COUNTY OF SAN DIEGO

GUIDELINES FOR DETERMINING SIGNIFICANCE

HYDROLOGY

LAND USE AND ENVIRONMENT GROUP

Department of Public Works
Department of Planning and Land Use

July 30, 2007

APPROVAL

I hereby certify that these **Guidelines for Determining Significance for Hydrology** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and were considered by the Director of Planning and Land Use, in coordination with the Director of Public Works on the 30th day of July, 2007.

ERIC GIBSON
Interim Director of Planning and Land Use

JOHN SNYDER
Director of Public Works

I hereby certify that these **Guidelines for Determining Significance for Hydrology** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and have hereby been approved by the Deputy Chief Administrative Officer (DCAO) of the Land Use and Environment Group on the 30th day of July, 2007. The Director of Planning and Land Use is authorized to approve revisions to these Guidelines for Determining Significance for Hydrology except any revisions to the Guidelines for Determining Significance presented in Section 4.0 must be approved by the DCAO.

Approved, July 30, 2007

CHANDRA WALLAR
Deputy CAO

EXPLANATION

These Guidelines for Determining Significance for Hydrology and information presented herein shall be used by County staff for the review of discretionary projects and environmental documents pursuant to the California Environmental Quality Act (CEQA). These Guidelines present a range of quantitative, qualitative, and performance levels for particular environmental effects. Normally, (in the absence of substantial evidence to the contrary), non-compliance with a particular standard stated in these Guidelines will mean the project will result in a significant effect, whereas compliance will normally mean the effect will be determined to be "less than significant." Section 15064(b) of the State CEQA Guidelines states:

> "The determination whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on factual and scientific data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting."

The intent of these Guidelines is to provide a consistent, objective and predictable evaluation of significant effects. These Guidelines are not binding on any decision-maker and do not substitute for the use of independent judgment to determine significance or the evaluation of evidence in the record. The County reserves the right to modify these Guidelines in the event of scientific discovery or alterations in factual data that may alter the common application of a Guideline.

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List of Acronyms

CEQA	California Environmental Quality Act
FEMA	Federal Emergency Management Act
FIA	Federal Insurance Administration
FIRM	Federal Insurance Rate Map
NFIP	National Flood Insurance Program
OES	Office of Emergency Services
RPO	County of San Diego Resource Protection Ordinance
SFHA	Special Flood Hazard Area

INTRODUCTION

This document provides guidance for evaluating adverse environmental effects that a proposed project may create or incur relating to flooding. Specifically, this document addresses the following questions listed in the California Environmental Quality Act (CEQA) Guidelines, Appendix G, VIII. Hydrology and Water Quality:

Would the project:

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

e) Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary, a Flood Insurance Rate Map or another flood hazard delineation map?

h) Place within a 100-year flood hazard area structures, which would impede or redirect flood flows?

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

j) Inundation by seiche, tsunami, or mudflow?

This document also addresses the following question listed in the California Environmental Quality Act (CEQA) Guidelines, Appendix G, VI. Geology and Soils:

Would the project:

b) Result in substantial soil erosion or the loss of topsoil.

Guidelines to answer these CEQA questions are provided in Section 4. As described in Section 2, no projects within the existing unincorporated County are likely to be inundated by a tsunami or seiche. Therefore, no guideline for tsunami or seiche has been included in Section 4.

Hydrology is linked to many other topics that are evaluated under CEQA. The County of San Diego has prepared guidelines for determining significance for many of these topics:

Table 1
CEQA Topics Linked to Hydrology

Topic	County of San Diego CEQA Guidelines
Water quality	Guidelines for Determining Significance for Surface Water Quality; Guidelines for Determining Significance for Groundwater.
Levee or dam failure	Guidelines for Determining Significance for Emergency Response Plans.
Groundwater	Guidelines for Determining Significance for Groundwater.
Landslides	Guidelines for Determining Significance of Geologic Hazards

Refer to these other Guidelines when evaluating hydrology impacts. All of the County's guidelines for determining significance can be found on the County of San Diego, Department of Planning and Land Use website (http://www.sdcounty.ca.gov/dplu/).

1.0 GENERAL PRINCIPLES AND EXISTING CONDITIONS

Hydrology is the scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere. This document focuses on the distribution and effects of water, how the hydrology can affect and be affected by a discretionary project, and how to prevent the project from being flooded or causing flooding. The various causes of flooding are discussed below. Also, the erosion and resulting sedimentation that flowing surface waters can cause is discussed.

1.1 Natural Flooding

Flooding is a general or temporary condition of partial or complete inundation of normally dry land areas. Flooding is commonly associated with the overflow of natural rivers or streams, but can also occur near stormwater diversion facilities, or in low-lying areas not designed to carry water at any time. Precipitation that does not infiltrate the ground becomes surface runoff and is transported by gravitational flow to a nearby conveyance (streams, channels, etc). The fraction of precipitation that actually infiltrates into the ground is dependent on a number of factors including the slope of the land, the soil type, the vegetation cover, and the rate of precipitation. Infiltration occurs more readily in coarse soils than in fine soils. Light rainfall events may only moisten the surface of the ground and the water will subsequently evaporate before it can infiltrate into the ground. Conversely, if precipitation is heavy and accumulates at a rate faster than it can infiltrate into the ground, the excess water will pond or flow along the ground surface as runoff.

Topography and proximity to water bodies typically control the frequency and severity of flooding for a particular area. The rate at which flooding may occur and subside varies with meteorological conditions and the severity of the storm event. Most flooding events occur over several days, but can also develop within a matter of hours, particularly in narrow valleys, or in desert alluvial fans that are prone to sheet flow.

