

= San Juan Creek =

San Juan Creek , also called the San Juan River , is a 29 @-@ mile (47 km) stream in Orange County , California that consists of a catchment basin encompassing 133 @.@ 9 square miles (347 km²) . Its mainstem rises in the Santa Ana Mountains , in the Trabuco Ranger District of the Cleveland National Forest . From there it runs parallel to the Ortega Highway as it winds west and south through San Juan Canyon , where it is joined by numerous small tributaries , and is joined by Trabuco Creek , its main branch as it passes through San Juan Capistrano . It flows into the Pacific Ocean at Doheny State Beach . Once out of the foothills , San Juan Creek flows through the city of San Juan Capistrano where groundwater flow direction generally is from the northeast to the southwest . Groundwater in this basin at the San Juan Capistrano reach is considered good . Recent efforts of stream conservation have been in the planning stage including habitat conservation plan work .

Historically , the San Juan Creek watershed was inhabited by the Acjachemen , now Juañeno Indians . The Juañeno received their current name from Spanish conquistadors in the 1770s , who built Mission San Juan Capistrano very near San Juan Creek , giving it its name . After the Spanish settlement , development in the watershed continued to grow and pollution of the creek has increased . The construction of Dana Point Harbor in 1960 increased the pollution of San Juan Creek at its mouth , posing an increasing danger to visitors of Doheny State Beach . In the late 1990s and early 21st century , floods destroyed many river control structures in the San Juan watershed , and the risk of floods continues to grow .

Although the San Juan watershed was formerly rich in biodiversity , with sixteen major plant communities and hundreds of species of birds , invertebrates , mammals , and others , the watershed is projected to be 48 percent developed by the year 2050 . Many reaches of open land in the San Juan watershed are now heavily developed , and urban runoff coming from residential communities is taking an increased toll on the creek and its tributaries . Although the mainstem San Juan Creek does not have any major water diversions or dams , its tributaries are heavily affected , most notably Trabuco and Oso Creeks .

= = Course = =

San Juan Creek begins high in the Santa Ana Mountains southwest of Lake Elsinore , at the head of the steep and narrow San Juan Canyon , at roughly 1 @,@ 690 feet (520 m) in elevation where Morrell Canyon Creek , draining the western Elsinore Mountains and southernmost Santa Ana Mountains , has its confluence with Bear Canyon Creek . From there , it flows steeply downhill over riffles and waterfalls , and paralleling California State Route 74 , here known as the Ortega Highway , as it winds through the rocky gorge . It drops over San Juan Falls , a 15 @-@ foot (4 @.@ 6 m) cascade , then crosses under an arch bridge that carries the Ortega Highway . It is joined by Hot Springs Creek and Cold Springs Creek on the right bank , while Lucas Canyon Creek meets it on the left .

Once out of the mountains , San Juan Creek proceeds to meander through a broad and shallow farming and ranching valley underlain by thick alluvial deposits . The creek swings west to receive Bell Canyon on the right , from several residential communities that overlook , but do not border , it. and Verdugo Canyon Creek from the left . Trampas Canyon enters from the left and Cañada Gobernadora and Cañada Chiquita enter from the right . The creek then crosses under Interstate 5 , and enters a flood control channel , turning south and receiving El Horno Creek on the right . It receives its largest tributary , Trabuco Creek , on the right bank , then continues south and east to the Pacific Ocean . Before it reaches the sea , however , it enters a lagoon at the northern end of Doheny State Beach , which occasionally spills into Capistrano Bay .

= = = Tributaries = = =

All direct tributaries of San Juan Creek , from mouth to source , are listed . The list also includes

streams that join major tributaries .

