in the monitoring project beginning in 2007 with the cooperation of LAC Utility personnel. Recently obtained groundwater level data for the supply wells are provided in the following sections. Historical groundwater level data for the supply wells were summarized by Koch and Rogers (2003) and other preceding Water Supply Reports for Los Alamos.

Table 6-1. General Information for Los Alamos County Water Supply Wells

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Date Completed</th>
<th>Completed Depth (ft)</th>
<th>Easting (ft)</th>
<th>Northing (ft)</th>
<th>Surface Elevation (ft)</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1A</td>
<td>12/15/1954</td>
<td>1519</td>
<td>1655240.9</td>
<td>1784353.3</td>
<td>6014</td>
<td>272</td>
<td>1513</td>
</tr>
<tr>
<td>G-3</td>
<td>8/25/1999</td>
<td>1800</td>
<td>1651676.4</td>
<td>1786218.3</td>
<td>6139</td>
<td>441</td>
<td>1100</td>
</tr>
<tr>
<td>G-3A</td>
<td>5/9/1998</td>
<td>2000</td>
<td>1648661.5</td>
<td>1786585.3</td>
<td>6212</td>
<td>590</td>
<td>1980</td>
</tr>
<tr>
<td>O-1</td>
<td>8/1/1990</td>
<td>2497</td>
<td>1649396.3</td>
<td>1772232.1</td>
<td>6396</td>
<td>1017</td>
<td>2477</td>
</tr>
<tr>
<td>O-4</td>
<td>3/1/1990</td>
<td>2617</td>
<td>1637337.4</td>
<td>1772995.1</td>
<td>6627</td>
<td>1115</td>
<td>2596</td>
</tr>
<tr>
<td>PM-1</td>
<td>2/1/1965</td>
<td>2499</td>
<td>1647734.3</td>
<td>1768112.1</td>
<td>6520</td>
<td>945</td>
<td>2479</td>
</tr>
<tr>
<td>PM-2</td>
<td>7/15/1965</td>
<td>2300</td>
<td>1636697.5</td>
<td>1760406.4</td>
<td>6715</td>
<td>1004</td>
<td>2280</td>
</tr>
<tr>
<td>PM-3</td>
<td>11/1/1966</td>
<td>2552</td>
<td>1642590.0</td>
<td>1769530.0</td>
<td>6610</td>
<td>956</td>
<td>2532</td>
</tr>
<tr>
<td>PM-4</td>
<td>8/15/1981</td>
<td>2874</td>
<td>1635623.0</td>
<td>1764740.0</td>
<td>6920</td>
<td>1260</td>
<td>2854</td>
</tr>
<tr>
<td>PM-5</td>
<td>9/1/1982</td>
<td>3092</td>
<td>1632110.0</td>
<td>1767790.0</td>
<td>7095</td>
<td>1440</td>
<td>3072</td>
</tr>
</tbody>
</table>

All LAC water supply wells are powered by electric motors except for PM-4, which has a natural-gas-powered motor. The electric-powered wells are typically operated at night and on weekends when electricity rates are lower. Thus these wells usually cycle on and off daily, in contrast to PM-4, which usually runs continuously when in use, which is usually just during the summer months when water demand is highest. Thus, due to the operational characteristics of the electric-powered wells, the data displayed in the following sections for these wells are the maximum daily water level, or the "non-pumping" water level, and the minimum daily or "pumping" water level. The difference between the non-pumping and the pumping water level is the drawdown for each well. The data shown for the wells that aren't operated cyclically, which are PM-4 and O-1 (which hasn't been used in recent years), are mean daily water levels.
6.1 G-1A

Location: G-1A is located in Guaje Canyon and is the easternmost well in the Guaje well field.
Completion Type: Single completion in the Santa Fe Group.
Period of Record: Well completed in 1954, periodic manual measurements (Koch and Rogers 2003).
Transducer installed in bubbler pressure line October 29, 2008; data through June 2010.
Remarks: G-1A was constructed without gage lines so manual measurements are not possible while the pump is installed. The transducer is connected to a bubble pressure line installed to the depth of the top of the pump. Drawdown during pumping is about 45 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>272</td>
<td>1513</td>
<td>5742</td>
<td>4501</td>
<td>1241</td>
<td>496</td>
<td>5618</td>
<td>1513</td>
<td>4501</td>
<td>1519</td>
<td>6</td>
<td>93</td>
<td>RT</td>
<td>T9f</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6014.0 ft; all measurements from this elevation.
6.2 G-2A

Location: G-2A is located in Guaje Canyon about 300 ft east of monitoring well G-3.
Completion Type: Single completion in the Santa Fe Group.
Remarks: The pumping and non-pumping water levels overlap depending on pumping stress to the aquifer. The drawdown is about 40 ft.

### G-2A Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>565</td>
<td>1660</td>
<td>5575</td>
<td>4158</td>
<td>1415</td>
<td>540</td>
<td>5568</td>
<td>1800</td>
<td>4165</td>
<td>2000</td>
<td>20</td>
<td>444.8</td>
<td>RT</td>
<td>Tsf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6138.0 ft; all depths are from this elevation

![G-2A Graph](image-url)
6.3 G-3

Location: G-3 is located in Guaje Canyon about 300 ft west of supply well G-2A.
Completion Type: Single completion in the Santa Fe Group.
Period of Record: Well originally completed as a supply well in July 1951; plugged back to 1103 ft and converted to a monitoring well in 1998, transducer installed June 2002; data through 2010.
Remarks: G-3 responds primarily to pumping at supply well G-2A; daily water level fluctuation is about 8 ft. The aquifer in the Guaje well field fluctuates seasonally 40 to 70 ft depending on pumping stresses.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>441</td>
<td>1100</td>
<td>5889</td>
<td>5939</td>
<td>659</td>
<td>None</td>
<td>None</td>
<td>1100</td>
<td>5039</td>
<td>1103</td>
<td>5039</td>
<td>3</td>
<td>66.7</td>
<td>RT</td>
<td>Taf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6139.0 ft; all depths are from this elevation.

G-3 Construction Information

G-3 Construction Information

Note: mean daily water level values displayed

Manual Water Level
Transducer Data
6.4 G-3A

Location: G-3A is located in Guaje Canyon about 1.5 mi west of monitoring well G-3.

Completion Type: Single completion in the Santa Fe Group.

Period of Record: Well completed as a supply well in May 1998; transducer installed December 2003; intermittent data through June 2010.

Remarks: Drawdown is 60 to 65 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>590</td>
<td>1980</td>
<td>5622</td>
<td>4232</td>
<td>1980</td>
<td>5652</td>
<td>1980</td>
<td>4232</td>
<td>2000</td>
<td>20</td>
<td>853.7</td>
<td>RT</td>
<td>Tsf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6212.0 ft; all measurements are from this elevation.
6.5 G-4A

Location: G-4A is located in lower Rendija Canyon near the confluence with Guaje Canyon and about 0.5 mi west of supply well G-3A.

Completion Type: Single completion in the Santa Fe Group.

Period of Record: Well completed as a supply well in April 1998; transducer installed December 2003; intermittent data through 2010.

Remarks: Drawdown is 80 to 85 ft.

---

**G-4A Construction Information**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>655</td>
<td>5644</td>
<td>4319</td>
<td>1325</td>
<td>630</td>
<td>6699</td>
<td>5669</td>
<td>1980</td>
<td>4319</td>
<td>2009</td>
<td>20.0</td>
<td>653.7</td>
<td>RT</td>
<td>Tsf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6299.0 ft; all measurements are from this elevation.
6.6 G-5A

Location: G-5A is located in Guaje Canyon upstream of Rendija Canyon and about 1.9 mi northwest of supply well G-4A.

Completion Type: Single completion in the Santa Fe Group.

Period of Record: Well completed as a supply well in May 1998; transducer installed January 2004; data through 2010.

Remarks: G-5A is not used on a regular basis. Drawdown is 140 to 150 ft.
6.7 O-1

Location: O-1 is located in lower Pueblo Canyon about 0.5 mi downstream of monitoring well R-5.
Completion Type: Single completion in the Santa Fe Group.
Period of Record: Well completed as a supply well in August 1990; transducer installed June 2007; data through June 2010.
Remarks: O-1 has not been used on a regular basis except for periodic groundwater sampling. Drawdown is about 100 ft. O-1 responds to pumping of supply well PM-1.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1017</td>
<td>2477</td>
<td>5379</td>
<td>5919</td>
<td>1460</td>
<td>877</td>
<td>5519</td>
<td>2477</td>
<td>2477</td>
<td>2477</td>
<td>2477</td>
<td>2477</td>
<td>2477</td>
<td>RT</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6396 ft; all measurements are from this elevation.

Note: Hydrograph shows mean daily values.
6.8 O-4

Location: O-4 is located in Los Alamos Canyon above the confluence with DP Canyon and about 1500 ft southeast of monitoring well R-6.

Completion Type: Single completion in the Santa Fe Group.

Period of Record: Well completed as a supply well in March 1990; transducer installed August 2008; data through 2010.

Remarks: O-4 drawdown is about 25 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydrozone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1115</td>
<td>2575</td>
<td>5512</td>
<td>4052</td>
<td>1460</td>
<td>928</td>
<td>5699</td>
<td>2575</td>
<td>4052</td>
<td>2575</td>
<td>0</td>
<td>0</td>
<td>RT</td>
<td>Tsf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6827 ft; all measurements are from this elevation.
6.9 PM-1

Location: PM-1 is located in lower Sandia Canyon near the eastern Laboratory boundary and about 360 ft northeast of monitoring well R-12.
Completion Type: Single completion in the Santa Fe Group.
Period of Record: Well completed as a supply well in February 1965; transducer installed December 2006; data through 2010.
Remarks: Drawdown is about 30 ft.
6.10 PM-2

Location: PM-2 is located in Pajarito Canyon about 0.25 mi west of monitoring well R-20 and about 220 ft southwest of recently installed monitoring well R-40.

Completion Type: Single completion in the Puye Formation and Santa Fe Group.

Period of Record: Well completed as a supply well in July 1965; transducer installed December 2004; data to October 23, 2007. The transducer was removed in October 2007 during pump removal and well rehabilitation. Data during April and May 2008 during pump testing. Transducer removed May 30, 2008, for well repairs, reinstalled March 8, 2010; data through 2010.

Remarks: Drawdown is about 70 ft. PM-2 responds to pumping at PM-4 (McLin 2006). PM-2 was not operated for most of 2008, 2009, and 2010 because of well maintenance and repairs.

PM-2 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Bottom Elev (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Vol (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1004</td>
<td>2280</td>
<td>5711</td>
<td>4435</td>
<td>1276</td>
<td>980</td>
<td>5735</td>
<td>2280</td>
<td>2300</td>
<td>20.0</td>
<td>790.8</td>
<td>RT</td>
<td>Tp</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6715 ft; all measurements are from this elevation.
6.11 PM-3

Location: PM-3 is located in Sandia Canyon about 1 mi west of PM-1 and about 330 ft northeast of monitoring well R-35a.
Completion Type: Single completion in Santa Fe Group.
Period of Record: Well completed as a supply well in November 1966; transducer installed October 2006; data through 2010.
Remarks: Drawdown is about 27 ft. PM-3 responds to pumping at O-4.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>956</td>
<td>2532</td>
<td>5654</td>
<td>4078</td>
<td>1576</td>
<td>5780</td>
<td>2532</td>
<td>4078</td>
<td>2552</td>
<td>20</td>
<td>605.4</td>
<td>RT</td>
<td>Tsf</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6610 ft; all measurements are from this elevation.
6.12 PM-4

Location: PM-4 is located on Mesita del Buey about midway between supply wells PM-2 and PM-5. The nearest monitoring well is R-52 about 0.45 mi to the southeast. R-15 in Mortandad Canyon is about 0.67 mi to the north.

Completion Type: Single completion in the Puye Formation and Santa Fe Group.


Remarks: Well is powered by a natural gas motor and when used is operated continuously. Drawdown in 2008 was about 48 ft and in 2010 about 54 ft. PM-4 responds to pumping at PM-2.

PM-4 Construction Information

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Top Depth (ft)</th>
<th>Screen Bottom Depth (ft)</th>
<th>Screen Top Elev (ft)</th>
<th>Screen Bottom Elev (ft)</th>
<th>Screen Length (ft)</th>
<th>Pump Intake Elev (ft)</th>
<th>Pump Intake Depth (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top of Sump Depth (ft)</th>
<th>Sump Bottom Depth (ft)</th>
<th>Sump Length (ft)</th>
<th>Sump Volume (L)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1260</td>
<td>2854</td>
<td>5660</td>
<td>4066</td>
<td>1594</td>
<td>1210</td>
<td>5710</td>
<td>2854</td>
<td>4066</td>
<td>2874</td>
<td>20</td>
<td>790.8</td>
<td>RT</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 6920 ft; all measurements are from this elevation

PM-4

- Manual
- Transducer

Note: mean daily water level values shown
6.13 PM-5

Location: PM-5 is located on a mesa south of Ten Site and Mortandad canyons. The nearest
monitoring well is R-33 in Ten Site Canyon about 1500 ft to the northeast.
Completion Type: Single completion in the Puye Formation and Santa Fe Group.
Period of Record: Well completed as a supply well in September 1982; transducer installed
December 2004. The transducer failed in October 2006 and was replaced in April 2007;
transducer failed again December 2008 and was replaced October 2009; data through 2010.
Remarks: PM-5 responds to pumping PM-4. Drawdown is about 80 ft.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Screen Depth (ft)</th>
<th>Screen Elev (ft)</th>
<th>Screen Elev (ft)</th>
<th>Screen Elev (ft)</th>
<th>Pump Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Top of Sump Elev (ft)</th>
<th>Sump Elev (ft)</th>
<th>Sump Elev (ft)</th>
<th>Hydro Zone Code</th>
<th>Geo Unit Code</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1440</td>
<td>3072</td>
<td>5655</td>
<td>4023</td>
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<td>1384</td>
<td>5711</td>
<td>3072</td>
<td>3072</td>
<td>3092</td>
<td>RT</td>
</tr>
</tbody>
</table>

Note: Ground Elevation: 7095 ft; all measurements are from this elevation.
7.0 Acknowledgments

The authors would like to acknowledge all those whose work contributed to this report, especially the LANL Program Field Operations Team members who collected most of the groundwater level data: Consuelo Montoya, Jackie Carr, Lisa Ansaray, William Shaw, David Woody, Megan Green, Harold Wershow, Chris Kassel, David Fellenz, Tony Brillante, and others. Thanks also to Steve Paris, Tim Goering, Danny Katzman, Mike Alexander, Max Maes, and John Archuleta for programmatic and operational support for the Groundwater Monitoring Project.

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Tim Goering, Velimer Vesselinev, Hector Hinojosa, and Danny Katzman provided helpful reviews of the report. Many thanks also to Hector Hinojosa for editing and compositional support.

8.0 References and Bibliography

The following reports and documents contain groundwater level data for wells at LANL.


Groundwater Level Status Report

March 2011


Groundwater Level Status Report


# Appendix A. Geologic Unit Codes

## Table A-1. Geologic Unit Codes

<table>
<thead>
<tr>
<th>Geologic Unit Code</th>
<th>Geologic Unit Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Polvadera Group</td>
</tr>
<tr>
<td>Qal</td>
<td>Quaternary alluvium</td>
</tr>
<tr>
<td>Qb</td>
<td>Bandelier Tuff, undivided</td>
</tr>
<tr>
<td>Qbo</td>
<td>Otowi Member of the Bandelier Tuff, undivided</td>
</tr>
<tr>
<td>Qbof</td>
<td>Otowi Member of the Bandelier Tuff, ash flows</td>
</tr>
<tr>
<td>Qbog</td>
<td>Otowi Member of the Bandelier Tuff, Guaje Pumice Bed</td>
</tr>
<tr>
<td>Qbt</td>
<td>Tshirege Member of the Bandelier Tuff, undivided</td>
</tr>
<tr>
<td>Qbt1</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 1, undivided</td>
</tr>
<tr>
<td>Qbt1g</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 1, glassy</td>
</tr>
<tr>
<td>Qbt1v</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 1, vapor phase</td>
</tr>
<tr>
<td>Qbt2</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 2</td>
</tr>
<tr>
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<td>Tshirege Member of the Bandelier Tuff, Unit 3</td>
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<td>Tshirege Member of the Bandelier Tuff, Unit 3, nonwelded</td>
</tr>
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<td>Qbt3t</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 3, transitional</td>
</tr>
<tr>
<td>Qbt4</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 4</td>
</tr>
<tr>
<td>Qbt5</td>
<td>Tshirege Member of the Bandelier Tuff, Unit 5</td>
</tr>
<tr>
<td>Qbt5t</td>
<td>Tshirege Member of the Bandelier Tuff, Tsankawi Pumice Bed</td>
</tr>
<tr>
<td>Qct</td>
<td>Cerro Toledo Interval</td>
</tr>
<tr>
<td>T</td>
<td>Tewa Group</td>
</tr>
<tr>
<td>Tb</td>
<td>Tertiary Basalts</td>
</tr>
<tr>
<td>Tb1</td>
<td>Middle Miocene Basalts, ~12.8 - 12.9 Ma</td>
</tr>
<tr>
<td>Tb2</td>
<td>Late Miocene Basalts, ~8.4 - 11.4 Ma</td>
</tr>
<tr>
<td>Tb4</td>
<td>Cerros del Rio Basaltic Rocks, Pliocene Lavae and associated tephra of the Cerro</td>
</tr>
<tr>
<td>Tcarm</td>
<td>Chamita Formation, axial river deposits</td>
</tr>
<tr>
<td>Tch</td>
<td>Chamita Formation</td>
</tr>
<tr>
<td>Tfi</td>
<td>Puye Formation, Older fanglomerate</td>
</tr>
<tr>
<td>Tjfp</td>
<td>Bearhead Rhyolite and Fanglomerats</td>
</tr>
<tr>
<td>Tk</td>
<td>Keres Group, undivided</td>
</tr>
<tr>
<td>Tp</td>
<td>Puye Formation, undivided</td>
</tr>
<tr>
<td>Tpf</td>
<td>Puye Formation, fanglomerates</td>
</tr>
<tr>
<td>Tpp</td>
<td>Puye Formation, pumiceous fanglomerates</td>
</tr>
<tr>
<td>Tpt</td>
<td>Puye Formation, Totavi river gravels</td>
</tr>
<tr>
<td>Tsff</td>
<td>Santa Fe Group, undivided</td>
</tr>
<tr>
<td>Tsfb</td>
<td>Santa Fe Group basalt</td>
</tr>
<tr>
<td>Tsfu</td>
<td>Santa Fe Group, excluding Tsfu</td>
</tr>
<tr>
<td>Tsfuv</td>
<td>Santa Fe Group, upper unit with volcanic detritus</td>
</tr>
<tr>
<td>Tt</td>
<td>Tsichicoma Formation, undivided</td>
</tr>
<tr>
<td>Tt1</td>
<td>Tsichicoma Formation, older flows</td>
</tr>
<tr>
<td>Tt2</td>
<td>Tsichicoma Formation, younger flows</td>
</tr>
</tbody>
</table>
## Appendix B: Mean Annual Water Level Data

Table B-1. Mean Annual Groundwater Levels at the Top of the Regional Aquifer in 2010

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Top of Regional Aquifer (ft)</th>
<th>No. of Data Values</th>
<th>Std. Dev. (ft)</th>
<th>Last Data Date</th>
<th>Well Name</th>
<th>Top of Regional Aquifer (ft)</th>
<th>No. of Data Values</th>
<th>Std. Dev. (ft)</th>
<th>Last Data Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDV-R-15-3</td>
<td>6019.1</td>
<td>4958</td>
<td>0.05</td>
<td>08/02/10</td>
<td>R-36b</td>
<td>5835.6</td>
<td>7718</td>
<td>0.28</td>
<td>11/19/10</td>
</tr>
<tr>
<td>CDV-R-37-2</td>
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<td>5242</td>
<td>0.07</td>
<td>08/09/10</td>
<td>R-36</td>
<td>5839.7</td>
<td>7719</td>
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<td>11/18/10</td>
</tr>
<tr>
<td>G-3</td>
<td>5737.9</td>
<td>7241</td>
<td>0.39</td>
<td>12/09/10</td>
<td>R-37</td>
<td>5899.0</td>
<td>14954</td>
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<td>11/29/10</td>
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<tr>
<td>R-1</td>
<td>5877.8</td>
<td>8062</td>
<td>0.29</td>
<td>12/02/10</td>
<td>R-38</td>
<td>5957.5</td>
<td>7743</td>
<td>0.16</td>
<td>11/19/10</td>
</tr>
<tr>
<td>R-10a</td>
<td>5737.7</td>
<td>6144</td>
<td>0.49</td>
<td>12/08/10</td>
<td>R-39</td>
<td>5853.4</td>
<td>10994</td>
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<td>12/07/10</td>
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<tr>
<td>R-11</td>
<td>5836.2</td>
<td>7718</td>
<td>0.33</td>
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<td>5928.7</td>
<td>7145</td>
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<td>R-13</td>
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<td>6971</td>
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<td>7635</td>
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<td>7015</td>
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<td>R-15</td>
<td>5847.5</td>
<td>7042</td>
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<td>R-42</td>
<td>5838.3</td>
<td>8075</td>
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<td>12/03/10</td>
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<tr>
<td>R-16r</td>
<td>5662.1</td>
<td>7738</td>
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<td>R-43</td>
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<td>6007</td>
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<td>11/23/10</td>
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<td>8074</td>
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<td>R-19</td>
<td>5967.2</td>
<td>5640</td>
<td>0.14</td>
<td>10/29/10</td>
<td>R-46</td>
<td>5884.9</td>
<td>7743</td>
<td>0.41</td>
<td>11/19/10</td>
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<tr>
<td>R-2</td>
<td>5859.2</td>
<td>6103</td>
<td>0.23</td>
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<td>R-47</td>
<td>6135.8</td>
<td>6872</td>
<td>1.09</td>
<td>11/14/10</td>
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<tr>
<td>R-20</td>
<td>5963.9</td>
<td>6848</td>
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<td>R-49</td>
<td>5774.9</td>
<td>8172</td>
<td>1.80</td>
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<tr>
<td>R-21</td>
<td>5854.4</td>
<td>7741</td>
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<td>6217</td>
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<td>R-22</td>
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## Table B-2. Mean Annual Groundwater Levels in Intermediate Wells in 2010

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Appendix C. Summary of Transient Responses

Table C-1. Summary of Transient Responses to Supply Well Pumping in LANL Monitoring Wells

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<th>C-1</th>
<th>PM-1</th>
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NE = not evaluated; ID = insufficient Data
Table C-1. Summary of Transient Responses to Supply Well Pumping in LANL Monitoring Wells (Continued)

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NE = not evaluated; ID = insufficient data
Appendix D. Summary of Intermediate Groundwater Level Responses to Runoff

D.1. Intermediate Groundwater Responses in Cerros del Rio Basalt (Tb4)

Figure D-1 shows the intermediate groundwater hydrographs for wells completed in the Cerros del Rio basalt. These wells are located in lower Los Alamos Canyon, lower Pueblo Canyon, middle Mortandad Canyon, and lower Pajarito Canyon (see Figure 4-1). Note the water levels in R-12 and R-23i are lower than in the other wells (scale on the right side of the hydrograph). Perched intermediate groundwater levels in the Cerros del Rio basalt in some wells show seasonal variations that are evaluated as probable response to large runoff events in Los Alamos Canyon.

Figure D-2 shows the intermediate groundwater level in Cerros del Rio basalt in wells in lower Los Alamos Canyon and lower Pueblo Canyon and the mean daily flow at gaging station E042 in lower Los Alamos Canyon. From 2001 to 2004 screens 2 and 3 in LAWS-01 in lower Los Alamos Canyon (Stone et al. 2004) show responses to small and large runoff events. During this period LAWS-01 screen 4 and nearby well TW-1A in lower Pueblo Canyon show similar responses, generally higher water levels in the winter and lower levels in the summer. From 2006 through 2010, similar seasonal responses are observed in POI-4 and R-3i. The perched water at R-3i declined during drilling of adjacent well R-3 during the summer of 2010 and recovered when R-3 construction was completed.

Large snowmelt runoff events occurred in Los Alamos Canyon in the spring of 2001, 2005, 2007, 2008, and 2010 as observed in lower Los Alamos Canyon at stream gage E042 (Figure D-2). No significant snowmelt runoff occurred in 2002, 2003, 2006, and 2009. Concurrent with the large snowmelt runoff in lower Los Alamos Canyon, intermediate groundwater levels in wells R-9i, R-12, and LAOI-7 show groundwater level rises that appear to be related to the snowmelt runoff events.
Figure D-2. Intermediate groundwater levels in Cerros del Rio basalt in Los Alamos and Pueblo canyons and mean daily flow at Gaging Station E042.

Figure D-3 shows the runoff at gage E042 from 2007 to 2010 and the water level responses in the Cerros del Rio basalt in wells R-9i screen 1, LAOl-7, and R-12 screen 1. The earliest water level response to snowmelt runoff is typically at R-9i screen 1, followed by LAOl-7 with a slightly reduced total response, and then followed possibly by a much subdued response at R-12 screen 1; again, note that the groundwater elevation at screen 1 in R-12 is about 170 ft lower than R-9i and LAOl-7. A significantly smaller and delayed response is also observed in R-9i screen 2. Additionally, two large storm runoff events in the summer of 2006 caused a rise in the groundwater level at R-9i screen 1 but little if any response at LAOl-7. With no snowmelt runoff in 2009, the groundwater levels at R-9i and LAOl-7 show a continued decline through 2009. However, the groundwater at R-12 screen 1 showed a rising trend in 2009, suggesting that the groundwater at R-12 may not be responding to the large runoff events in lower Los Alamos Canyon, or is possibly responding at a lag period greater than a few months. Additional monitoring is needed to understand the groundwater level fluctuations at R-12. The intermediate perched groundwater at all three wells again appear to have responded to snowmelt runoff in the spring of 2010.

Figure D-3. Intermediate groundwater responses to snowmelt runoff in 2007, 2008, 2009, and 2010 in Cerros del Rio basalt and mean daily flow at Gaging Station E042.
Figure D-4 shows the hydrographs for intermediate perched groundwater in R-12 in lower Sandia Canyon and R-23i in lower Pajarito Canyon and the runoff at stream gages E042 in Los Alamos Canyon and E250 in lower Pajarito Canyon. As indicated above, the groundwater level fluctuations at R-12 may not be the result of snowmelt runoff infiltration below Los Alamos Canyon. The groundwater level rise in R-23i in 2008 follows a large snowmelt runoff period in the spring of 2008 and may similarly be associated with snowmelt runoff in Pajarito Canyon. Following no runoff in lower Pajarito Canyon in 2009, the water levels in R-23i showed a declining trend. The groundwater at R-23i screen 2 in 2010 do not show an obvious response to snowmelt runoff in the spring of 2010. The water levels measured at R-23i screen 3 in 2010 appear to have been compromised by possible leakage from screen 2. Additional runoff monitoring in lower Pajarito Canyon and groundwater level data from R-23i are necessary to determine if groundwater at R-23i responds to runoff events.

Perched intermediate groundwater in the Cerros del Rio basalt beneath Mortandad Canyon in wells MCOI-5 and MCOI-6 (Figure D-1) shows a rising trend from mid 2006 to early 2008 when the water levels in both wells rose about 10 ft. A small rising trend continued at these wells in 2009 but the water levels were approximately stable in 2010. The trends in the groundwater levels in these wells do not appear to be related to specific runoff events; additional monitoring is needed to determine if the intermediate groundwater in these wells is influenced by runoff.

D.2. Intermediate Groundwater in Guaje Pumice Bed (Qbog)

Figure D-5 shows the hydrographs of perched intermediate groundwater in wells screened in the Guaje pumice bed and the mean daily runoff recorded in lower Los Alamos Canyon at stream gage E042. These wells are located in middle Los Alamos Canyon where the intermediate groundwater in the Guaje pumice bed is 100 to 300 ft below the canyon floor and is stratigraphically higher than the intermediate groundwater in the Puye Formation and Cerros del Rio basalts. The Guaje pumice bed is about 100 ft above the Cerros del Rio basalt in this area. There is no apparent correlation between trends in the groundwater levels in the Guaje pumice bed and runoff in Los Alamos Canyon.
D.3. Intermediate Groundwater in the Puye Formation (T\textsubscript{p})

Screens in monitoring wells LA\textsubscript{O}I\textsubscript{1}-3.2a, SCI-1, MCO\textsubscript{1}5-4, R-5 screen 2, R-6i, R0-47i, and TA-53i monitor perched intermediate groundwater in the Puye Formation (see Section 4). There is no apparent relationship between runoff and groundwater levels in these wells.

D.4. Intermediate Groundwater at TA-16

Intermediate groundwater is monitored in the TA-16 area at wells CdV-16(i)-1, R-25 screens 1, 2, and 4, R-25b, CdV-16-2(i)r, R-26 screen 1, R-26 PZ-2, and 16-26644. Figures D-6 and D-7 show the groundwater levels from these wells and the mean daily runoff at gage E252 in upper Water Canyon. Snowmelt runoff occurred at gage E252 in 2005, 2007, and 2008, and presumably in 2010 (data not yet available), but no significant runoff occurred in 2006 and 2009. The groundwater at CdV-16-1(i) and R-25 screens 1 and 2 show an apparent response to snowmelt runoff in 2007, 2008, and 2010 ranging from a few tenths of a foot in 2007 at R-25 screen 1 up to about 5 ft at CdV-16-1(i) in 2010. The screen at R-25b is at a similar elevation as R-25 screen 1, and showed a similar response to snowmelt runoff in 2010, although a sampling event at the beginning of runoff obscured some of the response at R-25b. In 2010 the groundwater at R-25 screen 2 rose about 1.5 ft in response to snowmelt runoff, while at screen 1, the rise was about 0.8 ft (Figure D-6).
Figure D-6. Intermediate groundwater levels in TA-16 wells and mean daily flow at Gaging Station E252.
Figure D-7. Intermediate groundwater levels in TA-16 wells and mean daily flow at Gaging Station E252.
R-25 screen 4 may have shown a slight response to runoff in 2007 (Figure D-7), but there was no apparent response in 2008 and 2010, although there was an abrupt rise at screen 4 in November 2010, which may have been a delayed response to drilling nearby well CDV-16-4ip. Note that R-25 screens 1 and 2 and CdV-16-1(i) showed water level responses to drilling and installing monitoring wells R-25b and R-25c in August and September 2008 and R-25 screen 2 showed an abrupt water level decline in 2010 during drilling of CDV-16-4ip.

There was no apparent response to snowmelt runoff at CdV-16-2(i)r in 2007 and 2010 (Figure D-7), but there may have been a response in 2008. After dry well CdV-16-1(i) was plugged and abandoned in 2009, the groundwater level at CdV-16-2(i)r showed a recovery of greater than 1 ft (see Section 3).

The perched intermediate groundwater at R-26 screen 1 in Cerro Toledo interval sediments has shown a continuing rise from 2005 to 2010, but no apparent response to snowmelt runoff. The monitoring of groundwater levels at nearby piezometer R-26 PZ-2 began in late 2009. This piezometer is screened in Unit 3 of the Bandelier Tuff and showed a total groundwater level rise of about 25 ft during snowmelt runoff in 2010 (Figure D-7). Similarly, the groundwater at monitoring well 16-26644 (also screened in Unit 3 of the Bandelier Tuff) rose about 15 ft during the spring of 2010, apparently in response to snowmelt runoff.

D.5. Summary of Runoff Impacts to Intermediate Perched Groundwater

Large snowmelt and storm runoff events in Los Alamos Canyon that extend eastward as far as the LANL boundary appear to infiltrate into subsurface units and impact groundwater levels in wells completed in the Cerros del Rio basalt. Intermediate perched groundwater in other geologic units beneath the middle part of Los Alamos Canyon and the surrounding Pajarito Plateau does not appear to be impacted by runoff events.

Similarly, intermediate perched groundwater in some wells at TA-16 appears to respond to large snowmelt runoff events. With no significant runoff events in 2009, the intermediate groundwater levels in most of the TA-16 area showed a continued decline. Reid et al. (2008) observed that the rapid infiltration to intermediate zones occurred at both the eastern and western side of the plateau in two contrasting hydrogeologic settings: runoff over fractured basalt in lower Los Alamos Canyon and possibly in lower Pajarito Canyon, and runoff crossing the Pajarito fault and associated fractured bedrock in the western part of the Pajarito Plateau. Reid et al. (2008) concluded that the key feature associated with the large runoff events and response in intermediate groundwater zones was persistent runoff and brittle bedrock near the surface that provided a conduit for infiltration.
Appendix E. Summary of Regional and Intermediate Groundwater Temperature

Table E-1. Groundwater Temperature in Regional Aquifer Wells

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<th>T (°C)</th>
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<td>RT</td>
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<td>Single</td>
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<td>RT</td>
<td>Tp4</td>
</tr>
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</table>

Multiple completion wells equipped with Westbay® sampling systems employ transducers with temperature sensors at each screen, which appropriately measure the in-situ water temperature at each screen; these data are shown on Tables E-1 and E-2 for each screen. Multiple completion wells equipped with Baski sampling systems employ transducers that are installed above the packer. The water level for the lower screen zones is appropriately measured via a small diameter tube that extends below the packer. However, the temperature sensors in transducers that measure the lower screen water levels in the Baski-equipped wells record the water temperature of the upper screen zone and not that of the lower screen zone. Thus the temperature of the water in the lower screens is
not appropriately measured and temperature data recorded by the transducers for the lower screen zones in Baski-equipped wells are not shown in Tables E-1 and E-2.

Table E-2. Groundwater Temperature in Intermediate Groundwater Wells

<table>
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<td>Qbt3</td>
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<td>Qbo</td>
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<td>CdV-16-2(i)</td>
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<td></td>
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<tr>
<td>CDV-37-1(i)</td>
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<tr>
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<td></td>
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<td>Tp</td>
</tr>
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<td>R-6i</td>
<td>Single</td>
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<td>Single</td>
<td>16.0</td>
<td></td>
<td>Tb4</td>
</tr>
<tr>
<td>TA-53i</td>
<td>Single</td>
<td>14.5</td>
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<td>Tpf</td>
</tr>
<tr>
<td>TW-2Ar</td>
<td>Single</td>
<td>11.5</td>
<td></td>
<td>Tpf</td>
</tr>
</tbody>
</table>
Figure E-1. Temperature of groundwater at the top of the regional aquifer.
Figure E-2. Temperature of intermediate groundwater.
Conceptual Models of Vadose Zone Flow and Transport beneath the Pajarito Plateau, Los Alamos, New Mexico

Kay H. Birdsell,* Brent D. Newman, David E. Broxton, and Bruce A. Robinson

ABSTRACT

The Pajarito Plateau in northern New Mexico, on which the Los Alamos National Laboratory is situated, is characterized by a thick vadose zone overlying the regional aquifer of the western Española Basin. In this study, conceptual models of vadose zone flow and transport processes are presented and then supported through the interpretation of field data, including synthesis with numerical models. The conceptual models differentiate the rate of percolation by their location and surface hydrologic setting, including wet and dry canyons, and wet, dry, and disturbed mesas. Net infiltration beneath wet canyons is the highest, with rates on the order of a meter per year (100–1000 mm yr⁻¹). Transport to the regional aquifer beneath the wettest canyons is likely on the order of several years to several decades, depending on the thicknesses of the various hydrostratigraphic layers. Perched water is sometimes found beneath wetter canyons and is associated with near-surface alluvial systems and at intermediate depths along low-permeability interfaces such as buried soils or unfractured regions of basalt flows. Percolation through the volcanic tuffs is generally considered to be via matrix-dominated flow, whereas fracture flow may play a key role in contaminant transport through densely welded tuffs or basalt units beneath wet canyons. Infiltration beneath dry canyons and dry mesas is much slower (10 mm yr⁻¹ or less), yielding transport times to the aquifer of hundreds to several thousands of years. However, long-term surface disturbances at mesa-top locations may alter infiltration rates such that at a local scale, the infiltration rates temporarily approach those of wetter canyons.

A CONCEPTUAL MODEL is an evolving hypothesis identifying the important features, processes, and events controlling fluid flow and contaminant transport of consequence at a specific field site in the context of a recognized problem (National Research Council, 2001). A well-defined site conceptual model is a useful tool for compiling and interpreting site data, focusing characterization work, developing the framework for numerical models, conveying information about the site to interested parties, and determining possible receptors that may be affected by disposal operations at the site. In fact, at a workshop sponsored by the National Research Council (2001), a panel of experts concluded that conceptual model development is the most important step in the overall modeling process used for site evaluation. They also pointed out that appropriate controlling processes can be identified through the development of alternative conceptual models accompanied by the evaluation of these alternatives through comparison with field observations. To best develop and test conceptual models, supporting data should be derived using a number of observational techniques and include a variety of data types.

Los Alamos National Laboratory (the Laboratory or LANL; Fig. 1) has performed research and development in nuclear weapons technologies and other national defense activities for more than 60 yr, beginning with the Manhattan Project in the 1940s. During this time, Laboratory operations have been accompanied by both disposal of and intentional or accidental releases of chemical contaminants into the environment at a variety of sites. Contaminants with possible negative impacts to groundwater include high explosives, radionuclides, chemical solvents, and metals. Today, the Laboratory is responsible for ensuring that none of its past contaminant releases pose a threat to human health now or in the future, and to carry out remediation activities to clean up contaminated sites. One of the key potential risks is groundwater contamination, possibly affecting drinking water quality in municipal or private wells. Contaminants must travel through a thick vadose zone to reach the regional aquifer. Therefore, a well-developed conceptual model describing vadose zone flow and transport beneath the Pajarito Plateau is key to assessing groundwater risk.

The conceptual models for vadose zone flow and transport for the plateau are used to characterize the hydrologic setting located between the ground surface and the regional aquifer and to help determine the fate, transport, and potential future risk of contaminants that have been released into the environment by the Laboratory. Because the Laboratory is large (> 100 km²) and covers complex terrain (Fig. 1), hydrologic conditions vary by location. For this reason, we have chosen to present the conceptual model for the plateau as multiple conceptual models that vary by location to more easily make distinctions between the varying hydrologic conditions. The ideas are based on ongoing observations of hydrologic processes that have been made since the mid 1940s (Griggs, 1964; Abrahams et al., 1961). Refinement of the conceptual models has occurred over the years and especially recently with the interpretation of data collected across the entire thickness of the vadose zone during the drilling of well-characterized regional aquifer wells (Vaniman et al., 2002; Broxton et al., 2002a; Ball et al., 2002; Longmire, 2002).

Our main purpose here is to describe the conceptual models of vadose zone flow and transport for the Pajarito Plateau and then to support these models by providing comprehensive sets of evidence from across the plateau. Toward that purpose, we briefly characterize the...
geohydrologic setting of the Pajarito Plateau, describe the hydrologic conceptual models, and then provide supporting evidence. The evidence consists of data sets, observations, and interpretation through numerical simulations. By compiling these sets of evidence into a comprehensive explanation of the processes that occur across the plateau, the credibility of the conceptual models is enhanced.

SITE DESCRIPTION

Topography and Stratigraphy

The Pajarito Plateau is a high, east-tilted tableland eroded into a series of narrow mesas separated by deep canyons. The map view in Fig. 1 and the two cross sections in Fig. 2 illustrate the topographic contrast between the mesa and canyons across the plateau. Mesa-top elevations range from approximately 2400 m on the west to about 1900 m on the east. About 1.22 and 1.61 Ma (Izett and Obradovich, 1994; Spell et al., 1990, 1996) cataclysmic eruptions from calderas in the central part of the Jemez Mountains deposited thick blankets of tuff over the area. Intense heat and hot volcanic gases welded these tufts into hard, resistant deposits that make up the upper surface of the plateau. Streams flowing eastward across the plateau from the Jemez Mountains to the Rio Grande have cut canyons deep into the tuff, forming the striking mesas and canyons that character-
The canyons tend to be deep and narrow in the western part of the plateau where streams are incised in the most strongly welded tuff units (Fig. 2a). The canyons become wider and shallower eastward, where thinner, less-welded tuffs overlie resistant basalt and coarse volcaniclastic deposits (Fig. 2b).

A comprehensive description of the regional hydrogeologic setting of the Pajarito Plateau is given in a companion paper by Broxton and Vaniman (2005). This section provides a brief overview of vadose zone stratigraphy that establishes a geologic framework for discussing conceptual models of contaminant transport. The two cross sections in Fig. 2 illustrate the lateral variations in vadose zone geology. The principal geologic units include, in descending order, the Tshirege and Otowi Members of the Bandelier Tuff, Puye Formation, and Cerros del Rio basalt. Descriptions of alluvial deposits and of other relatively minor bedrock units can be found in Broxton and Vaniman (2005).

The upper part of the vadose zone consists of an eastward-thinning wedge of Bandelier Tuff. The Bandelier Tuff is subdivided into two stratigraphic members, each consisting of a basal pumice fall overlain by a succession of rhyolitic ash-flow tuffs (Bailey et al., 1969). The Tshirege Member, which forms the surface outcrops throughout the plateau, is a compound-cooling unit consisting of alternating layers of nonwelded to moderately welded rhyolitic ash-flow tuffs. Welding within subunits of the Tshirege increases from east to west across the plateau, with some tuffs becoming densely welded near the western mountain front where they are thicker and more proximal to their source area. Within the Tshirege Member, welded tuffs are typically more highly fractured than the nonwelded tuffs that separate them. Fractures originating in welded zones, which include both cooling joints and tectonic fractures, commonly die out in overlying and underlying nonwelded tuffs. The Tshirege Member is up to 170 m thick in the south-central part of the Laboratory (Stimac et al., 2002). The Tsankawi Pumice Bed, a 0.3- to 1.2-m-thick fall deposit, marks the base of the Tshirege Member. The Otowi Member underlies the Tshirege Member and is exposed in lower canyon slopes in the northern part of the plateau. It is a multiple-flow unit made up of a relatively uniform sequence of nonwelded ash-flow tuffs. The maximum thickness of the Otowi Member is 128 m in the southwest part of the Laboratory. The Guaje Pumice Bed is a 2- to 15-m-thick stratified fall deposit at the base of the Otowi Member. The nonwelded portions of the Tshirege Member and all of the tuffs within the Otowi Member lack the pervasive cooling joints that characterize the welded portions of the Tshirege Member. Although high-
angle fractures tend to be rare in nonwelded tuffs, a few were documented by borehole videos and core samples (Broxton et al., 2002a).

The Puye Formation commonly underlies the Guaje Pumice Bed and consists of highly stratified, poorly cemented gravels and conglomerates consisting of surrounded dacitic and andesitic lava clasts in a poorly sorted, sandy to silty matrix. Debris flows, ash beds, pumiceous volcanioclastic sediments, and beds of fluvial sand and silt are interbedded with the gravels and conglomerates. Basaltic ash and lacustrine deposits are present in the upper part of the Puye Formation on the eastern side of the plateau. The formation reaches a maximum thickness of >335 m beneath the western part of the plateau but thins to 15 m in the northeast part of the plateau near the Rio Grande. Ancestral Rio Grande deposits called the Totavi Lentil are interbedded with the lower part of the Puye Formation on the east side of the plateau. These riverine deposits contain subangular dacitic detritus derived from volcanic sources to the west and rounded cobbles and boulders of quartzite, granite, and pegmatite derived from Precambrian highlands to the north and east. In some parts of the plateau, a distinctive pumice-rich rock unit beneath the Puye Formation, labeled younger pumiceous deposits in Fig. 2, overlies the Totavi Lentil. Borehole geophysical logs show that these pumiceous deposits typically have a higher porosity and lower bulk density than overlying fanglomerates. Thick deposits of older fanglomerate occur beneath the pumiceous deposits. These deposits, which are similar to but predate rocks normally assigned to the Puye Formation, are informally called older fanglomerate (Broxton and Vaniman, 2005).

Basaltic rocks of the Cerros del Rio volcanic field are intercalated with the upper part of the Puye Formation in the central and eastern part of the Pajarito Plateau. These basalts occur as numerous lava flows separated by interflow breccia, scoria, ash, and fluvial deposits. The lava flows typically contain highly brecciated tops and bottoms that provide zones of highly interconnected porosity over distances of tens to hundreds of meters. In some areas, the permeability of these zones is reduced by clays deposited in the pores of the breccias. Studies of basalts on the Columbia River Plateau found that, under saturated conditions, groundwater is most readily transmitted through the breccia zones at the tops and bottoms of basalt flows (Whiteman et al., 1994). The interiors of the flows are made up of dense, impermeable basalt. Fractures provide the primary source of permeability for the transport of liquid water and vapor in the dense flow interiors. Fracture patterns vary vertically within a flow unit with vertical columnar joints commonly occurring in the lower part of flow and irregular, complexly fanning fractures occurring in the upper part. Horizontal platy joints are also present near the base of some flow units.

Sources of Contamination

Many of the processes used to carry out the Laboratory's past and present missions use hazardous and radioactive materials. Throughout the Laboratory's history, some of these materials have been disposed of on Laboratory property or released into the environment. Since World War II, environmental legislation has evolved to become increasingly protective, and the Laboratory's operations have evolved with the legislation.

The Laboratory's Environmental Restoration Program is actively working to identify and restore contaminated sites. Original contaminant sources include, for example, septic tanks and lines, wastewater outfalls, material disposal areas (MDAs), firing ranges, and surface spills. In this paper, the focus is largely on contaminants associated with wastewater outfalls and MDAs. Wastewater from Laboratory technical areas (TAs) was historically drained through pipes and allowed to discharge into nearby canyons or mesa top lagoons. The outfalls are those areas below these effluent pipes and are a source of potential contamination for local canyons. Material disposal areas are generally mesa-top sites where waste was historically placed in near-surface pits or shafts. A variety of contaminants were disposed of in MDAs, including solid and liquid radioactive wastes, heavy metals, and organic wastes. These sites were intended to be permanent disposal facilities, and assessments are underway to determine whether any of these facilities pose long-term risks.

Climate and Near-Surface Hydrology

Arid and semiarid regions have common characteristics, such as thick vadose zones, infiltration that is often focused in topographic lows or beneath surface water bodies, and average annual potential evapotranspiration (ET) rates that far exceed precipitation rates. Under these conditions, infiltration events that propagate beneath the root zone are sporadic and occur only when the short-term infiltration rate exceeds the ET rate, such as during snowmelt or after large rainstorms. Consequently, the rates for deeper infiltration are difficult to quantify through traditional water balance studies because this component of the water balance can be orders of magnitude less than the other components (de Vries and Simmers, 2002; Scanlon et al., 2002; Scophleous, 2002; Sanford, 2002; Flint et al., 2002). These generalities apply to the Pajarito Plateau, which has a semiarid climate and a vadose zone that ranges in thickness between approximately 100 and 400 m (Fig. 2).

Average annual precipitation across the Pajarito Plateau ranges from >0.36 m along the western boundary near the Jemez Mountains to <0.36 m to the east at the Rio Grande (Bowen, 1990). Most precipitation occurs either as winter and spring snow or as summer "monsoon" rains. As a result, infiltration occurs episodically during spring snowmelt or the intense summer thunderstorm season and is often focused by runoff into the canyons.

Surface water flow in the canyons is generally ephemeral or intermittent, although a few canyons have short stretches with perennial surface flow. Anthropogenic discharges from water treatment outfalls can be a significant source of water in some canyons. Infiltration of
these surface sources form shallow perched alluvial groundwater systems in many of the canyons (Stone et al., 2001). These alluvial groundwater systems are not sufficiently extensive for domestic use, but nevertheless, they are an important component of the subsurface hydrologic system. Because of their close association with surface waters, these shallow perched systems generally show the earliest and most pronounced impacts of laboratory contamination of all groundwaters. They also serve as lateral pathways for the down-canyon migration of contaminants and provide storage for groundwater infiltrating to deeper parts of the vadose zone.

VADOSE ZONE CONCEPTUAL MODELS OF THE PAJARITO PLATEAU

The conceptual models for vadose zone flow and transport beneath the Pajarito Plateau identify wet canyons as being hydrologically different from dry canyons and dry mesas (LANL, 1998a; Rogers et al., 1996; Neeper and Gilkeson, 1996; Turin and Rosenberg, 1996; Birdsell et al., 2000). Table 1 shows a compilation of infiltration rates estimated using a variety of interpretive techniques for locations across the plateau. These data begin to illustrate the difference in infiltration rate depending on location (i.e., mesa or canyon). In addition, Kwiciklis et al. (2005) developed a map of average annual net infiltration in the Los Alamos area, on the basis of physical features such as elevation, vegetation, surface geology, and stream flow. They defined net infiltration as that water remaining after accounting for evapotranspiration in the shallow subsurface (i.e., the root zone). The highest net infiltration rates occur in the larger canyon systems, especially those that head in the mountains, with magnitudes of up to a few hundred millimeters per year caused by channelized runoff. In contrast, much lower net infiltration rates occur across mesas and in the smaller canyons that head on the plateau. These geographic variations in infiltration rates are key components of the site conceptual models.

In the subsections that follow, conceptual models are presented for (i) wet canyons, (ii) dry canyons, (iii) dry and disturbed mesas, and (iv) mountain-front mesas. First, however, a comparison of porous matrix flow and transport with more rapid fracture flow and transport is presented because this topic is relevant to the four location-specific conceptual models. Then, the location-specific conceptual models are given. Each conceptual model includes field observations and interpretations that support the application of these models to the Pajarito Plateau. Finally, a contrast between subsurface observations at mesa top and canyon sites is presented that further supports the distinction between canyons and mesas.

Along with each conceptual model description, field observations and/or interpretation are presented as evidence to support the model. Many of these cases are interpreted through numerical simulation using the Finite Element Heat and Mass (FEHM) code (Zywoloski et al., 1997). This code has been used extensively to model unsaturated and saturated flow and contaminant transport in porous and fractured media (Robinson and Busso, 2000; Robinson et al., 2005a; Keating et al., 2005). The numerical studies that follow employ the water characteristic-curve formulation of van Genuchten (1980) because that formulation was used to fit the available site data measured on core samples.

Matrix vs. Fracture Flow and Transport

Vadose zone flow through nonwelded to moderately welded units of the Bandelier Tuff is thought to occur through the porous matrix. Within densely welded tuffs and dense basalts, the vadose zone flow regime may be dominated by fracture flow. In contrast, matrix flow may occur within the more porous, brecciated zones in the basalt. The following evidence supports these hypotheses.

Matrix Flow in Nonwelded and Moderately Welded Tuffs

Across most of the plateau, the uppermost vadose zone consists of nonwelded to moderately welded Tshirege

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Table 1. Estimated net infiltration rates across the Pajarito Plateau. (Negative infiltration rate implies upward flow.)

<table>
<thead>
<tr>
<th>Location</th>
<th>Classification</th>
<th>Estimated net infiltration rate</th>
<th>Technique used for estimation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Los Alamos Canyon</td>
<td>wet canyon (natural with previous discharge)</td>
<td>213-1076 mm yr⁻¹</td>
<td>water balance study</td>
<td>Gray, 1997</td>
</tr>
<tr>
<td>Mortandad Canyon</td>
<td>wet canyon (anthropogenic recharge)</td>
<td>5.13, 0.25, and 1.5 mm yr⁻¹</td>
<td>analyzed vertical head gradients</td>
<td>Rogers et al., 1996</td>
</tr>
<tr>
<td>Cañada del Buey</td>
<td>dry canyon</td>
<td>-0.22 and 2.0</td>
<td>depths of subsurface tritium peaks</td>
<td>Kwicklis et al., 2005</td>
</tr>
<tr>
<td>Potrillo Canyon</td>
<td>dry canyon</td>
<td>6.9, 7.3, 0.07, -0.06, and 0.26 mm yr⁻¹</td>
<td>analyzed vertical head gradients</td>
<td>Rogers et al., 1996</td>
</tr>
<tr>
<td>Mesita del Buey</td>
<td>dry mesa</td>
<td>0.2 and 3.3</td>
<td>chloride mass-balance approach</td>
<td>Bergfeld and Newman, 2001</td>
</tr>
<tr>
<td>MDA G on Mesita del Buey</td>
<td>disturbed dry mesa site with waste disposal</td>
<td>1-5 mm yr⁻¹</td>
<td>moisture matching</td>
<td>Birdsell et al., 2000</td>
</tr>
<tr>
<td>Frijoles Mesa, 210-m bore near MDA AB</td>
<td>dry mesa with waste disposal</td>
<td>0.5-2.0 mm yr⁻¹</td>
<td>chloride mass-balance approach</td>
<td>Newman et al., 2005</td>
</tr>
<tr>
<td>MDA AB on Frijoles Mesa</td>
<td>disturbed mesa site with asphalt cover</td>
<td>300 mm yr⁻¹</td>
<td>water balance based on subsurface moisture</td>
<td>Roper et al., 1999</td>
</tr>
<tr>
<td>MDA P</td>
<td>disturbed mesa site with waste disposal</td>
<td>95 mm yr⁻¹</td>
<td>analyzed vertical head gradients</td>
<td>Rogers et al., 1996</td>
</tr>
<tr>
<td>TA-53 Lagoons on Mesita de los Alamos</td>
<td>disturbed mesa site with liquid waste disposal</td>
<td>230 mm yr⁻¹</td>
<td>analyzed vertical head gradients</td>
<td>Rogers et al., 1996</td>
</tr>
</tbody>
</table>
Member ash-flow tuffs and nonwelded Otowi Member ash-flow tuffs (Fig. 2). Unsaturated flow and transport through these tuffs is assumed to occur predominantly through the porous matrix. These units have typical porosities of 40 to 50%, moderate saturated hydraulic conductivities (e.g., \(10^{-4} \text{ cm s}^{-1}\)), and water contents that are generally far below saturated conditions (2–25%). (Abrahams et al., 1961; Rogers et al., 1996; Birdsell et al., 2000; Springer, 2005). Although these tuffs are often fractured, water flow is expected to be matrix dominated unless conditions approach full saturation (Soll and Birdsell, 1998), such as beneath liquid-waste disposal pits or outfalls. In contrast, under background conditions where the fractured tuffs form the dry finger mesas on the eastern side of the plateau, air is thought to circulate freely through the fractures resulting in evaporation of pore water (Neepner, 2002; Stauffer et al., 2005).

Field observations and analyses support the matrix-flow hypothesis. Robinson et al. (2005a) modeled a vadose zone, wellbore injection test that was performed on a mesa north of Pajarito Canyon in moderately welded tuffs of the Tshirege Member (Purtymun et al., 1989) (Fig. 1). Through a numerical analysis incorporating different conceptual models of fracture flow behavior, they showed that the observed moisture distribution was consistent with a continuum model without fractures. The agreement between the numerical model and the observations was acceptable, both qualitatively and quantitatively. Dual-permeability and discrete-fracture conceptual models could also reproduce the observations, but only by muting the effect of the fractures. They estimated an equivalent infiltration rate during the injection phase of about \(2.7 \times 10^6 \text{ mm yr}^{-1}\), which is greater than most estimates of infiltration across the plateau (Kwicklis et al., 2005). They concluded that if matrix-dominated flow is observed at the high effective infiltration rate of this injection test, then it is even more likely to be the case under natural conditions on the plateau.

Evidence of fracture transport in a nonwelded to partially welded tuff exists beneath an historic liquid-waste disposal facility at MDA Ton DP Mesa (Fig. 1). The disposal facility consisted of four adsorption beds dug 1.2 m deep into the mesa top and filled with cobbles and gravel. The beds received liquid wastes primarily between 1945 and 1950, with occasional disposals through 1967. Subsurface contaminant data from 1960, 1978, and 1996 collected beneath the adsorption beds show evidence of contaminant transport associated with fractures, while subsurface data collected in boreholes adjacent to the beds shows none (Nyhon et al., 1984; LANL, 2004b). However, the 1978 study, which targeted data collection in fractures beneath the adsorption beds, concluded that most fractures (8 of 10) did not enhance contaminant transport. The two observations of transport in fractures in that investigation occurred at similar depths (<7 m below the ground surface) to those cited in the 1960 study, even though the four investigative boreholes drilled in 1978 extended deeper (to 30 m) (Nyhon et al., 1984). Although the 1996 data show contamination in a 20-m-deep fracture, the general assumption is that fracture transport occurred while the beds actively received liquid waste and that the contaminants associated with the fractures are remnants of previous fracture flow episodes (LANL, 2004b). These data support the idea that some fractures in the nonwelded to moderately welded tuff will flow when the matrix is saturated.

**Fracture Flow in Densely Welded Tuffs**

In areas near the mountain front on the western edge of the plateau, the majority of tuffs making up the Tshirege Member are moderately to densely welded. These strongly welded tuffs are characterized by porosities ranging from 17 to 40%, unsaturated volumetric water contents from 3 to 12%, and low saturated hydraulic conductivities (e.g., \(10^{-4} \text{ to } 10^{-3} \text{ cm s}^{-1}\)) (LANL, 2003b). These tuffs are also more fractured in the vicinity of the Pajarito fault zone along the western mountain front and can support fracture flow and transport when sufficient water is present. A bromide tracer test and high explosives contaminant distributions suggest that both fracture-dominated and matrix-dominated flow occur near the mountain front, depending on the degree of welding of the tuff (LANL, 1998b; LANL, 2003b).

**Fracture Flow in Dense Basalts; Matrix Flow in Brecciated Basalts**

Like the densely welded tuff units, fracture flow is hypothesized to occur through the dense, low-porosity flow interiors of the Cerros del Río basalt. Evidence for fracture flow in basalt comes from a field experiment on the upstream side of a low-head weir located in lower Los Alamos Canyon (Fig. 1; Stone and Newell, 2002; Stone et al., 2004). The objective of the experiment was to monitor water flow and bromide tracer transport through fractured basalt under transient, unsaturated and periodically ponded conditions using three observation boreholes. Following three ponding events, the bromide tracer advanced quickly downward to a depth of several tens of meters within 10 to 14 d after the first ponding event (Stone et al., 2004). The rapid advance of bromide indicates that fracture flow and transport occur through basalts under ponded conditions. Model calibration of bromide transport yields an effective fracture porosity in the range of \(10^{-2} \text{ to } 10^{-3}\) and saturated hydraulic conductivity in the range of \(10^{-2} \text{ to } 10^{-3} \text{ cm s}^{-1}\) (Stauffer and Stone, 2005; Stauffer et al., 2004). The data and simulations both indicate that the bromide continued to advance through the fractured system even after the ponds had drained.

Perched groundwater has been identified in a number of boreholes on the plateau (Robinson et al., 2005b; Broxton and Vaniman, 2005) and is often located beneath the larger wet canyons and within the more porous, breccia zones in basalt. An example of perched water in basalt occurs at Well R-9 in lower Los Alamos Canyon (Fig. 1), where groundwater was found from 55 to 70 m deep in the middle of the 86-m sequence of stacked lava flows (Broxton et al., 2001). The groundwater is located within a breccia zone and an underlying highly fractured basalt flow. The base of the perched zone occurs where the highly fractured basalt grades...
downward into a massive flow interior with few fractures. Tritium concentrations in the perched water reveal that it is no more than a few decades old (Broxton et al., 2001).

It is apparent that groundwater flow in basalt occurs both as porous flow through breccia zones and as fracture flow where dense flow interiors are broken by interconnected fracture systems. Flow direction is likely controlled by the geometry of the interflow breccias and by fracture orientation, both of which are heterogeneous. Perched zones may be stagnant or may flow laterally. For contaminant transport calculations, water flow through the basalt is commonly purposely predicted to be via fast-flowing vertical fractures because so little is known about the true nature of flow through the basalt units (Birdsell et al., 2000).

**Wet Canyons**

**Wet Canyon Conceptual Model**

Figure 3 is a photograph of Cañon de Valle, a wet canyon on the western boundary of the plateau. Several features characterize the large, deep naturally wet canyons on the Pajarito Plateau, such as Los Alamos and Pueblo Canyons (Fig. 1 and 2). Their headwaters are in the mountains, they have large catchment areas (13-26 km²), surface flow occurs frequently, and perched alluvial groundwater often percolate through a geologic section above. Thus, especially along the eastern end of the plateau, the wet canyons have thinner vadose zones (compare, e.g., Los Alamos Canyon in Fig. 2a and 2b) and a shorter portion of the flow path that has matrix-dominated flow (compare, e.g., Pajarito Canyon in Fig. 2a and 2b) than for the less eroded areas of the plateau. Rates of lateral transport are rapid during surface flow events, which occur more frequently in the larger wet watersheds than in other areas of the plateau. Sorbing species transport slowly in alluvial waters and more commonly migrate down the canyon floor by sediment transport (LANL, 2004a; Lopes and Dionne, 1998; Solomons and Forstner, 1984; Watters et al., 1983). Since some of the wet canyons received liquid-waste discharges from outfalls, the alluvial systems then act as line sources for both water and contaminants to deeper parts of the vadose zone beneath the canyon floor. The resulting net percolation rates beneath the perched alluvial systems to the underlying unsaturated zone are expected to be among the highest across the plateau, approaching a meter per year (100-1000 mm yr⁻¹) (Gray, 1997; Kwicklis et al., 2005; Table 1).

From west to east, the vadose zone becomes progressively thinner and the geology becomes dominated by pre-Bandelier rock units, as can be seen by comparing Fig. 2a and 2b. This is especially true for the deep wet canyons, which are deeply incised into the underlying strata. In the eastern part of the plateau, contaminants transported laterally down canyon via surface flow or in alluvial groundwater often percolate through a geologic column consisting primarily of basalt and fanglomerate with little or no overlying tuff. Downward percolation is believed to be more rapid in the basalt than through porous tuff, as discussed in the matrix vs. fracture flow section above. Thus, especially along the eastern end of the plateau, the wet canyons have thinner vadose zones (compare, e.g., Los Alamos Canyon in Fig. 2a and 2b) and a shorter portion of the flow path that has matrix-dominated flow (compare, e.g., Pajarito Canyon in Fig. 2a and 2b) than for the less eroded areas of the plateau. Rates of lateral transport are rapid compared with other subsurface hydrologic processes on the plateau. As such, data for this prove useful for conceptual model validation. Discharge volumes and contaminant masses for the RLWTF outfall are well documented. As such, data for this prove useful for conceptual model validation. Discharge volumes have declined steadily since 1982. A perched alluvium system fills the canyon floor and varies in thickness from near zero to more than 30 m near the eastern boundary of the Laboratory (McLin

![Fig. 3. Photograph of Cañon de Valle, a wet canyon on the western edge of the plateau.](image-url)
et al., 1997). Purdyman (1974) observed that lateral transport of tritium and chloride was rapid through the alluvial system. He estimated lateral transport velocities between alluvial wells varying from 620 to 730 m yr$^{-1}$. The alluvial wells in Mortandad Canyon cover more than a 3-km distance downstream from the RLWTF and have been monitored for nitrate and radionuclides regularly since 1963 (LANL, 1997, 2001). Nitrate and tritium concentrations at the wells are roughly within a factor of two to three of each other, indicating that these nonsorbing species are well mixed throughout the alluvial groundwater. The rapid lateral transport and mixing of nonsorbing species support the concept that the wet alluvial systems spread contaminants down canyon such that they act as a line source of water and well-mixed contaminants to the deeper vadose zone. In contrast, the concentrations of adsorbing species, such as strontium and plutonium, in the alluvial water decline by an order of magnitude or more as the water flows down canyon (LANL, 1997). This variation in concentration with distance would need to be considered when predicting transport of adsorbing species from the alluvial aquifer.

A series of one-dimensional vadose zone flow and transport simulations, using 38 columns to represent the canyon bottom, were performed to support a probabilistic risk assessment of Mortandad Canyon (Hollis et al., 2005). As an upper-boundary condition, the simulations apply a water balance to the alluvial aquifer to estimate recharge from the alluvial aquifer to the deeper vadose zone. The water balance approach assumes that the volume of water entering the canyon is a function of the discharge volume from the RLWTF, the main anthropogenic water source to the canyon, and that recharge is a function of the distance from the source. An estimate of the time-varying percolation rate at the alluvium–tuff interface in the vicinity of Well R-15 (Fig. 1) developed for the stochastic analysis is shown in Fig. 4. This particular example uses mean values for the three parameters in the study that define the distribution of infiltrating water throughout the canyon floor, with the main control being the assumed dilution of the recorded RLWTF discharge volumes (Hollis et al., 2005). The percolation estimates are indicative of rates expected in wet canyons; they range from 300 mm yr$^{-1}$ to >1.5 m yr$^{-1}$.

Nitrate concentration data collected in core from two vadose zone boreholes, R-15 and MCOBT-8.5 (Longmire et al., 2001; Broxton et al., 2002b), also confirm wet canyon behavior in Mortandad Canyon. Here nitrate has migrated to a depth of at least 100 m in the vadose zone in approximately 40 yr, as shown in Fig. 5. An example nitrate concentration profile predicted at the location of Well R-15 with the transient one-dimensional vadose zone simulation described above agrees well with the concentration data (Fig. 5). The simulation uses the transient percolation rate shown in Fig. 4 and measured nitrate releases from the RLWTF (LANL, 1997), although one-half the nitrate mass is assumed to be degraded due to denitrification (Hollis et al., 2005). The simulation also assumes that water flow through the tuff units is matrix dominated, and flow through the basalt is fracture dominated.

Nitrate has also been observed in the regional aquifer at levels near 2 mg L$^{-1}$ (LANL, 2003a) in Well R-15. This well is 337 m deep and extends 44 m into the regional aquifer. These nitrate levels are elevated relative to background levels in regional groundwater and are believed to be the result of Laboratory liquid-effluent discharges to Mortandad Canyon (Longmire, 2002).

Los Alamos Canyon is a large canyon that is both naturally wet and has previously received wastewater discharges. Laboratory derived contaminants (tritium, perchlorate) released in liquid effluents into this canyon and the adjacent Pueblo Canyon have reached the regional aquifer and are present in one municipal water supply well (Otowi-1) (LANL, 2004c). Well Otowi-1, located in Pueblo Canyon near the confluence with Los Alamos Canyon (Fig. 1), is in an area in which alluvium sits directly on top of basalts and the Puye formation. Further up Los Alamos and Pueblo Canyons, significant thicknesses of Bandelier Tuff are present. In contrast to
Otowi-1, no contaminants have been detected in water supply well Otowi-4 (LANL, 2004c), located in a region in which more than 50 m of Bandelier Tuff is present (Fig. 1). Thus, the Otowi-4 result is consistent with a conceptual model of matrix-dominated flow and longer travel times through the nonwelded Bandelier Tuff, and the Otowi-1 observation is consistent with fracture flow through the basalt units. The numerical model of Los Alamos Canyon developed in Robinson et al. (2005c) yielded results consistent with these observations.

To summarize, these data and interpretation demonstrate several of the features included in the wet canyon conceptual model. First, lateral transport by both surface water and perched alluvial groundwater spreads nonsorbing contaminants down canyon to create a line source of contamination to the deeper vadose zone. Next, wastewater discharges can cause wet-canyon hydrologic behavior in small canyons that would otherwise likely have little net infiltration, as discussed in the upcoming section. Also, a matrix-flow model for the tuff units appears to adequately capture infiltration beneath Mortandad Canyon even though a perched system sits atop the tuff, and the transient percolation rate is estimated to have been on the order of a meter per year. In contrast, near Otowi-1, at the confluence of Los Alamos and Pueblo Canyons, little or no tuff is present, and a rapid fracture flow model through the basalts best explains the contaminant observations. Finally, the presence of anthropogenic contaminants in regional groundwater confirms that beneath wet canyons some vadose zone pathways have travel times on the order of a few decades.

**Dry Canyons**

**Dry Canyon Conceptual Model**

Figure 6 is a photograph of lower Sandia Canyon (Fig. 1), which is considered a dry canyon. In contrast to wet canyons, dry canyons head on the plateau, have smaller catchment areas (<13 km²), experience infrequent surface flows, and have limited or no saturated alluvial systems in their floors. If anthropogenic sources are present, they are small volume sources. These hydrologic factors yield little lateral near-surface contaminant migration and slower unsaturated flow and transport from the surface to the regional aquifer. For example, because surface and alluvial waters are less common, contaminants remain near their original sources. Pathways through the vadose zone tend to be longer in the shallow dry canyons, which have thicker sections of nonwelded to moderately welded tuff than in the deeper-cut wet canyons; see, for example, Cañada del Buey in Fig. 2. Net infiltration beneath dry canyons is much slower, with rates generally believed to be less than tens of millimeters per year and commonly on the order of 1 mm yr⁻¹. Finally, transport times to the aquifer beneath dry canyons are expected to be from hundreds to several thousands of years (Nylander et al., 2003).

**Dry Canyon Examples**

Estimated net infiltration rates by Rogers et al. (1996) (Table 1) suggest fluxes of a few millimeters per year or less for two dry canyon locations, Potrillo Canyon and Cañada del Buey. Water content and chloride profiles from Potrillo Canyon Borehole PC-4 are presented in Fig. 7. The example shows that even in a “dry” canyon there can be zones of high water content (i.e., water contents are in the 40% range at about 17 m). However, the chloride mass-balance estimate of flux from this borehole is only 4.5 mm yr⁻¹, and the chloride-based vadose zone residence time exceeds 1700 yr.
from laboratory operations can drive infiltration rates to increase to near wet canyon levels (Table 1). Even with elevated infiltration, at most sites flow remains matrix dominated. Fracture flow has occurred beneath a long-term liquid disposal site with ponded conditions, as discussed above. However, fracture flow is thought to cease once liquid disposals stop (Soll and Birdsell, 1998). Infiltration rates are expected to return to low, near-background levels when the surface and vegetation return to native conditions.

Dry and Disturbed Mesa Examples

Two examples of vadose zone conditions from dry and disturbed mesas are discussed. The first example uses volumetric water content and chloride profiles from four boreholes (Fig. 9) from Mesita del Buey located near the eastern boundary of the laboratory (Fig. 1). In this mesa, vadose zone water contents above the level of the adjacent canyon bottoms are variable, but a large fraction of the mesa has extremely low water contents of <5% (<12% saturation). Chloride accumulation in the vadose zone is also variable, but all four boreholes have significant chloride inventories. Some samples have pore water chloride concentrations that exceed 1000 mg L⁻¹. The chloride data (Newman, 1996) and numerical modeling (Birdsell et al., 2000) indicate that downward fluxes vary with depth and across the mesa. Chloride mass-balance flux estimates range from 0.03 to 6 mm yr⁻¹, with the highest fluxes associated with the upper 6 to 9 m. However, all four boreholes have a depth interval where fluxes are <1 mm yr⁻¹. Chloride-based residence times range from 1300 to 17000 yr (Newman, 1996). The low fluxes and long residence times suggest that there is little water movement through the mesa.

Even though the natural conditions in dry mesas result in low downward fluxes, disturbance can alter how quickly water moves through the vadose zone. Rogers et al. (1996) showed that addition of water or focusing of flow on mesa tops (e.g., waste water lagoons or storm water diversion ditches) can result in flux increases of tens to hundreds of millimeters per year (Table 1). Another example of how rapidly dry mesa conditions can shift from disturbance is provided by periodic water content monitoring of Borehole 1121 on Mesita del Buey. When the borehole was drilled, chloride and water content data reflected the native conditions in the mesa (Fig. 10). Subsequently, focused runoff from an asphalt pad resulted in transient ponding in a localized area around Borehole 1121. Periodic water content monitoring in Borehole 1121 using neutron probe revealed increasing water contents down to about 24 m in <10 yr (Fig. 10; Newell, 1996 and 2000, unpublished data). This example shows that transient ponding can affect deep portions of dry-mesa vadose zones in less than a decade.

The second dry or disturbed mesa example is from Frijoles Mesa, located at the south-central portion of the Laboratory (Fig. 1). Explosives experiments were conducted at MDA AB on Frijoles Mesa in 1960 and...
Fig. 9. Water content and chloride profiles from MDA G (Newman, 1996).
Fig. 10. Changes in volumetric water content in borehole 1121 as a result of episodic ponding (Newell, 1996 and 2000, unpublished data). Ponding occurred from focused runoff from an asphalted area.

Fig. 11. Volumetric Water Content in four boreholes for background conditions at TA-49 near MDA AB (Levitt et al., 2005).

Fig. 12. Volumetric water content for disturbed conditions at TA-49, MDA AB. Data are for two boreholes beneath an asphalt area (Farley, 1994, unpublished data). Simulation results are for transient simulations with increased deep percolation during asphalt lifetime (Birdsell et al., 1999).
Mountain-Front Mesas

Mountain-Front Mesa Conceptual Model

Mesas along the mountain front of the plateau are classified as being naturally wet mesas. Figure 13 shows a photograph of a mountain-front mesa area at TA-16 (Fig. 1). In contrast to the dry mesas, these mesas receive greater precipitation (e.g., 500 mm yr$^{-1}$) and increased runoff and infiltration. The wet, mountain-front mesas contain numerous perennial and ephemeral springs. Such springs are rare in the dry mesas of the eastern part of the plateau, except where the regional groundwater aquifer discharges along the Rio Grande. Duffy (2004) discusses the importance of mountain-front processes and conditions in semiarid landscapes and suggests that the mountain block and mountain-front areas are the dominant recharge zones in semiarid landscapes. Thus, hydrologic conditions are quite different along the wet mountain-front mesas. One other important difference is that the upper tuff units along the mountain front are often moderately to strongly welded because of the close proximity to the caldera source. Welding results in increased fracturing during cooling, and because the mountain-front mesas lie within the Pajarito Fault Zone, additional fracturing and minor faulting of the tuff units have resulted. The welded tuffs create a hydraulic condition where matrix hydraulic conductivities are low (e.g., $10^{-7}$ to $10^{-9}$ cm s$^{-1}$), but fracture densities are relatively high. Thus, there is a propensity for significant fracture flow. Fracturing appears to control the locations of natural springs along the mountain-front mesas. Also, fracture flow related to outfalls and wastewater lagoons is suggested by water content and contaminant distributions (LANL, 2003b).

Mountain-Front Mesa Examples

To illustrate how rapidly vadose zone flow and transport can occur in wet, mountain-front mesas, a bromide tracer test is described. This tracer experiment was conducted in a former high explosives outfall pond at TA-16. Use of the outfall had been discontinued, and ponded water conditions no longer existed at the site. In 1997, 100 kg of potassium bromide were applied to the outfall pond with 3028 L of water. The main goal of the study was to determine whether there was a connection between the mesa-top outfall pond and two high explosives—contaminated springs that flowed along the north side of the mesa. Except for the tracer solution, no additional water was added to the site. Thus, precipitation was the dominant driver for tracer transport. Borehole monitoring and drilling during the test showed that the vadose zone was largely unsaturated. Tracer was observed in the first spring after only 4 mo. These observations indicate that more than 300 m of lateral transport and 33 m of vertical transport. Tracer was observed in the second spring after about 7 mo. Such rapid movement of tracer to the springs is inconsistent with fluxes that would be expected under unsaturated, matrix-type flow conditions (LANL, 1998b, 2003b). Thus, rapid movement along locally saturated fractures (possibly in combination with matrix flow) is implied. It is also worth noting that $<2\%$ of the applied tracer mass actually made it to the springs. Subsequent drilling and sampling in the application area 3 yr after the tracer was released suggests nearly all of the tracer mass was still in the top 1.2 m of the vadose zone (LANL, 2003b). This result illustrates that vadose fluxes in the mountain-front zone are not always large and that there can be a great deal
Table 2. Comparison of canyon and mesa hydrogeochemical characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Max. Cl⁻</th>
<th>Avg. Cl⁻</th>
<th>Max. SO₄⁻</th>
<th>Avg. SO₄⁻</th>
<th>Max. δ¹⁸O</th>
<th>Avg. δ¹⁸O</th>
<th>Max. δD</th>
<th>Avg. δD</th>
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<tbody>
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<td>Canyons</td>
<td>172</td>
<td>50</td>
<td>641</td>
<td>78</td>
<td>-7</td>
<td>-33</td>
<td>52</td>
<td>20</td>
</tr>
<tr>
<td>Mesas</td>
<td>1761</td>
<td>398</td>
<td>8913</td>
<td>1766</td>
<td>-1</td>
<td>-8</td>
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<td>7</td>
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<td>Difference</td>
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<td>368</td>
<td>8272</td>
<td>8913</td>
<td>6</td>
<td>2</td>
<td>-33</td>
<td>-13</td>
</tr>
</tbody>
</table>

of variation in fluxes, depending on whether fracture or matrix flow (or both) occur.

**Mesa–Canyon Comparison**

To further demonstrate the pronounced difference between the subsurface hydrologic conditions beneath mesas and canyons, a direct comparison of data collected at a variety of mesa and canyon sites is presented in this section. A statistical examination of vadose zone water content, anion concentrations (e.g., chloride), and stable isotopes (δ¹⁸O and δD) supports the hypothesis that canyons are hydrologically different from mesas. These characteristics serve as sensitive indicators for differences in recharge through the vadose zones. Cores from nine canyon and 13 mesa boreholes from relatively undisturbed locations were examined. Water content and anion and stable isotope data from the core samples were collected following Newman et al. (1997a). For each borehole, the average and maximum values of pore water chloride and sulfate concentrations, pore water δ¹⁸O values, and volumetric water contents were determined. Data for each characteristic (averaged for all canyon and mesa boreholes, respectively) are shown in Table 2 along with the difference between the values. The differences between the canyons and mesas are substantial in most cases.

To test whether these differences were significant, the nonparametric Mann–Whitney U test was run using the various mesa and canyon borehole values. The nonparametric test was used primarily because of the small number of analyses available. For a p value of 0.05, the tests showed that all of the characteristics for both the maximum and average values were significantly different for the mesas and canyons. The dramatic differences between the mesa and canyon characteristics can also be seen from box and whisker plots of water content and chloride concentration shown in Fig. 14 and 15. These comparisons of mesa and canyon vadose zone characteristics support the conceptual model that there are significant differences between the mesas and the canyons in hydrologic behavior and in downward fluxes. Unfortunately, there are not enough data to test for significant differences between dry and wet canyons.

**SUMMARY AND CONCLUSIONS**

Field observations, data and numerical models were used in conjunction to develop and test the conceptual models of vadose zone hydrology beneath the Pajarito Plateau. Many of our findings have relevance to studies being conducted in other arid and semiarid regions and provide insights into flow and transport mechanisms, the role of hydrogeology in controlling vadose zone flow, and the influence of topographic and surface water flow conditions on infiltration and deep percolation. Therefore, understanding of the unsaturated zone hydrologic processes studied here should have a general applicability and interest that goes beyond the characterization of the Pajarito Plateau in north-central New Mexico. Our principle findings and the means for reaching these conclusions are summarized below.

**Topography and Surface-Water Setting.** The conceptual models distinguish differences among wet canyons, dry canyons and mesas, and mountain-front mesas. Wet canyons receive larger quantities of deep infiltration due to surface and shallow groundwater flow in alluvium. In contrast, little net infiltration occurs beneath dry canyons and mesas. Mountain-front mesas receive consi-
erably more infiltration, and the particular hydrostratigraphic conditions give rise to localized perched water, and lateral flow through fractures to nearby springs. These ideas are supported by the following observations and interpretations of data from across the plateau:

- Moisture profile measurements and numerical simulation of vadose zone flow
- Major ion, stable-isotope, and contaminant concentration measurements
- Water budget studies in individual canyons (Gray, 1997; Kwicklis et al., 2005)
- Tracer tests in perched water for the mountain-front mesa case

**Anthropogenic Impacts.** Both canyons and mesas can be significantly changed from their natural conditions by human activities. On mesas, asphalt pavements on mesas reduce ET, and moisture builds up underneath. If the asphalt focusses runoff or subsequently cracks, localized high infiltration can take place in a location where it ordinarily would not. In canyons, effluent discharges from LANL or Los Alamos County sources can significantly increase surface and alluvial groundwater flow, which in turn typically increases the infiltration rate to the deeper vadose zone. These ideas are supported by the following observations and interpretations:

- Measurements and numerical modeling of water contents beneath and adjacent to areas paved to support LANL facilities
- Water content and contaminant transport measurements and numerical modeling of canyons impacted by LANL facilities

**Flow and Transport Mechanisms.** The two principle stratigraphic units of interest for vadose zone flow and transport beneath the Pajarito Plateau are the Bandelier Tuff and Cerros del Rio basalt. Water percolates through the porous and permeable matrix of most sub-units of the Bandelier Tuff. Many of these units are sparsely fractured, but even for those with fractures, water quickly imbibes into the matrix. An exception is the uppermost units of the Tshirege Member, present from LANL or Los Alamos County sources can significantly increase surface and alluvial groundwater flow, which in turns typically increases the infiltration rate to the deeper vadose zone. These ideas are supported by the following observations and interpretations:

- Measurements and numerical modeling of water contents beneath and adjacent to areas paved to support LANL facilities
- Water content and contaminant transport measurements and numerical modeling of canyons impacted by LANL facilities

**Vadose Zone Travel Times.** Travel times of contaminants from wet canyons to the regional aquifer can be as short as several years to several decades. The shortest travel times occur when water infiltrates directly into fractured basalt. When significant thickness of Bandelier tuff is present, travel times on the order of decades are more common. Travel times to the water table for dry canyons or undisturbed mesas are much longer; times in excess of thousands of years are consistent with the available data. These ideas are supported by the following observations and interpretations:

- Numerical modeling of wet canyons (Robinson et al., 2005c)
- Contaminant profiles in vadose zone boreholes
- Chloride and isotope profiles in mesa-top boreholes
- Regional aquifer contaminant concentrations from groundwater surveillance activities (LANL, 2004c, 2003a)

In conclusion, the conceptual models provide a general picture of the relevant processes controlling vadose zone flow and transport at the LANL site. Preliminary assessments of a particular site on the Pajarito Plateau can be based on the results presented herein. More detailed, site-specific investigations may be required to develop in-depth understanding and models with predictive capability. In those cases, the conceptual models serve as guiding sets of principles on which site-specific data-collection programs can be based.

**ACKNOWLEDGMENTS**

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Soil Survey of Sandoval County Area, New Mexico, Parts of Los Alamos, Sandoval, and Rio Arriba Counties
How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section General Soil Map Units for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the Index to Map Sheets. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the Contents, which lists the map units by symbol and name and shows the page where each map unit is described.

The Contents shows which table has data on a specific land use for each detailed soil map unit. Also see the Contents for sections of this publication that may address your specific needs.
This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1977-1985. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Natural Resources Conservation Service and the United States Department of Interior, Bureau of Land Management and Bureau of Indian Affairs; and the New Mexico Agricultural Experiment Station. The survey is part of the technical assistance furnished to the San Juan, Cuba, Coronado, Ciudad, and Santa Fe-Pojoaque Soil and Water Conservation Districts.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: "Valle Grande:" is the Spanish term for "great valley." Depicted here is a typical landscape of the Cosey-Jarmilo association, 2 to 20 percent slopes, in the foreground; Panion very cobbly sandy loam, 35 to 65 percent slopes, is on the steep mountain slopes in the far background.

Additional Information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.
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Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Dennis Alexander
State Conservationist
Soil Survey of Sandoval County Area, New Mexico, Parts of Los Alamos, Sandoval, and Rio Arriba Counties

By Leroy Hacker, Natural Resources Conservation Service and Christopher Banet, Bureau of Indian Affairs

Fieldwork by Leroy Hacker, Dale Swanson, Mark Seyfried, Tommie Parham, and Javier Ruiz, Natural Resources Conservation Service, and Christopher Banet and William Rigdon, Bureau of Indian Affairs

United States Department of Agriculture, Natural Resources Conservation Service
In cooperation with United States Department of the Interior, Bureau of Land Management, Bureau of Indian Affairs, and New Mexico Agricultural Experiment Station

General Nature of the Survey Area

Sandoval County Area is in north-central New Mexico. The survey area is bordered on the north by the Jicarilla Apache Area, Rio Arriba County Area, and the Santa Fe National Forest; on the east by Santa Fe County; on the south by Bernalillo County; and on the west by Cabezon Area, Cibola Area, McKinley County Area, and San Juan County, Eastern Part. It has a total of 1,550,000 acres or about 2,422 square miles, and includes parts of Sandoval and Los Alamos Counties.

Bernalillo, the county seat of Sandoval County, is on the Rio Grande in the south-central part of the survey area. Los Alamos, the county seat of Los Alamos County, is in the north-eastern corner of the survey area. Highways N.M. 550, 96, and 4, U.S. 85, Interstate 25, and the Santa Fe railway traverse the survey area.

The Rio Grande, the only perennial stream, traverses the eastern part of the survey area from north to south. The Rio Puerco and Jemez River are intermittent streams in the west and central parts of the survey area.

Elevation ranges from about 11,252 feet on Redondo Peak, the highest point in the survey area, to about 5,000 feet where the Rio Grande enters Bernalillo County.

Principal land uses in the survey area are livestock grazing, wood and timber harvesting, recreation, wildlife production, high-intensity irrigated farming, and urban development. The irrigated farming is in the Rio Grande and Jemez River Valleys. Urban development is concentrated in the Rio Rancho area.

Descriptions, names, and delineations of the soils in this survey area do not fully agree with those of Bernalillo, Cabezon, San Juan, or Santa Fe Counties. This is the result of new concepts of soil classification, changes in series concepts, different needs and uses, and the time the soil survey work was performed. Map unit differences are noted in the map unit descriptions. Updated correlations are in progress for these older surveys.
Agriculture

Agriculture in Sandoval and Los Alamos counties is many centuries old. Records indicate that Pueblo Indians were irrigating land and growing crops when first encountered by the Spaniards in 1540. They have continued to irrigate their lands up to the present time. Although there are a number of small and widely separated tracts of irrigated land in the valleys of the Jemez River, Rio Puerco, and their tributaries, most of the land now irrigated is in the Rio Grande Valley.

These lands along the Rio Grande are in an organized irrigation district known as the Middle Rio Grande Conservancy District. It was formed in 1925 to consolidate the many old ditch and diversion headings into major diversion dams and irrigation systems.

Water supplies generally are not as dependable for the small and scattered tracts of irrigated land that lie outside the Rio Grande Valley. Irrigation water for these lands
Soil Survey of Sandoval County Area, New Mexico

comes from the smaller streams originating in the mountains, and generally is available only in the spring or following periods of heavy rainfall.

The 16,000 acres of irrigated land is all within Sandoval County. Although this is a very small percentage of the total land area, it contributes much to the economy of the area. Wide varieties of crops are grown; however, many are of extremely limited acreage. Alfalfa, corn, and small grains, which are the principal crops, are grown on approximately 50 percent of the irrigated land.

Dryland farming, which was practiced to a limited extent in the western and northern parts of Sandoval County, has declined to the point that little land is now used for this purpose. Between 1920 and 1940, homesteaders settled in the more suitable parts of this area and acquired tracts of 320 to 640 acres on which they grew beans and corn successfully in some years. The low and erratic rainfall, however, made dryland farming extremely hazardous, and raising livestock gradually replaced the production of crops.

A high percentage of the land in this area is used for grazing livestock, and ranching is the principal type of agricultural enterprise. Livestock operations range from small flocks of sheep to medium-sized cow-calf-yearling operations.

Wildlife and recreation are also important land uses in this survey area. The high mountainous parts of this area, as well as adjacent foothills, provide good habitat for many species of wildlife and many opportunities for outdoor recreation such as camping, fishing, hunting, and other outdoor activities.