The potential for flooding in the County of San Diego is high. The climate is semi-arid and the seasonal precipitation is highly variable in frequency, magnitude and location. The infrequent flooding events can cause false security that leads to building in areas that may flood. Infrequent large bursts of rain can rush down steep canyons and flood areas unexpectedly.

Flooding in San Diego and the rest of southern California most frequently occurs during winter storm events between the months of November and April, and occasionally during the summer when a tropical storm makes landfall in the region. National Weather Service records of flooding and heavy rainfall events demonstrate that just one to two inches of rain within a few days can cause localized flooding, while events that bring three or more inches of precipitation will induce more severe stages of flooding, including flash floods, mudflows and landslides.

1.1.1 Flash Floods and Debris Flows

Debris flows, also known as mudflows, are shallow water-saturated landslides that travel rapidly down slopes carrying rocks, brush, and other debris. Mudflows are the most common disaster in San Diego. A mudflow occurs naturally as a result of heavy rainfall on a slope that contains loose soil or debris. Human activity can also induce a slide, such as when soil becomes saturated from a broken water pipe or incorrect diversion of runoff concentrated from developed areas saturates soil. Recent forest fires also contribute to the potential for mudflows throughout the County of San Diego. The loss of vegetation may result in destabilization of surface soil and an increase in velocity of surface water runoff, increasing the potential for mudflows.

Mudflows predominantly occur in mountainous areas underlain by geologic formations that produce sandy soils. Weathered gabbroic soils contain large amounts of clay that shrinks and expands with exposure to water, and also have a high potential for instability and sliding. Mudflows can be initiated on slopes as low as 15 degrees, but are more frequently found on slopes as steep as 45 degrees. The path of a mudflow is determined by local topography, and will typically follow existing drainage patterns. The fluidity and depth of the water/soil/debris mixture and the steepness of a channel are all variables that influence the rate of movement of a mudflow. At the foot of a long steep slope, a flow may move at avalanche speed (approximately 40 feet per second / 27 miles per hour) and contains tremendous force capable of destroying buildings and roadways.

Areas recently burned by wildfires are particularly susceptible to flash floods and debris flows during rainstorms. Just a short period of moderate rainfall on a burn scar can lead to flash floods and debris flows. Rainfall that is normally absorbed or intercepted by vegetation can run off almost instantly, causing creeks and drainage areas to flood much sooner during a storm, and with more water, than normal. Additionally, the soils in a burn scar are highly erodible so flood waters can contain high amounts of mud, boulders, and vegetation. The powerful force of rushing water, soil, and rock, both within the burned area and downstream, can destroy culverts, bridges, roadways, and structures, and can place people at risk if care is not taken.

1.1.2 Alluvial Fan Floods

Alluvial fans are a desert phenomenon where streams emerge from canyons and deposit sand and rock in a cone-shaped formation fanning out from the canyon mouth. Alluvial fans form in arid and semi-arid environments where steep mountain fronts meet flatter valley floors. The infrequent but intense storms in these environments produce flash floods that can carry heavy debris and sediment loads. The swiftly flowing streams and washes of steep canyons can transport more debris than slowly moving streams on the gentle valley slopes. When fast moving debris-laden flows reach the mouth of the canyon and spread out across the land, the energy is dissipated over a wider area and they lose the capacity to carry the debris. The flows then deposit large amounts of debris along the mountain front. Over the centuries this buildup of debris spreads out from the canyon mouth to form the classic conical shape of the alluvial fan.

The slope of the fan and the size of the alluvial particles generally decrease from the apex to the toe. These changes result in the formation of three distinct hydraulic zones on the fan:

- The Channelized Flow Zone, characterized by a single, entrenched channel cut into the fan as the flow leaves the upstream canyon;
- The Braided Flow Zone, below the alluvial fan apex and where the flow spreads out and becomes more shallow, losing some of its sediment transport capacity; and
- The Sheet Flow Zone, below the braided zone, where the slope of the fan continues to flatten, more sediment is deposited, multi-channel flow increases, and the shallow flow becomes slower and diffusely spread across a broad swath.

The potential for high velocity flow and heavy sediment load means that virtually all parts of the fan can be threatened by catastrophic flooding.

In San Diego County alluvial fans occur mostly in the desert. As development expands in the desert, more projects are built on the alluvial fans and are subject to sheet flow flooding.

1.1.3 Tsunamis

Tsunamis are long-wavelength, long-period sea waves generated by an abrupt movement of large volumes of water. These waves can be caused by underwater earthquakes, landslides, volcanic eruptions, meteoric impacts, or onshore slope failures. In San Diego wave heights and run-up elevations from tsunami have historically fallen within the normal range of tides (Joy 1968, as cited in OES and UDC 2004). Table 2 gives the years and heights of the largest tsunami effects in San Diego.

Table 2
Tsunami Heights in San Diego

Year	Height (feet)
1952	2.3
1957	1.5
1960	4.6
1964	3.7

Source: OES and UDC 2004

At the most risk is the coast of San Diego, all of which is incorporated. The historic record and the location of unincorporated lands away from the coastline indicate that no projects within the unincorporated County have probable potential to be inundated by a tsunami and no guideline for tsunami has been included in Section 4.

1.1.4 Seiches

A seiche is a standing wave in a completely or partially enclosed body of water. Areas located along the shoreline of a lake or reservoir are susceptible to inundation by a seiche. High winds, seismic activity, or changes in atmospheric pressure are typical causes of seiches. The size of a seiche and the affected inundation area is dependant on different factors including size and depth of the water body, elevation, source, and if human made, the structural condition of the body of water in which the seiche occurs.

In San Diego's semi-arid climate, naturally occurring enclosed water bodies are not common. Instead most enclosed water bodies are reservoirs built by local municipalities and water districts to provide water service to local residents and businesses. Typically, all land around the reservoirs' shorelines are in public holdings, such as the City of San Diego or Helix Water District, which restrict private land development and minimize risk of inundation from seiches. Moreover, the public land holdings are not within the jurisdiction of the unincorporated County. Therefore, no guideline for seiches has been included in Section 4.

