4 Physical Characteristics

Physical characteristics determine the hydrology, vegetation and development patterns for the entire watershed. These characteristics are discussed in this section to increase the understanding of the natural processes that affect the Rose Creek Watershed.

4.1 Elevation

The topographic profile of the RCW ranges from sea level at the mouth of Rose Creek at Mission Bay to over 1,100 feet in the headwaters on MCAS Miramar. The most noticeable high point is Mt. Soledad in La Jolla that rises 822 feet above sea level (Figure 4-1). Elevation influences several important natural conditions including precipitation, runoff, slope stability and vegetation. The higher elevations receive an average of 15-18 inches of rain on the eastern most limits of the watershed while the lower elevations average less than 12 inches per year. Slope stability is a concern in areas of rough terrain, as they are more likely to have erosion problems caused by periods of intense rainfall or increased velocities.

4.2 Slope

Steep slopes (>50%) are predominantly found along the bluffs of Rose Canyon and San Clemente Canyon on the western edge of the RCW (Table 4-1). These slopes lessen in steepness as the canyons move eastward toward the mesas of MCAS Miramar. Gently sloped mesa tops (0-3%) dominate the watershed occupying roughly 39% of the watershed (Figure 4-2). West of Interstate 805 (in the communities of Clairemont Mesa and University) the mesa tops are highly developed, which is in sharp contrast to the large expanse of undeveloped mesa top present on MCAS Miramar. A majority of the moderately steep slopes between 25-50% can be found in the headwaters within eastern MCAS Miramar.

Table 4-1: Slope Categories

Slope Percentage	Total Acres	Percent of Rose Canyon
0 - 3%	9,161	39%
3 - 10%	5,887	25%
10 - 25%	3,849	16%
25 - 50%	3,538	15%
> 50%	993	4%

Figure 4-1: Topography

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Figure 4-2: Slopes

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4.3 Precipitation

Precipitation patterns show the average annual precipitation totals ranges from about 12 inches to 15 inches in a west to east gradient, with the eastern headwater receiving the highest amounts (Figure 4-3). This pattern reflects an orographic effect that is common throughout the coastally influenced portions of southern California where precipitation generally increases with increasing elevation. This phenomenon includes a dry season typically occurs during the summer months with higher precipitation primarily occurs during the winter and spring. In the RCW, most of the streams are naturally dry during the summer with current low flows being the result of urban runoff and irrigation return flows. Understanding the precipitation pattern is important to this Assessment because it affects runoff flow characteristics, timing and amounts, which in turn influences the types and extents of wetland restoration, creation, or enhancement opportunities.

4.4 Soils

The RCW is comprised of a large variety of soils with the majority being within the loam category. The two largest soils types, gravelly loam and cobbly loam compose 49% of the watershed (Table 4-2). This soil type is largely found west of Interstate 805 in the communities of Mira Mesa, Kearny Mesa, Scripps Miramar Ranch and MCAS Miramar (Figure 4-4). This soil is made up of undulating to gently rolling soils that formed on gravelly marine terraces. These soils have little value for farming or ranching, which has allowed native vegetation such as Diegan Coastal Sage Scrub and various types of chaparral to develop and persist. Loamy sand can be found adjacent to Rose Canyon and San Clemente Canyon from Interstate 805 to Mission Bay.

Table 4-2: Soils Categories

Soils	Clairemont Mesa	Kearny Mesa	La Jolla	MCAS Miramar	Mira Mesa	Mission Bay Park	Pacific Beach	Scripps Miramar Ranch	University City	Totals
Clay Loam	90								134	224
Clays	96		2	25					755	878
Coarse sandy loam									4	4
Cobbly loam	26	136	31	3,180	6		18	648	380	4,425
Fine sandy loam	489	358	5	720					1,129	2,701
Gravel pit				89						89
Gravelly loam		319		5,910	73			164	481	6,947
Gravelly loamy sand			69	402				10	42	522
Loamy alluvial land				4						4
Loamy sand	162		45			3	55		683	949
Made land	163		49			35	35		47	329
Riverwash	53	15		661					48	776
Terrace escarpments	403	1	493	1,198	7		52		251	2,405
Tidal flats						4				4
Unclassified				4		9	8			20
Urban land complex	1,557	40	129			1	355		1,060	3,143
Water				8						8
Totals	3,040	869	823	12,201	85	53	522	821	5,014	23,427

Figure 4-3: Precipitation

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Figure 4-4: Soils

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4.5 Geology

Based on the SanGIS geological data, there are three major geologic hazards within the RCW (Figure 4-5 and Table 4-3). These three hazards are landslides, liquefactions and slide prone areas:

