Draft Staff Report

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Suspend the Recreational Beneficial Uses in Engineered Channels during Unsafe Wet Weather Conditions

Prepared by
California Regional Water Quality Control Board, Los Angeles Region

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Photo on cover of Ballona Creek storm conditions on March 15, 2003
(Courtesy of Culver City)

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I. INTRODUCTION

The Regional Board is proposing to amend its Basin Plan to acknowledge the inherent danger of recreating in engineered flood control channels during unsafe conditions characterized by high velocities and deep water. Specifically, the Regional Board proposes to suspend the recreational beneficial use(s) in engineered flood control channels where access can be restricted during and immediately following significant storm events to address the physically unsafe conditions in these channels. At present, the recreational beneficial uses (Water Contact Recreation or REC-1 and Non-contact Water Recreation or REC-2) assigned to these channels apply at all times, regardless of weather conditions or any other condition that could make recreational activities unsafe or infeasible. The proposed amendment would revise the recreational beneficial use designations (REC uses) for these engineered channels to reflect recreational use(s) that are temporarily suspended during and immediately following defined storm events.

Engineered flood control channels are constructed to reduce the incidence of flooding in urbanized areas by conveying stormwater runoff to the ocean or other discharge point as efficiently as possible. To accomplish this, the channels are usually lined, on the sides and/or bottom, with rip-rap or concrete. This modification creates "swiftwater" conditions during and immediately following storm events (see Exhibit 1, Photo 1). The vertical walls or steep-sided slopes of these channels in conjunction with restrictive fencing limit direct access to channelized creeks and streams for the purpose of recreational use (see Exhibit 1, Photos 2, 3, and 4).

The inherent danger of recreating in these channels during and immediately following storm events is widely recognized and is already addressed by Los Angeles and Ventura Counties through county policies. In Los Angeles County, protocols for locking access gates to flood control channels and preparing for possible swift-water rescues in these channels during defined storm events have been set by the Los Angeles County, California Multi-Agency Swift Water Rescue Committee. In Ventura County, access gates to these channels are kept locked at all times.

Since the suspension of the REC use(s) during defined storm events reduces the level of protection for the water body, the USEPA requires the Regional Board to conduct a use attainability analysis (UAA) for each water body to which the suspension would apply (USEPA, 2002, 1998, 1994). To meet these requirements, the Regional Board has developed this categorical UAA for all engineered flood control channels during defined storm events.

II. BACKGROUND

A. Designation of Beneficial Uses

According to 40 C.F.R. § 131.3(f), designated uses are those uses specified in water quality standards for each water body or segment whether or not they are being attained. Section 101(a)(2) of the federal Clean Water Act (CWA) says, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

40 C.F.R. §131.10 directs States on the designation of uses:

> (a) Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial and other purposes including navigation. In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States.
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> (b) In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall provide for the attainment and maintenance of the water quality standards of downstream waters.
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> (c) States may adopt sub-categories of a use and set the appropriate criteria to reflect varying needs of such sub-categories of uses, for instance, to differentiate between cold water and warm water fisheries.
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> (d) At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under sections 301(b) and 306 of the Act and cost-effective and reasonable best management practices for nonpoint source pollution.

B. Recreational Use Designations in the Los Angeles Region

Existing and potential uses of inland surface waters in the region are listed in Table 2-1 of the Basin Plan (CRWQCB, 1994). The Basin Plan defines recreational uses as follows:

> Water Contact Recreation (REC-1): "Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs." (CRWQCB, 1994, p. 2-2)

> Non-contact Water Recreation (REC-2): "Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities." (CRWQCB, 1994, p. 2-2)

Per 40 C.F.R. 131.3(f), existing beneficial uses refer to those beneficial uses that have been attained for a water body on, or after, November 28, 1975. Potential use designations are based on a number of factors, including:

a) plans to put the water to such future use,
b) potential to put the water to such future use,
c) designation of a use by the Regional Board as a regional water quality goal, or
d) public desire to put the water to such future use (CRWQCB, 1994).

C. Historical Basis for Recreational Use Designations in the Los Angeles Region

As stated earlier, section 101(a)(2) of the federal Clean Water Act (CWA) states that, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water will be achieved by July 1, 1983." This formed a broad basis for the beneficial use designations for surface waters of the State.

In addition to this consideration, a comprehensive review of existing data and solicited input from stakeholders was conducted in the early 1970s to determine the existing and potential beneficial uses for the waters of the Los Angeles Region. These were the bases for the beneficial uses as designated in the 1975 Water Quality Control Plans for the Los Angeles River Basin and Santa Clara River Basin (Basin Plans). Data and reports for this assessment were obtained from the California Departments of Health, Fish and Game, Conservation, and Water Resources, as well as the Southern California Association of Governments, County of Los Angeles, Los Angeles County Flood Control District, and various regional and local water agencies. Comments received from public agencies, public utilities, industrial organizations, water companies and private citizens were also considered (CRWQCB, 1975). Beneficial uses identified included existing or potential water contact recreation (REC-1) for virtually all waters in the region, and non-contact water recreation (REC-2) for most waters in the region.

Prior to the 1994 update of the Basin Plans, researchers at California State University, Fullerton conducted a comprehensive review of the Region's beneficial uses under a contract with the Regional Board (Saint, Prem K., *et al.*, 1993). The review included an evaluation of existing data, detailed field investigations and surveys of agencies and interest groups. Over 350 sites were surveyed as part of the field investigations and 50 agencies and interest groups were contacted and asked to provide input to the study. Based on the study results, the researchers recommended the addition of 126 rivers, 44 lakes and reservoirs, 45 groundwater basins, 9 coastal features and 108 wetlands and

accompanying beneficial uses to the revised Basin Plan. On the basis of field surveys and interviews, "existing", "intermittent" or "potential" REC-1 and REC-2 uses were proposed for many of these newly included water bodies.

D. Regional and National Developments Regarding Recreational Use Designations

The 1994 Basin Plan preserved these recreational beneficial uses. Recently, however, the validity and appropriateness of the REC use(s) assigned to engineered flood control channels where access is restricted or prohibited due to public safety concerns has been questioned by public agencies such as the Los Angeles County Department of Public Works (LACDPW) (County of Los Angeles DPW, 2001, 2002a, 2002b, 2002c). In light of these concerns and similar concerns expressed by the State Water Resources Control Board (State Board), the Regional Board submitted a letter to the State Board outlining possible alternatives for re-evaluating the REC beneficial use(s) assigned to these engineered channels (LARWQCB, 2002).[1] One of these alternatives was to conduct a categorical UAA for the REC use(s) of all engineered flood control channels with restricted or prohibited access during defined storm events corresponding to physically unsafe conditions.

The USEPA has also recently recognized potential circumstances where REC use(s) may be inappropriate due to high wet weather flows that result in dangerous conditions physically precluding recreation (USEPA, 2002). Specifically, USEPA states in its Implementation Guidance for Ambient Water Quality Criteria for Bacteria, May 2002 Draft, that "an intermittent REC-1 use may be appropriate when the water quality criteria [referred to in State terminology as "objectives"] associated with REC-1 are not attainable for all wet weather events" (p. 32). One example used by USEPA is high wet weather flows that result in dangerous conditions physically precluding recreation such as arroyo washes in the arid west. In light of this type of situation, USEPA suggests that meeting the REC-1 bacteriological objectives may be suspended during defined periods of time, usually after a specified hydrologic or climatic event, or for a specified number of events or days per year.

