# 3. Geological and Soil Conditions

Flows of basalt at varying depths and widths run through the Plan Area. Six lava flows have been identified that issued from volcanic fissures related to the subsidence of the Albuquerque basin approximately 190,000 years ago. (See **Exhibit 7, *Lava Flows***) Successive flows decreased in temperature and increased in viscosity. Superimposition of the flows can be seen in the Geologic Windows.

According to the National Park Service report, *Albuquerque West Mesa Petroglyph Study*, June 1987, "Soil has formed on West Mesa as the rocks have slowly weathered. The common parent materials are basalt and fine alluvial silt and sand. Sand is common in this environment and, if not part of the parent rock, is soon added by the wind. On the mesa top, soil varies in depth from 0 on the escarpment rim and volcanic cones to more than 5 feet in broad areas of little slope." Generally in the western portions of the Plan Area at higher elevations closer to the volcanic cones, soil is thinner and basalt is closer to the surface.

Soil conditions are mapped on **Exhibit 8, *Soil Series*** using information from the *Northwest Mesa Escarpment Plan* (NWMEP). Information regarding geology and soils was obtained from the Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties as cited in the NWMEP.

According to the NWMEP, four types of soils overlie the basalt along the upper edge of the volcanic escarpment and mesa. As shown on the map, the predominant type is Alameda sandy loam at 0-5% slopes. Moderately deep and well drained, runoff is medium and water erosion is slight. The second most prevalent soil type is Madurez-Wink, which is deeper, well drained and gently sloping. Wind erosion is moderate to severe. Akela-Rock outcrop at 1-9% slope occurs near the escarpment edge and in the western portion of the Plan Area. It is a cobbly sandy loam, with a shallow depth to bedrock. According to the NWMEP, the underlying basalt is exposed throughout 20% of this complex. Runoff is very rapid and water erosion moderate.

The Kokan-Rock outcrop association characterizes the face of the volcanic escarpment and the area within and surrounding the Northern Geologic Window. Basalt boulders cover 40% of the escarpment face. Runoff is rapid. Shallow depth to bedrock, steep slopes, small stones, and inability to maintain cut slopes in the outcrop severely limits use of the complex for excavations and dwellings.

Much of SAD 227 consists of Latene sandy loam at 1-5% slopes. This soil type is comparatively deep and well drained. Engineers describe conditions of approximately two feet of soil in this area that needed little fill.

## *Development and Engineering Considerations*

Retention of the natural landscape is a key goal of this Plan and of previously adopted City policies. Importing large amounts of fill, as developments in the area have done, is not a desirable solution because this type of treatment masks the natural terrain and geological conditions that make the area unique, desirable, and of value to residents and the larger community.

**Surface water.** According to the NWMEP, "Mesa top soils impose certain constraints on development. Vertical joints along the rim of the escarpment are planes of weakness,