= = Geology = =

= = = Rocks and topography = = =

The geology of the San Juan Creek watershed is complex , but can be described as having many seismic fault zones , with streams tending to follow these fault zones where canyons have formed , and having extremely erosive soils . The alluvial floodplain of San Juan Creek tends to have very deep concentrations in lower reaches and are said to be poorly drained . Soil types in the San Juan watershed can be divided into the Metz @-@ San Emigdio , Sorrento @-@ Mocho , Myford . Alo @-@ Bosanko , Cieneba @-@ Anaheim @-@ Soper , and Friant @-@ Cieneba @-@ Exchequer associations , in order from most level to steepest . Sedimentary bedrock composes many hillsides in the San Juan watershed , and poses a landslide danger during earthquakes , severe erosion or other events that may cause failure of hillside stability .

There are also several seismic faults within the watershed . These include a fault line (Cristianitos) running along Oso Creek northeast @-@ southwest , passing offshore 7 miles (11 km) south of the mouth of San Juan Creek , as well as another fault zone (Mission Viejo) that parallels the Cristianitos but ends far more south , in San Diego County . In summary , the San Juan watershed can be considered as being bisected by two faults , running through its approximate center . The first recorded earthquake in the area partially destroyed Mission San Juan Capistrano in 1812 , followed by others in 1862 , 1933 and 1938 .

The uplift of the San Joaquin Hills , a small coastal mountain range generally following the Pacific coast of Orange County , created a physical barrier for streams flowing off the Santa Ana Mountains . But by the Wisconsinian Glaciation , an enormous climate change helped solve that problem . During the Wisconsinian Glaciation , a period of time that lasted from about 70 @,@ 000 to 10 @,@ 000 years ago , glaciers and ice sheets moved south from Canada into the northern United States , radically altering the climate of the entire continent . The arid Southern California climate was supplanted by a temperate rainforest climate that would receive rainfall in excess of 80 to 90 inches (2 @,@ 000 to 2 @,@ 300 mm) per year . San Juan Creek and other streams along the South Coast became powerful rivers that cut their way through the San Joaquin Hills , but this condition reverted by the end of the period . Several wet periods did occur throughout the Ice Age , but the Wisconsinian was the largest .

= = = Hydrology and groundwater = = =

Groundwater in the San Juan Creek basin , also referred to as the " San Juan Creek Groundwater Basin " , has a total volume of roughly 900 @,@ 000 acre feet (1 @.@ 1 × 10⁹ m³) . (California State Water Resources Control Board , 1977 .) Natural groundwater recharge in the San Juan basin is estimated to be roughly 160 @,@ 000 acre feet (200 @,@ 000 @,@ 000 m³) per year historically , mostly from precipitation . This amount has been reduced due to extensive development of the lower segment of the watershed , which is continuing to reduce the amount of open ground that can potentially serve in groundwater recharge . Artificially sourced water from irrigation and other uses is responsible for recharging roughly 37 @,@ 500 acre feet (46 @,@ 300 @,@ 000 m³) annually . The watershed is essentially split into half by the Cristianitos and Mission Viejo fault zones , which result in the division of the " Upper " and " Lower " groundwater basins . The groundwater mostly lies in alluvium , which ranges from a depth of 200 feet (61 m) in the lower watershed to mostly none in the upper reaches of the watershed .

Historically , the total surface outflow from the San Juan basin into the Pacific was calculated at 5 @,@ 200 acre feet (6 @,@ 400 @,@ 000 m³) annually . Increasing urban development , resulting in increased runoff from irrigation and other sources , brought the annual outflow to 7 @,@ 800 acre feet (9 @,@ 600 @,@ 000 m³) as of 1993 . The maximum annual yield is 9 @,@ 000 acre feet (

11 @, @ 000 @, @ 000 m³) . Although water from San Juan Creek , tributaries and basin groundwater are increasingly used for a limited amount of agricultural and municipal purposes , the annual yield from the watershed is continually increasing . As the groundwater recharge rate of the watershed is relatively high , it is safe to assume that groundwater levels will recover quickly from human use and human @-@ induced pollution .