[1] Most recently, during a public hearing to consider approval of a Basin Plan amendment updating the Region's bacteria objectives set to protect the REC-1 use, State Board expressed concerns about the appropriateness of assigning recreational beneficial uses to engineered flood control channels where access is restricted or prohibited (see State Board Resolution No. 2002-0142).

III. PROPOSED ACTION

The Regional Board proposes to suspend the REC use(s) assigned to engineered flood control channels during and immediately after defined storm events where access to the channel can be restricted during the defined conditions. The rationale for this suspension is, first, that these storm events result in high flows/velocities that create physically unsafe conditions that cannot be remedied. Second, during these storm events, it is the policy of Los Angeles County to lock the access gates to these channels due to the inherent danger of recreating in these channels during wet weather, thus preventing individuals from engaging in recreational activities in the channel. The policy of Ventura County is to keep access gates to these flood control channels locked at all times.

A. Water Bodies Covered by Amendment

Staff evaluated whether to conduct water body-by-water body UAAs or a categorical UAA covering all water bodies meeting certain criteria. For this limited circumstance, staff proposes a regional approach, since all water bodies subject to the suspension of REC use(s) have similar features that justify it. Specifically, water bodies to which the suspension of the REC use(s) would apply during the defined conditions include those meeting all of the following criteria:

a) inland water bodies
b) flowing water bodies
c) engineered channels
d) water bodies where access can be restricted or prohibited (through fencing/signs)

See Appendix 1 for a list and map of the 61 inland, flowing water body segments in Los Angeles and Ventura Counties to which the suspension would apply.[2]

A categorical suspension of REC use(s) during and immediately following defined storm events for inland, flowing engineered channels where access is restricted or prohibited is a practical approach and does not reduce public health protection in these channels, since the recreational use(s) do not exist under the proposed conditions for the suspension.[3] Furthermore, as discussed in section VI.A, downstream REC uses must continue to be protected. As described earlier, engineered channels are designed to convey water rapidly out to a discharge point, making conditions unusually unsafe for recreational activities during high flows/velocities associated with storm events. While not sufficient alone to

[2] These water bodies were selected using a two-step approach. First, staff identified all inland, flowing water bodies listed in Table 2-1 of the Basin Plan where the REC use(s) were qualified due to restricted or prohibited access. Second, staff circulated this list internally among staff knowledgeable about the proposed water bodies to confirm that each of the water bodies met the criteria for inclusion in the proposed amendment. Staff will follow-up with field surveys of the candidate water bodies where necessary to confirm physical characteristics and access restrictions.

[3] The recreational uses do not exist because (1) during the defined wet weather conditions, the velocity and depth of the water in these channels renders them unsafe for recreation and (2) under the defined wet weather conditions, Los Angeles County routinely locks all access gates to these flood control channels and Ventura County keeps access gates to flood control channels locked at all times.

trigger a suspension of the REC uses, restricted or prohibited access to these channels is also proposed as a complementary prerequisite for the suspension to ensure that people cannot access a water body during the defined wet weather periods.[4]

Staff evaluated, but does not recommend applying the suspension of REC use(s) to all inland water bodies for the following reasons.[5] Inland water bodies include those that would not be subject to the high flows/velocities that occur in engineered channels. For example, lakes obviously are not characterized by high flows/velocities during storm events that would result in unsafe conditions. As for other inland, flowing water bodies, they may have neither (1) conditions of an engineered channel that would make recreation unsafe during storm events nor (2) restricted or prohibited access.

B. Condition Triggering Suspension of REC Use(s)

Staff evaluated several possible triggers for the suspension of REC use(s) in engineered channels with restricted or prohibited access. These included:

a) flow and velocity (e.g., "swiftwater" conditions),
b) depth (e.g., outside of low flow channel), and
c) rainfall (e.g., total daily rainfall).

A summary of staff's evaluation regarding the feasibility and appropriateness of using each of these triggers is provided in Appendix 2.

Based on this evaluation, staff concludes that rainfall is the most appropriate trigger. The reason for this is three-fold. First, the Los Angeles County, California Multi-Agency Swift Water Rescue Committee uses rainfall prediction as the basis for routinely locking access gates to County flood control channels and putting swiftwater rescue personnel on alert. Written guidance for County personnel and other involved agencies is provided by the Committee in the "Operational Standards and Guidelines Document" (dated December 10, 1999). This document outlines the protocols used by the City of Los Angeles Fire Department, County of Los Angeles Fire Department, Sheriff's Department, Lifeguards and Department of Public Works to prepare for and provide swift-water rescues. Under the "Water Rescue Pre-Deployment Section" (Sec. 6.00, p. 13), three storm levels are defined (Levels 1-3) based on storm warnings with an 80% prediction of specified levels (e.g., ½ inch, 1 inch, 1½ inches) of rain over 24 hours.[6] The following are the three alert levels:

[4] USEPA states, "For states and authorized tribes using this [high-flow cutoff] approach, EPA encourages the development of an plan to communicate to the public the conditions under which recreation should not occur" (USEPA, 2002, p. 34).

[5] Furthermore, staff evaluated, but does not recommend applying the suspension to coastal water bodies, since there is use during and immediately following storm events (e.g. surfing) and access is not restricted.

[6] According to LA County Flood Control, these protocols are implemented in the following way. There are 12 superintendents who are responsible for closing gates to flood control channels in LA County when they deem appropriate. Each superintendent looks at Doppler information generally and estimates for their geographic region whether they should close the gates.

Level 1	1 inch of rain (if unsaturated ground) or ½ inch (if saturated ground)
Level 2	1 ½ inch of rain (if unsaturated ground) or 1 inch (if saturated ground)
Level 3	Rainfall/saturation levels exceeding those listed for Level 2 Generalized flash floods, urban flooding and/or mud and debris flows Urban flooding with possible life hazards.

Other factors that the agencies consider when determining deployment levels include:
1) The effect of major wildland and interface burn areas. Large burn areas result in increased runoff and high potential for mud and debris flows and flash floods.
2) Flood watches and flood warnings.
3) Real time effects of the storm, which may differ from weather forecasts, resulting in severe conditions in particular geographic areas.
4) Releases in the flood control channels.

At the Level 1 Alert threshold, County personnel routinely lock all access gates to flood control channels. Access gates are kept locked for at least 24 hours after the storm event (Burke, J., 2003, personal communication).

The second reason that rainfall is selected as the most appropriate trigger is because there are numerous rain gages throughout Los Angeles and Ventura Counties making precipitation data readily available whereas flow, velocity and depth data are not available for all candidate channels (see Appendix 2 for more details). Third, rainfall is an adequate proxy for high flows/velocities resulting in unsafe conditions, given the reliance on rainfall prediction by the Multi-Agency Swift Water Rescue Committee. To confirm this, staff used five years of data (water years 1998-2002) to match days above the Level 1 Alert rainfall thresholds of ½ inch or 1 inch with corresponding flow, velocity and depth data in several local channels and compared this data to swift-water rescue data from these same channels as well as other agencies' protocols for evaluating when conditions in these channels are unsafe. Specifically, staff relied upon a protocol used by the USGS and the County of Orange in which in-stream conditions are evaluated using the following calculation to determine whether it is safe for monitoring personnel to be in a stream or channel. The calculation is the peak depth (in feet) multiplied by the peak velocity (in feet/second). If the result is greater than or equal to 10, then it is considered unsafe (Caldwell, A., 2003, personal communication; County of Orange, 2001).