**History of the Survey Area**

The region has had continuous habitation since the Ice Age (Sandia Man Cave), and is presently the home of eight Indian pueblos.

Near Los Alamos, Bandelier National Monument is a spectacular open record of sporadic farming dating almost 3,000 years ago. In the next thousand years (nearly 2000 B.C.), a more established type of farming was taking place by people inhabiting the cave shelters of the canyon.

Further down river, the distinctive natural river crossing of the Rio Grande just north of the Sandia Mountains is the geographic crossroads of the area. North, south, east, and west traffic was centered in and around Bernalillo, which is now the County Seat of Sandoval County.

The first land to be settled by Spanish colonists in the winter of 1540 was near Bernalillo. Like the Pueblo Indians, they farmed the flat lands along the river and throughout the next century, settlers began establishing ranches there.

In the 1620s, the Spanish built mission churches in the Rio Grande pueblos. By 1680, there were 3,000 Spaniards in this region called New Spain, and ten times that many Indians. In 1680, the Indians rose up and drove the Spanish out of the valley back to Mexico, where they stayed for 15 years before returning to New Mexico.

Bernalillo was established as a village in 1695. Vineyards and orchards were planted and were an important industry in the central valley. Sheep ranching in the 18th and 19th centuries was an important occupation of the Spanish land grant families.

In 1848, General Kearney took possession of New Mexico for the United States. In 1849, Sandoval was called Santa Ana County and by 1852, another change established the county borders running across Arizona to the California line. In 1876, Santa Ana County was abolished and the area was annexed to Bernalillo County. In 1903, it was named Sandoval County for a prominent family in the area at the time. Finally on March 16, 1949, the County of Los Alamos was formed from portions of Sandoval and Santa Fe Counties.

In 1942, the Federal government purchased most of what is now Los Alamos County for use in developing the world's first atomic fission weapon. The Atomic
Energy Commission, predecessor to the Department of Energy, took control of Los Alamos Scientific Laboratory (LASL) in 1947. The area became an "open city" in 1957 when restrictive access was lifted. In 1980, the lab's name was changed to Los Alamos National Laboratory (LANL). LANL continues to be one of the outstanding research centers of the world today, and operates in cooperation with the University of California.

In 2000, the population of Sandoval County was about 89,908 and that of Los Alamos County was about 18,343.

**The Geology and Geomorphology of Sandoval County**

The geology and geomorphology of Sandoval County is a complex area including portions of two major physiographic divisions. A portion of the northwestern corner of the county falls within the Rocky Mountain System major division, and more specifically within the Southern Rocky Mountains physiographic province. This area is characterized by complex mountains of various types and intermountain basins. The remainder of the county is included within the Intermontane Plateaus major division. Within this division are portions of the Colorado Plateaus physiographic province, Navajo and Datil sections; and the Basin and Range physiographic province, Mexican Highland section.

The Southern Rocky Mountain physiographic province includes the Jemez and Nacimiento mountains. The Nacimiento Mountains are the surface expression of the Nacimiento uplift and fault zone. The western edge of the Nacimiento Mountains is bordered by the westerly dipping Mesozoic rocks of the San Juan Basin. The Nacimiento uplift has been slightly overthrust to the west and formed a prominent hogback between the east edge of the San Juan Basin and the west edge of the uplift. The Nacimiento Fault escarpment extends north to south from northeast of Cuba to a point west of San Ysidro. Most of this escarpment is composed of Precambrian age granite. The granite is overlain by upper Paleozoic rocks in an irregular, 3 to 6 mile wide band along its eastern edge. These are in turn overlain by the younger deposits of volcanic flows and pyroclastics that form the broad based cone surrounding the Jemez volcanic center. The cone extends south to the Jemez Pueblo, and to the west bank of the Rio Grande.

The Jemez Mountains are the dominant physical feature in this area. These mountains were created through volcanic activity. The remnant volcanic caldera is one of the largest caldera features on the earth. Several resurgent domes have risen in the interior of the caldera with the largest cone rising to an elevation of 11,252 feet above sea level. Within the Jemez Mountains, large volumes of volcanic tuff and pumice are found. These materials represent two large eruptions that shaped the form of these mountains. Huge amounts of volcanic gases and ash representing 50 cubic miles of rock materials were ejected from the destroyed composite volcano. Ash clouds drifted as far north and east as Iowa. The welded ash known as the Bandelier Tuff was deposited by these eruptions. Geothermal springs are well represented in these mountains. The source of the hot water is shallow, hot rocks bearing evidence to the areas volcanic past.

The Colorado Plateau physiographic province covers the northwest portion of the county. This area is represented by the southeastern portion of the San Juan Basin. Tertiary aged rocks of the San Jose Formation and the Nacimiento Formation are found at the ground surface. These units consist of sandstone, siltstone, and claystone. Some of the clays have high shrink-swell potential. Some Cretaceous aged marine sandstones and shale are also found on the flanks of the San Juan Basin. Some of the marine deposited shale are quite thick and contribute to water quality issues due to the large amounts of salts found in these units.
The Navajo Section of the Colorado Plateau physiographic province is found in the southwest corner of the survey area. It is characterized by a young plateau with minor relief. The plateau is formed from Cretaceous aged marine sandstone and shale. The landforms represented include mesas and canyons with eroded shale plains. Exposures of underlying Triassic and Jurassic aged rocks are scattered across the area but generally concentrated on the western flanks of the Nacimiento Mountains. These exposures in some cases are the result of erosion of the overlying, relatively soft Cretaceous rocks, but more commonly due to the movement of deep seated faults. Volcanic necks and lava flows are found in the westernmost portion of this area. These Tertiary aged rocks and flows are scattered through the Rio Puerco valley. The western extent of these flows form Mesa Chivato. Cabezon Peak is the largest and best known volcanic neck in the region. Its prominent profile is due to the erosion of softer Cretaceous aged rocks that surround the more erosive resistant volcanic materials.

The Navajo Section is drained by the Rio Puerco. The river is deeply incised within the highly erosive silty to sandy soils. Some of the extent of the erosion was caused by relocation of the channel south of Cuba by the highway department. The relocation of the channel caused a shortening and steepening of the channel geomorphology. The result of these changes caused the river to downcut in excess of 20 feet in some areas. The remainder of the watershed was forced to adjust to the newly created base level. The result of this adjustment was large-scale erosion and the movement of extreme amounts of sediment down the Rio Puerco and into the Rio Grande.

The Basin and Range physiographic province located within Sandoval County is found in the southeast corner of the county. The Mexican Highland section is characterized by isolated mountain ranges separated by aggraded desert plains. From the southern and southeastern boundary of the Jemez volcanic deposits, the land surface is covered with the poorly indurated rocks of the Tertiary aged Santa Fe Group. These basin fill deposits are associated with materials moving from surrounding mountains and highlands and filling the down-dropped basins that formed the ancestral Rio Grande River corridor. The extreme southeastern corner of the survey includes the northern end of the Sandia Mountains. The Sandia Mountains are the uplifted portion of a massive fault block that exposes Precambrian aged granite to the west, and is capped with easterly dipping Pennsylvanian aged limestone and sandstone. Geologic hazards, including radon gas and collapsible soils, are associated with alluvial fans and channels draping off the flanks of the Sandia Mountains. The mode of deposition of much of the alluvial fans makes them favorable to the development of collapsible soils.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous
areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

**Mapping Unit Composition**

Soils in this survey area were mapped at two levels of detail. The detail of mapping in an area was selected based on the area's anticipated long term use.
At the most detailed level, mapping units are narrowly defined. Soil boundaries are plotted and verified at closely spaced intervals. Agricultural areas along the Rio Grande Valley were mapped at this level of detail.

Most of the survey area is used as rangeland, and mapping was performed at a less detailed level. The mapping units in this area are broadly defined. Soil boundaries were plotted and verified at widely spaced intervals. In general, these mapping units are less homogeneous and contain more minor soil components areas than the more detailed mapping units. These units are designed primarily for planning the management of large tracts of land as rangeland. They provide general information for development, but the information should be used with caution. Onsite investigation is essential to provide the detail needed for planning intensive land uses.

Climate

Prepared by the Natural Resources Conservation Service National Water and Climate Center, Portland, Oregon.

Climate tables are created from climate stations Cuba, Jemez Springs, Torreon Navajo Mission, and Wolf Canyon, New Mexico.

Thunderstorm days, relative humidity, percent sunshine, and wind information are estimated from First Order station in Albuquerque, New Mexico.

Table 1 gives data on temperature and precipitation for the survey area as recorded at these four climate stations in the period 1971 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, average temperatures are 27.2, 34.9, 30.9 and 24.0 degrees F at Cuba, Jemez Springs, Torreon, and Wolf Canyon, respectively. Average daily minimum temperatures are 10.5, 21.5, 17.4, and 9.3 degrees, respectively. The lowest temperatures on record were -40 degrees at Cuba on February 1, 1951; and -18 degrees at Jemez Springs, -33 degrees at Torreon, and -36 degrees at Wolf Canyon, all on January 6, 1971.

In summer, average temperatures are 64.5, 70.1, 70.0, and 56.7 degrees, respectively, at Cuba, Jemez Springs, Torreon, and Wolf Canyon. Average daily maximum temperatures are 83.1, 86.8, 87.0, and 73.9 degrees, respectively. The highest temperatures ever recorded were 102 degrees at Cuba on July 3, 1953; 101 degrees at Jemez Springs on July 28, 1995; 107 degrees at Torreon on August 9, 1962; and 90 degrees at Wolf Canyon on July 11, 1958.

Growing degree days are shown in Table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Average annual total precipitation is variable across this soil survey area. In general, lower elevations, mostly in the south and west, receive between 8 and 12 inches of annual precipitation, while to the north amounts increase with elevation, and are generally between 11 and 18 inches. Elevations above 7,000 feet receive up to 30 inches or more, depending on slope and other factors. Average annual precipitation at these four stations is 12.57 inches at Cuba, 17.63 inches at Jemez Springs, 10.80 inches at Torreon, and 24.28 inches at Wolf Canyon (at 8,220 feet in elevation).

Generally, about half of the annual precipitation falls between June and September at elevations below 7,500 feet, but in the higher mountainous elevations a greater percentage of precipitation falls as snow during the winter. The heaviest 1-day precipitation amounts during the periods of record were 2.25 inches at Cuba on October 31, 1998; 2.78 inches at Jemez Springs on October 16, 1960; 1.83 inches at
Thunderstorms occur on about 40 days each year (with slightly more at the higher elevations), and most occur between May and September, with more than 22 in July and August.

Average seasonal snowfall over the area also is quite dependent on elevation and location relative to the mountains. Average annual snowfall is 27.6, 32.5, 20.5, and 128.1 inches, respectively, at Cuba, Jemez Springs, Torreon, and Wolf Canyon. The greatest snow depths at any one time during the periods of record were 22 inches at Cuba, recorded on December 20, 1967; 20 inches at Jemez Springs, on January 16, 1987; 16 inches at Torreon on March 22, 2000; and 46 inches at Wolf Canyon on February 2, 1979. On average, about 15 to 25 days per year have at least 1 inch of snow on the ground at lower elevations, while at higher elevations up to 90 days or more are snow-covered. For these four stations, number of days ranges from 18 at Cuba and Torreon, to 25 at Jemez Springs, and 96 days at Wolf Canyon. The heaviest 1-day snowfalls on record were 13.5 inches at Cuba, recorded on March 4, 1964; 19.8 inches at Jemez Springs on January 16, 1987; 14.0 inches at Torreon on March 21, 2000; and 26.0 at Wolf Canyon on January 16, 1987.

The average relative humidity in mid-afternoon is about 40 percent in the winter and between 15 and 20 percent in the summer. Humidity is higher at night, and the average at dawn is about 70 percent in the winter and 45 percent in the summer. The sun shines about 75 to 80 percent of the time in summer and around 65 to 70 percent in winter. The prevailing wind is from the northwest in the winter and early spring and from the south and southeast the remainder of the year. Average wind speed is highest, around 12 miles per hour, in April.
General Soil Map Unit Descriptions

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Dry soils on plateaus and flood plains

This group consists of two map units and makes up about 9 percent of the survey area. The slopes range from 0 to 15 percent, but included areas range to 40 percent. The present vegetation consists of grass and shrubs. Elevation is 5,000 to 6,000 feet. The average annual precipitation is 8 to 10 inches; the average annual air temperature is 53 to 55 degrees F., and the average frost-free period is 140 to 160 days.

The soils in this group formed in alluvium and eolian material derived from sediment of mixed sources.

The soils in this group are used for irrigated farming, urban development, and wildlife habitat.

1. Gilco-Trail-Peralta

Very deep soils on the flood plain of the Rio Grande River

This map unit is in the east-central part of the survey area along the Rio Grande River. The slopes range from 0 to 4 percent. The native vegetation on this unit consists mainly of grasses and shrubs. Elevation is 5,000 to 6,000 feet. The average annual precipitation is 8 to 10 inches; the average annual air temperature is 53 to 55 degrees F., and the average frost-free period is 140 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 34 percent Gilco and similar soils, 26 percent Trail and similar soils, and 15 percent Peralta soils. The remaining 25 percent is comprised of components of minor extent.

Gilco soils are on the flood plain of the Rio Grande River. These soils are very deep, moderately well drained, and moderately permeable. They formed in stream alluvium. The surface layer is brown loam about 4 inches thick. The underlying material is light yellowish brown stratified silt loam, loam, and fine sandy loam to a depth of 60 inches or more.
Trail soils are on the flood plain of the Rio Grande. These soils are very deep, moderately well drained, and moderately rapidly permeable. They formed in eolian material and stream alluvium. The surface layer is light yellowish brown fine sandy loam about 9 inches thick. The upper 27 inches of the underlying material is very pale brown loamy sand. The lower part is very pale brown sandy loam to a depth of 60 inches or more.

Peralta soils are on the flood plain of the Rio Grande. These soils are very deep, somewhat poorly drained, and moderately permeable. They formed in stream alluvium. The surface layer is brown loam about 10 inches thick. The underlying layer is stratified brown, light yellowish brown, pale brown, and yellowish brown very fine sandy loam, fine sandy loam, loamy sand, and loamy fine sand, with thin lenses of silt loam, and clay loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Jocity and Sparham soils and Riverwash along the Rio Grande channel.

This unit is used mainly for irrigated crops. It is also used for wildlife habitat, urban development, and livestock grazing. The hazard of soil blowing and seepage are the main limitations for most uses.

This unit supports a diversity of wildlife habitats, including riparian trees, river, and wetland; irrigated croplands, orchards, and rural residential.

Characteristic wildlife includes raccoon, striped skunk, cottontail rabbit, pocket gopher, mourning dove, pheasant, swallow, bullsnake, and woodhouse toad. The aquatic and wetland habitats support beaver, muskrat, and bullfrogs. This unit is an important migratory corridor for sandhill cranes, snow geese, and ducks.

2. Sheppard-Grieta

Very deep soils on dunes and ridges

This map unit is in the south-central part of the survey area. The slopes range from 1 to 15 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 5,000 to 6,000 feet. The average annual precipitation is 8 to 10 inches; the average annual air temperature is 53 to 55 degrees F., and the average frost-free period is 140 to 160 days.

This unit makes up about 6 percent of the survey area. It is about 45 percent Sheppard soils and 43 percent Grieta soils. The remaining 12 percent is comprised of components of minor extent.

Sheppard soils are on dunes. These soils are very deep, somewhat excessively drained, and rapidly permeable. They formed in eolian sands. The surface layer is light brown loamy fine sand about 3 inches thick. The upper 24 inches of the underlying material is strong brown loamy fine sand. The lower part is pink loamy fine sand to a depth of 60 inches or more.

Grieta soils are on ridges. These soils are very deep, well drained, and moderately permeable. They formed in eolian material and fan alluvium. The surface layer is brown loamy fine sand about 7 inches thick. The subsoil is yellowish brown and pale brown sandy clay loam about 14 inches thick. The substratum is light yellowish brown, white, and very pale brown coarse sandy loam to a depth of 60 inches or more.

Other soils in this unit are Cascajo, Embudo, and Tijeras soils.

This unit is used mainly for urban development. It is also used for wildlife habitat and livestock grazing. A hazard of soil blowing due to the sandy surface layers is the main limitation to most uses. Vegetative cover aids in the control of soil blowing.

This unit furnishes a desert grassland wildlife habitat which has been heavily impacted by human activities. While the vegetative base is in fair or good condition, the habitat has been degraded.

Characteristic wildlife includes coyote, badger, kit fox, scaled quail, horned lark, western kingbird, collared lizard, and prairie rattlesnake.
Moist soils on valley floors, valley sides, plateaus, cuestas, and mesas

This group consists of 11 map units. It makes up about 82 percent of the survey area. The slopes range from 0 to 60 percent but may climb to 70 percent. The present vegetation consists of grass and trees. Elevation is dominantly 5,500 to 6,500 feet, but ranges from 5,000 to 7,500 feet. The average annual precipitation is 10 to 16 inches; the average annual air temperature is 48 to 54 degrees F., and the average frost-free period is 110 to 140 days.

The soils formed in alluvium, colluvium, and eolian materials derived from volcanic rocks, gypsum, limestone, sandstone, and shale.

This group is used for livestock grazing, fuel wood, and wildlife habitat.

3. Harvey-Cascajo-Ildefonso

Very deep soils on mesas, hills, and fan terraces

This map unit is in the eastern part of the survey area. The slopes range from 1 to 45 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 6,300 to 6,500 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 52 to 54 degrees F.; and the average frost-free period is 120 to 140 days.

This unit makes up about 9 percent of the survey area. It is about 30 percent Harvey and similar soils, 23 percent Cascajo and similar soils, and 22 percent Ildefonso and similar soils. The remaining 25 percent is comprised of components of minor extent.

Harvey soils are on mesas. These soils are very deep, well drained, and moderately permeable. They formed in eolian material and fan alluvium. The surface layer is pinkish gray loam about 4 inches thick. The subsoil is pinkish gray loam about 6 inches thick. The upper 31 inches of the substratum is pinkish gray and pink clay loam. The lower part is reddish yellow sandy clay loam to a depth of 60 inches or more.

Cascajo soils are on hills. These soils are very deep, excessively drained, and rapidly permeable. They formed in fan alluvium. The surface layer is pale brown and very pale brown very gravelly sandy loam about 5 inches thick. The upper 6 inches of the underlying material is very pale brown very gravelly sandy loam. The next 19 inches is pale and light brown very gravelly loamy sand. The lower part is light brown extremely cobbly loamy sand to a depth of 60 inches or more.

Ildefonso soils are on fan terraces. These soils are very deep, well drained, and moderately rapidly permeable. They formed in colluvium and fan alluvium. The surface layer is brown cobbly loam about 2 inches thick. The subsoil is brown and pale brown very gravelly loam about 11 inches thick. The upper 27 inches of the substratum is very pale brown very cobbly sandy loam. The lower part is very pale brown extremely cobbly sandy to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Skyvillage, Pastura, and Placitas soils, and Riverwash.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat and urban development. Slope and droughtiness are the main limitations to most uses. Overgrazing is an important concern of management because it increases the risk of water erosion, and promotes an increase of undesirable plants.

This unit contains both desert grassland and juniper grassland wildlife habitats. There is little habitat diversity other than shrub thickets in the drainage ways.

Characteristic wildlife includes coyote, kit fox, blacktailed jackrabbit, kangaroo rat, spotted ground squirrel, horned lark, burrowing owl, scaled quail, striped whiptail lizard, bullsnake, and western rattlesnake.
4. Pinavetes-Clovis-Zia
Very deep soils on dunes, plains, alluvial fans, and stream terraces

This map unit is in the central part of the survey area. The slopes range from 1 to 35 percent. The vegetation on this unit consists mainly of grasses and shrubs with scattered trees. Elevation is 5,100 to 7,200 feet. The average annual precipitation is 10 to 13 inches. The average annual air temperature is 52 to 54 degrees F; the average frost-free period is 120 to 140 days.

This unit makes up about 9 percent of the survey area. It is about 32 percent Pinavetes soils, 25 percent Clovis soils, and similar soils, and 23 percent Zia soils. The remaining 20 percent is comprised of components of minor extent.

Pinavetes soils are on dunes. These soils are very deep, excessively drained, and rapidly permeable. They formed in eolian sands derived dominantly from sandstone. The surface layer is light yellowish brown loamy sand about 10 inches thick. The underlying material is light yellowish brown sand to a depth of 60 inches or more.

Clovis soils are on plains. These soils are very deep, well drained, and moderately permeable. They formed in eolian material and slope alluvium. The surface layer is pale brown fine sandy loam about 3 inches thick. The subsoil is brown sandy clay loam about 19 inches thick. The substratum is light brown and reddish yellow sandy clay loam to a depth of 60 inches or more.

Zia soils are on alluvial fans and stream terraces. These soils are very deep, well drained, and moderately rapidly permeable. They formed in eolian material and fan and stream alluvium. The surface layer is pale brown sandy loam about 5 inches thick. The upper 9 inches of the underlying material is pale brown sandy loam. The lower part is light gray, very pale brown, and light yellowish brown sandy loam and sandy clay loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Sandoval and Skyvillage soils, Rock outcrop, and Riverwash.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat and urban development. Soil blowing is the main limitation for most uses. Overgrazing is an important concern of management because it increases the risk of soil blowing and promotes an increase in undesirable plants.

This unit consists of desert shrub, and desert grassland wildlife habitat is interspersed by thin shrub thickets along drainageways. Habitats have been rated as fair for pronghorn and poor for mule deer.

Characteristic wildlife include coyote, kit fox, pronghorn antelope, blacktailed jackrabbit, spotted ground squirrel, horned lark, prairel falcon, meadowlark, horned lizard, bullsnake, and prairie rattlesnake.

5. Sparank
Very deep soils on alluvial fans

This map unit is in the west-central part of the survey area. The slopes range from 0 to 3 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 5,500 to 6,400 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 140 days.

This unit makes up about 3 percent of the survey area. It is about 82 percent Sparank and similar soils. The remaining 18 percent is comprised of components of minor extent.

Sparank soils are on alluvial fans. These soils are very deep, well drained, and very slowly permeable. They formed in stream alluvium. The surface layer is brown clay loam about 2 inches thick. The upper 22 inches of the underlying material is brown silty clay. The lower part is pale brown and dark grayish brown silty clay and silty clay loam to a depth of 60 inches or more.
Other soils and miscellaneous areas in this unit are Orlie, Pinavetes, and Zia soils, and Riverwash.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat, irrigated crops, and urban development. A hazard of flooding, slow permeability, and gullying are the main limitations for most uses. Overgrazing is an important concern of management because it increased the risk of flooding and gullying and promotes an increase in undesirable plants.

This unit consists of valley and bottomland grasslands wildlife habitats which are mostly in poor vegetative condition. Diversity of vegetation is provided by seasonal streamflow, wetlands, salt flats, and scattered thickets of trees or shrubs.

Characteristic wildlife includes blacktailed jackrabbit, pocket gopher, prairie dog, scaled quail, sandpiper, woodhouse toad, and garter snake.

6. Rock outcrop-Frijoles-Hackroy

Rock outcrop and deep to shallow soils on narrow mesas and plateaus formed from tuff and pumice

This map unit is in the northeastern part of the survey area. The slopes range from 1 to 8 percent. The vegetation consists mainly of pinyon and juniper. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 13 to 16 inches; the average annual air temperature is 48 to 52 degrees F; and the average frost-free period is 110 to 130 days.

This unit makes up about 3 percent of the survey area. It is about 52 percent Rock outcrop, 14 percent Frijoles soils, and 14 percent Hackroy soils. The remaining 20 percent is comprised of components of minor extent.

Rock outcrop is found on the edges and sides of mesas.

Frijoles soils are on mesas. These soils are deep, well drained, and moderately permeable. They formed in eolian material and alluvium. The surface layer is brown very fine sandy loam about 3 inches thick. The subsoil is brown very gravelly clay loam about 10 inches thick. The upper 7 inches of the substratum is pinkish gray extremely gravelly sandy loam. The lower part is pinkish white pumice pebbles to a depth of 60 inches or more.

Hackroy soils are on plateaus. These soils are very shallow or shallow, well drained, and slowly permeable. They formed in residuum. The surface layer is brown sandy loam about 3 inches thick. The subsoil is reddish brown clay about 10 inches thick. Tuff is at a depth of 13 inches.

Other soils in this unit are Hagerman, Nyjack, Penistaja, and Totavi.

This unit is used mainly for wildlife habitat. It is also used for urban development. Depth to tuff and pumice are the main limitations for most uses.

This unit contains a complex of wildlife habitat types. The valley is a combination of juniper grassland and shrub-forb grassland. Upslope there are valuable browse plants such as oak, sumac, saltbush, and sagebrush. There are pinyon-juniper woodlands on mesa tops and northern slopes. Stringers of ponderosa pine follow drainages and eastern slopes at higher elevations.

Characteristic wildlife includes mountain cottontail, coyote, woodrat, valley pocket gopher, scrub jay, raven, fence lizard, and western diamondback rattlesnake. The band-tailed pigeon uses this unit when foraging for oak acorns and pinyon nuts. The prominent rock outcrops furnish habitat for the ringtail, bats, and several hawks.

7. Bamac-Espiritu-Cochiti

Very deep soils on fan remnants, mountain slopes, and fan terraces

This map unit is in the east-central part of the survey area. The slopes range from 1 to 50 percent. The vegetation on this unit consists mainly of pinyon and juniper with an understory of grasses and shrubs. Elevation is 5,400 to 6,500 feet. The average
annual precipitation is 13 to 16 inches; the average annual air temperature is 48 to 52 degrees F.; and the average frost-free period is 110 to 130 days.

This unit makes up about 5 percent of the survey area. It is about 36 percent Bamac, 30 percent Espiritu and similar soils, and 13 percent Cochiti and similar soils. The remaining 19 percent is comprised of components of minor extent.

Bamac soils are on fan remnants. These soils are very deep, excessively drained, and very rapidly permeable. They formed in slope and fan alluvium. The surface layer is light yellowish brown very gravelly loamy sand about 4 inches thick. The upper 6 inches of the underlying material is light yellowish brown loamy sand. The lower part is very pale brown, pale brown, and pink very gravelly loamy coarse sand to a depth of 60 inches or more.

Espiritu soils are on mountain slopes. These soils are very deep, well drained, and moderately permeable. They formed in slope alluvium and colluvium. The surface layer is brown very gravelly fine sandy loam about 6 inches thick. The subsoil is brown and light brown very gravelly sandy clay loam about 16 inches thick. The substratum is stratified pale brown, strong brown, and reddish yellow very cobbly sandy clay loam, fine sandy loam, and very gravelly sandy loam to a depth of 60 inches or more.

Cochiti soils are on fan terraces. These soils are very deep, well drained, and slowly permeable. They formed in gravelly alluvium. The surface layer is dark yellowish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is reddish brown gravelly clay loam and very gravelly clay. The lower 9 inches is light reddish brown very gravelly clay loam. The substratum is light reddish brown very gravelly sandy loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Elpedro, Flugle, and Montecito soils, and Rock outcrop.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat and fuel wood production. A hazard of droughtiness, slope, and sandy surface layer are the main limitations for most uses. Overgrazing is an important concern of management because it increases the risk of water erosion and promotes an increase in undesirable plants.

This unit provides pinon-juniper wildlife habitat which furnishes winter range for elk and mule deer. Characteristic wildlife includes coyote, gray fox, rock squirrel, pinon jay, plain titmouse, redtail hawk, short horned lizard, and blacktailed rattlesnake.

8. Silver-Ildefonso-Clovis
Very deep soils on mesas, fan terraces, and plains

This map unit is in the central part of the survey area. The slopes range from 1 to 15 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 5,600 to 7,300 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 52 to 54 degrees F.; and the average frost-free period is 120 to 140 days.

This unit makes up about 8 percent of the survey area. It is about 43 percent Silver and similar soils, 20 percent Ildefonso and similar soils, and 19 percent Clovis and similar soils. The remaining 18 percent is comprised of components of minor extent.

Silver soils are on mesas. These soils are very deep, well drained, and slowly permeable. They formed in eolian material and slope alluvium. The surface layer is pale brown loam about 4 inches thick. The upper 16 inches of the subsoil is light brown and brown silty clay loam. The lower 19 inches is brown clay loam. The substratum is brown clay loam to a depth of 60 inches or more.

Ildefonso soils are on fan terraces. These soils are very deep, well drained, and moderately rapidly permeable. They formed in fan alluvium and colluvium derived from basalt. The surface layer is brown cobbly loam about 2 inches thick. The subsoil
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is brown and pale brown very gravelly loam about 11 inches thick. The substratum is very pale brown very cobbly sandy loam and extremely cobbly sand to a depth of 60 inches or more.

Clovis soils are on plains. These soils are very deep, well drained, and moderately permeable. They formed in eolian material and slope alluvium. The surface layer is pale brown fine sandy loam about 3 inches thick. The subsoil is brown sandy clay loam about 19 inches thick. The substratum is light brown and reddish yellow sandy clay loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Sandoval, Orejas, and Prieta soils, and Rock outcrop.

This unit is used for livestock grazing. It is also used for wildlife habitat. Overgrazing is an important concern of management because of the increase in undesirable plants.

This unit consists of a mesa grassland wildlife habitat.

Characteristic wildlife includes coyote, blacktailed jackrabbit, ground squirrel, least chipmunk, prairie falcon, golden eagle, and bullsnake.

9. Royosa-Fragua

Very deep soils on dunes and fan remnants

This map unit is in the central part of the survey area. The slopes range from 1 to 8 percent. The vegetation on this unit consists mainly of pinyon and juniper with a grass understory. Elevation is 5,600 to 6,200 feet. The average annual precipitation is 13 to 16 inches; the average annual air temperature is 48 to 52 degrees F; and the average frost-free period is 110 to 130 days.

This unit makes up about 6 percent of the survey area. It is about 60 percent Royosa and similar soils and 35 percent Fragua and similar soils. The remaining 5 percent is comprised of components of minor extent.

Royosa soils are on dunes. These soils are very deep, somewhat excessively drained, and very rapidly permeable. They formed in eolian sands. The surface layer is very pale brown sand about 5 inches thick. The underlying material is brown and brownish yellow sand and loamy sand to a depth of 60 inches or more.

Fragua soils are on fan remnants. These soils are very deep, well drained, and moderately rapidly permeable. They formed in fan alluvium and eolian material derived from sandstone. The surface layer is brown loamy sand about 3 inches thick. The subsoil is brown sandy loam about 21 inches thick. The substratum is brown sandy loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are San Mateo soils and Rock outcrop.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat and fuel wood production. A hazard of droughtiness, soil blowing, and a sandy surface layer are the main limitations for most uses. Overgrazing is an important concern of management because it increases the risk of soil blowing and promotes an increase in undesirable plants.

This unit provides juniper grassland and pinyon-juniper woodland wildlife habitats. Habitat condition is low and provides poor winter range for elk and mule deer.

10. Blanchot-Badland-Counceror

Very deep soils and Badland on valley sides and stream terraces

This map unit is in the northwestern part of the survey area. The slopes range from 1 to 8 percent. The vegetation on this unit consists mainly of grasses and shrubs with widely scattered trees. Elevation is 6,600 to 7,000 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 48 to 52 degrees F; and the average frost-free period is 120 to 140 days.
This unit makes up about 5 percent of the survey area. It is about 31 percent Blancot and similar soils, 25 percent Badland, and 20 percent Counselor soils. The remaining 24 percent is comprised of components of minor extent.

Blancot soils are on valley sides. These soils are very deep, well drained, and moderately slowly permeable. They formed in fan alluvium. The surface layer is pale brown fine sandy loam about 2 inches thick. The subsoil is grayish brown and yellowish brown clay loam about 21 inches thick. The substratum is pale brown and light brownish gray sandy loam with thin strata of silty clay loam to a depth of 60 inches or more.

Badland areas are on ridges and side slopes. They are derived from shale.

Counselor soils are on stream terraces. These soils are very deep, well drained, and moderately rapidly permeable. They formed in eolian material and stream alluvium. The surface layer is pale brown fine sandy loam about 2 inches thick. The upper 35 inches of the underlying material is pale brown fine sandy loam. The next 3 inches is pale brown clay loam. The lower part is pale brown sandy loam to a depth of 60 inches or more.

Other soils in this unit are Doakum, Mespun, Tsosie, and Lybrook soils.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat. A hazard of soil blowing, gullying, and water erosion are the main limitations for most uses. Overgrazing is an important concern of management because it increases the risk of soil blowing and gullying and promotes an increase of undesirable plants.

This unit provides a grassland wildlife habitat of low rating.

Characteristic wildlife includes coyote, prairie dog, pocket gopher, blacktailed jackrabbit, burrowing owl, horned lark, meadowlark, horned lizard, and western toad.

11. Sandoval-Querencia-Zia
Shallow and very deep soils on ridges, alluvial fans, and stream terraces

This map unit is in the west-central part of the survey area. The slopes range from 1 to 30 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 5,100 to 7,000 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 52 to 54 degrees F.; and the average frost-free period is 120 to 140 days.

This unit makes up about 20 percent of the survey area. It is about 31 percent Sandoval and similar soils, 27 percent Querencia and similar soils, and 17 percent Zia and similar soils. The remaining 25 percent is comprised of components of minor extent.

Sandoval soils are on ridges. These soils are shallow, well drained, and moderately slowly permeable. They formed in slope alluvium. The surface layer is light yellowish brown fine sandy loam about 2 inches thick. The upper 4 inches of the underlying material is light gray clay loam. The lower part is light brownish gray clay loam to a depth of 15 inches. Shale is at a depth of 15 inches.

Querencia soils are on alluvial fans. These soils are very deep, well drained, and moderately permeable. They formed in fan alluvium and colluvium. The surface layer is light brownish gray sandy clay loam about 4 inches thick. The upper 8 inches of the subsoil is light yellowish brown clay loam. The lower 12 inches is pale yellow loam. The substratum is pale yellow loam to a depth of 60 inches or more.

Zia soils are on stream terraces and alluvial fan. These soils are very deep, well drained, and moderately rapidly permeable. They formed in eolian material and fan and stream alluvium. The surface layer is pale brown sandy loam about 5 inches thick. The underlying material is pale brown, light gray, very pale brown, and light yellowish brown sandy loam and sandy clay loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Saldo, Camino, Winona, San Mateo, and Sarenk soils, and Rock outcrop.
This unit is used mainly for livestock grazing. It is also used for wildlife habitat. The hazard of soil blowing and water erosion are the main limitations for most uses. Overgrazing is an important concern of management because it increases the hazard of soil blowing and water erosion and promotes an increase of undesirable plants.

This unit furnishes a grassland wildlife habitat with shrubs located in drainages and on eroded areas. There is a herd of pronghorn antelope located east of Cabezon Peak. Overall pronghorn antelope habitat has been rated as low. An important migration route for elk and mule deer lies between Sierra Nacimiento and La Ventana Mesa.

Characteristic wildlife includes pronghorn antelope, blacktailed jackrabbit, coyote, kangaroo rat, prairie dog, horned iark, raven, ferruginous hawk, and golden eagle.

12. Menefee-Vessilla-Orlie

_Shallow and very deep soils on hillslopes, mesas, and cuestas_

This map unit is in the western and northwestern parts of the survey area. The slopes range from 2 to 60 percent. The vegetation consists mainly of pinyon and juniper. Elevation is 6,500 to 8,000 feet. The average annual precipitation is 13 to 16 inches; the average annual air temperature is 48 to 52 degrees F.; and the frost-free period is 110 to 130 days.

This unit makes up about 12 percent of the survey area. It is about 26 percent Menefee and similar soils, 25 percent Vessilla and similar soils, and 25 percent Orlie and similar soils. The remaining 24 percent is comprised of components of minor extent.

Menefee soils are on hillslopes. These soils are shallow, well drained, and slowly permeable. They formed in colluvium and residuum. The surface layer is light yellowish brown clay loam about 5 inches thick. The underlying material is light olive brown and light brownish gray clay loam to a depth of 17 inches. Shale is at a depth of 17 inches.

Vessilla soils are on structural benches and mesas. These soils are shallow or very shallow, well drained, and moderately rapidly permeable. They formed in eolian material, slope alluvium and residuum. The surface layer is light yellowish brown gravelly fine sandy loam about 2 inches thick. The underlying material is light brown gravelly fine sandy loam about 9 inches thick. Sandstone is at a depth of 11 inches.

Orlie soils are on cuestas. These soils are very deep, well drained, and moderately slowly permeable. They formed in fan alluvium and eolian material. The surface layer is pale brown loam about 2 inches thick. The subsoil is brown clay loam about 20 inches thick. The substratum is pale brown and brown silty clay loam and clay loam to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Sparham, Tecco, and Wauquie soils, Rock outcrop, and Badland.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat and fuel wood production. Shallow soil depth, water erosion hazard and slope are the main limitations for most uses. Overgrazing is an important concern of management because it increases the risk of water erosion and gullying and promotes an increase in undesirable plants.

This unit occurs as widely scattered wildlife habitats dominated by pinyon-juniper woodland, but also including rocky areas. Shrubs may be an important habitat component. Sources of water may be scarce in dry years.

Characteristic wildlife includes mule deer, bobcat, porcupine, mountain cottontail, woodrat, scrub jay, junco, Cooper's hawk, brown towhee, and blacktailed rattlesnake.
13. Doakum-Betonnie

Very deep soils on hills

This map unit is in the northwestern part of the survey area. The slopes range from 0 to 8 percent. The vegetation consists mainly of grasses and shrubs with scattered trees. Elevation is 6,600 to 7,000 feet. The average annual precipitation is 10 to 13 inches; the average annual air temperature is 48 to 52 degrees F.; and the average frost-free period is 110 to 130 days.

This unit makes up about 2 percent of the survey area. It is about 55 percent Doakum soils, and 35 percent Betonnie soils. The remaining 10 percent is components of minor extent.

Doakum soils are on hills. These soils are very deep, well drained and moderately permeable. They formed in eolian material and slope alluvium. The surface layer is light yellowish brown fine sandy loam about 5 inches thick. The subsoil is brown clay loam and sandy clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam and clay loam.

Betonnie soils are on hills. These soils are very deep, well drained, and moderately rapidly permeable. They formed in eolian material and slope alluvium. The surface layer is light yellowish brown fine sandy loam about 2 inches thick. The subsoil is brown fine sandy loam and sandy loam about 16 inches thick. The substratum to a depth of 60 inches or more is yellowish brown and pale brown sandy loam.

Other soils in this unit are Blancot, Eslendo, and Mespun soils.

This unit is used mainly for livestock grazing. It is also used for wildlife habitat. Overgrazing is an important concern of management because it increases the risk of soil blowing and gullying and promotes an increase of undesirable plants.

This unit of desert shrub and desert grassland wildlife habitat is interspersed by thin shrub thickets along drainageways. Habitats have been rated as fair for pronghorn antelope and poor for mule deer.

Characteristic wildlife include coyote, kit fox, pronghorn antelope, blacktailed jackrabbit, spotted ground squirrel, horned lark, prairie falcon, meadowlark, horned lizard, bullsnake, and prairie rattlesnake.

Moist, cold soils on mountain slopes and mountain valleys

This group consists of 2 units. It makes up about 9 percent of the survey area. The slopes range from 1 to 80 percent. The present vegetation consists of mountain grasses and trees. Elevation is 8,000 to 11,000 feet, but included areas range only to 7,500 feet. The average annual precipitation is 20 to 30 inches; the average annual air temperature is 38 to 45 degrees F.; and the average frost-free period is 45 to 90 days.

The soils formed in alluvium and colluvium derived dominantly from tuff and rhyolite.

This group is used for livestock grazing, timber production, and wildlife habitat.

14. Cosey-Jarmillo-Tranquilar

Very deep soils on mountain slopes and stream terraces

This map unit is in the northern part of the survey area. The slopes range from 1 to 20 percent. The vegetation on this unit consists mainly of grasses and shrubs. Elevation is 8,000 to 9,200 feet. The average annual precipitation is 20 to 25 inches; the average annual air temperature is 42 to 45 degrees F.; and the average frost-free period is 60 to 90 days.

This unit makes up about 2 percent of the survey area. It is about 30 percent Cosey and similar soils, 24 percent Jarmillo and similar soils, and 21 percent Tranquilar soils. The remaining 25 percent is components of minor extent.

Cosey soils are on mountain slopes. These soils are very deep, well drained and moderately slowly permeable. They formed in slope alluvium and colluvium. The
Redondo-Palon-Calaveras

Very deep soils on mountain slopes

This map unit is in the northern part of the survey area. The slopes range from 5 to 80 percent. The vegetation on this unit consists mainly of trees. Elevation is 8,500 to 11,000 feet. The average annual precipitation is 25 to 30 inches; the average annual air temperature is 38 to 42 degrees F.; and the average frost-free period is 45 to 60 days.

This unit makes up about 7 percent of the survey area. It is about 33 percent Redondo and similar soils, 23 percent Palon and similar soils, and 22 percent Calaveras and similar soils. The remaining 22 percent is comprised of components of minor extent.

Redondo soils are on mountain slopes. These soils are very deep, well drained, and moderately rapidly permeable. They formed in colluvium. The surface layer is grayish brown coarse sandy loam about 2 inches thick. The subsurface layer is light brownish gray and light gray coarse sandy loam about 13 inches thick. The upper 7 inches of the subsoil is pink coarse sandy loam. The lower subsoil is light gray and light brown gravelly coarse sandy loam, very gravelly coarse sandy loam, extremely gravelly coarse sandy loam, and extremely cobbly coarse sandy loam to a depth of 60 inches or more.

Palon soils are on mountain slopes. They formed in colluvium and slope alluvium. These soils are very deep, well drained, and moderately rapidly permeable. The surface layer is dark gray and light brownish gray very cobbly sandy loam and extremely cobbly sandy loam about 8 inches thick. The subsurface layer is light gray extremely cobbly sandy loam about 22 inches thick. The subsoil is pink very cobbly sandy loam with light brown sandy clay loam lamellae to a depth of 60 inches or more.

Calaveras soils are on mountain slopes. These soils are very deep, well drained, and moderately permeable. They formed in colluvium. The surface layer is grayish brown and pale brown silt loam about 11 inches thick. The upper 19 inches of the
subsoil is pale brown gravelly silt loam and very cobbly loam. The lower part is light brown extremely cobbly coarse sandy loam and extremely cobbly loamy sand to a depth of 60 inches or more.

Other soils and miscellaneous areas in this unit are Cypher, Osha, Sedmar, Tocal, and Totavi soils, Rubbie land, and Rock outcrop.

This unit is used mainly for timber production. It is also used for wildlife habitat. The slopes are the main limitation for most uses.

This unit furnishes montane conifer forest wildlife habitats. The endangered Jemez Mountain Salamander is found within drainages containing volcanic talus.

Characteristic wildlife includes elk, mule deer, black bear, tassel eared and red squirrel, sapsucker, hairy woodpecker, and Clark’s nutcracker.
Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown
on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Sparham clay loam is a phase of the Sparham series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Flugle-Waumac complex, 1 to 8 percent slopes is an example.

An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Orlie-Sparham association, 0 to 5 percent slopes is an example.

This survey includes miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

1—Silver-Clovis loams, 1 to 7 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 7,300 feet (1,707 to 2,225 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Silver and similar soils: 55 percent
Clovis and similar soils: 35 percent
Minor components: 10 percent

Component Descriptions

Silver soils

Landscape: Uplands
Landform: Mesas, plateaus, hills, fan remnants
Position on landform: Toeslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from sandstone and shale
Slope: 1 to 7 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.7 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Sandoval County Area, New Mexico

Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, needlegrass, winterfat
Land capability subclass (irrigated): 4e
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 4 inches; loam
Bt1—4 to 8 inches; silty clay loam
Bt2—8 to 20 inches; silty clay loam
Bt3—20 to 39 inches; clay loam
C—39 to 60 inches; clay loam

Clovis soils
Landscape: Uplands
Landform: Fan remnants, plains
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from sandstone and shale
Slope: 1 to 7 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.6 inches (high)
Shrink-swell potential: About 3.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, bottlebrush squirreltail
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; loam
Bt—3 to 20 inches; clay loam
Bk1—20 to 40 inches; sandy clay loam
Bk2—40 to 60 inches; fine sandy loam

Minor Components
Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

Prieta and similar soils
Composition: About 5 percent
Slope: 1 to 7 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Malpais

2—Clovis-Prieta-Silver association, 3 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 7,300 feet (1,707 to 2,225 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Clovis and similar soils: 35 percent
Prieta and similar soils: 35 percent
Silver and similar soils: 20 percent
Minor components: 10 percent

Component Descriptions

Clovis soils
Landscape: Uplands
Landform: Fan remnants, plains
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from sandstone and shale
Slope: 3 to 8 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.6 inches (high)
Shrink-swell potential: About 2.6 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, bottlebrush squirreltail
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; loam
Bt—3 to 24 inches; clay loam
Bk—24 to 60 inches; fine sandy loam

Prieta soils
Landscape: Plains
Landform: Mesas, lava flows
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from basalt
Slope: 3 to 15 percent
    Aspect: East to west
    Shape (down/across): Linear/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 14 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Malpais
Potential native vegetation: blue grama, alkali sacaton, hairy grama, little bluestem,
    sideoats grama, black grama, spike muhly, wolftail
Land capability subclass (nonirrigated): 7s

Typical Profile:
    A—0 to 3 inches; very stony loam
    Bt1—3 to 10 inches; very stony clay loam
    Bt2—10 to 14 inches; very stony clay loam
    Bk—14 to 19 inches; very stony clay loam
    R—19 to 60 inches; bedrock

Silver soils
Landscape: Plains
Landform: Fan remnants, hills, mesas, plateaus
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Eolian deposits over slope alluvium derived from sandstone and
    shale
Slope: 3 to 8 percent
    Aspect: East to west
    Shape (down/across): Concave/linear
Surface fragments: About 2 percent subrounded cobbles, about 2 percent
    subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.6 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, bottlebrush
    squirreltail, needlegrass, winterfat
Land capability subclass (nonirrigated): 6e
Typical Profile:
A—0 to 8 inches; loam
Bt—8 to 30 inches; silty clay loam
C—30 to 60 inches; silty clay loam

Minor Components
Rock outcrop
Composition: About 10 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

3—Montecito-Orejas complex, 1 to 7 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,800 to 7,600 feet (2,073 to 2,316 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Montecito and similar soils: 60 percent
Orejas and similar soils: 30 percent
Minor components: 10 percent

Component Descriptions

Montecito soils
Landscape: Uplands
Landform: Plains, mesas, hills
Position on landform: Summits
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 1 to 7 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.6 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
Common trees: twoneedle pinyon, oneseed juniper
Other plants: blue grama, bottlebrush squirreltail, muttongrass
Land capability subclass (nonirrigated): 6e
Sandoval County Area, New Mexico

**Typical Profile:**
- **A**—0 to 3 inches; fine sandy loam
- **Bt**—3 to 18 inches; clay loam
- **2Bk**—18 to 60 inches; clay loam

**Orejas soils**
- **Landscape:** Uplands
- **Landform:** Plateaus, mesas
- **Position on landform:** Summits
- **Position on landform:** Side slope
- **Parent material:** Eolian deposits over colluvium and/or slope alluvium derived from sandstone and shale
- **Slope:** 1 to 7 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Linear/linear
- **Surface fragments:** About 30 percent subrounded cobbles
- **Depth class:** Shallow
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Slowest permeability:** 0.2 to 0.6 in./hr. (moderately slow)
- **Available water capacity:** About 1.9 inches (very low)
- **Shrink-swell potential:** About 4.5 percent (moderate)
- **Runoff class:** High
- **Calcium carbonate maximum:** About 10 percent
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
- **Ecological site:** Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
- **Potential native vegetation:**
  - Common trees: twoneedle pinyon, oneseed juniper
  - Other plants: big sagebrush, blue grama, sideoats grama, oneseed juniper, twoneedle pinyon
- **Land capability subclass (nonirrigated):** 7s

**Typical Profile:**
- **A**—0 to 2 inches; cobbly loam
- **Bt1**—2 to 5 inches; very cobbly clay loam
- **Bt2**—5 to 14 inches; very cobbly clay loam
- **Bt3**—14 to 17 inches; very cobbly clay loam
- **C**—17 to 19 inches; very gravelly clay loam
- **R**—19 to 60 inches; bedrock

**Minor Components**
- **Rock outcrop**
  - **Composition:** About 10 percent
  - **Depth to restrictive feature:** 0 inches to bedrock (lithic)

**4—Montecito complex, 3 to 30 percent slopes**

**Map Unit Setting**
- **Major Land Resource Area:** 36
- **Elevation:** 6,000 to 7,000 feet (1,829 to 2,134 meters)
- **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Montecito and similar soils: 45 percent
Montecito, bouldery and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions
Montecito soils
Landscape: Uplands
Landform: Hills, mesas, plains
Position on landform: Summits
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 3 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.5 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
   Common trees: twoneedle pinyon, oneseed juniper
   Other plants: blue grama, bottlebrush squirreltail, muttongrass
Land capability subclass (nonirrigated): 6e

Typical Profile:
   A—0 to 3 inches; fine sandy loam
   Bt—3 to 22 inches; clay loam
   2Bk—22 to 60 inches; loam

Montecito, bouldery soils
Landscape: Uplands
Landform: Hills, mesas, plains
Position on landform: Summits
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 3 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.3 inches (high)
Shrink-swell potential: About 3.7 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
  Common trees: twoneedle pinyon, oneseed juniper
  Other plants: big sagebrush, Gambel oak, blue grama, bottlebrush squirreltail,
                broom snakeweed, muttongrass, pingue rubberweed, side oats grama
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 5 inches; extremely bouldery loam
  Bt—5 to 28 inches; clay loam
  2Bk1—28 to 45 inches; loam
  2Bk2—45 to 60 inches; sandy loam

Minor Components
Rock outcrop
  Composition: About 10 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Vessillia and similar soils
  Composition: About 5 percent
  Slope: 3 to 30 percent
  Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Shallow Sandstone

Sandoval and similar soils
  Composition: About 5 percent
  Slope: 3 to 30 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Shallow

10—Trail silty clay loam, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Trail and similar soils: 85 percent
Minor components: 15 percent
Component Descriptions

Trail soils

*Landscape:* Valleys
*Landform:* Channels, valley floor remnants, flood plains, alluvial fans
*Position on landform:* Toeslopes
*Position on landform:* Base slope, rise
*Parent material:* Eolian deposits over stream alluvium derived from sandstone
*Slope:* 0 to 1 percent
  *Aspect:* East to west
  *Shape (down/across):* Concave, linear/linear
*Depth class:* Very deep
*Drainage class:* Moderately well drained
*Slowest permeability:* 6.0 to 20 in./hr. (rapid)
*Available water capacity:* About 4.9 inches (low)
*Shrink-swell potential:* About 1.6 percent (low)
*Flooding hazard:* Rare
*Seasonal high water table depth:* About 48 to 72 inches
*Runoff class:* Very low
*Calcium carbonate maximum:* About 5 percent
*Gypsum maximum:* None
*Salinity maximum:* About 4 mmhos/cm (very slightly saline)
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)
*Ecological site:* Bottomland
*Potential native vegetation:* alkali sacaton, giant sacaton, fourwing saltbush
*Land capability subclass (irrigated):* 4e
*Land capability subclass (nonirrigated):* 7s

Typical Profile:
- Ap—0 to 6 inches; silty clay loam
- C1—6 to 30 inches; stratified loamy sand to sandy loam
- C2—30 to 45 inches; sand
- C3—45 to 60 inches; loamy fine sand

Minor Components

Aga and similar soils
  *Composition:* About 10 percent
  *Slope:* 0 to 1 percent
  *Drainage class:* Moderately well drained
  *Flooding hazard:* Rare
  *Ecological site:* Bottomland

Gilco and similar soils
  *Composition:* About 5 percent
  *Slope:* 0 to 1 percent
  *Drainage class:* Moderately well drained
  *Flooding hazard:* Rare
  *Ecological site:* Bottomland

11—Trail fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

*Major Land Resource Area:* 42
*Elevation:* 5,000 to 6,000 feet (1,524 to 1,829 meters)
Sandoval County Area, New Mexico

*Mean annual precipitation*: 8 to 10 inches (203 to 254 millimeters)
*Mean annual air temperature*: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
*Frost-free period*: 140 to 160 days

**Map Unit Composition**

Trail and similar soils: 85 percent
Minor components: 15 percent

**Component Descriptions**

**Trail soils**
*Landscape*: Valleys
*Landform*: Alluvial fans, channels, flood plains, valley floor remnants
*Position on landform*: Toeslopes
*Position on landform*: Rise, tread
*Parent material*: Eolian deposits over stream alluvium derived from sandstone
*Slope*: 0 to 1 percent
  *Aspect*: East to west
  *Shape (down/across)*: Linear, concave/linear
*Depth class*: Very deep
*Drainage class*: Moderately well drained
*Slowest permeability*: 2.0 to 6.0 in./hr. (moderately rapid)
*Available water capacity*: About 5.9 inches (low)
*Shrink-swell potential*: About 1.5 percent (low)
*Flooding hazard*: Occasional
*Seasonal high water table depth*: About 48 to 72 inches
*Runoff class*: Very low
*Calcium carbonate maximum*: About 5 percent
*Gypsum maximum*: None
*Salinity maximum*: About 4 mmhos/cm (very slightly saline)
*Sodium adsorption ratio maximum*: About 5 (slightly sodic)
*Ecological site*: Bottomland
*Potential native vegetation*: alkali sacaton, giant sacaton, fourwing saltbush
*Land capability subclass (irrigated)*: 4e
*Land capability subclass (nonirrigated)*: 7s

**Typical Profile**:
  Ap—0 to 9 inches; fine sandy loam
  C1—9 to 36 inches; stratified loamy sand to sandy loam
  C2—36 to 60 inches; sandy loam

**Minor Components**

**Aga and similar soils**
  *Composition*: About 5 percent
  *Slope*: 0 to 1 percent
  *Drainage class*: Moderately well drained
  *Flooding hazard*: Rare
  *Ecological site*: Bottomland

**Gilco and similar soils**
  *Composition*: About 5 percent
  *Slope*: 0 to 1 percent
  *Drainage class*: Moderately well drained
  *Flooding hazard*: Rare
  *Ecological site*: Bottomland
Riverwash

Composition: About 3 percent
Landscape: Valleys
Landform: Streams, channels
Slope: 0 to 3 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Peralta and similar soils

Composition: About 2 percent
Slope: 1 to 3 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Occasional
Ecological site: Bottomland

13—Sandoval-Querencia association, 2 to 7 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Sandoval and similar soils: 65 percent
Querencia and similar soils: 20 percent
Minor components: 15 percent

Component Descriptions

Sandoval soils
Landscape: Uplands
Landform: Hills, ridges
Position on landform: Summits
Position on landform: Nose slope
Parent material: Slope alluvium derived from shale
Slope: 2 to 7 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.9 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 5 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Shallow
Sandoval County Area, New Mexico

Potential native vegetation: sideoats grama, New Mexico Feathergrass, cane bluestem, little bluestem, galleta
Land capability subclass (nonirrigated): 7s

Typical Profile:
- A1—0 to 2 inches; fine sandy loam
- A2—2 to 6 inches; clay loam
- C1—6 to 10 inches; clay loam
- C2—10 to 15 inches; clay loam
- Cr—15 to 60 inches; bedrock

Querencia soils
Landscape: Uplands
Landform: Valley sides, stream terraces, alluvial fans
Position on landform: Footslopes
Position on landform: Rise
Parent material: Fan alluvium over colluvium derived from sandstone and shale
Slope: 2 to 7 percent
- Aspect: East to west
- Shape (down/across): Linear/Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.2 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, bottlebrush squirreltail, fourwing saltbush, needlegrass, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
- A—0 to 4 inches; sandy clay loam
- Bw—4 to 12 inches; clay loam
- Bw—12 to 24 inches; loam
- Bk—24 to 60 inches; loam

Minor Components
Camino and similar soils
Composition: About 5 percent
Slope: 1 to 6 percent
Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Clayey

Badland
Composition: About 5 percent
Slope: 5 to 75 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)
San Mateo and similar soils
   Composition: About 3 percent
   Slope: 0 to 3 percent
   Drainage class: Well drained
   Flooding hazard: Rare
   Ecological site: Swale

Skyvillage and similar soils
   Composition: About 2 percent
   Slope: 8 to 25 percent
   Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Shallow Sandstone

15—Camino-Sandoval complex, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,900 to 6,200 feet (1,798 to 1,890 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Camino and similar soils: 40 percent
Sandoval and similar soils: 35 percent
Minor components: 25 percent

Component Descriptions

Camino soils
   Landscape: Uplands
   Landform: Valley sides, plateaus
   Position on landform: Backslopes
   Position on landform: Side slope
   Parent material: Fan alluvium over residuum weathered from shale
   Slope: 1 to 6 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
   Depth class: Deep
   Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
   Drainage class: Well drained
   Slowest permeability: .06 to 0.2 in./hr. (slow)
   Available water capacity: About 7.8 inches (moderate)
   Shrink-swell potential: About 7.5 percent (high)
   Runoff class: Medium
   Calcium carbonate maximum: About 10 percent
   Gypsum maximum: None
   Salinity maximum: About 4 mmhos/cm (very slightly saline)
   Sodium adsorption ratio maximum: About 5 (slightly sodic)
   Ecological site: Clayey
   Potential native vegetation: alkali sacaton, giant sacaton, western wheatgrass,
      galleta, blue grama, fourwing saltbush
   Land capability subclass (nonirrigated): 6c
Typical Profile:
A—0 to 2 inches; silty clay loam
Bw1—2 to 5 inches; clay
Bw2—5 to 20 inches; clay
Bk—20 to 51 inches; clay
Cr—51 to 60 inches; bedrock

Sandoval soils
Landscape: Uplands
Landform: Ridges, hills
Position on landform: Summits
Position on landform: Nose slope
Parent material: Slope alluvium derived from shale
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Convex/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.3 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 10 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 13 (moderately sodic)
Ecological site: Shallow
Potential native vegetation: sideoats grama, New Mexico Feathergrass, cane bluestem, little bluestem, galleta
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 2 inches; fine sandy loam
C—2 to 17 inches; clay loam
Cr—17 to 60 inches; bedrock

Minor Components
Querencia and similar soils
   Composition: About 10 percent
   Slope: 1 to 8 percent
   Drainage class: Well drained
   Ecological site: Loamy

Badland
   Composition: About 10 percent
   Slope: 5 to 75 percent
   Depth to restrictive feature: 0 inches to bedrock (paralithic)

Sparank and similar soils
   Composition: About 5 percent
   Slope: 0 to 3 percent
   Drainage class: Well drained
   Flooding hazard: Occasional
   Ecological site: Clayey Bottomland
16—Rock outcrop-Prieta complex, 3 to 15 percent slopes

Map Unit Setting

*Major Land Resource Area:* 36

*Elevation:* 5,600 to 7,200 feet (1,707 to 2,195 meters)

*Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)

*Mean annual air temperature:* 52 to 54 degrees F. (11.1 to 12.2 degrees C.)

*Frost-free period:* 120 to 140 days

Map Unit Composition

Rock outcrop: 50 percent

Prieta and similar soils: 30 percent

Minor components: 20 percent

Component Descriptions

**Rock outcrop**

*Description:* Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.

*Landform:* Ridges, volcanic cones

*Aspect:* East to west

*Depth to restrictive feature:* 0 inches to bedrock (lithic)

*Land capability subclass (nonirrigated):* 8s

**Prieta soils**

*Landscape:* Uplands

*Landform:* Lava flows, mesas

*Position on landform:* Backslopes

*Parent material:* Eolian deposits over slope alluvium derived from basalt

*Slope:* 3 to 15 percent

*Aspect:* East to west

*Shape (down/across):* Convex/linear

*Surface fragments:* About 20 percent subrounded stones

*Depth class:* Shallow

*Depth to restrictive feature:* 10 to 20 inches to bedrock (lithic)

*Drainage class:* Well drained

*Slowest permeability:* 0.2 to 0.6 in./hr. (moderately slow)

*Available water capacity:* About 2.1 inches (very low)

*Shrink-swell potential:* About 4.5 percent (moderate)

*Runoff class:* Very high

*Calcium carbonate maximum:* About 8 percent

*Gypsum maximum:* None

*Salinity maximum:* About 2 mmhos/cm (nonsaline)

*Sodium adsorption ratio maximum:* About 5 (slightly sodic)

*Ecological site:* Malpais

*Potential native vegetation:* blue grama, alkali sacaton, hairy grama, sideoats grama, black grama, little bluestem, spike muhly, wolf tail

*Land capability subclass (nonirrigated):* 7s
Typical Profile:
A—0 to 5 inches; stony silt loam
Bt—5 to 15 inches; very stony clay loam
Bk—15 to 19 inches; very stony clay loam
R—19 to 60 inches; bedrock

Minor Components
Clovis and similar soils
Composition: About 10 percent
Slope: 1 to 4 percent
Drainage class: Well drained
Ecological site: Loamy

Silver and similar soils
Composition: About 5 percent
Slope: 1 to 7 percent
Drainage class: Well drained
Ecological site: Loamy

Prieta and similar soils
Composition: About 5 percent
Slope: 1 to 2 percent
Drainage class: Moderately well drained
Floodling hazard: Rare
Ecological site: Malpais

17—Vessilla-Menefee-Rock outcrop complex, 3 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,800 to 7,500 feet (2,073 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Vessilla and similar soils: 35 percent
Menefee and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent

Component Descriptions
Vessilla soils
Landscape: Uplands
Landform: Ridges, breaks, hills, mesas
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Eolian deposits over slope alluvium derived from sandstone
Slope: 3 to 15 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.3 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  - Common trees: oneseed juniper, twoneedle pinyon
  - Other plants: Indian ricegrass, blue grama, mountain big sagebrush, oak, galleta, sideoats grama
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 5 inches; sandy loam
C—5 to 11 inches; sandy loam
R—11 to 60 inches; bedrock

Menefee soils
Landscape: Uplands
Landform: Hillslopes, mesas, mountainsides
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Colluvium over residuum weathered from shale
Slope: 3 to 15 percent
  - Aspect: East to west
    - Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
  - Common trees: oneseed juniper, Rocky Mountain juniper, twoneedle pinyon
  - Other plants: blue grama, galleta, Gambel oak, big sagebrush, sideoats grama
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 3 inches; clay loam
C—3 to 10 inches; clay loam
2Cr—10 to 60 inches; bedrock
Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Breaks, escarpments, ledges
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Orlie and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Sparham and similar soils
Composition: About 10 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Clayey

18—Sparham clay, 0 to 3 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,500 to 7,500 feet (1,981 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Sparham and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sparham soils
Landscape: Valleys
Landform: Flood plains, valley sides, alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Fan alluvium derived from sandstone and shale
Slope: 0 to 3 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Flooding hazard: Occasional
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Clayey
Potential native vegetation: western wheatgrass, alkali sacaton, bottlebrush squirreltail, prairie junegrass
Land capability subclass (irrigated): 3s
Land capability subclass (nonirrigated): 6c

Typical Profile:
- A—0 to 7 inches; clay
- C1—7 to 20 inches; clay loam
- C2—20 to 29 inches; clay loam
- C3—29 to 47 inches; silty clay loam
- C4—47 to 53 inches; clay loam
- C5—53 to 60 inches; clay loam

Minor Components
Riverwash
- Composition: About 5 percent
- Landscape: Valleys
- Landform: Streams, channels
- Position on landform: Toeslopes
- Position on landform: Base slope
- Slope: 0 to 3 percent
- Shape (down/across): Concave/linear
- Drainage class: Somewhat poorly drained
- Flooding hazard: Frequent

Menefee and similar soils
- Composition: About 5 percent
- Slope: 5 to 35 percent
- Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Shallow

Vessilla and similar soils
- Composition: About 5 percent
- Slope: 5 to 30 percent
- Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Ecological site: Shallow Sandstone

20—Gilco clay loam, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days
Map Unit Composition

Gilco and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Gilco soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Surface fragments: About 12 percent subrounded gravel
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.2 inches (high)
Shrink-swell potential: About 1.6 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 7c

Typical Profile:
   Ap—0 to 6 inches; clay loam
   C—6 to 60 inches; stratified fine sandy loam to loam

Minor Components

Peralta and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Sparham and similar soils
Composition: About 5 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Occasional
Ecological site: Bottomland
Aga and similar soils

- **Composition:** About 5 percent
- **Slope:** 0 to 1 percent
- **Drainage class:** Moderately well drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland

### 21—Rock outcrop-Hackroy complex, 1 to 8 percent slopes

#### Map Unit Setting

- **Major Land Resource Area:** 36
- **Elevation:** 6,000 to 7,200 feet (1,829 to 2,195 meters)
- **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

#### Map Unit Composition

- **Rock outcrop:** 60 percent
- **Hackroy and similar soils:** 25 percent
- **Minor components:** 15 percent

#### Component Descriptions

**Rock outcrop**
- **Description:** Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
- **Landform:** Ledges, escarpments, benches
- **Aspect:** East to west
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)
- **Land capability subclass (nonirrigated):** 8s

**Hackroy soils**
- **Landscape:** Uplands
- **Landform:** Mesas, plateaus
- **Position on landform:** Summits
- **Position on landform:** Nose slope
- **Parent material:** Residuum weathered from tuff
- **Slope:** 1 to 8 percent
- **Aspect:** East to west
- **Shape (down/across):** Convex/linear
- **Depth class:** Very shallow and shallow
- **Depth to restrictive feature:** 8 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Slowest permeability:** .06 to 0.2 in./hr. (slow)
- **Available water capacity:** About 1.7 inches (very low)
- **Shrink-swell potential:** About 7.5 percent (high)
- **Runoff class:** Very high
- **Calcium carbonate maximum:** None
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
- **Ecological site:** Pinus edulis/Rhus triloba/Bouteloua gracilis
- **Potential native vegetation:**
  - **Common trees:** oneseed juniper, twoneedle pinyon
Other plants: blue grama, Indian ricegrass, needle and thread, skunkbush sumac

*Land capability subclass (nonirrigated): 7s*

**Typical Profile:**
- A—0 to 3 inches; sandy loam
- Bt—3 to 12 inches; clay
- 2R—12 to 60 inches; bedrock

**Minor Components**
- Frijoles and similar soils
  - Composition: About 10 percent
  - Slope: 1 to 8 percent
  - Drainage class: Well drained
  - Ecological site: pinyon-juniper forest
- Nyjack and similar soils
  - Composition: About 5 percent
  - Slope: 1 to 5 percent
  - Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
  - Drainage class: Well drained
  - Ecological site: pinyon-juniper forest

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**22—Aga silty clay loam, 0 to 1 percent slopes**

**Map Unit Setting**
- Major Land Resource Area: 42
- Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
- Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
- Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
- Frost-free period: 140 to 160 days

**Map Unit Composition**
- Aga and similar soils: 85 percent
- Minor components: 15 percent

**Component Descriptions**

**Aga soils**
- Landscape: Valleys
- Landform: Flood plains
- Position on landform: Toeslopes
- Position on landform: Base slope
- Parent material: Stream alluvium derived from igneous and sedimentary rock
- Slope: 0 to 1 percent
  - Aspect: East to west
  - Shape (down/across): Concave/linear
- Depth class: Very deep
- Drainage class: Moderately well drained
- Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
- Available water capacity: About 6.8 inches (moderate)
- Shrink-swell potential: About 1.7 percent (low)
- Flooding hazard: Rare
- Seasonal high water table depth: About 42 to 60 inches
- Runoff class: Low
Calcium carbonate maximum: About 10 percent  
Gypsum maximum: None  
Salinity maximum: About 4 mmhos/cm (very slightly saline)  
Sodium adsorption ratio maximum: About 5 (slightly sodic)  
Ecological site: Bottomland  
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush  
Land capability subclass (irrigated): 2s  
Land capability subclass (nonirrigated): 7c  

Typical Profile:  
A—0 to 8 inches; silty clay loam  
C1—8 to 24 inches; loam  
2C2—24 to 60 inches; sand  

Minor Components  
Gilco and similar soils  
Composition: About 10 percent  
Slope: 0 to 1 percent  
Drainage class: Moderately well drained  
Flooding hazard: Rare  
Ecological site: Bottomland  

Trail and similar soils  
Composition: About 5 percent  
Slope: 0 to 1 percent  
Drainage class: Somewhat excessively drained  
Flooding hazard: Rare  
Ecological site: Bottomland  

23—Hickman clay loam, 1 to 3 percent slopes  

Map Unit Setting  
Major Land Resource Area: 36  
Elevation: 6,500 to 7,500 feet (1,981 to 2,286 meters)  
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)  
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)  
Frost-free period: 110 to 130 days  

Map Unit Composition  
Hickman and similar soils: 85 percent  
Minor components: 15 percent  

Component Descriptions  
Hickman soils  
Landscape: Valleys  
Landform: Flood plains, valley floors  
Position on landform: Toeslopes  
Position on landform: Base slope  
Parent material: Stream alluvium derived from igneous and sedimentary rock  
Slope: 1 to 3 percent  
Aspect: East to west  
Shape (down/across): Concave/linear  
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.9 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Flooding hazard: Rare
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (non saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Swale
Potential native vegetation: western wheatgrass, alkali sacaton, big sagebrush, bottlebrush squirreltail
Land capability subclass (irrigated): 3e
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 4 inches; clay loam
C1—4 to 12 inches; sandy clay loam
C2—12 to 49 inches; clay loam
C3—49 to 60 inches; sandy clay loam

Minor Components
Royosa and similar soils
  Composition: About 8 percent
  Slope: 1 to 8 percent
  Drainage class: Somewhat excessively drained
  Ecological site: Deep Sand

Sparham and similar soils
  Composition: About 7 percent
  Slope: 0 to 1 percent
  Drainage class: Somewhat poorly drained
  Flooding hazard: Rare
  Ecological site: Clayey Bottomland

24—Orlie-Sparham association, 0 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 7,000 to 7,500 feet (2,134 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Orlie and similar soils: 45 percent
Sparham and similar soils: 35 percent
Minor components: 20 percent
Component Descriptions

Orlie soils

Landscape: Valleys
Landform: Valley sides, mesas, cuestas, hills
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 1 to 5 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Loamy
Potential native vegetation: western wheatgrass, big sagebrush, galleta, Indian ricegrass, needle and thread, fourwing saltbush
Land capability subclass (nonirrigated): 6c

Typical Profile:
  A—0 to 2 inches; fine sandy loam
  Bt—2 to 25 inches; clay loam
  C—25 to 60 inches; stratified sandy clay loam to clay loam

Sparham soils

Landscape: Valleys
Landform: Alluvial fans, valley sides, flood plains
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 2 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 9.4 inches (high)
Shrink-swell potential: About 7.5 percent (high)
Flooding hazard: Occasional
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Clayey
Potential native vegetation: western wheatgrass, alkali sacaton, bottlebrush squirreltail, prairie junegrass

Land capability subclass (irrigated): 3s
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; clay
C—3 to 60 inches; silty clay

Minor Components
Menefee and similar soils
Composition: About 10 percent
Slope: 5 to 35 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

Riverwash
Composition: About 5 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Sedmar and similar soils
Composition: About 5 percent
Slope: 1 to 15 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Pinyon-Juniper forest

25—Gilco loam, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Gilco and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Gilco soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.4 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 7e

Typical Profile:
   Ap—0 to 4 inches; loam
   C1—4 to 34 inches; stratified silt loam to loam to fine sandy loam
   C2—34 to 60 inches; stratified fine sandy loam to loam

Minor Components
Aga and similar soils
   Composition: About 10 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland

Sparham and similar soils
   Composition: About 5 percent
   Slope: 0 to 3 percent
   Drainage class: Well drained
   Flooding hazard: Occasional
   Ecological site: Bottomland

26—Orlie loam, 0 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,200 to 6,800 feet (1,890 to 2,073 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days
Map Unit Composition

Orlie and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Orlie soils
Landscape: Valleys
Landform: Cuestas, mesas, valley sides, hills
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 0 to 8 percent
  Aspect: East to west
  Shape (down/across): Linear/Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Loamy
Potential native vegetation: western wheatgrass, big sagebrush, galleta, Indian ricegrass, needle and thread, fourwing saltbush
Land capability subclass (nonirrigated): 6c

Typical Profile:
  A—0 to 2 inches; loam
  Bt1—2 to 13 inches; clay loam
  Bt2—13 to 22 inches; clay loam
  C1—22 to 36 inches; silty clay loam
  C2—36 to 50 inches; clay loam
  C3—50 to 60 inches; silty clay loam

Minor Components
Menefee and similar soils
  Composition: About 8 percent
  Slope: 5 to 35 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Shallow

Vessilla and similar soils
  Composition: About 7 percent
  Slope: 1 to 3 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Shallow Sandstone
27—Aga loam, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Aga and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Aga soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
    Aspect: East to west
    Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.0 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 42 to 60 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2s
Land capability subclass (nonirrigated): 7c

Typical Profile:
    A—0 to 10 inches; loam
    C1—10 to 23 inches; loam
    2C2—23 to 43 inches; sand
    2C3—43 to 60 inches; sand

Minor Components
Gilco and similar soils
    Composition: About 10 percent
    Slope: 0 to 1 percent
    Drainage class: Moderately well drained
    Flooding hazard: Rare
    Ecological site: Bottomland
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Trail and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

29—Trail loamy sand, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Trail and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Trail soils
Landscape: Valleys
Landform: Alluvial fans, channels, flood plains, valley floor remnants

Figure 2.—Typical landscape of Trail loamy sand, 0 to 1 percent slopes, and Riverwash, along the Jemez River.
Position on landform: Toeslopes
Position on landform: Rise, base slope
Parent material: Eolian deposits derived from sandstone over stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Linear, concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 4.1 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, black grama, dropseed, sand sagebrush
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7s

Typical Profile:
   A—0 to 6 inches; loamy sand
   C—6 to 60 inches; stratified loamy sand to sandy loam

Minor Components
Aga and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland

Peralta and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Somewhat poorly drained
   Flooding hazard: Rare
   Ecological site: Bottomland

Gilco and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland
31—Riverwash

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 54 to 56 degrees F. (12.2 to 13.3 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Riverwash: 90 percent
Minor components: 10 percent

Component Descriptions

Riverwash
Description: Riverwash consists of unstable sand and silt that is reworked by water and wind so frequently, that it supports little or no vegetation.
Landscape: Valleys
Landform: Streams
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 3 percent
Aspect: East to west
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.9 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Frequent
Runoff class: Very low
Calcium carbonate maximum: About 1 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 1 (slightly sodic)
Land capability subclass (nonirrigated): 8w

Minor Components
Torrifluvents and similar soils
Composition: About 10 percent
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 1 percent
Aspect: East to west
Shape (down/across): Concave/linear
Drainage class: Moderately well drained
Flooding hazard: Rare
33—Pits

Map Unit Setting

Major Land Resource Area: 36

Map Unit Composition

Pits: 100 percent

Component Descriptions

Pits
Description: Pits consist of quarries and gravel and borrow pits.
Slope: 0 to 4 percent
   Aspect: East to west
Runoff class: Low
Land capability subclass (nonirrigated): 8s

34—Ildefonso-Witt association, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,200 to 5,700 feet (1,585 to 1,737 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Ildefonso and similar soils: 55 percent
Witt and similar soils: 30 percent
Minor components: 15 percent

Component Descriptions

Ildefonso soils
Landscape: Uplands
Landform: Hills, fan remnants, mesas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Fan alluvium over colluvium derived from igneous and sedimentary rock
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Surface fragments: About 25 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.0 inches (low)
Shrink-swell potential: About 2.2 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Limy
Potential native vegetation: thickspike wheatgrass, western wheatgrass, New Mexico Feathergrass, blue grama, hairy grama, winterfat
Land capability subclass (nonirrigated): 7s

Typical Profile:
- A—0 to 3 inches; cobbly loam
- Bk—3 to 17 inches; cobbly loam
- C—17 to 60 inches; stratified very cobbly sandy loam to very cobbly loam

Witt soils
Landscape: Uplands
Landform: Mesas, fan remnants, bajadas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone over fan alluvium derived from basalt
Slope: 1 to 5 percent
- Aspect: East to west
- Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, fourwing saltbush, galleta
Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 3 inches; very fine sandy loam
- Bt—3 to 27 inches; loam
- Bk—27 to 60 inches; loam

Minor Components
Rock outcrop
- Composition: About 10 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)

Prieta and similar soils
- Composition: About 5 percent
- Slope: 3 to 15 percent
- Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Ecological site: Malpais
41—Dune land

Map Unit Setting

Major Land Resource Area: 36

Map Unit Composition

Dune land: 100 percent

Component Descriptions

Dune land
Description: Dune land consists of areas of loose, windblown, generally sandy material, mostly bare of vegetation. Their characteristic shape is low mounds, ridges, or hills. They are capable of movement from place to place.