1.2 Other Flooding

1.2.1 Urbanization

The conversion of undeveloped, natural areas to urbanized uses throughout San Diego's watersheds can contribute to increased potential for flooding, by increasing the rate and amount of runoff in a watershed and altering drainage patterns. Construction of impervious surfaces such as rooftops, roads and driveways reduces the amount of rainfall that can infiltrate the ground surface and move to the subsurface. As a result, the volume of surface water runoff increases within a watershed; subsequently, artificial conveyances such as gutters, storm pipes and natural channel improvements to accommodate additional volume accelerate the rate of flow of water in the watershed. This faster moving, higher volume of surface water runoff within a watershed results in a higher probability and increased severity of flooding within a watershed, if facilities are not adequately maintained or constructed to carry peak flow capacity.

1.2.2 Landform Modification

Any alteration to natural drainage patterns by modifying landforms that control the conveyance of surface water can increase the potential for flooding. Grading or other modifications, including directly altering the course of a stream or river by excavation or embankment, can increase velocities of floodwaters, which increases the potential for flooding downstream of the modification. A reduction in the capacity of the watercourse can increase the potential for flooding at the site of the modification as well as upstream from the activity.

1.2.3 Dam Failure

Dam failure inundation is flooding caused by the release of impounded water from failure or overtopping of a dam. The failure of a dam occurs most commonly as a result poor design, neglect, or structural damage caused by earthquakes. This event is extremely hazardous, as it will typically occur quickly and without warning. Areas directly below the dam are at the greatest risk, and as the water moves further downstream and reduces in depth, the magnitude of the damage and potential risk to life and property decreases.

There have been approximately 40 dams built in the San Diego Operational Area for the purpose of water conservation and storage. Twenty of these occur throughout local jurisdictions in San Diego County (Table 3). Failure of any of these dams would affect downstream areas within the unincorporated portions of the County. Dam owners have prepared “Dam Inundation Maps” that delineated dam inundation zones or the areas at risk in the event of failure, for each dam. These maps are on file with the County of San Diego.

Table 3
Large Dams in San Diego County

Reservoir	*Dam Type*	*Year Completed*	*Maximum Capacity (acre/feet)*
Barrett	Gravity	1922	44,860
Chet Harritt	Earth	1962	10,500
Cuyamaca	Earth	1887	11,700
Dixon	Earth-rock	1970	2,500
El Capitan	Hydraulic	1934	116,450
Henshaw	Hydraulic	1923	203,580*
Lake Hodges	Multiple Arch	1918	33,550
Loveland	Arch	1945	27,700
Lower Otay	Gravity	1919	56,300
Miramar	Earth	1960	7,200
Morena	Rock	1895	50,200
Murray	Multiple Arch	1918	6,080
Olivenhain	Gravity	2003	24,000
Poway	Earth	1971	3,300
Rodriguez	Multiple Arch	1936	111,000
San Dieguito	Multiple Arch	1918	1,130
San Vicente	Gravity	1943	90,200
Sutherland	Multiple Arch	1954	29,000
Sweetwater	Gravity	1888	27,680
Wohlford	Hydraulic	1924	7,500

Source: Office of Emergency Services, Operational Area Emergency Plan.
**Lake Henshaw is kept at a maximum capacity of 55,000 acre-feet.*
Note: Rodriguez Dam is located in Tijuana, Mexico and controls portions of the flow of the Tijuana River that traverses through Otay, San Ysidro, and Imperial Beach on its way to the Pacific Ocean.

1.2.4 Faulty Drainage Facilities

Drainage facilities including storm drains, culverts, inlets, channels or other such structures are designed to prevent flooding by collecting stormwater runoff and directing flows to either the natural drainage course and/or away from urban development. The capacity of a drainage structure can typically be adequately determined by a hydrology and drainage study; however if drainage facilities are not adequately designed or built, or properly maintained, the facilities can overflow or fail, resulting in flooding.

1.3 Federal and County Maps of Flood Prone Areas

The potential for people and property to be exposed to the risk of flooding has been increased by placing housing in watercourses or designated flood prone areas such as 100-year floodplains, floodways, or other flood hazard areas as designated by Federal, State or local agencies. The placement of structures in flood hazard areas can also impede or redirect flood flows causing, an increase in the potential for flooding up and downstream. Flood prone areas in San Diego County that have been mapped are identified on maps prepared by Federal Agencies and the County as described below.

1.3.1 Federal Insurance Rate Map (FIRM)

The Federal Insurance Rate Map (FIRM) is the official map created and distributed by the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP) that delineates the Special Flood Hazard Areas (SFHAs), those areas subject to inundation by the base flood, for every county and community that participates in the NFIP. FIRMs contain flood risk information based on historic, meteorologic, hydrologic, and hydraulic data, as well as open-space conditions, flood control works, and development.

Flood Zone Designations are locations within the SFHA indicating the magnitude and degree of potential flooding. Table 4 describes the flood zones found on FIRMs.

Table 4
Flood Zones and Descriptions

Zone	Description
A	Areas of 100-year flood: Base Flood Elevations are not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown. For areas of alluvial fan flooding, velocities are also determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are determined.
A1-A30	Areas of 100-year flood; base flood elevations are determined.
AE	Areas of 100-year flood; base flood elevations are determined.
A99	Areas of 100-year flood to be protected by flood protection systems under construction; base flood elevations are not determined.
AR	Areas of 100-year flood that results from the de-certification of a previously accredited flood protection system that is determined to be in the process of being restored to provide a 100-year or greater level of flood protection.
B	Areas between the 100-year and the 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the 100-year flood.
C	Areas of minimal flooding.
D	Areas of undetermined, but possible flood hazards.
X (shaded)	Areas of 500-year flood; areas of 100-year flood with average depths less than one (1) foot or where contributing drainage area is less than one (1) square mile; or areas protected by levees from the 100-year flood.
X (unshaded)	Areas determined to outside the 500-year floodplain.