The results of this analysis demonstrate that a significant percentage (63% on average and as much as 83%) of unsafe days (as determined using the USGS protocol described above) occur on days where the preceding day's rainfall was greater than ½ inch, regardless of whether ground conditions were saturated or unsaturated.[7] See Appendix 3, Table 1. (The counterpoint to this is that on average 37% of unsafe days occur on days

[7] In the data analysis, staff compared the preceding day's rainfall to conditions on the target day. Staff chose this approach due to the lag time associated with storm flows. See Appendix 3, Figures 1 to 3, for an example of this lag time. Had staff compared both the preceding day's rainfall as well as rainfall on the target day to conditions on the target day, the percentages above may have been slightly higher.

outside of the defined wet weather conditions.) Additionally, 36 percent of documented swift-water rescues from 2001 to 2002 occurred on days with rainfall greater than or equal to ½ inch, while 71% occurred on days considered "unsafe".[8] See Appendix 3, Table 2. Finally, our analysis shows that, on average, 82% of days and as high as 100% of days where the preceding day's rainfall was greater than ½ inch were considered unsafe per the USGS protocol, regardless of whether the ground was saturated. See Appendix 3, Table 1. (Again, the counterpoint to this is that on average 18% of days where the preceding day's rainfall was greater than ½ inch were *not* considered unsafe.) The results of this analysis show that using days with greater than ½ inch of rainfall and the following day will provide protection by suspending the use during 63% of unsafe days. Additionally, this trigger appears appropriate and justifiable based on this analysis, since on average 82% of days where the preceding day's rainfall was greater than ½ inch were considered unsafe. See Appendix 3 for a more detailed discussion and presentation of this analysis.

On the basis of the detailed data analysis described above and in Appendix 3, staff proposes to use the Level 1 Alert (with saturated conditions) threshold [rainfall greater than or equal to ½ inch as measured at the closest rain gage] as the trigger for suspension of the REC use(s) assigned to a particular engineered channel.[9] Staff proposes to use the Level 1 Alert (with saturated conditions) threshold because rainfall in Southern California tends to be concentrated over a short "wet season" during November to March and, in particular, from January to March, leading to a greater likelihood of saturated conditions as compared to unsaturated conditions. Furthermore, staff's analysis indicates that days deemed "unsafe" based on other agencies' protocols are more likely to occur on days where the preceding day's rainfall is between ½ to 1 inch than on days where the preceding day's rainfall is greater than 1 inch, regardless of ground conditions (i.e. saturated vs. unsaturated).[10] See Appendix 3, Table 1. Therefore, it is more protective of public safety to use the ½ inch rain threshold than the 1 inch rain threshold (i.e., the recreational use(s) will be suspended on a greater number of unsafe days if the ½ inch threshold is used as compared to the 1 inch threshold). In addition, due to the lag time associated with storm flows, staff proposes to apply the suspension for 24 hours after the specified rain event. (See Appendix 3, Figures 1 to 3.) This comports with the policy of Los Angeles County to keep all access gates locked for a minimum of 24 hours following the specified rain event (Burke, J., 2003, personal communication).

[8] Eighty-two percent of swift-water rescues from 2001 to 2002 occurred on days with rainfall greater than 0.1 inch or days following rainfall of greater than 0.1 inch.

[9] Staff evaluated several methods for identifying the precipitation corresponding to a particular engineered channel. These included using one centralized rain gage per county, one gage per watershed, or the closest gage to the engineered channel. Due to the variability in rainfall in the region, as confirmed by our analysis of these different methods, staff concluded that the closest rain gage to the engineered channel should be used. Consideration should be given to the completeness and quality of the data from that gage. If the data are incomplete or of poor quality, the next closest gage should be used.

[10] This can be explained by the fact that there tend to be more days with rainfall between ½ to 1 inch than days with rainfall greater than 1 inch. However, it is also insightful that the percentage of unsafe days where the preceding day's rainfall was between ½ inch and 1 inch (32%) is similar to the percentage of unsafe days where the preceding day's rainfall was greater than 1 inch (26%).

IV. LEGAL JUSTIFICATION FOR SUSPENSION OF REC USE(S)

A. Legal Requirements for Removal of Designated Uses

Per 40 C.F.R. § 131.10(g), States may remove a designated use that is not an existing use, as defined in 40 C.F.R. § 131.3, or establish subcategories of use if the State can demonstrate that attaining the designated use is not feasible for one or more of the following reasons:

1. Naturally occurring pollutant concentrations prevent the attainment of the use,
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met;
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) [Effluent Limitations] and 306 [National Standards of Performance] of the Act would result in substantial and widespread economic and social impact.

1. Restrictions on Removal of Use: 40 C.F.R. § 131.10

Federal regulations restrict States from removing designated beneficial uses. Specifically 40 C.F.R. § 131.10 (h) prohibits States from removing designated uses if:

1. They are existing uses, as defined in 40 C.F.R. § 131.3, unless a use requiring more stringent criteria is added; or
2. Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices.

Furthermore, 40 C.F.R. § 131.10(i) states that where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

2. Use Attainability Analyses: 40 C.F.R. § 131.3(g)

40 C.F.R. § 131.3(g) defines a use attainability analysis (UAA) as a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in § 131.10(g).

Under section 40 C.F.R. § 131.10(j) of the Water Quality Standards Regulation, States are required to conduct a UAA whenever a State wishes to remove a designated use that is specified in section 101(a)(2) of the Act or adopt subcategories of uses specified in section 101(a)(2) that require less stringent criteria.

USEPA (2002) provides guidance on conducting UAAs for recreational uses and provides the following factors that may be addressed:

a) physical analyses considering the actual use (as of November 28, 1975), public access to the water body, facilities promoting the use of recreation, proximity to residential areas, safety considerations, and substrate, depth, width, etc. of a water body;
b) chemical analyses of existing water quality ;
c) potential for water quality improvements including an assessment of nutrients and bacteriological contaminants; and
d) economic/affordability analyses.

This reaffirms previous USEPA guidance in which USEPA suggested that, when evaluating recreational uses, States look at a suite of factors such as whether the water body is actually being used for primary contact recreation, existing water quality, water quality potential, access, recreational facilities, location, proximity to residential areas, safety considerations, and physical conditions of the water body in making any use attainability decision (USEPA, 1994).

On the subject of physical analyses, USEPA has previously stated that, “physical factors, which are important in determining attainability of aquatic life uses, may not be used as the basis for removing or not designating a recreational use consistent with the CWA section 101(a)(2) goal” (US EPA, 1994). This precludes States from relying upon either factor 2 (low flows) or factor 5 (physical factors in general) as the *sole* basis for determining attainability of recreational uses. The reason for this preclusion is that States and USEPA have an obligation to do as much as possible to protect the health of the public. In certain instances, people will use whatever water bodies are available for recreation, regardless of the physical conditions (USEPA, 1994).

USEPA is in the process of considering whether the regulation or Agency guidance should be amended to allow consideration of physical factors, alone, as the basis for removing, or not designating primary contact recreational uses (USEPA, 1998). As part of this process, USEPA has convened a national workgroup to discuss recreational use designations. A key topic being vetted by the workgroup is Use Attainability Analyses for recreational uses.