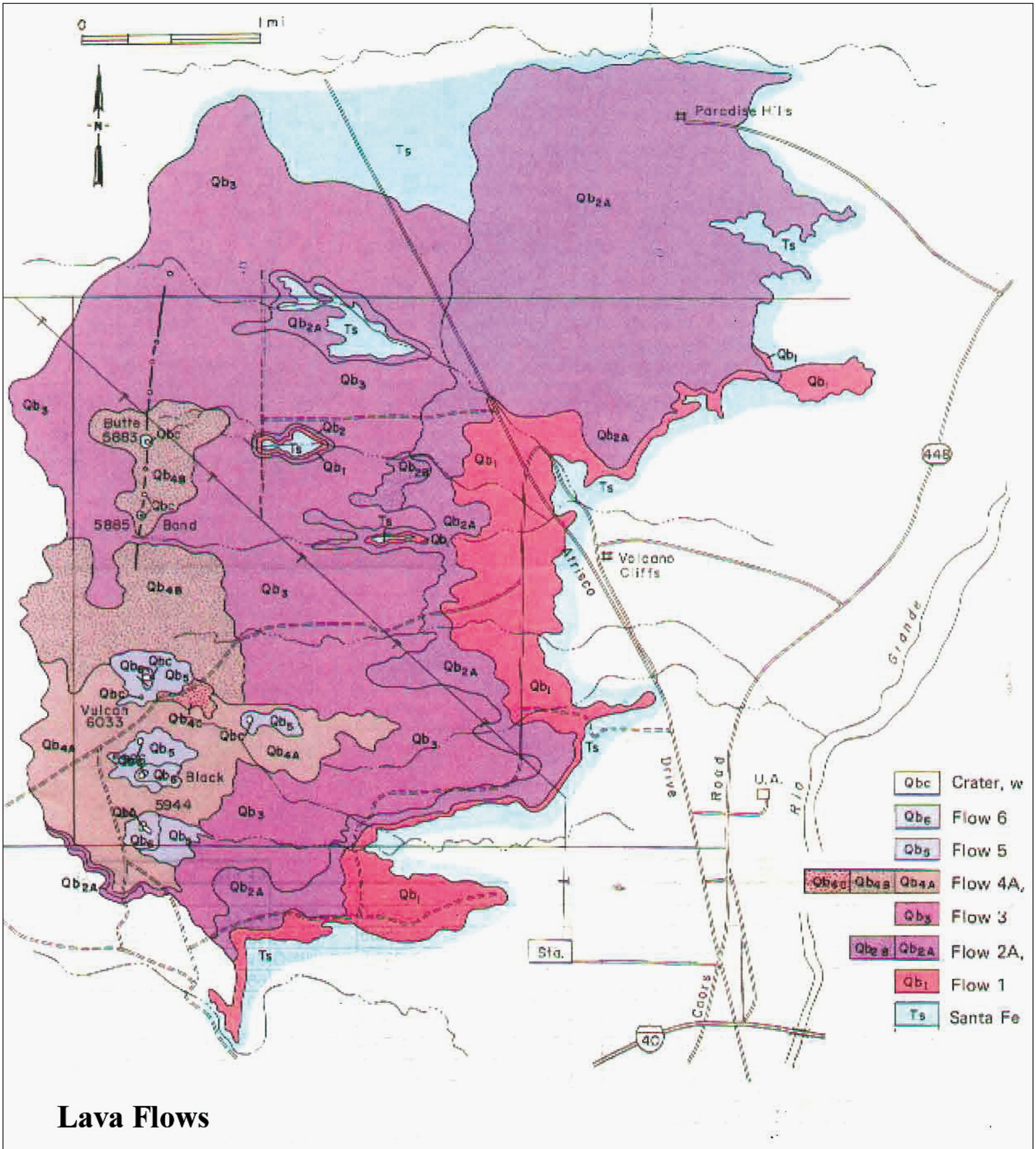


**Exhibit 7**
Lava Flows

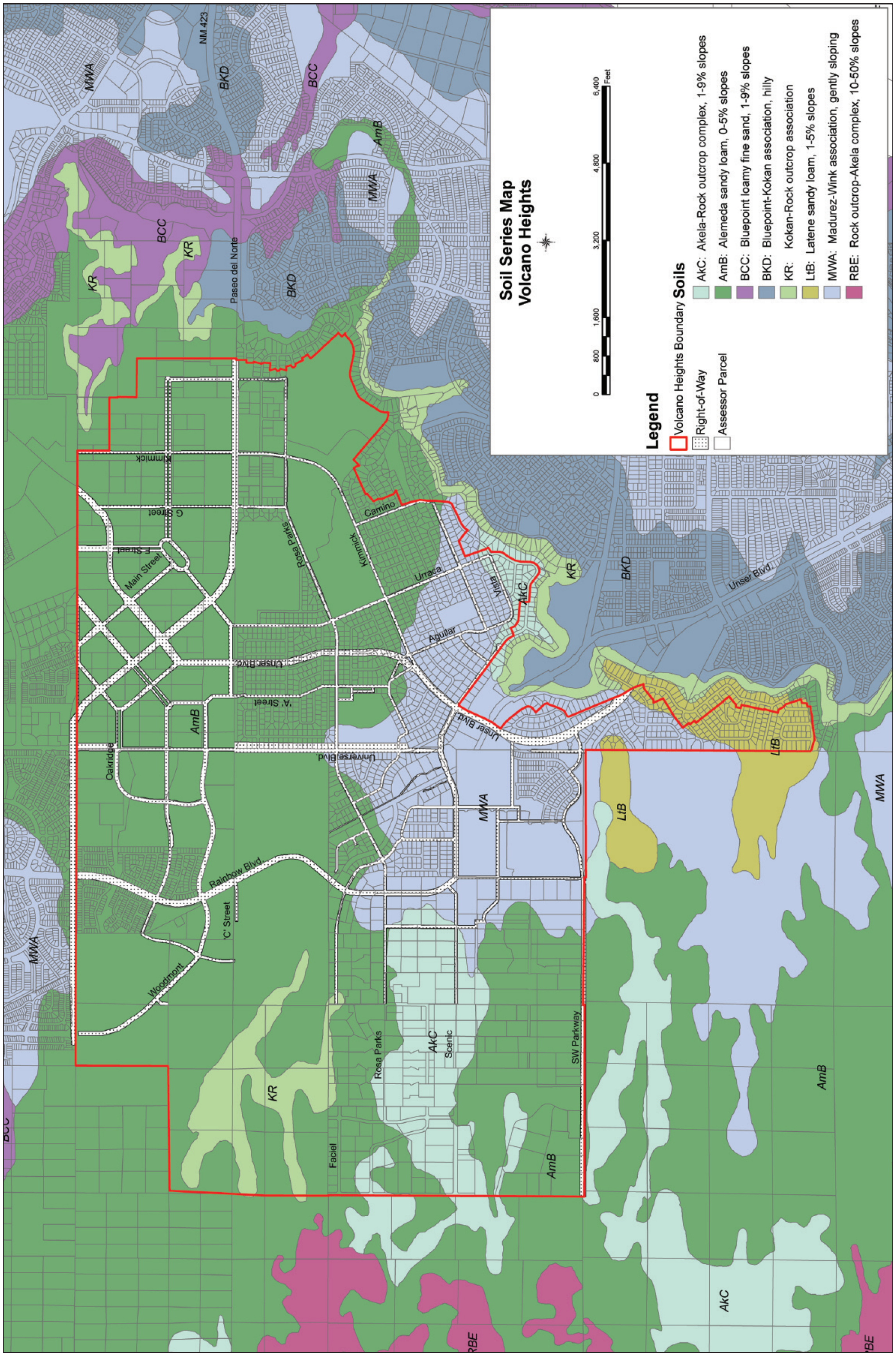


**Exhibit 8**
Soil Series

and as the soft sediments below the basalt are weakened by water passing down the joints, blocks of rock detach and roll down the slope. This instability would be increased by indiscriminate use of explosives and by utility line trenches channeling surface water into the joints. Care should be taken in the use of explosives and in trenching for utility lines to avoid channeling surface water into the joints. Back from the rim where the soil is deep enough to bury utility lines without disturbing bedrock, development would have less impact and would be less costly. An additional problem is low soil density and therefore low bearing strength. To correct this problem, the soil should be precompacted before constructing streets and building foundations."

**Depth of soil / depth to basalt.** Engineering firms familiar with development in the area describe depth of soil as tremendously variable, ranging from areas where the basalt is exposed, areas with intermittent rock, and areas that have several feet of soil.

Interviews with engineering firms that have experience with development in the Plan Area also indicated that the first layer of basalt—up to five feet in depth—is fractured and porous and can normally be excavated with earth moving equipment. The deeper layer of solid rock requires blasting or trenching.