1.3.2 County Flood Plain Map

The County of San Diego publishes an aerial map showing 100-year floodplain lines, floodway lines, and floodwater surface elevations, or flood plain hazard areas.

1.3.3 County Alluvial Fan Map

The County of San Diego Flood Hazard Map for Borrego Valley delineates alluvial fans where sheet flooding can occur.

1.4 <u>Erosion</u>

Erosion is a natural process caused by water, wind, mechanical, or chemical forces acting on exposed natural landforms. This document addresses erosion by water.

The natural process of erosion removes soil, sediment and rock from exposed areas and transports the resulting sediment. Sediment and soils are composed of small pieces of decomposed rock material such as sand, gravel, loam, clay or silt that also contain varying amounts of organic materials. The water and its sediment load can cause erosion in terrestrial and fluvial environments

1.4.1 Erosion Environments

Terrestrial
The terrestrial environment consists of landforms that are not normally inundated with water, such as ridges, hill slopes, mesas, and valleys. Water, primarily as precipitation runoff, is the primary cause of erosion on these types of landforms. Once the rate of precipitation exceeds the rate of infiltration of water into the soil, water will collect on the ground's surface and move with the force of gravity down slope. Generally, steeper slopes experience greater rates of erosion because the energy level of the flowing water that passes over the slope is higher. In addition, soil and sediment composition of the ground can affect the rate of erosion. Soil and sediment composition influence the rate of infiltration, the rate at which the sediment will detach from the ground surface, and the maximum amount of sediment that can be suspended in the moving water. The presence of vegetative cover, root systems, and/or organic material in the near subsurface will prevent the detachment of particles from the ground surface and reduces the rate of erosion. The texture and structure of the sediment that is dependent on the particle size and the composition and age of the sediment layer will also have a strong effect on the erosion potential of a sediment layer.

Fluvial
The fluvial environment consists of features that are normally inundated with water such as rivers, streams, creeks, canyons, washes, and floodplains. The process of erosion by water defines these landforms. They are shaped by the amount and velocity of water and the surface material in which they occur. The balance of erosion and deposition within the fluvial regime changes the shape of landforms slowly over time,

except during storm events that cause more drastic effects as water energy is increased.

Typically, the faster-moving component of a fluvial landform will scour and erode the surface material suspending sediment within the water. This condition is intensified when the transport capacity of the stream is exceeded. Transport capacity is defined as the amount of sediment that can be suspended within the water flow at a certain speed based on the type of sediment being carried. The fluvial process transports sediment from the headwaters of San Diego's rivers in the Peninsular Ranges west to the Pacific Ocean or east to the desert basins.

1.4.2 Measuring Erosion

The rate of erosion is dependent on the type of material that is eroded, the type and amount of erosive forces, and the shape of the landform involved. The impact of raindrops on the soil surface can break down soil aggregates and disperse the aggregate material. Lighter aggregate materials such as very fine sand, silt, clay and organic matter can be easily removed by the raindrop splash and runoff water; greater raindrop energy or runoff amounts might be required to move the larger sand and gravel particles.

Soil movement by rainfall is usually greatest and most noticeable during short-duration, high-intensity thunderstorms. Although the erosion caused by long-lasting and less-intense storms is not as spectacular or noticeable as that produced during thunderstorms, the amount of soil loss can be significant, especially when compounded over time. Runoff can occur whenever excess water on a slope cannot be absorbed into the soil or trapped on the surface. The amount of runoff can be increased if infiltration is reduced due to soil compaction. Runoff from agricultural land may be greatest during spring months when soils may be saturated and vegetative cover is minimal.

The US Department of Agriculture's Soil Survey for the San Diego Area conducted in 1973 rated and classified each soil's level of erodibility typical of that class. A rating of slight, moderate, or severe was applied to each classification based on the criteria shown in Table 5 below. The table identifies four factors that affect the erodibility of a soil type. Note that climate, plant cover and physiographic features are not a part of the rating system for erodibility since these factors vary independent of the soil classification type.

Table 5
Criteria for Rating Soil Erodibility

Soil Properties Affecting Erodibility	Erodibility		
	Slight	**Moderate**[1]	**Severe**[1,2]
Surface layer texture (sediment composition)[3]	Clay	Clay loam, sandy loams, or loam	Sands, or loamy sands
Grade of granular, crumb, or blocky structure in the surface layer (particle size and strength).	Strong	Moderate	Weak and massive and single grain
Depth to material that restricts permeability	More than 40 inches	40 to 20 inches	Less than 20 inches
Slope	Less than 15 percent	15 to 30 percent	More than 30 percent

Table 12 from Soil Survey, San Diego Area, California Part II

1 Rating is slight for clay loam, sandy loams, loam, sands and loamy sands if coarse fragments cover more than 75 percent of surface.

2 Rating is moderate for sands and loamy sands if coarse fragments cover 25 to 75 percent of surface.

3 Rating is according to surface layer texture if coarse fragments cover only 1 to 25 percent of surface.

The type and amount of erosional force will also affect the erosional rate. Higher erosional forces will create exponentially greater rates of erosion. The slope of a site will also have a strong effect on the rate of erosion for a particular site.

2.0 EXISTING REGULATIONS AND STANDARDS

There are several existing regulations that prevent, reduce or avoid the potential for flooding as a result of altering drainage patterns, increasing runoff, developing in flood prone areas, and placing people or housing in areas susceptible to inundation by a dam failure or natural disaster. The following discussion details the most important Federal, State and local laws, regulations, policies and programs that address flooding issues in the United States, State of California and the County of San Diego.