Landscape: Dune fields
Landform: Shrub-coppice dunes
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 0 to 20 percent
Aspect: East to west
Shape (down/across): Convex/convex
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.4 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 1 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 1 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 1 (slightly sodic)
Land capability subclass (nonirrigated): 8e

47—Cascajo very gravelly sandy loam, 12 to 30 percent slopes

Map Unit Setting

Major Land Resource Area: 70
Elevation: 5,300 to 6,100 feet (1,615 to 1,859 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Cascajo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Cascajo soils
Landscape: Uplands
Landform: Ridges, knolls, hills
Position on landform: Backslopes
Position on landform: Side slope
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Parent material: Fan alluvium derived from sandstone
Slope: 12 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 59 percent subrounded gravel
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 2.2 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Gravelly
Potential native vegetation: blue grama, New Mexico Feathergrass, sideoats grama,
twoneedle pinyon, black grama, one-seed juniper
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 2 inches; very gravelly sandy loam
Bw—2 to 5 inches; very gravelly sandy loam
Bk1—5 to 11 inches; very gravelly sandy loam
Bk2—11 to 23 inches; very gravelly loamy sand
C1—23 to 30 inches; very gravelly loamy sand
C2—30 to 60 inches; extremely cobbly loamy sand

Minor Components
La Fonda and similar soils
Composition: About 5 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Harvey and similar soils
Composition: About 5 percent
Slope: 5 to 10 percent
Drainage class: Well drained
Ecological site: Limy

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

51—Sparham clay loam, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days
Map Unit Composition

Sparham and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sparham soils
Landscape: Valleys
Landform: Alluvial fans, valley sides, flood plains
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.06 to 0.2 in./hr. (slow)
Available water capacity: About 11.0 inches (high)
Shrink-swell potential: About 5.4 percent (moderate)
Flooding hazard: Occasional
Seasonal high water table depth: About 4 to 10 inches
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Clayey Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 3e
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 6 inches; clay loam
   C1—6 to 20 inches; clay loam
   C2—20 to 36 inches; clay
   C3—36 to 60 inches; clay loam

Minor Components
Gilco and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Clayey Bottomland

Gilco, sandy substrata and similar soils
   Composition: About 5 percent
   Slope: 1 to 4 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Clayey Bottomland
Riverwash

Composition: About 5 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 1 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

52—Totavi loamy sand, 0 to 5 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 7,000 to 7,500 feet (2,134 to 2,286 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Totavi and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Totavi soils
Landscape: Valleys
Landform: Closed depressions, valley floors, stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from tuff
Slope: 0 to 5 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in/hr. (rapid)
Available water capacity: About 4.1 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Runoff class: Very low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa-Juniperus deppeana/Quercus gambelii
Potential native vegetation:
Common trees: one-seed juniper, Utah juniper, ponderosa pine
Other plants: needle and thread, western wheatgrass, Gambel oak, one-seed juniper, skunkbush sumac
Land capability subclass (nonirrigated): 4s
Typical Profile:
- A—0 to 15 inches; loamy sand
- C1—15 to 19 inches; loamy sand
- C2—19 to 60 inches; loamy sand

Minor Components
Riverwash
- Composition: About 5 percent
- Landscape: Valleys
- Landform: Streams, channels
- Position on landform: Toe slopes
- Position on landform: Base slope
- Slope: 0 to 3 percent
- Shape (down/across): Concave/linear
- Drainage class: Somewhat poorly drained
- Flooding hazard: Frequent

Hackroy and similar soils
- Composition: About 5 percent
- Slope: 1 to 5 percent
- Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Ecological site: Pinyon-juniper forest

Nyjack and similar soils
- Composition: About 5 percent
- Slope: 1 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Pinyon-juniper forest

53—Witt-Harvey association, 1 to 7 percent slopes

Map Unit Setting
- Major Land Resource Area: 70
- Elevation: 5,600 to 6,700 feet (1,707 to 2,042 meters)
- Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
- Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- Frost-free period: 120 to 140 days

Map Unit Composition
- Witt and similar soils: 55 percent
- Harvey and similar soils: 30 percent
- Minor components: 15 percent

Component Descriptions
Witt soils
- Landscape: Uplands
- Landform: Bajadas, fan remnants, mesas
- Position on landform: Backslopes
- Position on landform: Side slope
- Parent material: Eolian deposits and alluvium derived from igneous and sedimentary rock
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Slope: 1 to 7 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.7 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, galleta, sideoats grama, black grama, fourwing saltbush, obtuse panicgrass, plains lovegrass, sand dropseed, threawn
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 3 inches; loam
BA—3 to 6 inches; silt loam
Bt1—6 to 11 inches; silty clay loam
Bt2—11 to 18 inches; silty clay loam
Btk—18 to 25 inches; silty clay loam
Bk1—25 to 39 inches; silt loam
Bk2—39 to 53 inches; silt loam
C—53 to 60 inches; silt loam

Harvey soils
Landscape: Uplands
Landform: Bajadas, plateaus, mesas
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Eolian deposits derived from sandstone over fan alluvium derived from basalt
Slope: 1 to 7 percent
Aspect: East to west
Shape (down/across): Convex/linear
Surface fragments: About 5 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.5 inches (high)
Shrink-swell potential: About 3.6 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Limy
Potential native vegetation: black grama, sideoats grama, blue grama, needlegrass, winterfat, Bigelow sagebrush, fourwing saltbush, western wheatgrass
Land capability subclass (nonirrigated): 7e
Typical Profile:
A—0 to 10 inches; loam
Bw—13 to 28 inches; clay loam
Bk—28 to 42 inches; sandy clay loam
C—42 to 60 inches; sandy loam

Minor Components
Ildefonso and similar soils
Composition: About 10 percent
Slope: 10 to 35 percent
Drainage class: Well drained
Ecological site: Limy

La Fonda and similar soils
Composition: About 5 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

54—Harvey-Cascajo association, 5 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 70
Elevation: 5,300 to 6,500 feet (1,615 to 1,981 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Harvey and similar soils: 45 percent
Cascajo and similar soils: 40 percent
Minor components: 15 percent

Component Descriptions
Harvey soils
Landscape: Uplands
Landform: Bajadas, mesas, plateaus
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Edian deposits and alluvium derived from igneous and sedimentary rock
Slope: 5 to 15 percent
Aspect: East to west
Shape (down/across): Convex/linear
Surface fragments: About 10 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.3 inches (high)
Shrink-swell potential: About 4.1 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
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Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Limy
Potential native vegetation: black grama, sideoats grama, blue grama, needlegrass, winterfat, Bigelow sagebrush, fourwing saltbush, western wheatgrass
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bw—2 to 11 inches; fine sandy loam
Bk—11 to 23 inches; clay loam
C—23 to 60 inches; sandy clay loam

Cascajo soils

Landscape: Uplands
Landform: Hills, knolls, ridges
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from sandstone
Slope: 5 to 15 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Surface fragments: About 10 percent subrounded gravel
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.5 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 20 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Gravelly
Potential native vegetation: New Mexico Feathergrass, black grama, blue grama, hairy grama, sideoats grama, plains lovegrass, winterfat, wolftail
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 3 inches; very gravelly sandy loam
AB—3 to 9 inches; very gravelly sandy loam
Bk—9 to 28 inches; very gravelly sand
C—28 to 60 inches; very gravelly sand

Minor Components
La Fonda and similar soils
   Composition: About 10 percent
   Slope: 1 to 5 percent
   Drainage class: Well drained
   Ecological site: Loamy
Witt and similar soils

Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

55—La Fonda loam, 1 to 5 percent slopes

Map Unit Setting

Major Land Resource Area: 70
Elevation: 6,000 to 6,500 feet (1,829 to 1,981 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

La Fonda and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

La Fonda soils
Landscape: Plains
Landform: Fan remnants, fan piedmonts
Position on landform: Footslopes
Position on landform: Slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 1 to 5 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, galleta, sideoats grama,
   black grama, fourwing saltbush, obtuse panicgrass, plains lovegrass, sand
   dropseed, threeawn
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 4 inches; loam
   Bw—4 to 26 inches; loam
   Bk—26 to 60 inches; loam
Minor Components
Harvey and similar soils
Composition: About 5 percent
Slope: 5 to 10 percent
Drainage class: Well drained
Ecological site: Limy

Witt and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

Ildefonso and similar soils
Composition: About 5 percent
Slope: 15 to 35 percent
Drainage class: Well drained
Ecological site: Breaks

56—Ildefonso cobbly loam, 15 to 35 percent slopes

Map Unit Setting
Major Land Resource Area: 70
Elevation: 5,500 to 6,500 feet (1,676 to 1,981 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Ildefonso and similar soils: 95 percent
Minor components: 15 percent

Component Descriptions
Ildefonso soils
Landscape: Plains
Landform: Mesas, fan remnants, hills
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium and colluvium derived from sandstone
Slope: 15 to 35 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 30 percent subangular gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.6 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Breaks
Potential native vegetation: black grama, blue grama, little bluestem, mountain muhly, side oats grama, New Mexico Feathergrass, twoneedle pinyon, wolftail
Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 3 inches; cobbly loam
- Bw—3 to 9 inches; cobbly loam
- Bk—9 to 15 inches; very gravelly loam
- C—15 to 60 inches; very cobbly loam

Minor Components
- La Fonda and similar soils
  - Composition: About 5 percent
  - Slope: 1 to 5 percent
  - Drainage class: Well drained
  - Ecological site: Loamy

- Harvey and similar soils
  - Composition: About 5 percent
  - Slope: 5 to 10 percent
  - Drainage class: Well drained
  - Ecological site: Limy

- Rock outcrop
  - Composition: About 3 percent
  - Depth to restrictive feature: 0 inches to bedrock (lithic)

- Witt and similar soils
  - Composition: About 2 percent
  - Slope: 1 to 8 percent
  - Drainage class: Well drained
  - Ecological site: Loamy

57—Badland

Map Unit Setting

Major Land Resource Area: 37

Map Unit Composition

Badland: 90 percent
Minor components: 10 percent

Component Descriptions

Badland
Description: Badland consists of areas of exposed raw shale that is essentially denuded of vegetation. These areas are highly dissected.
Landscape: Hills
Landform: Escarpments, ledges, rockfalls
Position on landform: Summits
Position on landform: Nose slope
Sandoval County Area, New Mexico

Slope: 5 to 75 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth to restrictive feature: 0 inches to bedrock (paralithic)
Drainage class: Somewhat excessively drained
Runoff class: Very high
Land capability subclass (nonirrigated): 8

Minor Components
Eslendo and similar soils
Composition: About 5 percent
Slope: 5 to 30 percent
Depth to restrictive feature: 4 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

Doakum and similar soils
Composition: About 5 percent
Slope: 0 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

58—Deama-Elpedro association, 5 to 30 percent slopes

Map Unit Setting
Major Land Resource Area: 70
Elevation: 6,000 to 7,000 feet (1,829 to 2,134 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Deama and similar soils: 45 percent
Elpedro and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions
Deama soils
Landscape: Hills
Landform: Mesas, ridges, plateaus
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Colluvium derived from limestone
Slope: 15 to 30 percent
Aspect: East to west
Shape (down/across): Convex/linear
Surface fragments: About 10 percent subrounded cobbles, about 10 percent subangular channers, about 20 percent subrounded stones
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.8 to 2.0 in./hr. (moderate)
Available water capacity: About 1.4 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 60 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: black grama, Bigelow sagebrush, little bluestem, sideoats grama
Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 7 inches; very stony silt loam
  Bk—7 to 14 inches; very cobbly silt loam
  2R—14 to 60 inches; bedrock

Elpedro soils
Landscape: Hills
Landform: Benches, mesas, fan piedmonts, valley sides
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over colluvium derived from limestone
Slope: 5 to 12 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in/hr. (moderately slow)
Available water capacity: About 11.2 inches (high)
Shrink-swell potential: About 3.7 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: juniper, twoneedle pinyon
  Other plants: blue grama, galleta, bottlebrush squirreltail, oak, western wheatgrass
Land capability subclass (nonirrigated): 6e

Typical Profile:
  A—0 to 5 inches; loam
  Bt1—5 to 12 inches; silty clay loam
  Bt2—12 to 19 inches; silty clay loam
  Bt3—19 to 25 inches; silty clay loam
  Btk1—25 to 36 inches; silty clay loam
  Btk2—36 to 45 inches; silt loam
  Btk3—45 to 60 inches; loam
Minor Components
La Fonda and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Rock outcrop
Composition: About 10 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

59—Harvey-Ildefonso-La Fonda association, 3 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 70
Elevation: 6,200 to 6,800 feet (1,890 to 2,073 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Harvey and similar soils: 35 percent
Ildefonso and similar soils: 35 percent
La Fonda and similar soils: 15 percent
Minor components: 15 percent

Component Descriptions
Harvey soils
Landscape: Uplands
Landform: Bajadas, mesas, plateaus
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone over fan alluvium and colluvium derived from igneous and sedimentary rock
Slope: 3 to 9 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.6 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Limy
Potential native vegetation: black grama, sideoats grama, blue grama, winterfat, Bigelow sagebrush, fourwing saltbush, needlegrass, western wheatgrass
Land capability subclass (nonirrigated): 7e
Typical Profile:
A—0 to 4 inches; loam
Bw—4 to 10 inches; loam
Bk1—10 to 18 inches; clay loam
Bk2—18 to 41 inches; clay loam
C—41 to 60 inches; sandy clay loam

Ildefonso soils
Landscape: Uplands
Landform: Fan remnants, mesas, hills
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Fan alluvium and/or colluvium derived from igneous and sedimentary rock
Slope: 7 to 15 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 5 percent subrounded gravel, about 10 percent subrounded cobbles
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.0 inches (low)
Shrink-swell potential: About 2.0 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Breaks
Potential native vegetation: black grama, blue grama, little bluestem, mountain muhly, sideoats grama, New Mexico Feathergrass, twoneedle pinyon, wolftail
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 2 inches; cobbly loam
Bw1—2 to 8 inches; very gravelly loam
Bw2—8 to 13 inches; very gravelly loam
Bk1—13 to 32 inches; very cobbly sandy loam
Bk2—32 to 40 inches; very cobbly sandy loam
C—40 to 60 inches; extremely cobbly sand

La Fonda soils
Landscape: Uplands
Landform: Fan remnants, fan piedmonts
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 3 to 7 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.3 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, galleta, sideoats grama, black grama, fourwing saltbush, obtuse panicgrass, plains lovegrass, sand dropseed, threeawn
Land capability subclass (nonirrigated): 6c

Typical Profile:
- A—0 to 3 inches; loam
- Bw1—3 to 7 inches; loam
- Bw2—7 to 14 inches; clay loam
- Bw3—14 to 26 inches; loam
- Bk1—26 to 42 inches; loam
- Bk2—42 to 60 inches; loam

Minor Components
Ildefonso and similar soils
- Composition: About 10 percent
- Slope: 15 to 35 percent
- Drainage class: Well drained
- Ecological site: Breaks

Witt and similar soils
- Composition: About 5 percent
- Slope: 1 to 8 percent
- Drainage class: Well drained
- Ecological site: Loamy

63—Placitas gravelly loam, 8 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 70
Elevation: 5,700 to 6,300 feet (1,737 to 1,920 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Placitas and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Placitas soils
- Landscape: Uplands
- Landform: Fan remnants
- Position on landform: Toeslopes
- Position on landform: Tread
Parent material: Fan alluvium derived from conglomerate
Slopes: 8 to 40 percent
   Aspect: East to west
   Shape (down/across): Linear/Linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 1.5 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: High
Calcium carbonate maximum: About 25 percent
Gypsum maximum: None
Salinity maximum: About 2 mhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Gravelly
Potential native vegetation: blue grama, New Mexico Feathergrass, sideots grama, twoneedle pinyon, black grama, oneseed juniper
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 5 inches; gravelly loam
   Bw—5 to 10 inches; very gravelly sandy loam
   Bk—10 to 27 inches; very gravelly sandy loam
   R—27 to 60 inches; bedrock

Minor Components
Skyvillage and similar soils
   Composition: About 8 percent
   Slope: 5 to 40 percent
   Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Shallow Sandstone

Zia and similar soils
   Composition: About 7 percent
   Slope: 5 to 20 percent
   Drainage class: Well drained
   Ecological site: Sandy

64—Skyvillage-lldefonso association, 8 to 40 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days
Map Unit Composition

Skyvillage and similar soils: 40 percent
Ildefonso and similar soils: 35 percent
Minor components: 25 percent

Component Descriptions

**Skyvillage soils**
*Landscape:* Uplands
*Landform:* Ridges, structural benches, mesas, hills, breaks, cuestas
*Position on landform:* Shoulders
*Position on landform:* Head slope, side slope, nose slope
*Parent material:* Slope alluvium derived from sandstone
*Slope:* 8 to 25 percent
*Aspect:* East to west
*Shape (down/across):* Convex/linear
*Depth class:* Very shallow and shallow
*Depth to restrictive feature:* 6 to 20 inches to bedrock (lithic)
*Drainage class:* Well drained
*Slowest permeability:* 2.0 to 6.0 in./hr. (moderately rapid)
*Available water capacity:* About 2.4 inches (very low)
*Shrink-swell potential:* About 1.5 percent (low)
*Runoff class:* Very high
*Calcium carbonate maximum:* About 10 percent
*Gypsum maximum:* None
*Salinity maximum:* About 2 mmhos/cm (nonsaline)
*Sodium adsorption ratio maximum:* About 0 (nonsodic)
*Ecological site:* Shallow Sandstone
*Potential native vegetation:* sideoats grama, blue grama, little bluestem, Indian ricegrass, galleta
*Land capability subclass (nonirrigated):* 7s

*Typical Profile:*
- **A**—0 to 4 inches; fine sandy loam
- **C1**—4 to 11 inches; fine sandy loam
- **C2**—11 to 18 inches; sandy loam
- **2R**—18 to 60 inches; bedrock

**Ildefonso soils**
*Landscape:* Uplands
*Landform:* Fan remnants, mesas
*Position on landform:* Backslopes
*Position on landform:* Side slope
*Parent material:* Fan alluvium and/or colluvium derived from igneous and sedimentary rock
*Slope:* 8 to 40 percent
*Aspect:* East to west
*Shape (down/across):* Linear/linear
*Surface fragments:* About 2 percent subrounded stones, about 8 percent subrounded cobbles, about 32 percent subrounded gravel
*Depth class:* Very deep
*Drainage class:* Well drained
*Slowest permeability:* 2.0 to 6.0 in./hr. (moderately rapid)
*Available water capacity:* About 3.6 inches (low)
*Shrink-swell potential:* About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Breaks
Potential native vegetation: black grama, blue grama, little bluestem, mountain muhly, plains lovegrass, side oats grama, New Mexico Feathergrass
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 3 inches; gravelly sandy loam
Bw—3 to 14 inches; very gravelly sandy loam
Bk—14 to 60 inches; very gravelly sandy loam

Minor Components
Riverwash
Composition: About 10 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Deama and similar soils
Composition: About 10 percent
Slope: 15 to 30 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: pinyon-juniper forest

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

65—Ildefonso-Harvey association, 10 to 35 percent slopes

Map Unit Setting

Major Land Resource Area: 70
Elevation: 5,000 to 5,700 feet (1,524 to 1,737 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Ildefonso and similar soils: 50 percent
Harvey and similar soils: 30 percent
Minor components: 20 percent
Component Descriptions

Ildefonso soils
Landscape: Hills
Landform: Mesas, fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Fan alluvium over colluvium derived from igneous and sedimentary rock
Slope: 10 to 35 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 2 percent subrounded stones, about 13 percent subrounded cobbles, about 43 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.5 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Breaks
Potential native vegetation: black grama, blue grama, little bluestem, mountain muhly, plains lovegrass, sideoats grama, New Mexico Feathergrass
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 6 inches; very gravelly sandy loam
Bw—6 to 38 inches; very gravelly sandy loam
Bk—38 to 60 inches; very gravelly sandy loam

Harvey soils
Landscape: Uplands
Landform: Bajadas, mesas, plateaus
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from igneous and sedimentary rock
Slope: 10 to 15 percent
Aspect: East to west
Shape (down/across): Convex/linear
Surface fragments: About 5 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.9 inches (moderate)
Shrink-swell potential: About 3.2 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Limy
Potential native vegetation: black grama, sideoats grama, blue grama, needlegrass, winterfat, Bigelow sagebrush, fourwing saltbush, western wheatgrass
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 4 inches; loam
Bk1—4 to 23 inches; loam
Bk2—23 to 36 inches; loam
C—36 to 60 inches; sandy loam

Minor Components
La Fonda and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Riverwash
Composition: About 5 percent
Landscape: Valleys
Landform: Channels, streams
Position on landform: T toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Placitas and similar soils
Composition: About 5 percent
Slope: 8 to 40 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Gravelly

66—Zia sandy loam, 3 to 6 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,100 to 5,700 feet (1,554 to 1,737 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Zia and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Zia soils
Landscape: Valleys
Landform: Alluvial fans
Sandoval County Area, New Mexico

**Position on landform:** Toeslopes
**Position on landform:** Rise
**Parent material:** Eolian deposits over fan alluvium derived from sandstone
**Slope:** 3 to 6 percent
   **Aspect:** East to west
   **Shape (down/across):** Linear/linear
**Depth class:** Very deep
**Drainage class:** Somewhat excessively drained
**Slowest permeability:** 2.0 to 6.0 in./hr. (moderately rapid)
**Available water capacity:** About 7.1 inches (moderate)
**Shrink-swell potential:** About 1.5 percent (low)
**Runoff class:** Low
**Calcium carbonate maximum:** About 15 percent
**Gypsum maximum:** None
**Salinity maximum:** About 2 mmhos/cm (nonsaline)
**Sodium adsorption ratio maximum:** About 5 (slightly sodic)
**Ecological site:** Sandy
**Potential native vegetation:** blue grama, western wheatgrass, Indian ricegrass, black grama, oneseed juniper
**Land capability subclass (nonirrigated):** 6c

**Typical Profile:**
- A—0 to 4 inches; sandy loam
- C—4 to 60 inches; sandy loam

**Minor Components**
**Riverwash**
   **Composition:** About 5 percent
   **Landscape:** Valleys
   **Landform:** Channels, streams
   **Position on landform:** Toeslopes
   **Position on landform:** Base slope
   **Slope:** 0 to 3 percent
   **Shape (down/across):** Concave/linear
   **Drainage class:** Somewhat poorly drained
   **Flooding hazard:** Frequent

**San Mateo and similar soils**
   **Composition:** About 5 percent
   **Slope:** 0 to 3 percent
   **Drainage class:** Well drained
   **Flooding hazard:** Rare
   **Ecological site:** Swale

**Cascajo and similar soils**
   **Composition:** About 5 percent
   **Slope:** 12 to 30 percent
   **Drainage class:** Excessively drained
   **Ecological site:** Hills
67—Sandoval-Poley complex, 3 to 30 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,000 to 7,000 feet (1,829 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Sandoval and similar soils: 40 percent
Poley and similar soils: 35 percent
Minor components: 25 percent

Component Descriptions

Sandoval soils
Landscape: Hills
Landform: Ridges
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Slope alluvium derived from shale
Slope: 3 to 30 percent
    Aspect: East to west
    Shape (down/across): Linear/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.1 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 10 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow
Potential native vegetation: side oats grama, New Mexico Feathergrass, cane
    bluestem, little bluestem, galleta
Land capability subclass (nonirrigated): 7s

Typical Profile:
    A—0 to 2 inches; loam
    C—2 to 11 inches; clay loam
    Cr—11 to 60 inches; bedrock

Poley soils
Landscape: Hills
Landform: Fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium derived from sandstone and shale
Sandoval County Area, New Mexico

Slope: 3 to 30 percent
Aspect: East to west
Shape (down/ across): Linear/ linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./ hr. (slow)
Available water capacity: About 8.8 inches (moderate)
Shrink-swell potential: About 3.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Foothills
Potential native vegetation: blue grama, black grama, sideoats grama, oneseed juniper, New Mexico Feathergrass, sacahuista

Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 3 inches; very cobbly loam
Bt1—3 to 12 inches; clay loam
Bt2—12 to 17 inches; clay loam
Btk—17 to 21 inches; clay loam
Bk1—21 to 40 inches; clay loam
Bk2—40 to 60 inches; very gravelly sandy loam

Minor Components
Camino and similar soils
Composition: About 10 percent
Slope: 1 to 6 percent
Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Clayey

Skyvillage and similar soils
Composition: About 5 percent
Slope: 8 to 25 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

Montecito and similar soils
Composition: About 5 percent
Slope: 3 to 30 percent
Drainage class: Well drained
Ecological site: Pinyon-juniper forest

San Mateo and similar soils
Composition: About 5 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale
68—Penistaja-Querencia complex, 2 to 7 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,700 to 6,400 feet (1,737 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Penistaja and similar soils: 45 percent
Querencia and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions

Penistaja soils
Landscape: Uplands
Landform: Mesas, alluvial fans, bajadas, plateaus, cuestas, hills
Position on landform: Footslopes
Position on landform: Head slope, side slope, nose slope, rise
Parent material: Eolian deposits over slope alluvium derived from sandstone and shale
Slope: 2 to 7 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.3 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: sand dropseed, spike muhly, winterfat, galleta, sand bluestem, black grama, blue grama
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 2 inches; loamy fine sand
Bt—2 to 15 inches; sandy clay loam
Btk—15 to 27 inches; sandy clay loam
Bk—27 to 38 inches; clay loam
C—38 to 60 inches; sandy clay loam

Querencia soils
Landscape: Uplands
Landform: Stream terraces, valley sides, alluvial fans
Position on landform: Footslopes
Position on landform: Rise
Parent material: Fan alluvium over colluvium derived from sandstone and shale
Sandoval County Area, New Mexico

Slope: 2 to 7 percent
Aspect: East to west
Shape (down/ across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.6 inches (moderate)
Shrink-swell potential: About 3.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, bottlebrush squirreltail, fourwing saltbush, needlegrass, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bw—2 to 40 inches; sandy clay loam
Bk—40 to 60 inches; fine sandy loam

Minor Components
Camino and similar soils
Composition: About 10 percent
Slope: 1 to 6 percent
Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Clayey

San Mateo and similar soils
Composition: About 5 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale

Sandoval and similar soils
Composition: About 5 percent
Slope: 3 to 30 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

71—Palon cobbly sandy loam, 15 to 35 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,500 to 9,500 feet (2,591 to 2,896 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days
Map Unit Composition

Palon and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Palon soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountain flank
Parent material: Slope alluvium over colluvium derived from rhyolite
Slope: 15 to 35 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 2.8 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
  Common trees: white fir, ponderosa pine, Douglas-fir
  Other plants: prairie junegrass, quaking aspen, silverweed cinquefoil, Arizona fescue, mountain muhly, nodding brome
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A--0 to 6 inches; cobbly sandy loam
  E--6 to 27 inches; very cobbly sandy loam
  Bt--27 to 60 inches; extremely cobbly sandy loam

Minor Components
Jarmillo and similar soils
  Composition: About 8 percent
  Slope: 2 to 20 percent
  Drainage class: Well drained
  Ecological site: Mountain Loam

Rock outcrop
  Composition: About 7 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

72—Palon very cobbly sandy loam, 35 to 65 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,600 to 9,300 feet (2,621 to 2,835 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Palon and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Palon soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountain flank
Parent material: Slope alluvium over colluvium derived from rhyolite
Slope: 35 to 65 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.2 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
  Common trees: white fir, ponderosa pine, Douglas-fir
  Other plants: prairie junegrass, quaking aspen, silverweed cinquefoil, Arizona fescue, mountain muhly, nodding brome
Land capability subclass (nonirrigated): 7c

Typical Profile:
  Oi—0 to 2 inches; slightly decomposed plant material
  A1—2 to 4 inches; very cobbly sandy loam
  A2—4 to 10 inches; extremely cobbly sandy loam
  E—10 to 32 inches; extremely cobbly sandy loam
  Bt1—32 to 53 inches; very cobbly sandy loam
  Bt2—53 to 60 inches; very cobbly sandy loam

Minor Components
Palon, bouldery and similar soils
  Composition: About 5 percent
  Slope: 15 to 35 percent
  Drainage class: Well drained
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Rubble land
  Composition: About 5 percent
  Slope: 35 to 60 percent
  Drainage class: Excessively drained
Rock outcrop
  Composition: About 5 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

74—Origo-Pavo association, 5 to 35 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,600 to 10,000 feet (2,621 to 3,048 meters)
Mean annual precipitation: 25 to 30 inches (635 to 762 millimeters)
Mean annual air temperature: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
Frost-free period: 45 to 60 days

Map Unit Composition

Origo and similar soils: 50 percent
Pavo and similar soils: 25 percent
Minor components: 25 percent

Component Descriptions

Origo soils
  Landscape: Mountains
  Landform: Mountain slopes
  Position on landform: Backslopes
  Position on landform: Mountainflank
  Parent material: Slope alluvium over colluvium derived from rhyolite
  Slope: 15 to 35 percent
    Aspect: East to west
    Shape (down/across): Linear/linear
  Depth class: Very deep
  Drainage class: Well drained
  Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
  Available water capacity: About 2.0 inches (very low)
  Shrink-swell potential: About 1.5 percent (low)
  Runoff class: Medium
  Calcium carbonate maximum: None
  Gypsum maximum: None
  Salinity maximum: About 2 mmhos/cm (nonsaline)
  Sodium adsorption ratio maximum: About 0 (nonsodic)
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
  Potential native vegetation:
    Common trees: white fir, Douglas-fir, limber pine, quaking aspen
    Other plants: common juniper, nodding brome, prairie junegrass, unknown, ponderosa pine
  Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 7 inches; very cobbly sandy loam
  E—7 to 28 inches; extremely cobbly sandy loam
  Bt—28 to 60 inches; extremely cobbly sandy loam
Pavo soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from tuff
Slope: 5 to 20 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 7.6 inches (moderate)
Shrink-swell potential: About 1.8 percent (low)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Loam
Potential native vegetation: Arizona fescue, bluegrass, western wheatgrass, muhly, needlegrass, bottlebrush squirrelltail
Land capability subclass (nonirrigated): 7c

Typical Profile:
   A1—0 to 9 inches; loam
   A2—9 to 12 inches; sandy loam
   E—12 to 25 inches; sandy loam
   E/Bt1—25 to 35 inches; sandy loam
   E/Bt2—35 to 45 inches; fine sandy loam
   2Bt1—45 to 50 inches; gravelly clay loam
   3Bt2—50 to 60 inches; sandy loam

Minor Components
Cajete and similar soils
   Composition: About 10 percent
   Slope: 0 to 8 percent
   Drainage class: Well drained
   Ecological site: Mountain Grassland

Rock outcrop
   Composition: About 10 percent
   Depth to restrictive feature: 0 inches to bedrock (lithic)

Rubble land
   Composition: About 5 percent
   Slope: 35 to 60 percent
   Depth to restrictive feature: 0 inches to bedrock (lithic)
   Drainage class: Excessively drained
75—Origo very cobbly sandy loam, 35 to 65 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,600 to 10,000 feet (2,621 to 3,048 meters)
Mean annual precipitation: 25 to 30 inches (635 to 762 millimeters)
Mean annual air temperature: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
Frost-free period: 45 to 60 days

Map Unit Composition

Origo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Origo soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Slope alluvium over colluvium derived from rhyolite
Slope: 35 to 65 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.8 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
  Common trees: Engelmann spruce, white fir, Douglas-fir
  Other plants: common juniper, nodding brome, prairie junegrass, limber pine,
  ponderosa pine, quaking aspen
Land capability subclass (nonirrigated): 7e

Typical Profile:
  O1—0 to 1 inch; slightly decomposed plant material
  A1—1 inch to 6 inches; very cobbly sandy loam
  A2—6 to 12 inches; very cobbly sandy loam
  E—12 to 32 inches; very cobbly sandy loam
  Bt1—32 to 56 inches; very cobbly sandy loam
  Bt2—56 to 60 inches; very cobbly loamy sand
Sandoval County Area, New Mexico

**Minor Components**

**Pavo and similar soils**
- *Composition*: About 5 percent
- *Slope*: 5 to 20 percent
- *Drainage class*: Well drained
- *Ecological site*: Mountain Loam

**Rock outcrop**
- *Composition*: About 5 percent
- *Depth to restrictive feature*: 0 inches to bedrock (lithic)

**Rubble land**
- *Composition*: About 5 percent
- *Slope*: 35 to 60 percent
- *Drainage class*: Excessively drained

**82—Calaveras loam, 15 to 35 percent slopes**

**Map Unit Setting**

*Major Land Resource Area*: 48A
*Elevation*: 8,500 to 9,000 feet (2,591 to 2,743 meters)
*Mean annual precipitation*: 20 to 25 inches (506 to 635 millimeters)
*Mean annual air temperature*: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
*Frost-free period*: 60 to 90 days

**Map Unit Composition**

Calaveras and similar soils: 85 percent
Minor components: 15 percent

**Component Descriptions**

**Calaveras soils**
- *Landscape*: Mountains
- *Landform*: Mountain slopes
- *Position on landform*: Backslopes
- *Position on landform*: Mountainflank
- *Parent material*: Colluvium derived from tuff
- *Slope*: 15 to 35 percent
  - *Aspect*: East to west
  - *Shape (down/across)*: Linear/linear
- *Depth class*: Very deep
- *Drainage class*: Well drained
- *Slowest permeability*: 0.6 to 2.0 in./hr. (moderate)
- *Available water capacity*: About 3.4 inches (low)
- *Shrink-swell potential*: About 1.5 percent (low)
- *Runoff class*: High
- *Calcium carbonate maximum*: None
- *Gypsum maximum*: None
- *Salinity maximum*: About 2 mmhos/cm (nonsaline)
- *Sodium adsorption ratio maximum*: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
  Common trees: white fir, limber pine, Douglas-fir, ponderosa pine
  Other plants: common juniper, nodding brome, prairie junegrass, quaking aspen
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 2 inches; loam
  AE—2 to 6 inches; sandy loam
  2Bt—8 to 40 inches; very cobbly sandy loam
  3Bt—40 to 60 inches; extremely cobbly coarse sandy loam

Minor Components
Redondo and similar soils
  Composition: About 5 percent
  Slope: 35 to 80 percent
  Drainage class: Well drained
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Cajete and similar soils
  Composition: About 5 percent
  Slope: 0 to 8 percent
  Drainage class: Well drained
  Ecological site: Mountain Grassland

Cosey and similar soils
  Composition: About 5 percent
  Slope: 2 to 20 percent
  Drainage class: Well drained
  Ecological site: Mountain Loam

83—Calaveras-Rubble land association, 35 to 60 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 8,500 to 9,000 feet (2,591 to 2,743 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Calaveras and similar soils: 60 percent
Rubble land: 20 percent
Minor components: 20 percent

Component Descriptions
Calaveras soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from tuff
Slope: 35 to 60 percent
   Aspect: East to west
   Shape (down/ across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.5 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
   Common trees: white fir, limber pine, Douglas-fir, ponderosa pine
   Other plants: common juniper, nodding brome, prairie junegrass, quaking aspen
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 6 inches; loam
   AE—6 to 12 inches; sandy loam
   2Bt—12 to 24 inches; very cobbly sandy loam
   3Bt—24 to 60 inches; extremely cobbly coarse sandy loam

Rubble land
Description: Rubble land consists of areas with 90 percent or more of the surface
   covered with cobbles, stones, and boulders.
Landscape: Mountains
Landform: Ledges, escarpments
Position on landform: Shoulders
Position on landform: Mountainflank
Slope: 35 to 60 percent
   Aspect: East to west
   Shape (down/ across): Linear/linear
Drainage class: Excessively drained
Available water capacity: About 0.6 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Land capability subclass (nonirrigated): 8s

Minor Components
Redondo and similar soils
   Composition: About 10 percent
   Slope: 15 to 35 percent
   Drainage class: Well drained
   Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Rock outcrop

Composition: About 10 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

85—Redondo coarse sandy loam, 15 to 35 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,700 to 10,000 feet (2,652 to 3,048 meters)
Mean annual precipitation: 25 to 30 inches (635 to 762 millimeters)
Mean annual air temperature: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
Frost-free period: 45 to 60 days

Map Unit Composition

Redondo and similar soils. 85 percent
Minor components: 15 percent

Component Descriptions

Redondo soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from tuff
Slope: 15 to 35 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 4.2 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
Common trees: Engelmann spruce
Other plants: Arizona fescue, corkbark fir, sedge, Fendler meadowrue, common
juniper, kinnikinnick, prairie junegrass, silverweed cinquefoil
Land capability subclass (nonirrigated): Tc

Typical Profile:
A—0 to 2 inches; coarse sandy loam
E1—2 to 7 inches; coarse sandy loam
E2—7 to 15 inches; coarse sandy loam
BE—15 to 22 inches; coarse sandy loam
Bt1—22 to 29 inches; gravelly coarse sandy loam
Bt2—29 to 38 inches; very gravelly coarse sandy loam
Bt3—38 to 54 inches; extremely gravelly coarse sandy loam
Bt4—54 to 60 inches; extremely cobbly coarse sandy loam
Minor Components
Ess and similar soils
Composition: About 10 percent
Slope: 5 to 45 percent
Drainage class: Well drained
Ecological site: Subalpine Grassland

Rubble land
Composition: About 5 percent
Slope: 35 to 80 percent
Drainage class: Excessively drained

86—Redondo cobbly coarse sandy loam, 35 to 80 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,700 to 11,000 feet (2,652 to 3,353 meters)
Mean annual precipitation: 25 to 30 inches (635 to 762 millimeters)
Mean annual air temperature: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
Frost-free period: 45 to 60 days

Map Unit Composition
Redondo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Redondo soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from tuff
Slope: 35 to 80 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 2.4 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
Common trees: Engelmann spruce
Other plants: Arizona fescue, Fendler meadowrue, Rocky Mountain maple,
corkbark fir, kinnikinnick, limber pine, quaking aspen
Land capability subclass (nonirrigated): 7c
Typical Profile:
A—0 to 8 inches; cobbly coarse sandy loam
E—8 to 13 inches; very cobbly coarse sandy loam
BE—15 to 34 inches; extremely cobbly coarse sandy loam
Bt—34 to 60 inches; extremely cobbly coarse sandy loam

Minor Components
Ess and similar soils
Composition: About 8 percent
Slope: 5 to 45 percent
Drainage class: Well drained
Ecological site: Subalpine Grassland

Rubble land
Composition: About 7 percent
Slope: 35 to 80 percent
Drainage class: Excessively drained

87—Redondo-Rubble land association, 35 to 80 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 9,000 to 10,500 feet (2,743 to 3,200 meters)
Mean annual precipitation: 25 to 30 inches (635 to 762 millimeters)
Mean annual air temperature: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
Frost-free period: 45 to 60 days

Map Unit Composition
Redondo and similar soils: 50 percent
Rubble land: 25 percent
Minor components: 25 percent

Component Descriptions
Redondo soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from tuff
Slope: 35 to 80 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.4 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
   Common trees: Engelmann spruce
   Other plants: Arizona fescue, Fendler meadowrue, Rocky Mountain maple,
                 corkbark fir, kinnikinnick, limber pine, quaking aspen
Land capability subclass (nonirrigated): Te

Typical Profile:
   A—0 to 6 inches; cobbly loam
   E—6 to 13 inches; very cobbly coarse sandy loam
   Bt—13 to 60 inches; very cobbly coarse sandy loam

Rubble land
Description: Rubble land consists of areas with 90 percent or more of the surface
             covered with cobbles, stones, and boulders.
Landscape: Mountains
Landform: Talus slopes
Position on landform: Backslopes
Position on landform: Mountainflank, upper third
Slope: 35 to 80 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Drainage class: Excessively drained
Available water capacity: About 0.6 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Land capability subclass (nonirrigated): 6s

Minor Components
Ess and similar soils
   Composition: About 25 percent
   Landform: Mountains
   Slope: 5 to 45 percent
   Drainage class: Well drained
   Ecological site: Subalpine Grassland

88—Totavi-Jemez-Rock outcrop association, 0 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 7,800 to 8,800 feet (2,377 to 2,682 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days
Map Unit Composition

Totavi and similar soils: 45 percent
Jemez and similar soils: 30 percent
Rock outcrop: 15 percent
Minor components: 10 percent

Component Descriptions

Totavi soils
Landscape: Plains
Landform: Stream terraces, valley floors, closed depressions
Position on landform: Töeslopes
Position on landform: Base slope
Parent material: Fan alluvium derived from tuff
Slope: 0 to 5 percent
  Aspect: East to west
  Shape (down/across): Concave/concave
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 4.7 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa-Juniperus deppeana/Quercus gambelii
Potential native vegetation:
  Common trees: oneseed juniper, ponderosa pine
  Other plants: needle and thread, skunkbush sumac, western wheatgrass, Gambel oak
Land capability subclass (nonirrigated): 6s

Typical Profile:
  A—0 to 12 inches; sandy loam
  C—12 to 60 inches; loamy sand

Jemez soils
Landscape: Hills
Landform: Plateaus
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Slope alluvium derived from tuff
Slope: 5 to 15 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 4.6 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Sandoval County Area, New Mexico

Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
  - Common trees: white fir, ponderosa pine, Douglas-fir
  - Other plants: needle and thread, skunkbush sumac, western wheatgrass, Gambel oak

Land capability subclass (nonirrigated): 7c

Typical Profile:
  - A1—0 to 6 inches; loam
  - A2—6 to 13 inches; loam
  - BA—13 to 19 inches; clay loam
  - Bt—19 to 27 inches; sandy clay loam
  - R—27 to 60 inches; bedrock

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landscape: Hills
Landform: Breaks, escarpments
Position on landform: Summits
Position on landform: Nose slope
  - Aspect: East to west
  - Shape (down/across): Convex/linear
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Cajete and similar soils
  - Composition: About 10 percent
  - Slope: 8 to 30 percent
  - Drainage class: Well drained
  - Ecological site: Mountain Grassland

91—Zia sandy loam, 1 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,500 to 5,700 feet (1,676 to 1,737 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Zia and similar soils: 85 percent
Minor components: 15 percent
Component Descriptions

Zia soils
Landscape: Valleys
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Eolian deposits over stream alluvium derived from sandstone
Slope: 1 to 3 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 7.5 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: blue grama, western wheatgrass, Indian ricegrass, black
   grama, one-seed juniper
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 16 inches; sandy loam
   C1—16 to 22 inches; loamy sand
   C2—22 to 35 inches; sandy loam
   C3—35 to 60 inches; fine sandy loam

Minor Components
El Rancho and similar soils
   Composition: About 10 percent
   Slope: 0 to 2 percent
   Drainage class: Well drained
   Ecological site: Loamy

Galisteo and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Well drained
   Ecological site: Salt Flats

92—Galisteo silty clay loam, moderately saline, sodic, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,500 to 5,700 feet (1,676 to 1,737 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Galisteo, moderately saline, sodic and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

**Galisteo, moderately saline, sodic soils**
Landscape: Valleys
Landform: Stream terraces, alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 1 percent
  - Aspect: East to west
  - Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 9.4 inches (high)
Shrink-swell potential: About 7.1 percent (high)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Salty Bottomland
Potential native vegetation: alkali sacaton, western wheatgrass, bottlebrush squirreltail, galleta, four-wing saltbush, greasewood
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 6c

Typical Profile:
- Ap—0 to 12 inches; silty clay loam
- C—12 to 60 inches; clay

Minor Components

El Rancho and similar soils
  - Composition: About 10 percent
  - Slope: 0 to 2 percent
  - Drainage class: Well drained
  - Ecological site: Loamy

Zia and similar soils
  - Composition: About 5 percent
  - Slope: 5 to 20 percent
  - Drainage class: Well drained
  - Ecological site: Sandy
93—Zia loamy sand, 1 to 4 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,100 to 5,500 feet (1,554 to 1,676 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Zia and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Zia soils
Landscape: Valleys
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Eolian deposits over stream alluvium derived from sandstone
Slope: 1 to 4 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 6.7 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: blue grama, western wheatgrass, Indian ricegrass, black
   grama, oneseed juniper
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 8 inches; loamy sand
   C—8 to 60 inches; sandy loam

Minor Components
Gilco and similar soils
   Composition: About 10 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland
Sandoval County Area, New Mexico

Pinavetes and similar soils
Composition: About 5 percent
Slope: 5 to 15 percent
Drainage class: Excessively drained
Ecological site: Deep Sand

95—El Rancho loam, 0 to 2 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,300 to 5,500 feet (1,615 to 1,676 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

El Rancho and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

El Rancho soils
Landscape: Valleys
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 2 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.3 inches (moderate)
Shrink-swell potential: About 3.4 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush squirreltail, fourwing saltbush, winterfat
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 6c

Typical Profile:
Ap—0 to 5 inches; loam
C1—5 to 20 inches; sandy clay loam
C2—20 to 38 inches; sandy clay loam
2C3—38 to 60 inches; sandy loam
Minor Components
Galisteo and similar soils
  Composition: About 10 percent
  Slope: 0 to 1 percent
  Drainage class: Well drained
  Ecological site: Salt Flats

Zia and similar soils
  Composition: About 5 percent
  Slope: 1 to 4 percent
  Drainage class: Well drained
  Ecological site: Sandy

97—El Rancho clay loam, 0 to 2 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,300 to 5,500 feet (1,615 to 1,676 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
El Rancho and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
El Rancho soils
  Landscape: Valleys
  Landform: Stream terraces
  Position on landform: Toeslopes
  Position on landform: Base slope
  Parent material: Stream alluvium derived from sandstone and shale
  Slope: 0 to 2 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
  Depth class: Very deep
  Drainage class: Well drained
  Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
  Available water capacity: About 9.3 inches (high)
  Shrink-swell potential: About 4.5 percent (moderate)
  Runoff class: Low
  Calcium carbonate maximum: About 10 percent
  Gypsum maximum: None
  Salinity maximum: About 2 mmhos/cm (nonsaline)
  Sodium adsorption ratio maximum: About 5 (slightly sodic)
  Ecological site: Loamy
  Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush
  squirrelltail, fourwing saltbush, winterfat
  Land capability subclass (irrigated): 2a
  Land capability subclass (nonirrigated): 6c
Typical Profile:
    Ap—0 to 8 inches; clay loam
    C—8 to 60 inches; sandy clay loam

Minor Components
Jocity and similar soils
    Composition: About 8 percent
    Slope: 0 to 2 percent
    Drainage class: Moderately well drained
    Flooding hazard: Rare
    Ecological site: Bottomland

Zia and similar soils
    Composition: About 7 percent
    Slope: 1 to 4 percent
    Drainage class: Well drained
    Ecological site: Sandy

100—Orejas-Rock outcrop complex, 15 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 7,000 to 7,500 feet (2,134 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Orejas and similar soils: 40 percent
Rock outcrop: 40 percent
Minor components: 20 percent

Component Descriptions
Orejas soils
    Landscape: Uplands
    Landform: Plateaus, mesas
    Position on landform: Shoulders
    Position on landform: Side slope
    Parent material: Eolian material, alluvium and colluvium derived from basalt
    Slope: 15 to 40 percent
    Aspect: East to west
    Shape (down/across): Linear/linear
    Depth class: Shallow
    Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
    Drainage class: Well drained
    Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
    Available water capacity: About 1.8 inches (very low)
    Shrink-swell potential: About 4.5 percent (moderate)
    Runoff class: Very high
    Calcium carbonate maximum: About 10 percent
    Gypsum maximum: None
    Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)

Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis

Potential native vegetation:
- Common trees: two-needled pinyon, one-seed juniper
- Other plants: blue grama, sideoats grama, big sagebrush

Land capability subclass (nonirrigated): 7s

Typical Profile:
- A—0 to 5 inches; very stony loam
- Bt—5 to 15 inches; very cobbly clay loam
- C—15 to 19 inches; very cobbly clay loam
- R—19 to 60 inches; bedrock

Rock outcrop
- Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
- Landscape: Uplands
- Landform: Breaks, escarpments
- Aspect: East to west
- Depth to restrictive feature: 0 inches to bedrock (lithic)
- Land capability subclass (nonirrigated): 8s

Minor Components
- Montecito and similar soils
  - Composition: About 10 percent
  - Slope: 3 to 30 percent
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Drainage class: Well drained
Ecological site: pinyon-juniper forest

San Mateo and similar soils
Composition: About 10 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale

101—Blancot-Lybrook association, 0 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 37
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Blancot and similar soils: 55 percent
Lybrook and similar soils: 25 percent
Minor components: 20 percent

Component Descriptions

Blancot soils
Landscape: Uplands
Landform: Ridges, valley sides
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from sandstone and shale
Slope: 2 to 8 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.5 inches (high)
Shrink-swell potential: About 3.0 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: Indian ricegrass, blue grama, galleta, big sagebrush, sand dropseed, western wheatgrass
Land capability subclass (nonirrigated): 6c
Typical Profile:
A—0 to 2 inches; fine sandy loam
Bt1—2 to 5 inches; clay loam
Bt2—5 to 14 inches; clay loam
Btk—14 to 23 inches; clay loam
C1—23 to 40 inches; sandy loam
C2—40 to 49 inches; silty clay loam
C3—49 to 60 inches; sandy loam

Lybrook soils
Landscape: Valleys
Landform: Stream terraces, valley floors
Position on landform: toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 2 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.6 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 25 mmhos/cm (strongly saline)
Sodium adsorption ratio maximum: About 50 (strongly sodic)
Ecological site: Salt Flats
Potential native vegetation: alkali sacaton, fourwing saltbush, galleta, greasewood, shadscale saltbush, big sagebrush, inland saltgrass, western wheatgrass
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 1 inch; clay loam
C1—1 inch to 5 inches; silty clay loam
C2—5 to 21 inches; clay loam
C3—21 to 30 inches; silty clay loam
C4—30 to 60 inches; clay loam

Minor Components
Betonnie and similar soils
Composition: About 10 percent
Slope: 5 to 8 percent
Drainage class: Well drained
Ecological site: Sandy

Councilor and similar soils
Composition: About 10 percent
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Sandy
102—Sparham clay loam, 1 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,500 to 7,500 feet (1,981 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Sparham and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sparham soils
Landscape: Valleys
Landform: Valley sides, alluvial fans, flood plains
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from shale
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Flooding hazard: Occasional
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Bottomland
Potential native vegetation: western wheatgrass, alkali sacaton, bottlebrush squirreltail, prairie junegrass
Land capability subclass (irrigated): 3s
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 7 inches; clay loam
C1—7 to 29 inches; clay loam
C2—29 to 60 inches; silty clay loam

Minor Components
Hickman and similar soils
Composition: About 5 percent
Slope: 1 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale
Pinitos and similar soils
Composition: About 5 percent
Slope: 2 to 10 percent
Drainage class: Well drained
Ecological site: Loamy

Royosa and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

104—Cochiti-Montecito association, 1 to 30 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,500 to 7,000 feet (1,981 to 2,134 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Cochiti and similar soils: 50 percent
Montecito and similar soils: 30 percent
Minor components: 20 percent

Component Descriptions
Cochiti soils
Landscape: Uplands
Landform: Fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 3 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 15 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 4.8 inches (low)
Shrink-swell potential: About 4.1 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
- Common trees: oneseed juniper, twoneedle pinyon
- Other plants: blue grama, sideoats grama, bottlebrush squirreltail

Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 7 inches; gravelly loam
- Bt1—7 to 12 inches; gravelly clay loam
- Bt2—12 to 20 inches; very gravelly clay
- Bt3—20 to 29 inches; very gravelly clay loam
- C—29 to 60 inches; very gravelly sandy loam

Montecito soils
Landscape: Uplands
Landform: Hills, mesas, plains
Position on landform: Toeslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 1 to 5 percent
- Aspect: East to west
- Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 8.1 inches (moderate)
Shrink-swell potential: About 2.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
- Common trees: twoneedle pinyon, oneseed juniper
- Other plants: blue grama, bottlebrush squirreltail, muttongrass

Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 3 inches; loam
- Bt1—3 to 9 inches; clay loam
- Bt2—9 to 15 inches; clay loam
- Bt3—15 to 22 inches; clay loam
- 2Bk1—22 to 37 inches; sandy loam
- 2Bk2—37 to 60 inches; gravelly sandy loam

Minor Components
Cajete and similar soils
- Composition: About 10 percent
- Slope: 0 to 8 percent
- Drainage class: Well drained
- Ecological site: Loamy
Waumac and similar soils

*Composition:* About 10 percent  
*Slope:* 1 to 7 percent  
*Drainage class:* Well drained  
*Ecological site:* Sandy

### 105—Badland-Menefee complex, 15 to 35 percent slopes

#### Map Unit Setting

*Major Land Resource Area:* 36  
*Elevation:* 6,500 to 7,600 feet (1,981 to 2,316 meters)  
*Mean annual precipitation:* 13 to 16 inches (330 to 406 millimeters)  
*Mean annual air temperature:* 48 to 52 degrees F. (8.9 to 11.1 degrees C.)  
*Frost-free period:* 110 to 130 days

#### Map Unit Composition

Badland: 50 percent  
Menefee and similar soils: 30 percent  
Minor components: 20 percent

#### Component Descriptions

**Badland**

*Landform:* Escarpments  
*Slope:* 15 to 35 percent  
*Aspect:* East to west  
*Depth to restrictive feature:* 0 inches to bedrock (paralithic)  
*Drainage class:* Somewhat excessively drained  
*Runoff class:* Very high  
*Land capability subclass (nonirrigated):* 8

**Menefee soils**

*Landscape:* Hills  
*Landform:* Mesas, mountainsides, till slopes  
*Position on landform:* Backslopes  
*Position on landform:* Side slope  
*Parent material:* Colluvium over residuum weathered from shale  
*Slope:* 15 to 35 percent  
*Aspect:* East to west  
*Shape (down/across):* Convex/linear  
*Depth class:* Very shallow and shallow  
*Depth to restrictive feature:* 8 to 20 inches to bedrock (paralithic)  
*Drainage class:* Well drained  
*Slowest permeability:* 0.2 to 0.6 in./hr. (moderately slow)  
*Available water capacity:* About 1.9 inches (very low)  
*Shrink-swell potential:* About 4.5 percent (moderate)  
*Runoff class:* Very high  
*Calcium carbonate maximum:* About 5 percent  
*Gypsum maximum:* About 1 percent  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 0 (nonsodic)
Sandoval County Area, New Mexico

Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
- Common trees: one-seed juniper, Rocky Mountain juniper, two-needle pinyon
- Other plants: blue grama, galleta, sideoats grama, Gambel oak, big sagebrush
Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 4 inches; loam
- C—4 to 10 inches; clay loam
- 2Cr—10 to 60 inches; bedrock

Minor Components
Pinitos and similar soils
- Composition: About 10 percent
- Slope: 2 to 10 percent
- Drainage class: Well drained
- Ecological site: Loamy

Sparham and similar soils
- Composition: About 10 percent
- Slope: 0 to 3 percent
- Drainage class: Well drained
- Flooding hazard: Occasional
- Ecological site: Clayey

106—Stumble association, 1 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,600 feet (1,524 to 1,707 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 110 to 160 days

Map Unit Composition
Stumble and similar soils: 50 percent
Stumble, sandy and similar soils: 30 percent
Minor components: 20 percent

Component Descriptions
Stumble soils
- Landscape: Valleys
- Landform: Fan aprons, inset fans, alluvial fans, fan remnants
- Position on landform: Footslopes
- Parent material: Eolian deposits derived from sandstone
- Slope: 10 to 40 percent
- Aspect: East to west
- Shape (down/across): Linear, convex/linear
- Depth class: Very deep
- Drainage class: Somewhat excessively drained
- Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 2.6 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Gravelly Sand
Potential native vegetation: black grama, bush muhly
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 4 inches; very gravelly fine sandy loam
  Bw—4 to 10 inches; gravelly fine sandy loam
  C1—10 to 24 inches; loamy sand
  C2—24 to 60 inches; gravelly coarse sand

Stumble, sandy soils
Landscape: Valleys
Landform: Alluvial fans, fan remnants, fan aprons, inset fans
Position on landform: Footslopes
Position on landform: Rise, side slope
Parent material: Eolian deposits derived from sandstone
Slope: 1 to 10 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Deep Sand
Potential native vegetation: black grama, Indian ricegrass, dropseed, bush muhly,
  sand sagebrush
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 4 inches; gravelly loamy sand
  Bw—4 to 18 inches; loamy sand
  C—18 to 60 inches; gravelly coarse sand

Minor Components
Embudo and similar soils
  Composition: About 10 percent
  Slope: 1 to 15 percent
  Drainage class: Well drained
  Ecological site: Sandy
Grieta and similar soils
Composition: About 10 percent
Slope: 1 to 4 percent
Drainage class: Well drained
Ecological site: Loamy

108—Embudo gravelly sandy loam, 1 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,600 feet (1,524 to 1,707 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.7 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Embudo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Embudo soils
Landscape: Valleys
Landform: Fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from granite
Slope: 1 to 15 percent
Aspect: East to west
Shape (down/across): Linear/Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 5.5 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: black grama, dropseed, Indian ricegrass, sand sagebrush
Land capability subclass (nonirrigated): 7c

Typical Profile:
AB—0 to 6 inches; gravelly sandy loam
Bk1—6 to 30 inches; sandy loam
2Bk2—30 to 60 inches; loamy sand
Minor Components
Cascajo and similar soils
Composition: About 5 percent
Slope: 12 to 30 percent
Drainage class: Excessively drained
Ecological site: Hills

Riverwash
Composition: About 5 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 3 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Sheppard and similar soils
Composition: About 3 percent
Slope: 10 to 40 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

Tijeras and similar soils
Composition: About 2 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Sandy

109—Embudo-Tijeras association, 1 to 9 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,100 to 5,600 feet (1,554 to 1,707 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Embudo and similar soils: 50 percent
Tijeras and similar soils: 35 percent
Minor components: 15 percent

Component Descriptions
Embudo soils
Landscape: Valleys
Landform: Fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from granite
Sandoval County Area, New Mexico

Slope: 3 to 9 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.8 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: black grama, dropseed, Indian ricegrass, sand sagebrush
Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 4 inches; gravelly sandy loam
- Bw—4 to 12 inches; gravelly fine sandy loam
- Bk1—12 to 30 inches; gravelly coarse sandy loam
- Bk2—30 to 60 inches; gravelly loamy coarse sand

Tijeras soils
Landscape: Valleys
Landform: Fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from granite
Slope: 1 to 6 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 4.6 inches (low)
Shrink-swell potential: About 2.4 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: black grama, dropseed, Indian ricegrass, sand sagebrush
Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 4 inches; gravelly fine sandy loam
- Bt—4 to 10 inches; sandy clay loam
- Btk—10 to 20 inches; sandy clay loam
- Bk1—20 to 26 inches; gravelly sandy loam
- Bk2—26 to 60 inches; very gravelly coarse sandy loam
Minor Components
Grieta and similar soils
Composition: About 10 percent
Slope: 2 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Sheppard and similar soils
Composition: About 5 percent
Slope: 3 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

110—Rock outcrop-Saido complex, 5 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,300 to 6,000 feet (1,615 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 64 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Rock outcrop: 45 percent
Saido and similar soils: 40 percent
Minor components: 15 percent

Component Descriptions
Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, breaks
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Saido soils
Landscape: Hills
Landform: Mesas, cuestas, knolls, fans
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Slope alluvium derived from gypsum
Slope: 5 to 40 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 10.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 80 percent
Sandoval County Area, New Mexico

**Sandoval County Area, New Mexico**

**Salinity maximum:** About 8 mmhos/cm (slightly saline)

**Sodium adsorption ratio maximum:** About 0 (nonsodic)

**Ecological site:** Gyp Upland

**Potential native vegetation:** alkali sacaton, black grama, bush muhly, gyp dropseed, blue grama, coldenia, fourwing saltbush, galleta, gypsum grama

**Land capability subclass (nonirrigated):** 7e

**Typical Profile:**
- A—0 to 5 inches; silt loam
- By1—5 to 9 inches; silt loam
- By2—9 to 15 inches; silt loam
- By3—15 to 25 inches; silt loam
- C—25 to 60 inches; loam

**Minor Components**

**Riverwash**
- **Composition:** About 5 percent
- **Landscape:** Valleys
- **Landform:** Streams, channels
- **Position on landform:** Toeslopes
- **Position on landform:** Base slope
- **Slope:** 0 to 3 percent
- **Shape (down/across):** Concave/linear
- **Drainage class:** Somewhat poorly drained
- **Floodling hazard:** Frequent

**Penistaja and similar soils**
- **Composition:** About 5 percent
- **Slope:** 2 to 7 percent
- **Drainage class:** Well drained
- **Ecological site:** Loamy

**Hagerman and similar soils**
- **Composition:** About 5 percent
- **Slope:** 1 to 5 percent
- **Depth to restrictive feature:** 20 to 40 inches to bedrock (ilithic)
- **Drainage class:** Well drained
- **Ecological site:** Loamy

**111—Rock outcrop-Zia complex, 8 to 25 percent slopes**

**Map Unit Setting**

- **Major Land Resource Area:** 36
- **Elevation:** 5,400 to 6,400 feet (1,646 to 1,951 meters)
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Map Unit Composition**

- **Rock outcrop:** 50 percent
- **Zia and similar soils:** 35 percent
- **Minor components:** 15 percent
Component Descriptions

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, breaks
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): Bs

Zia soils
Landscape: Valleys
Landform: Alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 8 to 25 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 8.2 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Sandoval County Area, New Mexico

Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation: blue grama, hairy grama, black grama, sideoats grama, galleta, oneseed juniper, sacahuista
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 5 inches; sandy loam
C—5 to 60 inches; fine sandy loam

Minor Components
Penistaja and similar soils
   Composition: About 5 percent
   Slope: 1 to 5 percent
   Drainage class: Well drained
   Ecological site: Loamy

Hagerman and similar soils
   Composition: About 5 percent
   Slope: 1 to 5 percent
   Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Loamy

San Mateo and similar soils
   Composition: About 3 percent
   Slope: 0 to 3 percent
   Drainage class: Well drained
   Flooding hazard: Rare
   Ecological site: Swale

Skyvillage and similar soils
   Composition: About 2 percent
   Slope: 3 to 20 percent
   Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Shallow Sandstone

112—Tijeras gravelly fine sandy loam, 1 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,100 to 5,600 feet (1,554 to 1,707 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Tijeras and similar soils: 85 percent
Minor components: 15 percent
Component Descriptions

Tijeras soils

Landscape: Uplands
Landform: Fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from granite
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 6.5 inches (moderate)
Shrink-swell potential: About 2.1 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: black grama, dropseed, Indian ricegrass, sand sagebrush
Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 3 inches; gravelly fine sandy loam
- Bt—3 to 14 inches; sandy clay loam
- Bk—14 to 60 inches; gravelly sandy loam

Minor Components

Embudo and similar soils
- Composition: About 15 percent
- Landform: Fan remnants
- Slope: 1 to 15 percent
- Drainage class: Well drained
- Ecological site: Sandy

114—Zia-San Mateo association, 0 to 9 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,500 to 6,200 feet (1,676 to 1,890 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Zia and similar soils: 40 percent
San Mateo and similar soils: 40 percent
Minor components: 20 percent
Component Descriptions

Zia soils
Landscape: Valleys
Landform: Alluvial fans
Position on landform: Footslopes
Position on landform: Rise
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 1 to 9 percent
Aspect: East to west
Shape (down/ across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 8.3 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush squirreltail, fourwing saltbush, one-seed juniper, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; fine sandy loam
C—3 to 60 inches; fine sandy loam

San Mateo soils
Landscape: Valleys
Landform: Alluvial fans, valley sides, flood plains
Position on landform: Footslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 3 percent
Aspect: East to west
Shape (down/ across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.2 inches (high)
Shrink-swell potential: About 4.3 percent (moderate)
Flooding hazard: Rare
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 30 mmhos/cm (strongly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Swale
Potential native vegetation: galleta, big sagebrush, blue grama, bottlebrush squirreltail, other half shrubs, western wheatgrass
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 6e
Typical Profile:
A—0 to 7 inches; sandy loam
C—7 to 60 inches; stratified sandy loam to loam to clay loam to silty clay loam

Minor Components
Sparank and similar soils
Composition: About 10 percent
Slope: 0 to 1 percent
Drainage class: Well drained
Flooding hazard: Occasional
Ecological site: Clayey Bottomland

Querencia and similar soils
Composition: About 10 percent
Slope: 1 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

120—Pinavetes loamy sand, 3 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,300 to 6,000 feet (1,615 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Pinavetes and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Pinavetes soils
Landscape: Dune fields
Landform: Dunes, valley sides
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 3 to 5 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in/hr. (rapid)
Available water capacity: About 2.9 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Sandoval County Area, New Mexico

Figure 5.—Typical landscape of Pinavetes loamy sand, 3 to 5 percent slopes.

Ecological site: Deep Sand  
Potential native vegetation: Indian ricegrass, blue grama, sand sagebrush  
Land capability subclass (nonirrigated): 6e

Typical Profile:  
A—0 to 10 inches; loamy sand  
C1—10 to 35 inches; sand  
C2—35 to 60 inches; sand

Minor Components  
San Mateo and similar soils  
Composition: About 10 percent  
Slope: 0 to 3 percent  
Drainage class: Well drained  
Flooding hazard: Rare  
Ecological site: Swale

Zia and similar soils  
Composition: About 5 percent  
Slope: 1 to 3 percent  
Drainage class: Well drained  
Ecological site: Sandy
124—Rock outcrop

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,300 to 6,000 feet (1,615 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)

Map Unit Composition

Rock outcrop: 90 percent
Minor components: 10 percent

Component Descriptions

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Mesas, escarpments
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Vessilla and similar soils
Composition: About 10 percent
Slope: 5 to 40 percent
Depth to restrictive feature: 5 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

129—Menefee clay loam, 5 to 35 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,800 to 7,800 feet (2,073 to 2,377 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Menefee and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Menefee soils
Landscape: Hills
Landform: Mountainsides, hillslopes, mesas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium over residuum weathered from shale
Slope: 5 to 35 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.4 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
  Common trees: Rocky Mountain juniper, oneseed juniper, twoneedle pinyon
  Other plants: blue grama, Gambel oak, galleta, big sagebrush, sideoats grama
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 5 inches; clay loam
C1—5 to 10 inches; clay loam
C2—10 to 17 inches; clay loam
2Cr—17 to 60 inches; bedrock

Minor Components
Pinitos and similar soils
  Composition: About 5 percent
  Slope: 2 to 10 percent
  Drainage class: Well drained
  Ecological site: pinyon-juniper forest

Cochiti and similar soils
  Composition: About 5 percent
  Slope: 3 to 30 percent
  Drainage class: Well drained
  Ecological site: pinyon-juniper forest

Badland
  Composition: About 5 percent
  Slope: 5 to 75 percent
  Depth to restrictive feature: 0 inches to bedrock (paralithic)

130--Pinavetes-Galisteo, moderately saline, sodic, association, 0 to 5 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,500 to 6,000 feet (1,676 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days
Map Unit Composition

Pinavetes and similar soils: 45 percent
Galisteo, moderately saline, sodic and similar soils: 40 percent
Minor components: 15 percent

Component Descriptions

Pinavetes soils
Landscape: Valleys
Landform: Dunes, valley sides
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 0 to 5 percent
Aspect: East to west
Shape (down/across): Convex/convex
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 4.1 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, sand sagebrush
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 2 inches; loamy sand
C—2 to 60 inches; loamy sand

Galisteo, moderately saline, sodic soils
Landscape: Valleys
Landform: Alluvial fans, stream terraces
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 2 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 9.0 inches (moderate)
Shrink-swell potential: About 7.5 percent (high)
Flooding hazard: Rare
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Salty Bottomland
Sandoval County Area, New Mexico

*Potential native vegetation:* alkali sacaton, western wheatgrass, bottlebrush squirreltail, galleta, fourwing saltbush, greasewood

*Land capability subclass (nonirrigated):* 6c

**Typical Profile:**
- Ap—0 to 2 inches; clay loam
- C—2 to 60 inches; clay

**Minor Components**

**Riverwash**
- *Composition:* About 5 percent
- *Landscape:* Valleys
- *Landform:* Streams, channels
- *Position on landform:* Toeslopes
- *Position on landform:* Base slope
- *Slope:* 0 to 3 percent
- *Shape (down/across):* Concave/linear
- *Drainage class:* Somewhat poorly drained
- *Flooding hazard:* Frequent

**El Rancho and similar soils**
- *Composition:* About 5 percent
- *Slope:* 0 to 2 percent
- *Drainage class:* Well drained
- *Ecological site:* Loamy

**San Mateo and similar soils**
- *Composition:* About 5 percent
- *Slope:* 0 to 3 percent
- *Drainage class:* Well drained
- *Flooding hazard:* Rare
- *Ecological site:* Swale

142—Grieta fine sandy loam, 1 to 4 percent slopes

**Map Unit Setting**

*Major Land Resource Area:* 42
*Elevation:* 5,000 to 6,000 feet (1,524 to 1,829 meters)
*Mean annual precipitation:* 8 to 10 inches (203 to 254 millimeters)
*Mean annual air temperature:* 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
*Frost-free period:* 140 to 160 days

**Map Unit Composition**

Grieta and similar soils: 85 percent
Minor components: 15 percent

**Component Descriptions**

**Grieta soils**
- *Landscape:* Uplands
- *Landform:* Plateaus, fan remnants, ridges, mesas
- *Position on landform:* Shoulders
- *Position on landform:* Side slope
- *Parent material:* Eolian deposits over fan alluvium derived from sandstone
Slope: 1 to 4 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Surface fragments: About 5 percent fine subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 7.9 inches (moderate)
Shrink-swell potential: About 3.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Loamy
Potential native vegetation: black grama, dropseed, Indian ricegrass, sand sagebrush
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 3 inches; fine sandy loam
   Bt1—3 to 11 inches; fine sandy loam
   Bt2—11 to 34 inches; sandy clay loam
   Bk1—34 to 48 inches; sandy clay loam
   Bk2—48 to 60 inches; loamy sand

Minor Components
Sheppard and similar soils
   Composition: About 15 percent
   Slope: 3 to 8 percent
   Drainage class: Somewhat excessively drained
   Ecological site: Deep Sand

143—Clovis fine sandy loam, 1 to 4 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,000 to 6,600 feet (1,829 to 2,012 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Clovis and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Clovis soils
Landscape: Uplands
Landform: Fan remnants, plains, mesas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from sandstone and shale
Sandoval County Area, New Mexico

Slope: 1 to 4 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.8 inches (moderate)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 25 percent
Gypsum maximum: None
Salinity maximum: About 2 mhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 1 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, bottlebrush squirreltail
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; fine sandy loam
Bt1—3 to 7 inches; sandy clay loam
Bt2—7 to 12 inches; sandy clay loam
Bt3—12 to 22 inches; sandy clay loam
Bk1—22 to 34 inches; sandy clay loam
Bk2—34 to 60 inches; sandy clay loam

Minor Components
Harvey and similar soils
Composition: About 5 percent
Slope: 5 to 10 percent
Drainage class: Well drained
Ecological site: Limy

Zia and similar soils
Composition: About 5 percent
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Sandy

Pinavetes and similar soils
Composition: About 5 percent
Slope: 3 to 5 percent
Drainage class: Excessively drained
Ecological site: Deep Sand

145—Grieta-Sheppard loamy fine sands, 2 to 9 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,200 to 6,000 feet (1,585 to 1,829 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days
Map Unit Composition

Grieta and similar soils: 55 percent
Sheppard and similar soils: 40 percent
Minor components: 5 percent

Component Descriptions

Grieta soils
Landscape: Uplands
Landform: Fan remnants, ridges, plateaus, mesas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 2 to 5 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 6.5 inches (moderate)
Shrink-swell potential: About 2.2 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, bottlebrush squirreltail
Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 7 inches; loamy fine sand
  Bt1—7 to 14 inches; sandy clay loam
  Bt2—14 to 21 inches; sandy clay loam
  Bk1—21 to 38 inches; coarse sandy loam
  Bk2—38 to 50 inches; coarse sandy loam
  Bk3—50 to 60 inches; coarse sandy loam

Sheppard soils
Landscape: Uplands
Landform: Alluvial fans, benches, dunes, structural benches, terraces
Position on landform: Shoulders
Position on landform: Rise, side slope
Parent material: Eolian deposits derived from sandstone
Slope: 3 to 9 percent
  Aspect: East to west
  Shape (down/across): Linear, convex/linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 5.3 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
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Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, black grama, sand dropseed, sand sagebrush, spike dropseed
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 5 inches; loamy fine sand
C—5 to 27 inches; loamy fine sand
C—27 to 60 inches; loamy fine sand

Minor Components
Cascajo and similar soils
Composition: About 3 percent
Slope: 12 to 30 percent
Drainage class: Excessively drained
Ecological site: Hills

Riverwash
Composition: About 2 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

146—Sedmar loamy sand, 1 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 7,000 to 8,000 feet (2,134 to 2,438 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Sedmar and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sedmar soils
Landscape: Uplands
Landform: Ridges, cuestas
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Slope alluvium over residuum weathered from sandstone
Slope: 1 to 15 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelli
Potential native vegetation:
- Common trees: ponderosa pine, Gambel oak
- Other plants: prairie junegrass, Rocky Mountain juniper, Utah juniper, true mountain mahogany
Land capability subclass (nonirrigated): 7c

Typical Profile:
A—0 to 3 inches; loamy sand
C1—3 to 13 inches; sandy loam
C2—13 to 18 inches; loamy sand
2R—18 to 60 inches; bedrock

Minor Components
Menefee and similar soils
- Composition: About 8 percent
- Slope: 15 to 35 percent
- Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Ponderosa Pine Forest

Rock outcrop
- Composition: About 7 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)

150—Doakum-Betonnie fine sandy loams, 0 to 8 percent slopes

Map Unit Setting
Major Land Resource Area: 37
Elevation: 6,500 to 7,000 feet (2,012 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Doakum and similar soils: 55 percent
Betonnie and similar soils: 35 percent
Minor components: 10 percent
**Component Descriptions**

**Doakum soils**

*Landscape:* Uplands  
*Landform:* Mesas, plateaus, hills, cuestas, bajadas  
*Position on landform:* Footslopes  
*Position on landform:* Head slope, side slope, nose slope  
*Parent material:* Eolian deposits over slope alluvium derived from sandstone and shale  
*Slope:* 0 to 5 percent  
*Aspect:* East to west  
*Shape (down/across):* Linear/linear  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Slowest permeability:* 0.2 to 0.6 in./hr. (moderately slow)  
*Available water capacity:* About 10.0 inches (high)  
*Shrink-swell potential:* About 4.4 percent (moderate)  
*Runoff class:* Low  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 8 mmhos/cm (slightly saline)  
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)  
*Ecological site:* Loamy  
*Potential native vegetation:* Indian ricegrass, blue grama, galleta, big sagebrush, bottlebrush squirreltail, sand dropseed, western wheatgrass  
*Land capability subclass (nonirrigated):* 6c  

**Typical Profile:**  
A—0 to 5 inches; fine sandy loam  
Bt1—5 to 11 inches; clay loam  
Bt2—11 to 17 inches; sandy clay loam  
Bk1—17 to 24 inches; sandy clay loam  
Bk2—24 to 31 inches; clay loam  
Bk3—31 to 44 inches; loam  
C—44 to 60 inches; loam

**Betonnie soils**

*Landscape:* Uplands  
*Landform:* Cuestas, mesas, plateaus, hills, valley sides, fan remnants  
*Position on landform:* Footslopes  
*Position on landform:* Head slope, side slope, nose slope  
*Parent material:* Eolian deposits over slope alluvium derived from sandstone  
*Slope:* 5 to 8 percent  
*Aspect:* East to west  
*Shape (down/across):* Linear/linear  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Slowest permeability:* 2.0 to 6.0 in./hr. (moderately rapid)  
*Available water capacity:* About 7.3 inches (moderate)  
*Shrink-swell potential:* About 1.5 percent (low)  
*Runoff class:* Low  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: Indian ricegrass, dropseed, needle and thread, winterfat, alkali sacaton, fourwing saltbush, mormon tea, sand sagebrush, sandhill muhly
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; fine sandy loam
BA—2 to 4 inches; fine sandy loam
Bt—4 to 12 inches; fine sandy loam
BC—12 to 18 inches; sandy loam
C1—18 to 34 inches, sandy loam
C2—34 to 60 inches; sandy loam

Minor Components
Blancot and similar soils
Composition: About 5 percent
Slope: 3 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Eslendo and similar soils
Composition: About 3 percent
Slope: 5 to 30 percent
Depth to restrictive feature: 4 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

Mespun and similar soils
Composition: About 2 percent
Slope: 5 to 30 percent
Drainage class: Excessively drained
Ecological site: Sandy

162—Hackroy-Nyjack association, 1 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,000 to 7,200 feet (1,829 to 2,195 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Hackroy and similar soils: 45 percent
Nyjack and similar soils: 40 percent
Minor components: 15 percent

Component Descriptions
Hackroy soils
Landscape: Uplands
Landform: Mesas, plateaus
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Residuum weathered from tuff
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 1.9 inches (very low)
Shrink-swell potential: About 7.5 percent (high)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
- Common trees: oneseed juniper, twoneedle pinyon
- Other plants: Indian ricegrass, blue grama, needle and thread, skunkbush sumac
Land capability subclass (nonirrigated): 7s

Typical Profile:
- A—0 to 3 inches; sandy loam
- Bt—3 to 13 inches; clay
- 2R—13 to 60 inches; bedrock

Nyjack soils
Landscape: Uplands
Landform: Plateaus, mesas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium derived from tuff
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 6.1 inches (moderate)
Shrink-swell potential: About 3.2 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa-Juniperus deppeana/Quercus gambelii
Potential native vegetation:
- Common trees: oneseed juniper, ponderosa pine, twoneedle pinyon
- Other plants: blue grama, little bluestem, wavyleaf oak, western wheatgrass
Land capability subclass (nonirrigated): 6c
**Typical Profile:**
- A—0 to 3 inches; loam
- Bt1—3 to 13 inches; clay loam
- Bt2—13 to 24 inches; clay loam
- 2C—24 to 39 inches; gravelly sandy loam
- 2Cr—39 to 60 inches; bedrock

**Minor Components**

Frijoles and similar soils
- **Composition:** About 10 percent
- **Slope:** 1 to 8 percent
- **Drainage class:** Well drained
- **Ecological site:** Pinyon-Juniper forest

Rock outcrop
- **Composition:** About 5 percent
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)

163—Jemez loam, 1 to 15 percent slopes

**Map Unit Setting**

- **Major Land Resource Area:** 36
- **Elevation:** 7,000 to 7,500 feet (2,134 to 2,286 meters)
- **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
- **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- **Frost-free period:** 60 to 90 days

**Map Unit Composition**

- Jemez and similar soils: 85 percent
- Minor components: 15 percent

**Component Descriptions**

**Jemez soils**

- **Landscape:** Uplands
- **Landform:** Plateaus, hills
- **Position on landform:** Summits
- **Position on landform:** Side slope
- **Parent material:** Slope alluvium derived from tuff
- **Slope:** 1 to 15 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Linear/Linear
- **Depth class:** Moderately deep
- **Depth to restrictive feature:** 20 to 40 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Slowest permeability:** 0.2 to 0.6 in./hr. (moderately slow)
- **Available water capacity:** About 7.0 inches (moderate)
- **Shrink-swell potential:** About 4.5 percent (moderate)
- **Runoff class:** High
- **Calcium carbonate maximum:** None
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
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Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Potential native vegetation:
- Common trees: white fir, ponderosa pine, Douglas-fir
- Other plants: needle and thread, skunkbush sumac, western wheatgrass, Gambel oak

Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 3 inches; loam
- BA—3 to 24 inches; clay loam
- Bt—24 to 39 inches; sandy clay loam
- R—39 to 60 inches; bedrock

Minor Components

Carjo and similar soils
- Composition: About 5 percent
- Slope: 1 to 9 percent
- Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Pinus ponderosa/Quercus gambelii

Alanos and similar soils
- Composition: About 5 percent
- Slope: 5 to 40 percent
- Drainage class: Well drained
- Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Mirand and similar soils
- Composition: About 3 percent
- Slope: 5 to 30 percent
- Drainage class: Well drained
- Ecological site: Pinus ponderosa/Quercus gambelii

Rock outcrop
- Composition: About 2 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)

170—San Mateo loam, 0 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 6,800 feet (1,768 to 2,073 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

San Mateo and similar soils: 85 percent
Minor components: 15 percent
Figure 6.—Typical landscape of San Mateo loam, 0 to 3 percent slopes. This area is prone to flooding.

Component Descriptions

San Mateo soils

Landscape: Valleys
Landform: Alluvial fans, valley sides, flood plains
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 3 percent
   Aspect: East to west
   Shape (down/across): Linear/Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.7 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Flooding hazard: Rare
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Swale
Potential native vegetation: galleta, big sagebrush, blue grama, bottlebrush squirreltail, other half shrubs, western wheatgrass
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 2 inches; loam
- C1—2 to 10 inches; clay loam
- C2—10 to 23 inches; clay loam
- C3—23 to 32 inches; clay loam
- C4—32 to 54 inches; clay loam
- C5—54 to 60 inches; clay loam

Minor Components
Camino and similar soils
- Composition: About 5 percent
- Slope: 1 to 6 percent
- Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Clayey

Querencia and similar soils
- Composition: About 3 percent
- Slope: 1 to 8 percent
- Drainage class: Well drained
- Ecological site: Loamy

Sandoval and similar soils
- Composition: About 3 percent
- Slope: 3 to 30 percent
- Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: Shallow

Skyvillage and similar soils
- Composition: About 2 percent
- Slope: 3 to 20 percent
- Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Ecological site: Shallow Sandstone

Sparank and similar soils
- Composition: About 2 percent
- Slope: 0 to 3 percent
- Drainage class: Well drained
- Flooding hazard: Occasional
- Ecological site: Clayey Bottomland

180—Counselor-Eslendo-Mespun complex, 5 to 30 percent slopes

Map Unit Setting

Major Land Resource Area: 37
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Councelor and similar soils: 40 percent
Eslendo and similar soils: 30 percent
Mespun and similar soils: 25 percent
Minor components: 5 percent

Component Descriptions

Councelor soils
Landscape: Uplands
Landform: Stream terraces, fan remnants, valley floors, valley sides
Position on landform: Toeslopes
Position on landform: Side slope
Parent material: Eolian deposits over stream alluvium derived from sandstone and shale
Slope: 5 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.5 in./hr. (moderately slow)
Available water capacity: About 8.1 inches (moderate)
Shrink-swell potential: About 1.7 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: Indian ricegrass, blue grama, dropseed, New Mexico Feathergrass, big sagebrush, galleta, mormon tea, needle and thread, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; fine sandy loam
C1—2 to 7 inches; fine sandy loam
C2—7 to 37 inches; fine sandy loam
C3—37 to 40 inches; clay loam
C4—40 to 60 inches; sandy loam

Eslendo soils
Landscape: Uplands
Landform: Ridges
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Residuum weathered from shale
Slope: 5 to 30 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
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Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Shallow
Potential native vegetation: Indian ricegrass, galieta, blue grama, big sagebrush, mormon tea, threeawn

Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 3 inches; clay loam
C—3 to 10 inches; clay loam
Cr—10 to 60 inches; bedrock

Mespun soils
Landscape: Uplands
Landform: Dunes
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 5 to 30 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 4.8 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, sand dropseed, sand sagebrush, spike dropseed
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 6 inches; loamy fine sand
C—6 to 60 inches; loamy sand

Minor Components
Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)
183—Sheppard loamy fine sand, 8 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,200 to 5,700 feet (1,585 to 1,737 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Sheppard and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sheppard soils
Landscape: Uplands
Landform: Structural benches, stream terraces, alluvial fans, benches, dunes
Position on landform: Shoulders
Position on landform: Rise, side slope
Parent material: Eolian deposits derived from sandstone
Slope: 8 to 15 percent
   Aspect: East to west
   Shape (down/across): Linear, convex/linear, convex
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 5.3 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, black grama, sand dropseed, sand sagebrush, spike dropseed
Land capability subclass (nonirrigated): 7s

Typical Profile:
   A—0 to 4 inches; loamy fine sand
   C1—4 to 45 inches; loamy fine sand
   C2—45 to 60 inches; loamy fine sand

Minor Components
Cascajo and similar soils
   Composition: About 7 percent
   Slope: 1 to 9 percent
   Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: Hills
Sheppard and similar soils

- **Composition:** About 7 percent
- **Slope:** 3 to 8 percent
- **Drainage class:** Somewhat excessively drained
- **Ecological site:** Deep Sand

Riverwash

- **Composition:** About 1 percent
- **Landscape:** Valleys
- **Landform:** Channels, streams
- **Position on landform:** Toeslopes
- **Position on landform:** Base slope
- **Slope:** 0 to 3 percent
- **Shape (down/across):** Concave/linear
- **Drainage class:** Somewhat poorly drained
- **Flooding hazard:** Frequent

185—Frijoles very fine sandy loam, 1 to 8 percent slopes

**Map Unit Setting**

- **Major Land Resource Area:** 36
- **Elevation:** 6,000 to 7,000 feet (1,829 to 2,134 meters)
- **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

**Map Unit Composition**

- **Frijoles and similar soils:** 90 percent
- **Minor components:** 10 percent

**Component Descriptions**

**Frijoles soils**

- **Landscape:** Uplands
- **Landform:** Mesas
- **Position on landform:** Summits
- **Position on landform:** Side slope
- **Parent material:** Eolian deposits over alluvium derived from pumice
- **Slope:** 1 to 8 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Linear/linear
- **Depth class:** Very deep
- **Depth to restrictive feature:** 15 to 30 inches to abrupt textural change
- **Drainage class:** Well drained
- **Slowest permeability:** 0.2 to 0.6 in./hr. (moderately slow)
- **Available water capacity:** About 2.1 inches (very low)
- **Shrink-swell potential:** About 2.0 percent (low)
- **Runoff class:** Medium
- **Calcium carbonate maximum:** About 5 percent
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis

Potential native vegetation:
- Common trees: oneseed juniper, twoneedle pinyon
- Other plants: Arizona fescue, blue grama

Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 3 inches; very fine sandy loam
- Bt1—3 to 8 inches; very gravelly clay loam
- Bt2—8 to 13 inches; very gravelly clay loam
- 2C1—13 to 20 inches; extremely gravelly sandy loam
- 3C2—20 to 60 inches; fragmental material

Minor Components
Nyjack and similar soils
- Composition: About 10 percent
- Slope: 1 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: pinyon-juniper forest

190—Zia-Skyvillage-Rock outcrop complex, 5 to 40 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Zia and similar soils: 35 percent
Skyvillage and similar soils: 25 percent
Rock outcrop: 15 percent
Minor components: 25 percent

Component Descriptions

Zia soils
- Landscape: Uplands
- Landform: Alluvial fans
- Position on landform: Toeslopes
- Position on landform: Rise
- Parent material: Eolian deposits over fan alluvium derived from sandstone
- Slope: 5 to 20 percent
- Aspect: East to west
- Shape (down/across): Linear/linear
- Depth class: Very deep
- Drainage class: Well drained
- Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
- Available water capacity: About 7.1 inches (moderate)
- Shrink-swell potential: About 1.5 percent (low)
- Runoff class: Low
Sandoval County Area, New Mexico

**Calcium carbonate maximum**: About 15 percent  
**Gypsum maximum**: None  
**Salinity maximum**: About 2 mmhos/cm (nonsaline)  
**Sodium adsorption ratio maximum**: About 0 (nonsodic)  
**Ecological site**: Sandy  
**Potential native vegetation**: blue grama, hairy grama, black grama, sideoats grama, galleta, oneseed juniper, sacahuista  
**Land capability subclass (nonirrigated)**: 6c

**Typical Profile**:  
- A—0 to 5 inches; sandy loam  
- C1—5 to 28 inches; sandy loam  
- C2—28 to 60 inches; sandy loam

**Skyvillage soils**  
**Landscape**: Uplands  
**Landform**: Breaks, cuestas, hills, mesas, ridges, structural benches  
**Position on landform**: Backslopes  
**Position on landform**: Side slope, nose slope, head slope  
**Parent material**: Slope alluvium derived from sandstone  
**Slope**: 5 to 40 percent  
  - **Aspect**: East to west  
  - **Shape (down/across)**: Linear/linear  
**Depth class**: Very shallow and shallow  
**Depth to restrictive feature**: 6 to 20 inches to bedrock (lithic)  
**Drainage class**: Well drained  
**Slowest permeability**: 2.0 to 6.0 in./hr. (moderately rapid)  
**Available water capacity**: About 2.3 inches (very low)  
**Shrink-swell potential**: About 1.5 percent (low)  
**Runoff class**: Very high  
**Calcium carbonate maximum**: About 10 percent  
**Gypsum maximum**: None  
**Salinity maximum**: About 2 mmhos/cm (nonsaline)  
**Sodium adsorption ratio maximum**: About 0 (nonsodic)  
**Ecological site**: Shallow Sandstone  
**Potential native vegetation**: sideoats grama, blue grama, little bluestem, Indian ricegrass, galleta  
**Land capability subclass (nonirrigated)**: 7s

**Typical Profile**:  
- A—0 to 2 inches; fine sandy loam  
- C1—2 to 11 inches; fine sandy loam  
- C2—11 to 16 inches; fine sandy loam  
- 2R—16 to 60 inches; bedrock

**Rock outcrop**  
**Description**: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.  
**Landform**: Breaks, escarpments  
  - **Aspect**: East to west  
**Depth to restrictive feature**: 0 inches to bedrock (lithic)  
**Land capability subclass (nonirrigated)**: 8s
Minor Components
Penistaja and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Badland
Composition: About 10 percent
Slope: 5 to 75 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)

Sandoval and similar soils
Composition: About 5 percent
Slope: 3 to 30 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

191—Sheppard loamy fine sand, 3 to 8 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,200 to 5,700 feet (1,585 to 1,737 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Sheppard and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Sheppard soils
Landscape: Uplands
Landform: Alluvial fans, stream terraces, dunes, benches, structural benches
Position on landform: Shoulders
Position on landform: Side slope, rise
Parent material: Eolian deposits derived from sandstone
Slope: 3 to 6 percent
Aspect: East to west
Shape (down/across): Convex, linear/convex, linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 5.3 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, black grama, sand dropseed, sand sagebrush, spike dropseed
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 3 inches; loamy fine sand
  C1—3 to 27 inches; loamy fine sand
  C2—27 to 60 inches; loamy fine sand

Minor Components
Grieta and similar soils
  Composition: About 12 percent
  Slope: 1 to 4 percent
  Drainage class: Well drained
  Ecological site: Loamy

Riverwash
  Composition: About 3 percent
  Landscape: Valleys
  Landform: Channels, streams
  Position on landform: Toeslopes
  Position on landform: Base slope
  Slope: 0 to 3 percent
  Shape (down/across): Concave/linear
  Drainage class: Somewhat poorly drained
  Flooding hazard: Frequent

200—Sedillo very cobbly sandy loam, 5 to 25 percent slopes, stony

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,400 to 6,100 feet (1,646 to 1,859 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Sedillo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Sedillo soils
Landscape: Uplands
Landform: Fan remnants, stream terraces, bajadas
Position on landform: Toeslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 5 to 25 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 2.3 inches (very low)
Shrink-swell potential: About 2.0 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 30 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Gravelly
Potential native vegetation: blue grama, big sagebrush, black grama, hairy grama,
needlegrass, New Mexico Feathergrass, oneseed juniper, sideoats grama,
western wheatgrass, winterfat
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 4 inches; very cobbly sandy loam
  Bt—4 to 13 inches; very gravelly sandy clay loam
  Bk—13 to 60 inches; extremely gravelly coarse sandy loam

Minor Components
Pastura and similar soils
  Composition: About 5 percent
  Slope: 1 to 4 percent
  Depth to restrictive feature: 7 to 20 inches to petrocalcic
  Drainage class: Well drained
  Ecological site: Limy

Clovis and similar soils
  Composition: About 5 percent
  Slope: 1 to 4 percent
  Drainage class: Well drained
  Ecological site: Loamy

Riverwash
  Composition: About 3 percent
  Landscape: Valleys
  Landform: Channels, streams
  Position on landform: toeslopes
  Position on landform: Base slope
  Slope: 0 to 3 percent
  Shape (down/across): Concave/linear
  Drainage class: Somewhat poorly drained
  Flooding hazard: Frequent

Sedillo and similar soils
  Composition: About 2 percent
  Slope: 5 to 25 percent
  Drainage class: Well drained
  Ecological site: Foothills
201—Rock outcrop-Sedgran association, 25 to 55 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 8,000 feet (1,768 to 2,438 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Rock outcrop: 55 percent
Sedgran and similar soils: 35 percent
Minor components: 10 percent

Component Descriptions

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, ridges
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Sedgran soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank, lower third
Parent material: Colluvium derived from granite
Slope: 25 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 0.4 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Hills
Potential native vegetation: black grama, sideoats grama, New Mexico Feathergrass, little bluestem, New Mexico muhly, blue grama, mountain mahogany, needle and thread, oneseed juniper, skunkbush sumac, wavyleaf oak
Land capability subclass (nonirrigated): 7e
Typical Profile:
A—0 to 4 inches; extremely gravelly loamy coarse sand
C—4 to 13 inches; very gravelly loamy coarse sand
2R—13 to 60 inches; bedrock

Minor Components
Sedillo and similar soils
Composition: About 9 percent
Slope: 5 to 25 percent
Drainage class: Well drained
Ecological site: Foothills

Riverwash
Composition: About 1 percent
Landscape: Valleys
Landform: Channels, streams
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

206—Pinitos loam, 1 to 15 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 7,000 to 7,600 feet (2,134 to 2,316 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Pinitos and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Pinitos soils
Landscape: Uplands
Landform: Hills, mesas, cuestas, fan remnants
Position on landform: Shoulders
Position on landform: Side slope, side slope
Parent material: Fan alluvium derived from sandstone and shale
Slope: 1 to 15 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.7 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 12 percent
Sandoval County Area, New Mexico

**Gypsum maximum:** None

**Salinity maximum:** About 2 mmhos/cm (nonsaline)

**Sodium adsorption ratio maximum:** About 2 (slightly sodic)

**Ecological site:** Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis

**Potential native vegetation:**
- Common trees: one-seed juniper, two-needle pinyon
- Other plants: Indian ricegrass, blue grama, New Mexico Feathergrass, bottlebrush squirreltail, mountain big sagebrush, western wheatgrass

**Land capability subclass (nonirrigated):** 7c

**Typical Profile:**
- A—0 to 4 inches; loam
- Bt1—4 to 10 inches; clay loam
- Bt2—10 to 27 inches; clay loam
- Btk—27 to 39 inches; clay loam
- C—39 to 60 inches; clay loam

**Minor Components**

**Sparham and similar soils**
- **Composition:** About 5 percent
- **Slope:** 0 to 3 percent
- **Drainage class:** Well drained
- **Flooding hazard:** Occasional
- **Ecological site:** Clayey

**Hickman and similar soils**
- **Composition:** About 5 percent
- **Slope:** 1 to 3 percent
- **Drainage class:** Well drained
- **Flooding hazard:** Rare
- **Ecological site:** Swale

**Menefee and similar soils**
- **Composition:** About 5 percent
- **Slope:** 5 to 35 percent
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (paralithic)
- **Drainage class:** Well drained
- **Ecological site:** Shallow

**207—Penistaja-Zia complex, 1 to 8 percent slopes**

**Map Unit Setting**

- **Major Land Resource Area:** 36
- **Elevation:** 5,400 to 6,100 feet (1,646 to 1,859 meters)
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Map Unit Composition**

- Penistaja and similar soils: 60 percent
- Zia and similar soils: 25 percent
- Minor components: 15 percent
Penistaja soils
Landscape: Uplands
Landform: Plateaus, alluvial fans, bajadas, cuestas, hills, mesas
Position on landform: Footslopes
Position on landform: Head slope, rise, side slope, nose slope
Parent material: Eolian deposits over alluvium derived from sandstone and shale
Slope: 1 to 5 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.5 inches (moderate)
Shrink-swell potential: About 2.9 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush, squirreltail, galleta, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 3 inches; very fine sandy loam
   Btk—3 to 29 inches; sandy clay loam
   C—29 to 60 inches; fine sandy loam

Zia soils
Landscape: Uplands
Landform: Plateaus
Position on landform: Toe slopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 8.3 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush, squirreltail, fourwing saltbush, oneseed juniper, winterfat
Land capability subclass (irrigated): 3e
Land capability subclass (nonirrigated): 6c
Typical Profile:
A—0 to 5 inches; fine sandy loam
C—5 to 60 inches; fine sandy loam

Minor Components
Clovis and similar soils
Composition: About 10 percent
Slope: 3 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

Pinavetes and similar soils
Composition: About 5 percent
Slope: 5 to 15 percent
Drainage class: Excessively drained
Ecological site: Deep Sand

208—Sedillo very gravelly fine sandy loam, 25 to 55 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,100 to 6,500 feet (1,554 to 1,981 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Sedillo and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Sedillo soils
Landscape: Uplands
Landform: Bajadas, fan remnants, stream terraces
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 25 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.6 inches (low)
Shrink-swell potential: About 1.7 percent (low)
Runoff class: High
Calcium carbonate maximum: About 25 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Gravelly
Potential native vegetation: blue grama, big sagebrush, black grama, hairy grama, needlegrass, New Mexico Feathergrass, oneseed juniper, sideoats grama, western wheatgrass, winterfat
Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 2 inches; very gravelly fine sandy loam
- Bt—2 to 3 inches; very gravelly sandy clay loam
- Bk1—8 to 12 inches; very gravelly sandy loam
- Bk2—12 to 60 inches; extremely gravelly sandy loam

Minor Components
Ildefonso and similar soils
  Composition: About 5 percent
  Slope: 15 to 35 percent
  Drainage class: Well drained
  Ecological site: Limy

Pinavetes and similar soils
  Composition: About 5 percent
  Slope: 5 to 15 percent
  Drainage class: Excessively drained
  Ecological site: Deep Sand