Trenches about 5 feet in depth and 4 miles in length were dug to place water and sewer lines between the water reservoir and pump station on the east side of the Plan Area to Double Eagle II airport on the west side. The consultant engineer reported that basalt was found in about 70-75% of this reach. He estimated that about 20% of the length was friable and the remaining 50% was solid basalt.

**Cost of trench excavation.** In much of the Plan Area, trenching will be required for utility extensions. A special diamond-tooth trencher has been used successfully to trench through hard basalt layers where necessary. Utility trenches are about 5 to 5 1/2 feet in depth.

Utility lines were laid in trenches along the roads within SAD 227, excavated by blasting. These costs were included in the Special Assessment District charges, which net assessments averaged $32,000 per parcel (total land development cost including all utilities, soft costs, etc.).

Costs are variable depending on the strength and depth of the basalt and the continuous or discontinuous nature of the trenching work. The cost for the Double Eagle II trenches was $15 to $20 per lineal foot. These costs were incurred in 2003. The cost to trench a small reach through solid basalt near the Escarpment was estimated as $80 to $100 per lineal foot. A local engineer provided an average cost at about $35 to $50 per lineal feet for a large scale project associated with digging trenches for an entire subdivision.

More detailed engineering analysis of soil conditions should precede detailed plans (subdivision plats, Special Assessment Districts, Private Infrastructure Districts, master plans for activity centers, etc.). General soil testing, including depth to bedrock, should provide information useful to contractors and city engineers concerned with the expense of installing utilities.

# 4. Treatment of Natural Features

## *Drainage Channels*

The Monument and affiliated City open space create a major natural ecosystem for Albuquerque. At the heart of the ecosystem are the Boca Negra / Mariposa arroyos, making up a 21 square-mile watershed. **Exhibit 9, *Parks and Natural Drainages*** shows the natural arroyos and drainage systems traversing the area. The watershed is generally bounded by the Calabacillas Arroyo basin on the north and the San Antonio arroyo basin on the south. The developed watershed channel extends to a small area below the escarpment and into the Mariposa Detention Basin.

The AMAFCA master plan for stormwater drainage provides for a regional detention basin at Unser and Universe, but does not detail all stormwater facilities. **Exhibit 10, *Stormwater Infrastructure*** shows the constructed drainage facilities. While some of the area's stormwater runoff will need to flow to engineered pipes and channels, some parts of the different Boca Negra arroyos courses can continue to act as natural drainage facilities. The arroyos may function as stormwater facilities so long as the preserved swath is wide enough to carry 100-year flows. In addition, AMAFCA requires management and maintenance of the arroyos so that no alterations reduce the flow capacity the arroyos have been planned to carry.

Drainage channels have played an important cultural role for prehistoric communities, connecting ceremonial sites on the volcanic mesa through the Escarpment to former Pueblo villages along the Rio Grande.

While the key geologic and cultural features have been set aside as public open space, urbanization around these wilderness areas will dramatically change them. Urbanization that disconnects or destroys the interconnected arroyos and rivers reduces the viability of plant and animal species. Preserving the arroyos not only maintains the richest habitat, but also the very features that ecologically link the largest expanses of open space to each other. To the east, the ecosystem is largely cut off in Taylor Ranch. However, to the west, the opportunity still remains to link the ecosystem to the Rio Puerco wilderness.

The open space that exists within and adjacent to the Plan does not have a fully developed formal trail system that links open space into a consolidated network. Under current plans, drainage channels are not being used to their potential as walking and biking trails that could link the natural open areas.

## *Open Space Edge Treatment*

The Monument has miles of edge and adjacent private lands are in a natural state. Currently people access the open space anywhere along the edge and can take in exceptional views of the volcanoes, the Rio Grande valley and the Sandia Mountains, much as people have done for thousands of years. New development could block this physical access and the views, greatly reducing the value of the open space amenity to the public at-large. The open space is best preserved as a public amenity by designing scenic trails and roads along open space edges. Design standards for developments built adjacent to the open space edge will help to achieve visual harmony with the high desert landscape.