Table 4-3: Geologic Hazards

Geological Hazards	Clairemont Mesa	Kearny Mesa	La Jolla	MCAS Miramar	Mira Mesa	Mission Bay Park	Pacific Beach	Scripps Miramar Ranch	University	Totals
Landslides	16		49	11					10	85
Liquefaction	256	11	4	770		53	139	3	244	1,479
Slide Prone Formations	665	29	421	204			64		436	1,819
Totals	937	40	474	985	0	53	203	3	689	3,383

Landslides can be described as movement of mass rock, debris or earth down a slope. Landslides are a type of "mass wasting" which denotes a down movement of soil and rock under the influence of gravity. Landslides vary in sizes depending on the geology and initial cause of the landslide. They also cause $1-2 billion in damages nationwide and 25 or more fatalities each year and pose serious threats to highway structures, mining, tourism and energy production. Within the RCW, there are 85 acres of known and confirmed landslides. Of the 85 acres, 54 acres have been confirmed landslides that have predominantly occurred on the steep slopes of Rose Creek south of the confluence with San Clemente Creek.

Liquefaction is a phenomenon in which the strength and stiffness of soil is reduced by an earthquakes shaking or other rapid loading. Liquefaction occurs in saturated soils in which the space between individual particles is completely filled with water. Increased water pressure caused by the shaking of an earthquake allows the particles to move in respect to each other thereby decreasing the stability of the soil. Liquefaction mainly occurs in low lying areas such as bays, rivers lakes and lagoons. Within the RCW, potential liquefaction can be found along the entire length of both San Clemente Creek and Rose Creek and at the mouth of Rose Creek in Mission Bay. Liquefaction can occur in the entire area of Mission Bay Park. Since it contains the majority of the length of Rose Creek and San Clemente Creek, MCAS Miramar has the highest amount of liquefaction at 770 acres (Figure 4-5).

Slide Prone Formations are areas of neutral to unfavorable geologic formations that can cause landslides. These areas can be identified as having steep slopes with very little vegetation to stabilize the slope. Slide Prone Formations can be found along the steep hills along Rose Creek and San Clemente Creek. The potential for landslides to occur during wet periods can be exacerbated by the build up of iceplant on many steep slopes, which can lead to slumping due to the added weight of the plant material and its shallow root system. The largest threat being on the slopes south of the Interstate 5 and State Route 52 merge where industrial facilities as well as Interstate 5 are located. Clairemont Mesa has the largest amount of Slide Prone Formations at 665 acres with University second at 436 acres. Of the 522 acres of Pacific Beach in the RCW, 60% are Slide Prone Formations and 40% of La Jolla's 823 acres are prone to slides.

4.6 Faults

Faults are fractures in the earth along which blocks of crust on either side that have moved relative to one another. There are four types of fault systems within the RCW that span about 28 miles throughout the western portion of the watershed. Concealed faults are buried under the uppermost layers of crust and do not produce geologic formations seen from the surface. There are also known faults that have been identified by scientists and inferred faults that are only generally located. Shear Zones are deep level equivalents to faults. They accumulate relative displacement of rock bodies by either high temperature conditions or low strain rates and the bands of rock undergo deformation. Table 4-4 lists the types of faults in the RCW.

4.6.1 Rose Canyon Fault

The western end of the RCW lies within the Rose Canyon Fault Zone which is the major fault zone in the San Diego area. This fault zone is approximately 19 miles in length and extends from La Jolla south through Rose Canyon, then Old Town and on into San Diego Bay and across to the Silver Strand (Figure 4-5). The southern end of the fault extends from the City of San Diego to the Tijuana area and is comprised of at least three faults and is an extension of another fault system called the Newport – Inglewood fault. The Rose Canyon Fault Zone is also responsible for two of San Diego's most recognizable landmarks—Mount Soledad and San Diego Bay. The Rose Canyon Fault Zone has steps or "kinks' in it. The left step near Ardath Road caused compression, which piles up sedimentary layers to form Mount Soledad. Near the south end of the fault zone, a right-step caused the fault to spread apart, resulting in the formation of a basin and San Diego Bay. This fault is capable of producing a magnitude 6.9 earthquake and has a slip rate of about 1.1mm a year. The Rose Canyon

Fault Zone is still active and its most recent major activity was during the Holocene era, about 11,000 years ago.

Table 4-4: Fault Systems

Geological Hazards	Clairemont Mesa	Kearny Mesa	La Jolla	MCAS Miramar	Mira Mesa	Mission Bay Park	Pacific Beach	Scripps Miramar Ranch	University	Totals
Concealed Zone	4		1				1		4	9
Known Fault	1		2				1		2	5
Inferred Fault	4		3				1		2	9
Shear Zone	2		1							
Totals	11	0	7	0	0	0	3	0	8	28

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Figure 4-5: Geologic Hazards

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