B. Legal Justification for Suspension of REC Use(s) during Defined Rain Events

Suspension of REC use(s) in engineered channels with restricted or prohibited access during rainfall of greater than or equal to ½ inch and the 24 hours following the rain event is legally justified for three reasons. These are:

(1) During the defined wet weather events, recreation is not an existing use in engineered channels,
(2) Under the defined wet weather conditions during which the suspension would apply, recreational uses in these channels are not attainable through effluent limitations under CWA section 301(b)(1)(A) and (B) and section 306 or through cost effective and reasonable best management practices, and
(3) These water bodies meet two of the six conditions listed in 40 C.F.R. 131.10(g) during the defined wet weather conditions.

The logic underlying each of these reasons is discussed in detail below.

1. During the defined wet weather events, recreation is not an existing use in engineered channels.

During the defined wet weather conditions, recreation is not an existing use in engineered flood control channels with restricted access, for two related reasons.[11] First, during the defined wet weather conditions, the rate of flow, velocity and depth of the water in engineered channels renders them unsafe for individuals to engage in recreational activities. This is particularly true for REC-1 activities because REC-1 involves body contact recreation. As presented earlier, the definition of REC-1 is:

> *"Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing or use of natural hot springs."* (CRWQCB, 1994, p. 2-2)

While REC-2 does not normally involve body contact with water, it does involve recreational activities in close proximity to water. As a result, REC-2 activities may result in accidental contact with water. Due to the extreme danger associated with recreation in or near these channels during the defined wet weather conditions, REC-2 activities, which may involve accidental contact with the water, are also unsafe. This is because if someone recreating near the water body fell into the water, they could be quickly swept downstream due to the high velocities, flow rates, and depths characterizing the defined

[11] Note that while some of the water bodies proposed for inclusion in this amendment have "existing" REC uses assigned to them, these uses have never been "existing" during the defined wet weather conditions for the reasons discussed below.

wet weather conditions. Furthermore, the geometry of these flood control channels (i.e. vertical or steeply sloped sides) makes it extremely difficult to get out of the channel during these conditions. See section III.B and Appendix 3 for a detailed analysis of unsafe conditions. (See Exhibit 1, Photos 4 and 5.)

Second, under the defined wet weather conditions including the 24 hours after the rain event, Los Angeles County routinely locks all access gates to these flood control channels per the protocols outlined in the "Operational Standards and Guidelines Document" (December 10, 1999) prepared by the Multi-Agency Swift Water Rescue Committee. Access gates to engineered flood control channels in Ventura County are always locked. Therefore, recreational activities are prohibited in these channels under the defined wet weather conditions. (See Exhibit 1, Photos 6 and 7.)

2. Under the defined wet weather conditions during which the suspension would apply, recreational uses are not attainable through effluent limitations under CWA section 301(B)(1)(A) and (B) and section 306 or through cost effective and reasonable best management practices.

Due to the design of the engineered flood control channels, recreational uses are not attainable during the defined wet weather conditions that would trigger the suspension even if water quality was adequate to support the uses. In other words, it is not water quality that ultimately precludes attainment of the REC uses, but rather the physical conditions during the defined wet weather conditions in hydrologically modified (engineered) channels. This is because, as described earlier, engineered flood control channels are constructed to reduce the incidence of flooding in urbanized areas by conveying stormwater runoff to the ocean or other discharge point as efficiently as possible. To accomplish this, the channels are usually lined, on the bottom and sides, with rip-rap or concrete. Furthermore, the channel sides are usually vertical or steeply sloped. These modifications, necessary for flood control, create "swiftwater" conditions during and immediately following storm events. Due to the need for flood control during storm events, these channels cannot be modified to eliminate the physical danger associated with recreation in or near these channels during wet weather conditions.

3. These water bodies meet two of the six conditions listed in 40 C.F.R. 131.10(g).

As described earlier, there are six factors that may be used to justify removal of a designated use that is not an existing use or the establishment of sub-categories of a use. Federal regulation (40 C.F.R. 131.10(g)) requires that at least one of these six factors be met. These six factors are as follows:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated

for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

The suspension of the REC use(s) in engineered flood control channels with restricted access is justified by factors 2 and 4 above. Regarding factor 2, southern California streams are naturally flashy systems due to the predominantly dry climate and short, concentrated wet season. These natural flashy conditions result in intermittent dangerous flow volumes and velocities after rain events that prevent the attainment of the use during and for the 24 hours after a ½-inch rain event.[12]

In addition, the natural conditions in the factor 2 analysis are further exacerbated in engineered flood control channels, which are designed to contain and convey water rapidly to a discharge point. This results in the use being unattainable under factor 4 as well. These hydrologic modifications, made for the purpose of flood control, in combination with natural conditions (i.e., characteristically flashy systems during wet weather) physically preclude the attainment of the recreational use during and immediately following a ½-inch or greater storm event. Further, it is not feasible to restore the water body to its original condition or operate the modifications in such a way as to attain the use during the defined wet-weather events.

[12] Furthermore, regarding factor 2, because the natural conditions of concern are high flow/velocity conditions, these conditions cannot be compensated for by the discharge of sufficient volume of effluent discharges to enable uses to be met.

V. DISCUSSION OF ALTERNATIVES

Below staff presents four sets of alternatives, including (1) which recreational uses to suspend, (2) which trigger to use to identify periods subject to the suspension, (3) which associated water quality objectives to suspend, and (4) a "no action" alternative. Alternatives within each set are mutually exclusive, but alternatives between sets 1, 2 and 3 are intended to be considered in combination.

A. To Which Recreational Uses Should the Suspension Apply?

1. REC-1 Use Only

Due to the inherent danger of recreating in the water during high flow, velocity and depth conditions associated with storm events and the fact that the access gates are locked during these conditions, there is little likelihood that REC-1 uses could occur in these circumstances. Under this recommendation, the REC-2 use and the associated objectives set to protect the REC-2 use would still apply during periods when the REC-1 use was suspended.

2. REC-1 and REC-2 Uses

Suspending both REC-1 and REC-2 uses is reasonable and can be justified by the inability of the channels to support REC-2 activities under the defined conditions. To examine whether REC-2 uses are supported under these conditions, it is useful to examine again the definition of REC-2.

> *Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.* (CRWQCB, 1994, p. 2-2)

The REC-2 use involves activities in proximity to water bodies and, therefore, may involve accidental contact with water, which under the defined wet weather conditions is unsafe. As discussed earlier, this is because if someone recreating near the water body fell into the water, they could be quickly swept downstream due to the high velocities, flow rates, and depths characterizing the defined wet weather conditions. Furthermore, the geometry of these flood control channels (i.e. vertical or steeply sloped sides) makes it extremely difficult to get out of the channel during these conditions. See section III.B and Appendix 3 for a detailed analysis of unsafe conditions. Furthermore, it is unlikely that any of the REC-2 activities are possible where access to the water is barred by fencing and locked access gates during the defined wet weather conditions. On the other hand, where access is prohibited, individuals could come in proximity to a channel (i.e., as close as the fencing would allow). This proximity may result in the incidental

ingestion of water (e.g., from splashing). It is the incidental/accidental ingestion of water that is being protected against with the REC-2 use.

B. Which Trigger Should Be Used to Initiate the Suspension?

1. Days of Rainfall greater than or equal to ½ inch plus the 24 Hours Following the Rain Event (Level 1 Alert threshold).