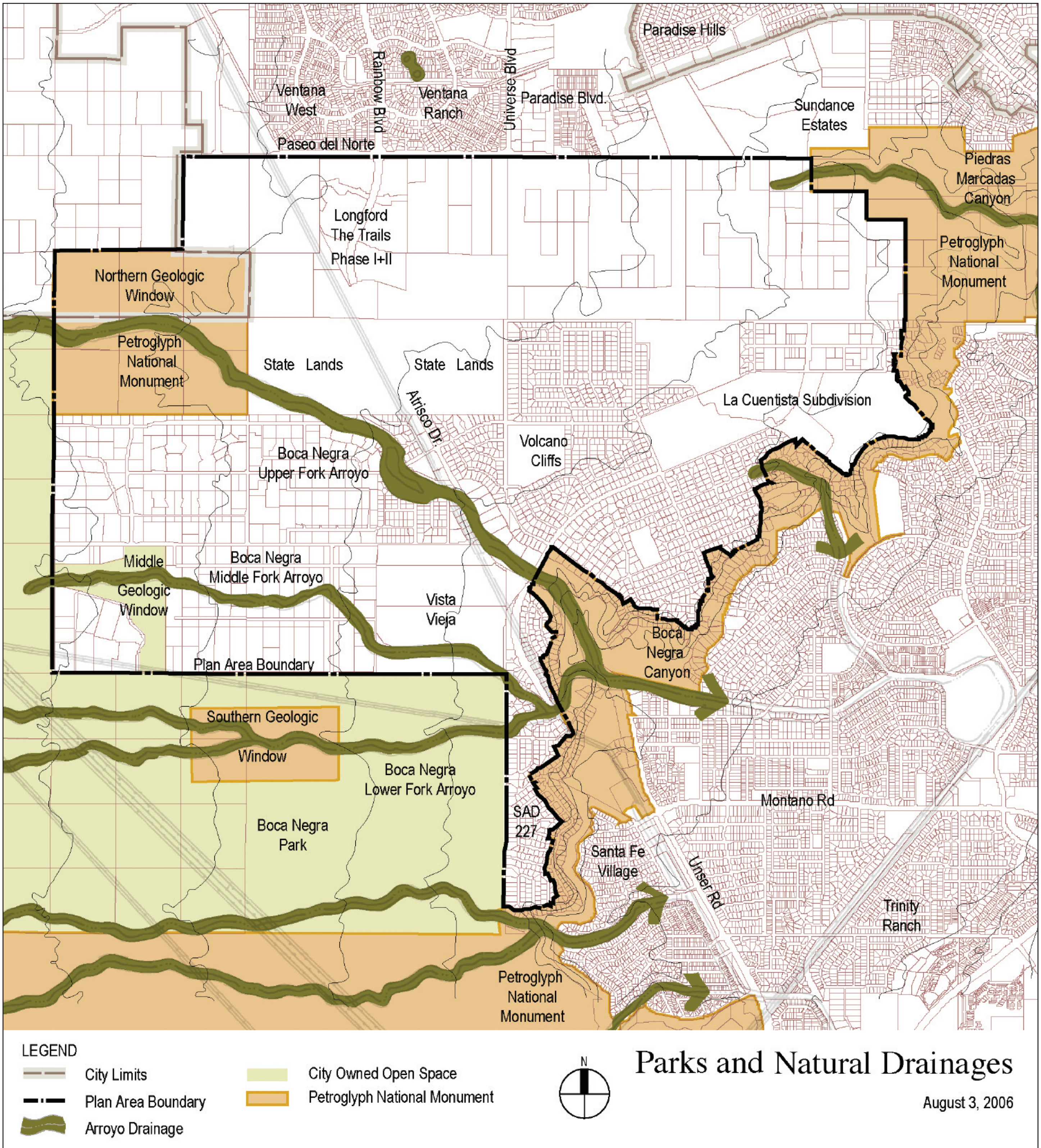


**Exhibit 9**
Parks and Natural Drainages