2.1 Federal Regulations and Standards

Federal Emergency Management Agency [Code of Federal Regulations, Title 44, Part 9, http://www.gpoaccess.gov/cfr/index.html]

FEMA is the primary agency in charge of administering programs and coordinating with communities to establish effective flood plain management standards. FEMA is responsible for preparing FIRM for communities, which delineate both the areas of special flood hazards[1] and the risk premium zones applicable to the community. It is the responsibility of State and local agencies to implement regulations, ordinances, and

1 The National Flood Insurance Program defines a Special Flood Hazard Area as shown on a FIRM as that area with a one percent chance of being flooded in any given year; hence the property is in the 100-year floodplain. A floodplain is any land area susceptible to being inundated by floodwaters from any source.

policies in compliance with FEMA requirements, to adequately address floodplain management issues and attempt to prevent loss of life and property, health and safety hazards, and other adverse affects to public health and safety as a result of flooding.

National Flood Insurance Act [as amended US Code, Title 42, Chapter 50, § 4001-4129 http://www.fema.gov/pdf/nfip/floodact.pdf]
This legislation established the National Flood Insurance Program (NFIP). The 1968 Act provided for the availability of flood insurance within communities that were willing to adopt floodplain management programs to mitigate future flood losses. The act also required the identification of all floodplain areas within the United States and the establishment of flood-risk zones within those areas.

National Flood Insurance Program [US Code, Title 42, Chapter 50, § 4001-4129 http://www4.law.cornell.edu/uscode/42/ch50.html]
Enacted in 1968 to limit the growth of flood control and disaster relief expenditures through a reasonably priced Federal flood insurance program. This program is the Federal regulatory program under which flood-prone areas are identified and flood insurance is made available to residents of participating communities. The primary objectives of the National Flood Insurance Program (NFIP) were to: (1) make federal flood insurance available to home and business owners and renters who were exposed to flood hazards; and (2) as a condition of insurance availability, to require the adoption of specified hazard mitigation practices, including land use practices that restrict development on flood-prone lands. The NFIP was broadened and modified in 1973 by the Flood Disaster Protection Act which requires the purchase of flood insurance as a condition for receiving any form of Federal or federally related financial assistance. Communities that join the NFIP must comply with its regulations by adopting and enforcing minimum flood plain management standards and by taking an active role in flood damage prevention in order to remain in the program and receive federally funded loans in the event of a flood disaster. The NFIP is administered by the Federal Insurance Administration (FIA), a component of the FEMA.

National Flood Insurance Reform Act [http://www.fema.gov/pdf/nfip/riegle.pdf]
The National Flood Insurance Reform Act was signed into law in 1994 and was designed to strengthen the NFIP by providing for mitigation insurance and establishing a grant program for State and community flood mitigation planning projects.

2.2 State Regulations and Standards

California Environmental Quality Act [Public Resources Code 21000-21178; California Code of Regulations, Guidelines for Implementation of CEQA, Appendix G, Title 14, Chapter 3, §15000-15387 http://ceres.ca.gov/topic/env_law/ceqa/guidelines/]
Under CEQA, lead agencies are required to consider impacts to hydrology and water quality. The State CEQA Guidelines recommend focusing on impacts that may result from: substantially altering drainage patterns; placing housing within a 100-year flood hazard area; placing structures within a 100-year flood hazard area; exposing people or structures to as a result of the failure of a dam; and exposing people or structures to inundation by a seiche, tsunami, or mudflow.

Cobey-Alquist Flood Plain Management Act [Water Code, Division V, Part 2, Chapter 4, § 8400- 8415 http://www.leginfo.ca.gov/]
Encourages local governments to plan, adopt and enforce land use regulations for floodplain management, in order to protect people and property from flooding hazards. This act also identifies requirements that jurisdictions must meet in order to receive state financial assistance for flood control.

2.3 Local Regulations and Standards

San Diego County General Plan, Public Safety Element (Part VII)
[http://ceres.ca.gov/planning/counties/San_Diego/plans.html]
The Public Safety Element was developed to introduce safety considerations into the planning and decision making processes in order to reduce the risk of injury, loss of life, and property damage associated with the hazards identified in the element. The element also proposes policies and recommendations aimed at enhancing public safety through prevention as well as response preparation. Chapter 3 of the element, Geologic Hazards, addresses non-seismic hazards, specifically slope instability/erosion and landslides, which can cause flooding.

San Diego County General Plan, Seismic Safety Element (Part V)
[http://ceres.ca.gov/planning/counties/San_Diego/plans.html]
In 1984, the Government Code (§ 65302g) was amended to require that the Seismic Safety Element be consolidated with the Public Safety Element. The Seismic Safety Element is an update to the seismic safety portion of the Safety Element and has the following objectives: define degrees of risk in various parts of the County; minimize risk to human life from structures located in hazardous areas; provide a basis for designating land uses in risk areas; ensure essential facilities will operate in the event of a disaster; facilitate post-disaster relief and recovery operations; and increase public awareness of hazards. Section 6 addresses and provides policies on landslides, Section 8 addresses and provides policies on tsunamis and seiches and Section 9 addresses and provides policies on inundation caused by dam failure.

San Diego County General Plan, Conservation Element (Part X)
[http://ceres.ca.gov/planning/counties/San_Diego/plans.html]
The Conservation Element identifies and describes the natural resources of the County of San Diego and includes policies and action programs to conserve those resources. Chapter 3, Water, Finding 21 under Drainage and Flood Control, addresses the effects of land use changes on the hydrology of an area, including changes in peak flow characteristics (floods), changes in total run-off, changes in the quality of water, and changes in the appearance of the area.