Analysis showing that a trigger of greater than or equal to ½ inch of rainfall, including the 24 hours following the rain event, will capture 63% of "unsafe days" supports this alternative. From another standpoint, analysis showing that 82% of days with rainfall greater than ½ inch were followed by "unsafe" days also supports this alternative. Due to the lag time associated with storm flows, continuing to apply the suspension for 24 hours after the specified rain event is reasonable and justified. This also comports with the Level 1 Alert threshold used by Los Angeles County and its policy to keep all access gates locked for a minimum of 24 hours following the specified rain event.

Under this alternative, the suspension would typically apply 16 to 22 days per year (or 4 to 6% of the year) based on an evaluation of historical rainfall data from LAX and three representative rain gages in Ventura County.[13] See Appendix 3, Table 4.

2. Days of Rainfall greater than 1 inch plus the 24 Hours Following the Rain Event (Level 1 Alert threshold with antecedent unsaturated conditions).

This approach is less conservative from the public safety standpoint than Alternative B.1 in that the recreational use(s) would still apply on a number of days with rainfall of ½ inch to 1 inch when conditions would be deemed "unsafe." (It is, however, more conservative from a water body protection standpoint.) As discussed earlier, the average percentage of unsafe days occurring on days where rainfall of ½ to 1 inch fell on the preceding day (32%) was nearly the same as the average percentage of unsafe days where rainfall of greater than 1 inch fell on the preceding day (26%). Using the more conservative ½ inch trigger captures 63% of unsafe days, on average, while using the less conservative 1 inch trigger only captures 29% of unsafe days, on average. Furthermore, looking at the data from another standpoint, the majority (69%) of days where rainfall of ½ to 1 inch fell the preceding day were deemed unsafe.

Under this alternative, the suspension would typically apply 6 to 12 days per year (or 2 to 3% of the year) based on an evaluation of historical rainfall data from LAX and three representative rain gages in Ventura County.[14] See Appendix 3, Table 5.

[13] This may be an overestimate because staff has assumed that no day with rainfall greater than or equal to ½ inch was followed by a second consecutive day of rainfall greater than or equal to ½ inch. If one or more days of rainfall greater than or equal to ½ inch were followed consecutively by a day(s) of rainfall greater than or equal to ½ inch, these numbers would be smaller.

[14] This may be an overestimate because staff has assumed that no day with rainfall greater than or equal to 1 inch was followed by a second consecutive day of rainfall greater than or equal to 1 inch. If one or more

C. To Which Water Quality Objectives [Set to Protect Recreational Uses] Should the Suspension Apply?

Under either Alternative A.1 or A.2, the associated objectives set to protect the REC use(s) that should be concurrently suspended should only include those that satisfy the following conditions:

1) The constituents should degrade over a relatively short period of time; conversely, those that are stable or bioaccumulate should not be exempted due to the potential for extended and cumulative downstream impacts beyond the period of the suspension.
2) High levels of these constituents should be of concern to those partaking in only those recreational activities where ingestion of water is possible, for these are the uses that are precluded by the defined wet weather events. Conversely, constituents that could have an effect on other beneficial uses that still occur during wet weather events, should not be suspended, e.g. fish consumption.
3) High levels of these constituents should not in any way affect the non-proximal aesthetic enjoyment of the water body.

Therefore, the bacteria objectives set to protect the REC use(s) are the only objectives that should be concurrently suspended along with the REC use(s). This comports with USEPA guidance, which only envisioned applying a "high flow/velocity" exemption to recreational uses and the associated bacteriological criteria (USEPA, 2002).

D. No Action

Another alternative would be to do nothing and, as such, continue to apply the REC use(s) to all water bodies at all times. Recreational uses would be fully protected; however, the beneficial use designations will not reflect the actual or potential use of these channels under the defined wet weather conditions. Some stakeholders may view this alternative as unreasonably protective.

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days of rainfall greater than or equal to 1 inch were followed consecutively by a day(s) of rainfall greater than or equal to 1 inch, these numbers would be smaller.

VI. OTHER CONSIDERATIONS

A. Protection of Downstream Recreational Uses

40 C.F.R. Part 131.10(b) states that "in designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall provide for the attainment and maintenance of the water quality standards of downstream waters." Many of the candidate channels in this proposed amendment flow directly, or indirectly as tributaries to other water bodies, to coastal water bodies and beaches. Many of these coastal water bodies (e.g. beaches) are currently listed as impaired due to bacteria. The Regional Board must ensure that the downstream coastal recreational uses are protected during wet weather events (subject to any other pertinent implementation procedures for the bacteria objectives) and that the recreational uses of the candidate channels are protected when normal/safe conditions return.

On the coast, in Santa Monica Bay, a reference system approach[15] is employed as the regulatory mechanism to protect the REC-1 use of the Bay's beaches. Tables 4 and 5 in Appendix 3 provide estimates of the number of days on which a suspension of the REC use(s) would apply. Because the number of allowable exceedance days under the reference system approach will be re-evaluated in four years based on data from the wave wash (the point of compliance for the TMDL), staff cannot draw definitive conclusions as to whether the recommendations here conflict with the reference system approach. It appears that Alternative A.1 to suspend the REC-1 use only would not be in conflict with the reference system approach under most conditions. It is not clear whether Alternative A.2 to suspend both the REC-1 and REC-2 uses would be in conflict with the downstream reference system approach or not. To assess this, staff would need better information on bacterial degradation rates and transport times from each of the engineered channels to which the suspension would apply.

B. Antidegradation Requirements

Per the State Anti-degradation Policy (State Board Resolution 68-16), there may be no lowering of water quality from that currently attained. The policy states, "Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality shall be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed

[15] Under this approach, a reference system is selected on the coast, which is influenced less than any other area in the watershed by human activities. The number of exceedances for that coastal area is considered to be a result of natural or background conditions. That number is then set as the allowable exceedance days for the rest of the coast unless a particular location has fewer exceedance days than the reference site, in which case antidegradation provisions apply.

in the policies" (SWRCB, 1968). In other words, existing water quality must be maintained even after the effective date of the proposed amendment.

C. Anti-backsliding Requirements

When the Regional Board reissues NPDES permits, the effluent limitations generally must be as stringent as the prior permit. This concept is known as anti-backsliding and it is codified in federal Clean Water Act section 402(o) and separately in 40 C.F.R. § 122.44(l). There are several exceptions to the anti-backsliding provisions of Federal law. In general, the relaxation water quality objectives, as permitted by the proposed Basin Plan amendment, does not exempt a discharger from the anti-backsliding provisions of the federal Clean Water Act. The Regional Board must evaluate NPDES permits on a case-by-case basis when the permits are reissued to determine whether an applicable anti-backsliding exception applies.

D. Future Uses

Suspending the recreational use(s) of the candidate engineered channels does not preclude a lifting of this suspension should conditions within these channels change in the future. While such changes seem unlikely in most cases due to the necessary use of these channels for flood control, none of the alternatives would preclude a return to fully protecting all recreational uses at all times, if warranted.