Due to the lower amount of urbanization in the San Juan watershed as compared with other watersheds in the county , the 100 @-@ year flood inundation risk is also significantly lower than that of most of the nearby watersheds . It has been calculated that a 100 @-@ year flood in the watershed would only affect a roughly 0 @. @ 5 mi (0 @. @ 80 km) wide area for the lower reaches of San Juan Creek inside San Juan Capistrano , while for Trabuco Creek , only a 0 @. @ 2 mi (0 @. @ 32 km) wide area would be affected , mainly due to severe downcutting . A fact of note is that the failure of the earthen Trampas Canyon Dam (in Trampas Canyon , 2 miles (3 @. @ 2 km) upstream of San Juan Capistrano) would actually create a floodwave slightly larger than that of the 100 year flood that would race down San Juan Creek to its mouth . However , many levees in the San Juan area are still inadequately suited to a 100 @-@ year flood , regardless of the extent .

= = Watershed = =

The Santa Ana Mountains occupy most of the north , east and south parts of the approximately 133 @. @ 9 @-@ square @-@ mile (347 km²) San Juan Creek watershed , while the San Joaquin Hills and one of their small subranges border the watershed on the southwest , east , and northwest . The three major tributaries , San Juan , Trabuco and Bell Creeks , all originate in the Santa Ana Mountains . There are four main alluvial river valleys in the watershed , drained by San Juan , Trabuco , Oso and Bell Creeks . The San Juan Creek valley occupies the south portion of the watershed , running roughly south before spreading wider near the coast , and running northeast until it turns sharply to the southeast to meet the Pacific Ocean at the city of Dana Point . The Trabuco Creek valley runs west from the northeasternmost portion of the watershed , then gradually becomes wider in a section called the Plano Trabuco then it joins the smaller , urbanized valley of Oso Creek , which runs primarily south . The combined valley then runs southward to merge with the San Juan Creek valley in San Juan Capistrano . The Bell Creek valley is narrower , beginning a few miles south of Trabuco Canyon , California , and running in an almost perfectly straight southward course to San Juan Creek , which at this point is shortly out of the uppermost reach of its watershed , San Juan Canyon . There are 19 other major creeks in the watershed , including Tijeras Canyon Creek and El Horno Creek , both of which drain parts of the foothills of the Santa Ana Mountains .

San Juan Creek is considered as part of the 500 @-@ square @-@ mile (1 @, @ 300 km²) San Juan Hydrologic Unit , which is a coastal region running from central @-@ south Orange County to the north extent of San Diego County , which borders Orange County on the south . The hydrologic unit also covers the watersheds of Aliso Creek , Salt Creek , Prima Deshecha Cañada , Segunda Deshecha Cañada , and San Mateo Creek , in order from north to south . Elevation above sea level ranges from 0 to 5 @, @ 700 feet (0 to 1 @, @ 737 m) , and precipitation in the hydrologic unit ranges from 12 to 16 inches (300 to 410 mm) annually . Except for San Mateo Creek , all of the other streams in the unit have a relatively developed watershed . San Juan Creek receives extra runoff from agriculture , urban activities , commercial irrigation , and other human @-@ induced sources , which creates an extra unnatural flow (consisting of urban runoff and agricultural return flows) . This runoff is often polluted by trash , heavy metals , and oil received while running over pavement , and pesticides and fertilizer if draining farmland . A specific point of concern in the watershed is Oso Creek . A Southern California environmentalist , Michael Hazzard , said after diving into Upper Oso Creek Reservoir to retrieve an outboard motor :

I spent three days diving to retrieve an outboard motor and my skin broke out in hives and boils and my gallbladder suffered and I later had six operations over a 21 ? 2 @-@ year period .

= = = Wildlife = = =

San Juan Creek was originally rich in riparian zones and other habitats in both its upper and lower watershed , with wetlands totaling over 300 acres (1 @. @ 2 km²) historically in the lower reaches , before the rapid population explosion of Orange County began . There are 16 major vegetation zones in the watershed . Currently , the total wetland acreage in the watershed is 3 acres (0 @. @ 0.12 km²) , or one percent of the historic total . In 1987 , just five bird species were confirmed in the watershed , while for fish , benthic invertebrates , and certain insects there were no confirmed observations , in part due to insufficient site coverage . Steelhead trout have recently been observed in the creek and its tributary , Trabuco Creek . A further reason for the decline of creek habitat and wildlife is mainly due to invasive plant and animal species , including giant reed (*Arundo donax*) and many sport fishes , such as bluegill and striped bass . However , a notable aspect of the creek water is while a sample taken at the creek mouth in January 1995 had a temperature of 13.8oC (56 @. @ 84 degrees Fahrenheit) , many creeks along the Orange County coast have much higher temperatures .