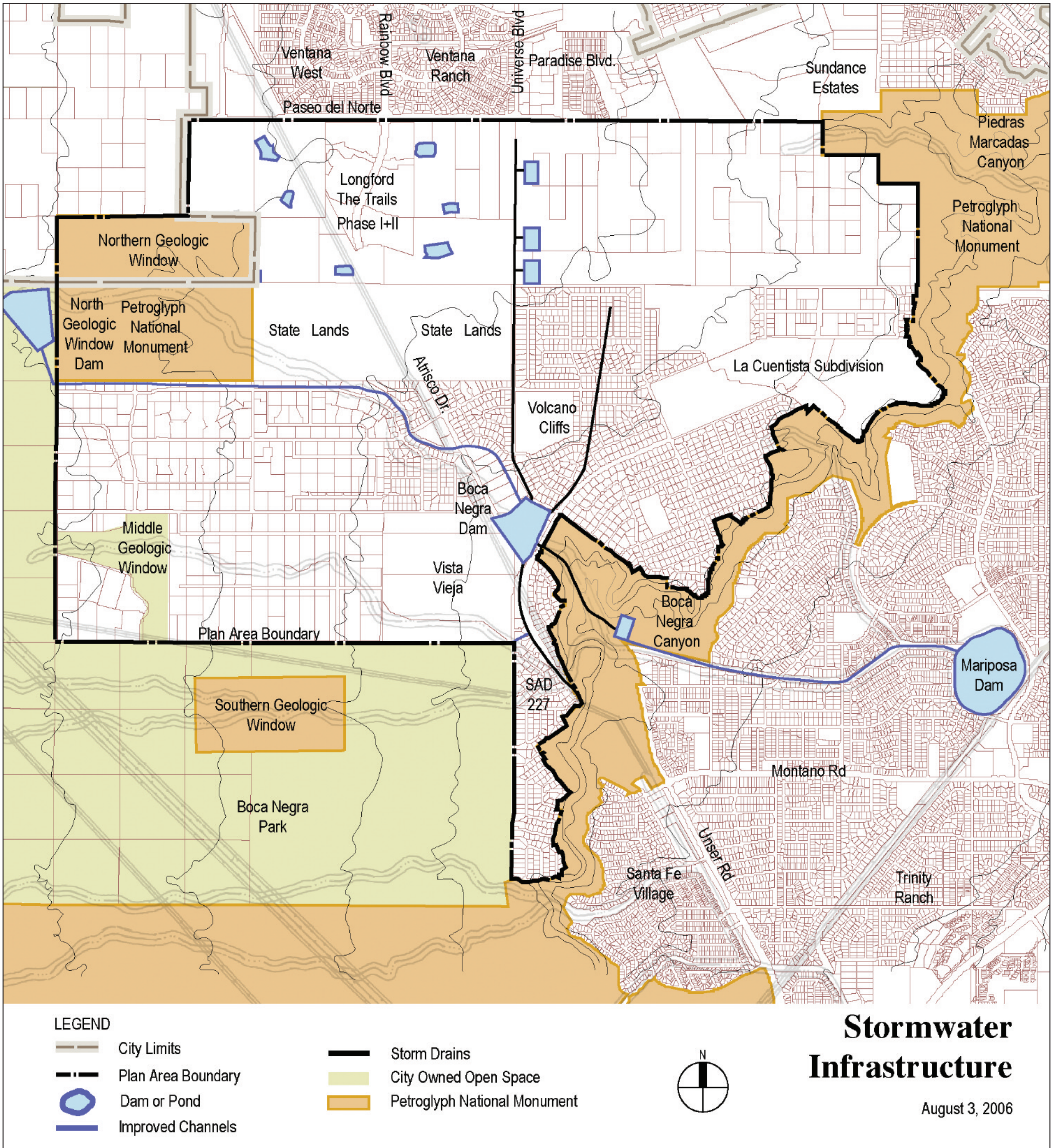


**Exhibit 10**
Stormwater Infrastructure