VII. RECOMMENDED ALTERNATIVE

The Regional Board recommends suspending the water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities, using as a trigger days of rainfall greater than or equal to ½ inch and the 24 hours following the rain event, which comports with the Los Angeles County Level 1 Alert threshold with antecedent saturated conditions. This alternative is justified by the unsafe conditions in engineered flood control channels during storm events of greater than or equal to ½ inch, regardless of ground conditions (i.e. saturated or unsaturated). Furthermore, the candidate channels are routinely locked by Los Angeles County under these conditions, while Ventura County keeps its access gates locked at all times, preventing individuals from engaging in recreational activities in these channels during these conditions.[16] The suspension would apply to inland, flowing, engineered channels where it is possible to restrict access during the defined conditions. Water quality objectives set to protect (1) other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall still remain in effect.

In making this recommendation, staff has considered all factors set forth in §13241 of the Porter Cologne Water Quality Control Act:

a) Past, present and probable future beneficial uses of the candidate engineered channels have been, are and will be limited by the hydrologic modifications and other physical factors (i.e. natural conditions).
b) Bacteriological water quality objectives set to protect recreational uses are not being met in 62 percent of the assessed candidate water bodies, however, TMDLs will rectify this in the future, taking into account any suspension of the recreational uses per this amendment.
c) Stormwater is the primary source of bacterial contamination in these channels, particularly during the wet weather conditions under which the suspension would apply. Historically, stormwater has been difficult to control, particularly during wet weather conditions. Furthermore, given the role these channels serve for flood control, it will be particularly difficult to control flows during and immediately following large storm events.
d) With regard to economic considerations, the recommended alternative is not expected to impose any additional cost and will likely reduce future costs by

[16] Regional Board staff recognizes a potential gap between current Los Angeles County policies and the proposed amendment on days with between ½ inch and 1 inch of rainfall where there are unsaturated ground conditions. On these days, current Los Angeles County policies would not require locking access gates, though our analysis shows conditions to be unsafe on the majority of these days. Ways of addressing this gap are discussed in section VIII “Implementation Provisions”.

suspending the recreational uses and associated bacteria objectives during some wet weather events.

e) The recommended alternative will have no impact on the need for developing housing within the region.

f) The need to develop and use recycled water will not be affected by the proposed modifications and, in fact, the ability to reuse stormwater may be facilitated by this amendment by providing flexibility as to where stormwater controls must be implemented.

VIII. IMPLEMENTATION PROVISIONS

The Regional Board is proposing to suspend REC-1 and REC-2 uses in engineered channels on days of greater than or equal to ½ inch of rain and the 24 hours following in acknowledgement of the inherent danger of recreating in these channels during these periods. Staff's recommendation is based on analysis presented in section III.B and Appendix 3, which shows that in general rainfall greater than ½ inch results in unsafe conditions (based on velocity and depth considerations) regardless of whether there are saturated or unsaturated conditions.

The current protocols used in Los Angeles County for locking access gates to engineered channels during storm events provide an effective mechanism for preventing access to these channels when conditions are unsafe. However, staff recognizes a potential gap between current County policies and the proposed amendment on days with between ½ inch and 1 inch of rainfall where there are unsaturated ground conditions. On these days, current County policies would not require locking access gates, though our analysis shows conditions to be unsafe on the majority of these days.

To address this gap, the Regional Board proposes to work in coordination with Los Angeles County Flood Control as well as the Multi-Agency Swift-Water Rescue Committee to identify a mechanism for letting the public know that conditions in these channels are unsafe on days of greater than or equal to ½ inch of rain and the 24 hours following and, therefore, recreational use of these channels is being suspended in the interest of public safety. Potential mechanisms may include permanent signage, press releases, and public outreach in coordination with other public education programs (e.g., the municipal storm water permit public outreach program).

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APPENDIX 2: SUMMARY OF EVALUATION OF POSSIBLE CONDITIONS TRIGGERING SUSPENSION OF REC USE(S)

The Regional Board proposes to suspend the REC-1 beneficial uses for those water bodies where high velocities and deep water create unsafe conditions that preclude individuals from partaking in REC-1 activities. Various implementation options were evaluated with respect to this action.

Water Bodies to be Covered

Water bodies to be covered by a high-flow suspension could include any of the following criteria:

a) inland water bodies
b) flowing water bodies (not lakes)
c) engineered channels
d) water bodies where access is restricted or prohibited (through fencing/signs)

Criteria (a) and (b) must be met for water bodies to be covered by this suspension, but alone they are not enough. Inland water bodies include those that may not be subject to the unsafe conditions that occur in engineered channels. For example, clearly lakes are not subject to high velocities that would cause unsafe conditions. Additionally, access to many lakes cannot be restricted during storm events. Flowing water bodies also could include those that flow more slowly (e.g. due to natural meanders and vegetation). Slow flowing water bodies do not necessarily have the conditions of an engineered channel that make recreation inherently dangerous during storm events.

Therefore, in addition to criteria (a) and (b), criteria (c) and (d) must also be met. Engineered channels are designed to convey water rapidly out to a discharge point, making conditions unusually unsafe for recreation. Therefore, engineered channels (criterion c) should be categorically exempt. Restricted or prohibited access to the engineered channels (criterion d) should also be a complementary prerequisite for employing the suspension because only then is there an assurance that people cannot access a water body in order to engage in recreational activities. See Appendix 1 for a list of engineered water bodies in the region to which access is restricted or prohibited.

The Los Angeles Regional Water Quality Control Board's "Basin Plan" contains a list of inland surface water bodies where access is restricted or prohibited in Los Angeles and Ventura Counties. Staff conducted a search for readily available flow data for each of the inland flowing water bodies where access is restricted or prohibited.

The Los Angeles County Department of Public Works maintains comprehensive information on facilities by channel type. This enabled Regional Board staff to confirm our list of candidate water bodies with the County's to isolate those water bodies to which this amendment would apply.

The Ventura County Flood Control District (VCFCD) does not have a comprehensive list of facilities by channel type. The County currently has a GIS coverage showing channel location and length with basic information (drawing number, project name, year of construction, etc.) of all VCFCD facilities. The County is currently developing a database that would break the list of channels down by channel type and dimensions, but it was not available for use in developing the proposed amendment. There is no

record provided by the VCFCD as to which channels are engineered or have restricted access. Therefore, Regional Board staff cannot confirm our list with the County's to isolate those water bodies to which this amendment would apply.

Conditions Triggering Suspension

The possible triggers for a suspension include:

1) Velocity-basis (requires flow and area data) (e.g., "swift water" conditions).

   Velocity can be calculated by dividing the flow by the area (V=Q/A).
   Area can be calculated by multiplying the depth by the cross-sectional area (A=D*(Cross-Sectional Area)).

2) Depth Basis

3) Rainfall-basis (e.g., total daily rainfall).

The following section analyzes the feasibility of each of these three options for Ventura County and Los Angeles County, given readily available data.

Ventura County

1). Velocity Data (flow and area)

a). Flow Data
The Ventura County Flood Control District (VCFCD) provides peak flow data over the most current 24-hour period at http://www.ventura.org/vcpwa/fc/fws/ for a limited number of water bodies. Real-time data is recorded at the county offices. Ventura County is in the process of developing Internet access to historical rainfall and hydrologic data. Also the USGS web-site (http://water.usgs.gov) is helpful for gages in Ventura County as it has real-time as well as historical flow data.