Rock outcrop
  Composition: About 3 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Zia and similar soils
  Composition: About 2 percent
  Slope: 3 to 6 percent
  Drainage class: Well drained
  Ecological site: Sandy

210—Ildefonso very stony loam, 25 to 70 percent slopes, rubbly

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,000 to 5,800 feet (1,524 to 1,768 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Ildefonso and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Ildefonso soils
Landscape: Uplands
Landform: Fan remnants, hills, mesas
Position on landform: Backslopes, side slopes
Parent material: Fan alluvium over colluvium derived from sandstone and shale
Slope: 25 to 70 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in/hr. (moderate)
Available water capacity: About 4.7 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Limy
Potential native vegetation: blue grama, New Mexico Feathergrass, sideoats grama,
  twoneedle pinyon
Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 3 inches; very stony loam
  Bw—3 to 9 inches; very stony loam
  Bk—9 to 60 inches; very stony loam

Minor Components
Rock outcrop
  Composition: About 5 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Rubble land
  Composition: About 5 percent
  Slope: 35 to 60 percent
  Drainage class: Excessively drained

Prieta and similar soils
  Composition: About 5 percent
  Slope: 3 to 15 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Malpais

211—Zia-Clovis association, 2 to 10 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,500 to 6,400 feet (1,676 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days
Map Unit Composition

Zia and similar soils: 45 percent
Clovis and similar soils: 30 percent
Minor components: 25 percent

Component Descriptions

Zia soils
Landscape: Uplands
Landform: Plateaus
Position on landform: Footslopes
Parent material: Eolian deposits derived from sandstone over fan alluvium derived from sandstone, eolian deposits and alluvium derived from sandstone and shale
Slope: 2 to 10 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 7.5 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: blue grama, western wheatgrass, Indian ricegrass, black grama, one-seed Juniper
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 5 inches; sandy loam
Bw—5 to 14 inches; sandy loam
C1—14 to 33 inches; sandy loam
C2—33 to 46 inches; sandy clay loam
C3—46 to 60 inches; sandy loam

Clovis soils
Landscape: Uplands
Landform: Fan remnants, plains
Position on landform: Footslopes
Parent material: Eolian deposits derived from sandstone over fan alluvium derived from sandstone and shale, eolian deposits and alluvium derived from sandstone and shale
Slope: 2 to 8 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.5 to 2.0 in./hr. (moderate)
Available water capacity: About 8.8 inches (moderate)
Shrink-swell potential: About 4.4 percent (moderate)
Runoff class: Medium  
Calcium carbonate maximum: About 25 percent  
Gypsum maximum: None  
Salinity maximum: About 2 mmhos/cm (nonsaline)  
Sodium adsorption ratio maximum: About 2 (slightly sodic)  
Ecological site: Loamy  
Potential native vegetation: blue grama, bottlebrush squirreltail  
Land capability subclass (nonirrigated): 6c

Typical Profile:  
A—0 to 5 inches; fine sandy loam  
B—5 to 60 inches; sandy clay loam

Minor Components
Penistaja and similar soils  
Composition: About 15 percent  
Slope: 2 to 7 percent  
Drainage class: Well drained  
Ecological site: Loamy

Pinavetes and similar soils  
Composition: About 10 percent  
Slope: 5 to 15 percent  
Drainage class: Excessively drained  
Ecological site: Deep Sand

213—Pinavetes-Rock outcrop complex, 15 to 35 percent slopes

Map Unit Setting
Major Land Resource Area: 36  
Elevation: 5,600 to 6,100 feet (1,707 to 1,859 meters)  
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)  
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
Frost-free period: 120 to 140 days

Map Unit Composition
Pinavetes and similar soils: 55 percent  
Rock outcrop: 30 percent  
Minor components: 15 percent

Component Descriptions
Pinavetes soils  
Landscape: Uplands  
Landform: Valley sides, dunes  
Position on landform: Shoulders  
Position on landform: Side slope  
Parent material: Eolian deposits derived from sandstone  
Slope: 15 to 35 percent  
Aspect: East to west  
Shape (down/across): Convex/convex  
Depth class: Very deep  
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.9 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, western wheatgrass, galleta, oneseed juniper, sand sagebrush, two-needle pinyon
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 7 inches; sand
C—7 to 60 inches; stratified sand to loamy sand

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, breaks
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Skyvillage and similar soils
Composition: About 10 percent
Slope: 8 to 25 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

Zia and similar soils
Composition: About 5 percent
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Sandy

215—Ess-Rock outcrop complex, 5 to 45 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 9,000 to 11,000 feet (2,743 to 3,353 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Ess and similar soils: 60 percent
Rock outcrop: 30 percent
Minor components: 10 percent
Component Descriptions

Ess soils
Landscape: Mountains
Landform: Mountain slopes, hills
Position on landform: Backslopes
Position on landform: Mountainflank, side slope
Parent material: Colluvium derived from rhyolite
Slope: 5 to 45 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 4.6 inches (low)
Shrink-swell potential: About 2.3 percent (low)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Subalpine Grassland
Potential native vegetation: Arizona fescue, sedge, bottlebrush squirreltail, mountain muhly, muttongrass, prairie junegrass, western wheatgrass
Land capability subclass (nonirrigated): 7c

Typical Profile:
A1—0 to 7 inches; very cobbly sandy loam
A2—7 to 15 inches; very cobbly sandy loam
Bt—15 to 29 inches; very cobbly sandy clay loam
C—29 to 60 inches; very cobbly loam

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Mountains
Position on landform: Mountainflank, mountaintop
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Calaveras and similar soils
Composition: About 10 percent
Landform: Mountain slopes
Position on landform: Mountainflank
Slope: 35 to 60 percent
Aspect: East to west
Drainage class: Well drained
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
217—Witt loam, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,200 to 6,000 feet (1,585 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Witt and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Witt soils
Landscape: Uplands
Landform: Mesas, fan remnants, bajadas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone over fan alluvium derived from basalt, eolian deposits and alluvium derived from sandstone and shale
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 1.8 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 20 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, fourwing saltbush, galleta
Land capability subclass (nonirrigated): 6e

Typical Profile:
   A—0 to 2 inches; loam
   Bt—2 to 9 inches; loam
   Sk—9 to 60 inches; stratified very fine sandy loam to loam

Minor Components
Penistaja and similar soils
   Composition: About 5 percent
   Slope: 1 to 5 percent
   Drainage class: Well drained
   Ecological site: Loamy
Harvey and similar soils
- **Composition:** About 5 percent
- **Slope:** 5 to 10 percent
- **Drainage class:** Well drained
- **Ecological site:** Limy

Ildefonso and similar soils
- **Composition:** About 5 percent
- **Slope:** 15 to 35 percent
- **Drainage class:** Well drained
- **Ecological site:** Limy

### 218—Ildefonso very cobbly loam, 1 to 15 percent slopes

**Map Unit Setting**
- **Major Land Resource Area:** 36
- **Elevation:** 5,200 to 5,800 feet (1,585 to 1,768 meters)
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Map Unit Composition**
- Ildefonso and similar soils: 85 percent
- Minor components: 15 percent

**Component Descriptions**

**Ildefonso soils**
- **Landscape:** Uplands
- **Landform:** Hills, fan remnants, mesas
- **Position on landform:** Footslopes
- **Position on landform:** Side slope
- **Parent material:** Fan alluvium over colluvium derived from sandstone and shale
- **Slope:** 1 to 15 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Linear/linear
- **Depth class:** Very deep
- **Drainage class:** Well drained
- **Slowest permeability:** 0.6 to 2.0 in./hr. (moderate)
- **Available water capacity:** About 3.8 inches (low)
- **Shrink-swell potential:** About 1.7 percent (low)
- **Runoff class:** Low
- **Calcium carbonate maximum:** About 20 percent
- **Gypsum maximum:** None
- **Salinity maximum:** About 4 mmhos/cm (very slightly saline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
- **Ecological site:** Limy
- **Potential native vegetation:** thickscape wheatgrass, western wheatgrass, New Mexico feathergrass, blue grama, hairy grama, winterfat
- **Land capability subclass (nonirrigated):** 7s
Typical Profile:
A—0 to 4 inches; very cobbly loam
B—4 to 8 inches; very cobbly loam
B—8 to 60 inches; very cobbly sandy loam

Minor Components
Pastura and similar soils
  Composition: About 5 percent
  Slope: 1 to 4 percent
  Depth to restrictive feature: 7 to 20 inches to petrocalcic
  Drainage class: Well drained
  Ecological site: Limy

Prieta and similar soils
  Composition: About 5 percent
  Slope: 3 to 15 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Maipais

Rock outcrop
  Composition: About 3 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Witt and similar soils
  Composition: About 2 percent
  Slope: 1 to 8 percent
  Drainage class: Well drained
  Ecological site: Loamy

220—Rock outcrop-Vessilla-Menefee complex, 30 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,100 to 7,200 feet (1,859 to 2,195 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Rock outcrop: 40 percent
Vessilla and similar soils: 30 percent
Menefee and similar soils: 20 percent
Minor components: 10 percent

Component Descriptions
Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, breaks
  Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Vessilla soils
Landscape: Uplands
Landform: Mesas, hills, breaks, ridges
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium over residuum weathered from sandstone
Slope: 30 to 40 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.2 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: Indian ricegrass, blue grama, mountain big sagebrush, oak, galleta, sideoats grama
Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 2 inches; sandy loam
  C—2 to 10 inches; sandy loam
  R—10 to 60 inches; bedrock

Menefee soils
Landscape: Uplands
Landform: Mountainsides, mesas, hillslopes
Position on landform: Shoulders
Position on landform: Nose slope
Parent material: Colluvium over residuum weathered from shale
Slope: 30 to 40 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
- Common trees: one seed juniper, Rocky Mountain juniper, twoneedle pinyon
- Other plants: blue grama, galleta, Gambel oak, big sagebrush, side oats grama
Land capability subclass (nonirrigated): Te

Typical Profile:
- A—0 to 2 inches; clay loam
- C—2 to 10 inches; clay loam
- 2Cr—10 to 60 inches; bedrock

Minor Components
Badland
Composition: About 5 percent
Slope: 5 to 75 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)

Rubble land
Composition: About 5 percent
Slope: 35 to 60 percent
Drainage class: Excessively drained

226—Galisteo loam, moderately saline, sodic, 1 to 3 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,700 to 6,200 feet (1,737 to 1,890 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Galisteo, moderately saline, sodic and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Galisteo, moderately saline, sodic soils
Landscape: Valleys
Landform: Alluvial fans, stream terraces
Position on landform: Toe slopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Sandoval County Area, New Mexico

Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.5 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 20 (moderately sodic)
Ecological site: Salty Bottomland
Potential native vegetation: alkali sacaton, western wheatgrass, galleta, fourwing saltbush, greasewood
Land capability subclass (nonirrigated): 6c

Typical Profile:
Ap—0 to 10 inches; loam
C—10 to 60 inches; silty clay loam

Minor Components
Zia and similar soils
Composition: About 5 percent
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Sandy

El Rancho and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Loamy

Ildefonso and similar soils
Composition: About 5 percent
Slope: 1 to 15 percent
Drainage class: Well drained
Ecological site: Limy

227—Hagerman-Bond association, 1 to 8 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,700 to 6,000 feet (1,737 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Hagerman and similar soils: 65 percent
Bond and similar soils: 20 percent
Minor components: 15 percent
Component Descriptions

**Hagerman soils**

*Landscape:* Uplands  
*Landform:* Mesas, hills, ridges  
*Position on landform:* Shoulders  
*Position on landform:* Crest  
*Parent material:* Eolian deposits over slope alluvium derived from sandstone  
*Slope:* 1 to 5 percent  
*Aspect:* East to west  
*Shape (down/across):* Linear/linear  
*Surface fragments:* About 5 percent subangular channers  
*Depth class:* Moderately deep  
*Depth to restrictive feature:* 20 to 40 inches to bedrock (lithic)  
*Drainage class:* Well drained  
*Slowest permeability:* 0.2 to 0.6 in./hr. (moderately slow)  
*Available water capacity:* About 6.5 inches (moderate)  
*Shrink-swell potential:* About 4.5 percent (moderate)  
*Runoff class:* Medium  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 0 (nonsodic)  
*Ecological site:* Loamy  
*Potential native vegetation:* blue grama, western wheatgrass, spike muhly, fourwing saltbush, galleta, sand dropseed  
*Land capability subclass (nonirrigated):* 6c  

*Typical Profile:*  
A—0 to 4 inches: fine sandy loam  
Bt—4 to 34 inches: clay loam  
2R—34 to 60 inches: bedrock

**Bond soils**

*Landscape:* Uplands  
*Landform:* Ridges, cuestas, mesas, hills  
*Position on landform:* Summits  
*Position on landform:* Crest  
*Parent material:* Eolian deposits over slope alluvium derived from sandstone  
*Slope:* 1 to 8 percent  
*Aspect:* East to west  
*Shape (down/across):* Convex/linear  
*Depth class:* Very shallow and shallow  
*Depth to restrictive feature:* 6 to 20 inches to bedrock (lithic)  
*Drainage class:* Well drained  
*Slowest permeability:* 0.6 to 2.0 in./hr. (moderate)  
*Available water capacity:* About 1.5 inches (very low)  
*Shrink-swell potential:* About 4.5 percent (moderate)  
*Runoff class:* Very high  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 0 (nonsodic)
Ecological site: Shallow Sandstone
Potential native vegetation: sideoats grama, blue grama, little bluestem, Indian ricegrass, galleta
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 4 inches; loamy fine sand
Bt—4 to 12 inches; sandy clay loam
R—12 to 60 inches; bedrock

Minor Components
Penistaja and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

228—Winona very channery fine sandy loam, 8 to 25 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,900 to 6,300 feet (1,798 to 1,920 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Winona and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Winona soils
Landscape: Uplands
Landform: Plateaus, hills
Position on landform: Shoulders
Position on landform: Nose slope, head slope, nose slope, side slope
Parent material: Residuum weathered from travertine
Slope: 8 to 25 percent
Aspect: East to west
Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 5 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 1.1 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 50 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow Sandstone
Potential native vegetation: sideoats grama, blue grama, little bluestem, needlegrass, juniper, muhly, winterfat
Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 2 inches; very channery fine sandy loam
- BK—2 to 13 inches; very channery loam
- R—13 to 60 inches; bedrock

Minor Components
Rock outcrop
Composition: About 15 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

230—Skyvillage-Sandoval-Rock outcrop complex, 3 to 20 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Skyvillage and similar soils: 35 percent
Sandoval and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent

Component Descriptions

Skyvillage soils
Landscape: Uplands
Landform: Structural benches, cuestas, ridges, breaks, mesas, hills
Position on landform: Shoulders
Position on landform: Side slope, nose slope, head slope
Parent material: Slope alluvium derived from sandstone
Slope: 3 to 20 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.3 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Sandoval County Area, New Mexico

Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow Sandstone
Potential native vegetation: sideoats grama, blue grama, little bluestem, Indian ricegrass, galleta
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 6 inches; sandy loam
C—6 to 11 inches; sandy loam
2R—11 to 60 inches; bedrock

Sandoval soils
Landscape: Uplands
Landform: Hills, ridges
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Slope alluvium derived from shale
Slope: 3 to 20 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 10 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Shallow
Potential native vegetation: sideoats grama, New Mexico Feathergrass, cane bluestem, little bluestem, galleta
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 2 inches; clay loam
C—2 to 10 inches; clay loam
Cr—10 to 60 inches; bedrock

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, breaks
  Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s
Minor Components
Penistaja and similar soils
Composition: About 10 percent
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy

Querencia and similar soils
Composition: About 10 percent
Slope: 1 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

231—Querencia loam, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,200 to 6,900 feet (1,890 to 2,103 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Querencia and similar soils: 85 percent
Minor components: 15 percent

Figure 7.—Typical landscape of Querencia loam, 1 to 8 percent slopes.
Component Descriptions

Querencia soils
Landscape: Valleys
Landform: Valley sides, stream terraces, alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Fan alluvium over colluvium derived from sandstone and shale
Slope: 1 to 8 percent
Aspect: East to west
Shape (down/across): Linear/Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 10.0 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, bottlebrush squirreltail, fourwing saltbush, needlegrass, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
- A—0 to 3 inches; loam
- Bw—3 to 21 inches; loam
- Bk—21 to 60 inches; loam

Minor Components
Sandoval and similar soils
Composition: About 5 percent
Slope: 3 to 20 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

Sparank and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Well drained
Flooding hazard: Occasional
Ecological site: Clayey Bottomland

San Mateo and similar soils
Composition: About 5 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale
234—Querencia-Zia complex, 2 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,800 to 6,900 feet (1,768 to 2,103 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Querencia and similar soils: 60 percent
Zia and similar soils: 20 percent
Minor components: 20 percent

Component Descriptions

Querencia soils
Landscape: Valleys
Landform: Stream terraces, valley sides, alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Fan alluvium over colluvium derived from sandstone and shale
Slope: 2 to 8 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 9.3 inches (high)
Shrink-swell potential: About 2.7 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, western wheatgrass, spike muhly, bottlebrush squirreltail, fourwing saltbush, needlegrass, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 3 inches; fine sandy loam
Bw—3 to 25 inches; loam
Bk—25 to 60 inches; stratified loam to fine sandy loam

Zia soils
Landscape: Valleys
Landform: Alluvial fans
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 2 to 8 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep  
Drainage class: Well drained  
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)  
Available water capacity: About 7.1 inches (moderate)  
Shrink-swell potential: About 1.5 percent (low)  
Runoff class: Low  
Calcium carbonate maximum: About 15 percent  
Gypsum maximum: None  
Salinity maximum: About 2 mmhos/cm (nonsaline)  
Sodium adsorption ratio maximum: About 5 (slightly sodic)  
Ecological site: Sandy  
Potential native vegetation: blue grama, western wheatgrass, Indian ricegrass, black grama, oneseed juniper  
Land capability subclass (nonirrigated): 6c

Typical Profile:
  A—0 to 11 inches; sandy loam  
  C—11 to 60 inches; sandy loam

Minor Components
Penistaja and similar soils
  Composition: About 10 percent  
  Slope: 1 to 5 percent  
  Drainage class: Well drained  
  Ecological site: Loamy

San Mateo and similar soils
  Composition: About 5 percent  
  Slope: 0 to 3 percent  
  Drainage class: Well drained  
  Flooding hazard: Rare  
  Ecological site: Swale

Sandoval and similar soils
  Composition: About 5 percent  
  Slope: 3 to 20 percent  
  Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)  
  Drainage class: Well drained  
  Ecological site: Shallow

235—Sandoval fine sandy loam, 3 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 36  
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)  
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)  
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
Frost-free period: 120 to 140 days

Map Unit Composition

Sandoval and similar soils: 85 percent  
Minor components: 15 percent
Figure 8.—Typical landscape of Sandoval fine sandy loam, 3 to 15 percent slopes.

Component Descriptions

Sandoval soils
Landscape: Uplands
Landform: Hills, ridges
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Slope alluvium derived from shale
Slope: 3 to 15 percent
   Aspect: East to west
   Shape (down/across): Convex/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.7 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: About 10 percent
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 13 (moderately sodic)
Ecological site: Shallow
Potential native vegetation: sideoats grama, New Mexico Feathergrass, cane bluestem, little bluestem, galleta
Land capability subclass (nonirrigated): 7s
Typical Profile:
A—0 to 2 inches; fine sandy loam
C1—2 to 16 inches; clay loam
C2—16 to 19 inches; clay loam
Cr—19 to 60 inches; bedrock

Minor Components
Querencia and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Well drained
Ecological site: Loamy

San Mateo and similar soils
Composition: About 5 percent
Slope: 0 to 3 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Swale

Badland
Composition: About 5 percent
Slope: 5 to 75 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)

236—Sparank clay loam, moderately saline, sodic, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Sparank, moderately saline, sodic and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Sparank, moderately saline, sodic soils
Landscape: Valleys
Landform: Stream terraces, alluvial fans, valley sides, valley floors, flood plains
Position on landform: Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 1 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 10.2 inches (high)
**Shrink-swell potential:** About 6.6 percent (high)
**Flooding hazard:** Occasional
**Runoff class:** Medium
**Calcium carbonate maximum:** About 10 percent
**Gypsum maximum:** None
**Salinity maximum:** About 16 mhos/cm (moderately saline)
**Sodium adsorption ratio maximum:** About 30 (strongly sodic)
**Ecological site:** Salty Bottomland
**Potential native vegetation:** alkali sacaton, western wheatgrass, galieta, fourwing saltbush, greasewood
**Land capability subclass (nonirrigated):** 7s

**Typical Profile:**
A—0 to 2 inches; clay loam
C1—2 to 10 inches; silty clay
C2—10 to 24 inches; silty clay
C3—24 to 40 inches; silty clay loam
C4—40 to 44 inches; silty clay
C5—44 to 60 inches; silty clay

**Minor Components**
Camino and similar soils
- **Composition:** About 10 percent
- **Slope:** 1 to 6 percent
- **Depth to restrictive feature:** 40 to 60 inches to bedrock (paralithic)
- **Drainage class:** Well drained
- **Ecological site:** Clayey

San Mateo and similar soils
- **Composition:** About 5 percent
- **Slope:** 0 to 3 percent
- **Drainage class:** Well drained
- **Flooding hazard:** Rare
- **Ecological site:** Swale

### 237—Sparank silty clay loam, 0 to 3 percent slopes

**Map Unit Setting**

**Major Land Resource Area:** 36
**Elevation:** 5,500 to 6,400 feet (1,676 to 1,951 meters)
**Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
**Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
**Frost-free period:** 120 to 140 days

**Map Unit Composition**
Sparank and similar soils: 85 percent
Minor components: 15 percent

**Component Descriptions**

**Sparank soils**
**Landscape:** Valleys
**Landform:** Valley sides, valley floors, alluvial fans, flood plains, stream terraces
**Position on landform:** Toeslopes
Position on landform: Rise
Parent material: Stream alluvium derived from sandstone and shale
Slope: 0 to 3 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 11.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Flooding hazard: Occasional
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 10 (slightly sodic)
Ecological site: Clayey Bottomland
Potential native vegetation: western wheatgrass, alkali sacaton, blue grama, fourwing saltbush, galleta, obtuse panicgrass
Land capability subclass (irrigated): 2a
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 4 inches; silty clay loam
   C—4 to 60 inches; silty clay loam

Minor Components
Camino and similar soils
   Composition: About 10 percent
   Slope: 1 to 6 percent
   Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: Clayey

San Mateo and similar soils
   Composition: About 5 percent
   Slope: 0 to 3 percent
   Drainage class: Well drained
   Flooding hazard: Rare
   Ecological site: Swale

240—Penistaja-Hagerman association, 1 to 5 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,000 to 6,400 feet (1,829 to 1,951 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days
Map Unit Composition

Penistaja and similar soils: 45 percent
Hagerman and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions

Penistaja soils
Landscape: Uplands
Landform: Plateaus, mesas, hills, cuestas, alluvial fans, bajadas
Position on landform: Footslopes
Position on landform: Rise, side slope, nose slope, head slope
Parent material: Eolian material and slope alluvium derived from sandstone and shale
Slope: 1 to 5 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.3 inches (high)
Shrink-swell potential: About 2.8 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush squirrelltail, galleta, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
   A—0 to 5 inches; fine sandy loam
   Bt—5 to 14 inches, clay loam
   Btk—14 to 29 inches; sandy clay loam
   C—29 to 60 inches; stratified sandy clay loam to fine sandy loam to loam

Hagerman soils
Landscape: Uplands
Landform: Mesas, hills, ridges
Position on landform: Shoulders
Position on landform: Crest
Parent material: Eolian material and slope alluvium derived from sandstone and shale
Slope: 1 to 5 percent
   Aspect: East to west
   Shape (down/across): Convex/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 4.7 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
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**Salinity maximum:** About 2 mmhos/cm (nonsaline)

**Sodium adsorption ratio maximum:** About 0 (nonsodic)

**Ecological site:** Loamy

**Potential native vegetation:** blue grama, western wheatgrass, spike muhly, fourwing saltbush, galleta, sand dropseed

**Land capability subclass (nonirrigated):** 6c

**Typical Profile:**
- A—0 to 2 inches; fine sandy loam
- Bt—2 to 9 inches; clay loam
- Btk—9 to 24 inches; clay loam
- 2R—24 to 60 inches; bedrock

**Minor Components**

**Skyvillage and similar soils**
- **Composition:** About 10 percent
- **Slope:** 8 to 25 percent
- **Depth to restrictive feature:** 6 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Ecological site:** Shallow Sandstone

**Rock outcrop**
- **Composition:** About 10 percent
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)

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**250—Pinavetes loamy fine sand, 5 to 15 percent slopes**

**Map Unit Setting**

**Major Land Resource Area:** 36

**Elevation:** 5,200 to 5,700 feet (1,585 to 1,737 meters)

**Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)

**Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)

**Frost-free period:** 120 to 140 days

**Map Unit Composition**

Pinavetes and similar soils: 90 percent

Minor components: 10 percent

**Component Descriptions**

**Pinavetes soils**

**Landscape:** Uplands

**Landform:** Dunes, valley sides

**Position on landform:** Shoulders

**Parent material:** Eolian deposits derived from sandstone

**Slope:** 5 to 15 percent

- **Aspect:** East to west
- **Shape (down/across):** Convex/convex

**Depth class:** Very deep

**Drainage class:** Excessively drained

**Slowest permeability:** 6.0 to 20 in./hr. (rapid)

**Available water capacity:** About 4.2 inches (low)

**Shrink-swell potential:** About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, sand sagebrush
Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 4 inches; loamy fine sand
- C—4 to 60 inches; loamy sand

Minor Components
Zia and similar soils
- Composition: About 10 percent
- Slope: 8 to 25 percent
- Drainage class: Well drained
- Ecological site: Sandy

262—Pastura loam, 1 to 4 percent slopes

Map Unit Setting
- Major Land Resource Area: 70
- Elevation: 5,400 to 5,800 feet (1,646 to 1,768 meters)
- Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
- Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- Frost-free period: 120 to 140 days

Map Unit Composition
- Pastura and similar soils: 90 percent
- Minor components: 10 percent

Component Descriptions
Pastura soils
- Landscape: Uplands
- Landform: Cuestas, mesas
- Position on landform: Shoulders
- Position on landform: Tread
- Parent material: Eolian materials and alluvium derived from sandstone and shale
- Slope: 1 to 4 percent
  - Aspect: East to west
  - Shape (down/across): Convex/linear
- Depth class: Very shallow and shallow
- Depth to restrictive feature: 5 to 20 inches to petrocalcic
- Drainage class: Well drained
- Slowest permeability: 0.3 to 2.0 in./hr. (moderate)
- Available water capacity: About 1.5 inches (very low)
- Shrink-swell potential: About 4.5 percent (moderate)
- Runoff class: Low
- Calcium carbonate maximum: About 15 percent
- Gypsum maximum: About 1 percent
- Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)

Ecological site: Shallow Limy Savannah

Potential native vegetation: black grama, blue grama, sideoats grama, needle and thread, winterfat, dropseed, galleta, juniper, muttongrass, bastard sage, Menodora

Land capability subclass (nonirrigated): 7s

Typical Profile:
- A—0 to 3 inches; loam
- Bw—3 to 10 inches; gravelly loam
- Bk—10 to 14 inches; gravelly loam
- Bkm—14 to 60 inches; cemented material

Minor Components
Ildefonso and similar soils
- Composition: About 5 percent
- Slope: 1 to 15 percent
- Drainage class: Well drained
- Ecological site: Limy

Harvey and similar soils
- Composition: About 5 percent
- Slope: 10 to 15 percent
- Drainage class: Well drained
- Ecological site: Limy

270—Blancot-Councilor-Tsosie association, 0 to 5 percent slopes

Map Unit Setting

Major Land Resource Area: 37
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Blancot and similar soils: 40 percent
Councilor and similar soils: 30 percent
Tsosie and similar soils: 25 percent
Minor components: 5 percent

Component Descriptions

Blancot soils
Landscape: Uplands
Landform: Ridges, valley sides
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Fan alluvium derived from sandstone and shale
Slope: 3 to 5 percent
- Aspect: East to west
- Shape (down/across): Linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 8.1 inches (moderate)
Shrink-swell potential: About 2.4 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 13 (moderately sodic)
Ecological site: Loamy
Potential native vegetation: Indian ricegrass, blue grama, galleta, big sagebrush, bottlebrush squirreltail, sand dropseed, western wheatgrass
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; fine sandy loam
Bt1—2 to 12 inches; sandy clay loam
B2—12 to 21 inches; clay loam
C—21 to 60 inches; sandy loam

Councilor soils
Landscape: Uplands
Landform: Fan remnants, valley sides, valley floors, stream terraces
Position on landform: Footslopes
Position on landform: Tread
Parent material: Eolian deposits over stream alluvium derived from sandstone and shale
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 7.1 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: Indian ricegrass, blue grama, dropseed, New Mexico Feathergrass, big sagebrush, galleta, mormon tea, needle and thread, winterfat
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; fine sandy loam
C—2 to 60 inches; sandy loam

Tsosie soils
Landscape: Uplands
Landform: Alluvial fans, stream terraces
Position on landform: Footslopes
Position on landform: Tread, rise
Parent material: Stream alluvium derived from sandstone and shale
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Slope: 0 to 3 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.7 inches (high)
Shrink-swell potential: About 3.2 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 10 (slightly sodic)
Ecological site: Salt Flats
Potential native vegetation: alkali sacaton, fourwing saltbush, galleta, greasewood, shadscale saltbush, big sagebrush, inland saltgrass, western wheatgrass
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 2 inches; clay loam
C1—2 to 10 inches; loam
C2—10 to 20 inches; clay loam
C3—20 to 26 inches; clay loam
C4—26 to 36 inches; clay loam
C5—36 to 44 inches; sandy loam
C6—44 to 55 inches; sandy loam
C7—55 to 60 inches; sandy loam

Minor Components
Badland
Composition: About 5 percent
Slope: 5 to 75 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)

281—Carjo loam, 1 to 9 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 7,000 to 8,000 feet (2,134 to 2,438 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Carjo and similar soils: 90 percent
Minor components: 10 percent

Component Descriptions
Carjo soils
Landscape: Uplands
Landform: Ridges, hills, mesas
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Residuum weathered from tuff
Slope: 1 to 9 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.06 to 0.2 in./hr. (slow)
Available water capacity: About 4.2 inches (low)
Shrink-swell potential: About 4.9 percent (moderate)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelli
Potential native vegetation:
   Common trees: ponderosa pine
   Other plants: Arizona fescue, blue grama, big bluestem, little bluestem, twoneedle pinyon, wavyleaf oak
Land capability subclass (nonirrigated): 5c

Typical Profile:
   A—0 to 4 inches; loam
   BA—4 to 12 inches; clay loam
   Bt—12 to 20 inches; clay
   C—20 to 25 inches; very fine sandy loam
   2R—25 to 60 inches; bedrock

Minor Components
Frijoles and similar soils
   Composition: About 5 percent
   Slope: 1 to 8 percent
   Drainage class: Well drained
   Ecological site: ponderosa forest

Nyjack and similar soils
   Composition: About 3 percent
   Slope: 1 to 5 percent
   Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: ponderosa forest

Toca! and similar soils
   Composition: About 2 percent
   Slope: 3 to 8 percent
   Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
282—Tocal very fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 7,000 to 8,000 feet (2,134 to 2,438 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Tocal and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Tocal soils
Landscape: Mountains
Landform: Plateaus
Position on landform: Shoulders
Position on landform: Mountaintop
Parent material: Eolian deposits derived from sandstone over residuum weathered from tuff
Slope: 3 to 8 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 2.5 inches (very low)
Shrink-swell potential: About 5.1 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 1 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
   Common trees: ponderosa pine, white fir, Douglas-fir
   Other plants: bottlebrush squirreltail, Gambel oak, little bluestem, mountain muhly, true mountain mahogany
Land capability subclass (nonirrigated): 7s

Typical Profile:
   A—0 to 5 inches; very fine sandy loam
   Bt1—5 to 8 inches; clay loam
   Bt2—8 to 11 inches; clay
   2Bt3—11 to 14 inches; silt loam
   2Cr—14 to 60 inches; bedrock
Minor Components
Aranos and similar soils
Composition: About 10 percent
Slope: 20 to 40 percent
Drainage class: Well drained
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Minor and similar soils
Composition: About 5 percent
Slope: 5 to 30 percent
Drainage class: Well drained
Ecological site: Pinus ponderosa/Quercus gambelli

283—Mirand-Alanos complex, 5 to 40 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,500 to 9,500 feet (2,591 to 2,896 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Mirand and similar soils: 45 percent
Aranos and similar soils: 30 percent
Minor components: 25 percent

Component Descriptions

Mirand soils
Landscape: Mountains
Landform: Canyons, mountain slopes
Position on landform: Backslopes
Parent material: Colluvium derived from volcanic rock
Slope: 5 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 001 to .06 in./hr. (very slow)
Available water capacity: About 10.8 inches (high)
Shrink-swell potential: About 5.6 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelli
Potential native vegetation:
Common trees: ponderosa pine
Other plants: Arizona fescue, mountain muhly, muttongrass, California brome, Gambel oak, prairie junegrass
Land capability subclass (nonirrigated): 7c
Typical Profile:
- Oi—0 to 2 inches; slightly decomposed plant material
- A—2 to 6 inches; loam
- Bt1—6 to 11 inches; clay loam
- Bt2—11 to 17 inches; gravelly clay loam
- Bt3—17 to 27 inches; clay loam
- Bt4—27 to 47 inches; clay
- 2Bt5—47 to 60 inches; clay loam

Alanos soils
Landscape: Mountains
Landform: Mountain slopes, hillsides
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Slope alluvium over colluvium derived from volcanic rock
Slope: 5 to 40 percent
- Aspect: East to west
- Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 4.7 inches (low)
Shrink-swell potential: About 6.1 percent (high)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
- Common trees: ponderosa pine, Douglas-fir
- Other plants: Arizona fescue, blue grama, California brome, pine dropseed,
  Gambel oak, lupine
Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 6 inches; cobbly loam
- E—6 to 9 inches; cobbly loam
- Bt1—9 to 30 inches; extremely gravelly clay loam
- Bt2—30 to 60 inches; very gravelly clay

Minor Components
Calaveras and similar soils
- Composition: About 10 percent
- Slope: 35 to 60 percent
- Drainage class: Well drained
- Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Palon and similar soils
- Composition: About 5 percent
- Slope: 35 to 65 percent
- Drainage class: Well drained
- Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Pavo and similar soils
Composition: About 5 percent
Slope: 5 to 20 percent
Drainage class: Well drained
Ecological site: Mountain Loam

Rubble land
Composition: About 5 percent
Slope: 35 to 60 percent
Drainage class: Excessively drained

290—Alanos-Rock outcrop complex, 20 to 40 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 7,800 to 8,500 feet (2,377 to 2,591 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Alanos and similar soils: 50 percent
Rock outcrop: 30 percent
Minor components: 20 percent

Component Descriptions

Alanos soils
Landscape: Mountains
Landform: Hillsides, mountain slopes
Position on landform: Backslopes
Parent material: Slope alluvium over colluvium derived from tuff
Slope: 20 to 40 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 4.3 inches (low)
Shrink-swell potential: About 6.7 percent (high)
Runoff class: Very high
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Potential native vegetation:
Common trees: ponderosa pine, Douglas-fir
Other plants: Arizona fescue, California brome, blue grama, pine dropseed,
Gambel oak, lupine
Land capability subclass (nonirrigated): 7c
Sandoval County Area, New Mexico

Typical Profile:
- A—0 to 4 inches; loam
- E—4 to 9 inches; loam
- BE—9 to 18 inches; very gravelly loam
- Bt1—18 to 26 inches; extremely gravelly clay
- Bt2—26 to 60 inches; extremely gravelly clay

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Ridges
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Alanos and similar soils
- Composition: About 10 percent
- Slope: 5 to 40 percent
- Drainage class: Well drained
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Tocal and similar soils
- Composition: About 5 percent
- Slope: 3 to 8 percent
  Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Carjo and similar soils
- Composition: About 5 percent
- Slope: 1 to 9 percent
  Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Pinus ponderosa/Quercus gambelii

300—Waumac-Bamac association, 1 to 7 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,400 to 6,200 feet (1,646 to 1,890 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Waumac and similar soils: 50 percent
Bamac and similar soils: 35 percent
Minor components: 15 percent
Component Descriptions

**Waumac soils**
*Landscape:* Valleys
*Landform:* Valley floors
*Position on landform:* Toeslopes
*Position on landform:* Base slope
*Parent material:* Fan alluvium derived from igneous and sedimentary rock
*Slope:* 1 to 7 percent
  *Aspect:* East to west
  *Shape (down/across):* Linear/linear
*Depth class:* Very deep
*Drainage class:* Well drained
*Slowest permeability:* 2.0 to 6.0 in./hr. (moderately rapid)
*Available water capacity:* About 6.9 inches (moderate)
*Shrink-swell potential:* About 1.5 percent (low)
*Runoff class:* Very low
*Calcium carbonate maximum:* About 15 percent
*Gypsum maximum:* None
*Salinity maximum:* About 2 mmhos/cm (nonsaline)
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)
*Ecological site:* Sandy
*Potential native vegetation:* blue grama, western wheatgrass, Indian ricegrass, black grama, oneseed juniper, twoneedle pinyon
*Land capability subclass (nonirrigated):* 6s

**Bamac soils**
*Landscape:* Valleys
*Landform:* Fan remnants, fan remnants, ridges, hills
*Position on landform:* Footslopes
*Position on landform:* Side slope, head slope
*Parent material:* Slope alluvium derived from igneous and sedimentary rock
*Slope:* 1 to 7 percent
  *Aspect:* East to west
  *Shape (down/across):* Linear/linear
*Depth class:* Very deep
*Drainage class:* Excessively drained
*Slowest permeability:* 6.0 to 20 in./hr. (rapid)
*Available water capacity:* About 1.9 inches (very low)
*Shrink-swell potential:* About 1.5 percent (low)
*Runoff class:* Very low
*Calcium carbonate maximum:* About 10 percent
*Gypsum maximum:* None
*Salinity maximum:* About 2 mmhos/cm (nonsaline)
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)
*Ecological site:* Foothills
*Potential native vegetation:* blue grama, western wheatgrass, Indian ricegrass, black grama
*Land capability subclass (nonirrigated):* 6e
Sandoval County Area, New Mexico

Typical Profile:
A—0 to 6 inches; gravelly loamy sand
C—6 to 60 inches; stratified very gravelly coarse sand to very gravelly loamy sand

Minor Components
Riverwash
Composition: About 10 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Royosa and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

301—Vastine-Jarola silt loams, 0 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 8,400 to 8,600 feet (2,560 to 2,621 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Vastine and similar soils: 45 percent
Jarola and similar soils: 40 percent
Minor components: 15 percent

Component Descriptions
Vastine soils
Landscape: Valleys
Landform: Stream terraces, flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 3 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Poorly drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.3 inches (low)
Shrink-swell potential: About 2.6 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 12 to 36 inches
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Loam
Potential native vegetation: tufted hairgrass, bluegrass, sedge, Canada wildrye,
Rocky Mountain iris, bluejoint, clover, shrubby cinquefoil, western wheatgrass
Land capability subclass (nonirrigated): 7c

Typical Profile:
A—0 to 4 inches; silt loam
A2—4 to 11 inches; loam
Bw—11 to 24 inches; loam
2C—24 to 60 inches; very gravelly loamy sand

Jarola soils
Landscape: Mountains
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous rock
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Poorly drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 7.7 inches (moderate)
Shrink-swell potential: About 3.6 percent (moderate)
Flooding hazard: Rare
Seasonal high water table depth: About 12 to 36 inches
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Meadow
Potential native vegetation: tufted hairgrass, bluegrass, sedge, Canada wildrye,
Rocky Mountain iris, bluejoint, clover, shrubby cinquefoil, western wheatgrass
Land capability subclass (nonirrigated): 7c

Typical Profile:
A—0 to 9 inches; silt loam
E—9 to 11 inches; silt loam
Bt1—11 to 17 inches; silty clay loam
Bt2—17 to 21 inches; clay loam
2C1—21 to 42 inches; gravelly sandy clay loam
2C2—42 to 60 inches; very gravelly sandy loam
Minor Components
Organic soils and similar soils
  Composition: About 10 percent
  Landscape: Mountains
  Landform: Marshes
  Position on landform: Toeslopes
  Position on landform: Base slope
  Slope: 0 to 3 percent
  Aspect: East to west
  Shape (down/across): Concave/concave
  Drainage class: Poorly drained
  Flooding hazard: Frequent

Tranquil and similar soils
  Composition: About 5 percent
  Slope: 1 to 8 percent
  Drainage class: Somewhat poorly drained
  Ecological site: Mountain Grassland

302—Tranquil-Jarmillo complex, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,500 to 8,800 feet (2,591 to 2,682 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Tranquil and similar soils: 50 percent
Jarmillo and similar soils: 30 percent
Minor components: 20 percent

Component Descriptions

Tranquil soils
  Landscape: Mountains
  Landform: Valley floors, stream terraces
  Position on landform: Toeslopes
  Position on landform: Side slope
  Parent material: Lacustrine deposits derived from igneous rock
  Slope: 1 to 8 percent
    Aspect: East to west
    Shape (down/across): Concave/linear
  Depth class: Very deep
  Drainage class: Somewhat poorly drained
  Slowest permeability: .06 to 0.2 in./hr. (slow)
  Available water capacity: About 9.5 inches (high)
  Shrink-swell potential: About 7.0 percent (high)
  Seasonal high water table depth: About 18 to 48 inches
  Runoff class: Very high
  Calcium carbonate maximum: None
  Gypsum maximum: None
  Salinity maximum: About 2 mmhos/cm (nonsaline)
**Sodium adsorption ratio maximum:** About 0 (nonsodic)

**Ecological site:** Mountain Grassland

**Potential native vegetation:** western wheatgrass, prairie junegrass, spike muhly, Rocky Mountain iris, sedge, shrubby cinquefoil

**Land capability subclass (nonirrigated):** 7c

**Typical Profile:**

- A1—0 to 4 inches; silty clay loam
- A2—4 to 13 inches; silty clay loam
- E1—8 to 11 inches; silty clay loam
- E2—11 to 13 inches; silty clay loam
- Bt1—13 to 20 inches; clay
- Bt2—20 to 34 inches; clay
- Bt3—34 to 42 inches; clay
- Bt4—42 to 50 inches; clay
- Bt5—50 to 60 inches; clay

**Jarmillo soils**

**Landscape:** Mountains

**Landform:** Stream terraces

**Position on landform:** Toeslopes

**Position on landform:** Base slope

**Parent material:** Stream alluvium over colluvium over lacustrine deposits derived from igneous rock

**Slope:** 1 to 8 percent

**Aspect:** East to west

**Depth class:** Very deep

**Drainage class:** Well drained

**Slowest permeability:** 0.2 to 0.6 in./hr. (moderately slow)

**Available water capacity:** About 10.1 inches (high)

**Shrink-swell potential:** About 2.1 percent (low)

**Runoff class:** Medium

**Calcium carbonate maximum:** None

**Gypsum maximum:** None

**Salinity maximum:** About 2 mmhos/cm (nonsaline)

**Sodium adsorption ratio maximum:** About 0 (nonsodic)

**Ecological site:** Mountain Loam

**Potential native vegetation:** Arizona fescue, bluegrass, western wheatgrass, muhly, needlegrass, bottlebrush squirreltail

**Land capability subclass (nonirrigated):** 7c

**Typical Profile:**

- A1—0 to 4 inches; loam
- A2—4 to 13 inches; loam
- AB—13 to 20 inches; loam
- Bw1—20 to 26 inches; loam
- Bw2—26 to 36 inches; loam
- Bw3—36 to 41 inches; fine sandy loam
- 2Bw4—41 to 51 inches; clay loam
- 3C—51 to 60 inches; very fine sandy loam
Minor Components
Vastine and similar soils
Composition: About 5 percent
Landscape: Mountains
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 3 percent
Aspect: East to west
Shape (down/across): Concave/linear
Drainage class: Poorly drained
Flooding hazard: Rare
Ecological site: Mountain Loam

Jarola and similar soils
Composition: About 5 percent
Landscape: Valleys
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Concave/linear
Drainage class: Poorly drained
Flooding hazard: Rare
Ecological site: Mountain Meadow

Cosey and similar soils
Composition: About 5 percent
Slope: 2 to 20 percent
Drainage class: Well drained
Ecological site: Mountain Loam

Tranquil, stony silt loam and similar soils
Composition: About 5 percent
Slope: 5 to 8 percent
Drainage class: Somewhat poorly drained
Ecological site: Mountain Grassland

304—Cosey-Jarmillo association, 2 to 20 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 8,600 to 8,800 feet (2,621 to 2,682 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Cosey and similar soils: 45 percent
Jarmillo and similar soils: 40 percent
Minor components: 15 percent
Component Descriptions

Cosey soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Slope alluvium over colluvium derived from rhyolite
Slope: 2 to 20 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 6.5 inches (moderate)
Shrink-swell potential: About 3.8 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Loam
Potential native vegetation: Arizona fescue, bluegrass, western wheatgrass,
needlegrass, bottlebrush squirreltail, mountain muhly
Land capability subclass (nonirrigated): 7c

Typical Profile:
A1—0 to 9 inches; silt loam
A2—9 to 15 inches; silt loam
BA—15 to 28 inches; gravelly loam
BT1—28 to 34 inches; very gravelly sandy clay loam
BT2—34 to 60 inches; extremely cobbly clay loam

Jarmillo soils
Landscape: Mountains
Landform: Stream terraces
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Alluvial, colluvial, and lacustrine deposits derived from igneous rock
Slope: 2 to 20 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.4 inches (moderate)
Shrink-swell potential: About 2.2 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Loam
Potential native vegetation: Arizona fescue, bluegrass, western wheatgrass, muhly, needlegrass, bottlebrush squirreltail
Land capability subclass (nonirrigated): 7c

Typical Profile:
A—0 to 17 inches; silt loam
Bw—17 to 33 inches; sandy loam
Cw—33 to 60 inches; sandy loam

Minor Components
Jarola and similar soils

Composition: About 10 percent
Landscape: Valleys
Landform: Stream terraces
Position on landform: Toeslopes
Slope: 1 to 5 percent
Aspect: East to west
Shape (down/across): Concave linear
Drainage class: Poorly drained
Flooding hazard: Rare
Ecological site: Mountain Meadow

Vastine and similar soils

Composition: About 5 percent
Landscape: Mountains
Landform: Flood plains
Position on landform: Toeslopes
Slope: 0 to 3 percent
Aspect: East to west
Shape (down/across): Concave linear
Drainage class: Poorly drained
Flooding hazard: Rare
Ecological site: Mountain Loam

307—Flugle-Waumac complex, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 6,100 feet (1,707 to 1,859 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Flugle and similar soils: 60 percent
Waumac and similar soils: 25 percent
Minor components: 15 percent
Figure 9.—Typical landscape of Flugle-Waumac complex, 1 to 8 percent slopes.

Component Descriptions

Flugle soils
Landscape: Uplands
Landform: Cuestas, hills, valley sides, fan remnants, ridges
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale
Slope: 1 to 5 percent
   Aspect: East to west
   Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.5 inches (moderate)
Shrink-swell potential: About 2.3 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Savannah
Potential native vegetation: blue grama, twoneedle pinyon, western wheatgrass,
   Indian ricegrass, juniper, needlegrass, other half shrubs
Land capability subclass (nonirrigated): 6c
Sandoval County Area, New Mexico

Typical Profile:
- A—0 to 3 inches; loam
- Bt—3 to 7 inches; sandy clay loam
- Btk1—7 to 12 inches; sandy clay loam
- Btk2—12 to 19 inches; sandy clay loam
- Bk—19 to 60 inches; fine sandy loam

Waumac soils
- Landscape: Uplands
- Landform: Valley floors
- Position on landform: Toeslopes
- Position on landform: Side slope
- Parent material: Stream alluvium derived from igneous and sedimentary rock
- Slope: 1 to 8 percent
  - Aspect: East to west
  - Shape (down/across): Concave/linear
- Depth class: Very deep
- Drainage class: Well drained
- Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
- Available water capacity: About 7.5 inches (moderate)
- Shrink-swell potential: About 1.5 percent (low)
- Runoff class: Low
- Calcium carbonate maximum: About 10 percent
- Gypsum maximum: None
- Salinity maximum: About 2 mmhos/cm (nonsaline)
- Sodium adsorption ratio maximum: About 5 (slightly sodic)
- Ecological site: Sandy
- Potential native vegetation: blue grama, western wheatgrass, Indian ricegrass, black grama, oneseed juniper, twoneedle pinyon
- Land capability subclass (nonirrigated): 6s

Typical Profile:
- A—0 to 3 inches; loamy sand
- C—3 to 60 inches; stratified fine sandy loam to sandy loam

Minor Components
- Fragua and similar soils
  - Composition: About 10 percent
  - Slope: 1 to 15 percent
  - Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
  - Drainage class: Well drained
  - Ecological site: Foothills

- Royosa and similar soils
  - Composition: About 5 percent
  - Slope: 1 to 8 percent
  - Drainage class: Somewhat excessively drained
  - Ecological site: Deep Sand
308—Cajete gravelly loam, 0 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,000 to 8,500 feet (2,438 to 2,591 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Cajete and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Cajete soils
Landscape: Mountains
Landform: Mountain slopes, stream terraces, hills
Position on landform: Footslopes
Position on landform: Mountainbase
Parent material: Residuum weathered from pumice
Slope: 0 to 8 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.7 inches (low)
Shrink-swell potential: About 2.1 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Grassland
Potential native vegetation: Arizona fescue, needlegrass, Kentucky bluegrass,
   bluegrass, western wheatgrass, Thurber fescue, pine dropseed
Land capability subclass (nonirrigated): 7c

Typical Profile:
   A1—0 to 7 inches; gravelly loam
   A2—7 to 15 inches; gravelly loam
   Bw—15 to 33 inches; very gravelly sandy loam
   C1—33 to 45 inches; very gravelly sand
   C2—45 to 49 inches; extremely gravelly sand
   C3—49 to 60 inches; very gravelly sand

Minor Components
Calaveras and similar soils
   Composition: About 10 percent
   Slope: 15 to 35 percent
   Drainage class: Well drained
   Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia
Sandoval County Area, New Mexico

Jarmillo and similar soils
  Composition: About 5 percent
  Slope: 2 to 20 percent
  Drainage class: Well drained
  Ecological site: Mountain Loam

311—Cosey-Tranquilar-Calaveras association, 5 to 20 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,600 to 9,200 feet (2,621 to 2,804 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Cosey and similar soils: 35 percent
Tranquilar and similar soils: 30 percent
Calaveras and similar soils: 25 percent
Minor components: 10 percent

Component Descriptions

Cosey soils
  Landscape: Mountains
  Landform: Mountain slopes
  Position on landform: Toeslopes
  Parent material: Slope alluvium over colluvium derived from rhyolite
  Slope: 5 to 20 percent
    Aspect: East to west
    Shape (down/across): Linear/linear
  Depth class: Very deep
  Drainage class: Well drained
  Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
  Available water capacity: About 5.7 inches (low)
  Shrink-swell potential: About 3.9 percent (moderate)
  Runoff class: Low
  Calcium carbonate maximum: None
  Gypsum maximum: None
  Salinity maximum: About 2 mmhos/cm (nonsaline)
  Sodium adsorption ratio maximum: About 0 (nonsodic)
  Ecological site: Mountain Loam
  Potential native vegetation: Arizona fescue, bluegrass, western wheatgrass,
    needlegrass, bottlebrush squirreltail, mountain muhly
  Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 13 inches; silt loam
  BA—13 to 24 inches; gravelly loam
  Bt—24 to 60 inches; extremely cobbly clay loam
**Tranquil soils**

*Landscape:* Mountains

*Landform:* Stream terraces, valley floors

*Position on landform:* Toeslopes

*Position on landform:* Mountainbase

*Parent material:* Lacustrine deposits derived from igneous rock

*Slope:* 5 to 8 percent

  *Aspect:* East to west

  *Shape (down/across):* Linear/linear

*Depth class:* Very deep

*Drainage class:* Somewhat poorly drained

*Slowest permeability:* .06 to 0.2 in./hr. (slow)

*Available water capacity:* About 9.9 inches (high)

*Shrink-swell potential:* About 6.6 percent (high)

*Seasonal high water table depth:* About 18 to 48 inches

*Runoff class:* Very high

*Calcium carbonate maximum:* None

*Gypsum maximum:* None

*Salinity maximum:* About 2 mmhos/cm (nonsalinic)

*Sodium adsorption ratio maximum:* About 0 (nonsodic)

*Ecological site:* Mountain Grassland

*Potential native vegetation:* western wheatgrass, prairie junegrass, spike muhly, Rocky Mountain iris, sedge, shrubby cinquefoil

*Land capability subclass (nonirrigated):* 7c

**Typical Profile:**

- **A**—0 to 14 inches; silt loam
- **E-14** to 20 inches; silt loam
- **Bt1**—20 to 42 inches; clay
- **Bt2**—42 to 60 inches; clay

**Calaveras soils**

*Landscape:* Mountains

*Landform:* Mountain slopes

*Position on landform:* Footslopes

*Position on landform:* Mountainbase

*Parent material:* Colluvium derived from tuff

*Slope:* 5 to 20 percent

  *Aspect:* East to west

  *Shape (down/across):* Linear/linear

*Depth class:* Very deep

*Drainage class:* Well drained

*Slowest permeability:* 0.6 to 2.0 in./hr. (moderate)

*Available water capacity:* About 4.9 inches (low)

*Shrink-swell potential:* About 2.2 percent (low)

*Runoff class:* Medium

*Calcium carbonate maximum:* None

*Gypsum maximum:* None

*Salinity maximum:* About 2 mmhos/cm (nonsalinic)

*Sodium adsorption ratio maximum:* About 0 (nonsodic)
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Potential native vegetation:
- Common trees: limber pine, ponderosa pine, white fir, Douglas-fir
- Other plants: common juniper, nodding brome, prairie junegrass, unknown, quaking aspen

Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 4 inches; silt loam
- E—4 to 11 inches; silt loam
- Bw—11 to 17 inches; gravelly silt loam
- 2Bt1—17 to 30 inches; very cobbly loam
- 2B2—30 to 39 inches; extremely cobbly coarse sandy loam
- 3Bt3—39 to 60 inches; extremely cobbly loamy sand

Minor Components
Jarmillo and similar soils
- Composition: About 5 percent
- Slope: 2 to 20 percent
- Drainage class: Well drained
- Ecological site: Mountain Loam

Cosey and similar soils
- Composition: About 5 percent
- Slope: 2 to 20 percent
- Drainage class: Well drained
- Ecological site: Mountain Loam

312—Royosa sand, 1 to 8 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,900 to 6,200 feet (1,798 to 1,890 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Royosa and similar soils: 90 percent
Minor components: 10 percent

Component Descriptions
Royosa soils
- Landscape: Dune fields
- Landform: Dunes
- Position on landform: Shoulders
- Parent material: Eolian deposits derived from sandstone
- Slope: 1 to 8 percent
  - Aspect: East to west
  - Shape (down/across): Convex/convex
- Depth class: Very deep
- Drainage class: Somewhat excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 3.6 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 3 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, dropseed, needle and thread, bottlebrush squirreltail, oneseed juniper
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 5 inches; sand
C1—5 to 16 inches; sand
C2—16 to 60 inches; loamy sand

Minor Components
Waumac and similar soils
  Composition: About 5 percent
  Slope: 1 to 7 percent
  Drainage class: Well drained
  Ecological site: Sandy

Fragua and similar soils
  Composition: About 5 percent
  Slope: 1 to 8 percent
  Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Foothills

314—Fragua-Waumac-Royosa complex, 1 to 8 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,600 to 6,200 feet (1,707 to 1,890 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Fragua and similar soils: 40 percent
Waumac and similar soils: 30 percent
Royosa and similar soils: 25 percent
Minor components: 5 percent

Component Descriptions
Fragua soils
Landscape: Uplands
Landform: Dipslopes, fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 1 to 8 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 7.0 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Foothills
Potential native vegetation: Indian ricegrass, blue grama, western wheatgrass, alkali sacaton, mesa dropseed, oneseed juniper, twoneedle pinyon
Land capability subclass (nonirrigated): 6c

Typical Profile:
  A—0 to 3 inches; loamy sand
  Bt1—3 to 8 inches; sandy loam
  Bt2—8 to 24 inches; sandy loam
  C—24 to 60 inches; sandy loam

Waumac soils
Landscape: Uplands
Landform: Valley floors
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 8 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 8.1 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: Indian ricegrass, blue grama, western wheatgrass, alkali sacaton, mesa dropseed, oneseed juniper, twoneedle pinyon
Land capability subclass (nonirrigated): 6s

Typical Profile:
  A—0 to 3 inches; loamy fine sand
  C—3 to 60 inches; fine sandy loam
Royosa soils
Landscape: Uplands
Landform: Dunes
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Convex/convex
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 3.5 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 3 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, dropseed, needleandthread, oneseed juniper, squirreltail
Land capability subclass (nonirrigated): 6e

Typical Profile:
   A—0 to 7 inches; fine sand
   C—7 to 60 inches; fine sand

Minor Components
Flugle and similar soils
   Composition: About 5 percent
   Slope: 1 to 5 percent
   Drainage class: Well drained
   Ecological site: Savannah

317—Elpedro loam, 1 to 8 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,700 to 6,300 feet (1,737 to 1,920 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Elpedro and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Elpedro soils
Landscape: Uplands
Landform: Valley sides, benches, fan piedmonts, hills, mesas
Position on landform: Footslopes
Position on landform: Side slope

Parent material: Eolian deposits derived from sandstone over colluvium derived from limestone

Slope: 1 to 8 percent

Aspect: East to west

Shape (down/across): Linear/linear

Depth class: Very deep

Drainage class: Well drained

Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)

Available water capacity: About 10.6 inches (high)

Shrink-swell potential: About 4.5 percent (moderate)

Runoff class: Medium

Calcium carbonate maximum: About 15 percent

Gypsum maximum: None

Salinity maximum: About 2 mmhos/cm (nonsaline)

Sodium adsorption ratio maximum: About 5 (slightly sodic)

Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis

Potential native vegetation:

- Common trees: juniper, twoweedle pinyon
- Other plants: blue grama, galleta, oak, bottlebrush squirreltail, western wheatgrass

Land capability subclass (nonirrigated): 6e

Typical Profile:

- A—0 to 2 inches; loam
- Bt—2 to 22 inches; silty clay loam
- Btk—22 to 60 inches; loam

Minor Components

Flugle and similar soils

Composition: About 8 percent

Slope: 1 to 5 percent

Drainage class: Well drained

Ecological site: Savannah

Waumac and similar soils

Composition: About 7 percent

Slope: 1 to 7 percent

Drainage class: Well drained

Ecological site: Sandy

319—Bamac-Rock outcrop complex, 15 to 55 percent slopes

Map Unit Setting

Major Land Resource Area: 36

Elevation: 5,600 to 6,400 feet (1,707 to 1,951 meters)

Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)

Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)

Frost-free period: 110 to 130 days
Map Unit Composition

Bamac and similar soils: 60 percent
Rock outcrop: 25 percent
Minor components: 15 percent

Component Descriptions

Bamac soils

Landscape: Uplands
Landform: Fan remnants, fan remnants, ridges, hills
Position on landform: Footslopes
Position on landform: Head slope, side slope
Parent material: Alluvium derived from igneous and sedimentary rock
Slope: 15 to 55 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation: blue grama, hairy grama, black grama, sideoats grama,
   New Mexico Feathergrass, galleta, oneseed juniper, sacahuista
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 4 inches; very gravelly loamy sand
   AC—4 to 10 inches; loamy sand
   C1—10 to 21 inches; very gravelly loamy coarse sand
   C2—21 to 37 inches; very gravelly loamy coarse sand
   C3—37 to 60 inches; very gravelly loamy coarse sand

Rock outcrop

Description: Rock outcrop consists of barren or nearly barren areas of bedrock as
   benches, ledges, and escarpments.
Landform: Benches, ledges
   Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components

Espiritu and similar soils

Composition: About 10 percent
Slope: 15 to 40 percent
Drainage class: Well drained
Ecological site: Foothills
Waumac and similar soils

Composition: About 5 percent
Slope: 1 to 15 percent
Drainage class: Well drained
Ecological site: Sandy

320—Sparham silt loam, 0 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,500 to 7,500 feet (1,981 to 2,286 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Sparham and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Sparham soils
Landscape: Valleys
Landform: Flood plains, valley sides, alluvial fans
Position on landform: Slopes
Position on landform: Rise
Parent material: Fan alluvium derived from sandstone and shale
Slope: 0 to 3 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.06 to 0.2 in./hr. (slow)
Available water capacity: About 9.8 inches (high)
Shrink-swell potential: About 7.2 percent (high)
Flooding hazard: Occasional
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Clayey
Potential native vegetation: western wheatgrass, alkali sacaton, bottlebrush, squirreltail, prairie junegrass
Land capability subclass (irrigated): 3a
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 9 inches; silt loam
C1—9 to 32 inches; silty clay
C2—32 to 60 inches; silty clay
Minor Components
Hickman and similar soils
  Composition: About 10 percent
  Slope: 1 to 5 percent
  Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Swale

Royosa and similar soils
  Composition: About 5 percent
  Slope: 1 to 8 percent
  Drainage class: Somewhat excessively drained
  Ecological site: Deep Sand

321—Waumac-Royosa association, 1 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 6,700 feet (1,707 to 2,042 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Waumac and similar soils: 60 percent
Royosa and similar soils: 30 percent
Minor components: 10 percent

Component Descriptions

Waumac soils
  Landscape: Valleys
  Landform: Valley floors
  Position on landform: Toeslopes
  Aspect: East to west
  Shape (down/across): Linear/linear
  Depth class: Very deep
  Drainage class: Well drained
  Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
  Available water capacity: About 8.1 inches (moderate)
  Shrink-swell potential: About 1.5 percent (low)
  Runoff class: Low
  Calcium carbonate maximum: About 10 percent
  Gypsum maximum: None
  Salinity maximum: About 2 mmhos/cm (nonsaline)
  Sodium adsorption ratio maximum: About 2 (slightly sodic)
  Ecological site: Sandy
  Potential native vegetation: Indian ricegrass, blue grama, western wheatgrass, alkali sacaton, mesa dropseed, oneseed juniper, twoneedle pinyon
  Land capability subclass (nonirrigated): 6s
Sandoval County Area, New Mexico

Typical Profile:
A—0 to 3 inches; loamy fine sand
C—3 to 60 inches; fine sandy loam

Royosa soils
Landscape: Valleys
Landform: Dunes
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian deposits derived from sandstone
Slope: 1 to 8 percent
   Aspect: East to west
   Shape (down/across): Convex/convex
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.5 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 3 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, dropseed, needleandthread, bottlebrush squirreltail, oneseed juniper
Land capability subclass (nonirrigated): 6e

Typical Profile:
A—0 to 12 inches; fine sand
C—12 to 60 inches; fine sand

Minor Components
Bamac and similar soils
   Composition: About 5 percent
   Slope: 1 to 15 percent
   Drainage class: Excessively drained
   Ecological site: Foothills

Fragua and similar soils
   Composition: About 3 percent
   Slope: 1 to 15 percent
   Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: Foothills

Rock outcrop
   Composition: About 2 percent
   Depth to restrictive feature: 0 inches to bedrock (lithic)
322—Fragua very cobbly fine sandy loam, 15 to 70 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 7,400 feet (1,707 to 2,256 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Fragua and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Fragua soils
Landscape: Uplands
Landform: Dipslopes, fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over fan alluvium derived from sandstone
Slope: 15 to 70 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Deep and very deep
Depth to restrictive feature: 40 to 80 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 4.6 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Foothills
Potential native vegetation: blue grama, hairy grama, black grama, sideoats grama,
   New Mexico Feathergrass, galleta, sacahuista
Land capability subclass (nonirrigated): 6e

Typical Profile:
   A—0 to 3 inches; very cobbly fine sandy loam
   Bt1—3 to 16 inches; very fine sandy loam
   Bk—16 to 45 inches; loamy fine sand
   Cr—45 to 60 inches; bedrock

Minor Components
Flugle and similar soils
   Composition: About 5 percent
   Slope: 1 to 5 percent
   Drainage class: Well drained
   Ecological site: Savannah
Rock outcrop

**Composition:** About 5 percent

**Depth to restrictive feature:** 0 inches to bedrock (lithic)

Vessilla and similar soils

**Composition:** About 3 percent

**Slope:** 5 to 30 percent

**Depth to restrictive feature:** 6 to 20 inches to bedrock (lithic)

**Drainage class:** Well drained

**Ecological site:** Pinyon-Juniper forest

Waumac and similar soils

**Composition:** About 2 percent

**Slope:** 1 to 15 percent

**Drainage class:** Well drained

**Ecological site:** Sandy

324—Rock outcrop-Atarque-Menefee complex, 5 to 25 percent slopes

**Map Unit Setting**

**Major Land Resource Area:** 36

**Elevation:** 5,700 to 6,600 feet (1,737 to 2,012 meters)

**Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)

**Mean annual air temperature:** 48 to 52 degrees F. (8.9 to 11.1 degrees C.)

**Frost-free period:** 110 to 130 days

**Map Unit Composition**

Rock outcrop: 30 percent

Atarque and similar soils: 25 percent

Menefee and similar soils: 25 percent

Minor components: 20 percent

**Component Descriptions**

**Rock outcrop**

**Description:** Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.

**Landform:** Ledges, escarpments

**Aspect:** East to west

**Depth to restrictive feature:** 0 inches to bedrock (lithic)

**Land capability subclass (nonirrigated):** 8s

**Atarque soils**

**Landscape:** Uplands

**Landform:** Cuestas, hills, dipslopes, mesas

**Position on landform:** Backslopes

**Position on landform:** Side slope

**Parent material:** Slope alluvium derived from sandstone and shale

**Slope:** 5 to 25 percent

**Aspect:** East to west

**Shape (down/across):** Linear/linear

**Depth class:** Very shallow and shallow

**Depth to restrictive feature:** 8 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow Sandstone
Potential native vegetation: sideoats grama, blue grama, little bluestem, Indian ricegrass, galleta, twoneedle pinyon
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 3 inches; sandy loam
Bt—3 to 9 inches; sandy clay loam
Btk—9 to 14 inches; sandy clay loam
R—14 to 60 inches; bedrock

Menefee soils
Landscape: Uplands
Landform: Hillslopes, mesas, mountainsides
Position on landform: Footslopes
Parent material: Colluvium over residuum weathered from shale
Slope: 8 to 25 percent
Aspect: East to west
Shape (down/across): Linear/Linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow
Potential native vegetation: blue grama, New Mexico feathergrass, sideoats grama, little bluestem, black grama, galleta
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 2 inches; gravelly loam
C—2 to 9 inches; clay loam
2Cr—9 to 60 inches; bedrock
Minor Components
Waumac and similar soils
  Composition: About 10 percent
  Slope: 1 to 15 percent
  Drainage class: Well drained
  Ecological site: Sandy

Vessilla and similar soils
  Composition: About 10 percent
  Slope: 5 to 30 percent
  Depth to restrictive feature: 6 to 20 inches to bedrock (paralithic)
  Drainage class: Well drained
  Ecological site: Shallow Sandstone

325—Rock outcrop-Vessilla-Espiritu complex, 25 to 65 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,000 to 6,400 feet (1,829 to 1,951 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Rock outcrop: 35 percent
Vessilla and similar soils: 25 percent
Espiritu and similar soils: 25 percent
Minor components: 15 percent

Component Descriptions
Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Ledges, escarpments
  Aspect: East to west
  Depth to restrictive feature: 0 inches to bedrock (lithic)
  Land capability subclass (nonirrigated): 8s

Vessilla soils
Landscape: Mountains
Landform: Mesas, hills, breaks, ridges, structural benches
Position on landform: Footslopes
Position on landform: Mountainflank, lower third
Parent material: Eolian deposits over slope alluvium over residuum weathered from sandstone
Slope: 25 to 55 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
  Depth class: Very shallow and shallow
  Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 1.1 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: sideoats grama, New Mexico Feathergrass, blue grama, little bluestem, galleta

Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 1 inch; very gravelly sandy loam
  C—1 inch to 10 inches; gravelly loam
  R—10 to 60 inches; bedrock

Espiritu soils

Landscape: Mountains
Landform: Mountain slopes, mesas
Position on landform: Toeslopes
Position on landform: Mountainflank, lower third
Parent material: Alluvium, eolian material and colluvium derived from igneous and sedimentary rock
Slope: 25 to 65 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.1 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: blue grama, wavyleaf oak, black grama, hairy grama, needle and thread, sideoats grama, true mountain mahogany

Land capability subclass (nonirrigated): 7e

Typical Profile:
  A—0 to 2 inches; very gravelly fine sandy loam
  Bt—2 to 20 inches; very gravelly sandy clay loam
  Bk—20 to 60 inches; very gravelly loam
Minor Components
Atarque and similar soils
Composition: About 5 percent
Slope: 25 to 45 percent
Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

Fragua and similar soils
Composition: About 5 percent
Slope: 5 to 25 percent
Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Foothills

Sedillo and similar soils
Composition: About 3 percent
Slope: 5 to 25 percent
Drainage class: Well drained
Ecological site: Foothills

Skyvillage and similar soils
Composition: About 2 percent
Slope: 8 to 25 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

342—Waumac-Vessilla-Rock outcrop complex, 5 to 40 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,200 to 6,900 feet (1,890 to 2,103 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Waumac and similar soils: 35 percent
Vessilla and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent

Component Descriptions

Waumac soils
Landscape: Uplands
Landform: Valley floors
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Fan alluvium derived from igneous and sedimentary rock
Slope: 5 to 20 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 6.9 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Sandy
Potential native vegetation: Indian ricegrass, blue grama, western wheatgrass, alkali
  sacaton, mesa dropseed, oneseed juniper, twoneedle pinyon
Land capability subclass (nonirrigated): 6s

Typical Profile:
  A—0 to 5 inches; loamy fine sand
  C—5 to 60 inches; sandy loam

Vessilla soils
Landscape: Uplands
Landform: Hills, ridges, breaks, mesas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium over residuum weathered from
  sandstone
Slope: 5 to 40 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: Indian ricegrass, blue grama, mountain big sagebrush, oak, galleta,
  sidecots grama
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 3 inches; fine sandy loam
  C—3 to 13 inches; fine sandy loam
  R—13 to 60 inches; bedrock
Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Ledges, escarpments
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Badland
Composition: About 10 percent
Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to bedrock (paralithic)

Royosa and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

Menefee and similar soils
Composition: About 5 percent
Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

345—Espiritu-Bamac association, 15 to 55 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,500 to 6,600 feet (1,676 to 2,012 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Espiritu and similar soils: 50 percent
Bamac and similar soils: 35 percent
Minor components: 15 percent

Component Descriptions
Espiritu soils
Landscape: Uplands
Landform: Fan piedmonts, mesas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Slope alluvium over colluvium derived from igneous and sedimentary rock
Slope: 15 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 10 percent subrounded cobbles
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 4.7 inches (low)
Shrink-swell potential: About 3.3 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation: blue grama, hairy grama, black grama, side oats grama, New Mexico Feathergrass, galleta, oneseed juniper, sacahuista
Land capability subclass (nonirrigated): 7e

Typical Profile:
A---0 to 6 inches; very gravelly fine sandy loam
Bt1---6 to 15 inches; very gravelly sandy clay loam
Bt2---15 to 22 inches; very gravelly sandy clay loam
Bk1---22 to 28 inches; very cobbly sandy clay loam
Bk2---29 to 38 inches; very cobbly sandy clay loam
2C1---38 to 46 inches; fine sandy loam
3C2---46 to 60 inches; very gravelly sandy loam
Minor Components
Waumac and similar soils
  *Composition*: About 5 percent
  *Slope*: 1 to 7 percent
  *Drainage class*: Well drained
  *Ecological site*: Sandy

Cochiti and similar soils
  *Composition*: About 5 percent
  *Slope*: 15 to 40 percent
  *Drainage class*: Well drained
  *Ecological site*: Pinyon-Juniper forest

Rock outcrop
  *Composition*: About 5 percent
  *Depth to restrictive feature*: 0 inches to bedrock (lithic)

346—Espiritu, cobbly-Bamac association, 15 to 40 percent slopes

Map Unit Setting
*Major Land Resource Area*: 36
*Elevation*: 5,900 to 6,900 feet (1,798 to 2,103 meters)
*Mean annual precipitation*: 13 to 16 inches (330 to 406 millimeters)
*Mean annual air temperature*: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
*Frost-free period*: 110 to 130 days

Map Unit Composition
Espiritu, cobbly and similar soils: 70 percent
Bamac and similar soils: 20 percent
Minor components: 10 percent

Component Descriptions
Espiritu, cobbly soils
  *Landscape*: Uplands
  *Landform*: Fan piedmonts, mesas
  *Position on landform*: Footslopes
  *Position on landform*: Side slope
  *Parent material*: Slope alluvium over colluvium derived from igneous and sedimentary rock
  *Slope*: 15 to 40 percent
  *Aspect*: East to west
  *Shape (down/across)*: Linear/linear
  *Surface fragments*: About 7 percent subrounded cobbles
  *Depth class*: Very deep
  *Drainage class*: Well drained
  *Slowest permeability*: 0.6 to 2.0 in./hr. (moderate)
  *Available water capacity*: About 3.3 inches (low)
  *Shrink-swell potential*: About 2.6 percent (low)
  *Runoff class*: High
  *Calcium carbonate maximum*: About 10 percent
  *Gypsum maximum*: None
  *Salinity maximum*: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: black grama, blue grama, sideoats grama, hairy grama, needle and thread, true mountain mahogany, wavyleaf oak
Land capability subclass (nonirrigated): 6e

Typical Profile:
  A—0 to 2 inches; extremely cobbly sandy loam
  Bt—2 to 24 inches; very gravelly sandy clay loam
  Bk—24 to 36 inches; extremely gravelly sandy loam
  2C—36 to 60 inches; very gravelly loamy sand

Bamac soils
Landscape: Uplands
Landform: Hills, ridges, fan remnants
Position on landform: Shoulders
Position on landform: Side slope, head slope
Parent material: Slope alluvium derived from igneous and sedimentary rock
Slope: 15 to 40 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.4 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: black grama, blue grama, sideoats grama, hairy grama, needle and thread, true mountain mahogany, wavyleaf oak
Land capability subclass (nonirrigated): 6e

Typical Profile:
  A—0 to 3 inches; very gravelly loamy sand
  C1—3 to 30 inches; very gravelly loamy coarse sand
  C2—30 to 45 inches; loamy sand
  C3—45 to 60 inches; very gravelly loamy sand

Minor Components
Cochiti and similar soils
  Composition: About 5 percent
  Slope: 15 to 40 percent
  Drainage class: Well drained
Sandoval County Area, New Mexico

Rock outcrop
Composition: About 3 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

Royocsa and similar soils
Composition: About 2 percent
Slope: 1 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

348—Wauquie-Rock outcrop complex, 25 to 45 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,000 to 6,800 feet (1,829 to 2,073 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Wauquie and similar soils: 60 percent
Rock outcrop: 20 percent
Minor components: 20 percent

Component Descriptions

Wauquie soils
Landscape: Mountains
Landform: Mountain slopes, hills, mesas, benches, canyons
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Slope alluvium over colluvium derived from igneous and sedimentary rock
Slope: 25 to 45 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.7 inches (low)
Shrink-swell potential: About 2.2 percent (low)
Runoff class: High
Calcium carbonate maximum: About 3 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis

Potential native vegetation:
Common trees: one-seed juniper, twoneedle pinyon
Other plants: Eriogonum, blue grama, skunkbush sumac, slender wheatgrass, bottlebrush squirreltail, wavyleaf oak

Land capability subclass (nonirrigated): 7s
Typical Profile:
A—0 to 2 inches; extremely gravelly sandy clay loam
Bt1—2 to 16 inches; very gravelly clay loam
Bt2—16 to 40 inches; very gravelly sandy loam
Bk—40 to 60 inches; extremely gravelly loamy sand

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, ledges
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Bamac and similar soils
Composition: About 5 percent
Slope: 15 to 55 percent
Drainage class: Excessively drained
Ecological site: Foothills

Waumac and similar soils
Composition: About 5 percent
Slope: 1 to 7 percent
Drainage class: Well drained
Ecological site: Sandy

Vessilia and similar soils
Composition: About 5 percent
Slope: 5 to 30 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow Sandstone

Royosa and similar soils
Composition: About 5 percent
Slope: 1 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Deep Sand

353—Cochiti-Espiritu association, 15 to 55 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,300 to 6,400 feet (1,615 to 1,951 meters)
Mean annual precipitation: 13 to 18 inches (330 to 456 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Cochiti and similar soils: 50 percent
Espiritu and similar soils: 45 percent
Minor components: 5 percent
Component Descriptions

Cochiti soils
Landscape: Uplands
Landform: Fan remnants
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Slope alluvium derived from igneous and sedimentary rock
Slope: 15 to 40 percent
  Aspect: East to west
    Shape (down/across): Linear/linear
Surface fragments: About 3 percent subrounded cobbles
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.8 inches (low)
Shrink-swell potential: About 2.5 percent (low)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-
  Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: blue grama, bottlebrush squirreltail, sideoats grama
Land capability subclass (nonirrigated): 6e

Typical Profile:
  A—0 to 4 inches; extremely gravelly loam
  Bt—4 to 22 inches; very gravelly clay loam
  C—22 to 60 inches; very gravelly loamy sand

Espiritu soils
Landscape: Uplands
Landform: Fan piedmonts, mesas
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Slope alluvium over colluvium derived from igneous and sedimentary rock
Slope: 25 to 55 percent
  Aspect: East to west
    Shape (down/across): Linear/linear
Surface fragments: About 3 percent subrounded cobbles
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 2.4 inches (very low)
Shrink-swell potential: About 2.2 percent (low)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Foothills

Potential native vegetation:
- Common trees: oneseed juniper, twoneedle pinyon
- Other plants: black grama, blue grama, sideoats grama, hairy grama, needle and thread, true mountain mahogany, wavyleaf oak

Land capability subclass (nonirrigated): 7e

Typical Profile:
- A—0 to 3 inches; very gravelly loam
- Bt—3 to 16 inches; very gravelly sandy clay loam
- Bk—16 to 60 inches; extremely gravelly loamy sand

Minor Components
- Teco and similar soils
  - Composition: About 3 percent
  - Slope: 8 to 40 percent
  - Drainage class: Well drained
  - Ecological site: Clayey

- Waumac and similar soils
  - Composition: About 2 percent
  - Slope: 1 to 7 percent
  - Drainage class: Well drained
  - Ecological site: Sandy

354—Waumac Variant very gravelly sandy loam, 1 to 15 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,600 to 5,900 feet (1,707 to 1,798 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Waumac Variant and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Waumac Variant soils
- Landscape: Uplands
- Landform: Ridges, hills
- Position on landform: Summits
- Position on landform: Nose slope
- Parent material: Residuum weathered from tuff
- Slope: 1 to 15 percent
  - Aspect: East to west
  - Shape (down/across): Convex/linear
- Depth class: Shallow
- Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
- Drainage class: Well drained
- Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 0.7 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
  Common trees: one-seed juniper, two-needle pinyon
  Other plants: Apache plume, black grama, blue grama, broom snakeweed, little bluestem, sandhill muhly
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 3 inches; very gravelly sandy loam
  C—3 to 12 inches; very gravelly sandy loam
  Cr—12 to 60 inches; bedrock

Minor Components
Rock outcrop
  Composition: About 10 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Waumac and similar soils
  Composition: About 5 percent
  Slope: 1 to 7 percent
  Drainage class: Well drained
  Ecological site: Sandy

358—Deama-Elpedro-Rock outcrop complex, 10 to 55 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,800 to 6,800 feet (1,768 to 2,073 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 46 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Deama and similar soils: 35 percent
Elpedro and similar soils: 25 percent
Rock outcrop: 25 percent
Minor components: 15 percent

Component Descriptions
Deama soils
  Landscape: Uplands
  Landform: Plateaus, hills, ridges, mesas
  Position on landform: Shoulders
  Position on landform: Side slope
  Parent material: Colluvium over residuum weathered from limestone
Slope: 10 to 55 percent
   Aspect: East to west
   Shape (down/across): Convex/linear
Depth class: Shallow
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 1.3 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 60 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
   Common trees: two-needle pinyon
   Other plants: blue grama, sideoats grama, New Mexico Feathergrass
Land capability subclass (nonirrigated): Te

Typical Profile:
   A—0 to 3 inches; very gravelly loam
   Bk—3 to 19 inches; very gravelly loam
   2R—19 to 60 inches; bedrock

Elpedro soils
Landscape: Uplands
Landform: Valley sides, mesas, hills, fan piedmonts, benches
Position on landform: Footslopes
Position on landform: Side slope
Parent material: Eolian deposits over colluvium derived from limestone
Slope: 10 to 40 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 10.8 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: blue grama, bottlebrush squirreltail, galleta, oak, western wheatgrass
Land capability subclass (nonirrigated): Te
Sandoval County Area, New Mexico

Typical Profile:
A—0 to 3 inches; very gravelly loam
Bt—3 to 37 inches; silty clay loam
Btk—37 to 60 inches; loam

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Espiritu and similar soils
Composition: About 10 percent
Slope: 15 to 40 percent
Drainage class: Well drained
Ecological site: Foothills

Menefee and similar soils
Composition: About 5 percent
Slope: 5 to 35 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: pinyon-juniper forest

396—Atarque-Menefee-Rock outcrop complex, 25 to 45 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,000 to 6,600 feet (1,829 to 2,012 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Atarque and similar soils: 30 percent
Menefee and similar soils: 30 percent
Rock outcrop: 25 percent
Minor components: 15 percent

Component Descriptions
Atarque soils
Landscape: Uplands
Landform: Dipslopes, hills, mesas, cuestas
Position on landform: Shoulders
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 3.1 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Shallow Sandstone
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: sideoats grama, New Mexico Feathergrass, blue grama, little bluestem
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 2 inches; extremely gravelly sandy loam
   Bt—2 to 16 inches; clay loam
   R—16 to 60 inches; bedrock

Menefee soils
Landscape: Uplands
Landform: Hillslopes, mesas, mountainsides
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium over residuum weathered from shale
Slope: 25 to 45 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.7 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: Bigelow sagebrush, mormon tea, Indian ricegrass, Mexican cliffrose, bluegrass, galleta, green rabbitbrush
Land capability subclass (nonirrigated): 7s
Sandoval County Area, New Mexico

**Typical Profile:**
- A—0 to 2 inches; gravelly clay loam
- C—2 to 14 inches; clay loam
- 2Cr—14 to 60 inches; bedrock

**Rock outcrop**
*Description:* Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.

*Landform:* Hills, escarpments
*Aspect:* East to west
*Depth to restrictive feature:* 0 inches to bedrock (lithic)
*Land capability subclass (nonirrigated):* 8s

**Minor Components**
- **Waumac and similar soils**
  - *Composition:* About 5 percent
  - *Slope:* 1 to 8 percent
  - *Drainage class:* Well drained
  - *Ecological site:* Sandy

- **Flugle and similar soils**
  - *Composition:* About 5 percent
  - *Slope:* 1 to 5 percent
  - *Drainage class:* Well drained
  - *Ecological site:* Savannah

- **Vessilla and similar soils**
  - *Composition:* About 5 percent
  - *Slope:* 3 to 15 percent
  - *Depth to restrictive feature:* 6 to 20 inches to bedrock (paralithic)
  - *Drainage class:* Well drained
  - *Ecological site:* Shallow Sandstone

**397—Rock outcrop-Cucho-Vessilla complex, 25 to 70 percent slopes**

**Map Unit Setting**
- **Major Land Resource Area:** 36
- **Elevation:** 6,000 to 7,200 feet (1,829 to 2,195 meters)
- **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

**Map Unit Composition**
- Rock outcrop: 30 percent
- Cucho and similar soils: 25 percent
- Vessilla and similar soils: 25 percent
- Minor components: 20 percent

**Component Descriptions**

**Rock outcrop**
*Description:* Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Hills, escarpments
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Cucho soils
Landscape: Uplands
Landform: Cuestas, fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium derived from shale
Slope: 25 to 70 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 45 percent subrounded gravel
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 4.4 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
- Common trees: oneseed juniper, twoneedle pinyon
- Other plants: Indian ricegrass, bottlebrush squirreltail, galleta, mountain mahogany, needle and thread, sideoats grama, skunkbush sumac, wavyleaf oak
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 2 inches; very gravelly clay loam
C1—2 to 9 inches; clay loam
C2—9 to 37 inches; very gravelly clay loam
Cr—37 to 60 inches; bedrock

Vessilla soils
Landscape: Uplands
Landform: Structural benches, hills, ridges, breaks, mesas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian material and alluvium derived from sandstone
Slope: 25 to 65 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.1 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: sideoats grama, New Mexico Feathergrass, blue grama, little bluestem, galieta
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 2 inches; gravelly fine sandy loam
   C—2 to 11 inches; gravelly fine sandy loam
   R—11 to 60 inches; bedrock

Minor Components
Atarque and similar soils
   Composition: About 5 percent
   Slope: 25 to 45 percent
   Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Shallow Sandstone

Menefee and similar soils
   Composition: About 5 percent
   Slope: 25 to 45 percent
   Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
   Drainage class: Well drained
   Ecological site: Pinyon-Juniper forest

Skyvillage and similar soils
   Composition: About 5 percent
   Slope: 8 to 25 percent
   Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: Shallow Sandstone

Waumac and similar soils
   Composition: About 5 percent
   Slope: 1 to 7 percent
   Drainage class: Well drained
   Ecological site: Sandy

398—Espiritu-Cucho association, 8 to 55 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,000 to 6,900 feet (1,829 to 2,103 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Espíritu and similar soils: 45 percent
Cucho and similar soils: 35 percent
Minor components: 20 percent

Component Descriptions
Espíritu soils

Landscape: Uplands
Landform: Mountain slopes, mesas
Position on landform: Backslopes
Position on landform: Mountainflank, lower third, side slope
Parent material: Slope alluvium and colluvium derived from igneous and sedimentary rock
Slope: 8 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Surface fragments: About 20 percent subrounded gravel
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.0 inches (very low)
Shrink-swell potential: About 2.6 percent (low)
Runoff class: High
Calcium carbonate maximum: About 1 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Foothills
Potential native vegetation: blue grama, hairy grama, black grama, sideoats grama, New Mexico Feathergrass, galleta, oneseed juniper, sacahuista
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 4 inches; very gravelly fine sandy loam
Bt—4 to 24 inches; very gravelly sandy clay loam
Bk—24 to 60 inches; extremely gravelly sandy loam

Cucho soils

Landscape: Uplands
Landform: Cuestas, fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium derived from shale
Slope: 15 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 7.2 inches (moderate)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Sallinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-
Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
Common trees: oneseed juniper, twoneedle pinyon
Other plants: Indian ricegrass, bottlebrush squirreltail, galleta, mountain
mahogany, needle and thread, sideoats grama, skunkbush sumac, wavyleaf
oak
Land capability subclass (nonirrigated): 7e

Typical Profile:
A—0 to 2 inches; very gravelly clay loam
C—2 to 37 inches; silty clay loam
Cr—37 to 60 inches; bedrock