County of San Diego Flood Damage Prevention Ordinance [County of San Diego Code of Regulatory Ordinances, Title 8, Division 11, § 811.101-811.104;
http://www.amlegal.com/sandiego_county_ca]
This ordinance was established to promote the pubic health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific

areas throughout the County of San Diego. Pursuant to this ordinance, SFHA in the County are identified as areas having a special flood or flood-related erosion / sedimentation hazard and shown on a FIRM, on a County flood plain map as within a 100-year flood plain or on an alluvial fan map within an alluvial fan area. This ordinance defines methods to accomplish the goals of reducing flood losses, including: restricting uses which are dangerous to health, safety and property due to erosion or water hazards; requiring uses vulnerable to floods to be protected against flood damage at the time of construction; controlling the alteration of natural flood plains; controlling filling, grading, or dredging which may increase flood damage; and preventing construction of flood barriers which will divert flood waters or increase flood hazards in other areas. This ordinance also provides for provisions for standards of construction and standards for subdivisions in areas of special flood hazards. By complying with the requirements of the Flood Damage Prevention Ordinance, projects are considered to be in compliance with FEMA regulations.

County of San Diego Resource Protection Ordinance (RPO) [County of San Diego Code of Regulatory Ordinances, Title 8, Division 6, Chapter 6 § 87.601-87.608; http://www.sdcounty.ca.gov/dplu/Resource/docs/3~pdf/res_prot_ord.pdf]
The RPO prohibits development of permanent structures for human habitation or as a place of work in a floodway. Uses permitted in a floodway pursuant to Article IV, Section 3 of this ordinance include agricultural, recreational, and other such low-intensity uses, provided, however, that no use shall be permitted which will substantially harm the environmental values of a particular floodway area. Mineral resource extraction is also permitted in a floodway, with an approved Major Use Permit and Reclamation Plan, provided that mitigation measures are required which produce any net gain in the functional wetlands and riparian habitat. Modifications to the floodway must meet design criteria, and concrete or rip rap flood control channels are allowed only when specific findings are made. Additionally, Article IV, Section 4 of the RPO allows uses permitted by zoning and those that are allowable in the floodway in the floodplain fringe, when the specific criteria are met.

County of San Diego Grading Ordinance [County of San Diego Code of Regulatory Ordinances, Title 8, Division 7, § 87.601-87.608, http://www.amlegal.com/sandiego_county_ca]
The revised Grading Ordinance was adopted by the Board of Supervisors and became effective on April 23, 2004. The purpose of the ordinance is to combine regulations affecting the grading and clearing of land, and activities affecting watercourses, within the unincorporated County of San Diego. Chapter 6 (Section § 87.601- 87.608) of the ordinance covers watercourses and is intended to protect persons and property against flood hazards by identifying prohibited acts in watercourses and acts prohibited unless a permit is obtained.

County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance [San Diego County Code of Regulatory Ordinances Chapter 8 of Division 7 of Title 6, http://www.amlegal.com/sandiego_county_ca]
The WPO and SSM were adopted January 16, 2002 and became effective on February 20, 2002. Both the WPO and SSM were amended January 10, 2003 (Ordinance No.

9518), and August 5, 2003 (Ordinance No. 9589). The stated purposes of these ordinances are to protect the health, safety and general welfare of the County of San Diego residents; to protect water resources and to improve water quality; to cause the use of management practices by the County and its citizens that will reduce the adverse effects of polluted runoff discharges on waters of the state; to secure benefits from the use of stormwater as a resource; and to ensure the County is compliant with applicable state and federal law. The WPO contains discharge prohibitions, and requirements that vary depending on type of land use activity and location in the County. The SSM is Appendix A of the WPO and sets out in more detail, by project category, what Dischargers must do to comply with the WPO and to receive permits for projects and activities that are subject to the WPO. The WPO and SSM define the requirements that are legally enforceable by the County in the unincorporated area of San Diego County.

Board of Supervisors Policy I-45: Definition of Watercourses in the County of San Diego Subject to Flood Control [http://www.sdcounty.ca.gov/cob/policy/]

The purpose of this policy is to define those watercourses in the County of San Diego that are subject to flood control so that appropriate responsibility can be determined. Flood control is defined as those watercourses which serve one square mile or more of watershed shown on the map on file with the Clerk of the Board as Document #468904. The policy was developed because consideration of flood control methods is essential in the land use decision-making process and the failure of flood control systems may result in property damage and loss of life. The policy provides for maps that specifically designate the watercourses subject to flood control thus eliminating the uncertainty and providing a clear and easily accessible record of the flood control district's area of concern.

Board of Supervisors Policy I-68: Proposed Projects in Flood Plains with Defined Floodways [http://www.sdcounty.ca.gov/cob/policy/]

This policy was developed to identify procedures to be used when proposed projects impact floodways as defined on County floodplain maps. The policy defines procedures to be implemented for the following types of proposals: major construction that would change the flood plain or floodway; relocation of a floodway; partial filling of the flood plain fringe; erosion and sedimentation in a flood plain; increased flood flows; and concrete or rip rap facilities.

Board of Supervisors Policy I-73: Hillside Development Policy [http://www.sdcounty.ca.gov/cob/policy/]

The purpose of this policy is to minimize the effects of disturbing natural terrain and to provide for creative design for hillside developments. It provides policies designed to minimize the permanent impact upon site resources including but not limited to existing natural terrain, established vegetation, visually significant geologic displays and portions of a site that have significant public or multiple-use value. Specifically, Policy 1.e requires planning of hillside developments to minimize potential soil, geological and drainage problems.