Of the list of 61 water bodies to be covered by this amendment, none are in Ventura County. There may be other water bodies that should be on the list. However, Ventura County's effort to break the list of channels down by channel type and dimensions was not available at the time of writing. There is no record provided by the VCFCD as to which channels are engineered or have restricted access. Therefore, Regional Board staff cannot confirm our list of candidate water bodies with Ventura County's inventory.

b). Area Data (Depth and Cross-Sectional Area)
The VCFCD web-site (listed above) provides peak depth data for the most current 24-hour period. The USGS web-site (listed above) provides annual maximum instantaneous peak stream flow and gage heights. Ventura County is in the process of developing Internet access to historical rainfall and hydrologic data. Cross-sectional area data can be found on as-built plans via request from VCFCD.

2). Depth Data
Depth data is described above.

3). Rainfall Data
The VCFCD web-site (listed above) provides rainfall totals over various time intervals, i.e. last hour, last 3 hours, last 6 hours, last 12 hours, last day and last 2 days. Ventura County is in the process of developing Internet access to historical rainfall and hydrologic data. Historical data was obtained for three representative gages in the county.

Los Angeles County

1). Velocity Data (flow and area)

a). Flow Data
Regional Board Staff has a list of facilities by channel type for Los Angeles County. Staff conducted a search for available flow data for each of the inland flowing water bodies where access is restricted or prohibited. Flow data is available from the Los Angeles County Department of Public Works (LACDPW) web site at: http://www.ladpw.com/wrd/report/9899/runoff/discharge.cfm. In looking at this web-site, staff concluded that less than ½ of the 61 candidate water bodies in Los Angeles County where access is restricted or prohibited have corresponding flow data. Therefore, it is not feasible to rely upon this data as a trigger to determine when to begin the suspension.

b). Area Data (Depth and Cross-Sectional Area)
In most cases depth data is used to determine the flow rate. Therefore, in most channels where a county has flow data, depth data also exists. Cross-sectional area data can be found from looking at particular as-built plans via request from LACDPW.

2). Depth Data
Depth data is described above.

3). Rainfall Data
Los Angeles County displays real-time data for 62 rain gages located throughout the county for 1, 3, 6, 12, 24, 36, and 48-hour increments and for the last 30 days on their web-site. The web-site is updated every 10 minutes. This rain data can be viewed at: http://ladpw.org/wrd/precip/.

Existing Protocol for Restricting Access

In Ventura County, there are no water rescue pre-deployment criteria that result in the closing of flood control access gates. All access gates to flood control channels and access roads are always locked. There are a few exceptions, where Ventura County Flood Control District (VCFCD) has a specific written agreement with a city for joint use of a VCFCD right-of-way. For these few areas where the public has access (most often, bike paths), the access road is not in an area that is at risk for flooding.

In Los Angeles County, the Los Angeles County, California Multi-Agency Swift Water Rescue Committee has published an “Operational Standards and Guidelines Document” (dated December 10, 1999). This guidance provides a framework for the City of Los

APPENDIX 2: SUMMARY OF EVALUATION OF POSSIBLE CONDITIONS TRIGGERING SUSPENSION OF REC USE(S)

Angeles Fire Department, County of Los Angeles Fire Department, Sheriff's Department, Lifeguards and Department of Public Works to provide water rescue. Under the "Water Rescue Pre-Deployment Section" (Sec. 6.00 on page 13), three storm levels are defined (Levels 1-3) based on storm warnings with an 80% prediction of certain quantities of rain over 24-hours. The following are the three alert levels:

Level 1	1 inch of rain (unsaturated ground) or ½ inch (saturated ground)
Level 2	1 ½ inch of rain (unsaturated ground) or 1 inch (saturated ground)
Level 3	Rainfall/saturation levels exceeding those listed for Level 2 Generalized flash floods, urban flooding and/or mud and debris flows Urban flooding with possible life hazards.

Other factors LA County considers when determining deployment levels include:

1) The effect of major wildland and interface burn areas. Large burn areas result in increased runoff and high potential for mud and debris flows and flash floods.
2) Flood Watches and Flood Warnings.
3) Real time effects of the storm (may differ from weather forecasts, resulting in severe conditions in particular geographic areas).
4) Releases in the Flood Control Channels.

Rainfall as Most Practical Trigger for Suspension

Velocity is probably the best direct measure, followed by depth, of unsafe conditions. However, from a practical standpoint, rainfall is the easiest to implement in a region-wide manner and is an adequate proxy for flow as indicated by the reliance on rainfall prediction by the Swift Water Rescue Committee. Rainfall is the factor that determines when Los Angeles County closes its access gates to many engineered channels. Ventura County has its access gates closed at all times, precluding access to channels. Rainfall data is readily available to county personnel and is measured by the county agencies among others. Los Angeles County has staff allocated and funded to close the gates that are county property using rainfall prediction as the basis for closure. In addition, as discussed earlier, flow meters or depth gages are not available for all engineered channels with restricted or prohibited access. Finally, based on our analysis, rainfall appears to correlate well with unsafe conditions as further described in Appendix 3.

Appendix 3 provides a description of the analysis staff conducted to determine that rain was an adequate proxy for unsafe conditions. In sum, unsafe conditions were estimated using a "rule of thumb" employed by USGS and also adopted by Orange County personnel, where if peak velocity * peak depth >= 10, then it is "unsafe." Unsafe days were compared to the preceding day's rainfall (i.e. rain >0.5 or >1.0 inch) to determine whether rainfall was an appropriate implementation trigger.

APPENDIX 2: SUMMARY OF EVALUATION OF POSSIBLE CONDITIONS TRIGGERING SUSPENSION OF REC USE(S)

Rainfall Estimation Methods

There are multiple methods for determining the amount of rainfall at any particular location. All are based on using rain gage data. Three methods are as follows:

1) Use of one centrally located gage per county.
2) Use of one centrally located gage per watershed (one gage per watershed with location within watershed to be determined based on availability of automatically recording rain gages and other factors).
3) Use of the nearest rain gage.

Staff analysis indicated that rainfall is highly variable and that the nearest rain gage should be used to estimate rainfall for particular water body segments.

APPENDIX 3: DATA ANALYIS RESULTS

Correlation between Unsafe Conditions and Rainfall at Select Locations in Three Watersheds

Staff conducted an analysis of the correlation between "unsafe conditions" (using velocity and depth) and daily rainfall amounts to determine whether rainfall is an adequate proxy for unsafe conditions. Specifically, staff used five years of data (water years 1998-2002) to match days above the Level 1 Alert rainfall thresholds of ½ inch or 1 inch (depending on local antecedent moisture condition) with corresponding physical conditions in several local channels. The physical conditions examined were those that could result in "unsafe" conditions, i.e. velocity and depth.

The results of this analysis demonstrate that a significant percentage (63% on average and as much as 83%) of unsafe days (as determined using the USGS protocol [1]) occur on days where rainfall the prior day was greater than ½ inch. [2] (The counterpoint to this is that on average 37% of unsafe days occur on days outside of the defined wet weather conditions.) Finally, the analysis shows that on average 82% of days and as high as 100% of days with rainfall greater than ½ inch were followed by "unsafe" days. (Again, the counterpoint to this is that on average 18% of days with rainfall greater than ½ inch were *not* followed by unsafe days.) See Table 1 below.

This analysis supports the use of rainfall events of greater than 1/2 inch, regardless of ground conditions (saturated vs. unsaturated) as a reasonable proxy for "unsafe" conditions in engineered channels the day following the rain event.