Minor Components
Menefee and similar soils
Composition: About 10 percent
Slope: 5 to 35 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Ecological site: Shallow

Waumac and similar soils
Composition: About 5 percent
Slope: 1 to 7 percent
Drainage class: Well drained
Ecological site: Sandy

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

399—Cucho-Teco complex, 8 to 40 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,900 to 7,000 feet (1,798 to 2,134 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition

Cucho and similar soils: 45 percent
Teco and similar soils: 35 percent
Minor components: 20 percent
Component Descriptions

Cucho soils
Landscape: Uplands
Landform: Cuestas, fan remnants
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Colluvium derived from shale
Slope: 15 to 40 percent
  Aspect: East to west
  Shape (down/ across): Linear/linear
Surface fragments: About 50 percent subrounded gravel
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in/hr. (moderately slow)
Available water capacity: About 7.2 inches (moderate)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: About 15 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Falugia paradoxa-
  Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
  Common trees: oneseed juniper, twoneedle pinyon
  Other plants: Indian ricegrass, bottlebrush squirreltail, galleta, mountain
    mahogany, needle and thread, sideoats grama, skunkbush sumac, wavyleaf
    oak
Land capability subclass (nonirrigated): 6e

Typical Profile:
  A—0 to 2 inches; very gravelly clay loam
  C—2 to 37 inches; clay loam
  Cr—37 to 60 inches; bedrock

Teco soils
Landscape: Uplands
Landform: Hills, cuestas
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Slope alluvium derived from sandstone and shale
Slope: 8 to 40 percent
  Aspect: East to west
  Shape (down/ across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in/hr. (slow)
Available water capacity: About 7.7 inches (moderate)
Shrink-swell potential: About 6.2 percent (high)
Runoff class: Very high
Calcium carbonate maximum: About 13 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Clayey
Potential native vegetation: alkali sacaton, western wheatgrass, New Mexico feathergrass, blue grama, galleta, fourwing saltbush, winterfat
Land capability subclass (nonirrigated): 6e

Typical Profile:
- A—0 to 1 inch; very cobbly fine sandy loam
- Bt1—1 inch to 7 inches; sandy clay
- Bt2—7 to 23 inches; clay
- Btk—23 to 40 inches; clay
- 2C—40 to 45 inches; very gravelly fine sandy loam
- 3Bkb—45 to 60 inches; channery sandy clay loam

Minor Components
Espiritu and similar soils
- Composition: About 10 percent
- Slope: 15 to 40 percent
- Drainage class: Well drained
- Ecological site: Foothills

Menefee and similar soils
- Composition: About 5 percent
- Slope: 5 to 35 percent
- Depth to restrictive feature: 10 to 20 inches to bedrock (paralithic)
- Drainage class: Well drained
- Ecological site: pinyon-juniper forest

Rock outcrop
- Composition: About 5 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)

405—Charo complex, 1 to 5 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 8,100 to 8,300 feet (2,469 to 2,530 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Charo and similar soils: 50 percent
Charo, noncobbly, and similar soils: 40 percent
Minor components: 10 percent

Component Descriptions
Charo soils
Landscape: Mountains
Landform: Mesas, ridges, hills
Position on landform: Shoulders
Position on landform: Crest, mountaintop
Parent material: Eolian deposits over residuum weathered from basalt
Slope: 1 to 5 percent
  Aspect: East to west
  Shape (down/across): Convex/linear
Surface fragments: About 2 percent subrounded stones
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in/hr. (slow)
Available water capacity: About 4.0 inches (low)
Shrink-swell potential: About 7.4 percent (high)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa-Juniperus deppeana/Quercus gambelii
Potential native vegetation:
  Common trees: Rocky Mountain juniper, twoneedle pinyon, ponderosa pine
  Other plants: blue grama, Arizona fescue, mountain muhly, spineless horsebrush, Fendler ceanothus, prairie junegrass
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 5 inches; cobbly loam
  Bt1—5 to 12 inches; clay
  Bt2—12 to 15 inches; clay
  Bt3—15 to 25 inches; clay
  C—25 to 28 inches; clay
  R—28 to 60 inches; bedrock

Charo, noncobbly soils
Landscape: Mountains
Landform: Hills, ridges, mesas
Position on landform: Shoulders
Position on landform: Crest, mountaintop
Parent material: Eolian deposits over residuum weathered from basalt
Slope: 1 to 3 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
Depth class: Moderately deep
Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in/hr. (slow)
Available water capacity: About 6.5 inches (moderate)
Shrink-swell potential: About 4.2 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Mountain Grassland
Potential native vegetation: Arizona fescue, mountain muhly, muttongrass, prairie junegrass
Land capability subclass (nonirrigated): 7c
Sandoval County Area, New Mexico

Typical Profile:
- A—0 to 8 inches; loam
- Bt—8 to 38 inches; clay
- R—38 to 60 inches; bedrock

Minor Components
Rock outcrop
- Composition: About 10 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)

409—Santa Fe very gravelly sandy loam, 15 to 40 percent slopes, stony

Map Unit Setting
- Major Land Resource Area: 36
- Elevation: 6,800 to 7,600 feet (2,073 to 2,316 meters)
- Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
- Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
- Frost-free period: 110 to 130 days

Map Unit Composition
- Santa Fe and similar soils: 85 percent
- Minor components: 15 percent

Component Descriptions
Santa Fe soils
- Landscape: Mountains
- Landform: Mountain slopes
- Position on landform: Backslopes
- Position on landform: Mountainflank
- Parent material: Slope alluvium over residuum weathered from granite
- Slope: 15 to 40 percent
  - Aspect: East to west
  - Shape (down/across): Linear/linear
- Depth class: Very shallow and shallow
- Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
- Available water capacity: About 0.5 inches (very low)
- Shrink-swell potential: About 4.5 percent (moderate)
- Runoff class: Very high
- Calcium carbonate maximum: None
- Gypsum maximum: None
- Salinity maximum: About 2 mmhos/cm (nonsaline)
- Sodium adsorption ratio maximum: About 0 (nonsodic)
- Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
- Potential native vegetation:
  - Common trees: one seed juniper, twoneedle pinyon
  - Other plants: sideoats grama, blue grama, galleta, pinyon ricegrass
- Land capability subclass (nonirrigated): 7s
Typical Profile:
- A—0 to 3 inches; very gravelly sandy loam
- Bt—3 to 8 inches; very gravelly sandy clay loam
- 2R—8 to 60 inches; bedrock

Minor Components
Rock outcrop
- Composition: About 10 percent
- Depth to restrictive feature: 0 inches to bedrock (lithic)
- Ecological site: pinyon-juniper forest

Vessilla and similar soils
- Composition: About 3 percent
- Slope: 5 to 40 percent
- Depth to restrictive feature: 6 to 20 inches to bedrock (lithic)
- Drainage class: Well drained
- Ecological site: pinyon-juniper forest

Waumac and similar soils
- Composition: About 2 percent
- Slope: 5 to 20 percent
- Drainage class: Well drained
- Ecological site: Sandy

410—Zia loam, 0 to 1 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition

Zia and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Zia soils
- Landscape: Valleys
- Landform: Stream terraces
- Position on landform: Toeslopes
- Position on landform: Base slope
- Parent material: Eolian deposits over stream alluvium derived from sandstone
- Slope: 0 to 1 percent
- Aspect: East to west
- Shape (down/across): Concave/linear
- Depth class: Very deep
- Drainage class: Well drained
- Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
- Available water capacity: About 8.1 inches (moderate)
- Shrink-swell potential: About 1.5 percent (low)
- Runoff class: Low
Sandoval County Area, New Mexico

Calcium carbonate maximum: About 15 percent  
Gypsum maximum: None  
Salinity maximum: About 2 mmhos/cm (nonsaline)  
Sodium adsorption ratio maximum: About 5 (slightly sodic)  
Ecological site: Loamy  
Potential native vegetation: blue grama, spike muhly, western wheatgrass, bottlebrush squirreltail, fourwing saltbush, oneseed juniper, winterfat  
Land capability subclass (irrigated): 3e  
Land capability subclass (nonirrigated): 6c

Typical Profile:  
A—0 to 10 inches; loam  
C—10 to 60 inches; stratified sandy loam to fine sandy loam

Minor Components  
Pinavetes and similar soils  
Composition: About 10 percent  
Landform: Dunes, valley sides  
Slope: 1 to 3 percent  
Aspect: East to west  
Drainage class: Excessively drained  
Ecological site: Deep Sand

El Rancho and similar soils  
Composition: About 5 percent  
Slope: 0 to 2 percent  
Drainage class: Well drained  
Ecological site: Loamy

414—Wauquie very gravelly fine sandy loam, 8 to 25 percent slopes

Map Unit Setting  
Major Land Resource Area: 36  
Elevation: 6,400 to 6,700 feet (1,951 to 2,042 meters)  
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)  
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)  
Frost-free period: 110 to 130 days

Map Unit Composition  
Wauquie and similar soils: 85 percent  
Minor components: 15 percent

Component Descriptions  
Wauquie soils  
Landscape: Uplands  
Landform: Mesas, canyons, fan piedmonts, benches, hills  
Position on landform: Backslopes  
Position on landform: Side slope  
Parent material: Slope alluvium over colluvium derived from igneous and sedimentary rock
Slope: 8 to 25 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 3.6 inches (low)
Shrink-swell potential: About 2.9 percent (low)
Runoff class: Medium
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-
   Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: Eriogonum, blue grama, skunkbush sumac, slender wheatgrass,
   bottlebrush squirreltail, wavyleaf oak
Land capability subclass (nonirrigated): 7s

Typical Profile:
   A—0 to 3 inches; very gravelly fine sandy loam
   Bt—3 to 30 inches; very gravelly sandy clay loam
   Bk—30 to 60 inches; stratified very gravelly sandy loam to very gravelly loamy
      coarse sand

Minor Components
Santa Fe and similar soils
   Composition: About 5 percent
   Slope: 15 to 40 percent
   Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: pinyon-juniper forest

Bamac and similar soils
   Composition: About 5 percent
   Slope: 15 to 55 percent
   Drainage class: Excessively drained
   Ecological site: Foothills

Laventana and similar soils
   Composition: About 5 percent
   Slope: 3 to 15 percent
   Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
   Drainage class: Well drained
   Ecological site: pinyon-juniper forest

417—Jocity loam, 0 to 2 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,300 to 5,500 feet (1,615 to 1,676 meters)
Sandoval County Area, New Mexico

Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Jocity and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Jocity soils
Landscape: Valleys
Landform: Alluvial fans, flood plains
Position on landform: Toeslopes
Position on landform: Rise, base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 2 percent
   Aspect: East to west
   Shape (down/across): Linear, concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.6 inches (high)
Shrink-swell potential: About 4.0 percent (moderate)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2e
Land capability subclass (nonirrigated): 7c

Typical Profile:
   Ap—0 to 10 inches; loam
   C1—10 to 26 inches; silty clay loam
   C2—26 to 32 inches; loam
   C3—32 to 50 inches; sandy clay loam
   C4—50 to 56 inches; sandy loam
   C5—56 to 60 inches; loamy sand

Minor Components
Zia and similar soils
   Composition: About 5 percent
   Slope: 1 to 3 percent
   Drainage class: Well drained
   Ecological site: Sandy
Aga and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Sparham and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

418—Jocity clay loam, 0 to 2 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,300 to 5,600 feet (1,615 to 1,707 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Jocity and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Jocity soils
Landscape: Valleys
Landform: Alluvial fans, flood plains
Position on landform: Toeslopes
Position on landform: Base slope, rise
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 2 percent
Aspect: East to west
Shape (down/across): Concave, linear/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 8.6 inches (moderate)
Shrink-swell potential: About 2.9 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2a
Land capability subclass (nonirrigated): 7c
Typical Profile:
A—0 to 12 inches; clay loam
C1—12 to 30 inches; clay loam
C2—30 to 60 inches; stratified loamy sand to sandy loam

Minor Components
Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Aga and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Sparham and similar soils
Composition: About 3 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Zia and similar soils
Composition: About 2 percent
Slope: 1 to 4 percent
Drainage class: Well drained
Ecological site: Sandy

419—Santa Fe-Wauquie-Rock outcrop complex, 25 to 70 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 6,400 to 8,400 feet (1,951 to 2,560 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Map Unit Composition
Santa Fe and similar soils: 40 percent
Wauquie and similar soils: 30 percent
Rock outcrop: 20 percent
Minor components: 10 percent

Component Descriptions
Santa Fe soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Backslopes, mountainflanks
Parent material: Slope alluvium over residuum weathered from granite
Slope: 25 to 70 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 0.8 inches (very low)
Shrink-swell potential: About 3.2 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: sideoats grama, blue grama, galleta, pinyon ricegrass
Land capability subclass (nonirrigated): 7e

Typical Profile:
   A—0 to 9 inches; extremely cobbly coarse sandy loam
   Bt—9 to 16 inches; very gravelly sandy clay loam
   2R—16 to 60 inches; bedrock

Wauquie soils
Landscape: Mountains
Landform: Benches, mountain slopes, canyons, hills, mesas
Position on landform: Footslopes
Position on landform: Mountainflank
Parent material: Slope alluvium over residuum weathered from granite
Slope: 25 to 55 percent
   Aspect: East to west
   Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 1.4 inches (very low)
Shrink-swell potential: About 2.3 percent (low)
Runoff class: High
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Juniperus monosperma-Pinus edulis/Fallugia paradoxa-Chrysothamnus nauseosus/Bouteloua hirsuta-Bouteloua gracilis
Potential native vegetation:
   Common trees: oneseed juniper, twoneedle pinyon
   Other plants: skunkbush sumac, Gambel oak, bluegrass, bottlebrush squirreltail, mountain big sagebrush, mountain mahogany, mountain muhly, pine dropseed, pinyon ricegrass, prairie junegrass
Land capability subclass (nonirrigated): 7e
Sandoval County Area, New Mexico

Typical Profile:
- A—0 to 4 inches; extremely cobbly fine sandy loam
- Bt1—4 to 11 inches; extremely cobbly sandy clay loam
- Bt2—11 to 18 inches; extremely cobbly sandy clay loam
- Bt3—18 to 29 inches; extremely cobbly sandy loam
- Bk—29 to 60 inches; extremely cobbly sand

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Escarpments, hills
Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Minor Components
Osna and similar soils
Composition: About 10 percent
Slope: 35 to 55 percent
Drainage class: Somewhat excessively drained
Ecological site: Pinus ponderosa/Quercus gambelii

420—Pinavetes loamy sand, 1 to 3 percent slopes

Map Unit Setting
Major Land Resource Area: 36
Elevation: 5,200 to 6,000 feet (1,585 to 1,829 meters)
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Map Unit Composition
Pinavetes and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Pinavetes soils
Landscape: Uplands
Landform: Dunes, valley sides
Position on landform: Shoulders
Position on landform: Side slope
Parent material: Eolian sands derived from sandstone
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Convex/convex
Depth class: Very deep
Drainage class: Excessively drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 2.7 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, blue grama, sand sagebrush
Land capability subclass (irrigated): 3s
Land capability subclass (nonirrigated): 6c

Typical Profile:
A—0 to 10 inches; loamy sand
C—10 to 60 inches; sand

Minor Components
Zia and similar soils
Composition: About 5 percent
Slope: 5 to 20 percent
Drainage class: Well drained
Ecological site: Sandy

El Rancho and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Loamy

Pinavetes and similar soils
Composition: About 5 percent
Slope: 5 to 15 percent
Drainage class: Excessively drained
Ecological site: Deep Sand

421—Gilco loam, moderately saline, sodic, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,100 to 5,500 feet (1,554 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Gilco, moderately saline, sodic and similar soils: 90 percent
Minor components: 10 percent

Component Descriptions
Gilco, moderately saline, sodic soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Sandoval County Area, New Mexico

Slope: 0 to 1 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 9.0 inches (high)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Salty Bottomland
Potential native vegetation: alkali sacaton, galleta, bottlebrush squirreltail, fourwing saltbush, greasewood
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7c

Typical Profile:
Ap—0 to 7 inches; loam
C1—7 to 19 inches; very fine sandy loam
C2—19 to 60 inches; stratified fine sandy loam to loam

Minor Components
Aga and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Jocity and similar soils
Composition: About 3 percent
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Peralta and similar soils
Composition: About 2 percent
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland
422—Vessilla-Menefee-Orlie association, 0 to 30 percent slopes

Map Unit Setting

Major Land Resource Area: 36
Elevation: 6,100 to 7,200 feet (1,859 to 2,195 meters)
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F (8.9 to 11.1 degrees C)
Frost-free period: 110 to 130 days

Map Unit Composition

Vessilla and similar soils: 35 percent
Menefee and similar soils: 30 percent
Orlie and similar soils: 25 percent
Minor components: 10 percent

Component Descriptions

Vessilla soils
Landscape: Uplands
Landform: Ridges, breaks, mesas, hills
Position on landform: Backslopes
Position on landform: Side slope
Parent material: Eolian deposits over slope alluvium over residuum weathered from sandstone
Slope: 5 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Very high
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis/Rhus trilobata/Bouteloua gracilis
Potential native vegetation:
Common trees: oneseed juniper, twoneedle pinyon
Other plants: Indian ricegrass, blue grama, mountain big sagebrush, oak, gallata, sideoats grama
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 1 inch; sandy loam
C—1 inch to 15 inches; sandy loam
R—15 to 60 inches; bedrock

Menefee soils
Landscape: Uplands
Landform: Hillslopes, mesas, mountainsides
Position on landform: Backslopes
Parent material: Colluvium over residuum weathered from shale
Slope: 2 to 9 percent
  Aspect: East to west
    Shape (down/ across): Linear/ linear
Depth class: Very shallow and shallow
Depth to restrictive feature: 8 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 2.0 inches (very low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Very high
Calcium carbonate maximum: About 15 percent
Gypsum maximum: About 1 percent
Salinity maximum: About 2 mhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis

Potential native vegetation:
  Common trees: Rocky Mountain juniper, oneseed juniper, twoneedle pinyon
  Other plants: blue grama, galleta, Gambel oak, big sagebrush, sideosage grama

Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 3 inches; clay loam
  C—3 to 10 inches; clay loam
  2Cr—10 to 60 inches; bedrock

Orlie soils
Landscape: Uplands
Landform: Mesas, valley sides, hills, cuestas
Position on landform: Footslopes
Parent material: Eolian material and alluvium derived from sandstone and shale
Slope: 0 to 6 percent
  Aspect: East to west
    Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 11.7 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 2 (slightly sodic)
Ecological site: Loamy
Potential native vegetation: western wheatgrass, big sagebrush, galleta, Indian ricegrass, needle and thread, fourwing saltbush
Land capability subclass (nonirrigated): 6c
Typical Profile:
A—0 to 4 inches; loam
Bt—4 to 14 inches; silty clay loam
C—14 to 60 inches; silty clay loam

Minor Components
Sparank and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Well drained
Flooding hazard: Occasional
Ecological site: Clayey Bottomland

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

423—Gilco loam, 1 to 4 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,300 to 5,500 feet (1,615 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F; (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Gilco and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Gilco soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 4 percent
Aspect: East to west
Shape (down/across): Concave/linear
Surface fragments: About 12 percent subrounded gravel
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 9.6 inches (high)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Sandoval County Area, New Mexico

Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 4e
Land capability subclass (nonirrigated): 7e

Typical Profile:
Ap—0 to 8 inches; loam
C1—8 to 14 inches; loam
C2—14 to 60 inches; stratified fine sandy loam to silt loam

Minor Components
Peralta and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Jocity and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Aga and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

426—Aga loam, moderately saline, sodic, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Aga, moderately saline, sodic and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Aga, moderately saline, sodic soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 5.0 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mhmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Bottomland
Potential native vegetation: alkali sacaton, fourwing saltbush, giant sacaton, inland saltgrass, greasewood
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7c

Typical Profile:
   A—0 to 8 inches; loam
   C1—8 to 20 inches; loam
   2C2—20 to 36 inches; loamy sand
   2C3—36 to 60 inches; gravelly sand

Minor Components
Gilco and similar soils
   Composition: About 10 percent
   Slope: 0 to 1 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland

Peralta and similar soils
   Composition: About 5 percent
   Slope: 0 to 2 percent
   Drainage class: Somewhat poorly drained
   Flooding hazard: Rare
   Ecological site: Bottomland

427—Aga loam, 1 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days
**Map Unit Composition**

Aga and similar soils: 85 percent  
Minor components: 15 percent

**Component Descriptions**

**Aga soils**
- **Landscape:** Valleys
- **Landform:** Flood plains
- **Position on landform:** Toe slopes
- **Position on landform:** Base slope
- **Parent material:** Stream alluvium derived from igneous and sedimentary rock
- **Slope:** 1 to 3 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Concave/linear
- **Depth class:** Very deep
- **Drainage class:** Moderately well drained
- **Soil test permeability:** 0.6 to 2.0 in./hr. (moderate)
- **Available water capacity:** About 7.5 inches (moderate)
- **Shrink-swell potential:** About 1.5 percent (low)
- **Flooding hazard:** Rare
- **Seasonal high water table depth:** About 42 to 60 inches
- **Runoff class:** Low
- **Calcium carbonate maximum:** About 10 percent
- **Gypsum maximum:** None
- **Salinity maximum:** About 4 mmhos/cm (very slightly saline)
- **Sodium adsorption ratio maximum:** About 5 (slightly sodic)
- **Ecological site:** Bottomland
- **Potential native vegetation:** giant sacaton, alkali sacaton, fourwing saltbush
- **Land capability subclass (irrigated):** 2a
- **Land capability subclass (nonirrigated):** 7c

**Typical Profile:**
- A—0 to 8 inches; loam
- C1—8 to 28 inches; loam
- 2C2—28 to 60 inches; loamy fine sand

**Minor Components**

**Gilco and similar soils**
- **Composition:** About 10 percent
- **Slope:** 0 to 1 percent
- **Drainage class:** Moderately well drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland

**Jocity and similar soils**
- **Composition:** About 5 percent
- **Slope:** 0 to 2 percent
- **Drainage class:** Moderately well drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland
428—Aga loam, moderately saline, sodic, 1 to 3 percent slopes

Map Unit Setting

*Major Land Resource Area:* 42  
*Elevation:* 5,200 to 5,500 feet (1,585 to 1,676 meters)  
*Mean annual precipitation:* 8 to 10 inches (203 to 254 millimeters)  
*Mean annual air temperature:* 53 to 55 degrees F. (11.7 to 12.8 degrees C.)  
*Frost-free period:* 140 to 160 days

Map Unit Composition

Aga, moderately saline, sodic and similar soils: 85 percent  
Minor components: 15 percent

Component Descriptions

*Aga, moderately saline, sodic soils*  
*Landscape:* Valleys  
*Landform:* Flood plains  
*Position on landform:* Toeslopes  
*Position on landform:* Base slope  
*Parent material:* Stream alluvium derived from igneous and sedimentary rock  
*Slope:* 1 to 3 percent  
*Aspect:* East to west  
*Shape (down/across):* Concave/linear  
*Depth class:* Very deep  
*Drainage class:* Moderately well drained  
*Slowest permeability:* 0.6 to 2.0 in./hr. (moderate)  
*Available water capacity:* About 5.5 inches (low)  
*Shrink-swell potential:* About 1.5 percent (low)  
*Flooding hazard:* Rare  
*Seasonal high water table depth:* About 48 to 72 inches  
*Runoff class:* Low  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 16 mmhos/cm (moderately saline)  
*Sodium adsorption ratio maximum:* About 30 (strongly sodic)  
*Ecological site:* Salty Bottomland  
*Potential native vegetation:* alkali sacaton, fourwing saltbush, giant sacaton, inland saltgrass, greasewood  
*Land capability subclass (irrigated):* 4s  
*Land capability subclass (nonirrigated):* 7c

Typical Profile:

*A*—0 to 4 inches; loam  
*C1*—4 to 16 inches; very fine sandy loam  
*2C2*—16 to 22 inches; loam  
*2C3*—22 to 60 inches; stratified sand to loamy sand
**Minor Components**

Peralta and similar soils
- **Composition:** About 5 percent
- **Slope:** 0 to 2 percent
- **Drainage class:** Somewhat poorly drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland

Glico and similar soils
- **Composition:** About 5 percent
- **Slope:** 0 to 1 percent
- **Drainage class:** Moderately well drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland

Josity and similar soils
- **Composition:** About 5 percent
- **Slope:** 0 to 2 percent
- **Drainage class:** Moderately well drained
- **Flooding hazard:** Rare
- **Ecological site:** Bottomland

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**430—Trail loam, 1 to 3 percent slopes**

**Map Unit Setting**

- **Major Land Resource Area:** 42
- **Elevation:** 5,000 to 5,500 feet (1,524 to 1,676 meters)
- **Mean annual precipitation:** 8 to 10 inches (203 to 254 millimeters)
- **Mean annual air temperature:** 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
- **Frost-free period:** 140 to 160 days

**Map Unit Composition**

- Trail and similar soils: 85 percent
- Minor components: 15 percent

**Component Descriptions**

**Trail soils**
- **Landscape:** Valleys
- **Landform:** Flood plains, valley floor remnants, channels, alluvial fans
- **Position on landform:** Toeslopes
- **Position on landform:** Rise, base slope
- **Parent material:** Eolian deposits over stream alluvium derived from sandstone
- **Slope:** 1 to 3 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Linear/linear
- **Depth class:** Very deep
- **Drainage class:** Somewhat excessively drained
- **Slowest permeability:** 2.0 to 6.0 in./hr. (moderately rapid)
- **Available water capacity:** About 4.4 inches (low)
- **Shrink-swell potential:** About 1.5 percent (low)
- **Flooding hazard:** Rare
- **Runoff class:** Very low
- **Calcium carbonate maximum:** About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: alkali sacaton, giant sacaton, fourwing saltbush
Land capability subclass (irrigated): 4e
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 10 inches; loam
C1—10 to 34 inches; loamy sand
C2—34 to 60 inches; stratified sand to fine sandy loam

Minor Components
Aga and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Peralta and similar soils
Composition: About 5 percent
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

431—Trail loamy sand, 1 to 4 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Trail and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Trail soils
Landscape: Valleys
Landform: Valley floor remnants, flood plains, channels, alluvial fans
Position on landform: Toeslopes
Position on landform: Base slope, rise
Parent material: Eolian deposits over stream alluvium derived from sandstone
Slope: 1 to 4 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 5.1 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Deep Sand
Potential native vegetation: Indian ricegrass, black grama, sand sagebrush, dropseed
Land capability subclass (irrigated): 4e
Land capability subclass (nonirrigated): 7s

Typical Profile:
  A—0 to 10 inches; loamy sand
  C—10 to 60 inches; stratified loamy sand to sand to gravelly sand to fine sandy loam

Minor Components
El Rancho and similar soils
  Composition: About 5 percent
  Slope: 0 to 2 percent
  Drainage class: Well drained
  Ecological site: Loamy

Aga and similar soils
  Composition: About 5 percent
  Slope: 0 to 1 percent
  Drainage class: Moderately well drained
  Flooding hazard: Rare
  Ecological site: Bottomland

Riverwash
  Composition: About 3 percent
  Landscape: Valleys
  Landform: Streams, channels
  Position on landform: Toeslopes
  Position on landform: Base slope
  Slope: 0 to 3 percent
  Shape (down/across): Concave/linear
  Drainage class: Somewhat poorly drained
  Flooding hazard: Frequent
Zia and similar soils
Composition: About 2 percent
Slope: 1 to 9 percent
Drainage class: Well drained
Ecological site: Sandy

433—Peralta loam, 0 to 1 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Peralta and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Peralta soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 1 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.6 inches (moderate)
Shrink-swell potential: About 1.8 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 24 to 36 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 13 (moderately sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 3e
Land capability subclass (nonirrigated): 7c

Typical Profile:
A—0 to 10 inches; loam
C—10 to 60 inches; stratified very fine sandy loam to fine sandy loam to loamy fine sand
Minor Components
Aga and similar soils
  Composition: About 10 percent
  Slope: 0 to 1 percent
  Drainage class: Moderately well drained
  Flooding hazard: Rare
  Ecological site: Bottomland

Gilco and similar soils
  Composition: About 5 percent
  Slope: 0 to 1 percent
  Drainage class: Moderately well drained
  Flooding hazard: Rare
  Ecological site: Bottomland

434—Peralta loam, 1 to 3 percent slopes

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 5,400 feet (1,524 to 1,646 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Peralta and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Peralta soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes, base slopes
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 7.8 inches (moderate)
Shrink-swell potential: About 2.3 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 24 to 36 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 13 (moderately sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 3e
Land capability subclass (nonirrigated): 7c
Typical Profile:
Ap—0 to 10 inches; loam
C1—10 to 16 inches; very fine sandy loam
C2—16 to 20 inches; clay loam
C3—20 to 28 inches; fine sandy loam
C4—28 to 40 inches; loamy sand
C5—40 to 45 inches; silt loam
C6—45 to 60 inches; loamy fine sand

Minor Components
Aga and similar soils
Composition: About 10 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

437—Peralta loam, moderately saline, sodic, 1 to 3 percent slopes

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,400 feet (1,524 to 1,646 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Peralta, moderately saline, sodic and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Peralta, moderately saline, sodic soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 8.4 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 24 to 36 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Salty Bottomland
Potential native vegetation: alkali sacaton, fourwing saltbush, giant sacaton, inland saltgrass, greasewood
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 4 inches; loam
C—4 to 60 inches; stratified loam to fine sandy loam to loamy sand

Minor Components
Aga and similar soils
Composition: About 10 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Glico and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

500—Rock outcrop-Osha-Rubble land complex, 40 to 70 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 7,000 to 9,000 feet (2,134 to 2,743 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Rock outcrop: 40 percent
Osha and similar soils: 30 percent
Rubble land: 20 percent
Minor components: 10 percent

Component Descriptions

Rock outcrop
Description: Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
Landform: Ledges, escarpments, benches
   Aspect: East to west
Depth to restrictive feature: 0 inches to bedrock (lithic)
Land capability subclass (nonirrigated): 8s

Osha soils
Landscape: Mountains
Landform: Mountain slopes, ridges
Position on landform: Backslopes
Position on landform: Mountainflank, crest
Parent material: Colluvium over residuum weathered from granite
Slope: 40 to 70 percent
   Aspect: East to west
   Shape (down/ across): Linear/linear
Depth class: Deep
Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
Drainage class: Somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.4 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelii
Potential native vegetation:
   Common trees: ponderosa pine
   Other plants: Gambel oak, blue grama, New Mexico locust, Rocky Mountain juniper, mountain muhly, prairie junegrass, skunkbush sumac, wavyleaf oak
Land capability subclass (nonirrigated): 7c

Typical Profile:
   AB—0 to 10 inches; very gravelly coarse sandy loam
   Bw—10 to 20 inches; very gravelly coarse sandy loam
   Ct—20 to 43 inches; extremely gravelly loamy coarse sand
   R—43 to 60 inches; bedrock

Rubble land
Description: Rubble land consists of areas with 90 percent or more of the surface covered with cobbles, stones, and boulders.
Landform: Hills
Position on landform: Side slope
Slope: 40 to 70 percent
   Aspect: East to west
Drainage class: Excessively drained
Available water capacity: About 0.6 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 0 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Land capability subclass (nonirrigated): 8s
Minor Components
Cypher and similar soils
Composition: About 5 percent
Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
Drainage class: Well drained
Ecological site: Pinus ponderosa/Quercus gambeli

Palon and similar soils
Composition: About 5 percent
Slope: 15 to 35 percent
Drainage class: Well drained
Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

503—Cajete-Cypher association, 8 to 50 percent slopes

Map Unit Setting
Major Land Resource Area: 48A
Elevation: 7,000 to 7,300 feet (2,134 to 2,225 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition
Cajete and similar soils: 65 percent
Cypher and similar soils: 25 percent
Minor components: 10 percent

Component Descriptions
Cajete soils
Landscape: Mountains
Landform: Hills, mountain slopes
Position on landform: Backslopes
Position on landform: Mountainflank, upper third, crest
Parent material: Residuum weathered from pumice
Slope: 8 to 30 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 3.3 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelli
Potential native vegetation:

- **Common trees:** ponderosa pine
- **Other plants:** Arizona fescue, Kentucky bluegrass, Thurber fescue, bluegrass, common juniper, mountain muhly, needlegrass, pine dropseed, sedge, western wheatgrass

*Land capability subclass (nonirrigated):* 7c

**Typical Profile:**

- **A—0 to 8 inches; extremely gravelly coarse sandy loam**
- **C—8 to 60 inches; very gravelly sandy loam**

**Cypher soils**

- **Landscape:** Mountains
- **Landform:** Ridges, mountain slopes
- **Position on landform:** Backslopes
- **Position on landform:** Mountainflank
- **Parent material:** Colluvium derived from tuff over residuum weathered from rhyolite
- **Slope:** 30 to 50 percent
- **Aspect:** East to west
- **Shape (down/across):** Linear/linear
- **Surface fragments:** About 2 percent subrounded cobbles
- **Depth class:** Shallow
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Slowest permeability:** 0.6 to 2.0 in./hr. (moderate)
- **Available water capacity:** About 0.8 inches (very low)
- **Shrink-swell potential:** About 1.5 percent (low)
- **Runoff class:** Very high
- **Calcium carbonate maximum:** None
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
- **Ecological site:** Pinus ponderosa/Quercus gambelii

*Potential native vegetation:*

- **Common trees:** ponderosa pine
- **Other plants:** Arizona fescue, little bluestem, mountain muhly, California brome, big bluestem, sideoats grama

*Land capability subclass (nonirrigated):* 7c

**Typical Profile:**

- **A—0 to 3 inches; very gravelly loam**
- **BC1—3 to 11 inches; very gravelly sandy loam**
- **BC2—11 to 15 inches; extremely gravelly sandy loam**
- **2R—15 to 60 inches; bedrock**

**Minor Components**

- **Laventana and similar soils**
  - **Composition:** About 5 percent
  - **Slope:** 3 to 15 percent
  - **Depth to restrictive feature:** 40 to 60 inches to bedrock (lithic)
  - **Drainage class:** Well drained
  - **Ecological site:** ponderosa forest
Mirand and similar soils

- **Composition**: About 3 percent
- **Slope**: 5 to 30 percent
- **Drainage class**: Well drained
- **Ecological site**: Pinus ponderosa/Quercus gambeli

Rock outcrop

- **Composition**: About 2 percent
- **Depth to restrictive feature**: 0 inches to bedrock (lithic)

### 504—Orejas-Guaje complex, 1 to 15 percent slopes

**Map Unit Setting**

- **Major Land Resource Area**: 36
- **Elevation**: 6,000 to 7,000 feet (1,829 to 2,134 meters)
- **Mean annual precipitation**: 13 to 16 inches (330 to 406 millimeters)
- **Mean annual air temperature**: 48 to 52 degrees F. (8.9 to 11.1 degrees C.)
- **Frost-free period**: 110 to 130 days

**Map Unit Composition**

- Orejas and similar soils: 40 percent
- Guaje and similar soils: 35 percent
- Minor components: 25 percent

**Component Descriptions**

Orejas soils

- **Landscape**: Uplands
- **Landform**: Plateaus, mesas
- **Position on landform**: Summits
- **Parent material**: Eolian material, slope alluvium and colluvium derived from basalt
- **Slope**: 5 to 15 percent
  - **Aspect**: East to west
  - **Shape (down/across)**: Convex/linear
- **Depth class**: Shallow
- **Depth to restrictive feature**: 10 to 20 inches to bedrock (lithic)
- **Drainage class**: Well drained
- **Slowest permeability**: 0.2 to 0.6 in./hr. (moderately slow)
- **Available water capacity**: About 1.7 inches (very low)
- **Shrink-swell potential**: About 4.5 percent (moderate)
- **Runoff class**: Very high
- **Calcium carbonate maximum**: About 10 percent
- **Gypsum maximum**: None
- **Salinity maximum**: About 2 mmhos/cm (non-saline)
- **Sodium adsorption ratio maximum**: About 5 (slightly sodic)
- **Ecological site**: Pinus edulis-Juniperus monosperma/Quercus gambeli/Bouteloua gracilis

**Potential native vegetation**:

- Common trees: two-needle pinyon, oneseed juniper
- Other plants: big sagebrush, blue grama, sideoats grama

**Land capability subclass (nonirrigated)**: 7s
Typical Profile:
- A—0 to 2 inches; very cobbly loam
- Bt—2 to 9 inches; very cobbly clay loam
- C—9 to 17 inches; very gravelly clay loam
- R—17 to 60 inches; bedrock

**Guaje soils**

*Landscapes:* Uplands  
*Landform:* Hills, volcanic cones  
*Position on landform:* Backslopes  
*Position on landform:* Side slope  
*Parent material:* Eolian material and alluvium derived from volcanic rock  
*Slope:* 1 to 8 percent  
  - *Aspect:* East to west  
  - *Shape (down/across):* Linear/linear  
*Surface fragments:* About 20 percent subrounded gravel  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Slowest permeability:* 2.0 to 6.0 in./hr. (moderately rapid)  
*Available water capacity:* About 3.1 inches (low)  
*Shrink-swell potential:* About 1.5 percent (low)  
*Runoff class:* Low  
*Calcium carbonate maximum:* About 20 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)  
*Ecological site:* Pinus edulis-Juniperus monosperma/Quercus gambelii/Bouteloua gracilis  
*Potential native vegetation:*  
  - Common trees: oneseed juniper, twoneedle pinyon  
  - Other plants: blue grama, galleta, side-oats grama, New Mexico Feathergrass, little bluestem, mountain muhly, pine dropseed, sand dropseed  
*Land capability subclass (nonirrigated):* 6s

Typical Profile:  
- A—0 to 4 inches; gravelly sandy loam  
- Bw—4 to 12 inches; gravelly sandy loam  
- Bk1—12 to 17 inches; very gravelly sandy loam  
- Bk2—17 to 45 inches; extremely gravelly sandy loam  
- Bk3—45 to 60 inches; very gravelly sandy loam

**Minor Components**

*Elpedro and similar soils*  
*Composition:* About 10 percent  
*Slope:* 1 to 8 percent  
*Drainage class:* Well drained  
*Ecological site:* pinyon-juniper forest

*Guaje, very cobbly and similar soils*  
*Composition:* About 10 percent  
*Slope:* 1 to 8 percent  
*Drainage class:* Well drained  
*Ecological site:* pinyon-juniper forest
Sandoval County Area, New Mexico

Orejas, steep and similar soils

- **Composition:** About 5 percent
- **Slope:** 15 to 40 percent
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Ecological site:** Pinyon-Juniper forest

### 600—Rock outcrop-Cypher complex, 35 to 60 percent slopes

#### Map Unit Setting

- **Major Land Resource Area:** 48A
- **Elevation:** 6,500 to 7,400 feet (1,981 to 2,256 meters)
- **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
- **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- **Frost-free period:** 60 to 90 days

#### Map Unit Composition

- **Rock outcrop:** 50 percent
- **Cypher and similar soils:** 35 percent
- **Minor components:** 15 percent

#### Component Descriptions

**Rock outcrop**

- **Description:** Rock outcrop consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments.
- **Landform:** Mountain slopes, scarps
- **Aspect:** East to west
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)
- **Land capability subclass (nonirrigated):** 8s

**Cypher soils**

- **Landscape:** Mountains
- **Landform:** Mountain slopes, ridges
- **Position on landform:** Backslopes, mountainflanks
- **Parent material:** Colluvium and residuum weathered from tuff and/or colluvium and residuum weathered from rhyolite
- **Slope:** 35 to 60 percent
- **Aspect:** East to west
- **Shape (down/across):** Linear/linear
- **Surface fragments:** About 3 percent subrounded gravel
- **Depth class:** Shallow
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Slowest permeability:** 0.6 to 2.0 in./hr. (moderate)
- **Available water capacity:** About 1.5 inches (very low)
- **Shrink-swell potential:** About 1.5 percent (low)
- **Runoff class:** Very high
- **Calcium carbonate maximum:** None
- **Gypsum maximum:** None
- **Salinity maximum:** About 2 mmhos/cm (nonsaline)
- **Sodium adsorption ratio maximum:** About 0 (nonsodic)
- **Ecological site:** Pinus ponderosa/Quercus gambelii
Potential native vegetation:
  Common trees: ponderosa pine
  Other plants: Arizona fescue, California brome, little bluestem, mountain muhly

Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 4 inches; very cobbly loam
  BC1—4 to 14 inches; very gravelly loam
  BC2—14 to 16 inches; very gravelly loam
  2R—16 to 60 inches; bedrock

Minor Components
Cypher and similar soils
  Composition: About 5 percent
  Slope: 15 to 35 percent
  Depth to restrictive feature: 10 to 20 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Pinus ponderosa/Quercus gambelli

Cajete and similar soils
  Composition: About 5 percent
  Slope: 8 to 30 percent
  Drainage class: Well drained
  Ecological site: Mountain Grassland

Laventana and similar soils
  Composition: About 3 percent
  Slope: 3 to 15 percent
  Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Pinus ponderosa/Quercus gambelli

Rock outcrop
  Composition: About 2 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

601—Laventana gravelly sandy loam, 3 to 15 percent slopes

Map Unit Setting
  Major Land Resource Area: 48A
  Elevation: 7,400 to 7,600 feet (2,256 to 2,316 meters)
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days

Map Unit Composition
  Laventana and similar soils: 85 percent
  Minor components: 15 percent
Component Descriptions

Laventana soils
Landscape: Mountains
Landform: Pediments, mountain slopes
Position on landform: Footslope
Position on landform: Mountain flank
Parent material: Colluvium derived from granite and/or colluvium derived from andesite
Slope: 3 to 15 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Deep
Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 4.1 inches (low)
Shrink-swell potential: About 4.4 percent (moderate)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelii
Potential native vegetation:
- Common trees: ponderosa pine
- Other plants: Gambel oak, mountain mahogany, bottlebrush squirreltail, prairie junegrass, sedge
Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 5 inches; gravelly sandy loam
- E—5 to 9 inches; very gravelly loam
- Bt—9 to 50 inches; very gravelly sandy clay loam
- 2R—50 to 60 inches; bedrock

Minor Components
Mirand and similar soils
Composition: About 10 percent
Slope: 5 to 30 percent
Drainage class: Well drained
Ecological site: Pinus ponderosa/Quercus gambelii

Rock outcrop
Composition: About 5 percent
Depth to restrictive feature: 0 inches to bedrock (lithic)

603—Laventana-Mirand very cobbly loams, 15 to 55 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 7,000 to 8,900 feet (2,134 to 2,713 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Laventana and similar soils: 50 percent
Mirand and similar soils: 35 percent
Minor components: 15 percent

Component Descriptions

Laventana soils
Landscape: Mountains
Landform: Pediments, mountain slopes
Position on landform: Footslopes
Position on landform: Mountain flank
Parent material: Colluvium derived from granite and/or colluvium derived from andesite
Slope: 20 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Deep
Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
Drainage class: Well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 4.8 inches (low)
Shrink-swell potential: About 4.5 percent (moderate)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelii
Potential native vegetation:
   Common trees: ponderosa pine
   Other plants: Gambel oak, mountain mahogany, bottlebrush squirreltail, prairie junegrass, sedge
Land capability subclass (nonirrigated): 7c

Typical Profile:
   Oi—0 to 1 inch, slightly decomposed plant material
   A—1 inch to 5 inches; very cobbly loam
   E—5 to 12 inches; gravelly silt loam
   Bt1—12 to 20 inches; very cobbly loam
   Bt2—20 to 31 inches; very gravelly loam
   Bt3—31 to 51 inches; very gravelly loam
   2R—51 to 60 inches; bedrock

Mirand soils
Landscape: Mountains
Landform: Mountain slopes
Position on landform: Toeslopes
Position on landform: Mountain flank
Parent material: Colluvium derived from rhyolite and/or colluvium derived from tuff
Sandoval County Area, New Mexico

**Slope:** 15 to 25 percent
**Aspect:** East to west
**Shape (down/across):** Linear/linear
**Depth class:** Very deep
**Drainage class:** Well drained
**Slowest permeability:** .06 to 0.2 in./hr. (slow)
**Available water capacity:** About 8.0 inches (moderate)
**Shrink-swell potential:** About 7.4 percent (high)
**Runoff class:** Very high
**Calcium carbonate maximum:** None
**Gypsum maximum:** None
**Salinity maximum:** About 2 mmhos/cm (nonsaline)
**Sodium adsorption ratio maximum:** About 0 (nonsodic)
**Ecological site:** Pinus ponderosa/Quercus gambelii

**Potential native vegetation:**
- Common trees: ponderosa pine
- Other plants: Arizona fescue, mountain muhly, prairie junegrass, California brome, Gambel oak, bottlebrush squirreltail, muttongrass, pine dropseed

**Land capability subclass (nonirrigated):** 7c

**Typical Profile:**
- A—0 to 6 inches; very cobbly loam
- Bt1—6 to 27 inches; cobbly clay
- Bt2—27 to 60 inches; sandy clay

**Minor Components**

Cypher and similar soils
- **Composition:** About 5 percent
- **Slope:** 15 to 35 percent
- **Depth to restrictive feature:** 10 to 20 inches to bedrock (lithic)
- **Drainage class:** Well drained
- **Ecological site:** Pinus ponderosa/Quercus gambelii

Cajete and similar soils
- **Composition:** About 5 percent
- **Slope:** 8 to 30 percent
- **Drainage class:** Well drained
- **Ecological site:** Mountain Grassland

Rock outcrop
- **Composition:** About 3 percent
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)

Totavi and similar soils
- **Composition:** About 2 percent
- **Slope:** 0 to 5 percent
- **Drainage class:** Well drained
- **Flooding hazard:** Rare
- **Ecological site:** Pinus ponderosa-Juniperus deppeana/Quercus gambelii
604—Cypher-Mirand complex, 15 to 55 percent slopes

Map Unit Setting

*Major Land Resource Area:* 48A  
*Elevation:* 6,900 to 9,000 feet (2,103 to 2,743 meters)  
*Mean annual precipitation:* 20 to 25 inches (508 to 635 millimeters)  
*Mean annual air temperature:* 42 to 45 degrees F. (5.6 to 7.2 degrees C.)  
*Frost-free period:* 60 to 90 days

Map Unit Composition

Cypher and similar soils: 55 percent  
Mirand and similar soils: 30 percent  
Minor components: 15 percent

Component Descriptions

**Cypher soils**  
*Landscape:* Mountains  
*Landform:* Mountain slopes, ridges  
*Position on landform:* Summits  
*Position on landform:* Mountainflank  
*Parent material:* Colluvium derived from tuff over residuum weathered from rhyolite  
*Slope:* 15 to 35 percent  
*Aspect:* East to west  
*Shape (down/across):* Linear/linear  
*Surface fragments:* About 10 percent subrounded gravel  
*Depth class:* Shallow  
*Depth to restrictive feature:* 10 to 20 inches to bedrock (lithic)  
*Drainage class:* Well drained  
*Slowest permeability:* 0.6 to 2.0 in./hr. (moderate)  
*Available water capacity:* About 1.5 inches (very low)  
*Shrink-swell potential:* About 1.5 percent (low)  
*Runoff class:* High  
*Calcium carbonate maximum:* None  
*Gypsum maximum:* None  
*Salinity maximum:* About 2 mmhos/cm (nonsaline)  
*Sodium adsorption ratio maximum:* About 0 (nonsodic)  
*Ecological site:* Pinus ponderosa/Quercus gambelli  
*Potential native vegetation:*  
  - Common trees: ponderosa pine  
  - Other plants: Arizona fescue, little bluestem, mountain muhly, California brome, big bluestem, sideoats grama  
*Land capability subclass (nonirrigated):* 7c

**Typical Profile:**  
Oi—0 to 1 inch; slightly decomposed plant material  
A—1 inch to 4 inches; very gravelly loam  
BCw—4 to 11 inches; very gravelly loam  
C—11 to 19 inches; extremely gravelly sandy loam  
2R—19 to 60 inches; bedrock

**Mirand soils**  
*Landscape:* Mountains  
*Landform:* Mountain slopes
Position on landform: Toeslopes
Position on landform: Mountainflank
Parent material: Colluvium derived from rhyolite and/or colluvium derived from tuff
Slope: 15 to 55 percent
  Aspect: East to west
  Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Well drained
Slowest permeability: .06 to 0.2 in./hr. (slow)
Available water capacity: About 6.4 inches (moderate)
Shrink-swell potential: About 7.5 percent (high)
Runoff class: High
Calcium carbonate maximum: None
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambelii
Potential native vegetation:
  Common trees: ponderosa pine
  Other plants: Arizona fescue, mountain muhly, California brome, Gambel oak, bottlenose squirreltail, muttongrass, pine dropseed, prairie junegrass
Land capability subclass (nonirrigated): 7c

Typical Profile:
  A—0 to 4 inches; very cobbly loam
  Bt—4 to 60 inches; cobbly clay

Minor Components
Alanos and similar soils
  Composition: About 5 percent
  Slope: 20 to 40 percent
  Drainage class: Well drained
  Ecological site: Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

Laventana and similar soils
  Composition: About 5 percent
  Slope: 3 to 15 percent
  Depth to restrictive feature: 40 to 60 inches to bedrock (lithic)
  Drainage class: Well drained
  Ecological site: Pinus ponderosa/Quercus gambelii

Rock outcrop
  Composition: About 3 percent
  Depth to restrictive feature: 0 inches to bedrock (lithic)

Totavi and similar soils
  Composition: About 2 percent
  Slope: 0 to 5 percent
  Drainage class: Well drained
  Flooding hazard: Rare
  Ecological site: Pinus ponderosa-Juniperus deppeana/Quercus gambelii
608—Osha association, 3 to 55 percent slopes

Map Unit Setting

Major Land Resource Area: 48A
Elevation: 8,500 to 9,000 feet (2,591 to 2,743 meters)
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Map Unit Composition

Osha, steep and similar soils: 60 percent
Osha and similar soils: 30 percent
Minor components: 10 percent

Component Descriptions

Osha, steep soils
Landscape: Mountains
Landform: Mountain slopes, ridges
Position on landform: Backslopes
Position on landform: Mountainflank
Parent material: Colluvium over residuum weathered from granite
Slope: 35 to 55 percent
Aspect: East to west
Shape (down/across): Linear/linear
Depth class: Very deep
Drainage class: Somewhat excessively drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 1.8 inches (very low)
Shrink-swell potential: About 1.5 percent (low)
Runoff class: Medium
Calcium carbonate maximum: None
Gypsum maximum: None
Sulfate maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 0 (nonsodic)
Ecological site: Pinus ponderosa/Quercus gambeli
Potential native vegetation:
- Common trees: ponderosa pine
- Other plants: Arizona fescue, pine dropseed, prairie junegrass, Gambel oak, New Mexico locust, bluegrass, mountain muhly
Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 3 inches; gravely coarse sandy loam
- AB—3 to 8 inches; gravely coarse sandy loam
- Bw—8 to 16 inches; gravely coarse sandy loam
- Ct1—16 to 32 inches; extremely gravely coarse sandy loam
- Ct2—32 to 60 inches; extremely gravely loamy coarse sand

Osha soils
Landscape: Mountains
Landform: Ridges, mountain slopes
Position on landform: Shoulders
Position on landform: Mountainflank
Sandoval County Area, New Mexico

**Parent material:** Colluvium and residuum weathered from granite
**Slope:** 3 to 35 percent
  - **Aspect:** East to west
  - **Shape (down/across):** Convex/linear
**Depth class:** Very deep
**Drainage class:** Somewhat excessively drained
**Slowest permeability:** 2.0 to 6.0 in./hr. (moderately rapid)
**Available water capacity:** About 2.2 inches (very low)
**Shrink-swell potential:** About 1.9 percent (low)
**Runoff class:** Low
**Calcium carbonate maximum:** None
**Gypsum maximum:** None
**Salinity maximum:** About 2 mmhos/cm (nonsaline)
**Sodium adsorption ratio maximum:** About 0 (nonsodic)
**Ecological site:** Pinus ponderosa/Quercus gambelii
**Potential native vegetation:**
  - Common trees: ponderosa pine
  - Other plants: Arizona fescue, Gambel oak, New Mexico locust, bluegrass, grouse whortleberry, mountain muhly, pine dropseed, prairie junegrass

**Land capability subclass (nonirrigated):** 7c

**Typical Profile:**
- AB—0 to 8 inches; gravelly coarse sandy loam
- Bw—8 to 16 inches; gravelly coarse sandy loam
- Ct1—16 to 32 inches; extremely gravelly coarse sandy loam
- Ct2—32 to 60 inches; extremely gravelly loamy coarse sand

**Minor Components**
Palon and similar soils
- **Composition:** About 8 percent
- **Slope:** 15 to 35 percent
- **Drainage class:** Well drained
- **Ecological site:** Pseudotsuga menziesii-Pinus ponderosa/Muhlenbergia

**Rock outcrop**
- **Composition:** About 2 percent
- **Depth to restrictive feature:** 0 inches to bedrock (lithic)

**823—Gilco loam, 1 to 4 percent slopes, unprotected**

**Map Unit Setting**

- **Major Land Resource Area:** 42
- **Elevation:** 5,000 to 5,500 feet (1,524 to 1,676 meters)
- **Mean annual precipitation:** 8 to 10 inches (203 to 254 millimeters)
- **Mean annual air temperature:** 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
- **Frost-free period:** 140 to 160 days

**Map Unit Composition**

Gilco, unprotected and similar soils: 85 percent
Minor components: 15 percent
Component Descriptions

**Gilco, unprotected soils**

*Landscape:* Valleys  
*Landform:* Flood plains  
*Position on landform:* Toeslopes  
*Position on landform:* Base slope  
*Parent material:* Stream alluvium derived from igneous and sedimentary rock  
*Slope:* 1 to 4 percent  
*Aspect:* East to west  
*Shape (down/across):* Concave/linear  
*Surface fragments:* About 12 percent subrounded medium and coarse gravel  
*Depth class:* Very deep  
*Drainage class:* Moderately well drained  
*Slowest permeability:* 0.6 to 2.0 in./hr. (moderate)  
*Available water capacity:* About 9.4 inches (high)  
*Shrink-swell potential:* About 1.5 percent (low)  
*Flooding hazard:* Rare  
*Seasonal high water table depth:* About 48 to 72 inches  
*Runoff class:* Low  
*Calcium carbonate maximum:* About 10 percent  
*Gypsum maximum:* None  
*Salinity maximum:* About 4 mmhos/cm (very slightly saline)  
*Sodium adsorption ratio maximum:* About 5 (slightly sodic)  
*Ecological site:* Bottomland  
*Potential native vegetation:*  
- Common trees: Rio Grande cottonwood  
- Other plants: giant sacaton, alkali sacaton, fourwing saltbush  
*Land capability subclass (irrigated):* 4e  
*Land capability subclass (nonirrigated):* 7e

**Typical Profile:**  
*Ap—0 to 8 inches: loam*  
*C—8 to 60 inches: stratified fine sandy loam to loam to silt loam*

**Minor Components**

**Jocity and similar soils**  
*Composition:* About 6 percent  
*Slope:* 0 to 2 percent  
*Drainage class:* Moderately well drained  
*Flooding hazard:* Rare  
*Ecological site:* Bottomland

**Aga and similar soils**  
*Composition:* About 5 percent  
*Slope:* 0 to 1 percent  
*Drainage class:* Moderately well drained  
*Flooding hazard:* Rare  
*Ecological site:* Bottomland
Peralta and similar soils
Composition: About 2 percent
Slope: 1 to 3 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Trail and similar soils
Composition: About 2 percent
Slope: 1 to 3 percent
Drainage class: Somewhat excessively drained
Flooding hazard: Rare
Ecological site: Bottomland

827—Aga loam, 1 to 3 percent slopes, unprotected

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Aga, unprotected and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Aga, unprotected soils
Landscape: Valleys
Landform: Flood plains
Position on landform: toeslopes
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 7.6 inches (moderate)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 42 to 60 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: giant sacaton, alkali sacaton, fourwing saltbush
Land capability subclass (irrigated): 2a
Land capability subclass (nonirrigated): 7c
Typical Profile:
A—0 to 8 inches; loam
C1—8 to 28 inches; loam
2C2—28 to 60 inches; loamy fine sand

Minor Components
Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Jocity and similar soils
Composition: About 3 percent
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Riverwash
Composition: About 3 percent
Landscape: Valleys
Landform: Channels, streams
Position on landform: Toeslopes
Position on landform: Base slope
Slope: 0 to 1 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Peralta and similar soils
Composition: About 2 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

Trail and similar soils
Composition: About 2 percent
Slope: 0 to 1 percent
Drainage class: Well drained
Flooding hazard: Rare
Ecological site: Bottomland

830—Trail loam, 1 to 3 percent slopes, unprotected

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.7 degrees C.)
Frost-free period: 140 to 160 days
Sandoval County Area, New Mexico

Map Unit Composition
Trail, unprotected and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions
Trail, unprotected soils
Landscape: Valleys
Landform: Valley floor remnants, alluvial fans, channels, flood plains
Position on landform: Toeslopes
Position on landform: Base slope, rise
Parent material: Eolian deposits over stream alluvium derived from sandstone
Slope: 1 to 3 percent
    Aspect: East to west
    Shape (down/across): Linear, concave/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 2.0 to 6.0 in./hr. (moderately rapid)
Available water capacity: About 5.4 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 4 mmhos/cm (very slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation: alkali sacaton, giant sacaton, fourwing saltbush
Land capability subclass (irrigated): 4e
Land capability subclass (nonirrigated): 7s

Typical Profile:
    A—0 to 8 inches; loam
    C—8 to 60 inches; stratified loamy sand to sand to sandy loam

Minor Components
Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Aga and similar soils
Composition: About 5 percent
Slope: 1 to 3 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland
Riverwash

Composition: About 3 percent
Landscape: Valleys
Landform: Channels, streams
Position on landform: Toeslopes, base slopes
Slope: 0 to 1 percent
Shape (down/ across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Peratta and similar soils

Composition: About 2 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

831—Trail loamy sand, 1 to 3 percent slopes, unprotected

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition

Trail, unprotected and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Trail, unprotected soils
Landscape: Valleys
Landform: Alluvial fans, channels, flood plains, valley floor remnants
Position on landform: Toeslopes
Position on landform: Rise, base slope
Parent material: Eolian deposits over stream alluvium derived from sandstone
Slope: 1 to 3 percent
Aspect: East to west
Shape (down/ across): Concave, linear/linear
Depth class: Very deep
Drainage class: Moderately well drained
Slowest permeability: 6.0 to 20 in./hr. (rapid)
Available water capacity: About 3.3 inches (low)
Shrink-swell potential: About 1.5 percent (low)
Flooding hazard: Rare
Seasonal high water table depth: About 48 to 72 inches
Runoff class: Very low
Calcium carbonate maximum: About 5 percent
Gypsum maximum: None
Salinity maximum: About 2 mmhos/cm (nonsaline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Sandoval County Area, New Mexico

Potential native vegetation: alkali sacaton, giant sacaton, fourwing saltbush

Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7s

Typical Profile:
A—0 to 10 inches; loamy sand
C1—10 to 30 inches; loamy sand
C2—30 to 60 inches; stratified sand to gravelly sand to sandy loam

Minor Components
Aga and similar soils
Composition: About 5 percent
Slope: 1 to 3 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Gilco and similar soils
Composition: About 5 percent
Slope: 0 to 1 percent
Drainage class: Moderately well drained
Flooding hazard: Rare
Ecological site: Bottomland

Riverwash
Composition: About 3 percent
Landscape: Valleys
Landform: Streams, channels
Position on landform: Toeslopes, base slopes
Slope: 0 to 1 percent
Shape (down/across): Concave/linear
Drainage class: Somewhat poorly drained
Flooding hazard: Frequent

Peralta and similar soils
Composition: About 2 percent
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Flooding hazard: Rare
Ecological site: Bottomland

835—Peralta loam, 1 to 3 percent slopes, unprotected

Map Unit Setting
Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Map Unit Composition
Peralta, unprotected, and similar soils: 85 percent
Minor components: 15 percent
Component Descriptions

Peralta, unprotected soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 1 to 3 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.6 to 2.0 in./hr. (moderate)
Available water capacity: About 9.2 inches (high)
Shrink-swell potential: About 3.8 percent (moderate)
Flooding hazard: Occasional
Seasonal high water table depth: About 24 to 36 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 8 mmhos/cm (slightly saline)
Sodium adsorption ratio maximum: About 5 (slightly sodic)
Ecological site: Bottomland
Potential native vegetation:
- Common trees: Rio Grande cottonwood
- Other plants: giant sacaton, alkali sacaton, fourwing saltbush, willow

Land capability subclass (nonirrigated): 7c

Typical Profile:
- A—0 to 6 inches; loam
- C—6 to 16 inches; loam
- C—16 to 60 inches; stratified sandy loam to clay loam

Minor Components
- Glico and similar soils
  - Composition: About 5 percent
  - Slope: 0 to 1 percent
  - Drainage class: Moderately well drained
  - Flooding hazard: Rare
  - Ecological site: Bottomland

- Aga and similar soils
  - Composition: About 5 percent
  - Slope: 1 to 3 percent
  - Drainage class: Moderately well drained
  - Flooding hazard: Rare
  - Ecological site: Bottomland

- Riverwash
  - Composition: About 3 percent
  - Landscape: Valleys
  - Landform: Channels, streams
  - Position on landform: Toe slopes
  - Position on landform: Base slope
  - Slope: 0 to 1 percent
  - Shape (down/across): Concave/linear
  - Drainage class: Somewhat poorly drained
  - Flooding hazard: Frequent

- Trail and similar soils
  - Composition: About 2 percent
  - Slope: 0 to 1 percent
  - Drainage class: Well drained
  - Flooding hazard: Rare
  - Ecological site: Bottomland

842—Peralta clay loam, moderately saline, sodic, 0 to 2 percent slopes, unprotected

Map Unit Setting

Major Land Resource Area: 42
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days
Map Unit Composition

Peralta, moderately saline, sodic, unprotected and similar soils: 85 percent
Minor components: 15 percent

Component Descriptions

Peralta, moderately saline, sodic, unprotected soils
Landscape: Valleys
Landform: Flood plains
Position on landform: Toeslopes
Position on landform: Base slope
Parent material: Stream alluvium derived from igneous and sedimentary rock
Slope: 0 to 2 percent
   Aspect: East to west
   Shape (down/across): Concave/linear
Depth class: Very deep
Drainage class: Somewhat poorly drained
Slowest permeability: 0.2 to 0.6 in./hr. (moderately slow)
Available water capacity: About 9.4 inches (high)
Shrink-swell potential: About 4.5 percent (moderate)
Floodling hazard: Rare
Seasonal high water table depth: About 24 to 36 inches
Runoff class: Low
Calcium carbonate maximum: About 10 percent
Gypsum maximum: None
Salinity maximum: About 16 mmhos/cm (moderately saline)
Sodium adsorption ratio maximum: About 30 (strongly sodic)
Ecological site: Salty Bottomland
Potential native vegetation: alkali sacaton, fourwing saltbush, giant sacaton, inland saltgrass, greasewood
Land capability subclass (irrigated): 4s
Land capability subclass (nonirrigated): 7s

Typical Profile:
   A—0 to 10 inches; clay loam
   C—10 to 60 inches; stratified sandy clay loam to sandy loam to clay loam

Minor Components

Trail and similar soils
   Composition: About 5 percent
   Slope: 0 to 1 percent
   Drainage class: Well drained
   Flooding hazard: Rare
   Ecological site: Bottomland

Jocity and similar soils
   Composition: About 5 percent
   Slope: 0 to 2 percent
   Drainage class: Moderately well drained
   Flooding hazard: Rare
   Ecological site: Bottomland
Riverwash
  Composition: About 5 percent
  Landscape: Valleys
  Landform: Channels, streams
  Position on landform: Toeslopes
  Position on landform: Base slope
  Slope: 0 to 1 percent
  Shape (down/across): Concave/linear
  Drainage class: Somewhat poorly drained
  Flooding hazard: Frequent

850—Water

Map Unit Setting

Major Land Resource Area: 36

Map Unit Composition

Water: 95 percent
Minor components: 5 percent

Component Descriptions

Water
  Aspect: East to west

Minor Components
Typic Torrifuvents and similar soils
  Composition: About 5 percent
  Landscape: Valleys
  Landform: Flood plains
  Position on landform: Toeslopes, base slopes
  Slope: 0 to 1 percent
  Aspect: East to west
  Shape (down/across): Concave/linear
  Drainage class: Moderately well drained
  Flooding hazard: Frequent

DAM—Dam

Map Unit Setting

Major Land Resource Area: 36

Map Unit Composition

Dam: 100 percent

Component Descriptions

Dam
Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; for agricultural waste management; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are not limited, slightly limited, somewhat limited, and very limited. The suitability ratings are expressed as well suited, moderately well suited, poorly suited, and unsuited or as good, fair, and poor.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact.
on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops, hay, and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil in the section Detailed Soil Map Units. Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland in the survey area comprises about 16,000 acres. The major concerns are a moderate hazard of soil blowing, moderate to low available water capacity, slow water intake rate, and seasonal high water tables.

Soil blowing is best controlled by cropping systems that keep the soil covered during the spring season. Low available water capacity can be overcome by method of irrigation, more frequent light irrigations, and crop selection. Slow water intake rates can be overcome by frequent, light applications after a deep early irrigation. High water tables can be overcome by drainage, crop selection, and irrigation water management.

Fertilization

All crops generally respond favorably to applications of nitrogen fertilizer. On sandy soils or on soils that have regularly received heavy applications of nitrogen and phosphorus, potassium may be needed. On cropland areas, soils should be tested at least every other year to determine present nutrient levels. Due to the high pH (8.0 - 8.5) of most of the soils in the area, some trace elements such as iron and zinc may become limiting. Lowering the pH by applying sulfur allows the trace elements to become available, as well as allowing for more efficient uptake of the major nutrients.

All of the soils in the area have low contents of organic matter. Use of barnyard manure, growing green manure crops that are plowed under, or returning large amounts of crop residues to the soil are beneficial practices. Care should be taken to avoid a buildup of salts when large amounts of manure are used.

Irrigation

All of the cropland in Sandoval County is irrigated. For the most part, water is supplied from the Rio Grande and the Jemez River. Irrigation water management is controlling the application of irrigation water in such a way that good crop growth is obtained without wasting water or causing soil erosion.

To irrigate properly, the farmer should know the amount of water the soil will hold, the depth to which plant roots penetrate, and the water requirements of the crop. Most crops should be irrigated when 40 to 50 percent of the available soil moisture has been depleted. A soil probe, auger, or even a shovel can be used to determine the moisture content of the root zone. The most visible symptoms of moisture stress are wilting leaves or leaves that take on a bluish cast. More drought-tolerant plants just exhibit a slow rate of growth. A check of the soil profile should be made about 48 hours after irrigation to determine whether the water reached the desired depth and whether it was applied uniformly. This simple check can reveal many problems of which the producer would not otherwise be aware.
The furrow and border methods are the two primary irrigation methods used in the survey area. The border method, which consists of surface flooding between low dikes on leveled land, is most widely used for alfalfa, pastures, and small grain. The furrow method, consisting of deeper, large furrows between the rows, is used for row crops.

If water is applied too rapidly on clayey soils such as the Sparham series in the survey area, it runs off or ponds at the lower end of the field. (Alfalfa is easily drowned.) If water is applied too slowly on sandy soils such as the Trail series, it penetrates below the root zone and is lost to plant use. A properly designed irrigation system matches the soil characteristics with the amount of water applied. Concrete-lined ditches and pipelines also are used to help conserve water.

**Tillage**

Most irrigated soils in this survey area have weak structure or poor tilth. Tillage performed when the soil is wet breaks down the soil structure and compacts the soil, resulting in restricted movement of air and water into the root zone. When farm equipment is driven over wet soil, a compacted layer (usually called a plowpan), commonly develops several inches below the surface due to the weight of the equipment. This one- to two-inch thick, tightly compressed layer restricts water intake and is often so dense that plant roots have difficulty penetrating it.

Tillage should be performed at varying depths, and only when the soil is dry, to prevent formation of a plowpan. The effect of such a pan can be corrected by chiseling or subsoiling and by growing deep-rooted crops such as alfalfa. Using a grass crop in a long-term rotation also helps to eliminate such restrictive layers. The practice of minimum tillage limits the number of trips over the field to only those that are essential, and this prevents soil damage. Growing "green manure crops," which are crops that are plowed under, is also very beneficial to these soils. Both of these practices can improve soil tilth, improve the water intake rate, and improve the soil structure. Minimum tillage also lowers operating costs.

**Conservation Cropping**

A conservation cropping sequence is the growing of crops with the needed cultural and management measures to maintain or improve soil tilth. The conservation cropping sequence should also help to control erosion. Cropping systems include rotations that contain grasses and legumes, as well as rotations that provide benefits without these crops. In this survey area, a simple crop sequence usually is used. The sequence is influenced by the needs and choices of the operator.

**Use of Crop Residue**

To maintain good crop yields, it is essential to incorporate crop residues into the soil. Stubble from small grains and other crop residues are important sources of organic matter. When residues are incorporated into the soil, soil microorganisms decompose them. This process of decomposition improves the soil structure, which, in turn, improves water intake and increases soil aeration. The organisms also release plant nutrients from the material they are breaking down, and the nutrients again become available to the growing crop.

**Alfalfa Production**

Alfalfa produces well in the Rio Grande and Jemez Valleys. Alfalfa stands with a density of less than 4 to 5 plants per square foot generally are not profitable and are grassy and weedy. Such stands should be rotated out of alfalfa for 1 to 2 years before replanting to alfalfa. Alfalfa roots produce a chemical that kills alfalfa seedlings and takes at least a year to dissipate. Consequently, at least one other crop should be
grown in the field prior to replanting alfalfa to prevent this early thinning due to the toxin in the soil.

Considerations when planting alfalfa are: 1) avoid soils that have a fluctuating high water table; 2) select the best adapted varieties; 3) prepare a good seedbed; 4) incorporate phosphorus fertilizer before planting; 5) control weeds (fall seedings have fewer weed problems); 6) use correct seeding rate (rates vary depending on variety and seeding method); 7) do not use a companion crop unless needed to prevent soil blowing; and 8) control insects at the proper time.

After a good stand is established, maintain the stand by cutting at about \(\frac{1}{10}\) bloom. This is a compromise that provides good quality and quantity without damaging the stand.

Yields per Acre

The average irrigated yields per acre that can be expected of the principal crops under a high level of management are shown in Table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of map units in the survey area also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in Table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

The productivity index is a relative rating of the capacity of a soil to produce a specific plant under a defined management system. The index is determined from yield data on a few benchmark soils and is used to calculate yields, the net returns from crops, land assessment values, and taxes and to perform risk analysis when land management decisions are made.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive land forming that would change slope, depth, or other characteristics of the soils, nor do they include...
possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

Land capability classifications for the individual soils in this survey can be found in the section Detailed Soil Map Units.

In the capability system, soils are generally grouped at two levels—capability class and subclass.

**Capability classes**, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- **Class 1** soils have slight limitations that restrict their use.
- **Class 2** soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- **Class 3** soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- **Class 4** soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- **Class 5** soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- **Class 6** soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- **Class 7** soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- **Class 8** soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

**Capability subclasses** are soil groups within one class. They are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, 2e. The letter e shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, draughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

**Prime Farmland and Farmland of Statewide and Local Importance**

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops.
when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slopes generally range from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service. There is no farmland in the survey that meets the criteria for prime farmland without supplemental irrigation. Statewide important farmlands are those having an irrigated land capability class of IV or better and are irrigated with a supply of irrigation water that will meet crop needs throughout the growing season.

In some local areas there is a need for certain additional farmlands for the production of food, feed, fiber, and forage, even though these lands are not identified as having national or statewide importance. Where appropriate, these lands are to be identified by the local agency or agencies concerned. In places, additional farmlands of local importance may include tracts of land that have been designated for agriculture by local ordinance.

The map units in the survey area that are considered prime farmland when irrigated listed in Table 6. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section Detailed Soil Map Units.

Rangeland

By George Chavez, State Rangeland Management Specialist, Natural Resource Conservation Service

Rangeland is land on which the historic climax plant community is predominantly grasses, grasslike plants, forbs, or shrubs. In areas that have similar climate and topography, the kind and amount of vegetation produced on rangeland is closely related to the kind of soil. Effective management is based on knowledge about the relationship among the soils, vegetation, and water.

The historic climax plant community is the association of plants that are best adapted to a unique combination of environmental factors. Even on the same soil, the proportion of these plants varies from place to place and from year to year. The dominant plant or plants are used to characterize the plant community because of their relative stability in areas where abnormal disturbance or deterioration has not occurred. The grasses, forbs and shrubs that characterize the potential natural plant community on each major soil are listed by common name.

Once the plant community has been characterized for each soil, similar plant communities are grouped into ecological sites. An ecological site is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

Soil properties that have the greatest influence on the productivity of range plants are those that affect the availability of moisture and plant nutrients. Other soil properties such as soil reaction, salt content, and the presence or absence of a high water table during any period of the year, are also important factors in differentiating ecological sites.

Ecological site descriptions can be used to identify the proportions of the total annual production of each plant. Detailed information on the ecological sites in this
survey area is available in the local office of the Natural Resource Conservation Service.

About 55 percent of the survey area is rangeland that supports grasses, forbs, and shrubs suitable for grazing. Yearlong cow and calf operations are the dominant ranch enterprise, but many cattle and sheep ranches and yearling operations are in the area. The livestock produced on these ranches provide the principal agricultural income in the area.

Management of grazing to increase ground cover improves the vigor and reproduction of the more productive grasses and shrubs. Continuous yearlong grazing or grazing the same pasture during the growing season every year may result in the deterioration of the plant community, reducing its value for livestock grazing, watershed, wildlife habitat, and erosion control.

A proper degree of grazing use combined with deferred grazing or prescribed grazing that varies the season of grazing is needed to maintain a healthy, balanced plant community. This practice will also result in high quality forage throughout the year. Periodic rest during different seasons of the year benefits different plants. Rest in summer encourages the production and reproduction of warm-season grasses such as side oats grama, black grama, galleta, and blue grama. Rest in spring or fall, or both, is beneficial to the cool-season grasses such as western wheatgrass, New Mexico feathergrass, and bottlebrush squirreltail. Rest during fall and winter months benefits shrubs such as fourwing saltbush and winterfat.

Flexibility in livestock and wildlife numbers and in the frequency and intensity of grazing is essential to the success of any grazing program. Effective livestock distribution is accomplished by the proper use of fences, livestock water developments, and salt for livestock.

The major management concern on most rangeland is to control the time and intensity of grazing so that the kinds and amounts of plants that make up the desired plant community may be maintained or reestablished. Forage production often is less than half of the potential because the natural vegetation in many parts of the county has been greatly depleted due to drought, infrequent beneficial wildfires, or continuous and excessive use. Brush, weeds, and cacti have increased or invaded on much of the rangeland, causing further depletion of the grass cover. Soil erosion generally occurs when the soils are not adequately covered.

In many areas where the landscape is broken by mesas, or where pastures are large, the distribution of grazing by livestock generally is poor. Poor distribution of livestock grazing results in areas that are underused and areas that are excessively used. This in turn results in loss of cover, invasion of undesirable plants, and accelerated erosion. Prescribed grazing that improves grazing distribution and proper grazing use is a management concern that may be facilitated by the installation of fencing and additional water. Manipulating or reducing undesirable brush species and minimizing soil erosion are other management concerns.

Table 7 shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in Table 7 follows.

Table 7 shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in Table 7 follows.
total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service.

*Total dry-weight production* is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

*Characteristic vegetation*—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *rangeland composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in the "National Range and Pasture Handbook," which is available in local offices of the Natural Resources Conservation Service.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

**Forest Productivity**

The tables in this section can help forest owners or managers plan the use of soils for wood crops. They show the potential productivity of the soils for wood crops and rate the soils according to the limitations that affect various aspects of forest management.

**Forest Productivity**

In Table 8, the *potential productivity* of merchantable or *common trees* on a soil is expressed as a site index and as a volume number. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. *Commonly grown trees* are those that forest managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. More detailed information regarding site
The index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet.

The volume of wood fiber, a number, is the yield likely to be produced by the most important tree species. This number, expressed as cubic feet per acre per year and calculated at the age of culmination of the mean annual increment (CMAI), indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Trees to manage are those that are preferred for planting, seeding, or natural regeneration and those that remain in the stand after thinning or partial harvest.

Recreation

The soils of the survey area are rated in Tables 9A and 9B according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Slightly limited indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in Tables 9A and 9B can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas.

The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The
soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Playgrounds* require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Paths and trails* for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

*Off-road motorcycle trails* require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

**Wildlife Habitat**

The six general areas containing wildlife habitat in the Sandoval County Area are discussed in the following paragraphs.

*Plateaus, mesas, and terraces* contain soils that have grasslands and pinyon-juniper forests on the gently undulating to steep slopes. Grasses and shrubs grow on soils ranging from very shallow to very deep.

The summits of plateaus and mesas support pinyon-juniper forests. Elevations range from 6,800 to 7,800 feet. A variety of wildlife utilizes these areas, some of which include gray squirrels, cottontail rabbits, prairie rattlesnakes, and pinyon jays.
Fan remnants and stream terraces form near valleys and mountains. These upland sites are home to badger, striped skunk, prairie dogs, prairie rattlesnakes, black-tailed jackrabbit, and hawks. Antelope could be reintroduced in the northern half of the survey if given protection until established. Badgers and other burrowing animals make extensive use of areas of coarse and moderately coarse textured soils.

Mountains occur in the northeastern portion of the survey area north of Bernalillo. The Jemez Mountains contain some of the most important wildlife habitat in the survey area. Woodlands of ponderosa pine, Douglas-fir, pinyon, juniper, and Gambel oak, provide habitat for turkey, mule deer, Elk, black bear, porcupine, cottontail rabbits, gray squirrels, band-tailed pigeons, owls, hawks, prairie rattlesnakes, and songbirds.

Open grassy valleys are home to prairie dogs. The Long-tailed weasel also occurs in these areas. Local wetlands are important for many birds, waterfowl, and local mammals. Steep slopes and variable topography also play important roles in wildlife habitat.

River and stream valleys occur along such streams as the Rio Grande, Rio Puerco, and Jemez River. They contain riparian vegetation and water for wildlife use. These areas are used by all local wildlife for some part of their needs.

Songbirds nest in cottonwood and willow trees in large numbers. Cavity nesting birds find many nest sites in holes within large cottonwood trees. Quail use the thick vegetation for cover and seed sources. The abundant prey species attract many predators such as coyote, hawks, prairie rattlesnakes, and bobcat. Mule deer may spend their whole lives in these river bottoms.

The potential for competition between livestock and wildlife is high. The plant communities in these riparian areas must be maintained in good condition to provide wildlife habitat, flood protection, water quality, and soil erosion control.

Wetlands are areas containing hydrophytic vegetation, hydric soils, and wetland hydrology. Marshes are wetlands dominated by grasses and grass-like plants, and they occur in few areas of the survey area. Some are in channels of the Rio Grande, Rio Puerco, and Jemez River valleys and are produced by ground water. Other small marshes are man-induced and formed by irrigation impoundments.

All of these wetlands are used extensively by a large variety of wildlife species. Predators and prey species alike gather at these oases in an otherwise dry landscape.

Wetlands provide natural protection from flooding, enhance water quality, furnish habitat for wildlife, and conserve water. Wetlands need protection from excessive grazing, drainage projects, and poorly planned urban development.

Breaks are the steep, broken lands on the escarpments of mesas and plateaus. Breaks are very eroded and dissected, with many small ridges and gullies. Vegetation grows on the soils occurring in breaks, but not in large amounts. Although annual production of air-dry vegetation is generally low, plant diversity is high. This botanic diversity along with the physical cover provided by the terrain provides an attractive habitat for wildlife. Mule deer hide in breaks and feed on browse plants such as true mountain mahogany. Coyote and red fox find cover in the intricate, rocky landscapes. Trees growing on breaks of higher elevation provide nest sites and hunting perches for raptors such as the red-tailed hawk.

Rock outcrops furnish wildlife habitat when they occur as cliffs below rims of plateaus, mesas, and canyons. Although little or no vegetation grows on rock outcrops, they are still important to many species. Eagles, hawks, turkey vultures, owls, diamondback rattles, and swallows utilize cliffs and ledges. Migratory bats seasonally roost in cracks and caves. Foxes, bobcats, bear, and cougars have dens in alcoves and caves.
Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the Soil Properties section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Tables 10A and 10B show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building
site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Dwellings* are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Small commercial buildings* are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.
Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Tables 11A and 11B show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Slightly limited indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level
floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A trench sanitary landfill is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an area sanitary landfill, solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can
contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

**Construction Materials**

Tables 12A and 12B give information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good*, *fair*, or *poor* as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

The soils are rated as a *probable* or *improbable* source of sand and gravel. A rating of *probable* means that the source material is likely to be in or below the soil. The numerical ratings in these columns indicate the degree of probability. The number 0.00 indicates that the soil is an improbable source. A number between 0.00 and 1.00 indicates the degree to which the soil is a probable source of sand or gravel.

*Sand and gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In Table 12A, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the lowest layer of the soil contains sand or gravel, the soil is rated as a probable source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water
capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect the productivity of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered slight if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and severe if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

Table 13 also gives, for each soil, the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 66 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill.
The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, a cemented pan, or other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.
Soil Properties

Data relating to soil properties are collected during the course of the soil survey. Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

Engineering Index Properties

Table 14 gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated. Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1998) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1998).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages
are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of particle-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is generally omitted in the table.

Physical Properties

Table 15 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In Table 15, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In Table 15, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In Table 15, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at \( \tfrac{1}{20} \) or \( \tfrac{1}{10} \) bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential,
available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability \( (K_{sat}) \) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity \( (K_{sat}) \). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at \( \frac{1}{10} \) or \( \frac{1}{100} \)-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In Table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in Table 15 as the K factor \((K_w \text{ and } K_f)\) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Erosion factor \( K_w \) indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor \( K_f \) indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor \( T \) is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.
Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.
4. Calcareous loams, silt loams, clay loams, and silty clay loams.
5. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
6. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
7. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
8. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
9. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Properties

Table 16 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.
Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Soil Features

Table 17 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A restrictive layer is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as low, moderate, or high, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as low, moderate, or high. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.
Water Features

Table 18 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The months in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 18 indicates, by month, depth to the top (upper limit) and base (lower limit) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 18 indicates surface water depth and the duration and frequency of ponding. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, long if 7 to 30 days, and very long if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. None means that ponding is not probable; rare that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); occasional that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and frequent that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and frequency are estimated. Duration is expressed as extremely brief if 0.1 hour to 4 hours, very brief if 4 hours to 2 days, brief if 2 to 7 days, long if 7 to 30 days, and very long if more than 30 days. Frequency is expressed as none, very rare,
rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.
Classification of the Soils

Soils are classified so that we can more easily remember significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their responses to manipulation. Through classification and then the use of soil maps, we can apply our knowledge of soils to specific areas.

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1998 and 1999). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *soil*. An example is Aridisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Argid (Arg, meaning presence of argillic horizon, plus *id* from Aridisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplargids (Hap/, meaning minimal horizonation, plus *argid*, the suborder of the Aridisols that has a argillic horizon).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplargids.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed , , mesic Typic Haplargids.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The Grieta series is an example of a fine-loamy, mixed, mesic Typic Haplargid.
Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The classifications given in Table 19 are those of the classifications at the time of correlation of this survey (1987).

Aga Series

Map units: 22, 27, 426, 427, 428, 827
Depth class: very deep
Drainage class: moderately well drained
Landform: flood plains
Parent material: stream alluvium derived from mixed sources
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Slope: 0 to 3 percent
Climatic data:
  Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
  Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
  Frost-free period: 140 to 160 days

Taxonomic class: Coarse-loamy over sandy or sandy-skeletal, mixed, calcareous, mesic Typic Torrifuvents

Typical Pedon
Aga loam, in an area of mapping unit 27, Aga loam, 0 to 1 percent slopes; Sandoval County; Santo Domingo Pueblo Quadrangle, unsectionized state plane coordinates N. 1,659,900 feet and E. 471,850 feet. NAD 83, UTM 13—03 78 346 E—39 35 898 N.

A—0 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; hard, firm, sticky and plastic; many fine and very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
C1—10 to 23 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.
2C2—23 to 43 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few fine and very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
2C3—43 to 60 inches; very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; 10 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics
A horizon
  Texture: loam or silty clay loam
C horizon
  Texture: very fine sandy loam
Sandoval County Area, New Mexico

2C horizon

**Hue:** 10YR or 7.5YR

**Value:** 5 to 7 when dry, and 4 to 6 when moist

**Chroma:** 3 or 4

**Texture:** sand, loamy sand, gravelly sand, or loamy fine sand

**Salinity:** from less than 2 to 16 mmhos/cm.

*Note:* The water table ranges from 4 to 6 feet.

### Alanos Series

**Map units:** 283, 290

**Depth class:** very deep

**Drainage class:** well drained

**Landform:** mountain slopes and hillsides

**Parent material:** slope alluvium and colluvium derived from tuff and rhyolite

**Elevation:** 7,800 to 9,500 feet (2,377 to 2,896 meters)

**Slope:** 5 to 40 percent

**Climatic data:**

- **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
- **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- **Frost-free period:** 60 to 90 days

**Taxonomic class:** Clayey-skeletal, mixed Typic Eutroborals

#### Typical Pedon

Alanos loam, in an area of mapping unit 290, Alanos-Rock outcrop complex, 20 to 40 percent slopes; Los Alamos County; Frijoles Quadrangle. NAD 83, UTM 13—03 78 380 E—39 67 869 N.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine and medium roots; 10 percent gravel; neutral; abrupt smooth boundary.

E—4 to 9 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; few fine vesicular pores; 10 percent gravel; neutral; abrupt smooth boundary.

BE—9 to 18 inches; pinkish gray (7.5YR 7/2) and reddish brown (5YR 5/4) very gravelly loam, brown (7.5YR 5/2) and reddish brown (5YR 4/4) moist, weak fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine roots; common fine black (5YR 2/1) iron and manganese concretions; 55 percent gravel; medium acid; clear smooth boundary.

Bt1—18 to 28 inches; reddish brown (5YR 5/4) extremely gravelly clay, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; common fine black (5YR 2/1) iron and manganese concretions; common thin clay films in pores and on gravel; 20 percent cobbles and 55 percent gravel; medium acid; clear smooth boundary.

Bt2—26 to 60 inches; brown (7.5YR 5/4) extremely gravelly clay, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; few thin clay films in pores and on gravel; 20 percent cobbles and 55 percent gravel; medium acid.
Range in Characteristics

Particle-size control section: 35 to 55 percent clay
Other features: Some pedons are slightly alkaline in the lower subhorizons.

A horizon
Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 3 to 5 moist
Chroma: 2 or 3
Texture: loam or cobbly loam

E horizon
Hue: 7.5YR or 10YR
Value: 6 or 7 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: loam, gravelly loam, or cobbly loam

Bt horizon
Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 3 to 6 moist
Chroma: 2 to 6
Texture: extremely gravelly clay loam, extremely gravelly clay, or very gravelly clay
Concretions: fine or medium iron and manganese concretions are in the upper part of the Bt horizon.

Note: C horizons are below 38 inches in some pedons.