3.0 TYPICAL ADVERSE EFFECTS

Flooding can cause direct and indirect adverse impacts on the environment. Typical direct impacts resulting from flooding include the loss of life and/or property; health and safety hazards; disruption of commerce, water, power, and telecommunications services; loss of agricultural lands; and infrastructure damage and flood relief. Human activity such as development, or landform modification in special flood hazard areas for residential, commercial or industrial uses or developing in areas susceptible to inundation by a seiche, tsunami, or mudflow can increase the potential of flooding. Placing housing and structures in flood hazard areas that impede or redirect flows can also lead to direct and indirect impacts upstream and downstream by increasing flood heights and velocities.

The alteration of drainage patterns and increase in runoff associated with the continual urbanization of floodplains can increase the frequency and amount of flooding by accelerating the rate of erosion and siltation through the watershed. This can lead to indirect effects on communities and sensitive biological resources downstream in the watershed, including: the deposition of pollutants and sediment to the watershed outlets; an increase in polluted runoff to surface and groundwater receiving bodies, and an increase in the flood potential downstream.

Alluvial fan sheet flow can inundate and cause water damage to structures, bury structures, knock them off their foundations, or completely destroy them by the impact of both high velocity water and debris, which can include sizable boulders (U.S. Army Corps of Engineers, 1988). The sudden flash flood nature of these events often precludes emergency warnings or preparations.

4.0 GUIDELINES FOR DETERMINING SIGNIFICANCE

The following significance guidelines should guide the evaluation of whether a significant impact to hydrology will occur as a result of project implementation. A project will generally be considered to have a significant effect if it proposes any of the following, absent specific evidence to the contrary. Conversely, if a project does not propose any of the following, it will generally not be considered to have a significant effect on hydrology, absent specific evidence of such an effect:

1. ***The project will substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.***

This guideline has been developed to address question c) in the CEQA Guidelines, Appendix G, VIII. This guideline requires the conformance of the project to design standards in the County's Drainage Design Manual[2] and the Stormwater Standards Manual[3].

2. ***The project will increase water surface elevation in a watercourse within a watershed equal or greater than 1 square mile, by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more in height.***

This significance guideline has been developed to address question d) in the CEQA Guidelines, Appendix G, VIII, which requires an analysis of the alteration of drainage patterns from landform alteration as well as increases in the rate or amount of runoff when evaluating impacts to hydrology and water quality. This guideline addresses County maps only. In addition, the Resource Protection Ordinance (RPO) defines the floodway as all areas necessary to pass the 100-year flood without increasing the water surface elevation more than 1 foot, or in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River, and Otay River, upon adoption by the Board of Supervisors of revised floodplain maps which so specify, the increase shall be no more than 2/10 of a foot. An increase greater than these values would cause the floodway capacity of the corresponding rivers to be exceeded. As such any project that would alter drainage patterns resulting in an increase in the water surface elevation greater than the aforementioned values, would be potentially significant.

3. ***The project will result in increased velocities and peak flow rates exiting the project site that would cause flooding downstream or exceed the stormwater drainage system capacity serving the site.***

This significance guideline has been developed to address question d) and e) in the CEQA Guidelines, Appendix G, VIII, as well as Part G.3 of the WPO SSM. It is not reasonable to have a quantified peak runoff flow rate and velocity as the guideline because soil characteristics, stormwater drainage capacity, floodway capacity, and surrounding land use are all watershed and project specific variables. A hydrology / drainage study will typically be required to determine the pre and post-construction peak runoff flow rates and velocities exiting the project site, as well as the capacity of existing drainage facilities and any potential downstream impacts. Stormwater drainage facilities, including storm drains, culverts, inlets, channels, curbs, roads or other drainage structures, are designed to prevent flooding by collecting stormwater runoff and directing flows to the natural drainage course and/or away from urban development. If drainage facilities are not adequately designed, built, or properly maintained, the capacity of the existing facilities can be exceeded resulting in flooding and increased sources of polluted runoff. Any proposed projects which exceeds the capacity of the existing or planned stormwater drainage system and/or cause downstream flooding to occur, would generally result in a potentially significant impact. This can typically be

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[2] http://www.sdcounty.ca.gov/dpw/docs/drainage/drainagedesignmanual0705.pdf
[3] http://www.sandiego.gov/development-services/news/pdf/stormwatermanual.pdf

mitigated through site design, improvements to existing stormwater drainage facilities or through the construction of new stormwater drainage facilities.

4. ***The project will result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety and property due to flooding.***

This significance guideline has been developed to address question g) and i) in the CEQA Guidelines, Appendix G, VIII, the County RPO and the Flood Damage Prevention Ordinance which prohibit the placement of housing or habitable structures in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, or other flood hazard delineation map which would subsequently endanger health, safety and property due to flooding. Flooding includes mudflows and debris flows.

The Flood Damage Prevention Ordinance defines methods to accomplish the goals of reducing flood losses, including: restricting uses which are dangerous to health, safety and property due to erosion or water hazards; requiring uses vulnerable to floods to be protected against flood damage at the time of construction; controlling the alteration of natural flood plains; controlling filling, grading, or dredging which may increase flood damage; and preventing construction of flood barriers which will divert flood waters or increase flood hazards in other areas. This ordinance also provides for provisions for standards of construction and standards for subdivisions in areas of special flood hazards.

The RPO restricts development for human habitation in the floodway and provides restrictions for development on the floodplain fringe. By complying with the requirements of the RPO and the Flood Damage Prevention Ordinance, projects are considered to be in compliance with FEMA regulations. Due to the substantial risks to life and property within flood hazard areas, especially within the floodway, placing housing that is not flood free and flood safe would be create a significant impact.