= = = Streamflow = = =

The USGS operated two stream gauges on San Juan Creek in the city of San Juan Capistrano , one from 1929 to 1969 and the second from 1970 to 1984 . For the former gauge , the highest recorded peak flow during that period was 22 @, @ 400 cubic feet per second (630 m³ / s) per second on 25 February 1969 , with a gauge height of 5 @. @ 6 feet (1 @. @ 7 m) . The second highest peak flow during that period was 13 @, @ 000 cubic feet per second (370 m³ / s) on 2 March 1938 , presumably at the peak of the Los Angeles Flood of 1938 . For the more recent stream gauge , the highest recorded flow was 14 @, @ 700 cubic feet per second (420 m³ / s) on 4 March 1978 , gauge height 17 feet (5 @. @ 2 m) . The second highest flow was 11 @, @ 700 cubic feet per second (330 m³ / s) on 20 February 1980 , gauge height 15 @. @ 43 feet (4 @. @ 70 m) . The highest flow recorded on San Juan Creek of all time , however , was not by a USGS stream gauge ; the flow of 33 @, @ 650 cubic feet per second (953 m³ / s) was recorded on 11 January 2005 .

= = History = =

= = = Indigenous peoples = = =

Before the 18th century , San Juan Creek and its tributary , Trabuco Creek , had indigenous names , but these are thus far unknown . The land in the San Juan watershed was mostly Acjachemen Indian territory , which extended from Aliso Creek in the north to San Mateo Creek in the south , a distance of roughly 35 miles (56 km) north @-@ south . Most of the population centered on the outfalls of the two large perennial streams in the area , San Juan and San Mateo Creeks , as well as Trabuco Creek .

Such inhabitants , who numbered roughly two thousand overall , were hunter @-@ gatherers , living in small , semi @-@ permanent villages beside or near perennial streams . There were five villages on the main stem , three of which were below the Trabuco Creek confluence , and four more in other parts of the watershed , mostly on Trabuco and Oso Creeks . Their diet usually consisted of fruits , acorns , and grains , and sometimes meat , while they practiced little agriculture . Shell middens indicate that they also harvested shellfish from the coast . Although natural disasters such as floods , drought , and wildfires occurred during that time , as they do today , the Juaneño did not affect the environment of the area in either a negative or positive way . No permanent structures were built in the San Juan watershed until the arrival of the Spanish .

= = = Spanish arrival = = =

The first European land exploration of Alta California , the Spanish Portolà expedition , passed this way on its way north , camping at the creek on July 23 , 1769 . Franciscan missionary Juan Crespi noted in his diary , " ... we came to a very pleasant green valley , full of willows , alders , live oaks , and other trees not known to us . It has a large arroyo , which at the point where we crossed it carried a good stream of fresh and good water , which , after running a little way , formed in pools in some large patches of tules . " On the return journey to San Diego , the party used the campsite again , on January 20 .

In 1776 , Father Junípero Serra founded Mission San Juan Capistrano on a site that was most probably close to the creek , and as a result , the creek takes its name from the mission . The first site , however , was abandoned due to lack of water , although the creek was known in historical accounts to be perennial . The mission was moved to a second site , where it now stands . The Acjachemen were dubbed the " Juañeno " by the Spanish , after the mission . The Spanish were among the first to create hydrological changes in the San Juan watershed , which included excavating irrigation channels , diverting water from streams , and channelizing and changing course of streams . Grazing animals , including cows , sheep and other livestock , began their prevalence during this period , destroying many native grasses and leaving the ecosystem unbalanced and prone to erosion .