Atarque Series

Map units: 324, 396
Depth class: very shallow to shallow
Drainage class: well drained
Landform: breaks; dipslopes of cuestas, hills, mesas, and ridges
Parent material: slope alluvium derived from sandstone and shale
Elevation: 5,700 to 6,600 feet (1,737 to 2,012 meters)
Slope: 5 to 45 percent
Climatic data:
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Taxonomic class: Loamy, mixed, mesic Lithic Haplustalfs

Typical Pedon

Atarque sandy loam, in an area of mapping unit 324, Rock outcrop-Atarque-Menefee complex, 5 to 25 percent slopes; Sandoval County; Ponderosa Quadrangle; about 2 miles northeast of the Jemez Pueblo; 200 feet south and 1,400 feet east of the northwest corner of sec. 11, T 16 N, R 2 E. NAD 27; UTM 13—03 45 805 E—39 44 974 N.

A—0 to 3 inches; light brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) moist; moderate very thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots; neutral; clear smooth boundary.

Bt—3 to 9 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; many thin clay films on faces of peds and lining pores; neutral; clear smooth boundary.
Btk—9 to 14 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; weak moderate subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; common thin clay films on faces of peds and lining pores; violently effervescent; common fine irregular shaped soft masses of calcium carbonate; slightly alkaline.

R—14 inches; sandstone bedrock.

**Range in Characteristics**

**A horizon**
- **Hue:** 10YR to 5YR
- **Value:** 4 to 7 dry, 3 to 5 moist
- **Chroma:** 2 to 6
- **Texture:** sandy loam or extremely gravelly sandy loam

**B horizons**
- **Hue:** 10YR to 5YR
- **Value:** 4 to 5 dry, 3 to 5 moist
- **Chroma:** 3 to 6
- **Texture:** sandy clay loam or clay loam

**Note:** Depth to bedrock: 6 to 20 inches

**Bamac Series**

**Map units:** 300, 319, 345, 346
**Depth class:** very deep
**Drainage class:** excessively drained
**Landform:** alluvial fans, fan remnants, fan terraces, hills, and ridges
**Parent material:** slope and fan alluvium derived from mixed sources
**Elevation:** 5,400 to 6,900 feet (1,646 to 2,103 meters)
**Slope:** 1 to 55 percent
**Climatic data:**
  - **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
  - **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  - **Frost-free period:** 110 to 130 days
**Taxonomic class:** Sandy-skeletal, mixed, mesic Typic Ustorthents

**Typical Pedon**

Bamac very gravely loamy sand, in an area of mapping unit 319, Bamac-Rock outcrop complex, 15 to 55 percent slopes; Sandoval County; Santo Domingo Pueblo SW Quadrangle; about 2.5 miles southwest of the Cochiti Pueblo; 2,550 feet east and 100 feet south of the northwest corner of sec. 26, T. 16 N., R. 5 E. NAD 83, UTM 13—03 74 829 E—39 39 774 N.

A—0 to 4 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; 55 percent gravel; slightly effervescent; moderately alkaline; clear smooth boundary.

AC—4 to 10 inches; light yellowish brown (10YR 6/4) loamy sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common medium roots; 10 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

C1—10 to 21 inches; very pale brown (10YR 7/3) very gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few
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fine roots; 45 percent gravel; slightly effervescent; moderately alkaline; gradual wavy boundary
C2—21 to 37 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; 55 percent gravel; slightly effervescent; moderately alkaline; gradual wavy boundary.
C3—37 to 60 inches; pink (7.5YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 50 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 0 to 5 percent clay
A horizon
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4
Texture: Gravelly or very gravelly loamy sand or sandy loam or extremely gravelly coarse sandy loam

C horizon
Hue: 7.5YR or 10YR
Value: 3 to 7 dry, 4 to 6 moist
Chroma: 3 to 6 moist or dry
Texture: very gravelly coarse sand, very gravelly loamy sand, or very gravelly loamy coarse sand. Some pedons have thin strata of loamy sand or coarse sand.

Note: Some pedons have Ck horizons.

Bettonnie Series

Map unit: 150
Depth class: very deep
Drainage class: well drained
Landform: dipslopes on cuestas, fan terraces, hills, valley sides, summits of plateaus and mesas
Parent material: eolian material and slope alluvium derived from sandstone
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Slope: 5 to 8 percent
Climatic data:
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10 to 11.1 degrees C.)
Frost-free period: 110 to 130 days
Taxonomic class: Coarse-loamy, mixed, mesic Ustalfic Haplargids

Typical Pedon

Bettonnie fine sandy loam, in an area of mapping unit 150, Doakum-Bettonnie fine sandy loams, 0 to 8 percent slopes; Sandoval County; Mule Dam Quadrangle; about 15 miles south of Councelor and 500 feet south and 2,400 feet west of the northeast corner of sec. 29, T. 22 N., R. 6 W. NAD 83, UTM 13—02 75 951 E—39 99 372 N.

A—0 to 2 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine and fine continuous pores; moderately alkaline; clear smooth boundary.
BA—2 to 4 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine continuous pores; moderately alkaline; clear smooth boundary.

Bt—4 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine continuous pores; clay bridging sand grains and few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

BC—12 to 18 inches; brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine continuous pores; moderately alkaline; clear smooth boundary.

C1—18 to 34 inches; yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; strongly effervescent; strongly alkaline; clear gradual boundary.

C2—34 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, firm, slightly sticky and nonplastic; strongly effervescent; moderately alkaline.

### Range in Characteristics

**A horizon**
- **Hue:** 7.5YR or 10YR
- **Value:** 5 to 6 dry, 3 or 5 moist
- **Chroma:** 3 or 4
- **Texture:** loamy fine sand, fine sandy loam, or sandy loam

**Bt horizon**
- **Hue:** 5YR or 7.5YR
- **Value:** 4 to 6 dry and moist
- **Chroma:** 3 to 6
- **Texture:** fine sandy loam or sandy loam

**C horizon**
- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 7 dry, 4 to 6 moist
- **Chroma:** 3 to 6
- **Texture:** fine sandy loam, loamy sand, and sandy loam

**Note:** Some pedons have Bk horizons; some contain thin strata of loamy sand.

### Blancot Series

**Map units:** 101, 270

**Depth class:** very deep

**Drainage class:** well drained

**Landform:** valley sides and ridges

**Parent material:** fan alluvium derived from sandstone and shale

**Elevation:** 6,600 to 7,000 feet (2,012 to 2,134 meters)

**Slope:** 2 to 8 percent

**Climatic data:**
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

**Taxonomic class:** Fine-loamy, mixed, mesic Ustalfic Haplargids
Typical Pedon

Blancot fine sandy loam, in an area of mapping unit 101, Blancot-Lybrook association, 0 to 8 percent slopes; Sandoval County; Galisteo Quadrangle; about 2,580 feet north and 1,450 feet east of the southwest corner of sec. 15, T. 22 N., R. 7 W. NAD 83, UTM 13—02 69 104 E—40 02 257 N.

A—0 to 2 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine continuous pores; moderately alkaline; clear smooth boundary.

Bt1—2 to 5 inches; grayish brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; common very fine and fine continuous pores; few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bt2—5 to 14 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine continuous pores; few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Btk—14 to 23 inches; yellowish brown (10YR 5/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine continuous pores; few thin clay films on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—23 to 40 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; slightly effervescent; moderately alkaline; clear gradual boundary.

C2—40 to 49 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, sticky and plastic; strongly effervescent; moderately alkaline; clear gradual boundary.

C2—49 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon

Hue: 10YR or 2.5Y
Value: 5 to 7 dry, 3 to 5 moist
Chroma: 2 to 4
Texture: fine sandy loam, loam, or silt loam

Bt horizon

Hue: 10YR or 2.5Y
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6 dry and moist
Texture: loam, sandy clay loam, or clay loam

Btk, Bk, and C horizons (when present)

Hue: 10YR or 2.5Y
Value: 5 or 6 dry, 3 to 5 moist
Chroma: 2 to 6 dry and moist
Texture: sandy loam, loam, sandy clay loam, clay loam, fine sandy loam, or silty clay loam

Note: Some pedons have accumulations of secondary calcium carbonate.
Bond Series

Map unit: 227
Depth class: very shallow to shallow
Drainage class: well drained
Landform: cuestas, hills, mesas, and ridges
Parent material: eolian material and slope alluvium derived from sandstone
Elevation: 5,700 to 6,000 feet (1,737 to 1,829 meters)
Slope: 1 to 8 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Loamy, mixed, mesic Lithic Ustollic Haplargids

Typical Pedon

Bond loamy fine sand, in an area of mapping unit 227, Hagerman-Bond association, 1 to 8 percent slopes; Sandoval County; Ojito Spring Quadrangle; about 3/4 mile north and 1/2 mile east of the Ojito Spring (along the Ojito Arroyo) on the Zia Pueblo portion of the Ojo Del Espiritu Santo Grant. NAD 83, UTM 13—03 23 191 E—39 39 809 N.

A—0 to 4 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and few medium roots; slightly alkaline; clear smooth boundary.

Bt—4 to 12 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine tubular pores; common thin clay films on faces of peds; neutral; abrupt smooth boundary.

R—12 inches; sandstone bedrock.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay
Depth to lithic contact: 6 to 20 inches

A horizon
  Hue: 5YR, 7.5YR or 10YR
  Value: 4 to 6 dry, 3 to 5 moist
  Chroma: 2 to 4
  Texture: loamy fine sand, sandy loam, or fine sandy loam

Bt horizon
  Hue: 5YR or 7.5YR
  Value: 4 or 6 dry, 3 to 6 moist
  Chroma: 3 to 6
  Texture: sandy clay loam, loam, sandy loam, or clay loam

C horizon (when present)
  Hue: 5YR or 7.5YR
  Value: 5 to 8 dry, 5 or 6 moist
  Chroma: 4 to 6 dry and moist
  Texture: sandy clay loam, loam, sandy loam, or clay loam

Note: Some pedons have Btk horizons.
Cajete Series

Map units: 308, 503  
Depth class: very deep  
Drainage class: well drained  
Landform: mountain slopes, hills, and stream terraces  
Parent material: residuum derived from pumice  
Elevation: 7,000 to 8,500 feet (2,134 to 2,591 meters)  
Slope: 0 to 30 percent  
Climatic data:  
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)  
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)  
  Frost-free period: 60 to 90 days  
Taxonomic class: Ashy-skeletal, frigid Mollic Vitrandepts

Typical Pedon

Cajete gravelly loam, in an area of mapping unit 308, Cajete gravelly loam, 0 to 8 percent slopes; Sandoval County; Redondo Peak Quadrangle; about 100 yards south of dirt tank and 10 yards north of ridge crest, Baca location No. 1. NAD 63, UTM 13—03 58 759 E—39 66 454 N.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; 20 percent pumice gravel; neutral; clear smooth boundary.

A2—7 to 15 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; 20 percent pumice gravel; neutral; gradual wavy boundary.

Bw—15 to 33 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; 40 percent pumice gravel; neutral; abrupt wavy boundary.

C1—33 to 45 inches; matrix: light gray (10YR 7/2) very gravelly sand, pale brown (10YR 6/3) moist; single grain; loose, nonsticky and nonplastic; many fine and medium roots concentrated near lamella; wavy lamella 0.5 to 1 inch thick, strong brown (7.5YR 5/6) extremely gravelly sandy loam, yellowish brown (10YR 5/6) moist, 75 percent pumice gravel; matrix has 50 percent pumice gravel; neutral; abrupt wavy boundary.

C2—45 to 49 inches; very pale brown (10YR 7/3) extremely gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; 60 percent pumice gravel; slightly alkaline; abrupt wavy boundary.

C3—49 to 60 inches; matrix; light gray (10YR 7/2) very gravelly sand, pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) moist; single grain; loose, nonsticky and nonplastic; lamella 0.25-0.5 inch thick with colors similar to those described in the C1; 50 percent fine pumice gravel; slightly alkaline.

Range in Characteristics

Depth to the base of the cambic horizon: 20 to 35 inches

A horizons
  Value: 3 to 5 dry, 2 or 3 moist
  Chroma: 1 to 3
  Texture: extremely gravelly coarse sandy loam or gravelly loam
  Content of rock fragments: 15 to 80 percent pumice
Calaveras Series

Map units: 82, 83, 311
Depth class: very deep
Drainage class: well drained
Landform: mountain slopes
Parent material: colluvium derived from tuff
Elevation: 8,500 to 9,200 feet (2,591 to 2,804 meters)
Slope: 5 to 60 percent

Climatic data:
- Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
- Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- Frost-free period: 60 to 90 days

Taxonomic class: Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

Typical Pedon

Calaveras silt loam, in an area of mapping unit 311, Cossey-Tranquilar-Calaveras association, 5 to 20 percent slopes; Sandoval County, Valle San Antonio Quadrangle; about .1 mile south of movie set on the main ranch road, Baca Location No. 1; NAP 83, UTM 13—03 63 714 E—39 71 088 N.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 5 percent gravel; slightly acid; clear smooth boundary.

E—4 to 11 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; 10 percent gravel; slightly acid; clear smooth boundary.

Bw—11 to 17 inches; pale brown (10YR 6/3) gravelly silt loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common coarse roots; 5 percent stones and 20 percent gravel; slightly acid; clear wavy boundary.

2Bt1—17 to 30 inches; pale brown (10YR 6/3) very cobbly loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common coarse roots; few thin patchy clay films on rock fragments; 5 percent stones, 20 percent cobbles, and 20 percent gravel; medium acid; gradual wavy boundary.
2Bt2—30 to 39 inches; light brown (7.5YR 6/4) extremely cobbly coarse sandy loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few coarse roots; many clay films bridging sand grains and many thick clay films occur on tops of rock fragments; 5 percent stones, 30 percent cobbles, and 30 percent gravel; neutral; gradual wavy boundary.

3Bt3—39 to 60 inches; light brown (7.5YR 6/4) extremely cobbly loamy sand, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few coarse roots; clay bridging sand grains; 10 percent stones, 30 percent cobbles, and 20 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 5 to 20 percent clay
Content of rock fragments: 10 to 85 percent total; 0 to 50 percent stones or cobbles, and 15 to 50 percent gravel

A horizon
  Hue: 10YR or 7.5YR
  Value: 3 to 7 dry, 2 to 5 moist
  Chroma: 1 to 4
  Texture: silt loam, loam, or very gravelly sandy loam

E horizon
  Hue: 7.5YR or 10YR
  Value: 6 or 7 dry, 3 or 4 moist
  Chroma: 2 to 4
  Texture: silt loam and sandy clay loam

2B horizons
  Hue: 7.5YR or 10YR
  Value: 5 to 7 dry, 4 or 5 moist
  Chroma: 2 to 4
  Texture: extremely cobbly coarse sandy loam, very cobbly sandy loam, or very cobbly loam. In some pedons, extremely cobbly loamy coarse sand or extremely cobbly loamy sand occurs below 35 inches.

Note: Some pedons may have an AE horizon of sandy loam texture.

Camino Series

Map unit: 15
Depth class: deep
Drainage class: well drained
Landform: valley sides and plateaus
Parent material: fan alluvium and residuum derived from shale
Elevation: 5,900 to 6,200 feet (1,798 to 1,890 meters)
Slope: 1 to 6 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Fine, mixed, mesic Ustolic Camborthids
Typical Pedon
Camino silty clay loam, in an area of mapping unit 15, Camino-Sandoval complex, 1 to 8 percent slopes; Sandoval County; Sky Village NW Quadrangle; on Alamo Ranch 800 feet south and 400 feet east of the northwest corner of sec. 14, T. 14 N., R. 1 W. NAD 83, UTM 13—03 25 862 E—39 24 200 N.

A—0 to 2 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 5/3) moist; weak fine subangular blocky structure; soft, friable, sticky and plastic; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bw1—2 to 5 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw2—5 to 20 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; strongly effervescent; few fine irregular soft masses of calcium carbonate; moderately alkaline; gradual smooth boundary.

Bk—20 to 51 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; very hard, very firm, very sticky and very plastic; 5 percent shale fragments; strongly effervescent; common fine irregular soft masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Cr—51 inches; soft olive shale.

Range in Characteristics

Particle-size control section: 40 to 50 percent clay
Salinity: EC of 2 to 4
Depth to bedrock: 40 to more than 60 inches

A horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4

Bw and Bk horizons
Hue: 2.5Y or 5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 3 or 4

Carjo Series

Map unit: 281
Depth class: moderately deep
Drainage class: well drained
Landform: hills, mesas, and summits of ridges
Parent material: residuum derived from tuff
Elevation: 7,000 to 8,000 feet (2,134 to 2,438 meters)
Slope: 1 to 9 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days

Taxonomic class: Fine, mixed Mollie Eutroborals
**Typical Pedon**

Carjo loam, in an area of mapping unit 281, Carjo loam, 1 to 9 percent slopes; Los Alamos County, Frijoles Quadrangle; at the east end of 2-mile mesa; 1,100 feet south and 1,500 feet west of the northeast corner of sec. 20, T. 19 N., R. 6 E. NAD 83, UTM 13—03 80 426 E—39 70 016 N.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine interstitial pores; neutral; clear smooth boundary.

BA—4 to 12 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many fine roots; many very fine interstitial pores; neutral; clear smooth boundary.

Bt—12 to 20 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine angular blocky structure; hard, firm, sticky and plastic; many fine and medium roots; common fine tubular pores; thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.

C—20 to 25 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; common fine tubular pores; slightly alkaline; abrupt smooth boundary.

2R—25 inches; tuff bedrock.

**Range in Characteristics**

*Depth to bedrock:* 20 to 40 inches

**A horizon**
- **Hue:** 7.5YR or 10YR
- **Value:** 3 to 5 dry, 2 or 3 moist
- **Chroma:** 1 to 5
- **Texture:** fine sandy loam or loam
- **Content of rock fragments:** 0 to 35 percent cobbles or flagstones, 0 to 15 percent gravel or channers

**B horizon**
- **Hue:** 10YR, 7.5YR or 5YR
- **Value:** 3 to 6 dry, 2 to 5 moist
- **Chroma:** 2 to 6
- **Texture:** clay or clay loam
- **Content of rock fragments:** 0 to 15 percent

**C or BC horizon**
- **Hue:** 7.5YR or 5YR
- **Value:** 5 or 6 dry, 4 or 5 moist
- **Chroma:** 3 or 4
- **Texture:** sandy loam, very fine sandy loam, or clay loam

Note: B/E or E horizons occur in some pedons.

**Cascajo Series**

*Map units:* 47, 54
*Depth class:* very deep
*Drainage class:* excessively drained
*Landform:* hills, knolls, ridges, and structural benches
*Parent material:* fan alluvium derived from sandstone
*Elevation:* 5,300 to 6,500 feet (1,615 to 1,981 meters)
Sandoval County Area, New Mexico

Slope: 5 to 30 percent
Climatic data:
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Taxonomic class: Sandy-skeletal, mixed, mesic Ustollic Calcorthids

Typical Pedon

Cascajo very gravelly sandy loam, in an area of mapping unit 47, Cascajo very gravelly sandy loam, 12 to 30 percent slopes; Sandoval County; San Felipe Pueblo Quadrangle; about 7 miles northeast of Ball Ranch Headquarters; 600 feet west and 700 feet south of the northeast corner of sec. 27, T. 14 N., R. 6 E. NAD 27; UTM 13—03 83 258 E—39 20 070 N.

A—0 to 2 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; 19 percent cobbles and 40 percent gravel; violently effervescent; slightly alkaline; abrupt smooth boundary.

Bw—2 to 5 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; 18 percent cobbles and 40 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—5 to 11 inches; very pale brown (10YR 8/3) very gravelly sandy loam, very pale brown (10YR 7/3) moist; weak fine subangular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; 5 percent cobbles and 40 percent gravel; violently effervescent; many fine filaments and threads of calcium carbonate; moderately alkaline; clear smooth boundary.

Bk2—11 to 23 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; few medium roots; 5 percent cobbles and 50 percent gravel; violently effervescent; common fine filaments and threads of calcium carbonate; moderately alkaline; clear smooth boundary.

C1—23 to 30 inches; light brown (7.5YR 6/4) very gravelly loamy sand, yellowish brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; few medium roots; 10 percent cobbles and 45 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—30 to 60 inches; light brown (7.5YR 6/4) extremely cobbly loamy sand, brown (7.5YR 5/4) moist; massive; soft, very friable; nonsticky and nonplastic; few medium roots; 50 percent cobbles and 30 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

A horizon
Hue: 10YR
Value: 6 dry and 4 moist
Chroma: 3 dry and moist

B and C horizons
Hue: 10YR or 7.5YR
Value: 4 to 8 dry and 5 to 7 moist
Texture: very gravelly sand, extremely cobbly loamy sand, or very gravelly loamy sand. Some pedons may have horizons of very gravelly sandy loam above the C horizons.
Charo Series

Map unit: 405
Depth class: moderately deep
Drainage class: well drained
Landform: hills, mesas, and ridges
Parent material: eolian material and residuum derived from basalt
Elevation: 8,100 to 8,300 feet (2,469 to 2,530 meters)
Slope: 1 to 5 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days
Taxonomic class: Fine, mixed Typic Argiborolls

Typical Pedon

Charo very cobbly loam, in an area of mapping unit 405, Charo complex, 1 to 5 percent slopes; Sandoval County; Laguna Seca Quadrangle; about one mile west of Laguna Seca; unsectionized; NAD 27; UTM 13—02 91 297 E—39 20 794 N.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and many medium roots; 2 percent stones, 15 percent cobbles and 15 percent gravel; neutral; clear smooth boundary.

Bt1—5 to 12 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; weak medium angular blocky structure; hard, firm, sticky and plastic; many fine roots and common very fine roots; few fine tubular pores; few thin dark reddish gray (5YR 4/2) clay films on faces of peds and in pores; neutral; clear smooth boundary.

Bt2—12 to 15 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium and coarse angular blocky structure; hard, firm, sticky and plastic; many very fine roots; common, moderately thick, dark reddish gray (10YR 4/2), clay films on faces of peds; neutral; gradual wavy boundary.

Bt3—15 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few fine and few medium pores; few thin clay films on faces of peds, in pores, and on coarse fragments; 5 percent cobbles and 5 percent gravel; slightly alkaline; gradual wavy boundary.

C—25 to 28 inches; reddish brown (5YR 4/4) and dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/4) and (5YR 3/2) moist; massive; very hard, very firm, very sticky and very plastic; few very fine and fine pores; 10 percent cobbles anó 10 percent gravel; slightly alkaline; abrupt wavy boundary.

R—28 inches; hard basalt.

Range in Characteristics

Particle-size control section: 35 to 60 percent clay
Depth to bedrock: 20 to 40 inches

A horizon
  Hue: 7.5YR or 10YR
  Chroma: 2 or 3
  Texture: loam, cobbly loam or very cobbly loam
Bt horizon
  Value: 4 or 5 dry, 3 or 4 moist
  Chroma: 3 to 6
  Texture: clay loam or clay

Note: C horizons occur in some pedons.

Clovis Series

Map units: 1, 2, 143, 211
Depth class: very deep
Drainage class: well drained
Landform: fan terraces, mesas, and plains
Parent material: eolian material and slope alluvium derived from sandstone and shale
Elevation: 5,500 to 7,300 feet (1,676 to 2,225 meters)
Slope: 1 to 8 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days

Taxonomic class: Fine-loamy, mixed, mesic Ustollic Haplargids

Typical Pedon

Clovis fine sandy loam, in an area of mapping unit 143, Clovis fine sandy loam, 1 to 4 percent slopes; Sandoval County; Arroyo de las Calabacillas Quadrangle; about 24 miles northwest of Río Rancho at the far northwest corner of the west mesa; 1,600 feet west and 2,000 feet north of the southeast corner of sec. 17, T. 13 N., R. 1 E. NAD 83, UTM 13—03 31 377 E—39 13 673 N.

A—0 to 3 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and few medium roots; slightly alkaline; abrupt wavy boundary.

Bt1—3 to 7 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and few medium roots; many thin clay films on sand grains; moderately alkaline; clear smooth boundary.

Bt2—7 to 12 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many thin clay films on sand grains; moderate alkaline; gradual wavy boundary.

Bt3—12 to 22 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many thin clay films on sand grains; moderately alkaline; clear wavy boundary.

Bk1—22 to 34 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; very hard, firm, sticky and plastic; violently effervescent; common fine filaments and threads of calcium carbonate; moderately alkaline; diffuse wavy boundary.

Bk2—34 to 60 inches; reddish yellow (7.5YR 6/6) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; very hard, firm, sticky and plastic; violently effervescent; common medium irregular soft masses of calcium carbonate; moderately alkaline.
Range in Characteristics

Particle-size control section: 18 to 35 percent
Content of rock fragments: 0 to 15 percent stones, cobbles, or gravel

A horizon
  Hue: 5YR, 7.5YR, or 10YR
  Value: 4 to 6 dry, 3 to 5 moist
  Chroma: 2 to 6 dry, 2 to 4 moist
  Texture: fine sandy loam or loam

BA, Bt, Btk horizons
  Hue: 2.5YR, 5YR, or 7.5YR
  Value: 4 to 6 dry, 3 to 5 moist
  Chroma: 4 or 6
  Texture: sandy clay loam or clay loam

Bk horizon
  Hue: 7.5YR or 10YR
  Value: 6 to 8 dry, 5 to 7 moist
  Chroma: 2 to 6
  Texture: fine sandy loam or sandy clay loam

Cochiti Series

Map units: 104, 353
Depth class: very deep
Drainage class: well drained
Landform: fan terrace, hills, mesas, plains, and stream terraces
Parent material: gravelly alluvium
Elevation: 5,900 to 7,000 feet (1,615 to 2,134 meters)
Slope: 3 to 40 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days

Taxonomic class: Clayey-skeletal, mixed, mesic Aridic Haplustalfs

Typical Pedon

Cochiti gravelly loam, in an area of mapping unit 104, Cochiti-Montecito association, 1 to 30 percent slopes; Sandoval County; Canada Quadrangle; about 10 miles west of Cochiti Pueblo; 1,500 feet east and 300 feet north of the center of sec. 11, T. 16 N., R. 4 E. NAD 83, UTM 13—03 65 807 E—39 44 031 N.

A—0 to 7 inches; dark yellowish brown (10YR 4/4) gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, firm, sticky and plastic; many fine and medium roots: 5 percent cobbles and 15 percent gravel; neutral; clear smooth boundary.

Bt1—7 to 12 inches; reddish brown (5YR 4/3) gravelly clay loam, reddish brown (5YR 4/3) moist; strong medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and coarse roots; thick continuous clay films on faces of peds; 5 percent cobbles and 25 percent gravel; slightly acid; clear smooth boundary.

Bt2—12 to 20 inches; reddish brown (5YR 4/4) very gravelly clay, reddish brown (5YR 4/4) moist; strong medium and coarse subangular blocky structure; very hard, firm, very sticky and very plastic; few fine and coarse roots; thick continuous clay
films on faces of peds; 5 percent cobbles and 40 percent gravel; neutral; clear smooth boundary.

Bt—20 to 29 inches; light reddish brown (5YR 6/4) very gravelly clay loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine and coarse roots; thin and continuous clay films on faces of peds; 5 percent cobbles and 40 percent gravel; neutral; clear smooth boundary.

C—29 to 60 inches; light reddish brown (5YR 6/4) very gravelly sandy loam, reddish brown (5YR 5/4) moist; massive; loose, nonsticky and nonplastic; few fine and coarse roots; 5 percent cobbles and 50 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 35 to 45 percent clay
Content of rock fragments: 35 to 50 percent by volume with 5 to 10 percent cobbles and 30 to 40 percent gravel

A horizon
   Hue: 7.5YR or 10YR
   Value: 4 or 5 dry, 3 or 4 moist
   Chroma: 3 or 4
   Texture: gravelly loam or extremely gravelly loam

B horizon
   Hue: 7.5YR or 5YR
   Value: 4 to 6 dry, 4 or 5 moist
   Chroma: 3 or 4
   Texture: very gravelly clay or very gravelly clay loam

2C horizon
   Hue: 7.5YR or 5YR
   Value: 5 or 6 dry, 4 or 5 moist
   Chroma: 3 to 6
   Texture: very gravelly loamy sand or very gravelly sandy loam

Cosey Series

Map units: 304, 311
Depth class: very deep
Drainage class: well drained
Landform: mountain slopes
Parent material: slope alluvium and colluvium derived from rhyolite
Elevation: 8,600 to 9,200 feet (2,621 to 2,804 meters)
Slope: 2 to 20 percent
Climatic data:
   Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
   Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
   Frost-free period: 60 to 90 days
Taxonomic class: Loamy-skeletal, mixed Typic Paleborolls

Typical Pedon

Cosey silt loam, in an area of mapping unit 304, Cosey-Jarmillo association, 2 to 20 percent slopes; Sandoval County; Valle Toledo Quadrangle; about 13 miles northeast of La Cueva, 300 feet south of the pipeline, and 2 miles southeast of road junction at west end of Toledo Valley. Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 67 849 E—39 78 865 N.
A1—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly acid; clear smooth boundary.
A2—9 to 15 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; moderate coarse granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly acid; clear smooth boundary.
BA—15 to 28 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; 10 percent cobbles and 20 percent gravel; slightly acid; gradual smooth boundary.
Bt1—28 to 34 inches; very pale brown (10YR 7/3) very gravelly sandy clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common moderately thick clay films on faces of peds; 10 percent cobbles and 50 percent gravel; slightly acid; gradual smooth boundary.
Bt2—34 to 60 inches; light brown (7.5YR 6/4) crushed, extremely cobbly clay loam, dark brown (7.5YR 4/4) moist; strata of very pale brown (10YR 7/3) silty clay loam and brownish yellow (10YR 6/6) sandy loam; weak medium subangular blocky structure; hard, firm, sticky and plastic; continuous thick clay films on faces of peds; 40 percent cobbles and 30 percent gravel; slightly acid.

Range in Characteristics

Particle-size control section: 27 to 35 percent clay
Depth to argilllic horizon: 22 to 35 inches

A horizon
- Value: 3, 4 or 5 dry, 2 or 3 moist
- Chroma: 1 to 3
- Texture: loam, silt loam

BA horizon
- Value: 6 to 8 dry, 4 to 6 moist
- Chroma: 2 or 3
- Texture: gravelly sandy loam, gravelly fine sandy loam, and gravelly loam

Bt horizon
- Hue: 7.5YR or 10YR
- Value: 4 to 7 dry, 3 to 5 moist
- Chroma: 3 or 4
- Texture: very gravelly sandy clay loam or extremely cobbly clay loam

Counselor Series

Map units: 180, 270
Depth class: very deep
Drainage class: well drained
Landform: stream terraces, fan terraces, valley floors, and valley sides
Parent material: eolian material and stream alluvium derived from sandstone and shale
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Slope: 1 to 30 percent
Climatic data:
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Taxonomic class: Coarse-loamy, mixed, calcareous, mesic Ustic Torriorthents

Typical Pedon
Councilor fine sandy loam, in an area of mapping unit 180, Councilor-Eslendo-Mespun complex, 5 to 30 percent slopes; Sandoval County; Galisteo SE Quadrangle; about 15 miles southwest of Councilor; 1,500 feet north and 1,500 feet east of the southwest corner of sec. 6, T. 21' N., R. 6 W. NAD 83, UTM 13—02 73 616 E—39 95 265 N.

A—0 to 2 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—2 to 7 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—7 to 37 inches; pale brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

C3—37 to 40 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few fine and very fine roots; strongly effervescent; very few fine irregular soft masses of calcium carbonate; moderately alkaline; clear smooth boundary.

C4—40 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 8 to 18 percent clay

A horizon
Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 3 to 5 moist
Chroma: 2 to 4

C horizon
Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 2 to 4 dry, 2 to 6 moist
Texture: fine sandy loam, sandy loam, or clay loam

Note: The C horizon contains thin strata of loamy sand, loamy fine sand, and sandy clay loam in some pedons.

Cucho Series

Map units: 397, 398, 399
Depth class: moderately deep
Drainage class: well drained
Landform: cuestas and fan terraces
Parent material: colluvium derived from shale
Elevation: 5,900 to 7,200 feet (1,798 to 2,195 meters)
Slope: 15 to 70 percent
Climatic data:
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
Frost-free period: 110 to 130 days
Taxonomic class: Fine-silty, mixed, calcareous, mesic Typic Ustorthents

Typical Pedon
Cucho very gravelly clay loam in an area of mapping unit 397, Rock outcrop-Cucho-Vessilla complex, 25 to 70 percent slopes; Sandoval County; Holy Ghost Spring Quadrangle; 1.5 miles east of state highway 44 and 0.5 miles south of the Jemez-Zia Indian Reservations boundary, unsectionized; NAD 83, UTM 13—03 27 007 E—39.52 N.

A—0 to 2 inches; pale yellow (2.5Y 7/4) and very pale brown (10YR 7/4) very gravelly clay loam, light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/4) moist; moderate fine granular structure; slightly hard, friable, sticky and slightly plastic; common fine and few medium roots; 45 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—2 to 9 inches; light gray (2.5Y 7/2) clay loam, light olive gray (2.5Y 6/2) moist; massive; hard, firm, sticky and plastic; few medium roots; slightly effervescent; neutral; gradual wavy boundary.

C2—9 to 37 inches; pale olive (2.5Y 6/3) clay loam, olive (2.5Y 5/3) moist; slightly hard, friable, slightly sticky and slightly plastic; few medium roots in upper part; 50 percent soft weathered shale fragments at upper boundary grading to 90 percent at lower boundary; matrix slightly effervescent; few medium strongly effervescent irregular soft masses of calcium carbonate; slightly alkaline; gradual wavy boundary.

Cr—37 to 60 inches; fractured shale.

Range in Characteristics
Particle-size control section: 18 to 35 percent clay, less than 15 percent fine sand or coarser
Calcium carbonate equivalent: 1 to 10 percent
Depth to a Cr horizon: 20 to 40 inches

A horizon
Hue: 2.5Y or 10YR
Value: 6 or 7 dry

C horizon
Hue: 5Y or 2.5Y
Value: 6 or 7 dry, 5 or 6 moist
Chroma: 2 to 4
Texture: clay loam or silty clay loam

Cypher Series
Map units: 503, 600, 604
Depth class: shallow
Drainage class: well drained
Landform: mountain slopes and ridges
Parent material: colluvium and residuum derived from rhyolite and tuff
**Elevation:** 6,500 to 9,000 feet (1,981 to 2,743 meters)

**Slope:** 15 to 60 percent

**Climatic data:**
- **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
- **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- **Frost-free period:** 60 to 90 days

**Taxonomic class:** Loamy-skeletal, mixed, frigid Lithic Ustochrepts

**Typical Pedon**

Cypher very gravelly loam, in an area of mapping unit 604, Cypher-Mirand complex, 15 to 55 percent slopes; Sandoval County; Bear Springs Peak Quadrangle; about 3/4 mile north of the Bear Springs Guard Station in the Cana de Cochiti; unsectioned; NAD 83, UTM 13—03 59 321 E—39 49 984 N.

Oi—0 to 1 inch; slightly decomposed forest litter.

A—1 inch to 5 inches; brown (10YR 5/3) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak platy structure parting to weak very fine granular; soft, very friable, slightly sticky and nonplastic; many very fine roots; few very fine tubular pores; 10 percent cobbles and 45 percent gravel; slightly acid; clear smooth boundary.

Bw—5 to 12 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and few coarse roots; common very fine tubular pores; 10 percent cobbles and 40 percent gravel; medium acid; clear smooth boundary.

C—12 to 20 inches; light brown (7.5YR 6/4) extremely gravelly sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and few coarse roots; common thin clay films on coarse fragments; 10 percent cobbles and 75 percent gravel; slightly acid; abrupt wavy boundary.

2R—20 inches; rhyolite bedrock.

**Range in Characteristics**

**Particle-size control section:** 10 to 25 percent clay

**Calcium carbonate equivalent:** 0 to 5 percent

**Depth to bedrock from mineral surface:** 10 to 20 inches

**A horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 2 to 5 dry, 2 to 4 moist
- **Chroma:** 2 to 4
- **Texture:** very gravelly loam or very cobbly loam

**Bw horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 5 to 7 dry, 4 to 6 moist
- **Chroma:** 2 to 4
- **Texture:** very gravelly sandy loam or very gravelly loam

**C horizon**

- **Hue:** 5YR, 7.5YR or 10YR
- **Value:** 6 or 7 dry, 4 or 5 moist
- **Chroma:** 2 to 4
- **Texture:** extremely gravelly sandy loam or very gravelly loam
Deama Series

Map units: 58, 358
Depth class: very shallow and shallow
Drainage class: well drained
Landform: hills, plateaus, and mesas
Parent material: colluvium derived from limestone
Elevation: 5,800 to 7,000 feet (1,768 to 2,134 meters)
Slope: 10 to 55 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days
Taxonomic class: Loamy-skeletal, carbonatic, mesic Lithic Calciustolls

Typical Pedon

Deama very stony silt loam, in an area of mapping unit 58, Deama-El Pedro association, 5 to 30 percent slopes; Sandoval County; Sandia Crest Quadrangle; about .75 mile northwest of La Madera; 1,300 feet west and 1,800 feet south of the northeast corner of sec. 35, T. 12 N., R. 5 E. NAD 83, UTM 13—03 74 645 E—38 98 880 N.

A—0 to 7 inches; dark brown (7.5YR 3/2) very stony silt loam, very dark brown (7.5YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many medium and coarse roots; 20 percent stones, 10 percent cobbles, and 10 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—7 to 14 inches; pinkish gray (7.5YR 7/2) very cobbly silt loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many coarse roots; 7 percent stones, 15 percent cobbles, and 20 percent gravel; violently effervescent; many thin filaments of calcium carbonate; moderately alkaline; abrupt smooth boundary.

2R—14 inches; limestone.

Range in Characteristics

Particle-size control section: 18 to 27 percent clay
Calcium carbonate equivalent: 40 to 60 percent in the particle-size control section
Depth to bedrock: 7 to 20 inches

A horizon
  Hue: 5YR to 10YR
  Value: 3 to 6 dry, 2 to 4 moist
  Chroma: 2 or 3, dry or moist
  Texture: very gravelly loam or very stony silt loam

Bk horizon
  Hue: 5YR to 10YR
  Value: 4 to 8 dry, 3 to 7 moist
  Chroma: 2 to 4, dry or moist
  Texture: very gravelly loam or very cobbly silt loam
**Doakum Series**

*Map unit: 150*

*Depth class: very deep*

*Drainage class: well drained*

*Landform: bajadas, dipslopes on cuestas, plateaus, drainageways, and hills*

*Parent material: eolian material and slope alluvium derived from sandstone and shale*

*Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)*

*Slope: 0 to 5 percent*

*Climatic data:*

- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (10 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

*Taxonomic class: Fine-loamy, mixed, mesic Ustalfic Haplargids*

**Typical Pedon**

Doakum fine sandy loam, in an area of mapping unit 150, Doakum-Betonnie fine sandy loams, 0 to 8 percent slopes; Sandoval County; Mule Dam Quadrangle, about 8 miles southwest of Counselor, 800 feet south and 1,400 feet west of the northeast corner of sec. 29, T. 22 N., R. 6 W. NAD 83, UTM 13—02 76 101 E—39 99 272 N.

A—0 to 5 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine continuous pores; moderately alkaline; clear smooth boundary.

Bt1—5 to 11 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common very fine and fine continuous pores; few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bt2—11 to 17 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine continuous pores; few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bk1—17 to 24 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and plastic; common very fine roots; few very fine and fine continuous pores; strongly effervescent; few medium irregular soft masses of calcium carbonate; strongly alkaline; clear smooth boundary.

Bk2—24 to 31 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive; hard, firm, sticky and plastic; few very fine roots; violently effervescent; few medium irregular soft masses of calcium carbonate; strongly alkaline; clear smooth boundary.

Bk3—31 to 44 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine roots; violently effervescent; few medium soft masses and seams of calcium carbonate; strongly alkaline; clear gradual boundary.

C—44 to 60 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; violently effervescent; strongly alkaline.

**Range in Characteristics**

*Particle-size control section: 18 to 35 percent clay*

*Salinity: EC of 2 to 8*
A horizon  
*Hue:* 7.5YR or 10YR  
*Value:* 4 to 6 dry, 3 to 5 moist  
*Chroma:* 2 to 4

Bt or Btk horizons  
*Hue:* 5YR or 7.5YR  
*Value:* 4 to 6 dry, 3 to 5 moist  
*Chroma:* 2 to 6  
*Texture:* loam, sandy clay loam, or clay loam

Bk horizon  
*Hue:* 5YR, 7.5YR or 10YR  
*Value:* 4 to 8 dry, 4 to 7 moist  
*Chroma:* 2 to 6  
*Texture:* loam, fine sandy loam, sandy clay loam, or clay loam  
*Calcium carbonate equivalent:* less than 15 percent

C horizon  
*Hue:* 10YR or 7.5YR  
*Value:* 5 to 7 dry, 4 or 5 moist  
*Chroma:* 3 or 4  
*Texture:* loam, very fine sandy loam, fine sandy loam, or loamy fine sand

**El Rancho Series**

*Map units:* 95, 97  
*Depth class:* very deep  
*Drainage class:* well drained  
*Landform:* stream terraces  
*Parent material:* stream alluvium derived from mixed sources  
*Elevation:* 5,300 to 5,500 feet (1,615 to 1,676 meters)  
*Slope:* 0 to 2 percent  
*Climatic data:*  
  - *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)  
  - *Mean annual air temperature:* 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
  - *Frost-free period:* 120 to 140 days  
*Taxonomic class:* Fine-loamy, mixed, calcareous, mesic Ustic Torriorthents

**Typical Pedon**

El Rancho loam, in an area of mapping unit 95, El Rancho loam, 0 to 2 percent slopes; Sandoval County; San Ysidro Quadrangle; the north edge of San Ysidro; unsectioned; NAD 83, UTM 13—03 39 479 E—39 36 553 N.

Ap—0 to 5 inches; reddish brown (5YR 5/3) loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

C1—5 to 20 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

C2—20 to 38 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; massive; hard, firm, sticky and plastic; few fine and very fine roots; violently effervescent; moderately alkaline; clear smooth boundary.
2C3—38 to 60 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; violently effervescent; moderately alkaline.

**Range in Characteristics**

*Particle-size control section:* 10 to 27 percent clay and greater than 50 percent sand

**A horizon**
- **Hue:** 5YR or 7.5YR
- **Value:** 5 or 6 dry, 3 or 4 moist
- **Chroma:** 3 or 4
- **Texture:** loam or clay loam

**C horizon**
- **Hue:** 5YR or 7.5YR
- **Value:** 5 to 7 dry, 3 to 5 moist
- **Chroma:** 3 to 6
- **Texture:** sandy loam or sandy clay loam

**Elpedro Series**

*Map units:* 58, 317, 358
*Depth class:* very deep
*Drainage class:* well drained
*Landform:* benches, fan piedmonts, hills, mesas, and valley sides
*Parent material:* eolian material and colluvium derived from limestone
*Elevation:* 5,700 to 7,000 feet (1,737 to 2,134 meters)
*Slope:* 1 to 40 percent
*Climatic data:*  
  - **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)  
  - **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)  
  - **Frost-free period:** 110 to 130 days

*Taxonomic class:* Fine-silty, mixed, mesic Aridic Haplustalfs

**Typical Pedon**

Elpedro loam, in an area of mapping unit 58, Deama-Elpedro association, 5 to 30 percent slopes; Sandoval County; Sandia Park Quadrangle; about 2 miles northeast of La Madera; unsectioned; NAD 83, UTM 13—03 76 147 E—39 00 367 N.

A—0 to 5 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; slightly alkaline; abrupt smooth boundary.

Bt1—5 to 12 inches; dark brown (7.5YR 3/4) silty clay loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; many fine and coarse roots; few thin discontinuous clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bt2—12 to 19 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; few very fine roots; thick continuous clay films on faces of peds; slightly effervescent; few seams and filaments of calcium carbonate; moderately alkaline; clear smooth boundary.

Bt3—19 to 25 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; few very fine roots; thick continuous clay films on faces of peds; slightly effervescent; few seams and filaments of calcium carbonate; moderately alkaline; clear smooth boundary.
Btk1—25 to 36 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5R 4/4) moist; strong fine prismatic structure parting to strong fine and medium subangular blocky; hard, friable, sticky and plastic; few very fine roots; thick continuous clay films on faces of peds; strongly effervescent; thin filaments of calcium carbonates on peds; slightly alkaline; clear smooth boundary.

Btk2—36 to 45 inches; brown (7.5YR 5/4) silt loam, brown (7.5YR 4/4) moist; weak medium prismatic structure; hard, friable, sticky and plastic; few very fine roots; thin continuous prismatic structure; hard, friable, sticky and plastic; few very fine roots; thin continuous clay films on faces of peds; strongly effervescent; seams and filaments of calcium carbonate on faces of peds; slightly alkaline; clear smooth boundary.

Btk3—45 to 60 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure; hard, friable, sticky and plastic; few very fine roots; thin discontinuous clay films on faces of peds; strongly effervescent; few calcium carbonate accumulations; slightly alkaline.

Range in Characteristics

Particle-size control section: 27 to 35 percent clay
Calcium carbonate equivalent: 0 to 15 percent
Reaction: slightly to moderately alkaline

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4
Texture: loam or very gravelly loam

Bt and Btk horizons

Hue: 10YR to 5YR
Value: 3 to 6 dry, 4 to 5 moist
Chroma: 3 to 5
Texture: silty clay loam, loam, and silt loam

Bk horizon (when present)

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4
Texture: loam, silt loam, or silty clay loam

Embudo Series

Map units: 108, 109
Depth class: very deep
Drainage class: well drained
Landform: fan remnants and fan terraces
Parent material: fan alluvium derived from granite
Elevation: 5,000 to 5,600 feet (1,524 to 1,707 meters)
Slope: 1 to 15 percent
Climatic data:

Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Taxonomic class: Coarse-loamy, mixed, mesic Typic Camborthids
Sandoval County Area, New Mexico

**Typical Pedon**

Embudo gravelly sandy loam, in an area of mapping unit 109, Embudo-Tijeras association, 1 to 9 percent slopes; Sandoval County; Alameda Quadrangle; about 1.5 miles east of Interstate Highway 25 and about 1 mile north of the Bernalillo-Sandoval County line; 950 feet east and 2,050 feet south of the northwest corner of sec. 32, T. 12 N., R. 4 E. NAD 83, UTM 13—03 59 192 E—38 99 070 N.

A—0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; 20 percent gravel; slightly alkaline; clear wavy boundary.

Bw—4 to 12 inches; pale brown (10YR 6/3) gravelly fine sandy loam; dark yellowish brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; 15 percent gravel; slightly alkaline; gradual wavy boundary.

Bk1—12 to 30 inches; pale brown (10YR 6/4) gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, nonsticky and nonplastic; few fine roots; 20 percent gravel; slightly effervescent with few medium rounded soft masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

2Bk2—30 to 60 inches; pale brown (10YR 6/4) gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; 30 percent gravel; slightly effervescent; few fine rounded soft masses of calcium carbonate; moderately alkaline.

**Range in Characteristics**

*Particle-size control section: 5 to 15 percent clay*

A and Bw horizons

**Value:** 4 to 6 dry, 3 to 5 moist  
**Chroma:** 2 to 4

Bk horizon

**Value:** 4 to 6 dry, 3 to 5 moist  
**Chroma:** 2 to 6  
**Texture:** gravelly coarse sandy loam and sandy loam

2Bk horizon

**Value:** 4 to 6 dry, 3 to 5 moist  
**Chroma:** 2 to 6  
**Content of rock fragments:** 10 to 70 percent gravel  
**Texture:** gravelly loamy coarse sand or loamy sand  
**Depth to sandy layer:** 18 to 30 inches

**Esledo Series**

*Map unit: 180  
Depth class: very shallow to shallow  
Drainage class: well drained  
Landform: ridges  
Parent material: residuum derived from shale  
Elevation: 6,500 to 7,000 feet (2,012 to 2,134 meters)  
Slope: 5 to 30 percent  
Climatic data:*

*Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)  
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)  
Frost-free period: 110 to 130 days*
Taxonomic class: Loamy, mixed, calcareous, mesic, shallow Ustic Torriorthents

Typical Pedon

Espíritu clay loam, in an area of mapping unit 180, Counselor-Esloendo-Mespun complex, 5 to 30 percent slopes; Galisteo SE Quadrangle; about 16 miles south of Galisteo; 1,760 feet south and 2,400 feet west of the northeast corner of sec. 29, T. 21 N., R. 7 W. NAD 83, UTM 13—02 69 87 1 E—39 89 619 N.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak fine granular structure; hard, firm, sticky and plastic; few very fine and fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C—3 to 10 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; slightly effervescent; disseminated calcium carbonate; moderately alkaline; abrupt smooth boundary.

Cr—10 inches; soft shale.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay
Soil depth: 4 to 20 inches to soft shale

Espíritu Series

Map units: 325, 345, 346, 353, 398
Depth class: very deep
Drainage class: well drained
Landform: mountain slopes and mesas
Parent material: slope alluvium and colluvium derived from mixed sources
Elevation: 5,300 to 6,900 feet (1,615 to 2,103 meters)
Slope: 8 to 65 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days

Taxonomic class: Loamy-skeletal, mixed, mesic Aridic Haplustalfs

Typical Pedon

Espíritu very gravelly fine sandy loam, in an area of mapping unit 345, Espíritu-Barmac association, 15 to 55 percent slopes; Sandoval County; Loma Creston Quadrangle; 11 miles northeast of the Zia Pueblo; unsectioned; NAD 83, UTM 13—03 60 501 E—39 35 768 N.

A—0 to 6 inches; brown (10YR 5/3) very gravelly fine sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and common medium roots; 10 percent cobbles and 30 percent gravel; slightly alkaline; clear smooth boundary.

Bt1—6 to 15 inches; brown (7.5YR 5/4) very gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; few fine tubular pores; common thin clay films on faces of peds; 10 percent cobbles and 30 percent gravel; slightly alkaline; clear wavy boundary.

Bt2—15 to 22 inches; light brown (7.5YR 6/4) very gravelly sandy clay loam, brown (7.5YR 4/4) moist; moderate fine subangular bicky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; few thin
clay films of faces of peds; 10 percent cobbles and 35 percent gravel; slightly alkaline; gradual wavy boundary.

Bk1—22 to 29 inches; pale brown (10YR 6/3) very cobbly sandy clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine tubular pores; 25 percent cobbles and 25 percent gravel; strongly effervescent; few medium irregular soft masses of calcium carbonate; slightly alkaline; gradual wavy boundary.

Bk2—29 to 38 inches; pale brown (10YR 6/3) very cobbly sandy clay loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; 25 percent cobbles and 25 percent gravel; strongly effervescent; few medium irregular soft masses of calcium carbonate; slightly alkaline; clear wavy boundary.

2C1—38 to 46 inches; strong brown (7.5YR 5/6) fine sandy loam, brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent; slightly alkaline; gradual wavy boundary.

3C2—46 to 60 inches; reddish yellow (7.5YR 6/6) very gravelly sandy loam, strong brown (7.5YR 4/6) moist; massive; hard, friable, nonsticky and nonplastic; 3 percent cobbles and 35 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Particle-size control section: 15 to 35 percent clay

A horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 to 4
Texture: extremely cobbly sandy loam, very gravelly loam, and very gravelly fine sandy loam

Bt horizon

Hue: 5YR, 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6

Bk horizon

Hue: 5YR, 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: extremely gravelly loamy sand, extremely gravelly sandy loam, very gravelly loam, and very cobbly sandy clay loam

C horizons (when present)

Hue: 5YR, 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: very gravelly sandy loam, extremely gravelly sandy loam, fine sandy loam, or very gravelly loam

Note: In some pedons, the lower C horizons are sand, very gravelly loamy sand, or extremely gravelly loamy sand.

Ess Series

Map unit: 215
Depth class: very deep
Drainage class: well drained
Landform: mountain slopes
Parent material: colluvium derived from rhyolite
Elevation: 9,000 to 11,000 feet (2,743 to 3,353 meters)
Slope: 5 to 45 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days

Taxonomic class: Loamy-skeletal, mixed Argic Cryic Argiudolls

Typical Pedon

Ess very cobbly sandy loam, in an area of mapping unit 215, Ess-Rock outcrop complex, 5 to 45 percent slopes; Sandoval County; Valle Toledo Quadrangle; about 100 yards west of ski lift near Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 73 642 E—39 71 846 N.

A1—0 to 7 inches; very dark gray (10YR 3/1) very cobbly sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; 5 percent stones, 35 percent cobbles and 10 percent gravel; neutral; clear smooth boundary.

A2—7 to 15 inches; very dark gray (10YR 3/1) very cobbly sandy loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; 5 percent stones, 30 percent cobbles and 10 percent gravel; neutral; clear smooth boundary.

Bt—15 to 29 inches; strong brown (7.5YR 5/6) very cobbly sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; few thin discontinuous clay films on rock fragments; 10 percent stones, 30 percent cobbles and 10 percent gravel; neutral; gradual wavy boundary.

C—29 to 60 inches; very pale brown (10YR 7/3) very cobbly loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 5 percent stones, 20 percent cobbles, and 30 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 20 to 30 percent clay

A horizon
  Hue: 7.5YR, 10YR
  Value: 3 to 5 dry, and 2 or 3 moist
  Chroma: 1 to 3

B horizon
  Hue: 5YR, 7.5YR, 10YR
  Value: 4 to 6 dry, 3 to 5 moist
  Chroma: 3 to 6

Flugel Series

Map unit: 307
Depth class: very deep
Drainage class: well drained
Landform: cuestas, fan terraces, hills, ridges, and valley sides
Parent material: eolian material and fan alluvium derived from sandstone and shale
Elevation: 5,600 to 6,100 feet (1,707 to 1,859 meters)
Slope: 1 to 5 percent
Climatic data:

Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Taxonomic class: Fine-loamy, mixed, mesic Aridic Haplustalfs

Typical Pedon

Flugle loam, in an area of mapping unit 307, Flugle-Waumac complex, 1 to 8 percent slopes; Sandoval County; Jemez Pueblo Quadrangle; about 3 miles northeast of Zia Pueblo; 630 feet west and 750 feet south of the northeast corner of sec. 13, T. 15 N., R. 2 E. NAD 83, UTM 13—03 46 170 E—39 33 463 N.

A—0 to 3 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 4/3) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots; neutral; abrupt smooth boundary.

Bt—3 to 7 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; common moderately thick clay films on faces of peks; neutral; clear smooth boundary.

Btk1—7 to 12 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; common fine irregular filaments of calcium carbonate; slightly alkaline; clear smooth boundary.

Btk2—12 to 19 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; few thin clay films on faces of peks; strongly effervescent; few fine calcium carbonate accumulations; slightly alkaline; clear smooth boundary.

Bk—19 to 60 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common very fine pores; strongly effervescent; few coarse calcium carbonate accumulations; slightly alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay and greater than 35 percent sand

A horizon

Hue: 5YR, 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4

B horizon

Hue: 5YR, 7.5YR or 10YR
Value: 3 to 6 dry, 3 to 5 moist
Chroma: 2 to 6

C or Bk horizon

Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 3 to 6
**Fragua Series**

*Map units: 314, 322*

*Depth class:* deep and very deep  
*Drainage class:* well drained  
*Landform:* fan remnants and dipslopes  
*Parent material:* eolian material and fan alluvium derived from sandstone  
*Elevation:* 5,600 to 7,400 feet (1,707 to 2,256 meters)  
*Slope:* 1 to 70 percent  
*Climatic data:*  
  *Mean annual precipitation:* 13 to 16 inches (330 to 406 millimeters)  
  *Mean annual air temperature:* 48 to 52 degrees F. (10.0 to 11.1 degrees C.)  
  *Frost-free period:* 110 to 130 days  
*Taxonomic class:* Coarse-loamy, mixed, mesic Aridic Haplustalfs

**Typical Pedon**

Fragua loamy sand, in an area of mapping unit 314, Fragua-Waumac-Royosa complex, 1 to 8 percent slopes; Sandoval County; Jemez Pueblo Quadrangle; 4 miles northeast of Zia Pueblo; 1,310 feet west and 760 feet north of the southeast corner of sec. 7, T. 15 N., R. 3 E. NAD 83, UTM 13—03 49 686 E—39 33 977 N.

**A horizon**
- 0 to 3 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist;  
  - moderate fine granular structure; soft, very friable, nonsticky and nonplastic;  
  - common fine roots; slightly alkaline; clear smooth boundary.

**Bt1**
- 3 to 8 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist;  
  - moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few very fine roots; common thin clay films on faces of peds; slightly alkaline; gradual wavy boundary.

**Bt2**
- 8 to 24 inches; brown (7.5YR 5/6) sandy loam, strong brown (7.5YR 4/6) moist;  
  - moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; few thin clay films on faces of peds; slightly alkaline; deep wavy boundary.

**C**
- 24 to 60 inches; brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) moist;  
  - massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; slightly alkaline.

**Range in Characteristics**

*Particle-size control section:* 10 to 18 percent clay  
*Depth to bedrock:* 40 to more than 60 inches

**A horizon**
- Hue: 7.5YR or 10YR  
  - Value: 5 or 6 dry, 3 or 5 moist  
  - Chroma: 3 or 4 dry, 2 to 4 moist  
  - Texture: loamy sand or very cobbly fine sandy loam

**Bt horizon**
- Hue: 5YR to 10YR  
  - Value: 4 or 6 dry, 3 to 5 moist  
  - Chroma: 4 to 6  
  - Texture: sandy loam, fine sandy loam, or very fine sandy loam
Bk or C horizon
- **Hue:** 7.5YR or 10YR
- **Value:** 5 to 7 dry, 3 to 6 moist
- **Chroma:** 4 to 8 dry, 4 or 6 moist
- **Texture:** loamy fine sand, fine sandy loam, or sandy loam

**Frijoles Series**

- **Map unit:** 185
- **Depth class:** very deep
- **Drainage class:** well drained
- **Landform:** summits of mesas
- **Parent material:** eolian material and alluvium derived from pumice
- **Elevation:** 6,000 to 7,000 feet (1,829 to 2,134 meters)
- **Slope:** 1 to 8 percent
- **Climatic data:**
  - **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
  - **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  - **Frost-free period:** 110 to 130 days
- **Taxonomic class:** Loamy-skeletal over fragmental, mixed, mesic Aridic Haplustalfs

**Typical Pedon**

Frijoles very fine sandy loam, in an area of mapping unit 185, Frijoles very fine sandy loam, 1 to 8 percent slopes; Los Alamos County; Frijoles Quadrangle; unsectionized; NAD 83, UTM 13-03 83 492 E-39 62 785 N.

- **A—0 to 3 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine vesicular pores; neutral; abrupt smooth boundary.**

- **Bt1—3 to 8 inches; brown (7.5YR 4/4) very gravelly clay loam, dark brown (7.5YR 3/4) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many fine roots; many fine vesicular pores; thin discontinuous clay films on faces of peds; 35 percent fine pumice gravel; neutral; clear smooth boundary.**

- **Bt2—8 to 13 inches; brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many fine roots; many fine vesicular pores; thin discontinuous clay films on faces of peds; 45 percent fine pumice gravel; neutral; clear smooth boundary.**

- **2C1—13 to 20 inches; pinkish gray (7.5YR 7/2) extremely gravelly sandy loam, pinkish gray (7.5YR 6/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; 70 percent pumice gravel; neutral; clear wavy boundary.**

- **3C2—20 to 60 inches; pinkish white (7.5YR 8/2) pumice gravel, pinkish gray (7.5YR 7/2) moist, few fine roots; strong brown (7.5YR 5/6) lamella; few fine thin discontinuous clay films within the lamella.**

**Range in Characteristics**

- **Particle-size control section:** 27 to 35 percent clay
- **Depth to contrasting particle-size:** 15 to 30 inches

**A horizon**
- **Value:** 4 or 5 dry, 3 or 4 moist
- **Chroma:** 2 or 3
Bt horizon
  Value: 4 to 6 dry, 3 or 4 moist
  Chroma: 4 or 6

**Galisteo Series**

*Map units:* 92, 130, 226
*Depth class:* very deep
*Drainage class:* well drained
*Landform:* stream terraces and alluvial fans
*Parent material:* stream alluvium derived from mixed sources
*Elevation:* 5,500 to 7,000 feet (1,676 to 2,134 meters)
*Slope:* 0 to 3 percent
*Climatic data:*
  *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)
  *Mean annual air temperature:* 50 to 54 degrees F. (10.0 to 12.2 degrees C.)
  *Frost-free period:* 120 to 140 days

*Taxonomic class:* Fine, mixed, calcareous, mesic Ustic Torriorthents

**Typical Pedon**

Galisteo silty clay loam, in an area of mapping unit 92, Galisteo silty clay loam, moderately saline, sodic, 0 to 1 percent slopes; Sandoval County; San Ysidro Quadrangle; on the west edge of San Ysidro between old and new highway; unsectionized; NAD 83, UTM 13—03 38 222 E—39 36 960 N.

Ap—O to 12 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; massive; hard, firm, very sticky and very plastic; common fine and medium roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C—12 to 60 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, extremely firm, very sticky and very plastic; few fine and very fine roots; strongly effervescent; moderately alkaline.

**Range in Characteristics**

*Particle-size control section:* 35 to 59 percent clay
*Salinity:* EC of 8 to 16
*Sodicity:* SAR of 5 to 30

A horizon
  *Hue:* 2.5YR to 7.5YR
  *Value:* 4 to 6 dry and 3 to 5 moist
  *Chroma:* 2 to 4 dry and moist
  *Texture:* loam, clay loam, and silty clay loam

C horizon
  *Hue:* 2.5YR to 7.5YR
  *Value:* 4 to 6 dry and 3 to 5 moist
  *Chroma:* 2 to 4 dry and moist
  *Texture:* silty clay loam and clay
**Gilco Series**

*Map units:* 20, 25, 421, 423, 823  
*Depth class:* very deep  
*Drainage class:* moderately well drained  
*Landform:* flood plains  
*Parent material:* stream alluvium derived from mixed sources  
*Elevation:* 5,000 to 6,000 feet (1,524 to 1,829 meters)  
*Slope:* 0 to 4 percent  
*Climatic data:*  
  - Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)  
  - Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)  
  - Frost-free period: 140 to 160 days  
*Taxonomic class:* Coarse-loamy, mixed, calcareous, mesic Typic Torrifluvents

**Typical Pedon**

Gilco loam, in an area of mapping unit 25, Gilco loam, 0 to 1 percent slope; Sandoval County; Santo Domingo Pueblo Quadrangle; in Pena Blanca area; unsectionized; NAD 83, UTM 13—03 78 027 E—39 35 759 N.

Ap—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—4 to 34 inches; light yellowish brown (10YR 6/4) stratified silt loam, loam, and fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—34 to 60 inches; light yellowish brown (10YR 6/4) stratified loam and fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; strongly effervescent; moderately alkaline.

**Range in Characteristics**

*Particle-size control section:* 10 to 18 percent clay  
*Salinity:* EC of 0 to 16  
*Sodium:* SAR less than 13

**A Horizon**

- **Hue:** 10YR or 7.5YR  
- **Value:** 5 or 6 dry, 4 or 5 moist  
- **Chroma:** 2 to 4  
- **Texture:** loam or clay loam

**C Horizon**

- **Hue:** 10YR or 7.5YR  
- **Value:** 5 to 7 dry, 4 or 5 moist  
- **Chroma:** 2 to 4  
- **Texture:** very fine sandy loam, fine sandy loam, silt loam, or loam

**Note:** The Gilco soil in mapping unit 421 Gilco loam, moderately saline, sodic, 0 to 1 percent slopes, has higher sodium absorption ratios than is typical for the Gilco Series and is considered a taxadjunct to the series.
**Grieta Series**

*Map units: 142, 145*

*Depth class: very deep*

*Drainage class: well drained*

*Landform: fan remnants, mesas, plateaus, and ridges*

*Parent material: eolian material and fan alluvium derived from mixed sources*

*Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)*

*Slope: 1 to 5 percent*

*Climatic data:*

- **Mean annual precipitation:** 8 to 10 inches (203 to 254 millimeters)
- **Mean annual air temperature:** 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
- **Frost-free period:** 140 to 150 days

*Taxonomic class: Fine-loamy, mixed, mesic Typic Haplargids*

**Typical Pedon**

Grieta loamy fine sand, in an area of mapping unit 145, Grieta-Sheppard loamy fine sands, 2 to 9 percent slopes; Sandoval County; Arroyo de las Calabacillas Quadrangle; about 6 miles northwest of Rio Rancho and 450 feet north and 720 feet east of the southwest corner of sec. 20, T. 13 N., R. 2 E. NAD 83, UTM 13—03 40 104 E—39 11 426 N.

A—0 to 7 inches: brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few fine and few very fine roots; slightly alkaline; clear smooth boundary.

Bt1—7 to 14 inches: yellowish brown (7.5YR 5/4) sandy clay loam, dark yellowish brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and common very fine roots; common thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bt2—14 to 21 inches: pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine very fine roots; 5 percent gravel; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—21 to 38 inches: light yellowish brown (10YR 6/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; 10 percent gravel; strongly effervescent; few fine irregularly shaped masses and thin coatings of calcium carbonate on undersides of coarse fragments; moderately alkaline; clear smooth boundary.

Bk2—38 to 50 inches: white (10YR 8/2) coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and nonplastic; 2 percent gravel; violently effervescent; calcium carbonate as coatings on sand grains and as common fine irregularly shaped masses; moderately alkaline; gradual smooth boundary.

Bk3—50 to 60 inches: very pale brown (10YR 7/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; 3 percent gravel; strongly effervescent; calcium carbonate as few fine irregularly shaped masses; moderately alkaline.

**Range in Characteristics**

*Particle-size control section: 18 to 35 percent clay and greater than 35 percent sand*

*Depth to calcic horizon: 20 to 40 inches*
A horizon

Hue: 5YR, 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: loamy fine sand or fine sandy loam

Bt horizon

Hue: 5YR, 7.5YR or 10YR
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: fine sandy loam or sandy clay loam

Bk horizon

Hue: 7.5YR or 10YR
Value: 5 to 8 dry, 4 to 6 moist
Chroma: 2 to 6
Texture: coarse sandy loam, sandy clay loam or loamy sand

**Guaje Series**

*Map unit:* 504
*Depth class:* very deep
*Drainage class:* well drained
*Landform:* basalt-capped mesas, hills, and volcanic cones
*Parent material:* basalt, volcanic ash, and pumice
*Elevation:* 6,000 to 7,000 feet (1,829 to 2,134 meters)
*Slope:* 1 to 8 percent
*Climatic data:*
  - *Mean annual precipitation:* 13 to 16 inches (330 to 406 millimeters)
  - *Mean annual air temperature:* 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  - *Frost-free period:* 110 to 130 days
*Taxonomic class:* Medial-skeletal, mesic Aridic Ustochrepts

**Typical Pedon**

Guaje gravelly sandy loam, in an area of mapping unit 504, Orejas-Guaje complex, 1 to 15 percent slopes; Sandoval County; Cochiti Dam Quadrangle; about 2 miles east of the Witt Peak recreation area boat dock; unsectionized; NAD 83, UTM 13—03 85 099 E—39 44 994 N.

A—0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak medium granular structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine medium roots; common fine interstitial pores; 20 percent fine pumice gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—4 to 12 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and common very fine roots; few fine interstitial pores; 10 percent cobbles and 20 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

Bk1—12 to 17 inches; very pale brown (10YR 7/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; 5 percent cobbles and 55 percent gravel; slightly effervescent; calcium carbonate as common fine soft masses and as coatings on coarse fragments; moderately alkaline; clear wavy boundary.
Bk2—17 to 45 inches; white (N 8/0) and very pale brown (10YR 8/3) extremely
gravelly sandy loam, light gray (10YR 7/2) and very pale brown (10YR 7/3) moist;
massive; hard, firm, nonsticky and nonplastic; weakly cemented; few fine roots;
few fine tubular pores; strongly effervescent; calcium carbonate and siliceous
material dominant throughout entire horizon causing 90 percent weak
cementation, interrupted only by fractures less than 3 mm wide and less than 4
inches apart; 5 percent cobbles and 60 percent gravel; moderately alkaline,
diffuse irregularly boundary.
Bk3—45 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale
brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few
fine roots; 5 percent cobbles and 50 percent gravel; strongly effervescent; calcium
carbonate disseminated throughout and engulfing coarse fragments; moderately
alkaline.

**Range in Characteristics**

*Particle-size control section: 5 to 15 percent clay*
*Depth to the weakly cemented horizon: 12 to 26 inches*

A horizon

*Hue:* 7.5YR or 10YR
*Value:* 5 to 7 dry, 3 to 5 moist
*Chroma:* 2 to 4

B horizons

*Hue:* 7.5YR or 10YR
*Value:* 5 to 8 dry, 4 to 7 moist
*Chroma:* 0 to 4
*Texture:* gravelly, very gravelly, and extremely gravelly sandy loams

**Hackroy Series**

*Map units: 21, 162*
*Depth class: very shallow to shallow*
*Drainage class: well drained*
*Landform: summits of mesas and plateaus*
*Parent material: residuum from tuff*
*Elevation: 6,000 to 7,200 feet (1,829 to 2,195 meters)*
*Slope: 1 to 8 percent*
*Climatic data:*

*Mean annual precipitation:* 13 to 16 inches (330 to 406 millimeters)
*Mean annual air temperature:* 48 to 52 degrees F. (10 to 11.1 degrees C.)
*Frost-free period:* 110 to 130 days

*Taxonomic class:* Clayey, mixed, mesic Lithic Haplustalfs

**Typical Pedon**

Hackroy sandy loam, in an area of mapping unit 162, Hackroy-Nyack association, 1
to 5 percent slopes; Los Alamos County; White Rock Quadrangle; on the east end of
Ancho Canyon Trail; unsectioned; NAD 83, UTM 13—03 87 647 E—39 61 208 N.

A—0 to 3 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak fine
subangular blocky structure; hard, friable, nonsticky and nonplastic; many fine
roots; common fine tubular pores; slightly alkaline; abrupt smooth boundary.
Bt—3 to 13 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine prismatic structure; hard, firm, sticky and plastic; many fine roots; few very fine tubular pores; 3 percent gravel; continuous clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

2R—13 inches; tuff.

Range in Characteristics

Particle-size control section: 35 to 50 percent clay

A horizon
Hue: 7.5YR or 10YR
Value: 4 or 6 dry, 2 to 4 moist
Chroma: 2 to 4

Bt1 horizon
Hue: 7.5YR or 5YR
Value: 3 to 6 dry, 3 or 4 moist
Chroma: 4 or 6, dry or moist

Hagerman Series

Map units: 227, 240
Depth class: moderately deep
Drainage class: well drained
Landform: hills, mesas and ridges
Parent material: eolian material and alluvium derived from sandstone
Elevation: 5,700 to 6,400 feet (1,737 to 1,951 meters)
Slope: 1 to 5 percent
Climatic data:
Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
Frost-free period: 120 to 140 days

Taxonomic class: Fine-loamy, mixed, mesic Ustollic Haplargids

Typical Pedon

Hagerman fine sandy loam, in an area of mapping unit 240, Penistaja-Hagerman association, 1 to 5 percent slopes; Sandoval County; Cabezon Peak Quadrangle; about 1.5 miles southeast of the Rio Puerco along the Gas Company of New Mexico pipeline; unsectioned; NAD 83, UTM 13—03 13 428 E—39 43 499 N.

A—0 to 2 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common medium and many fine roots; moderately alkaline; clear smooth boundary.

Bt—2 to 9 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common medium and many fine roots; thin continuous clay films on faces of peds; moderately alkaline; clear smooth boundary.

Btk—9 to 24 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few medium and many fine roots; few thin clay films on faces of peds; strongly effervescent; few fine accumulations of calcium carbonate; moderately alkaline; clear smooth boundary.

2R—24 inches; sandstone.
Range in Characteristics

Particle-size control section: 18 to 35 percent clay
Depth to bedrock: 20 to 40 inches

A horizon
   Hue: 5YR to 10YR
   Value: 4 to 6 dry, 3 or 4 moist
   Chroma: 2 to 6

Bt horizon
   Hue: 7.5YR to 2.5YR
   Value: 4 to 7 dry or moist
   Chroma: 3 to 6

Btk horizon (when present)
   Hue: 7.5YR to 2.5YR
   Value: 6 to 8 dry, 5 to 8 moist
   Chroma: 3 or 4

Harvey Series

Map units: 53, 54, 59, 65
Depth class: very deep
Drainage class: well drained
Landform: ridges, bajadas, mesas, and plateaus
Parent material: eolian material and fan alluvium derived from mixed sources
Elevation: 5,000 to 6,800 feet (1,524 to 2,073 meters)
Slope: 1 to 15 percent
Climatic data:
   Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
   Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
   Frost-free period: 120 to 140 days

Taxonomic class: Fine-loamy, mixed, mesic Ustollic Calciorthids

Typical Pedon

Harvey loam, in an area of mapping unit 59, Harvey-Ildefonso-La Fonda association, 3 to 15 percent slopes; Sandoval County; Sandia Park Quadrangle; about 1.8 miles west and 50 feet south along pipeline from Highway 14; unsectioned; NAD 83, UTM 13—03 83 907 E—39 00 604 N.

A—0 to 4 inches; pinkish gray (7.5YR 6/2) loam, brown (7.5YR 5/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bw—4 to 10 inches; pinkish gray (7.5YR 6/2) loam, brown (7.5YR 5/2) moist, weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—10 to 18 inches; pinkish gray (7.5YR 7/2) clay loam, pink (7.5YR 7/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; violently effervescent; many filaments and threads of calcium carbonate; moderately alkaline; clear smooth boundary.
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Bk2—18 to 41 inches; pink (7.5YR 7/4) clay loam, pink (7.5YR 7/4) moist; weak medium angular blocky structure; hard, firm, sticky and plastic; few fine roots; violently effervescent; common filaments and threads of calcium carbonate; moderately alkaline; gradual smooth boundary.

C—41 to 60 inches; reddish yellow (7.5YR 6/6) sandy clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; violently effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon
- **Hue:** 2.5YR to 10YR
- **Value:** 5 to 7 dry, 3 to 6 moist
- **Chroma:** 2 to 6
- **Texture:** fine sandy loam or loam

Bw horizon (when present)
- **Hue:** 5YR, 7.5YR, or 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 2 to 4
- **Texture:** fine sandy loam, loam, or clay loam

Bk horizon
- **Hue:** 2.5YR to 10YR
- **Value:** 5 to 8 dry, 4 to 7 moist
- **Chroma:** 0 to 6
- **Texture:** sandy loam, loam, sandy clay loam, or clay loam

**Hickman Series**

- **Map unit:** 23
- **Depth class:** very deep
- **Drainage class:** well drained
- **Landform:** flood plains and valley floors
- **Parent material:** stream alluvium derived from mixed sources
- **Elevation:** 6,500 to 7,500 feet (1,981 to 2,286 meters)
- **Slope:** 1 to 3 percent
- **Climatic data:**
  - **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
  - **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  - **Frost-free period:** 110 to 130 days
- **Taxonomic class:** Fine-loamy, mixed, calcareous, mesic Typic Ustifluvents

**Typical Pedon**

Hickman clay loam, 1 to 3 percent slopes, map unit 23; Sandoval County; Cuba Quadrangle; about 1/2 mile east of La Jara; about 2,100 feet west and 300 feet south of the northeast corner of sec. 33, T. 22 N., R. 1 W. NAD 83, UTM 13—03 24 826 E—39 96 568 N.

A—0 to 4 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.
C1—4 to 12 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; many very fine and few fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

C2—12 to 49 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine and few very fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

C3—49 to 60 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and few very fine roots; strongly effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon:
- **Hue:** 2.5Y, 10YR or 7.5YR
- **Value:** 5 or 6 dry, 4 or 5 moist
- **Chroma:** 3 or 4

C horizon:
- **Hue:** 2.5Y, 10YR or 7.5YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 3 to 6

Ildefonso Series

**Map units:** 34, 56, 59, 64, 65, 210, 218

**Depth class:** very deep

**Drainage class:** well drained

**Landform:** hills, mesas, and fan terraces

**Parent material:** fan alluvium and colluvium derived from mixed sources

**Elevation:** 5,000 to 6,800 feet (1,524 to 2,073 meters)

**Slope:** 1 to 70 percent

**Climatic data:**
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Taxonomic class:** Loamy-skeletal, mixed, mesic Ustollic Calciorthids

**Typical Pedon**

Ildefonso cobbly loam, in an area of mapping unit 59, Harvey-Ildefonso-La Fonda association, 3 to 15 percent slopes; Sandoval County; Sandia Park Quadrangle; about 1 mile west along pipeline from Highway 14 and the 0.5 mile north in the San Pedro Land Grant; unsectionized, NAD 83, UTM 13—03 85 342 E—38 99 611 N.

A—0 to 2 inches; brown (7.5YR 5/2) cobbly loam, dark brown (7.5YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 10 percent cobbles and 5 percent gravel; moderately alkaline; abrupt smooth boundary.

Bw1—2 to 8 inches; brown (7.5YR 5/2) very gravelly loam, dark brown (7.5YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, sticky and plastic; many fine and very fine roots; 10 percent cobbles and 40 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.
Bw2—8 to 13 inches; pale brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, friable, sticky and plastic; common very fine and medium roots; 15 percent cobbles and 40 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bk1—13 to 32 inches; very pale brown (10YR 7/3) very cobbly sandy loam, light brown (7.5YR 6/4) moist; massive; hard, firm, sticky and plastic; few medium roots; 35 percent cobbles and 20 percent gravel; violently effervescent; many filaments and seams of calcium carbonate, and thick coatings of calcium carbonate on coarse fragments; moderately alkaline; clear wavy boundary.

Bk2—32 to 40 inches; very pale brown (10YR 7/3) very cobbly sandy loam, pink (7.5YR 7/4) moist; massive; hard, firm, sticky and plastic; few coarse roots; 35 percent cobbles and 20 percent gravel; violently effervescent; common filaments and seams of calcium carbonate, and thick coatings of calcium carbonate on coarse fragments; moderately alkaline; clear wavy boundary.

C—40 to 60 inches; very pale brown (10YR 7/3) extremely cobbly sand, light brown (7.5YR 6/4) moist; single grain; loose, nonsticky and nonplastic; 60 percent cobbles and 20 percent gravel; strongly effervescent; moderately alkaline.

**Range in Characteristics**

*Particle-size control section: 8 to 25 percent clay*

A and Bw horizons
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 4 to 6 dry, 3 or 4 moist
- **Chroma:** 2 to 6
- **Texture:** very stony loam, very cobbly loam, cobbly loam, gravelly sandy loam, and very gravelly sandy loam

Bk horizon
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 5 to 8 dry, 4 to 7 moist
- **Chroma:** 1 to 4
- **Texture:** very cobbly loam, very cobbly sandy loam, very gravelly sandy loam, very stony loam, and extremely cobbly sand

*Note:* This horizon is weakly cemented in some pedons.

**Jarmillo Series**

*Map units: 302, 304*
*Depth class: very deep*
*Drainage class: well drained*
*Landform: stream terraces*
*Parent material: alluvium, colluvium, and lacustrine sediments derived from rhyolite and tuff*
*Elevation: 8,500 to 8,800 feet (2,591 to 2,682 meters)*
*Slope: 1 to 20 percent*
*Climatic data:*
  - **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
  - **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  - **Frost-free period:** 60 to 90 days

*Taxonomic class: Coarse-loamy, mixed Pachic Haploborolls*
Typical Pedon

Jarmillo loam, in an area of mapping unit 302, Tranquil-Jarmillo complex, 1 to 8 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about 6 miles northeast of La Cueva on the south side of the east-west fence in San Antonio Valley, and 450 feet west of the point where the fence intersects the road between San Antonio Valley and Sulphur Springs, Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 55 699 E—39 81 078 N.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, common very fine, and few medium roots; slightly acid; clear smooth boundary.

A2—4 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; slightly acid; clear smooth boundary.

AB—13 to 20 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; slightly acid; clear wavy boundary.

Bw1—20 to 26 inches; light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; neutral; gradual wavy boundary.

Bw2—26 to 36 inches; matrix of very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; neutral; gradual wavy boundary.

Bw3—36 to 41 inches; matrix of light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; lamellae (5) are 1/16 to 1/4 inch thick, grayish brown (10YR 5/2) dry and dark grayish brown (10YR 4/2) moist; few very fine and medium roots; neutral; abrupt wavy boundary.

2Bw4—41 to 51 inches; white (2.5Y 8/2) clay loam, light yellowish brown (2.5Y 6/4) moist; moderate coarse prismatic structure; hard, firm, slightly sticky and plastic; organic stains on prism faces; neutral; abrupt wavy boundary.

3C—51 to 60 inches; white (2.5Y 8/2) very fine sandy loam, light yellowish brown (2.5Y 6/4) moist; massive; hard, firm, slightly sticky and plastic; lamellae (1) 1/8 inch thick, grayish brown (10YR 5/2) dry and very dark grayish brown (10YR 3/2) moist; neutral; clear wavy boundary.

Range in Characteristics

Particle-size control section: 8 to 18 percent clay

A horizon

Hue: 2.5Y or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: silt loam or loam

B horizon

Hue: 2.5Y or 10YR
Value: 6 to 8 dry, 3 to 6 moist
Chroma: 2 to 4
Texture: fine sandy loam, loam, and clay loam
Sandoval County Area, New Mexico

C horizon

Hue: 2.5Y or 10YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 2 to 4
Texture: loam, very fine sandy loam, and sandy loam

Jarola Series

Map unit: 301
Depth class: very deep
Drainage class: poorly drained
Landform: stream terraces and valley floors
Parent material: stream alluvium derived from rhyolite, tuff, and pumice
Elevation: 8,400 to 8,600 feet (2,560 to 2,621 meters)
Slope: 1 to 5 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days

Taxonomic class: Fine-loamy, mixed, frigid Typic Argialbolls

Typical Pedon

Jarola silt loam, in an area of mapping unit 301, Vastine-Jarola silt loams, 0 to 5 percent slopes; Sandoval County; Bland Quadrangle; about 100 feet east of main road to headquarters and about 250 feet south of the Jemez River, Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 65 529 E—39 67 968 N.

A—0 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; slightly acid; abrupt smooth boundary.

E—9 to 11 inches; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—11 to 17 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; many fine roots; many thick clay and organic coatings on faces of peds; neutral; clear smooth boundary.

Bt2—17 to 21 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; common moderately thick organic and clay coatings on faces of peds; neutral; clear smooth boundary.

2C1—21 to 42 inches; grayish brown (10YR 5/2) gravelly sandy clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; few fine roots; 15 percent gravel; neutral; gradual smooth boundary.

2C2—42 to 60 inches; grayish brown (2.5Y 5/2) very gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; 40 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 25 to 40 percent clay
A horizon
   Value: 4 or 5 dry, 2 or 3 moist
   Chroma: 1 or 2

E horizon
   Value: 5 to 7 dry, 3 to 5 moist
   Chroma: 1 or 2

B horizon
   Hue: 10YR or 2.5Y
   Chroma: 1 to 3
   Texture: silty clay loam or clay loam

C horizon
   Hue: 10YR or 2.5Y
   Value: 5 to 7 dry, 4 to 6 moist
   Chroma: 1 to 4

Jemez Series

Map units: 88, 163
Depth class: moderately deep
Drainage class: well drained
Landform: hills and interfluves of plateaus
Parent material: slope alluvium derived from tuff
Elevation: 7,000 to 8,800 feet (2,134 to 2,682 meters)
Slope: 1 to 15 percent
Climatic data:
   Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
   Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
   Frost-free period: 60 to 90 days
Taxonomic class: Fine-loamy, mixed Molllic Eutroboralfs

Typical Pedon

Jemez loam, in an area of mapping unit 88, Totavi-Jemez-Rock outcrop association, 0 to 15 percent slopes; Sandoval County; Redondo Peak Quadrangle; about 2 miles east of Redondo Campground, Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 54 807 E—39 67 297 N.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; slightly alkaline; clear smooth boundary.

A2—6 to 13 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common medium roots; slightly alkaline; clear smooth boundary.

E—13 to 19 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common medium roots; slightly alkaline; clear smooth boundary.

Bt—19 to 27 inches; pink (7.5YR 7/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common thin discontinuous clay films on faces of peds; slightly alkaline; abrupt wavy boundary.

R—27 inches; tuff.
Range in Characteristics

Particle-size control section: 20 to 35 percent clay
Depth to lithic contact: 20 to 40 inches

A horizon

Hue: 10YR or 7.5YR
Value: 2 to 5 dry, 2 to 4 moist
Chroma: 1 to 4

E horizon (a lower A horizon in some pedons)

Hue: 10YR or 7.5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4

Bt horizon

Hue: 5YR to 10YR
Value: 4 to 7 dry, 4 or 5 moist
Chroma: 2 to 6
Texture: clay loam or sandy clay loam

Note: 10YR colors occur in the upper part of the Bt horizon or as coatings on faces of peds.

Jocity Series

Map units: 417, 418
Depth class: very deep
Drainage class: moderately well drained
Landform: flood plains and alluvial fans
Parent material: stream alluvium derived from mixed sources
Elevation: 5,300 to 5,600 feet (1,615 to 1,707 meters)
Slope: 0 to 2 percent
Climatic data:
    Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
    Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
    Frost-free period: 140 to 160 days
Taxonomic class: Fine-loamy, mixed, calcareous, mesic Typic Torrifluvents

Typical Pedon

Jocity loam, 0 to 2 percent slope, map unit 417; on the Sandia Pueblo, Sandoval County; Bernalillo Quadrangle; 400 feet south and 450 feet east of the center of sec. 24, of T. 12 N., R. 3 E. NAD 83, UTM 13—03 56 572 E—39 02 182 N.

Ap—0 to 10 inches; brown (10YR 4/3) loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, sticky, plastic; common very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—10 to 26 inches; brown (10YR 4/3) silty clay loam, dark yellowish brown (10YR 3/4) moist; massive; very hard, firm, very sticky and plastic; common very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—26 to 32 inches; yellowish brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; very hard, friable, very sticky and plastic; few very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C3—32 to 50 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, friable, sticky and plastic; few very fine roots; violently effervescent; moderately alkaline; gradual smooth boundary.
C4—50 to 56 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; violently effervescent; strongly alkaline; abrupt smooth boundary.

C5—56 to 60 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; loose, nonsticky and nonplastic; violently effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 4 to 7 dry, 3 to 5 moist
- **Chroma:** 1 to 5, dry or moist
- **Texture:** loam or clay loam

C horizon
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 4 to 7 dry, 3 to 5 moist
- **Chroma:** 1 to 6, dry or moist
- **Texture:** stratified, loamy sand, sandy loam, fine sandy loam, loam, silt loam, sandy clay loam, or clay loam

La Fonda Series

**Map units:** 55, 59
**Depth class:** very deep
**Drainage class:** well drained
**Landform:** fan terraces and fan piedmonts
**Parent material:** fan alluvium derived from mixed sources
**Elevation:** 6,000 to 6,800 feet (1,829 to 2,073 meters)
**Slope:** 1 to 7 percent
**Climatic data:**
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Taxonomic class:** Fine-loamy, mixed, mesic Ustollic Camborthids

Typical Pedon

La Fonda loam, in an area of mapping unit 59, Harvey-Ildefonso-La Fonda association, 3 to 15 percent slopes; Sandoval County; Sandia Park Quadrangle; about 1.8 miles west along pipeline from Highway 14 and 700 feet north; unsectionized; NAD 83, UTM 13-03 85 343 E—38 99 641 N.