5. ***The project will place structures within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:***

   a. ***Alter the Lines of Inundation resulting in the placement of other housing in a 100 year flood hazard;***

   OR

   b. ***Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River 2/10 of a foot or more in height.***

This significance guideline has been developed to address question h) in the CEQA Guidelines, Appendix G, VIII, the County RPO and the Flood Damage Prevention Ordinance which prohibit activities or placement of structures in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, or other flood hazard delineation map which would subsequently endanger health, safety and property due to an increase in flood levels during the occurrence of a base flood discharge. Discussions on the RPO and the Flood Damage Prevention Ordinance are included in subsection 4.3 above and in subsection 2.3, Local Regulations and Standards.

Any discretionary land use project that would through its implementation alter the Lines of Inundation resulting in the placement of other housing in a 100-year flood hazard or increase water surface elevation as discussed in section 4.1, would create a significant impact.

5.0 STANDARD MITIGATION AND PROJECT DESIGN CONSIDERATIONS

A project will be evaluated for its effect on hydrology under the criteria specified in Section 4. If mitigation or project design factors are identified that could reduce a significant effect, those shall be incorporated into the project. While project design elements and/or mitigation shall be incorporated into a project, it may not always be possible to reduce the impact to below a level of significant. In general, if mitigation or project redesign does not reduce a significant impact to hydrology to below a level of significant, the impact will be considered significant and unmitigable.

Mitigation measures used in the planning and land use process to avoid or reduce impacts associated with flooding are typically identified in the engineering study and are specifically designed for the project being implemented. Standard design methods for construction and for certain types of development are required for all projects within areas of special flood hazards to reduce or avoid the effects of flooding. These design considerations are identified in the County of San Diego Flood Damage and Prevention Ordinance, the RPO, and the County Drainage Design Manual. The standard design methods address the following types of issues and others:

- Engineering analysis requirements;
- Anchoring of structures and impediments to water flow to prevent flotation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads during a 100-year flood;
- Materials and utility equipment that are resistant to flood damage;
- Setbacks;
- Building elevations; and
- Fill.

Project specific design and mitigation measures also provide means of reducing the level of significance of impacts. Measures to reduce flood risks may involve structural and non-structural methods. Available measures include, but are not limited to, the following:

- Minimizing and restricting land development in flood plains, especially within the floodway, through zoning, general plan, and land use policy;
- Intentionally flooding low-lying areas to reduce the velocity and quantity of flow;
- Reducing or preventing the generation of sediment and pollutants from new development;
- Preserving natural riparian areas in flood plains and creating green belt buffers to absorb overflow, reducing runoff and filtering excessive pollutants from surface and groundwater sources;
- Finish grading of a site, at a site-specific slope after construction and improvements are completed, to properly drain discharge away from foundations and slabs;
- Limiting the height and slope of cuts and fills;
- Properly compacting fills and keying them into bedrock;
- Properly controlling flow of water onto slopes; and
- Constructing walls to divert mudflows.

6.0 REPORTING

Hydrology reports must following the guidelines in the San Diego County Hydrology Manual available at www.sdcounty.ca.gov/dpw/engineer/hydrologymanual.html or for purchase at the DPW counter at the County Annex, 5201 Ruffin Road, Suite B, San Diego, California 92123.

7.0 REFERENCES

Boyle Engineering. Borrego Valley Flood Management Report. 1989.

California Geologic Survey Note 33 , "Hazards From "Mudslides", Debris Avalanches and Debris Flows in Hillside and Wildfire Areas".

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SANDAG, Watersheds of the San Diego Region, March-April 1998.

Unified San Diego County Emergency Services Organization Operational Area Emergency Plan, March 2000.

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[ATTACHMENT A]

DEFINITIONS

Alluvial – Pertaining to or composed of alluvium, or deposited by a stream or running water.

Alluvial fan – a fan-shaped deposit of water-transported material (alluvium) that typically forms at the base of topographic features where there is a marked break in slope. Consequently, alluvial fans tend to be coarse-grained, especially at their mouths. At their edges, however, they can be relatively fine-grained.

Base flood – The flood having a one percent chance of being equaled or exceeded in any given year (also known as the 100-year flood).

Base flood elevation (BFE) – The water surface level of a watercourse or waterbody, referenced to an established datum, which corresponds to a flood event that has a one percent chance of being equaled or exceeded in any given year.

Flood plain – The relatively flat area of low lands adjoining and including the channel of a river, stream, watercourse, bay, or other body of water which is subject to inundation by the flood waters of the 100-year frequency flood as shown on floodplain maps approved by the Board of Supervisors. Areas subject to inundation are shown as the Lines of Inundation of the 100-year flood.

Flood plain fringe – The area within the floodplain that is not in the floodway.

Floodway – The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood (100-year flood) without increasing the water surface elevation more than the designated height, but not to exceed more than one foot.

Fluvial – Of or pertaining to rivers; growing or living in a stream or river; produced by the action of a stream or river.

Hydrology – The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Seiche – An oscillation of a body of water in an enclosed or semi-enclosed basin that varies in period, depending on the physical dimensions of the basin, from a few minutes to several hours, and in height from several centimeters to a few meters. It is caused chiefly by local changes in atmospheric pressure, aided by winds, tidal currents, and occasionally earthquakes.

Watercourse – Any natural or artificial, stream, river, creek, ditch, channel, canal, conduit, drain, waterway, gully, ravine, or wash in which water flows in a definite direction or course either continuously or intermittently, and which has a defined channel, bed, and banks; or any area adjacent thereto designated as subject to inundation by reason of overflow or flood water as designated and delineated on those certain maps or plats approved and adopted by the Board of Supervisors.

Watershed – An area of land where water and sediment drain to a common outlet by moving through a series of common pathways. Topographic high points, or ridgelines, define the boundaries of a watershed and “catch” all precipitation that fall within the boundaries of the watershed. Precipitation that falls within the watershed is retained in the watershed until it reaches the unique outlet point. A watershed may drain to a creek, river, wetland, lake, estuary, lagoon, marsh, ocean, or a groundwater basin.