The origin of the name of Trabuco Creek (Spanish : " Blunderbuss Creek " , literally) stems from the Gaspar de Portolà expedition of 1769 , during which a soldier lost a blunderbuss (" trabuco ") , and the name became associated with the creek after that point . The origin of the name of Oso Creek (Spanish : " Bear Creek ") is not known . Many of the creeks in the watershed have names of Spanish origin , which were most likely named by the Spanish conquistadors a long time before the area was annexed by the United States .

In 1812 , a heavy earthquake severely damaged many of the structures built by the Spanish . The Great Stone Church at Mission San Juan Capistrano , which had been built only six years before , collapsed ; over forty people were reported to have been killed .

Before urban development , the partially devastated lands caused by overgrazing during the Spanish period was still potentially capable of rebounding to their natural state . In 1964 , the urban percentage was 3 , while by 1988 , it had increased to 18 percent . In the 1990s , the watershed was 32 percent urban , and the projected growth by 2050 is 50 percent . Many areas in the watershed now have no chance to revert to their natural state as long as human habitation continues .

= = = 20th century to present = = =

In the late 1960s , the construction of Dana Point Harbor began very near the mouth of San Juan Creek . This harbor prevented the occurrence of a large surf break phenomenon , colloquially known as " Killer Dana " , in the bay . With the disappearance of Killer Dana , water circulation in the bay decreased . Resultantly , as pollution from San Juan Creek continued to flow freely into the bay , it stayed there for a longer period of time in comparison with that if the harbor had never been built . The pollution problems are ongoing , posing problems at Doheny Beach , where the 850 @, @ 000 annual visitors are threatened by the continuing pollution from San Juan Creek .

During floods in the 1990s , an almost sheer 30 @-@ foot (9 @. @ 1 m) waterfall was rapidly scoured out of a steep earthen slope on Trabuco Creek , downstream of a railroad bridge and upstream of the Oso Creek confluence . This drop required quick reinforcement with grouted riprap , and still exists , with an average gradient of 29 percent before sheerly plunging into a murky stream pool . It still poses a major barrier to migrating fish and other riverine organisms , and thus isolates the lower few miles of Trabuco Creek from the relatively natural upper course .

In 1996 , severe floods caused by heavy rainstorms in the San Juan watershed caused both San Juan and Trabuco creeks to overflow , destroying long sections of concrete lining near their confluence . The damage was chiefly caused by severe basal erosion , which led to subsequent failure of the concrete walls and levees . Once the concrete was breached , the bare earth underlying it was exposed to erosion , threatening a nearby residential community , but the floods receded before any serious harm was done . The failed sections were repaired with grouted riprap ,

which can still be seen today .

In early 2005 , even more severe floods that also caused flooding along area streams such as San Diego Creek and Aliso Creek impacted the San Juan watershed , with an all @-@ time highest flow of 33 @,@ 650 cubic feet per second (953 m³ / s) recorded on January 11 . Although the floods did not exceed the San Juan Creek channel capacity of 58 @,@ 800 cubic feet per second (1 @,@ 670 m³ / s) , the west levee of the channel inside San Juan Capistrano nearly failed . Also in 2005 , pumps were installed on Tick and Dove Creeks (tributaries of Bell Canyon , which flows into San Juan Creek) to remove urban runoff stemming from a 1 @,@ 100 @-@ acre (4 @.@ 5 km²) residential community on a nearby ridge . The pumps remove excess flow and divert it to storage basins for later use as reclaimed irrigation water .

In May 2009 , it was announced that levee repairs along San Juan Creek would close a popular bikeway for up to two years , with repairs finished later in 2013 . This spurred protests from many area residents who are common users of the path .