A—0 to 3 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; common very fine irregular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bw1—3 to 7 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots; common very fine irregular pores; violently effervescent; few fine calcium carbonate accumulations; moderately alkaline; clear smooth boundary.
Bw2—7 to 14 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine irregular pores; violently effervescent; few fine calcium carbonate masses; moderately alkaline; clear smooth boundary.

Bw3—14 to 26 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine irregular pores; violently effervescent; few fine calcium carbonate masses; moderately alkaline; clear smooth boundary.

Bk1—26 to 42 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine irregular pores; violently effervescent; common fine soft calcium carbonate accumulations; moderately alkaline; clear smooth boundary.

Bk2—42 to 60 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine irregular pores; violently effervescent; common fine soft calcium carbonate masses; moderately alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon
  Hue: 2.5YR to 7.5YR
  Value: 4 to 6 dry, 3 or 4 moist
  Chroma: 3 or 4

Bw horizon
  Hue: 2.5YR to 7.5YR
  Value: 4 to 7 dry, 3 to 5 moist
  Chroma: 3 to 6

Bk and C horizons
  Hue: 5YR or 7.5YR
  Chroma: 3 or 4

Laventana Series

Map units: 601, 603
Depth class: deep
Drainage class: well drained
Landform: mountain slopes and pediments
Parent material: colluvium derived from andesite and granite
Elevation: 7,000 to 8,900 feet (2,134 to 2,713 meters)
Slope: 3 to 55 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days
Taxonomic class: Loamy-skeletal, mixed, Mollic Eutroboralfs

Typical Pedon

Laventana very cobbly loam in an area of mapping unit 603, Laventana-Mirand very cobbly loams, 15 to 55 percent slopes; Sandoval County; Bear Springs Peak
Quadrangle; about 2 miles northwest of Bear Springs Peak; NAD 83, UTM 13—03 56
586 E—39 51 074 N.

O—0 to 1 inch; forest litter.
A—1 inch to 4 inches; brown (10YR 4/3) very cobbly loam, dark brown (10YR 3/3)
moist; moderate very thin platy structure; soft, very friable, nonsticky and
nonplastic; many very fine and few fine roots; many very fine tubular pores; 2
percent stones, 35 percent cobbles, and 15 percent gravel; slightly acid; clear
smooth boundary.
E—4 to 11 inches; light yellowish gray (10YR 6/2) gravelly silt loam, dark grayish
brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard,
friable, nonsticky and nonplastic; many very fine and a few fine, medium and
coarse roots; common very fine and a few fine tubular pores; 5 percent cobbles
and 20 percent gravel; slightly acid; clear smooth boundary.
Bt1—11 to 19 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 4/3)
moist; strong medium subangular blocky structure parting to strong fine angular
blocky; hard, firm, sticky and plastic; common very fine roots; many very fine
tubular pores; common thin clay films on faces of peds and in pores; 25 percent
cobbles and 15 percent gravel; slightly acid; gradual smooth boundary.
Bt2—19 to 30 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3)
moist; strong very fine and medium angular blocky structure; hard, firm, sticky
and plastic; common very fine roots; many very fine tubular pores; common thin
clay films on faces of peds and in pores; 10 percent cobbles and 40 percent
gavel, slightly acid; gradual smooth boundary.
Bt3—30 to 50 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR
4/3) moist; moderate medium angular blocky structure; hard, firm, slightly sticky
and slightly plastic; few very fine roots; common very fine tubular pores; common
moderately thick clay films on faces of peds and in pores; 10 percent cobbles and
40 percent gravel; neutral; abrupt wavy boundary.
2R—50 inches; fractured andesite.

Range in Characteristics

Particle-size control section: 20 to 35 percent clay.
Depth to bedrock: between 40 and 60 inches

A horizon
Value: 3 to 6 dry, 2 or 3 moist (when mixed to 7 inches the values are 5 or less
dry)
Chroma: 2 or 3
Texture: gravelly sandy loam or very cobbly

E horizon
Value: 5 to 7 dry
Chroma: 2 or 3
Texture: very gravelly loam or gravelly silt loam

Bt horizons
Hue: 7.5YR or 10YR
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: very gravelly loam, very cobbly loam, or very gravelly sandy clay loam
Depth to the base of the Bt horizons: 40 inches or more
**Lybrook Series**

*Map unit: 101*

*Depth class: very deep*

*Drainage class: well drained*

*Landform: stream terraces and valley floors*

*Parent material: stream alluvium derived from mixed sources*

*Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)*

*Slope: 0 to 2 percent*

*Climatic data:*

- *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)*
- *Mean annual air temperature:* 48 to 52 degrees F. (10.0 to 11.1 degrees C.)*
- *Frost-free period:* 110 to 130 days

*Taxonomic class: Fine, mixed, calcareous, mesic Ustic Torriorthents*

**Typical Pedon**

Lybrook clay loam in an area of map unit 101, Blancot-Lybrook association, 0 to 8 percent slopes; Sandoval County; Lybrook SE Quadrangle; about 15 miles south of Lybrook; 2,640 feet north and 2,640 feet east of the southwest corner of sec. 3, T. 21 N., R. 7 W. NAD 83, UTM 13—02 69 155 E—39 95 751 N.

A—0 to 1 inch; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—1 inch to 5 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; moderately alkaline; clear smooth boundary.

C2—5 to 21 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; moderately alkaline; clear gradual boundary.

C3—21 to 30 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C4—30 to 60 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine roots; strongly effervescent; very strongly alkaline.

**Range in Characteristics**

*Particle-size control section: 35 to 45 percent clay*

*Salinity: EC of 2 to 4*

*Sodicity: SAR of 13 to 30*

A horizon

- *Value:* 5 or 6 dry, 4 or 5 moist
- *Chroma:* 2 or 3

C horizon

- *Value:* 5 or 6 dry, 4 or 5 moist
- *Chroma:* 2 through 4
- *Texture:* clay loam or silty clay loam
Menefee Series

Map units: 17, 105, 129, 220, 324, 396, 422
Depth class: very shallow and shallow
Drainage class: well drained
Landform: hillslopes, mesas, and mountainsides
Parent material: colluvium and residuum derived from shale
Elevation: 5,700 to 7,800 feet (1,737 to 2,377 meters)
Slope: 2 to 45 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days
Taxonomic class: Loamy, mixed, calcareous, mesic, shallow Typic Ustorthents

Typical Pedon

Menefee clay loam, in an area of mapping unit 129, Menefee clay loam, 5 to 35 percent slopes; Sandoval County; Regina Quadrangle; about 1.5 miles north and 1.5 miles east of Regina; 50 feet east and 50 feet north of the center of sec. 22, T. 23 N., R. 1 W. NAD 83, UTM 13—03 26 573 E—40 08 671 N.

A—0 to 5 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—5 to 10 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and plastic; few fine and medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—10 to 17 inches; light brownish gray (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/3) moist; massive; hard, firm, sticky and plastic; few very fine and medium roots; strongly effervescent; very strongly alkaline; gradual irregular boundary.

2Cr—17 inches; soft calcareous shale.

Range in Characteristics

Depth to paralithic contact: 8 to 20 inches

A horizon
  Hue: 10YR or 2.5Y
  Value: 4 to 7 dry, 3 to 5 moist
  Chroma: 2 to 4
  Texture: loam, clay loam, gravelly loam, or gravelly clay loam

C horizons
  Hue: 10YR or 2.5Y
  Value: 5 to 7, 4 to 6 moist
  Chroma: 2 to 5

Mespun Series

Map unit: 180
Depth class: very deep
Drainage class: excessively drained
Landform: dunes
Parent material: eolian sands derived mainly from sandstone
Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)
Sandoval County Area, New Mexico

**Slope:** 5 to 30 percent

**Climatic data:**
- Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
- Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
- Frost-free period: 110 to 130 days

**Taxonomic class:** Mixed, mesic Ustic Torripsamments

**Typical Pedon**
Mespun loamy fine sand, in an area of mapping unit 180, Counselor-Esllendo-Mespun complex, 5 to 30 percent slopes; Sandoval County; Galisteo SE Quadrangle; about 17 miles south of Galisteo; 1,560 feet south and 2,400 feet east of the NW corner of sec. 29, T. 21 N., R. 7 W. NAD 27; UTM 13—02 65 728 E—39 89 688 N.

A—0 to 6 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; loose, nonsticky and nonplastic; few very fine roots; moderately alkaline; clear smooth boundary.

C—6 to 60 inches; brown (7.5YR 5/4) loamy sand, brown (7.5YR 4/4) moist; single grain, loose, nonsticky and nonplastic; few very fine roots; moderately alkaline.

**Range in Characteristics**

**Particle-size control section:** 3 to 8 percent clay

A horizon
- Hue: 7.5YR
- Value: 4 to 6 dry, 3 to 5 moist
- Chroma: 3 to 6

C horizon
- Hue: 7.5YR
- Value: 4 to 7 dry, 3 to 6 moist
- Chroma: 3 to 8

**Mirand Series**

**Map units:** 283, 603, 604
**Depth class:** very deep
**Drainage class:** well drained
**Landform:** mountain slopes and canyons
**Parent material:** colluvium derived from rhyolite and tuff
**Elevation:** 6,900 to 9,500 feet (2,103 to 2,896 meters)
**Slope:** 5 to 55 percent

**Climatic data:**
- Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
- Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- Frost-free period: 60 to 90 days

**Taxonomic class:** Fine, mixed Mollic Eutroboralfs

**Typical Pedon**
Mirand loam, in an area of mapping unit 283, Mirand-Alanos complex, 5 to 40 percent slopes; Sandoval County; Valle San Antonio Quadrangle; in the upper end of Redondo Canyon; 20 feet south of gate leading from hot well area into Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 58 447 E—39 73 092 N.

O—0 to 2 inches; decomposed organic matter from grasses and needles.
A—2 to 4 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, very friable, sticky and plastic; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—4 to 9 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common thin clay films on faces of peds; 10 percent gravel; slightly acid; clear smooth boundary.

Bt2—9 to 15 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many thick clay films on faces of peds; 15 percent gravel; neutral; clear smooth boundary.

Bt3—15 to 24 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; few fine roots; many thick clay films on faces of peds; 10 percent gravel; neutral; clear smooth boundary.

Bt4—24 to 45 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, firm, very sticky and very plastic; few very fine roots; many thick clay films on faces of peds; 10 percent gravel; slightly acid; abrupt wavy boundary.

2Bt5—45 to 60 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; common fine distinct strong brown (7.5YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few medium roots; common thick clay film lime pores; 10 percent gravel; very strongly acid.

**Range in Characteristics**

*Particle-size control section:* 35 to 55 percent clay

A horizon
- **Value:** 3 to 5 dry, 2 or 3 moist
- **Chroma:** 1 or 2
- **Texture:** loam or very cobbly loam

Bt horizon
- **Hue:** 5YR to 10YR
- **Value:** 5 to 7 dry, 4 to 6 moist
- **Chroma:** 3 to 6
- **Texture:** clay loam, gravelly clay loam, sandy clay, clay, or cobbly clay

**Montecito Series**

*Map units:* 3, 4, 104
*Depth class:* very deep
*Drainage class:* well drained
*Landform:* hills, summits of mesas and plains
*Parent material:* eolian material and fan alluvium derived from sandstone and shale
*Elevation:* 6,000 to 7,600 feet (1,829 to 2,316 meters)
*Slope:* 1 to 30 percent
*Climatic data:*
- **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
- **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
- **Frost-free period:** 110 to 130 days

*Taxonomic class:* Fine, mixed, mesic Aridic Haplustalfs
Sandoval County Area, New Mexico

**Typical Pedon**

Montecito loam, in an area of mapping unit 104, Cochiti-Montecito association, 1 to 30 percent slopes; Sandoval County; Canada Quadrangle; 10 miles northwest of Cochiti Pueblo; 2,400 feet north and 300 feet east of the center of sec. 2, T. 16 N., R. 4 E. NAD 83, UTM 13—03 65 540 E—39 46 249 N.

A—0 to 3 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; common medium roots; neutral; abrupt smooth boundary.

Bt1—3 to 9 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; few fine and very fine roots; many thick clay films on faces of peds; neutral; clear smooth boundary.

Bt2—9 to 15 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; few very fine roots; many thick clay films on faces of peds; neutral; clear smooth boundary.

Bt3—15 to 22 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many thick clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

2Bk1—22 to 37 inches; pinkish white (7.5YR 8/2) sandy loam, pink (7.5YR 7/4) moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; 10 percent gravel; violently effervescent; common weakly cemented calcium carbonate masses; moderately alkaline; gradual wavy boundary.

2Bk2—37 to 60 inches; pinkish white (7.5YR 8/2) gravelly sandy loam, pink (7.5YR 7/4) moist; massive; soft, friable, slightly sticky and slightly plastic; 25 percent gravel; violently effervescent; common weakly cemented calcium carbonate masses; moderately alkaline.

**Range in Characteristics**

Particle-size control section: 35 to 50 percent clay

Depth to the calcic horizon: 10 to 35 inches

A Horizon

*Hue:* 7.5YR or 10YR
*Value:* 4 to 6 dry, 3 to 5 moist
*Chroma:* 3 to 6
*Texture:* fine sandy loam, loam, or extremely bouldery loam

Bt Horizon

*Hue:* 7.5YR or 10YR
*Value:* 4 to 6 dry, 3 to 5 moist.
*Chroma:* 3 to 6

Bk Horizon

*Hue:* 7.5YR or 10YR
*Value:* 6 to 8 dry, 5 to 8 moist
*Chroma:* 1 to 4
*Texture:* sandy loam, gravelly sandy loam, loam, or clay loam
Nyjack Series

Map unit: 162  
Depth class: moderately deep  
Drainage class: well drained  
Landform: summits of mesas and plateaus  
Parent material: eolian material and slope alluvium derived from tuff  
Elevation: 6,000 to 7,000 feet (1,829 to 2,134 meters)  
Slope: 1 to 5 percent  
Climatic data:  
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)  
  Mean annual air temperature: 48 to 52 degrees F. (10 to 11.1 degrees C.)  
  Frost-free period: 110 to 130 days  
Taxonomic class: Fine-loamy, mixed, mesic Aridic Haplustalfs  

Typical Pedon  
Nyjack loam, in an area of mapping unit 162, Hackroy-Nyjack association, 1 to 5 percent slopes; Los Alamos County; Frijoles Quadrangle; about .5 mile east of LASL Administration Building, 2,000 feet west, 660 feet west, 660 feet south of the southwest corner of sec. 21, T. 19 N., R. 6 E. NAD 83, UTM 13—03 81 468 E—39 68 841 N.  

A—0 to 3 inches; brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many vesicular pores; slightly acid; abrupt smooth boundary.  

Bt1—3 to 13 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine medium roots; many vesicular pores; few thin clay films on faces of peds; neutral; clear smooth boundary.  

Bt2—13 to 24 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine tubular pores; thin discontinuous clay films on faces of peds; neutral; abrupt smooth boundary.  

2C—24 to 39 inches; light brown (7.5YR 6/4) gravelly sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; 25 percent pumice gravel; neutral; abrupt smooth boundary.  

Cr—39 inches; tuff bedrock.  

Range in Characteristics  
Particle-size control section: 27 to 35 percent clay  
Depth to paralithic contact: 20 to 40 inches  

A horizon  
  Hue: 7.5YR or 10YR  
  Value: 4 or 5 dry, 3 or 4 moist  
  Chroma: 2 to 4, dry or moist  

Bt horizons  
  Hue: 5YR to 10YR  
  Value: 4 to 7 dry, 3 to 5 moist  
  Chroma: 3 to 6, dry or moist  

Bt3 horizon (when present)  
  Hue: 5YR to 10YR  
  Value: 4 to 7 dry, 3 to 5 moist  
  Chroma: 3 to 6, dry or moist  

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2C horizon

- **Hue:** 5YR to 10YR
- **Value:** 4 to 6 dry, 4 or 5 moist
- **Chroma:** 3 or 4 dry

**Orejas Series**

- **Map units:** 3, 100, 504
- **Depth class:** shallow
- **Drainage class:** well drained
- **Landform:** mesas and plateaus
- **Parent material:** eolian material, slope alluvium, and colluvium derived from basalt
- **Elevation:** 6,000 to 7,600 feet (1,829 to 2,316 meters)
- **Slope:** 1 to 40 percent
- **Climatic data:**
  - **Mean annual precipitation:** 13 to 16 inches (330 to 406 millimeters)
  - **Mean annual air temperature:** 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  - **Frost-free period:** 110 to 130 days
- **Taxonomic class:** Clayey-skeletal, mixed, mesic Lithic Haplustalfs

**Typical Pedon**

Orejas cobbly loam, in an area of mapping unit 3, Montecito-Orejas complex, 1 to 7 percent slopes; Sandoval County; Cabezon Peak Quadrangle; on Mesa Prieta; 2,000 feet north and 350 feet east of the southwest corner of sec. 10, T. 15 N., R. 2 W. NAD 83, UTM 13-03 14 762 E-39 34 960 N.

- **A**—0 to 2 inches; yellowish brown (10YR 5/4) cobbly loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; 30 percent cobbles; slightly alkaline, abrupt smooth boundary.
- **Bt1**—2 to 5 inches; brown (10YR 4/3) very cobbly clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on faces of peds; 45 percent cobbles; neutral; clear smooth boundary.
- **Bt2**—5 to 14 inches; dark yellowish brown (10YR 4/4) very cobbly clay loam, dark yellowish brown (10YR 3/4); moderate fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; many thick clay films on faces of peds; 45 percent cobbles; moderately alkaline; clear smooth boundary.
- **Bt3**—14 to 17 inches; brown (10YR 5/3) very cobbly clay loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few moderately thick clay films on faces of peds; 45 percent cobbles; slightly effervescent; moderately alkaline; clear smooth boundary.
- **C**—17 to 19 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; 10 percent cobbles and 30 percent gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.
- **R**—19 inches; basalt.

**Range in Characteristics**

- **Particle-size control section:** 35 to 50 percent clay
- **Depth to bedrock:** 10 to 20 inches

**A horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 5 or 6 dry, 3 or 4 moist
- **Chroma:** 2 to 4
- **Texture:** cobbly loam, very cobbly loamy, or very stony loam
Bt horizon
  Hue: 7.5YR or 10YR
  Value: 4 to 6 dry, 3 or 4 moist
  Chroma: 2 to 4

C horizons
  Value: 5 or 6 dry, 4 or 5 moist
  Chroma: 2 or 3
  Texture: very gravelly clay loam or very cobbly clay loam

**Origo Series**

*Map units*: 74, 75
*Depth class*: very deep
*Drainage class*: well drained
*Landform*: mountain slopes
*Parent material*: slope alluvium and colluvium derived from rhyolite and tuff
*Elevation*: 8,600 to 10,000 feet (2,621 to 3,048 meters)
*Slope*: 15 to 65 percent

**Climatic data:**
  *Mean annual precipitation*: 25 to 30 inches (635 to 762 millimeters)
  *Mean annual air temperature*: 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
  *Frost-free period*: 45 to 60 days

**Taxonomic class**: Loamy-skeletal, mixed Psammentic Cryoboralfs

**Typical Pedon**

Origo very cobbly sandy loam, in an area of mapping unit 75, Origo very cobbly sandy loam, 35 to 65 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about 7 miles north of La Cueva on the north side of Cerro Seco, Baca Location No. 1; NAD 83, UTM 13—03 58 587 E—39 80 079 N.

0—0 to 1 inch; leaves, needles, twigs, and bark.

A1—1 inch to 5 inches; gray (10YR 5/1) very cobbly sandy loam, very dark gray (10YR 3/1) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; few coarse and many fine roots; 10 percent stones, 40 percent cobbles, and 5 percent gravel; slightly acid; clear smooth boundary.

A2—5 to 11 inches; light brownish gray (10YR 6/2) very cobbly sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium roots and common coarse roots; 10 percent stones, 40 percent cobbles, and 5 percent gravel; neutral; gradual smooth boundary.

E—11 to 31 inches; very pale brown (10YR 7/3) very cobbly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and nonplastic; many fine and common medium roots; 10 percent stones, 40 percent cobbles, and 5 percent gravel; neutral; gradual wavy boundary.

Bt1—31 to 55 inches; very pale brown (10YR 7/3) very cobbly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; (lamellae are 1/4 to 1 inch thick and comprise about 7 inches of the horizon; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 5/4) moist;) massive; slightly hard, friable, slightly sticky and slightly plastic; few coarse medium roots;) clay films on sand grains and clay bridging sand grains in
lamellae; 10 percent stones and 40 percent cobbles; very strongly acid; gradual wavy boundary.

Bt2—55 to 60 inches; white (10YR 8/2) very cobbly loamy sand, very pale brown (10YR 7/3) moist; massive; slightly hard, firm, nonsticky and nonplastic; (lamellae are 1/4 to 1 inch thick; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; clay films on sand grains and clay bridging sand grains;) few coarse and medium roots; 10 percent stones and 40 percent cobbles; very strongly acid.

Range in Characteristics

Particle-size control section: 5 to 20 percent clay

A horizon
Value: 5 or 6 dry, 3 to 5 moist
Chroma: 1 to 3

E horizon
Hue: 7.5YR or 10YR
Value: 7 or 8 dry, 5 to 7 moist
Chroma: 1 to 4
Texture: extremely cobbly sandy loam and very cobbly sandy loam

Bt horizon
Hue: 10YR or 7.5YR
Value: 5 to 8 dry, 5 to 7 moist
Chroma: 2 to 4
Texture: very cobbly loamy sand, very cobbly sandy loam, and extremely cobbly sandy loam
Depth to the Bt horizon: 18 to 34 inches

Bt lamellae
Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4
Texture: sandy loam and sandy clay loam

Orlie Series

Map units: 24, 26, 422
Depth class: very deep
Drainage class: well drained
Landform: dipslopes of cuestas, mesas, hills, and valley sides
Parent material: eolian material and fan alluvium derived from sandstone and shale
Elevation: 6,100 to 7,500 feet (1,859 to 2,286 meters)
Slope: 0 to 8 percent
Climatic data:
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
Frost-free period: 110 to 130 days
Taxonomic class: Fine-loamy, mixed, mesic Aridic Haplustalfs

Typical Pedon

Orlie loam, in an area of mapping unit 26, Orlie loam, 0 to 8 percent slopes; Sandoval County; Jarosa Quadrangle; 6 miles west of the continental divide along the boundary
of the Jicarilla Indian Reservation; 1,075 feet south and 700 feet west of the northeast corner of sec. 6, T. 21 N., R. 3 E. NAD 83, UTM 13—03 51 252 E—39 94 408 N.

A—0 to 2 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few coarse and common fine roots; moderately alkaline; clear smooth boundary.

Bt1—2 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bt2—13 to 22 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few thin clay films on faces of peds; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—22 to 36 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—36 to 50 inches; brown (7.5YR 5/4) clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C3—50 to 60 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine roots; slightly effervescent; moderate alkaline.

Range in Characteristics

Particle-size control section: 27 to 35 percent clay

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4
Texture: fine sandy loam or loam

Bt horizon

Hue: 5YR, 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: clay loam or silty clay loam

C or Bk horizons (when present)

Hue: 7.5YR or 10YR
Value: 4 or 6 dry, 3 or 5 moist
Chroma: 3 or 4 dry, 3 to 6 moist
Texture: sandy clay loam, clay loam, or silty clay loam

Osha Series

Map units: 500, 608
Depth class: deep
Drainage class: somewhat excessively drained
Landform: mountain slopes and ridges
Parent material: colluvium and residuum derived from granite
Elevation: 7,000 to 9,000 feet (2,134 to 2,743 meters)
Slope: 3 to 70 percent
Sandoval County Area, New Mexico

Climatic data:
Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
Frost-free period: 60 to 90 days

Taxonomic class: Loamy-skeletal, mixed Typic Haploborolls

Typical Pedon

Osha gravelly coarse sandy loam, in an area of mapping unit 608, Osha association, 3 to 55 percent slopes; Sandoval County; San Miquel Mountain Quadrangle; about 6 miles east and 2 miles south of Laventana; NAD 83, UTM 13—03 31 585 E—39 62 960 N.

A—0 to 3 inches; very dark gray (1OYR 3/1) gravelly coarse sandy loam, (10YR 2/1) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; common very fine tubular pores; 20 percent gravel; neutral; clear smooth boundary.

AB—3 to 8 inches; grayish brown (10YR 5/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and medium and few coarse roots; many very fine tubular pores; 20 percent gravel; slightly acid; clear smooth boundary.

Bw—8 to 16 inches; light brown (7.5YR 6/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/4) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and common medium roots; many very fine tubular pores; 20 percent gravel; neutral; clear smooth boundary.

Ct1—16 to 32 inches; strong brown (7.5YR 5/6) extremely gravelly coarse sandy loam, strong brown (7.5YR 4/6) moist; massive; weathered granite has retained the original shape and relative position of the altered minerals; fractures between mineral grains that are less than 1 inch apart; hard, firm, nonsticky and nonplastic; many very fine roots; common moderately thick clay films on mineral grains; 75 percent gravel; neutral; diffuse wavy boundary.

Ct2—32 to 60 inches; reddish yellow (7.5YR 6/6) extremely gravelly loamy coarse sand, strong brown (7.5YR 5/6) moist; massive; consolidated rock structure; weathered granite has retained the original shape and relative position of the altered minerals; fractures between mineral grains are 0.5 to 2.5 inches apart; hard, friable, nonsticky and nonplastic; common very fine roots; few moderately thick clay films on mineral grains; 80 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 6 to 12 percent clay
Depth to granite (lithic) contact: 40 to 60 inches, and deeper in some pedons

A horizon
Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 1 to 3
Texture: gravelly coarse sandy loam and very gravelly coarse sandy loam

B or C horizon
Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: gravelly coarse sandy loam, very gravelly coarse sandy loam, extremely gravelly coarse sandy loam, or extremely gravelly loamy coarse sand
**Palon Series**

*Map units: 71, 72*
*Depth class: very deep*
*Drainage class: well drained*
*Landform: mountain slopes*
*Parent material: slope alluvium and colluvium derived mainly of rhyolite*
*Elevation: 8,500 to 9,500 feet (2,591 to 2,896 meters)*
*Slope: 15 to 65 percent*
*Climatic data:*
  *Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)*
  *Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)*
  *Frost-free period: 60 to 90 days*
*Taxonomic class: Loamy-skeletal, mixed Psammentic Eutroboralfs*

**Typical Pedon**

Palon very cobbly sandy loam; 35 to 65 percent slopes, map unit 72; Sandoval County; Valle San Antonio Quadrangle; about 5 miles north of La Cueva on the south side of Cerro Seco, Baca Location No. 1; NAD 83, UTM 13—03 58 417 E—39 78 037 N.

O1—0 to 2 inches; leaves, needles, twigs, and bark.
A1—2 to 4 inches; dark gray (10YR 4/3) very cobbly sandy loam, very dark gray (10YR 3/1) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots and common medium roots; 10 percent stones, 30 percent cobbles, and 5 percent gravel; neutral; abrupt smooth boundary.
A2—4 to 10 inches; light brownish gray (10YR 6/2) extremely cobbly sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots and common medium roots; 20 percent stones, 40 percent cobbles, and 10 percent gravel; neutral; clear wavy boundary.
E—10 to 32 inches; light gray (10YR 7/2) extremely cobbly sandy loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many medium, common fine, and few coarse roots; 20 percent stones, 45 percent cobbles, and 5 percent gravel; neutral; abrupt wavy boundary.
Bt1—32 to 53 inches; pink (7.5YR 7/4) very cobbly sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; (lamellae are 1/4 to 1 inch thick; total thickness of lamellae is 6 inches or more; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; clay bridging sand grains;) few fine and medium roots; 15 percent stones, 35 percent cobbles, and 5 percent gravel; neutral; gradual wavy boundary.
Bt2—53 to 60 inches; pink (7.5YR 7/4) very cobbly sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; (lamellae are 1/4 to 1 inch thick; total thickness is 6 inches or more; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; clay bridging sand grains;) few fine roots; 10 percent stones, 30 percent cobbles, and 5 percent gravel; neutral.

**Range in Characteristics**

*Particle-size control section: 10 to 25 percent clay*
A horizon
  Value: 4 to 6 dry, 2 to 4 moist
  Chroma: 1 to 3
  Texture: cobbly sandy loam, very cobbly sandy loam, or extremely cobbly sandy loam

E horizon
  Hue: 7.5YR or 10YR
  Value: 6 to 8 dry, 4 to 7 moist
  Chroma: 2 to 6
  Texture: very cobbly sandy loam or extremely cobbly sandy loam

Bt horizon
  Hue: 7.5YR or 10YR
  Value: 4 to 7 dry, 3 to 5 moist
  Chroma: 2 to 6
  Texture: very cobbly sandy loam or extremely cobbly sandy loam

Pastura Series

Map unit: 262
Depth class: very shallow to shallow
Drainage class: well drained
Landform: sideslopes of hills and mesas
Parent material: residuum derived from limestone
Elevation: 5,400 to 5,800 feet (1,646 to 1,768 meters)
Slope: 1 to 4 percent

Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 140 to 150 days

Taxonomic class: Loamy, mixed, mesic, shallow Ustollic Paleorthids

Typical Pedon

Pastura loam, in an area of mapping unit 262, Pastura loam, 1 to 4 percent slopes; Sandoval County; San Felipe Mesa Quadrangle; about 4 miles northwest of Placitas and 100 feet east and 2,640 feet south of the northwest corner of sec. 20, T. 13 N., R. 1 W. NAD 83, UTM 13—03 20 663 E—39 12 515 N.

A—0 to 3 inches; light yellowish brown (10YR 8/4) loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; moderately alkaline; abrupt smooth boundary.

Bw—3 to 10 inches; light yellowish brown (10YR 8/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; 15 percent gravel; moderately alkaline; clear smooth boundary.

Bk—10 to 14 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and very fine roots; 15 percent gravel; moderately alkaline; abrupt wavy boundary.

Bkm—14 inches; indurated petrocalcic broken into plates 3 to 12 inches horizontally and 2 to 4 inches vertically.
Range in Characteristics

*Particle-size control section:* 18 to 35 percent clay  
*Depth to petrocalcic horizon:* 5 to 20 inches

A horizon
- **Hue:** 5YR to 10YR  
- **Value:** 4 to 7 dry, 3 to 5 moist  
- **Chroma:** 2 to 6

Bw horizon (or Bk horizon where present)
- **Hue:** 5YR to 10YR  
- **Value:** 4 to 7 dry, 4 to 6 moist  
- **Chroma:** 2 to 6

*Note:* A Bkm horizon, which consists of a series of strongly cemented to indurated petrocalcic horizons, may be present beneath the uppermost-indurated horizon. These layers range in thickness from 6 to 36 inches separated by gravelly and cobbly soil material.

**Pavo Series**

*Map unit:* 74  
*Depth class:* very deep  
*Drainage class:* well drained  
*Landform:* mountain slopes  
*Parent material:* colluvium derived mainly from tuff and pumice  
*Elevation:* 8,600 to 10,000 feet (2,621 to 3,048 meters)  
*Slope:* 5 to 20 percent  
*Climatic data:*  
- **Mean annual precipitation:** 25 to 30 inches (635 to 762 millimeters)  
- **Mean annual air temperature:** 38 to 42 degrees F. (3.3 to 5.6 degrees C.)  
- **Frost-free period:** 45 to 60 days  
*Taxonomic class:* Fine-loamy, mixed Cryic Paleborolls

**Typical Pedon**

Pavo loam, in an area of mapping unit 74, Origo-Pavo association, 5 to 35 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about 1 mile south of hot springs in the San Antonio Valley, Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 58 992 E—39 80 935 N.

A1—0 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly acid; clear wavy boundary.

A2—9 to 12 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; 5 percent cobbles and 5 percent gravel; neutral; clear wavy boundary.

E—12 to 25 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; 10 percent gravel; neutral; clear wavy boundary.

E/Bt1—25 to 35 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; (lamellae are .4 to .7 inch thick and total 1.5 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; slightly hard, friable, slightly
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sticky and slightly plastic; clay films on sand grains and clay bridges between grains in lamellae; 5 percent gravel; neutral; clear wavy boundary.

E/Bt2—35 to 45 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; (lamellae are about .5 inch thick and total about 5 inches yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; hard, friable, slightly sticky and slightly plastic; clay films on sand grains and clay bridges between grains in lamellae; 5 percent gravel; neutral; clear smooth boundary.

2Bt1—45 to 50 inches; brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; thick continuous clay films on coarse fragments; 30 percent gravel; slightly acid; clear smooth boundary.

3Bt2—50 to 60 inches; very pale brown (10YR 7/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; clay films on sand grains and clay bridges between grains; 9 percent cobbles and 5 percent gravel; neutral.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay
Argillic horizon: greater than 24 inches deep and composed mainly of lamellae thicker than 1 cm

A horizon
  Value: 4 or 5 dry, 2 or 3 moist
  Chroma: 2 or 3
  Texture: loam or sandy loam

E horizon
  Hue: 7.5YR or 10YR
  Value: 5 to 7 dry, 4 or 5 moist
  Chroma: 3 or 4
  Texture: sandy loam or fine sandy loam

Bt horizon
  Hue: 5YR to 10YR
  Value: 5 or 6 dry, 4 or 5 moist
  Chroma: 3 or 4
  Texture: sandy loam, fine sandy loam, or sandy clay loam

2 and 3Bt horizons
  Hue: 5YR to 10YR
  Value: 5 to 7 dry, 4 or 5 moist
  Chroma: 3 or 4
  Texture: gravelly clay loam or sandy loam

Penistaja Series

Map units: 68, 207, 240
Depth class: very deep
Drainage class: well drained
Landform: alluvial fans, bajadas, cuestas, hills, mesas, and plateaus
Parent material: eolian material and fan alluvium derived from sandstone and shale
Elevation: 5,400 to 6,400 feet (1,646 to 1,951 meters)
Slope: 1 to 7 percent
**Climatic data:**

- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

**Taxonomic class:** Fine-loamy, mixed, mesic Ustollic Haplargids

**Typical Pedon**

Penistaja loamy fine sand, in an area of mapping unit 68, Penistaja-Querencia complex, 2 to 7 percent slopes; Sandoval County; about 4 miles east of Marquez; 700 feet north and 2,100 feet west of the southeast corner of sec. 24, T. 12 N., R. 2 W.

- **A**—0 to 2 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; slightly alkaline; abrupt smooth boundary.
- **Bt**—2 to 15 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; common moderately thick clay films on faces of peds; slightly alkaline; clear smooth boundary.
- **Btk**—15 to 27 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few thin clay films on faces of peds; slightly effervescent; slightly alkaline; clear smooth boundary.
- **Bk**—27 to 38 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine roots; slightly effervescent; few fine calcium carbonate accumulations; moderately alkaline; gradual smooth boundary.
- **C**—38 to 60 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, sticky and plastic; slightly effervescent; slightly alkaline.

**Range in Characteristics**

**Particle-size control section:** 20 to 35 percent clay

- **A horizon**
  - **Hue:** 5YR to 10YR
  - **Value:** 4 to 6 dry, 3 to 5 moist
  - **Chroma:** 2 to 6
  - **Texture:** loamy fine sand, fine sandy loam, and very fine sandy loam

- **Bt horizon**
  - **Hue:** 5YR or 7.5YR
  - **Value:** 4 to 6 dry, 3 to 5 moist
  - **Chroma:** 3 to 6
  - **Texture:** sandy clay loam or clay loam

- **Bk and C horizons**
  - **Hue:** 5YR to 10YR
  - **Value:** 4 to 8 dry, 3 to 7 moist
  - **Chroma:** 3 to 6
  - **Texture:** loam, fine sandy loam, loam, or sandy clay loam

**Peralta Series**

**Map units:** 433, 434, 437, 835, 842

**Depth class:** very deep

**Drainage class:** somewhat poorly drained
Landform: flood plains
Parent material: stream alluvium derived from mixed sources
Elevation: 5,000 to 5,500 feet (1,524 to 1,676 meters)
Slope: 0 to 3 percent
Climatic data:
  Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
  Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
  Frost-free period: 140 to 160 days
Taxonomic class: Coarse-loamy, mixed, calcareous, mesic Typic Ustifluvents

Typical Pedon

Peralta loam, in an area of mapping unit 434, Peralta loam, 1 to 3 percent slopes; Sandoval County; Bernalillo Quadrangle; about 1.5 miles northwest of the Sandia Pueblo; 300 feet south and 1,980 feet east of the northwest corner of sec. 13, T. 12 N., R. 3 E. NAD 83, UTM 13—03 56 360 E—39 04 486 N.

Ap—0 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; hard, firm, sticky and slightly plastic; many fine and very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

C1—10 to 16 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 3/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—16 to 20 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; few fine faint brown (10YR 5/3) and few fine distinct brown (7.5YR 4/6) mottles; massive; very hard, firm, sticky and plastic; very fine roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3—20 to 28 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; few fine and prominent strong brown (7.5YR 5/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—28 to 40 inches; pale brown (10YR 6/3) loamy sand, dark yellowish brown (10YR 4/4) moist; massive; loose, nonsticky and nonplastic; few very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C5—40 to 45 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; common fine distinct yellowish red (5YR 4/6) mottles; massive; hard, firm, sticky and slightly plastic; violently effervescent; moderately alkaline; abrupt smooth boundary.

C6—45 to 60 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 3/4) moist; single grain; loose, nonsticky and nonplastic; strongly effervescent; slightly alkaline.

Range in Characteristics

Particle-size control section: less than 18 percent clay
Depth to redoximorphic features: 12 to 30 inches

A horizon
  Value: 5 or 6 dry, 3 to 5 moist
  Chroma: 3 or 4
  Texture: loam or clay loam
C horizon

*Hue:* 7.5YR or 10YR  
*Value:* 3 to 7 dry, 3 to 5 moist  
*Chroma:* 2 to 4  
*Texture:* stratified silt loam, clay loam, very fine sandy loam, coarse sand, loam, sandy clay loam, fine sandy loam, sandy loam, loamy fine sand, and loamy sand  
*Salinity:* EC of 4 to 16

**Pinavetes Series**

*Map units:* 120, 130, 213, 250, 420  
*Depth class:* very deep  
*Drainage class:* excessively drained  
*Landform:* dunes and valley sides  
*Parent material:* eolian sands derived from sandstone  
*Elevation:* 5,200 to 6,100 feet (1,585 to 1,859 meters)  
*Slope:* 0 to 35 percent  
*Climatic data:*  
  *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)  
  *Mean annual air temperature:* 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
  *Frost-free period:* 120 to 140 days  
*Taxonomic class:* Mixed, mesic Ustic Torriipsamments

**Typical Pedon**

Pinavetes loamy sand, in an area of mapping unit 120, Pinavetes loamy sand, 3 to 5 percent slopes; Sandoval County; Bernalillo NM Quadrangle; about 5 miles southeast of Zia Pueblo; 1,100 feet south and 1,525 feet east of the northwest corner of section 24, T. 14 N., R. 2 E. NAD 83, UTM 13—03 47 076 E—39 22 110 N.

A—0 to 10 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; many very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.  
C1—10 to 35 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.  
C2—35 to 60 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; 10 percent gravel; strongly effervescent; moderately alkaline.

**Range in Characteristics**

A horizon

*Value:* 4 to 6 dry, 3 to 5 moist  
*Chroma:* 3 or 4  
*Texture:* sand, loamy sand, or loamy fine sand

C horizon

*Value:* 5 or 6 dry, 4 or 5 moist  
*Chroma:* 3 to 6  
*Texture:* sand, fine sand, or loamy sand
Pinitos Series

Map unit: 206
Depth class: very deep
Drainage class: well drained
Landform: dipslopes of cuestas, hills, mesas, and fan terraces
Parent material: fan alluvium derived from sandstone and shale
Elevation: 7,000 to 7,600 feet (2,134 to 2,316 meters)
Slope: 1 to 15 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 49 to 51 degrees F. (9.5 to 10.5 degrees C.)
  Frost-free period: 100 to 120 days
Taxonomic class: Fine-loamy, mixed, mesic Aridic Haplustalfs

Typical Pedon

Pinitos loam, in an area of mapping unit 206, Pinitos loam, 1 to 15 percent slopes; Sandoval County; Regina Quadrangle; 1,500 feet south and 1,300 feet east of the northwest corner of sec. 33, T. 23 N., R. 1 W. NAD 83, UTM 13—03 24 475 E—40 05 845 N.

A—0 to 4 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and common fine roots; many very fine and fine pores; neutral; clear smooth boundary.

Bt1—4 to 10 inches; brown (7.5YR 4/4) clay loam, dark brown (10YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; few medium pores; many thick clay films on faces of peds; neutral; clear smooth boundary.

Bt2—10 to 27 inches; strong brown (7.5YR 5/6) clay loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common and medium moderately thick clay films on faces of peds; neutral; clear smooth boundary.

Btk—27 to 39 inches; strong brown (7.5YR 5/6) clay loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; many very fine and fine pores; few fine clay films on faces of peds; slightly effervescent; few fine accumulations of calcium carbonate; slightly alkaline; gradual smooth boundary.

C—39 to 60 inches; strong brown (7.5YR 5/6) clay loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, sticky and plastic; few fine and medium roots; slightly effervescent; slightly alkaline.

Range in Characteristics

Particle-size control section: 20 to 35 percent clay

A Horizon
  Hue: 7.5YR or 10YR
  Value: 5 or 6 dry, 3 or 4 moist
  Chroma: 3 or 4 moist

Bt Horizon
  Hue: 7.5YR or 10YR
  Value: 4 or 5 dry, 3 or 4 moist
  Chroma: 4 to 6 dry
Bk or C Horizons

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 4 to 6

Placitas Series

Map unit: 63
Depth class: moderately deep
Drainage class: well drained
Landform: fan terraces
Parent material: fan alluvium from conglomerate
Elevation: 5,700 to 6,300 feet (1,737 to 1,920 meters)
Slope: 8 to 40 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Loamy-skeletal, mixed, mesic Ustollic Calcicorthids

Typical Pedon

Placitas gravelly loam, in an area of mapping unit 63, Placitas gravelly loam, 8 to 40 percent slopes; Sandoval County; Placitas Quadrangle; about 2 miles northeast of Placitas; 400 feet north and 200 feet west of the southeast corner of sec. 21, T. 13 N., R. 5 E. NAD 83, UTM 13—03 71 988 E—39 10 875N.
A—0 to 5 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and few very fine roots; 30 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
Bw—5 to 10 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; 40 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.
Bk—10 to 27 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; 55 percent gravel; violently effervescent; many seams and filaments of calcium carbonate; moderately alkaline; clear smooth boundary.
R—27 inches; conglomerate.

Range in Characteristics

Particle-size control section: 10 to 18 percent clay
Depth to lithic contact: 20 to 40 inches

A horizon
Hue: 10YR to 5YR
Value: 4 or 5 moist
Chroma: 2 to 4

B horizon
Hue: 7.5YR or 10YR
Value: 6 or 7 dry, 4 or 5 moist
Chroma: 3 or 4
**Poley Series**

**Map units:** 67  
**Depth class:** very deep  
**Drainage class:** well drained  
**Landform:** sideslopes of fan terraces  
**Parent material:** colluvium derived from shale and sandstone  
**Elevation:** 6,000 to 7,000 feet (1,829 to 2,134 meters)  
**Slope:** 3 to 30 percent  
**Climatic data:**  
  - Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)  
  - Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
  - Frost-free period: 120 to 140 days  
**Taxonomic class:** Fine, mixed, mesic Ustollic Haplargids

**Typical Pedon**

Poley very cobbly loam in an area of mapping unit 67, Sandoval-Poley complex, 3 to 30 percent slopes; Sandoval County; Cerro Tinaja Quadrangle; about 1 mile northeast of Cerro de Nuestra Senora; NAD 83, UTM 13—03 03 752 E—39 19 661 N.

A—0 to 3 inches; brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 4/4) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; 25 percent cobbles and 30 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bt1—3 to 12 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard friable, sticky and plastic; many very fine roots; few very fine tubular pores; few fine clay films on faces of peds; 10 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bt2—12 to 17 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; few very fine tubular pores; common thin, faint clay skins on faces of peds; slightly effervescent; slightly alkaline; clear smooth boundary.

Btk—17 to 21 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and plastic; few very fine roots; few very fine tubular pores; few thin, faint clay skins on faces of peds; 10 percent gravel; violently effervescent; with common medium irregularly shaped seams and filaments of segregated calcium carbonate; moderately alkaline; gradual smooth boundary.

Bk1—21 to 40 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and plastic; few very fine roots; few very fine tubular pores; 2 percent cobbles and 10 percent gravel; violently effervescent; many fine irregularly shaped filaments of segregated calcium carbonate; moderately alkaline; gradual smooth boundary.

Bk2—40 to 60 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; loose, nonsticky and nonplastic; few very fine roots; 40 percent gravel; violently effervescent; many fine irregularly shaped filaments of segregated calcium carbonate; slightly alkaline.

**Range in Characteristics**

**Particle-size control section:** 30 to 55 percent clay  
**Depth to calcic horizon:** 20 to 40 inches
A horizon
  *Hue:* 5YR, 7.5YR
  *Value:* 3 to 6 dry, 3 to 5 moist
  *Chroma:* 4 to 6 dry, 3 to 5 moist

Bt horizon
  *Hue:* 2.5YR, 5YR, 7.5YR
  *Value:* 4, 5 or 6 dry, 3, 4 or 5 moist
  *Chroma:* 3 to 8, dry or moist

Bk horizon
  *Hue:* 5YR, 7.5YR, 10YR
  *Value:* 5 to 8 dry, 4 to 8 moist
  *Chroma:* 1 to 6, dry or moist

**Prieta Series**

*Map units:* 2, 16  
*Depth class:* shallow  
*Drainage class:* well drained  
*Landform:* lava flows and mesas  
*Parent material:* eolian material and slope alluvium derived from basalt  
*Elevation:* 5,600 to 7,300 feet (1,707 to 2,225 meters)  
*Slopes:* 3 to 15 percent  
*Climatic data:*  
  *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)  
  *Mean annual air temperature:* 52 to 54 degrees F. (11.1 to 12.2 degrees C.)  
  *Frost-free period:* 120 to 140 days  
*Taxonomic class:* Clayey-skeletal, mixed, mesic Lithic Ustollic Haplargids  

**Typical Pedon**

Prieta very stony loam, in an area of mapping unit 2, Clovis-Prieta-Silver association,  
3 to 15 percent slopes; Sandoval County; Casa Salazar Quadrangle; on Prieta Mesa,  
580 feet east and 2,600 feet north of the southwest corner of sec. 15, T. 14 N., R. 2 W.  
NAD 83, UTM 13—03 14 613 E—39 23 855 N.

A—0 to 3 inches; brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) moist;  
weak fine granular structure; slightly hard, friable, slightly sticky and slightly  
plastic; many fine and very fine roots; 40 percent stones and 10 percent gravel;  
neutral; clear smooth boundary

Bt1—3 to 10 inches; brown (7.5YR 5/4) very stony clay loam, dark brown (7.5YR 4/4)  
moist; moderate fine subangular blocky structure; hard, firm, very sticky and very  
plastic; common fine and very fine roots; thin continuous clay films on faces of  
peds; 40 percent stones and 10 percent gravel; slightly alkaline; gradual smooth  
boundary.

Bt2—10 to 14 inches; brown (7.5YR 5/4) very stony clay loam, dark brown (7.5YR 4/4)  
moist; moderate medium subangular blocky structure; hard, firm, sticky and  
plastic; common fine and very fine roots; thin continuous clay films on faces of  
peds; 25 percent stones and 10 percent gravel; moderately alkaline; clear smooth  
boundary.

Bk—14 to 19 inches; very pale brown (10YR 7/3) very stony clay loam, brown (10YR  
5/3) moist; massive; slightly hard, friable, sticky and plastic; few fine roots; 40  
percent stones and 10 percent gravel; common fine filaments of calcium  
carbonate; moderately alkaline; abrupt smooth boundary.

R—19 inches; basalt.
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Range in Characteristics

Particle-size control section: 35 to 50 percent clay
Depth to basalt: 10 to 20 inches

A horizon
Hue: 10YR or 7.5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 2 to 4
Texture: very stony loam or stony silt loam

Bt horizon
Hue: 10YR or 7.5YR
Value: 4 or 6 dry, 3 or 5 moist
Chroma: 2 to 4

Bk horizon
Hue: 10YR or 7.5YR
Value: 4 to 7 dry, 3 or 6 moist
Chroma: 2 to 4

Querencia Series

Map units: 13, 68, 231, 234
Depth class: very deep
Drainage class: well drained
Landform: alluvial fans, stream terraces, and valley sides
Parent material: fan alluvium and colluvium derived from sandstone and shale
Elevation: 5,700 to 6,900 feet (1,737 to 2,103 meters)
Slope: 1 to 8 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Fine-loamy, mixed, mesic Ustollic Camborthids

Typical Pedon

Querencia sandy clay loam, in an area of mapping unit 13, Sandoval-Querencia association, 2 to 7 percent slopes; Sandoval County; Sky Village NW Quadrangle; about 3/4 mile southeast of Trujillo Tank, Alamo Ranch; 1,100 feet south and 1,500 feet west of the northeast corner of sec. 4, T. 13 N., R. 1 W. NAD 83, UTM 13—03 23 504 E—39 17 713 N.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common coarse, many fine and very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bw1—4 to 12 inches; light yellowish brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine and very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw2—12 to 24 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine and very fine roots; slightly effervescent; moderately alkaline; gradual smooth boundary.
Bk—24 to 60 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and very fine roots; slightly effervescent; calcium carbonate as few fine irregular masses; moderately alkaline; gradual smooth boundary.

**Range in Characteristics**

*Calcium carbonate equivalent:* less than 15 percent, calcareous in all parts
*Content of rock fragments:* 0 to 10 percent gravel
*Reaction:* slightly alkaline to moderately alkaline

**A horizon**
- **Hue:** 2.5Y or 10YR;
- **Value:** 5 or 6 dry, 4 or 5 moist
- **Chroma:** 2 to 4
- **Texture:** fine sandy loam, loam, or sandy clay loam

**Bw horizon**
- **Hue:** 2.5Y or 10YR;
- **Value:** 4 to 7 dry, 4 or 5 moist
- **Chroma:** 2 to 6
- **Texture:** loam, sandy clay loam, or clay

**Bk horizon**
- **Hue:** 2.5Y or 10YR
- **Value:** 4 to 7 dry, 4 or 5 moist
- **Chroma:** 2 to 6
- **Texture:** fine sandy loam and loam

**Redondo Series**

**Map units:** 85, 86, 87
**Depth class:** very deep
**Drainage class:** well drained
**Landform:** mountain slopes
**Parent material:** colluvium derived from tuff
**Elevation:** 8,700 to 11,000 feet (2,652 to 3,353 meters)
**Slope:** 15 to 80 percent

**Climatic data:**
- **Mean annual precipitation:** 25 to 30 inches (635 to 762 millimeters)
- **Mean annual air temperature:** 38 to 42 degrees F. (3.3 to 5.6 degrees C.)
- **Frost-free period:** 45 to 60 days

**Taxonomic class:** Loamy-skeletal, mixed Typic Cryoboralfs

**Typical Pedon**

Redondo coarse sandy loam, in an area of mapping unit 85, Redondo coarse sandy loam; 15 to 35 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about 3 miles northwest of Baca Location No. 1 Headquarters; unsectionized; NAD 83, UTM 13—03 63 260 E—39 72 828 N.

A—0 to 2 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few medium roots; slightly acid; clear smooth boundary.
E1—2 to 7 inches; light brownish gray (10YR 6/2) coarse sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium platy and weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and few medium roots; few thin silt coatings on faces of peds; slightly acid; clear smooth boundary.

E2—7 to 15 inches; light gray (10YR 7/2) coarse sandy loam, brown (10YR 5/3) moist; weak medium platy and weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few medium roots; very few very thin silt coating on faces of peds; 1 percent cobbles and 2 percent gravel; medium acid; clear wavy boundary.

BE—15 to 22 inches; pink (7.5YR 7/4) coarse sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few thin silt coatings on faces of peds; 3 percent gravel; medium acid; clear wavy boundary.

Bt1—22 to 29 inches; light gray (10YR 7/2) gravelly coarse sandy loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common moderately thick clay films on faces of peds; 25 percent gravel; medium acid; gradual wavy boundary.

Bt2—29 to 38 inches; light brown (7.5YR 6/4) very gravelly coarse sandy loam, brown (7.5YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine medium and coarse roots; common moderately thick clay films on rock fragments and bridging sand grains; 5 percent stones, 10 percent cobbles and 30 percent gravel; medium acid; diffuse wavy boundary.

Bt3—38 to 54 inches; light brown (7.5YR 6/4) extremely gravelly coarse sandy loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few and medium roots; common moderately thick clay films on rock fragments and bridging sand grains; 10 percent stones, 10 percent cobbles, and 60 percent gravel; medium acid; diffuse wavy boundary.

Bt4—54 to 60 inches; light brown (7.5YR 6/4) extremely cobbly coarse sandy loam, brown (7.5YR 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few medium roots; few moderately thick clay films on rock fragments and bridging sand grains; 15 percent stones, 25 percent cobbles, and 50 percent gravel; medium acid; diffuse wavy boundary.

Range in Characteristics

Particle-size control section: 10 to 18 percent clay

A horizon
- Hue: 7.5YR or 10YR
- Value: 5 to 7 dry, 3 to 5 moist
- Chroma: 2 or 3, dry or moist
- Texture: cobbly coarse sandy loam, coarse sandy loam, and cobbly loam

E horizon
- Hue: 7.5YR or 10YR
- Value: 6 to 8 dry, 4 to 6 moist
- Chroma: 1 to 4, dry or moist
- Texture: coarse sandy loam, very cobbly coarse sandy loam, or extremely cobbly coarse sandy loam
B horizon

Hue: 7.5YR or 10YR
Value: 4 to 8 dry, 4 or 5 moist
Chroma: 2 to 4, dry or moist
Texture: gravelly coarse sandy loam, very gravelly coarse sandy loam, very cobbly coarse sandy loam, or extremely cobbly coarse sandy loam

Royosa Series

Map units: 312, 314, 321
Depth class: very deep
Drainage class: somewhat excessively drained and excessively drained
Landform: dunes
Parent material: eolian sands derived from sandstone
Elevation: 5,600 to 6,700 feet (1,707 to 2,042 meters)
Slope: 1 to 8 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days
Taxonomic class: Mixed, mesic Typic Ustipsamments

Typical Pedon

Royosa sand, in an area of mapping unit 312, Royosa sand, 1 to 8 percent slopes; Sandoval County; Jemez Pueblo Quadrangle; about 4 miles north of the Zia Pueblo; 2,550 feet east and 2,000 feet north of the southwest corner of sec. 32, T. 16 N., R. 3 E. NAD 83, UTM 13—03 50 811 E—39 37 468 N.

A—0 to 5 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; slightly alkaline; clear smooth boundary.
C1—5 to 16 inches; brown (7.5YR 5/4) sand, brown (7.5YR 4/4) moist; single grain; loose, nonsticky and nonplastic; common medium and coarse roots; slightly alkaline; gradual smooth boundary.
C2—16 to 60 inches; brownish yellow (10YR 6/6) loamy sand, yellowish brown (10YR 5/6) moist; single grain; loose, nonsticky and nonplastic; slightly alkaline.

Range in Characteristics

Reaction: neutral to moderately alkaline

A horizon

Hue: 10YR to 5YR
Value: 5 to 7 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: sand or fine sand

C horizon

Hue: 10YR to 5YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 3 to 6
Texture: sand, fine sand, or loamy sand
Saido Series

Map unit: 110
Depth class: very deep
Drainage class: well drained
Landform: cuestas, fans, mesas, and knolls
Parent material: slope alluvium derived from silty gypsiferous material
Elevation: 5,300 to 6,000 feet (1,615 to 1,829 meters)
Slope: 5 to 40 percent
Climatic data:
  Mean annual precipitation: 10 to 12 inches (254 to 305 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Coarse-silty, gypsic, mesic Typic Gypsiorthids

Typical Pedon

Saido silt loam, in an area of mapping unit 110, Rock outcrop-Saido complex, 5 to 40 percent slopes; Sandoval County: San Ysidro Quadrangle; on the gypsum mine haul road about 2 miles south of San Ysidro; 1,500 feet north and 1,800 feet east of the southwest corner of sec. 13, T. 15 N., R. 1 E. NAD 83, UTM 13—03 37 730 E.—39 32 751 N.

A—0 to 5 inches; very pale brown (10YR 8/3) silt loam, pink (7.5YR 7/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few fine and coarse roots; common fine interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.

By1—5 to 9 inches; white (10YR 8/2) silt loam, very pale brown (10YR 7/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and coarse roots; common fine tubular pores; many medium masses of gypsum crystals; violently effervescent; moderately alkaline; clear smooth boundary.

By2—9 to 15 inches; white (10YR 8/2) silt loam, white (10YR 8/2) moist; massive; soft, very friable, nonsticky and nonplastic; many medium masses of gypsum crystals; violently effervescent; moderately alkaline; clear smooth boundary.

By3—15 to 25 inches; white (10YR 8/2) silt loam, white (10YR 8/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many medium masses of gypsum crystals; violently effervescent; moderately alkaline; clear smooth boundary.

C—25 to 60 inches; pink (7.5YR 8/4) loam, pink (7.5YR 7/4) moist; massive; soft, very friable, nonsticky and nonplastic; few medium masses of gypsum crystals; violently effervescent; moderately alkaline.

Range in Characteristics

Depth to gypsic horizon: 2 to 5 inches

A horizon
  Hue: 5YR, 7.5YR, or 10YR
  Value: 5 to 8 dry, 4 to 7 moist
  Chroma: 3 or 4

B and C horizons
  Hue: 7.5YR or 10YR
  Value: 6 to 8 dry, 5 to 7 moist
  Chroma: 1 to 4
San Mateo Series

Map units: 114, 170
Depth class: very deep
Drainage class: well drained
Landform: flood plains, alluvial fans, and valley sides
Parent material: stream alluvium from mixed sources
Elevation: 5,500 to 6,300 feet (1,676 to 2,073 meters)
Slope: 0 to 3 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Fine-loamy, mixed, calcareous, mesic Ustic Torrifluvents

Typical Pedon

San Mateo loam, in an area of mapping unit 170, San Mateo loam, 0 to 3 percent slopes; Sandoval County; San Ysidro Quadrangle; about 5 miles southwest of San Ysidro; 200 feet south and 1,500 feet east of the center of sec. 27, T. 15 N., R. 1 E. NAD 83, UTM 13—03 35 171 E—39 29 854 N.

A—0 to 2 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common medium and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—2 to 10 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) moist; massive; soft, friable, slightly sticky and slightly plastic; common medium and very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C2—10 to 23 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; slightly hard, firm, sticky and plastic; common fine and very fine roots; few medium roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C3—23 to 32 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, firm, sticky and plastic; few fine and very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—32 to 54 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, firm, sticky and plastic; few very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C5—54 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, firm, sticky and plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon
  Hue: 10YR or 2.5Y
  Value: 5 or 6 dry, 3 to 5 moist
  Chroma: 2 to 6 dry and moist
  Texture: sandy loam and loam
C horizon

Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5, moist
Chroma: 2 to 6
Texture: stratified sandy loam, loam, silty clay loam, and clay loam
Sodicity: SAR of 5 to 30

**Sandoval Series**

*Map units*: 13, 15, 67, 230, 235
*Depth class*: shallow
*Drainage class*: well drained
*Landform*: hills and ridges
*Parent material*: slope alluvium derived from shale
*Elevation*: 5,800 to 7,000 feet (1,768 to 2,134 meters)
*Slope*: 1 to 30 percent
*Climatic data*:
- *Mean annual precipitation*: 10 to 13 inches (254 to 330 millimeters)
- *Mean annual air temperature*: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- *Frost-free period*: 120 to 140 days

*Taxonomic class*: Loamy, mixed, calcareous, mesic, shallow Ustic Torriorthents

**Typical Pedon**

Sandoval fine sandy loam, in an area of mapping unit 13, Sandoval-Querencia association, 2 to 7 percent slopes; Sandoval County; Sky Village NW Quadrangle; about 5 miles south of the Alamo Ranch headquarters; 1,100 feet south and 2,700 feet east of the northwest corner of sec. 4, T. 13 N., R. 1 W. NAD 83, UTM 13—03 23 157 E—39 17 735 N.

A1—0 to 2 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly effervescent; strongly alkaline; abrupt smooth boundary.

A2—2 to 6 inches; light gray (2.5YR 7/2) clay loam, light olive brown (2.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—6 to 10 inches; light brownish gray (2.5YR 6/2) clay loam, grayish brown (2.5YR 5/2) moist; massive; hard, firm, sticky and plastic; common fine and very fine and few medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—10 to 15 inches; light brownish gray (2.5YR 6/2) clay loam, dark grayish brown (2.5YR 4/2) moist; massive; hard, firm, sticky and plastic; few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Cr—15 inches; soft calcareous shale.

**Range in Characteristics**

*Particle-size control section*: 18 to 35 percent clay
*Content of gypsum*: 5 to 10 percent
*Salinity*: EC of 2 to 4
*Sodicity*: SAR of 8 to 13
*Depth to paralithic contact*: 10 to 20 inches
A horizon
   
   Hue: 10YR or 2.5Y
   Value: 5 to 7 dry, 4 or 5 moist
   Chroma: 2 to 6
   Texture: loam, clay loam, and fine sandy loam

C horizon
   
   Hue: 2.5Y or 5Y
   Value: 5 to 7 dry, 4 or 5 moist
   Chroma: 2 to 4

Santa Fe Series

Map units: 409, 419
Depth class: very shallow to shallow
Drainage class: well drained
Landform: mountain slopes
Parent material: slope alluvium and residuum derived from granite
Elevation: 6,400 to 8,400 feet (1,951 to 2,560 meters)
Slope: 15 to 70 percent
Climatic data:
   Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
   Mean annual air temperature: 48 to 52 degrees F. (10 to 11.1 degrees C.)
   Frost-free period: 110 to 130 days

Taxonomic class: Loamy-skeletal, mixed, mesic Lithic Argiustolls

Typical Pedon

Santa Fe very gravelly sandy loam, in an area of mapping unit 409, Santa Fe very gravelly sandy loam, 15 to 40 percent slopes; Sandoval County; Gilman Quadrangle; about 8 miles west of the Jemez Pueblo; 1,300 feet north and 350 feet west of the SE corner of sec. 8, T. 16 N., R. 1 E. NAD 83, UTM 13—32 465 E—39 44 119 N

A—0 to 3 inches; dark reddish gray (5YR 4/2) very gravelly sandy loam, dark reddish brown (5YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine roots; common very fine tubular pores; 2 percent stones, 3 percent cobbles and 40 percent gravel; neutral; clear smooth boundary.

Bt—3 to 8 inches; weak red (2.5YR 4/2) very gravelly sandy clay loam, dusky red (2.5YR 3/2) moist; strong fine angular block structure; slightly hard, firm, sticky and plastic, common very fine roots, many very fine tubular pores, 10 percent cobbles and 35 percent gravel; many thin clay films on faces of peds; neutral, clear smooth boundary.

2R—8 inches; granite.

Range in Characteristics

Particle-size control section: 20 to 35 percent clay
Depth to bedrock: 8 to 20 inches

A horizon
   
   Hue: 5YR to 10YR
   Value: 3 to 5 dry, 2 or 3 moist
   Chroma: 2 or 3
   Texture: gravelly sandy loam or extremely cobbly coarse sandy loam
Sandoval County Area, New Mexico

Bt horizon

- **Hue:** 2.5YR to 7.5YR
- **Value:** 3 to 5 dry, 2 or 3 moist
- **Chroma:** 2 or 3

**Sedgran Series**

- **Map unit:** 201
- **Depth class:** very shallow to shallow
- **Drainage class:** excessively drained
- **Landform:** mountain slopes
- **Parent material:** colluvium derived from granite and sandstone
- **Elevation:** 5,800 to 8,000 feet (1,768 to 2,438 meters)
- **Slope:** 25 to 55 percent
- **Climatic data:**
  - **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
  - **Mean annual air temperature:** 52 to 54 degrees F (11.1 to 12.2 degrees C.)
  - **Frost-free period:** 120 to 140 days
- **Taxonomic class:** Sandy-skeletal, mixed, mesic Lithic Ustic Torriorthents

**Typical Pedon**

Sedgran extremely gravelly loamy coarse sand, in an area of mapping unit 201, Rock outcrop-Sedgran association, 25 to 55 percent slopes; Sandoval County; Alameda Quadrangle; about 3 1/4 miles east of Interstate Highway 25 and 1/8 miles north of the Sandoval-Bernalillo county line on the Sandia Pueblo Indian Reservation; 1,300 feet east and 450 of north of the southwest corner of sec. 34, T. 12 N., R. 4 E. NAD 83, UTM 13—03 62 490 E—38 98 152 N.

A—0 to 4 inches; yellowish brown (10YR 5/4) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 3/4) moist; moderate medium granular structure; loose, very friable, nonsticky and nonplastic; many fine roots; 20 percent cobbles and 45 percent gravel; neutral; clear wavy boundary.

C—4 to 13 inches; reddish yellow (7.5YR 6/6) and yellowish brown (7.5YR 5/4) very gravelly loamy coarse sand, brownish yellow (7.5YR 5/6) and dark yellowish brown (7.5YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 5 percent cobbles and 40 percent gravel; slightly alkaline; diffuse wavy boundary.

2R—13 inches; granite bedrock.

**Range in Characteristics**

- **Particle-size control section:** 5 to 10 percent clay
- **Depth to lithic contact:** 6 to 20 inches

**A horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 3 to 6

**C horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 4 to 6
**Sedillo Series**

*Map units: 200, 208*
*Depth class: very deep*
*Drainage class: well drained*
*Landform: bajadas, fan terraces, and stream terraces*
*Parent material: gravelly fan alluvium derived from mixed sources*
*Elevation: 5,100 to 6,500 feet (1,554 to 1,981 meters)*
*Slope: 5 to 55 percent*
*Climatic data:*
  *Mean annual precipitation:* 10 to 13 inches (254 to 330 millimeters)
  *Mean annual air temperature:* 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  *Frost-free period:* 120 to 140 days

*Taxonomic class: Loamy-skeletal, mixed, mesic Ustollic Haplargids*

**Typical Pedon**

Sedillo very gravelly fine sandy loam, in an area of mapping unit 208, Sedillo very gravelly fine sandy loam, 25 to 55 percent slopes; Sandoval County; San Felipe Pueblo Quadrangle; about one mile southeast of the San Felipe Pueblo, about 2000 feet south and 300 feet west of NE corner of sec. 29, T. 14 N., R. 5 E. NAD 83, UTM 13—03 70 512 E—39 19 951 N.

A—0 to 2 inches; brown (10YR 4/3) very gravelly fine sandy loam, dark brown (10YR 3/3) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots, 55 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bt—2 to 8 inches; brown (10YR 4/3) very gravelly sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; few thin clay films on faces of peds; 50 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—8 to 12 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 50 percent gravel; slightly effervescent; few coatings on undersides of rock fragments of calcium carbonate; slightly alkaline; gradual smooth boundary.

Bk2—12 to 60 inches; very pale brown (10YR 8/3) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; 60 percent gravel; violently effervescent; undersides of rock fragments coated with calcium carbonate; slightly alkaline.

**Range in Characteristics**

*Particle-size control section: 20 to 35 percent clay*

A horizon
  *Hue: 5YR to 10YR*
  *Value: 4 to 6 dry, 3 to 5 moist*
  *Chroma: 3 or 4*
  *Texture: very cobbly sandy loam and very gravelly fine sandy loam*
Bt horizon

- **Hue:** 10YR to 5YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 3 to 6

Bk horizon

- **Hue:** 5YR to 10YR
- **Value:** 5 to 8 dry, 3 to 7 moist
- **Chroma:** 2 to 6

**Textura:** extremely gravelly coarse sandy loam, very gravelly sandy loam, and extremely gravelly sandy loam

**Sedmar Series**

- **Map unit:** 146
- **Depth class:** very shallow to shallow
- **Drainage class:** excessively drained
- **Landform:** dipslopes of cuestas and ridges
- **Parent material:** slope alluvium and residuum derived from sandstone
- **Elevation:** 7,000 to 8,000 feet (2,134 to 2,438 meters)
- **Slope:** 1 to 15 percent
- **Climatic data:**
  - **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
  - **Mean annual air temperature:** 42 to 45 degrees F (5.6 to 7.2 degrees C.)
  - **Frost-free period:** 60 to 90 days

**Taxonomic class:** Sandy, mixed, frigid Lithic Ustorthents

**Typical Pedon**

Sedmar loamy sand, in an area of mapping unit 146, Sedmar loamy sand, 1 to 15 percent slopes; Sandoval County; Cuba Quadrangle; about 1 mile north of Cuba; 2,600 feet south and 200 feet west of the northeast corner of sec. 17, T. 21 N., R. 1 W. NAD 83, UTM 13—03 23 734 E—39 91 047 N.

**A**—0 to 3 inches; light yellowish brown (10YR 6/4) loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; neutral; abrupt smooth boundary.

**C1**—3 to 13 inches; brownish yellow (10YR 6/6) and brown (10YR 5/3) sandy loam, brown (10YR 4/3) and yellowish brown (10YR 5/6) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few common distinct yellowish brown (10YR 5/8) iron stains; neutral; clear smooth boundary.

**C2**—13 to 18 inches; brownish yellow (10YR 6/6) loamy sand, brownish yellow (10YR 6/6) moist; single grain; loose, nonsticky and nonplastic; neutral; abrupt smooth boundary.

**2R**—18 inches; sandstone.

**Range in Characteristics**

- **Particle-size control section:** 5 to 15 percent clay
- **Depth to lithic contact:** 6 to 20 inches

**A** and **C** horizons

- **Value:** 5 to 7 dry, 4 to 6 moist
- **Chroma:** 3 to 6

**Texture:** loamy sand stratified with layers of sandy loam
**Sheppard Series**

*Map units:* 145, 183, 191  
*Depth class:* very deep  
*Drainage class:* somewhat excessively drained  
*Landform:* dunes, alluvial fans, benches, structural benches, terraces, and stream terraces  
*Parent material:* eolian sands derived from sandstone  
*Elevation:* 5,000 to 6,000 feet (1,524 to 1,829 meters)  
*Slope:* 1 to 40 percent  
*Climatic data:*  
  - *Mean annual precipitation:* 8 to 10 inches (203 to 254 millimeters)  
  - *Mean annual air temperature:* 53 to 55 degrees F. (11.7 to 12.8 degrees C.)  
  - *Frost-free period:* 140 to 160 days  
*Taxonomic class:* Mixed, mesic Typic Torripsamments  

**Typical Pedon**

Sheppard loamy fine sand, in an area of mapping unit 191, Sheppard loamy fine sand, 3 to 8 percent slopes; Sandoval County; Bernalillo Quadrangle; unsectionized; NAD 83, UTM 13—03 55 559 E—39 06 478 N.

A—0 to 3 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—3 to 27 inches; strong brown (7.5YR 5/6) loamy fine sand, brown (7.5YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few fine and medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—27 to 60 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) moist; single grain; loose, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

**Range in Characteristics**

*Particle-size control section:* 3 to 10 percent clay  

A horizon  
  - *Value:* 5 or 6 dry, 4 or 5 moist  
  - *Chroma:* 3 or 4

C horizon  
  - *Hue:* 2.5YR to 7.5YR  
  - *Value:* 5 to 7 (4 to 6 moist)  
  - *Chroma:* 3 to 6  
  - *Texture:* loamy fine sand, sand, or loamy sand

**Silver Series**

*Map units:* 1, 2  
*Depth class:* very deep  
*Drainage class:* well drained  
*Landform:* mesas, fan terraces, hills, and plateaus  
*Parent material:* eolian material and slope alluvium derived from shale and sandstone  
*Elevation:* 5,600 to 7,300 feet (1,707 to 2,225 meters)  
*Slope:* 1 to 8 percent
Climatic data:

- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

Taxonomic class: Fine, mixed, mesic Ustollic Haplargids

**Typical Pedon**

Silver loam, in an area of mapping unit 1, Silver-Clovis loams, 1 to 7 percent slopes; Sandoval County; Casa Salazar Quadrangle; on Mesa Prieta; 1,300 feet north and 150 feet east of the center of sec. 9, T. 14 N., R. 2 W. NAD 83, UTM 13—03 13 700 E—39 25 879 N.

A—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak thick platy structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; common fine and very fine roots; neutral; clear smooth boundary.

Bt1—4 to 8 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bt2—8 to 20 inches; brown (7.5YR 5/2) silty clay loam, brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common fine and very fine roots; few thin clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bt3—20 to 39 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; few fine and very fine roots; many thick clay films on faces of peds; slightly alkaline; clear smooth boundary.

C—39 to 60 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, very sticky and very plastic; slightly alkaline.

**Range in Characteristics**

*Particle-size control section:* 35 to 50 percent clay

**A horizon**

- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 2 to 4

**Bt and Btk horizons**

- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 7 dry, 3 to 6 moist
- **Chroma:** 2 to 4
- **Texture:** clay loam or silty clay loam

**Bk and C horizons (where present)**

- **Hue:** 7.5YR or 10YR
- **Value:** 6 to 8 dry, 5 to 7 moist
- **Chroma:** 2 to 4
- **Texture:** clay loam and silty clay loam

**Skyvillage Series**

*Map units:* 64, 190, 230

*Depth class:* very shallow to shallow

*Drainage class:* well drained
Landform: breaks, structural benches, dipslopes of cuestas, summits of mesas and hills, and ridges
Parent material: slope alluvium derived from sandstone
Elevation: 5,800 to 6,400 feet (1,768 to 1,951 meters)
Slope: 3 to 40 percent
Climatic data:
- Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
- Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- Frost-free period: 120 to 140 days
Taxonomic class: Loamy, mixed, calcareous, mesic Lithic Ustic Torriorthents

Typical Pedon
Skyvillage fine sandy loam, in an area of mapping unit 190, Zia-Skyvillage-Rock outcrop complex, 5 to 40 percent slopes; Sandoval County; Sky Village NW Quadrangle; about 6 miles northeast of the Alamo Ranch headquarters; 700 feet north and 600 feet east of the center of sec. 22, T. 14 N., R. 1 W. NAD 83, UTM 13—05 25 078 E—39 22 260 N.

A—0 to 2 inches; pale yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—2 to 11 inches; light gray (2.5Y 7/2) fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly effervescent; moderately alkaline; clear wavy boundary.

C2—11 to 16 inches; light gray (2.5Y 7/2) fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; 10 percent gravel; slightly effervescent; slightly alkaline.

2R—16 inches; sandstone.

Range in Characteristics
Particle-size control section: 10 to 27 percent clay
Depth to bedrock: 6 to 20 inches

A and C horizons
- Hue: 2.5Y to 7.5YR
- Value: 5 to 7 dry, 4 or 5 moist
- Chroma: 2 to 6
- Texture: sandy loam or fine sandy loam

Sparank Series
Map units: 236, 237
Depth class: very deep
Drainage class: well drained
Landform: stream terraces, alluvial fans, valley sides, and flood plains
Parent material: stream alluvium derived from sandstone and shale
Elevation: 5,500 to 6,400 feet (1,676 to 1,951 meters)
Slope: 0 to 3 percent
Climatic data:
- Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
- Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- Frost-free period: 120 to 140 days
Taxonomic class: Fine, mixed, calcareous, mesic Ustic Torrifluvents

Typical Pedon

Sparank clay loam, in an area of mapping unit 236, Sparank clay loam, moderately saline, sodic, 0 to 1 percent slopes; Sandoval County; Holy Ghost Spring Quadrangle; about 3 miles northeast of San Luis; unsectionized; NAD 83, UTM 13—03 19 302 E—39 55 938 N.

A—0 to 2 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; few fine roots; slightly effervescent; strongly alkaline; clear smooth boundary.

C1—2 to 10 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; common fine roots; slightly effervescent; strongly alkaline; gradual smooth boundary.

C2—10 to 24 inches; brown (10YR 4/3) silty clay, brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; common medium roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C3—24 to 40 inches; pale brown (10YR 6/3) silty clay loam with thin strata of silt loam, brown (10YR 5/3) moist; massive; hard, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C4—40 to 44 inches; dark grayish brown (10YR 4/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C5—44 to 60 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; slightly effervescent; strongly alkaline.

Range in Characteristics

Sodicity: SAR less than 13, typically
Salinity: EC of 4 to 8, typically

A horizon
Hue: 10YR to 5Y
Value: 4 to 6 moist, 3 to 6 dry
Chroma: 1 to 4
Texture: sandy clay loam, silty loam, clay loam, silty clay loam, silty clay, or clay
Reaction: moderately alkaline or strongly alkaline

C horizon
Hue: 10YR to 5Y
Value: 3 to 7 dry or moist
Chroma: 1 to 4
Texture: clay, silty clay, silty clay loam, or clay loam. Usually contains thin strata of silt loam or loamy sand.
Reaction: moderately alkaline to very strongly alkaline

Note: Some pedons have few to many fine prominent relict mottles of 5Y or 2.5Y 4/6 to 4/8 below 20 inches.

Sparham Series

Map units: 18, 24, 51, 102, 320
Depth class: very deep
Drainage class: well drained, somewhat poorly drained
Landform: alluvial fans, flood plains, and valley sides
Parent material: fan and stream alluvium derived from sandstone and shale
Elevation: 5,000 to 7,500 feet (1,524 to 2,286 meters)
Slope: 0 to 3 percent
Climatic data:
- Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
- Mean annual air temperature: 50 to 55 degrees F. (10.0 to 12.8 degrees C.)
- Frost-free period: 110 to 160 days
Taxonomic class: Fine, mixed, calcareous, mesic Typic Ustifluvents

Typical Pedon

Sparham clay, in an area of mapping unit 102, Sparham clay loam, 1 to 3 percent slopes; Sandoval County; Cuba Quadrangle; about 1 mile northwest of Cuba; 1,500 feet south and 1,100 feet east of the northwest corner of sec. 20, T. 21 N., R. 1 W. NAD 83, UTM 13—03 22 490 E—39 89 805 N.

A—0 to 7 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and common fine roots; neutral; clear smooth boundary.
C1—7 to 20 inches; light brownish gray (10YR 6/2) clay loam, dark gray (10YR 4/1) moist; common medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; common very fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.
C2—20 to 29 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common fine prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine roots; slightly effervescent; moderately alkaline; gradual smooth boundary.
C3—29 to 47 inches; very pale brown (10YR 7/4) silty clay loam, yellowish brown (10YR 5/4) moist; few fine prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.
C4—47 to 53 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; common medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; slightly effervescent; moderately alkaline; abrupt smooth boundary.
C5—53 to 60 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; very hard, very firm, very sticky and very plastic; 10 percent fine gravel; moderately alkaline.

Range in Characteristics

Particle-size control section: 35 to 59 percent clay
Redoximorphic features: concentrations and depletions close to the surface are relict features
Depth to salts: 20 to 35 inches, when present
Depth to water table: typically 6 feet or greater (4 to 5 feet in some pedons)

A horizon
- Hue: 10YR, 2.5Y or 5Y
- Value: 4 to 6 dry, 3 to 6 moist. When crushed, moist value is less than 3.5, thickness is less than 7 inches.
- Chroma: 1 to 4 dry
- Texture: clay loam, silty clay loam, silt loam, or clay

C horizon
- Hue: 10YR, 2.5Y or 5Y
- Value: 3 to 7 dry, 3 to 6 moist
- Chroma: 1 to 4 dry and 1 to 6 moist
Texture: stratified clay loam, silty clay loam, silty clay, or clay (there are strata of textures as coarse as loamy sand)
Reaction: slightly alkaline to strongly alkaline
Sodicity: SAR of 5 to 30
Salinity: EC of 2 to 16, typically

Note: The Sparham component in map unit 51 is somewhat poorly drained and outside the range in characteristics of the series. The component is a taxadjunct to the series.

Stumble Series

Map unit: 106
Depth class: very deep
Drainage class: somewhat excessively drained
Landform: alluvial fans, fan aprons, fan remnants, and inset fans
Parent material: eolian sands derived from sandstone
Elevation: 5,000 to 5,600 feet (1,524 to 1,707 meters)
Slope: 1 to 40 percent
Climatic data:
Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
Frost-free period: 140 to 160 days

Taxonomic class: Mixed, mesic Typic Torripsamments

Typical Pedon

Stumble very gravelly fine sandy loam in an area of map unit 106, Stumble association, 1 to 40 percent slopes; Sandoval County; Bernalillo Quadrangle; about 1.5 miles northeast of the Sandia Indian Pueblo; 1,400 feet east and 401 feet north of the southwest corner of sec. 17, T. 12 N., R. 4 E. NAD 83, UTM 13—03 59 375 E—39 03 017 N.

A—0 to 4 inches; pale brown (10YR 6/3) very gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; 45 percent pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 10 inches; brown (7.5YR 5/4) gravelly fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; 25 percent pebbles; slightly effervescent; mildly alkaline; gradual wavy boundary.

C1—10 to 24 inches; very pale brown (10YR 7/4) loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; 10 percent pebbles; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—24 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 20 percent pebbles; slightly effervescent; moderately alkaline.

Range in Characteristics

A horizon
Value: 6 or 7 dry, 4 or 5 moist
Chroma: 2 or 3, dry or moist
Reaction: neutral to moderately alkaline
Texture: gravelly loamy sand or very gravelly fine sandy loam
Bw horizon (when present)
  
  Texture: gravelly fine sandy loam or loamy sand

C horizons
  
  Hue: 10YR or 2.5Y
  Value: 6 or 7 dry, 4 or 5 moist
  Chroma: 2 or 3, dry or moist

Texture: loamy sand or gravelly coarse sand, with strata of fine sand and sand

Teco Series

Map unit: 399
Depth class: very deep
Drainage class: well drained
Landform: cuestas and hills
Parent material: slope alluvium derived from sandstone and shale
Elevation: 5,900 to 7,000 feet (1,798 to 2,134 meters)
Slope: 8 to 40 percent

Climatic data:
  
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days

Taxonomic class: Fine, mixed, mesic Aridic Haplustalfs

Typical Pedon

Teco very cobbly fine sandy loam, in an area of mapping unit 399; Cucho-Teco complex, 8 to 40 percent slopes; Sandoval County; Holy Ghost Spring Quadrangle; about 3 miles south of the Jemez-Zia Pueblo boundary along State Highway 44 then east .25 mile; unsectionized; NAD 83, UTM 13—03 27 701 E—39 48 805 N.

A—0 to 1 inch; yellowish brown (10YR 5/4) very cobbly fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; many fine and few medium roots; 20 percent cobbles, 15 percent gravels; slightly alkaline; abrupt smooth boundary.

Bt1—1 inch to 7 inches; reddish brown (5YR 5/4) sandy clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure parting to moderate fine granular; hard, firm, sticky and plastic; common fine roots; few fine tubular pores; few fine clay films lining pores; slightly alkaline; clear smooth boundary.

Bt2—7 to 23 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; moderate fine subangular and angular blocky structure; hard, firm, very sticky and very plastic; common fine roots; common fine tubular pores; few thin faint dark brown (7.5YR 4/4) clay skins on vertical faces of peds; slightly effervescent; slightly alkaline; gradual wavy boundary.

Btk—23 to 40 inches; pink (7.5YR 7/4) clay, light brown (7.5YR 6/4) moist; massive; hard, firm, sticky and plastic; few fine roots; strongly effervescent; few fine clay films on faces of peds; common medium irregularly shaped segregated soft masses of calcium carbonate; slightly alkaline; clear wavy boundary.

2C—40 to 45 inches; light yellowish brown (10YR 6/4) very gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; loose, nonsticky and nonplastic; strongly effervescent; 30 percent gravel, 10 percent cobbles; slightly alkaline; gradual wavy boundary.
3Bkb—45 to 60 inches; pale yellow (5Y 8/3) channery sandy clay loam, pale yellow (5Y 7/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 25 percent soft shale fragments; strongly effervescent; many large, white (5YR 8/2) soft masses of calcium carbonate in rounded pockets and vertical seams; slightly alkaline.

**Range in Characteristics**

*Particle-size control section:* 35 to 45 percent clay  
*Depth to calcic horizon:* 20 to 40 inches

**A horizon**  
*Hue:* 10YR to 5YR  
*Value:* 5 to 7 dry, 3 to 6 moist  
*Chroma:* 3 or 4

**Bt horizon**  
*Hue:* 7.5YR to 2.5YR  
*Value:* 4 to 7 dry, 3 to 7 moist  
*Chroma:* 2 to 6

**Bk horizon**  
*Hue:* 7.5YR to 2.5YR  
*Value:* 5 to 7 dry, 3 to 7 moist  
*Chroma:* 4 to 8

**Tijeras Series**

*Map units:* 109, 112  
*Depth class:* very deep  
*Drainage class:* well drained  
*Landform:* fan remnants and ridges  
*Parent material:* fan alluvium derived from granite  
*Elevation:* 5,100 to 5,600 feet (1,554 to 1,707 meters)  
*Slope:* 1 to 6 percent  
*Climatic data:*  
*Mean annual precipitation:* 8 to 10 inches (203 to 254 millimeters)  
*Mean annual air temperature:* 53 to 55 degrees F. (11.7 to 12.8 degrees C.)  
*Frost-free period:* 140 to 160 days

*Taxonomic class:* Fine-loamy, mixed, mesic Typic Haplargids  

**Typical Pedon**

Tijeras gravelly fine sandy loam, in an area of mapping unit 109; Embudo-Tijeras association, 1 to 9 percent slopes; Sandoval County; Alameda Quadrangle; located about 2 miles east of interstate highway 25 and .75 mile north of the Bernalillo-Sandoval County line; 2,500 feet east and 2,000 feet south of the northwest corner of sec. 32, T. 12 N., R. 4 E. NAD 83, UTM 13—03 59 674 E—38 99 074 N.

**A**—0 to 4 inches; pale brown (10YR 6/3) gravelly fine sandy loam; brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and nonplastic; many fine roots; 20 percent gravel; moderately alkaline; clear smooth boundary.

**Bt**—4 to 10 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine roots; common fine tubular pores; common thin clay films on faces of peds; moderately alkaline; clear wavy boundary.
Btk—10 to 20 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; few thin clay films on faces of peds; slightly effervescent; few fine rounded calcium carbonate masses; moderately alkaline; clear wavy boundary.

Bk1—20 to 26 inches; pink (7.5YR 7/4) gravelly sandy loam, light brown (10YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine tubular pores; 20 percent gravel; strongly effervescent; few, medium rounded calcium carbonate masses; moderately alkaline; gradual wavy boundary.

Bk2—26 to 60 inches; pink (7.5YR 7/4) very gravelly coarse sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; 50 percent gravel; slightly effervescent; few fine rounded pink calcium carbonate masses; moderately alkaline.