= = River modifications = =

Although most streams in the San Juan watershed are less developed than those in the neighboring Aliso Creek and Salt Creek watersheds , San Juan , Oso and Trabuco Creeks have undergone an extensive series of modifications designed to control floods , reduce excessive erosion , and provide reclaimed water for irrigation . A growing amount of urban runoff flows into the creek and its tributaries , adding to the excessive perennial flow referred to often as a " nuisance flow " or " dry season nuisance flow " . Historically , only San Juan and Trabuco creeks were known to be perennial , while most of the tributaries , except for spring @-@ fed ones such as Holy Jim Creek , were ephemeral . Oso Creek was formerly ephemeral , but currently it can flow in excess of 100 cubic feet per second (2 @.@ 8 m³ / s) in up to ten percent of a year . Finally , the long series of human @-@ made modifications to the creek have resulted in its mouth , Doheny State Beach , placing tenth in the most polluted beaches of California .

San Juan Creek is channelized for approximately 3 @.@ 5 miles (5 @.@ 6 km) from immediately upstream of the Interstate 5 bridge to the mouth . Trabuco Creek is only channelized for several hundred yards above its confluence with the larger stream . In sharp contrast is Oso Creek , which is channelized along nearly its entire length , while Bell Canyon Creek is free @-@ flowing . Two large reservoirs , Upper Oso and Lake Mission Viejo , are built on Oso Creek , with a total storage capacity of roughly 7 @,@ 500 acre feet (0 @.@ 0093 km³) . While Lake Mission Viejo is primarily for recreation , the 115 @-@ acre (0 @.@ 47 km²) Upper Oso Reservoir collects Oso Creek water and diverts it for irrigation use , while any low @-@ flow spillage that occurs over its dam is collected at a small downstream dam that feeds a pipe that pumps it back to the reservoir ; in this way the Upper Oso Reservoir can be considered as a pumped @-@ storage operation , although it does not produce hydroelectricity . A notable aspect of the reservoir is that it was vital in providing water to extinguish a large wildfire in October 2002 . The dam is rockfill , 800 feet (240 m) long and 142 feet (43 m) high .

A few check dams exist on small upper tributaries of San Juan Creek , mostly inside the Cleveland National Forest , as well as a small , abandoned gabion structure lower on San Juan Creek . The structure , which was formerly a small dam , is now out of operation , but its roughly 3 @-@ to @-@ 4 @-@ foot (0 @.@ 91 to 1 @.@ 22 m) drop still poses a problem for migrating steelhead trout . There are a few water diversion weirs that exist on San Juan tributary streams to divert water for irrigation , ranching and limited municipal uses , but due to limited flows and polluted water , the usefulness of these structures are limited .

A number of drop structures , which are small dams used to control water velocity , exist on streams in the San Juan watershed , primarily also on Trabuco and Oso creeks . On Trabuco Creek , there are eight drop structures , mostly built of riprap . The largest are a 30 @-@ foot (9 @.@ 1 m) cascade immediately downstream of a Metrolink bridge and a concrete drop structure at the terminus of a culvert that crosses underneath Interstate 5 ; however , neither is inventoried by the Orange County Flood Control Division . There are also about seven drop structures on Oso Creek ,

most of which are also built of riprap . The mainstem San Juan Creek does not have any notable drop structures , dams or water diversions .

As with channelization , levees are only found in the lower San Juan watershed . San Juan Creek is bounded with levees from upstream of Interstate 5 to very near its mouth at Doheny Beach , while Trabuco Creek has levees from upstream of Del Obispo Street (a continuation of the Ortega Highway) downstream to its mouth at San Juan Creek . Oso Creek has some raised banks , but it is not certain if those are levees . Smaller tributaries , such as El Horno Creek and Bell Canyon , do not have levees . Although the San Juan and Trabuco Creek levees are said to have a " fairly high level of protection currently " , failure scenarios of levees in the San Juan watershed have been extensively studied , and they have been determined to possibly fail for a variety of reasons , some of which have already been demonstrated in the floods of 1996 and 2005 . In response to the danger of another flood , work has begun on a new west @-@ bank levee replacement that will finish in 2013 .

= = Stream crossings = =

This is a list of major crossings of San Juan Creek , proceeding upstream of the mouth .