**Range in Characteristics**

*Particle-size control section:* 18 to 30 percent clay

**A horizon**
- **Hue:** 7.5YR or 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 2 to 4

**Bt horizon**
- **Hue:** 5YR to 10YR
- **Value:** 4 to 6 dry, 3 to 5 moist
- **Chroma:** 2 to 5

**Bk horizon**
- **Hue:** 7.5YR or 10YR
- **Value:** 5 to 7 dry, 4 to 6 moist
- **Content of rock fragments:** 35 to 70 percent granite gravel

**Tocal Series**

**Map unit:** 282
**Depth class:** very shallow to shallow
**Drainage class:** well drained
**Landform:** interfluves on plateaus
**Parent material:** eolian material over residuum derived from tuff
**Elevation:** 7,000 to 8,000 feet (2,134 to 2,438 meters)
**Slope:** 3 to 8 percent

**Climatic data:**
- **Mean annual precipitation:** 20 to 25 inches (508 to 635 millimeters)
- **Mean annual air temperature:** 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- **Frost-free period:** 60 to 90 days

**Taxonomic class:** Clayey, mixed Lithic Eutroboralfs

**Typical Pedon**

Tocal very fine sandy loam, in an area of mapping unit 282, Tocal very fine sandy loam, 3 to 8 percent slopes; Los Alamos County; Guaje Mountain Quadrangle; about .5 mile northwest of LASL administration building; 750 feet west and 700 feet south of the center of sec. 17, T. 19 N., R. 6 E. NAD 83, UTM 13—03 79 860 E—39 70 969 N.
A—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many interstitial pores; neutral; abrupt smooth boundary.

Bt1—5 to 8 inches; reddish brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many fine roots; few very fine interstitial pores; thin continuous clay films on faces of peds; neutral; abrupt smooth boundary.

Bt2—8 to 11 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many medium roots; few very fine tubular pores; thick continuous clay films on faces of peds; neutral; clear smooth boundary.

2Bt3—11 to 14 inches; light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, sticky and plastic; many medium roots; few very fine tubular pores; few reddish brown (5YR 4/4) clay filling in pores; neutral; abrupt smooth boundary.

2Cr—14 inches; tuff.

**Range in Characteristics**

*Particle-size control section:* 15 to 45 percent clay

*Depth to tuff bedrock:* 8 to 20 inches

**A horizon**

*Hue:* 7.5YR or 10YR

*Value:* 4 to 6 dry, 2 to 4 moist

*Chroma:* 2 or 3

**B horizon**

*Hue:* 7.5YR or 5YR

*Value:* 4 to 6 dry, 3 or 4 moist

*Chroma:* 3 to 6

**Totavi Series**

*Map units:* 52, 88

*Depth class:* very deep

*Drainage class:* somewhat excessively drained

*Landform:* stream terraces, closed depressions, and valley floors

*Parent material:* stream alluvium derived from tuff and pumice

*Elevation:* 7,000 to 8,800 feet (2,134 to 2,682 meters)

*Slope:* 0 to 5 percent

*Climatic data:*  

*Mean annual precipitation:* 20 to 25 inches (508 to 635 millimeters)

*Mean annual air temperature:* 42 to 45 degrees F. (5.6 to 7.2 degrees C.)

*Frost-free period:* 60 to 90 days

*Taxonomic class:* Ashy, frigid Mollie Vitrandepts

**Typical Pedon**

Totavi loamy sand, in an area of mapping unit 52, Totavi loamy sand, 0 to 5 percent slopes; Los Alamos County; Frijoles Quadrangle; about 1.4 miles east of Meson Lab entrance; 100 feet south and 150 feet east of the center of sec. 24, T. 19 N., R. 6 E. NAD 83, UTM 13—03 86 516 E—39 69 460 N.
A—0 to 15 inches; grayish brown (10YR 5/2) loamy sand, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; 10 percent pebble-sized tuff and pumice fragments; neutral; abrupt wavy boundary.

C1—15 to 19 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, very friable, nonsticky and nonplastic; common very fine and fine roots; about 50 percent of the fine earth fraction is medium or coarser sand; 10 percent pebble-sized tuff and pumice fragments; neutral; abrupt boundary.

C2—19 to 60 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and plastic; few very fine roots; about 35 percent of the fine earth fraction is medium or coarser sand; 10 percent pebble-sized tuff and pumice fragments; neutral.

Range in Characteristics

Particle-size control section: 5 to 15 percent clay
Content of rock fragments: tuff, pumice, latite, dacite

A horizon
- Hue: 7.5YR or 10YR
- Value: 4 or 5 dry, 2 or 3 moist
- Chroma: 2 or 3, dry or moist
- Texture: loamy sand or sandy loam

C or Bw horizon
- Hue: 7.5YR or 10YR
- Value: 4 to 7 dry, 3 to 5 moist
- Chroma: 2 to 4

Trail Series

Map units: 10, 11, 29, 430, 431, 830, 831
Depth class: very deep
Drainage class: moderately well drained, somewhat excessively drained
Landform: flood plains, alluvial fans, channels, and valley floor remnants
Parent material: eolian material and stream alluvium derived from sandstone
Elevation: 5,000 to 6,000 feet (1,524 to 1,829 meters)
Slope: 0 to 4 percent
Climatic data:
- Mean annual precipitation: 8 to 10 inches (203 to 254 millimeters)
- Mean annual air temperature: 53 to 55 degrees F. (11.7 to 12.8 degrees C.)
- Frost-free period: 140 to 160 days

Taxonomic class: Sandy, mixed, mesic Typic Torrifluvents

Typical Pedon

Trail fine sandy loam, in an area of mapping unit 11, Trail fine sandy loam, 0 to 1 percent slopes; Sandoval County; Jemez Pueblo Quadrangle; Pena Blanca Area, unsectionized; NAD 83, UTM 13—03 47 611 E—39 36 023 N.

Ap—0 to 9 inches; light yellowish brown (10YR 6/4) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.
C1—9 to 36 inches; very pale brown (10YR 7/4) loamy sand with stratum of sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

A horizon
- Hue: 2.5YR to 10YR
- Value: 5 to 7 dry, 4 to 6 moist
- Chroma: 2 to 6 dry, 2, 3 or 4 moist
- Texture: loamy sand, fine sandy loam, loam, or silty clay loam

C horizon
- Hue: 2.5YR to 10YR
- Value: 5 to 7 dry, 4 to 6 moist
- Chroma: 2 to 6 dry, 2, 3 or 4 moist
- Texture: loamy sand, loamy fine sand, fine sand, sand with thin strata of sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam

Tranquilar Series

Map units: 302, 311
- Depth class: very deep
- Drainage class: somewhat poorly drained
- Landform: stream terraces and valley floors
- Parent material: lacustrine deposits from rhyolite and tuff
- Elevation: 8,500 to 9,200 feet (2,591 to 2,804 meters)
- Slope: 1 to 8 percent

Climatic data:
- Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
- Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
- Frost-free period: 60 to 90 days

Taxonomic class: Very-fine, montmorillonitic, frigid Typic Argialbolls

Typical Pedon

Tranquilar silty clay loam, In an area of mapping unit 302, Tranquilar-Jarmillo complex, 1 to 8 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about 2.5 miles southeast from the northwest corner of Baca Location No. 1; unsectionized; NAD 83, UTM 13—03 56 228 E—39 83 041 N.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, very friable, sticky and plastic; many fine and very fine roots; slightly acid; clear smooth boundary.

A2—4 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and few medium roots; slightly acid; clear smooth boundary.

E1—8 to 11 inches; gray (10YR 6/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; slightly acid; abrupt smooth boundary.
E2—11 to 13 inches; light gray (10YR 7/2) ped exteriors silty clay loam, dark grayish brown (10YR 4/2) moist; ped interiors, light brownish gray (10YR 6/2), very dark grayish brown (10YR 3/2) moist; few fine faint reddish yellow (7.5YR 6/6) mottles inside peds; weak thin platy structure; slightly hard, friable, sticky and plastic; few very fine roots; medium acid; abrupt smooth boundary.

Bt1—13 to 20 inches; very dark grayish brown (10YR 3/2) ped exteriors clay, very dark brown (10YR 2/2) moist; ped interiors brown (10YR 5/3), dark brown (10YR 3/3) moist; few fine faint reddish yellow (7.5YR 6/6) mottles inside peds; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; few very fine and few medium roots; thin organic films; thin clay films on faces of peds; pressure faces on a few peds; strongly acid; gradual wavy boundary.

Bt2—20 to 34 inches; dark grayish brown (10YR 4/2) ped exteriors clay, very dark grayish brown (10YR 3/2) moist; clay interiors very pale brown (10YR 7/3), brown (10YR 4/3) moist; few fine faint reddish yellow (7.5YR 6/6) mottles inside peds; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; continuous moderately thick clay films and organic stains on faces of peds; pressure faces on a few peds; very strongly acid; gradual wavy boundary.

Bt3—34 to 42 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; common fine prominent yellowish red (5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, very firm, very sticky and very plastic; few very fine and medium roots; continuous moderately thick clay films on faces of peds with discontinuous patchy organic films; pressure faces on a few peds; very strongly acid; gradual wavy boundary.

Bt4—42 to 50 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; common, fine, prominent reddish yellow (7.5YR 6/6) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, very firm, very sticky and very plastic; few very fine and medium roots; continuous moderately thick clay films on faces of peds; pressure faces on a few peds; extremely acid; gradual wavy boundary.

Bt5—50 to 60 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; common fine prominent reddish yellow (7.5YR 6/8) mottles; very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; few very fine and medium roots; continuous moderately thick clay films on faces of peds; very strongly acid; gradual wavy boundary.

Range in Characteristics

Particle-size control section: 60 to 75 percent clay
Depth to a seasonal water table: 20 to 48 inches from March to July

A horizon
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 1 or 2 dry or moist
Texture: silt loam, silty clay loam

E horizon
Value: 5 to 7 dry, 3 to 6 moist
Chroma: 1 or 2 dry or moist
Texture: silt loam or silty clay loam
Bt horizon
   Hue: 7.5YR or 10YR
   Value: 3 to 7 dry, 2 to 7 moist
   Chroma: 3 to 8

**Tsosie Series**

*Map unit: 270*
*Depth class: very deep*
*Drainage class: well drained*
*Landform: stream terraces and alluvial fans*
*Parent material: stream alluvium derived from shale and sandstone*
*Elevation: 6,600 to 7,000 feet (2,012 to 2,134 meters)*
*Slope: 0 to 3 percent*
*Climatic data:*
   *Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)*
   *Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)*
   *Frost-free period: 110 to 130 days*

*Taxonomic class: Fine-loamy, mixed, calcareous, mesic Ustic Torriorthents*

**Typical Pedon**

Tsosie clay loam, in an area of mapping unit 270, Blancot-Courcelor-Tsosie association, 0 to 5 percent slopes; Sandoval County; Galisteo SE Quadrangle; about 8 miles south of Galisteo, 1,100 feet north and 2,200 feet west of the southeast corner of sec. 6, T. 21 N., R. 6 W. NAD 83, UTM 13—02 74 088 E—39 95 089 N.

A—0 to 2 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine continuous pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—2 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots; slightly effervescent; strongly alkaline; clear gradual boundary.

C2—10 to 20 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C3—20 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C4—26 to 36 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine continuous pores; strongly alkaline; clear smooth boundary.

C5—36 to 44 inches; yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; moderately alkaline; clear smooth boundary.

C6—44 to 55 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; strongly alkaline; clear smooth boundary.

C7—55 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly effervescent; strongly alkaline.
Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon

Hue: 2.5Y or 10YR
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 2 to 4

C horizon

Hue: 2.5Y or 10YR
Value: 5 to 7 dry, 3 to 5 moist
Chroma: 2 to 4
Texture: clay loam, sandy clay loam, or loam in upper part of the subsoil; stratified sandy loam to silty clay loam in the lower part.

Note: In some pedons, fine sandy loam, sandy loam, and silt loam textures occur below the control section or as thin lenses within it.

Vastine Series

Map unit: 301
Depth class: very deep
Drainage class: poorly drained
Landform: flood plains, stream terraces, and valley floors
Parent material: mixed stream alluvium
Elevation: 8,400 to 8,600 feet (2,560 to 2,621 meters)
Slope: 0 to 3 percent
Climatic data:
  Mean annual precipitation: 20 to 25 inches (508 to 635 millimeters)
  Mean annual air temperature: 42 to 45 degrees F. (5.6 to 7.2 degrees C.)
  Frost-free period: 60 to 90 days
Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, frigid Typic Haplaquolls

Typical Pedon

Vastine silt loam, in an area of mapping unit 301, Vastine-Jarola silt loams, 0 to 5 percent slopes; Sandoval County; Valle San Antonio Quadrangle; about .1 mile southwest of hot springs in San Antonio Valley, Baca Location No. 1; unsectioned; NAD 83, UTM 13—03 59 079 E—39 81 660 N.

A1—0 to 4 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, firm, sticky and plastic; many fine and very fine roots; neutral; clear smooth boundary.

A2—4 to 11 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few very fine roots; neutral; gradual smooth boundary.

Bw—11 to 24 inches; light gray (10YR 6/1) loam, gray (10YR 5/1) moist; common fine distinct pale yellow (2.5Y 7/4) mottles; moderate medium blocky structure; hard, firm, sticky and plastic; few fine roots; 10 percent gravel; neutral; clear smooth boundary.

2C—24 to 60 inches; gray (10YR 5/1) very gravelly loamy sand, dark gray (10YR 4/1) moist; massive; loose, nonsticky and nonplastic; 55 percent gravel; slightly alkaline.
Range in Characteristics

Particle-size control section: 18 to 35 percent clay in the upper part of the subsoil
Depth to a seasonal high water table: 12 to 36 inches
Depth to the gravelly substratum: 24 to 33 inches

A horizon
  Hue: 5Y to 7.5YR
  Value: 4 or 5 dry, 2 or 3 moist
  Chroma: 1 or 2

B horizon
  Hue: 5Y to 7.5YR
  Value: 4 to 6 dry, 2 to 5 moist
  Chroma: 0 to 8.
  Other features: colors in this horizon are variegated in some pedons

2C horizon
  Hue: 5Y to 7.5YR
  Value: 5 or 6 dry, 4 or 5 moist
  Chroma: 1 to 3,
  Content of rock fragments: 35 to 60 percent gravel is common below 24 inches
  Other features: colors in this horizon are variegated in some pedons

Vessilla Series

Map units: 17, 220, 325, 342, 397, 422
Depth class: very shallow to shallow
Drainage class: well drained
Landform: structural benches on escarpments and breaks; sideslopes of hills, mesas, and ridges
Parent material: eolian material, slope alluvium, and residuum derived from sandstone
Elevation: 6,000 to 7,500 feet (1,829 to 2,286 meters)
Slope: 3 to 65 percent
Climatic data:
  Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
  Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
  Frost-free period: 110 to 130 days

Taxonomic class: Loamy, mixed, calcareous, mesic Lithic Ustorthents

Typical Pedon

Vessilla gravelly fine sandy loam, in an area of mapping unit 397, Rock outcrop-Cucho-Vessilla complex, 25 to 70 percent slopes; Sandoval County; Holy Ghost Spring Quadrangle; 15 miles northwest of San Ysidro; NAD 83, UTM 13—03 28 014 E—39 50 605 N.

A—0 to 2 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and medium fine roots; 25 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C—2 to 11 inches; light brown (7.5YR 6/4) gravelly fine sandy loam, brown (7.5YR 5/4) moist; massive; loose, nonsticky and nonplastic; common fine roots; 20 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

R—11 inches; sandstone.
Range in Characteristics

Particle-size control section: 12 to 20 percent clay
Depth to sandstone: 4 to 20 inches

A and C horizons
Hue: 7.5YR or 10YR
Value: 4 to 7 dry, 4 to 6 moist
Chroma: 3 to 6 dry or moist
Texture: sandy loam, fine sandy loam, loamy sand, loam, gravelly fine sandy loam, gravelly loamy sand, gravelly sandy loam, very gravelly sandy loam, gravelly loam, and channery loam

Waumac Series

Map units: 300, 307, 314, 321, 342
Depth class: very deep
Drainage class: well drained
Landform: alluvial fans, valley floors, and stream terraces
Parent material: fan and stream alluvium derived from sandstone and igneous rocks
Elevation: 5,400 to 6,900 feet (1,646 to 2,103 meters)
Slope: 1 to 20 percent

Climatic data:
Mean annual precipitation: 13 to 16 inches (330 to 406 millimeters)
Mean annual air temperature: 48 to 52 degrees F. (10.0 to 11.1 degrees C.)
Frost-free period: 110 to 130 days

Taxonomic class: Coarse-loamy; mixed, calcareous, mesic Typic Ustorthents

Typical Pedon

Waumac loamy sand, in an area of mapping unit 300, Waumac-Bamac association, 1 to 7 percent slopes; Sandoval County; Santo Domingo Pueblo Quadrangle; one-half mile south of the Cochiti Indian Pueblo, 100 yards east of the Highway 85; 100 feet west and 1,070 feet north of the southeast corner of sec. 24, T. 16 N., R. 5 E. NAD 83, UTM 13—03 77 273 E—39 40 079 N.

A—0 to 3 inches; pale brown (10YR 6/3) loamy sand, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; few fine tubular pores; moderately alkaline; clear smooth boundary.

C1—3 to 31 inches; pale brown (10YR 6/3) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; loose, nonsticky and nonplastic; few very fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—31 to 60 inches; pale brown (10YR 6/3) gravelly fine sandy loam; dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; 20 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 10 to 18 percent clay

A horizon
Hue: 7.5YR, 10YR or 2.5Y
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: loamy sand or loamy fine sand
C horizon
  
  *Hue:* 5YR, 7.5YR or 10YR  
  *Value:* 5 or 6 dry, 4 or 5 moist  
  *Chroma:* 3 or 4  
  *Texture:* sandy loam, fine sandy loam, and gravelly fine sandy loam  

*Note:* Thin strata of loamy sand and coarse sandy loam occur in some pedons. This horizon can be noncalcareous to depths of 18 inches in some pedons.

**Waumac Variant Series**

*Map unit:* 354  
*Depth class:* shallow  
*Drainage class:* well drained  
*Landform:* hills  
*Parent material:* coarse textured material derived from tuff  
*Elevation:* 5,600 to 5,900 feet (1,707 to 1,798 meters)  
*Slope:* 1 to 15 percent  
*Climatic data:*  
  - *Mean annual precipitation:* 13 to 16 inches (305 to 356 millimeters)  
  - *Mean annual air temperature:* 48 to 52 degrees F. (10.0 to 11.1 degrees C.)  
  - *Frost-free period:* 110 to 130 days  
  
*Taxonomic class:* Ashy-skeletal, mesic, shallow Typic Ustorthents

**Typical Pedon**

Waumac Variant very gravelly sandy loam, in an area of mapping unit 354, Waumac variant very gravelly sandy loam, 1 to 15 percent slopes; Sandoval County; Cochiti Dam Quadrangle; 0.5 mile south of the old sawmill, 2,200 feet north and 1,000 feet east of the southwest corner of sec. 31, T. 17 N., R. 6 E. NAD 83, UTM 13—03 77 535 E—39 46 752 N.

A—0 to 3 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common interstitial pores; 55 percent gravel; slightly alkaline; clear smooth boundary.

C—3 to 12 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common interstitial pores; 55 percent gravel; slightly alkaline.

Cr—12 inches; tuff.

**Range in Characteristics**

*Particle-size control section:* 10 to 18 percent clay  
*Depth to paralithic contact:* 10 to 20 inches

A horizon:
  - *Hue:* 10YR  
  - *Value:* 5 or 6 dry, 4 or 5 moist  
  - *Chroma:* 2 to 4

C horizon
  - *Hue:* 10YR  
  - *Value:* 5 or 6 dry, 4 or 5 moist  
  - *Chroma:* 3 or 4
**Wauquie Series**

*Map units: 348, 414, 419*
*Depth class: very deep*
*Drainage class: well drained*
*Landform: mountain slopes, benches, canyons, hills, and mesas*
*Parent material: slope alluvium and colluvium derived from granite and shale*
*Elevation: 6,000 to 8,400 feet (1,829 to 2,560 meters)*
*Slope: 8 to 55 percent*
*Climatic data:*
  *Mean annual precipitation:* 13 to 16 inches (330 to 406 millimeters)
  *Mean annual air temperature:* 48 to 52 degrees F. (10 to 11.1 degrees C.)
  *Frost-free period:* 110 to 130 days
*Taxonomic class: Loamy-skeletal, mixed, mesic Aridic Haplustalfs*

**Typical Pedon**

Wauquie extremely cobbly fine sandy loam, in an area of mapping unit 419; Santa Fe-Wauquie-Rock outcrop, 25 to 70 percent slopes; Sandoval County; La Ventana Quadrangle; about 5 miles east of La Ventana; unsectionized; NAD 83, UTM 13—03 28 986 E—39 62 292 N.

A—0 to 4 inches; reddish brown (5YR 5/4) extremely cobbly fine sandy loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common medium roots; many very fine vesicular pores; 5 percent stones; 25 percent cobbles, and 45 percent gravel; neutral; clear smooth boundary.

Bt1—4 to 11 inches; reddish brown (2.5YR 4/4) extremely cobbly sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and common medium roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 5 percent stones, 25 percent cobbles and 45 percent gravel; neutral; gradual smooth boundary.

Bt2—11 to 18 inches; reddish brown (2.5YR 4/4) extremely cobbly sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 5 percent stones, 25 percent cobbles and 45 percent gravel; neutral; gradual smooth boundary.

Bt3—18 to 29 inches; reddish brown (5YR 4/4) extremely cobbly sandy loam, dark reddish brown (5YR 3/4) moist; massive; soft, friable, nonsticky and nonplastic; common medium roots; few very fine tubular pores; many colloidal stains on sand grains and gravel; 5 percent stones, 25 percent cobbles and 50 percent gravel; slightly alkaline; gradual smooth boundary.

Bk—29 to 60 inches; light reddish brown (5YR 6/4) extremely cobbly sand, reddish brown (5YR 5/4) moist; massive; loose, nonsticky and nonplastic; few medium roots; few interstitial pores; 5 percent stones, 25 percent cobbles, and 50 percent gravel; few calcium carbonate coatings on underside of gravel; slightly alkaline.

**Range in Characteristics**

*Particle-size control section: 18 to 35 percent clay*
Sandoval County Area, New Mexico

A horizon

- **Hue:** 5YR to 10YR
- **Value:** 3 to 6 dry, 2 to 4 moist
- **Chroma:** 2 to 4
- **Texture:** extremely gravelly sandy clay loam, extremely cobbly fine sandy loam, or very gravelly fine sandy loam

Bt horizon (Btk horizon in some pedons)

- **Hue:** 2.5YR to 10YR
- **Value:** 4 to 6 dry, 3 or 4 moist
- **Chroma:** 2 to 6
- **Texture:** very gravelly clay loam, extremely cobbly sandy clay loam, very gravelly sandy clay loam, and extremely cobbly sandy loam

Bk horizon

- **Hue:** 2.5YR to 10YR
- **Value:** 5 to 8 dry, 4 to 6 moist
- **Chroma:** 2 to 6
- **Texture:** very gravelly sandy loam, very gravelly loamy coarse sand, extremely gravelly loamy sand, extremely cobbly sandy loam, extremely cobbly sand, extremely cobbly loam

**Winona Series**

- **Map unit:** 228
- **Depth class:** shallow
- **Drainage class:** well drained
- **Landform:** hills and plateaus
- **Parent material:** material derived from travertine
- **Elevation:** 5,900 to 6,300 feet (1,798 to 1,920 meters)
- **Slope:** 8 to 25 percent
- **Climatic data:**
  - Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  - Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  - Frost-free period: 120 to 140 days
- **Taxonomic class:** Loamy-skeletal, carbonatic, mesic Lithic Ustollic Calciorthids

**Typical Pedon**

Winona very channery fine sandy loam, in an area of mapping unit 228, Winona very channery fine sandy loam, 8 to 25 percent slopes; Sandoval County; San Ysidro Quadrangle; about 10 miles northwest of San Ysidro; NAD 83, UTM 13—03 30 477 E—39 42 612 N.

- **A**—0 to 2 inches; brown (7.5YR 5/4) very channery fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 15 percent cobbles and 40 percent channers; coarse fragments are carbonate concretions and travertine fragments coated with pendants of calcium carbonate; violently effervescent; slightly alkaline; clear smooth boundary.
- **Bk**—2 to 13 inches; brown (7.5YR 5/4) very channery loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 45 percent channers with calcium carbonate pendants; violently effervescent; slightly alkaline.
- **R**—13 inches; travertine.
Range in Characteristics

*Particle-size control section:* 15 to 30 percent clay

*Depth to bedrock:* 11 to 20 inches

**A horizon**
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 4, 5, or 6 dry, 3 or 4 moist
- **Chroma:** 2, 3, or 4 dry

**Bk horizon**
- **Hue:** 5YR, 7.5YR, 10YR
- **Value:** 5, 6, or 7 dry; 3, 4, 5, or 6 moist
- **Chroma:** 2, 3, or 4, dry or moist

**Witt Series**

*Map units:* 34, 53, 217

*Depth class:* very deep

*Drainage class:* well drained

*Landform:* bajadas, fan terraces, and mesas

*Parent material:* Eolian material and fan alluvium from basalt

*Elevation:* 5,200 to 6,700 feet (1,585 to 2,042 meters)

*Slope:* 1 to 8 percent

*Climatic data:*
- **Mean annual precipitation:** 10 to 13 inches (254 to 330 millimeters)
- **Mean annual air temperature:** 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
- **Frost-free period:** 120 to 140 days

*Taxonomic class:* Fine-silty, mixed, mesic Ustollic Hapludolls

**Typical Pedon**

Witt loam, in an area of mapping unit 53, Witt-Harvey association, 1 to 7 percent slopes; Sandoval County; Golden Quadrangle; about 3 miles northwest of Golden; 300 feet south and 900 feet west of the northeast corner of sec. 1, T. 12 N., R. 6 E.

NAD 83, UTM 13—03 86 526 E—39 07 226 N.

A—0 to 3 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; moderately alkaline; abrupt smooth boundary.

BA—3 to 6 inches; brown (7.5YR 4/4) silt loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; mildly alkaline; clear smooth boundary.

Bt1—6 to 11 inches; brown (7.5YR 4/4) silt loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; strongly effervescent; mildly alkaline; clear smooth boundary.

Bt2—11 to 18 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

Btk—18 to 25 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; strongly effervescent; common medium masses of calcium carbonate; moderately alkaline; clear smooth boundary.
Bk1—25 to 39 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; strongly effervescent; common medium masses of calcium carbonate; moderately alkaline; abrupt smooth boundary.

Bk2—39 to 53 inches; pinkish white (7.5YR 8/2) silt loam, pinkish gray (7.5YR 7/2) moist; massive; slightly hard, firm, sticky and plastic; few very fine roots; violently effervescent; many medium masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—53 to 60 inches; pink (7.5YR 7/4) silt loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; violently effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 18 to 35 percent clay

A horizon
  Hue: 5YR, 7.5YR, 10YR
  Value: 4 to 7 dry, 3 to 5 moist
  Chroma: 2 to 4
  Texture: very fine sandy loam or loam

Bt horizon
  Hue: 5YR, 7.5YR, 10YR
  Value: 4 to 7 dry, 3 to 5 moist
  Chroma: 2 to 6
  Texture: silt loam, silt loam, and loam

Bk horizon
  Hue: 5YR or 7.5YR
  Value: 5 to 8 dry, 4 to 7 moist
  Chroma: 2 to 4
  Texture: loam, silt loam, silt loam, or very fine sandy loam

Note: A C horizon is present in some pedons.

Zia Series

Map units: 66, 91, 93, 111, 114, 190, 207, 211, 234, 410
Depth class: very deep
Drainage class: somewhat excessively well drained
Landform: alluvial fans, stream terraces, summits of mesas and plateaus
Parent material: eolian material and fan and stream alluvium derived from sandstone
Elevation: 5,000 to 6,900 feet (1,524 to 2,103 meters)
Slope: 0 to 25 percent
Climatic data:
  Mean annual precipitation: 10 to 13 inches (254 to 330 millimeters)
  Mean annual air temperature: 52 to 54 degrees F. (11.1 to 12.2 degrees C.)
  Frost-free period: 120 to 140 days
Taxonomic class: Coarse-loamy, mixed, calcareous, mesic Ustic Torriorthents

Typical Pedon

Zia sandy loam, in an area of mapping unit 211, Zia-Clivis association, 2 to 10 percent slopes; Sandoval County; Arroyo de las Calabacillas Quadrangle; about 6
miles east of Alamo Ranch Headquarters; 1,400 feet west and 300 feet north of the southeast corner of sec. 21, T. 13 N., R. 1 E. NAD 83, UTM 13—03 33 005 E—39 11 510 N.

A—0 to 5 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and few fine roots; 5 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—5 to 14 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—14 to 33 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent; slightly alkaline; gradual smooth boundary.

C2—33 to 46 inches; very pale brown (10YR 7/3) sandy clay loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, sticky and plastic; few fine and very fine roots; 5 percent gravel; violently effervescent; calcium carbonate as very few fine irregular masses; moderately alkaline; clear smooth boundary.

C3—46 to 60 inches; light yellowish brown (10YR 6/4) sandy loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and slightly plastic; 10 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Particle-size control section: 8 to 18 percent clay

A horizon
Hue: 5YR to 10YR
Value: 4 to 7 dry, 3 to 5 moist
Chroma: 2 to 6
Texture: loamy sand, sandy loam, fine sandy loam, or loam

Bw or C horizon
Hue: 5YR to 10YR
Value: 4 to 8 dry, 3 to 7 moist
Chroma: 2 to 6
Texture: fine sandy loam or sandy loam. The C horizon contains strata of loamy sand or sandy clay loam in most pedons.
Factors of Soil Formation

Soil is a collection of natural bodies occurring on the earth’s surface and is capable of supporting plants. Its properties result from the extent to which physical, chemical, and biological processes have affected the material from which soil is derived, the parent material. The main processes active in the soils of the Sandoval County area are: weathering of soil particles and rock material through dissolution and disintegration; accumulation and oxidation of organic matter in surface layers; formation of soil structure and surface crusting; movement of dissolved soil constituents with soil water, and precipitation of soil constituents from soil water; and movement of clay particles with soil water downward through the soil.

Most of these soil processes enhance plant growth, and some bring about hindrances to plant growth. Some soil processes are dependent upon other processes having reached a certain stage. Soil processes, or their lack, give the present soil its characteristics and are governed by five soil-forming factors: time, parent material, climate, relief, and living organisms. Understanding and recognizing soil-forming processes that occur affords the soil user the ability to predict the capability of soils for many uses.

Climate

The climate of an area is greatly responsible for the types of soil processes and for the rate at which these processes occur. The main features of climate affecting soil processes are precipitation and temperature.

The climate of the Sandoval County area at present is semi-arid continental. The lowest areas have annual precipitation of about eight inches and mean annual air temperature of about 55 degrees. These being the driest are areas of least vegetation. The small amount of organic matter produced by the vegetation is rapidly oxidized, resulting in soils with light colored surface horizons as in Sheppard and Grieta series.

With increased temperature, chemical and biochemical reactions are hastened. In addition, freeze-thaw cycles speed the weathering of soil and rock particles. The temperature also greatly affects evaporation of water from the soil and transpiration of water from plants.

As the amount of precipitation increases, the potential amount of vegetation on a soil increases. The number of days per year that the soil is moist during the frost-free period determines how much vegetation can be supported and the time during which soil processes occur. The depth to which water penetrates the soil is also very important as it determines the maximum depth of root penetration and the depth beyond which soil transforming processes are greatly slowed. If there is not enough precipitation for water to move through the entire soil and enter the ground water system, calcium carbonate deposits are precipitated at the depth of maximum water penetration.

In the cold, wet, mountainous areas of the Sandoval County area, soils such as Redondo and Calaveras series support stands of large trees. These areas receive 25 or more inches of precipitation per year and the average annual air temperature is about 40 degrees F. The soils in these areas are moist more days per year than most.
other soils in the Sandoval County area. The cooler temperatures allow for a buildup of organic matter in the surface layers of these soils.

Older soils in the area have been influenced by past climates. Past climates were similar to the present one, but slightly more moist and cooler. Similar soil processes took place, at an accelerated rate when compared to present conditions. For this reason, some soils in the driest part of the Sandoval County area have strongly developed features such as the petrocalcic horizon of the Pastura series, and the calcic and argillic horizons of the Clovis series.

Living Organisms

The life associated with a soil greatly influences the processes within, the features and the characteristics of a soil.

The vegetation supported by a soil is part of this life. Plant roots provide channels for water flow into depths of soils which otherwise might receive little water. Plant material provides the bulk of the organic portion of soil that is important to fertility. Plant life is very important in retaining soils in place, protecting them from erosion. A good plant cover will reduce evaporation of water from the soil surface and reduce runoff, providing a soil with more moist days each year. The plant cover also shades the soil surface and causes the soil to stay cooler than areas exposed to direct sunlight.

Soil insects, worms, and rodents affect aeration and intake rate by mixing and burrowing. Some animals affect the vegetation on the soil by their eating habits. Large animals, especially in dry areas where soil crusts form, enhance seed germination by walking across the soil surface, providing in their hoof prints a favorable seedbed.

Microscopic organisms function importantly in nutrient cycling. Fungi, bacteria, nematodes, and others process organic material and release nutrients for further plant growth. They also add acids, gases, and other chemical compounds that affect soil processes.

Many soils have been changed as a result of human intervention. People change vegetation on soils, animal and microbial life of soils, soil climate, and relief, through urban development, farming, ranching, logging, and sundry enterprises.

Topography

Soil topography has a profound influence on the development of soil features. Its many facets, including degree of slope, direction of slope, shape and roughness of slope, influence the climate of a soil and the extent of erosive forces affecting a soil.

On steep soils, erosion potential is greatest and soil features develop slowly. As organic matter accumulations and weathered soil material washes away, new soil parent material or bedrock nears the surface. If the erosion is moderate or severe, it is accompanied by a decrease in vegetation and an increase in runoff water, which in turn enhances the erosion.

Soils on very slight or level slopes often receive depositions of soil material. This process also slows the development of soil features, since soil material is buried too deeply before soil transforming processes are able to cause features to develop. This process is accompanied by an increase in amount of vegetation since along with new material, the soil receives run-on water.

The climate of a soil is affected greatly by the runoff or run-on water it sheds or receives.

Soils with a concave slope such as San Mateo or Sparank series receive a great amount of their moisture from adjacent, steeper slopes. Soils with more slope shed various amounts of water, depending on their steepness, amount of vegetation, and surface roughness. Soils with a very gravelly surface composed of angular pebbles
protruding from the surface can retain precipitation, even with a steep slope. A very gravelly surface of rounded, imbedded gravel however will shed water rapidly and deprive the soil of moisture.

On steep slopes there is a wide difference in climate between adjacent north-facing and south-facing slopes. Less direct sunlight on north-facing slopes results in an evapotranspiration rate and temperatures lower than that on south-facing slopes. This accounts for more days during which the soil is moist and more vegetation on north-facing slopes.

Topography has been an important factor in developing the landforms of this area. The following are landforms recognized in the survey area and some of the soils associated with them. Landforms are not static; they are continually being created and eroded.

**Alluvial Fans**

*Alluvial fans* originate from upslope landscapes. Sediment loads are deposited when slope gradients change from upland positions to less sloping landforms. An inherent feature of fan development is the continuously changing pattern of channels and loci of deposition. Over a long period of time, these changes ensure the maintenance of fans formed by distributing material widely over the surface. The soils on this landscape position are generally very deep with soil textures highly variable depending on the local geology from which they are formed. In this survey, the soil series found on alluvial fan positions are the Querencia series.

**Dunes**

This landform has developed from Holocene-age and present-day eolian sands. These relatively small transverse dunes formed perpendicular to the prevailing winds. Most dunes in this area are stable due to the establishment of vegetation that restricts their activity. *Dunes* can be found as a component on most of the other landforms portrayed in this section. These soils can be very deep and located in large dune fields or as a shallow mantle over bedrock controlled surfaces. The Mespun series is found on dunes.

**Escarpments**

*Escarpments* are a familiar feature in the survey area. They are relatively steep slopes or cliffs produced by erosion and faulting. Due to the steep slopes the soils formed on this landform are generally shallow. Examples of soil series on escarpments are the Skyvillage and Santa Fe series.

**Fan Remnants**

On this position, soils exhibit different degrees of pedogenic (soil) development. The degree of development depends upon the amounts of translocated calcium carbonate and/or silicified clays, which are related to the age of the soil.

*Fan remnants* have been dissected or downcut to the point at which flooding rarely occurs. This landform has two important components. One is the summit, where erosional activity is relatively low. This area will show the different degrees of soil development and age. The second component is the side slope, where erosional activity is cutting uphill into the more stable summit. In most areas in the survey, the surface has a thick eolian mantle that is being eroded.

Soils on fan remnants vary greatly in their makeup. The Pinitos series can be found in the survey area on fan remnants.

**Flood Plains**

This landform is formed by early Holocene-age to present-day stream alluvium. In this survey area, floodwaters flow at low to very low gradients along valley floors and
are elongated in nature. The soils on these flood plains receive periodic depositions of fresh alluvium, causing an irregular decrease in organic carbon and weak to no soil development. Soils on this landform are predominantly very deep with soil textures highly variable depending on the local geology they are formed from. The Jocity and Trail soils are formed in flood plains found along the Rio Grande and Jemez Rivers.

Mesas and Cuestas

These landforms have two important components. The first consists of the mesa summit and the cuesta dipslope. They are both nearly level to gently sloping, bedrock-controlled surfaces that are generally stable. The Bond and Hagerman series are found on these surfaces. The soils are characterized by well-developed argillic horizons.

The second component is the escarpment, where erosional activity is cutting back into the more stable summit. Soils on this component have little or no horizon development due to the steep slopes where erosional activity is greatest. Typical soils representing this escarpment component are the Vessilla and Skyvillage series.

Mesas differ from cuestas in that an escarpment on all sides terminates the mesa summit, while a cuesta will generally have one or more sides that grade into the surrounding terrain following gentle slopes.

Stream Terraces

This position is the erosional remnant of the active flood plains that existed during the late Pleistocene to Holocene ages. The slopes are in the same general direction as the current flood plain. The soils in this position are underlain by stratified sand, gravel, loamy, silty, or clayey sediments and, in some cases, buried paleosols.

The soils on stream terraces have been stable for a sufficient time period to form cambic horizons. Formation of soil structure and accumulations of calcium carbonate and sometimes gypsum characterize a cambic horizon. This position is still subject to some flooding during major events. These rare flooding occurrences and the thin alluvial deposits from the floodwaters do not inhibit soil development. Typical soils that represent stream terraces are the Zia and Counselor series.

Mountains

The mountain slopes consist of multiple landforms and positions and may be formed by several processes are therefore not considered a geomorphic surface. Soil development on these landforms is highly dependent on the nature of the bedrock such as its chemical composition, grain size, and hardness. The most influential soil-forming factors in determining how soil developed on hills and mountains are time and the slope gradient of the bedrock.

Soils on this landform vary greatly in horizon development, from soils with no development to soils with well-developed argillic horizons. Soils that have little or no horizon development are usually found on the steeper slopes where erosional activity is greatest. Soils that have well-developed horizons are generally on gently sloping to moderately steep slopes where erosion is slight to moderate. The Redondo and Palon series are examples of soils found in the Jemez Mountains.

The interaction of all the facets of soil topography can account for wide soil variations over short distances.

Parent Material

A complex geologic history, ranging from formation of sedimentary rocks while great seas covered the earth, to volcanism and mountain forming processes provided a great many rock formations in the Sandoval County area, the constituents of which to a great extent, determined the chemical, mineralogical, and textural attributes of
the soils. Unless already unconsolidated, it is the decomposition and disintegration of these rocks which give rise to the parent material of soil.

Parent materials in the Sandoval County area fall into two broad categories. The first is material that, after weathering from rock, is not moved, but remains in place and is subject to soil-forming processes. The second category is unconsolidated rock-derived material that has been transported by water, wind, or by force of gravity.

Soils formed in non-transported materials have mineralogical, chemical and textural traits, which are directly related to the rock from which the material is derived. There are many examples of such soils in the Sandoval County area. The Bond, Hagerman, Skyvillage, Vessilla, and Sedgran series all contain high amounts of sand-sized quartz, inherited from their weathered sandstone parent material. Soils developed from weathered shale, such as Menefee, Sandoval, Camino, and Cucho series contain a great deal of silt- and clay-sized particles of various clay minerals, feldspars, and some quartz. Other soils formed in place from weathered rock material include the Sedgran and Osha series from weathered granite, the Redondo series from weathered tuff, and the Deama series from weathered limestone.

Soils formed in transported materials can have particles weathered from one rock type, a few or many types, depending on the method and distance of transport. Colluvial soils are formed in material moved by the force of gravity, which is transported a relatively short distance, down slopes. The Wauquie series formed in material moved down slopes after weathering from granite and shale. Alanos series formed in transported weathered tuff, and Palon series are formed in weathered rhyolite that has moved down slopes.

The second type of transported soil parent material is eolian, or wind blown sediments. These are materials that begin as particles on the surface of other soils, and end up comprising the entire depth of a new soil. The Pinavetes, Sheppard, and Royosa series, when found in upland areas, are derived from eolian sand.

Alluvium is the third type of transported soil parent material found in the Sandoval County area. It is material that has been moved and deposited by streams and rivers. Alluvium is rarely derived from one rock type, and its sediments generally are of diverse mineralogy diversified. Often alluvial sediments are sorted according to texture. It is deposited in layers, which are often well defined and contrasting in texture, color, and organic matter content. Alluvium is found throughout the Sandoval County area and its age varies greatly. Recent deposits of alluvium are found along the Rio Grande, Rio Puerco and their tributaries. Soils such as the Gilco, Aga, San Mateo, Peralta, Sparank, Jocity, and Sparham series are formed in recent alluvium and display well defined layering. Older alluvium, much of which was deposited by the ancestral Rio Grande and its tributaries is locally extensive in the survey area. Soil development processes have obliterated most evidence of layering in these soils. Some soils formed in old alluvium are Sheppard, Bamac, Espiritu, Cascajo, and Grieta series.

Many soils in the Sandoval County area are formed in more than one kind of parent material. Mountain soils, such as Laventana series, are often formed in a mantle of colluvium overlying in situ material weathered from bedrock. Soils atop basalt mesas, like Prieta series formed in in situ weathered basalt material mixed with eolian silt. Fragua series formed in eolian sands mixed with weathered sandstone, and sometimes have a cap of colluvial basalt particles. All soils in the area receive eolian deposits, in varying amounts. Often this is in minor yearly contributions of calcareous dust, which over many years can bring about a highly calcareous soil.

In addition to being the initial material on which soil processes act, the parent material partly affects which and how fast soil-transforming processes occur. This is affected mainly by the rate that the parent material weathers, its mineralogy and the particle size of its weathering products.
Time

The formation of parent material (the unconsolidated mineral and organic material which when exposed at the earth's surface give rise to soil) by the weathering of geologic deposits requires a great amount of time. In addition, soil processes require a period of time before bringing about soil properties significantly different from properties inherited from the parent material. Many soil processes are dependent on the previous operation of other, different soil processes.

Therefore, the amount of time that a soil has been in place is very important to its present character. In the Sandoval County area, soils in the Rio Grande and Rio Puerco valleys have been there a short time, resulting in soils like Gilco, Aga, Jocity, and Sparank series that have little evidence of operating soil processes except for the accumulation of a small amount of organic matter in the surface layer. These and other young soils resemble very closely the original parent material from which they were derived.

Older soils have developed features, such as argillic horizons, calcic horizons, cambic horizons, which indicate the relative length of time a soil has been in place, and which processes have been operational in the soil. The older a soil becomes, the less it resembles the parent material from which it was derived.

Recognition of horizons and features, with knowledge of how their accompanying processes affect soil fertility, soil bulk density and other properties give great insight into the value of soil for specific uses. All of the five soil-forming factors occur in wide variation throughout the Sandoval County area, resulting in a great variety of soils. These soils represent a great natural resource and provide for a multiplicity of land uses. Knowledge of soils and their formation can help the user to protect and use the resources wisely.
References


Glossary

**ABC soil.** A soil having an A, a B, and a C horizon.

**AC soil.** A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alkali (sodic) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Alluvial cone.** The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

**Alluvial fan.** The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Animal unit month (AUM).** The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

**Aquic conditions.** Current soil wetness characterized by saturation, reduction, and redoximorphic features.

**Argillic horizon.** A subsoil horizon characterized by an accumulation of illuvial clay.

**Arroyo.** The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium.

**Aspect.** The direction in which a slope faces.

**Association, soil.** A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

- **Very low** ........................................ 0 to 3
- **Low** ........................................ 3 to 6
- **Moderate** ..................................... 6 to 9
- **High** ........................................ 9 to 12
- **Very high** .................................... more than 12

**Backslope.** The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.
Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bajada. A broad alluvial slope extending from the base of a mountain range out into a basin and formed by coalescence of separate alluvial fans.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See "Crown.")

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.
Capillary water. Water held as a thin film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a “channer.”

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common...
compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

**Conglomerate.** A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

**Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

**Consistence, soil.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Coppice dune.** A small dune of fine grained soil material stabilized around shrubs or small trees.

**Corrosion.** Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Cropping system.** Growing crops according to a planned system of rotation and management practices.

**Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

**Cuesta.** A hill or ridge that has a gentle slope on one side and a steep slope on the other; specifically, an asymmetric, homoclinal ridge capped by resistant rock layers of slight or moderate dip.

**Culmination of the mean annual increment (CMAI).** The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

**Desert pavement.** On a desert surface, a layer of gravel or larger fragments that was emplaced by upward movement of the underlying sediments or that remains after finer particles have been removed by running water or the wind.

**Dip slope.** A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a
consideration unless they have significantly changed the morphology of the soil.
Seven classes of natural soil drainage are recognized—excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Draw.** A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

**Duff.** A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

**Ecological site.** An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Endosaturation.** A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

**Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

**Ephemeral stream.** A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

**Episaturation.** A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

**Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

**Extrusive rock.** Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

**Fan remnant.** A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.
Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 5 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.
Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillsidet, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows.

O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.
Cr horizon.—Soft, consolidated bedrock beneath the soil.
R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.
Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Iliuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

- Less than 0.2 ............................................... very low
- 0.2 to 0.4 ....................................................... low
- 0.4 to 0.75 ................................................... moderately low
- 0.75 to 1.25 .................................................. moderate
- 1.25 to 1.75 .................................................. moderately high
- 1.75 to 2.5 ..................................................... high
- More than 2.5 ............................................... very high

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

- Basin. Water is applied rapidly to nearly level plains surrounded by levees or dikes.
- Border. Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
- Controlled flooding. Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
- Corrugation. Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
- Drip (or trickle). Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements.
Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.
Knoll. A small, low, rounded hill rising above adjacent landforms.
Ksat. Saturated hydraulic conductivity. (See "Permeability.")
Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.
Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.
Leaching. The removal of soluble material from soil or other material by percolating water.
Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at \( \frac{1}{3} \) or \( \frac{1}{10} \)-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.
Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.
Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.
Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.
Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.
Low strength. The soil is not strong enough to support loads.
Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.
Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.
Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.
Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.
Mesa. A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.
Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.
Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
**Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.

**Major Land Resource Area.** These are geographically associated land resource units. Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.

**Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.

**Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

**Mountain.** A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

**Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

**Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

**Natric horizon.** A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

**Neutral soil.** A soil having a pH value of 6.6 to 7.3. (See “Reaction, soil.”)

**Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxides are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

**Nose slope.** A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

- Very low .................. less than 0.5 percent
- Low .......................... 0.5 to 1.0 percent
- Moderately low ............. 1.0 to 2.0 percent
- Moderate .................. 2.0 to 4.0 percent
- High ........................ 4.0 to 8.0 percent
- Very high ................. more than 8.0 percent
Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Paleosols. A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

- Extremely slow .................................. 0.0 to 0.01 inch
- Very slow ...................................... 0.01 to 0.06 inch
- Slow ........................................... 0.06 to 0.2 inch
- Moderately slow .............................. 0.2 to 0.6 inch
- Moderate ..................................... 0.6 inch to 2.0 inches
- Moderately rapid ............................ 2.0 to 6.0 inches
- Rapid ......................................... 6.0 to 20 inches
- Very rapid .................................... more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See "Reaction, soil.")

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.
Potential native plant community. See “Climax plant community.”

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses; grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

- Ultra acid .............................................. less than 3.5
- Extremely acid ......................................... 3.5 to 4.4
- Very strongly acid .................................. 4.5 to 5.0
- Strongly acid .......................................... 5.1 to 5.5
- Moderately acid ..................................... 5.6 to 6.0
- Slightly acid .......................................... 6.1 to 6.5
- Neutral ................................................ 6.6 to 7.3
- Slightly alkaline ..................................... 7.4 to 7.8
- Moderately alkaline ............................... 7.9 to 8.4
- Strongly alkaline .................................... 8.5 to 9.0
- Very strongly alkaline ............................ 9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth’s surface; the loose earth material above the solid rock.
Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The degree to which a soil is affected by soluble salts. Salinity is expressed as a electrical conductivity (EC) of a saturation extract. The solution resistance is measured in mhos/cm. The degrees of salinity and their respective ratios are:

- Non saline: 0-2
- Very slightly saline: 2-4
- Slightly saline: 4-8
- Moderately saline: 8-16
- Strongly saline: >16

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-Swell. Soil volume changes due to increases or decreases in moisture content. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/5 or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a
fraction, the resulting value is COLE, coefficient of linear extensibility. The Shrink-swell classes are defined as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>LEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Moderate</td>
<td>3-6</td>
</tr>
<tr>
<td>High</td>
<td>6-9</td>
</tr>
<tr>
<td>Very High</td>
<td>&gt;9</td>
</tr>
</tbody>
</table>

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or as the ratio of Na⁺ to Ca²⁺ + Mg²⁺. The degrees of sodicity and their respective ratios are:

- Slight .............................................. less than 13:1
- Moderate ......................................... 13-30:1
- Strong ............................................ more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of
climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

<table>
<thead>
<tr>
<th>Separates</th>
<th>Size Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very coarse sand</td>
<td>2.0 to 1.0</td>
</tr>
<tr>
<td>Coarse sand</td>
<td>1.0 to 0.5</td>
</tr>
<tr>
<td>Medium sand</td>
<td>0.5 to 0.25</td>
</tr>
<tr>
<td>Fine sand</td>
<td>0.25 to 0.10</td>
</tr>
<tr>
<td>Very fine sand</td>
<td>0.10 to 0.05</td>
</tr>
<tr>
<td>Silt</td>
<td>0.05 to 0.002</td>
</tr>
<tr>
<td>Clay</td>
<td>less than 0.002</td>
</tr>
</tbody>
</table>

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.
Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.
Tables
### Table 1: Temperature and Precipitation

(Recorded in the period 1971-2000 at Cuba, NM #2241)

<table>
<thead>
<tr>
<th>Month</th>
<th>Average daily maximum</th>
<th>Average daily minimum</th>
<th>Average temperature higher than 2 years in 10 will have</th>
<th>Average temperature lower than 2 years in 10 will have</th>
<th>Average number of growing degree days</th>
<th>Average number of days with less than 0.10 inch snowfall</th>
<th>Average number of days with more than 0.10 inch snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>42.0</td>
<td>7.7</td>
<td>---</td>
<td>---</td>
<td>1</td>
<td>0.02</td>
<td>0.16</td>
</tr>
<tr>
<td>February</td>
<td>46.0</td>
<td>13.7</td>
<td>29.6</td>
<td>63</td>
<td>6</td>
<td>0.50</td>
<td>0.10</td>
</tr>
<tr>
<td>March</td>
<td>53.5</td>
<td>20.8</td>
<td>47.2</td>
<td>71</td>
<td>42</td>
<td>0.99</td>
<td>0.22</td>
</tr>
<tr>
<td>April</td>
<td>61.6</td>
<td>25.8</td>
<td>43.7</td>
<td>77</td>
<td>148</td>
<td>0.63</td>
<td>0.08</td>
</tr>
<tr>
<td>May</td>
<td>70.9</td>
<td>33.7</td>
<td>52.3</td>
<td>85</td>
<td>374</td>
<td>0.87</td>
<td>0.18</td>
</tr>
<tr>
<td>June</td>
<td>81.4</td>
<td>40.7</td>
<td>61.1</td>
<td>94</td>
<td>631</td>
<td>0.80</td>
<td>0.14</td>
</tr>
<tr>
<td>July</td>
<td>85.1</td>
<td>48.7</td>
<td>66.9</td>
<td>95</td>
<td>832</td>
<td>1.91</td>
<td>0.94</td>
</tr>
<tr>
<td>August</td>
<td>87.7</td>
<td>48.3</td>
<td>65.5</td>
<td>93</td>
<td>773</td>
<td>2.20</td>
<td>1.36</td>
</tr>
<tr>
<td>September</td>
<td>76.2</td>
<td>39.7</td>
<td>57.9</td>
<td>89</td>
<td>538</td>
<td>1.41</td>
<td>0.48</td>
</tr>
<tr>
<td>October</td>
<td>55.7</td>
<td>27.4</td>
<td>46.5</td>
<td>80</td>
<td>222</td>
<td>1.10</td>
<td>0.38</td>
</tr>
<tr>
<td>November</td>
<td>51.9</td>
<td>17.3</td>
<td>34.5</td>
<td>71</td>
<td>16</td>
<td>0.89</td>
<td>0.16</td>
</tr>
<tr>
<td>December</td>
<td>44.1</td>
<td>10.2</td>
<td>27.1</td>
<td>62</td>
<td>7</td>
<td>0.83</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Yearly:  
- Average: 63.4 27.8 45.6
- Maximum: 99 -26
- Minimum: -15

Units:  
- °F
- °C
- Inches

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F.).
Table 1.--Temperature and precipitation--continued

(Recorded in the period 1971-2000 at Jemez Springs, NM #4369)

<table>
<thead>
<tr>
<th>Month</th>
<th>Average daily maximum</th>
<th>Average daily minimum</th>
<th>2 years in 10 will have</th>
<th>Temperature</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP</td>
<td>OP</td>
<td>OP</td>
<td>OP</td>
<td>Units</td>
</tr>
<tr>
<td>January</td>
<td>46.2</td>
<td>19.8</td>
<td>33.0</td>
<td>63</td>
<td>-2</td>
</tr>
<tr>
<td>February</td>
<td>51.7</td>
<td>23.9</td>
<td>37.8</td>
<td>68</td>
<td>3</td>
</tr>
<tr>
<td>March</td>
<td>58.3</td>
<td>28.9</td>
<td>43.6</td>
<td>74</td>
<td>12</td>
</tr>
<tr>
<td>April</td>
<td>66.8</td>
<td>34.5</td>
<td>50.6</td>
<td>91</td>
<td>19</td>
</tr>
<tr>
<td>May</td>
<td>75.4</td>
<td>42.1</td>
<td>58.8</td>
<td>89</td>
<td>29</td>
</tr>
<tr>
<td>June</td>
<td>86.0</td>
<td>50.5</td>
<td>68.3</td>
<td>98</td>
<td>37</td>
</tr>
<tr>
<td>July</td>
<td>88.5</td>
<td>55.6</td>
<td>72.0</td>
<td>98</td>
<td>46</td>
</tr>
<tr>
<td>August</td>
<td>85.4</td>
<td>54.4</td>
<td>69.9</td>
<td>95</td>
<td>45</td>
</tr>
<tr>
<td>September</td>
<td>79.5</td>
<td>47.8</td>
<td>63.7</td>
<td>91</td>
<td>32</td>
</tr>
<tr>
<td>October</td>
<td>69.1</td>
<td>37.9</td>
<td>53.5</td>
<td>84</td>
<td>21</td>
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<tr>
<td>November</td>
<td>55.4</td>
<td>27.6</td>
<td>41.5</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td>December</td>
<td>47.1</td>
<td>20.5</td>
<td>34.0</td>
<td>63</td>
<td>0</td>
</tr>
</tbody>
</table>

Yearly:

- Average: 67.5
- Extreme: 101
- Total: 5124

Average number of growing degree days*:

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP</td>
<td>OP</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
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<td>52.2</td>
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<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
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<td></td>
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<td>52.2</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
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<td>52.2</td>
</tr>
<tr>
<td></td>
<td>37.0</td>
<td>52.2</td>
</tr>
</tbody>
</table>

Average number of days with 0.10 inch or more snowfall:

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP</td>
</tr>
<tr>
<td></td>
<td>13.03</td>
</tr>
<tr>
<td></td>
<td>20.72</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
</tr>
</tbody>
</table>
### Table 1. Temperature and precipitation—continued

(Recorded in the period 1971-2000 at Torreon Navajo Mission, NM 9031)

<table>
<thead>
<tr>
<th>Month</th>
<th>Average daily maximum</th>
<th>Average daily minimum</th>
<th>Temperature 2 years in 10 will have</th>
<th>Average minimum temperature lower than</th>
<th>Average maximum temperature higher than</th>
<th>Average number of growing degree days</th>
<th>Units</th>
<th>Average temperature</th>
<th>Average precipitation</th>
<th>Average number of days with 0.10 inch or more</th>
<th>Average snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>January-----</td>
<td>42.0</td>
<td>15.3</td>
<td>28.6</td>
<td>60</td>
<td>-50</td>
<td>4</td>
<td>0.61</td>
<td>0.19</td>
<td>0.98</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>February----</td>
<td>47.9</td>
<td>20.8</td>
<td>34.4</td>
<td>65</td>
<td>-3</td>
<td>21</td>
<td>0.43</td>
<td>0.19</td>
<td>0.63</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>March-------</td>
<td>57.1</td>
<td>25.6</td>
<td>41.3</td>
<td>75</td>
<td>9</td>
<td>107</td>
<td>0.73</td>
<td>0.20</td>
<td>1.13</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td>April-------</td>
<td>65.9</td>
<td>31.3</td>
<td>48.6</td>
<td>82</td>
<td>16</td>
<td>275</td>
<td>0.63</td>
<td>0.08</td>
<td>1.13</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>May---------</td>
<td>75.3</td>
<td>40.0</td>
<td>57.6</td>
<td>89</td>
<td>23</td>
<td>547</td>
<td>0.78</td>
<td>0.09</td>
<td>1.51</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>June--------</td>
<td>86.3</td>
<td>49.0</td>
<td>67.6</td>
<td>98</td>
<td>32</td>
<td>814</td>
<td>0.59</td>
<td>0.05</td>
<td>1.05</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>July--------</td>
<td>88.9</td>
<td>55.5</td>
<td>72.2</td>
<td>99</td>
<td>38</td>
<td>993</td>
<td>1.56</td>
<td>0.78</td>
<td>2.27</td>
<td>4</td>
<td>0.0</td>
</tr>
<tr>
<td>August------</td>
<td>85.9</td>
<td>54.4</td>
<td>70.1</td>
<td>96</td>
<td>42</td>
<td>932</td>
<td>1.86</td>
<td>0.85</td>
<td>2.77</td>
<td>5</td>
<td>0.0</td>
</tr>
<tr>
<td>September---</td>
<td>79.1</td>
<td>46.8</td>
<td>63.0</td>
<td>92</td>
<td>30</td>
<td>685</td>
<td>1.29</td>
<td>0.48</td>
<td>2.11</td>
<td>3</td>
<td>0.0</td>
</tr>
<tr>
<td>October-----</td>
<td>67.5</td>
<td>35.1</td>
<td>51.3</td>
<td>83</td>
<td>35</td>
<td>359</td>
<td>1.07</td>
<td>0.39</td>
<td>1.83</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td>November----</td>
<td>52.5</td>
<td>23.7</td>
<td>38.1</td>
<td>71</td>
<td>2</td>
<td>67</td>
<td>0.78</td>
<td>0.26</td>
<td>1.23</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>December----</td>
<td>43.3</td>
<td>16.2</td>
<td>29.8</td>
<td>61</td>
<td>-6</td>
<td>4</td>
<td>0.47</td>
<td>0.06</td>
<td>0.83</td>
<td>1</td>
<td>4.1</td>
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<tr>
<td>Average-----</td>
<td>66.0</td>
<td>34.5</td>
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<tr>
<td>Extreme-----</td>
<td>101</td>
<td>-33</td>
<td>99</td>
<td>-24</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Total-------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>4808</td>
<td>10.80</td>
<td>6.63</td>
<td>12.87</td>
<td>27</td>
<td>20.5</td>
</tr>
</tbody>
</table>
Table 1.--Temperature and precipitation--continued
(Recorded in the period 1971-2000 at Wolf Canyon, NM #9820)

<table>
<thead>
<tr>
<th>Month</th>
<th>Average daily maximum</th>
<th>Average daily minimum</th>
<th>2 years in 10 will have</th>
<th>Average number of growing degree days*</th>
<th>Average snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°F</td>
<td>°F</td>
<td>°F</td>
<td>units</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>37.5</td>
<td>7.6</td>
<td>22.5</td>
<td>55 -18</td>
<td>2.03</td>
</tr>
<tr>
<td>February</td>
<td>40.2</td>
<td>11.1</td>
<td>25.7</td>
<td>87 -15</td>
<td>1.97</td>
</tr>
<tr>
<td>March</td>
<td>45.7</td>
<td>17.3</td>
<td>31.5</td>
<td>62 -5</td>
<td>2.13</td>
</tr>
<tr>
<td>April</td>
<td>53.7</td>
<td>22.7</td>
<td>38.2</td>
<td>70 3</td>
<td>2.39</td>
</tr>
<tr>
<td>May</td>
<td>62.5</td>
<td>28.9</td>
<td>45.9</td>
<td>77 3</td>
<td>1.40</td>
</tr>
<tr>
<td>June</td>
<td>71.2</td>
<td>35.1</td>
<td>54.2</td>
<td>83 22</td>
<td>1.21</td>
</tr>
<tr>
<td>July</td>
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<td>41.7</td>
<td>58.7</td>
<td>86 30</td>
<td>3.17</td>
</tr>
<tr>
<td>August</td>
<td>72.8</td>
<td>41.6</td>
<td>57.2</td>
<td>82 32</td>
<td>3.85</td>
</tr>
<tr>
<td>September</td>
<td>67.4</td>
<td>35.0</td>
<td>51.2</td>
<td>80 20</td>
<td>2.12</td>
</tr>
<tr>
<td>October</td>
<td>57.6</td>
<td>28.6</td>
<td>41.6</td>
<td>73 9</td>
<td>2.03</td>
</tr>
<tr>
<td>November</td>
<td>44.8</td>
<td>16.1</td>
<td>30.5</td>
<td>64 9</td>
<td>1.83</td>
</tr>
<tr>
<td>December</td>
<td>38.4</td>
<td>9.2</td>
<td>23.8</td>
<td>56 -15</td>
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<tr>
<td>Yearly</td>
<td></td>
<td></td>
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<tr>
<td>Average</td>
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<td>89</td>
<td>-36</td>
<td>66</td>
<td>-21</td>
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</tr>
<tr>
<td>Total</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>2218</td>
<td>24.28</td>
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</table>

Table 2.--Freeze dates in spring and fall
(Recorded in the period 1971-2000 at Cuba, NM #2241)

<table>
<thead>
<tr>
<th>Probability</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24°F or lower</td>
</tr>
<tr>
<td>Last freezing temperature in spring:</td>
<td></td>
</tr>
<tr>
<td>1 year in 10 later than--</td>
<td>May 31</td>
</tr>
<tr>
<td>2 years in 10 later than--</td>
<td>May 25</td>
</tr>
<tr>
<td>5 years in 10 later than--</td>
<td>May 13</td>
</tr>
<tr>
<td>First freezing temperature in fall:</td>
<td></td>
</tr>
<tr>
<td>1 year in 10 earlier than--</td>
<td>September 19</td>
</tr>
<tr>
<td>2 years in 10 earlier than--</td>
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<tr>
<td>5 years in 10 earlier than--</td>
<td>October 3</td>
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Table 2.--Freeze dates in spring and fall--continued
(Recorded in the period 1971-2000 at Jemez Springs, NM #4362)

<table>
<thead>
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<tbody>
<tr>
<td></td>
<td>24 °F or lower</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1 year in 10 later than--</td>
<td>April 20</td>
</tr>
<tr>
<td>2 years in 10 later than--</td>
<td>April 15</td>
</tr>
<tr>
<td>5 years in 10 later than--</td>
<td>April 5</td>
</tr>
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</table>

First freezing temperature in fall:

<table>
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<tr>
<th></th>
<th>1 year in 10 earlier than--</th>
<th>2 years in 10 earlier than--</th>
<th>5 years in 10 earlier than--</th>
</tr>
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<tr>
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<td>October 21</td>
<td>October 4</td>
<td>September 26</td>
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<tr>
<td></td>
<td>October 26</td>
<td>October 10</td>
<td>October 1</td>
</tr>
<tr>
<td></td>
<td>November 5</td>
<td>October 22</td>
<td>October 10</td>
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Table 2.--Freeze dates in spring and fall--continued
(Recorded in the period 1971-2000 at Torreon Navajo Mission, NM #9021)

<table>
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<td>24°F or lower</td>
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<tr>
<td>Last freezing temperature in spring:</td>
<td></td>
</tr>
<tr>
<td>1 year in 10 later than--</td>
<td>May 13</td>
</tr>
<tr>
<td>2 years in 10 later than--</td>
<td>May 6</td>
</tr>
<tr>
<td>5 years in 10 later than--</td>
<td>April 23</td>
</tr>
<tr>
<td>First freezing temperature in fall:</td>
<td></td>
</tr>
<tr>
<td>1 year in 10 earlier than--</td>
<td>October 8</td>
</tr>
<tr>
<td>2 years in 10 earlier than--</td>
<td>October 14</td>
</tr>
<tr>
<td>5 years in 10 earlier than--</td>
<td>October 24</td>
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</table>
Table 2.--Freeze dates in spring and fall—continued
(Recorded in the period 1971-2000 at Wolf Canyon, NM #9820)

<table>
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<th>Temperature</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 °F or lower</td>
<td>28 °F or lower</td>
<td>32 °F or lower</td>
</tr>
<tr>
<td>Last freezing temperature in spring:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year in 10 later than--</td>
<td>June 14</td>
<td>June 28</td>
<td>July 10</td>
</tr>
<tr>
<td>2 years in 10 later than--</td>
<td>June 7</td>
<td>June 22</td>
<td>July 5</td>
</tr>
<tr>
<td>5 years in 10 later than--</td>
<td>May 24</td>
<td>June 12</td>
<td>June 26</td>
</tr>
<tr>
<td>First freezing temperature in fall:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year in 10 earlier than--</td>
<td>September 13</td>
<td>September 5</td>
<td>August 15</td>
</tr>
<tr>
<td>2 years in 10 earlier than--</td>
<td>September 19</td>
<td>September 10</td>
<td>August 22</td>
</tr>
<tr>
<td>5 years in 10 earlier than--</td>
<td>September 29</td>
<td>September 18</td>
<td>September 3</td>
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</table>
Table 3.--Growing season
(Recorded for the period 1971-2000 at Cuba, NM #2241)

<table>
<thead>
<tr>
<th>Probability</th>
<th>Daily minimum temperature</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily minimum temperature</td>
<td>Higher than 24°F</td>
<td>Higher than 28°F</td>
</tr>
<tr>
<td></td>
<td>Days</td>
<td>Days</td>
<td>Days</td>
</tr>
<tr>
<td>9 years in 10</td>
<td>117</td>
<td>97</td>
<td>70</td>
</tr>
<tr>
<td>8 years in 10</td>
<td>125</td>
<td>103</td>
<td>77</td>
</tr>
<tr>
<td>5 years in 10</td>
<td>141</td>
<td>116</td>
<td>92</td>
</tr>
<tr>
<td>2 years in 10</td>
<td>156</td>
<td>128</td>
<td>106</td>
</tr>
<tr>
<td>1 year in 10</td>
<td>165</td>
<td>134</td>
<td>114</td>
</tr>
</tbody>
</table>

Table 3.--Growing season--continued
(Recorded for the period 1971-2000 at Jemez Springs, NM #4369)

<table>
<thead>
<tr>
<th>Probability</th>
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<th></th>
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<tbody>
<tr>
<td></td>
<td>Daily minimum temperature</td>
<td>Higher than 24°F</td>
<td>Higher than 28°F</td>
</tr>
<tr>
<td></td>
<td>Days</td>
<td>Days</td>
<td>Days</td>
</tr>
<tr>
<td>9 years in 10</td>
<td>187</td>
<td>153</td>
<td>136</td>
</tr>
<tr>
<td>8 years in 10</td>
<td>196</td>
<td>164</td>
<td>143</td>
</tr>
<tr>
<td>5 years in 10</td>
<td>213</td>
<td>186</td>
<td>156</td>
</tr>
<tr>
<td>2 years in 10</td>
<td>230</td>
<td>207</td>
<td>169</td>
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<tr>
<td>1 year in 10</td>
<td>239</td>
<td>218</td>
<td>176</td>
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Table 3.--Growing season--continued
(Recorded for the period 1971-2000 at Torreon Navajo Mission, NM #9031)

<table>
<thead>
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<tbody>
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<td></td>
<td>Days</td>
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<td>9 years in 10</td>
<td>155</td>
</tr>
<tr>
<td>8 years in 10</td>
<td>167</td>
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<tr>
<td>5 years in 10</td>
<td>183</td>
</tr>
<tr>
<td>2 years in 10</td>
<td>199</td>
</tr>
<tr>
<td>1 year in 10</td>
<td>208</td>
</tr>
</tbody>
</table>

Table 3.--Growing season--continued
(Recorded for the period 1971-2000 at Wolf Canyon, NM #9820)

<table>
<thead>
<tr>
<th>Probability</th>
<th>Daily minimum temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Higher than 24 °F</td>
</tr>
<tr>
<td></td>
<td>Days</td>
</tr>
<tr>
<td>9 years in 10</td>
<td>97</td>
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<tr>
<td>8 years in 10</td>
<td>107</td>
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<tr>
<td>5 years in 10</td>
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<tr>
<td>2 years in 10</td>
<td>146</td>
</tr>
<tr>
<td>1 year in 10</td>
<td>157</td>
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</tbody>
</table>
Table 4.--Acreage and proportionate extent of the soils

<table>
<thead>
<tr>
<th>Map symbol</th>
<th>Soil name</th>
<th>Los Alamos County Acres</th>
<th>Rio Arriba County Acres</th>
<th>Sandoval County Acres</th>
<th>Total Acres</th>
<th>Extent Pct.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Silver-Clovis loams, 1 to 7 percent slopes----</td>
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<td>---</td>
<td>10,489</td>
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<tr>
<td>2</td>
<td>Clovis-Prieta-Silver association, 3 to 15 percent slopes---</td>
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<td>9,027</td>
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<td>9,027</td>
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<tr>
<td>3</td>
<td>Montecito-Orejas complex, 1 to 7 percent slopes---</td>
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<tr>
<td>4</td>
<td>Montecito complex, 3 to 30 percent slopes-----</td>
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<td>22,532</td>
<td>22,532</td>
<td>22,532</td>
<td>1.5</td>
</tr>
<tr>
<td>10</td>
<td>Trail silty clay loam, 0 to 1 percent slopes---</td>
<td>---</td>
<td>757</td>
<td>757</td>
<td>757</td>
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<tr>
<td>11</td>
<td>Trail fine sandy loam, 0 to 1 percent slopes---</td>
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<td>1,994</td>
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</tr>
<tr>
<td>13</td>
<td>Sandoval-Querencia association, 2 to 7 percent slopes---</td>
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<td>15</td>
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<td>17,038</td>
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<tr>
<td>16</td>
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<td>1,039</td>
<td>155</td>
<td>1,194</td>
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<tr>
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<tr>
<td>18</td>
<td>Sparham clay, 0 to 3 percent slopes------------</td>
<td>---</td>
<td>2,927</td>
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<td>2,927</td>
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</tr>
<tr>
<td>20</td>
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<td>1,111</td>
<td>1,111</td>
<td>1,111</td>
<td>*</td>
</tr>
<tr>
<td>21</td>
<td>Rock outcrop-Hackroy complex, 1 to 8 percent slopes---</td>
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<td>10,967</td>
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<tr>
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<td>531</td>
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<tr>
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<td>3,263</td>
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<tr>
<td>24</td>
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<td>22,785</td>
<td>22,785</td>
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<td>25</td>
<td>Gilco loam, 0 to 1 percent slopes---------------</td>
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<td>3,602</td>
<td>3,602</td>
<td>3,602</td>
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<tr>
<td>26</td>
<td>Orlie loam, 0 to 8 percent slopes---------------</td>
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<td>4,577</td>
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<td>27</td>
<td>Aga loam, 0 to 1 percent slopes----------------</td>
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<td>1,950</td>
<td>1,950</td>
<td>1,950</td>
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<tr>
<td>29</td>
<td>Trail loamy sand, 0 to 1 percent slopes---------</td>
<td>---</td>
<td>925</td>
<td>925</td>
<td>925</td>
<td>*</td>
</tr>
<tr>
<td>31</td>
<td>Riverwash---------------------------------------</td>
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<td>9,415</td>
<td>9,415</td>
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<tr>
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<td>Fitz-------------------------------------------</td>
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<td>1,320</td>
<td>1,320</td>
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<tr>
<td>34</td>
<td>Ildefonso-Witt association, 1 to 8 percent slopes---</td>
<td>---</td>
<td>20,220</td>
<td>20,220</td>
<td>20,220</td>
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<tr>
<td>41</td>
<td>Dune land---------------------------------------</td>
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<td>792</td>
<td>792</td>
<td>792</td>
<td>*</td>
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<tr>
<td>47</td>
<td>Cascajo very gravelly sandy loam, 12 to 30 percent slopes---</td>
<td>---</td>
<td>9,700</td>
<td>9,700</td>
<td>9,700</td>
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<tr>
<td>51</td>
<td>Sparham clay loam, 0 to 1 percent slopes--------</td>
<td>---</td>
<td>871</td>
<td>871</td>
<td>871</td>
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<tr>
<td>52</td>
<td>Totavi loamy sand, 0 to 5 percent slopes-------</td>
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<td>2,685</td>
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<td>Witt-Harvey association, 1 to 7 percent slopes---</td>
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<td>54</td>
<td>Harvey-Cascajo association, 5 to 15 percent slopes---</td>
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<td>33,134</td>
<td>33,134</td>
<td>33,134</td>
<td>2.2</td>
</tr>
<tr>
<td>55</td>
<td>La Fonda loam, 1 to 5 percent slopes-----------</td>
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<td>4,734</td>
<td>4,734</td>
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<td>56</td>
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<td>12,889</td>
<td>12,889</td>
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<td>0.9</td>
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<tr>
<td>57</td>
<td>Badland----------------------------------------</td>
<td>---</td>
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<td>17,590</td>
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<tr>
<td>58</td>
<td>Deana-Ripiedo association, 5 to 30 percent slopes---</td>
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<td>2,525</td>
<td>2,525</td>
<td>2,525</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Table 4.--Acreage and proportionate extent of the soils--continued

<table>
<thead>
<tr>
<th>Map symbol</th>
<th>Soil name</th>
<th>Los Alamos County</th>
<th>Rio Arriba County</th>
<th>Sandoval County</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>Harvey-Ildefonso-La Fonda association, 3 to 15 percent slopes</td>
<td>---</td>
<td>---</td>
<td>7,884</td>
<td>7,884</td>
</tr>
<tr>
<td>63</td>
<td>Placitas gravelly loam, 8 to 40 percent slopes</td>
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<td>8,545</td>
<td>8,545</td>
<td>0.6</td>
</tr>
<tr>
<td>64</td>
<td>Skivilage-Ildefonso association, 8 to 40 percent slopes</td>
<td>---</td>
<td>---</td>
<td>3,604</td>
<td>3,604</td>
</tr>
<tr>
<td>65</td>
<td>Ildefonso-Harvey association, 10 to 35 percent slopes</td>
<td>---</td>
<td>---</td>
<td>12,168</td>
<td>12,168</td>
</tr>
<tr>
<td>66</td>
<td>Zia sandy loam, 3 to 6 percent slopes</td>
<td>---</td>
<td>---</td>
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<td>16,387</td>
</tr>
<tr>
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<td>Sandoval-Poley complex, 3 to 10 percent slopes</td>
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<td>Penistaja-Querencia complex, 2 to 7 percent slopes</td>
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<td>---</td>
<td>10,942</td>
<td>10,942</td>
</tr>
<tr>
<td>71</td>
<td>Palon cobbly sandy loam, 15 to 35 percent slopes</td>
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<td>324</td>
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<td>3,165</td>
</tr>
<tr>
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<td>Palon very cobbly sandy loam, 35 to 65 percent slopes</td>
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<td>---</td>
<td>6,267</td>
<td>6,267</td>
</tr>
<tr>
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<td>Origo-Pavo association, 5 to 35 percent slopes</td>
<td>---</td>
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<tr>
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Table 4.--Acreage and proportionate extent of the soils--continued

<table>
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<th>Soil name</th>
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<th>Sandoval County</th>
<th>Total</th>
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<tbody>
<tr>
<td></td>
<td>Acres</td>
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<td>3,447</td>
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<tr>
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<td>1,052</td>
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<td>Waquie very gravelly fine sandy loam, 8 to 25 percent slopes</td>
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<td>Jociity loam, 0 to 2 percent slopes</td>
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<td>Santa Fe-Waquie-Rock outcrop complex, 25 to 70 percent slopes</td>
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<tr>
<td>Fiaavetes loamy sand, 1 to 3 percent slopes</td>
<td>---</td>
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<td>570</td>
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<tr>
<td>Gilco loam, moderately saline, sodic, 0 to 1 percent slopes</td>
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<td>277</td>
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<td>Vessilla-Menefee-Orlie association, 0 to 30 percent slopes</td>
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<td>77</td>
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<td>Laventana-Mirand very cobbly loams, 15 to 55 percent slopes</td>
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<tr>
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### Table 4.--Acreage and proportionate extent of the soils--continued

<table>
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<tr>
<th>Map symbol</th>
<th>Soil name</th>
<th>Los Alamos County Acres</th>
<th>Rio Arriba County Acres</th>
<th>Sandoval County Acres</th>
<th>Total Acres</th>
<th>Extent Pct.</th>
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<tbody>
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<td>Peralta clay loam, moderately saline, sodic, 0 to 2 percent slopes,</td>
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<td>511</td>
<td>511</td>
<td>*</td>
</tr>
<tr>
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<td>unprotected</td>
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<td>1,495,904</td>
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* Less than 0.1 percent.
Table 5.--Irrigated and nonirrigated yields by map unit component

(Yields in the "N" columns are for nonirrigated areas; those in the "I" columns are for irrigated areas. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

<table>
<thead>
<tr>
<th>Map symbol and soil name</th>
<th>Land capability</th>
<th>Alfalfa hay</th>
<th>Sweet corn</th>
<th>Pasture</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>I</td>
<td>N</td>
<td>I</td>
</tr>
<tr>
<td>1: Silver------------------- 6e</td>
<td>4e</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Clovis------------------- 6c</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2: Clovis------------------- 6c</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Prieta------------------- 7s</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Silver------------------- 6e</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3: Montecito------------------- 6e</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Orejas------------------- 7s</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4: Montecito------------------- 6e</td>
<td>---</td>
<td>---</td>
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</tr>
<tr>
<td>Montecito, bouldery------------------- 7s</td>
<td>---</td>
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<tr>
<td>10: Trail------------------- 7s</td>
<td>4e</td>
<td>---</td>
<td>6.00</td>
<td>---</td>
</tr>
<tr>
<td>11: Trail------------------- 7s</td>
<td>4e</td>
<td>---</td>
<td>6.00</td>
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</tr>
<tr>
<td>13: Sandoval------------------- 7s</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Querencia------------------- 6c</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>15: Camino------------------- 6c</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
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<tr>
<td>Sandoval------------------- 7s</td>
<td>---</td>
<td>---</td>
<td>---</td>
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</tr>
<tr>
<td>16: Rock outcrop------------------- 8s</td>
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Table 5.--Irrigated and nonirrigated yields by map unit component

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<thead>
<tr>
<th>Map symbol and soil name</th>
<th>Land capability</th>
<th>Alfalfa hay</th>
<th>Sweet corn</th>
<th>Pasture</th>
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<td>Tons N</td>
<td>Tons I</td>
<td>Tons N</td>
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<td>18: Menefee-----------------</td>
<td>7s</td>
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<td>Rock outcrop-----------------</td>
<td>8s</td>
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<td>--</td>
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<tr>
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<td>3s</td>
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<td>20: Gilco-----------------</td>
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<td>2e</td>
<td>--</td>
<td>7.50</td>
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<tr>
<td>21: Rock outcrop-----------------</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Hackroy-----------------</td>
<td>7s</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>22: Aga-----------------</td>
<td>7c</td>
<td>2s</td>
<td>--</td>
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</tr>
<tr>
<td>23: Hickman-----------------</td>
<td>6c</td>
<td>3e</td>
<td>--</td>
<td>2.00</td>
</tr>
<tr>
<td>24: Orlie-----------------</td>
<td>6c</td>
<td>--</td>
<td>--</td>
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<td>Sparham-----------------</td>
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<td>3s</td>
<td>--</td>
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<td>Map symbol and soil name</td>
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<td>Sweet corn</td>
<td>Pasture</td>
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<tr>
<td></td>
<td></td>
<td>N</td>
<td>I</td>
<td>Tons</td>
</tr>
<tr>
<td>33: Pits</td>
<td>8e</td>
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<td></td>
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</tr>
<tr>
<td>Witt</td>
<td>6e</td>
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<td>41: Dune land</td>
<td>8e</td>
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<td>53: Witt</td>
<td>6e</td>
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<td>7e</td>
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<td>54: Harvey</td>
<td>7e</td>
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<tr>
<td>Cascajo</td>
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<td>55: La Fonda</td>
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<td>56: Ildefonso</td>
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<td>Map symbol and soil name</td>
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<td>Sweet corn</td>
<td>Pasture</td>
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<td>59:</td>
<td>7s</td>
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<td>Skyvillage---------------</td>
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<td>7s</td>
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Table 5.--Irrigated and nonirrigated yields by map unit component
Table 5.--Irrigated and nonirrigated yields by map unit component

<table>
<thead>
<tr>
<th>Map symbol and soil name</th>
<th>Land capability</th>
<th>Alfalfa hay</th>
<th>Sweet corn</th>
<th>Pasture</th>
</tr>
</thead>
<tbody>
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<td>I</td>
<td>N</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Tons</td>
<td>Tons</td>
<td>Tons</td>
<td>Tons</td>
</tr>
<tr>
<td>82: Calaveras</td>
<td>7c</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>83: Calaveras</td>
<td>7e</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Rubble land</td>
<td>8s</td>
<td>---</td>
<td>---</td>
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</tr>
<tr>
<td>85: Redondo</td>
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<td>86: Redondo</td>
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<td>87: Redondo</td>
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<td>Rubble land</td>
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<td>88: Totawi</td>
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<tr>
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Table 5.--Irrigated and nonirrigated yields by map unit component

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<th>Pasture</th>
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Table 5.--Irrigated and nonirrigated yields by map unit component

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Table 5.--Irrigated and nonirrigated yields by map unit component

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Table 6.—Prime and other important farmland

(Only the soils considered prime or important farmland are listed. Urban or built-up areas of the soils listed are not considered prime or important farmland. If a soil is prime or important farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

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<td>Aga silt clay loam, 0 to 1 percent slopes</td>
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<td>Aga loam, 0 to 1 percent slopes</td>
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<td>Zia loam, 0 to 1 percent slopes</td>
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<td>Peralta loam, 0 to 1 percent slopes</td>
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Table 7.--Rangeland productivity

(Only the soils that support rangeland vegetation suitable for grazing are rated.)

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Table 7.--Rangeland productivity--continued

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Table 8.—Forestland productivity

Only those map units which produce harvestable timber are shown

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Table 8.--Forestland productivity--continued

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Table 9A. -- Camp areas, picnic areas, and playgrounds

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

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Table 9A.--Camp areas, picnic areas, and playgrounds--continued

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Table 9A. --Camp areas, picnic areas, and playgrounds--continued

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Table 9A.--Camp areas, picnic areas, and playgrounds--continued

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Table 9A.--Camp areas, picnic areas, and playgrounds--continued

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Table 9A.--Camp areas, picnic areas, and playgrounds--continued

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Table 9A.--Camp areas, picnic areas, and playgrounds--continued

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Table 9B. Paths, trails, and golf fairways

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

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Table 9B.--Paths, trails, and golf fairways--continued

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- Depth to bedrock
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- Not limited
- Large stones content
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Table 9B.--Paths, trails, and golf fairways--continued

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Table 10A.--Dwellings and small commercial buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

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Table 10A.--Dwellings and small commercial buildings--continued

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Table 10A.--Dwellings and small commercial buildings--continued

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Table 10A.--Dwellings and small commercial buildings--continued

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Table 10A.--Dwellings and small commercial buildings--continued

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Table 10A.--Dwellings and small commercial buildings--continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements | | Dwellings with basements | | small commercial buildings |
|--------------------------|------------------|----------------------------|----------------|---------------------------|---------------------------|
|                          |                  | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 414: Wauquie------------- | 85               | Very limited Slope 1.00 | Slope 1.00 | Very limited Slope 1.00 | Slope 1.00 |
|                          |                  | Shrink-swell 0.50 | Shrink-swell 0.50 |                   | Shrink-swell 0.50 |
| 417: Jocity-------------- | 85               | Very limited Flooding 1.00 | Flooding 1.00 | Very limited Flooding 1.00 | Flooding 1.00 |
|                          |                  | Shrink-swell 0.50 | Shrink-swell 0.50 | Depth to saturated zone 0.15 | Shrink-swell 0.50 |
| 418: Jocity-------------- | 85               | Very limited Flooding 1.00 | Flooding 1.00 | Very limited Flooding 1.00 | Flooding 1.00 |
|                          |                  | Shrink-swell 0.50 | Shrink-swell 0.50 | Depth to saturated zone 0.15 | Shrink-swell 0.50 |
| 419: Santa Fe------------ | 40               | Very limited Slope 1.00 | Slope 1.00 | Very limited Slope 1.00 | Slope 1.00 |
|                          |                  | Depth to hard bedrock 1.00 | Depth to hard bedrock 1.00 |                   | Depth to hard bedrock 1.00 |
|                          |                  | Shrink-swell 0.50 | Shrink-swell 0.50 | Large stones content 0.01 | Shrink-swell 0.50 |
|                          |                  | Large stones content 0.01 | Large stones content 0.01 |                   | Large stones content 0.01 |
|                          |                  | Wauquie------------- |            | Very limited Slope 1.00 | Slope 1.00 |
|                          |                  | Large stones content 0.08 | Large stones content 0.08 |                   | Large stones content 0.08 |
|                          |                  | Rock outcrop-------- | Not rated | Not rated | Not rated |
|                          |                  | Pinavetes----------- | Not rated | Not limited | Not limited |
|                          |                  | Gilco, moderately saline, sodic---- | Very limited Flooding 1.00 | Very limited Flooding 1.00 | Flooding 1.00 |
## Table 10A.--Dwellings and small commercial buildings--continued

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## Table 10A.—Dwellings and small commercial buildings—continued

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Table 10A.--Dwellings and small commercial buildings--continued

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