To compare the benefit of using a 1/2-inch rain event versus the 1-inch event, it is important to compare the respective statistics using both rain events. Both statistics are important:

- % "Unsafe" Days Preceded by Rain Days > X inch
- % Days with Rain > X inch that were Followed by "Unsafe" Days

Regarding the first bullet, the results of this analysis show that 63% of days that were considered unsafe occurred when greater than ½ inch of rain fell the preceding day. This statistic drops to 29% when rainfall was greater than 1 inch on the preceding day. Regarding the second bullet, on average 82% of days with rain greater than ½ inch were followed by "unsafe" days. This statistic rises to 94% for days with rainfall greater than 1 inch. Since both statistics listed are important, it is clear that using a 1/2 inch of rain as a trigger for the suspension results in higher percentages when considered cumulatively than the cumulative statistics for 1 inch. Therefore, it is more appropriate to use 1/2 inch of rain as a proxy for unsafe conditions; that is, a significant number of unsafe days would not be captured using 1 inch of rainfall as a proxy for unsafe conditions. While it is necessary to use a prediction of rain to allow time to prepare for unsafe conditions, the implementation of the suspension would be based on actual rainfall data from the closest rain gage with adequate data.

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[1] The USGS uses the following calculation as a "rule of thumb" for determining whether it is safe for monitoring personnel to be in a channel (Al Caldwell, USGS, San Diego office, personal communication, 2003). The calculation is the peak depth (ft) * peak velocity (ft/sec). If the result is greater than or equal to 10 then it is considered unsafe. The County of Orange, Environmental Resources Division, has adopted this "rule of thumb" into their practices (County of Orange, 2001).

[2] In the data analysis, staff compared the preceding day's rainfall to conditions on the target day. Staff chose this approach due to the lag time associated with storm flows. See Figures 1 through 3 for examples of this lag time. Had staff compared both the preceding day's rainfall as well as rainfall on the target day to conditions on the target day, the percentages above may have been slightly higher.

APPENDIX 3: DATA ANALYIS RESULTS

Table 1: High Flow Conditions at Select Stations in Three Watersheds In Region 4 (Water Years 1998-2002)

Station*	Watershed	# "Unsafe" Days	# Days with Rain >0.5 in.	# Days with Rain >1.0 in.	# Unsafe Days preceded by days with rain >0.5 inch	% "Unsafe" Days preceded by days with rain >0.5 inch	% Days with Rain >0.5 in. followed by "Unsafe" days	# Unsafe Days preceded by days with rain >1.0 inch	% "Unsafe" Days preceded by days with rain >1.0 inch	% Days with Rain >1.0 in. followed by "Unsafe" days
F34	LAR	19	25	11	13	68%	52%	10	53%	91%
F342	LAR	45	32	11	29	64%	91%	11	24%	100%
F285	LAR	35	30	13	29	83%	97%	13	37%	100%
F37	LAR	39	21	7	20	51%	95%	7	18%	100%
AVG	***LAR***	35	27	11	23	67%	84%	10	33%	98%
F274	SGR	30	23	9	17	57%	74%	8	27%	89%
F304	SGR	25	23	8	20	80%	87%	8	32%	100%
F312	SGR	21	20	7	12	57%	60%	5	24%	71%
AVG	***SGR***	25	22	8	16	65%	74%	7	27.7%	86.7%
F38	B	56	23	8	23	41%	100%	8	14%	100%
AVG	**ALL**	34	25	9	20	63%	82%	9	29%	94%

Notes: *See Table 1A for a description of each station.

APPENDIX 3: DATA ANALYIS RESULTS

Table 1A. Description of Stream Gaging Stations used in Data Analysis

Station	Watershed	Name	Channel Dimensions*	Assumptions
F34D-R	LAR	LOS ANGELES RIVER below Firestone Blvd	Concrete, with rip-rap side slopes, trapezoidal in section, with trapezoidal low flow channel. Top width is 265 feet. Height is 17 feet. Side slopes not given nor bottom width.	Low flow channel is 28 feet wide, no height given. Assumption that flows will not go out of low flow channel except during extreme events, none of which occurred during this five-year period. So treated cross section as a rectangle with width of 28 feet.
F342-R	LAR	BRANFORD STREET CHANNEL below Sharp Avenue	Trapezoidal, 10 feet wide at bottom and 7.5 feet deep with 1.5 to 1 side slopes.	No assumptions needed.
F285-R	LAR	BURBANK WESTERN STORM DRAIN at Riverside Dr.	Concrete rectangular section with 60 feet width and 12 feet in height.	No assumptions needed.
F37B-R	LAR	COMPTON CREEK near Greenleaf Drive	Concrete rectangular section, 60 feet wide by 13 feet deep.	No assumptions needed.
F274B-R	SGR	DALTON WASH at Merced Avenue	Concrete rectangular section, 60 feet wide, 14.5 feet tall.	No assumptions needed.
F304-R	SGR	WALNUT CREEK above Puente Avenue	Concrete rectangular section, 50 feet wide, 13.5 feet tall.	No assumptions needed.

APPENDIX 3: DATA ANALYIS RESULTS

Station	Watershed	Name	Channel Dimensions*	Assumptions
F312B-R	SGR	SAN JOSE CHANNEL below Seventh Avenue	Grouted rip-rap side slopes with natural bottom, trapezoidal section.	225 feet wide as the upper width, 16 and 17 feet as the maximum height on two sides. No dimensions for channel base or side slopes given. Assumed that side slope was 1.5:1 with base of 175 feet.
F38C-R	Ballona	BALLONA CREEK above Sawtelle Blvd.	Concrete ruble, trapezoidal in section	95 feet wide as the upper width, 23 feet tall in middle of channel. No base width given nor side slopes given. Assumed that side slope was 1.5:1 with base of 26 feet.

*Channel dimensions obtained from the Los Angeles Department of Public Works web site at http://www.ladpw.org/wrd/runoff/.

APPENDIX 3: DATA ANALYIS RESULTS

Illustration of Lag Time between Rainfall and Runoff

Figure 1: Ballona Creek above Sawtelle Blvd.

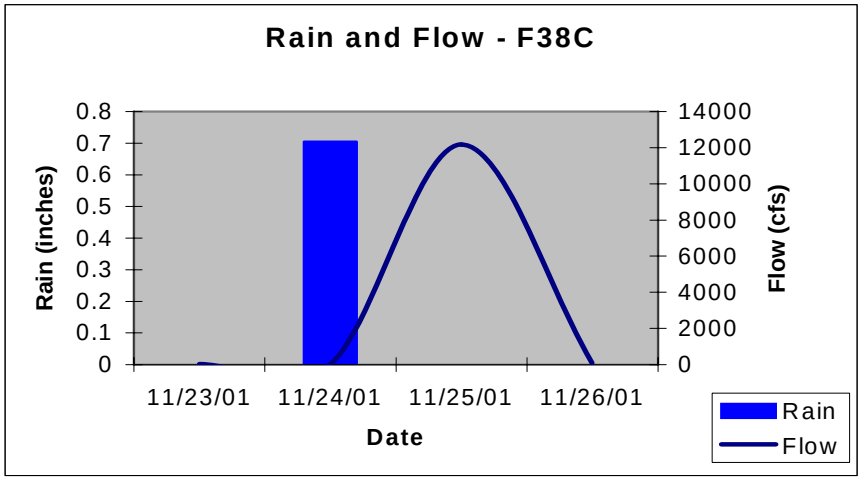
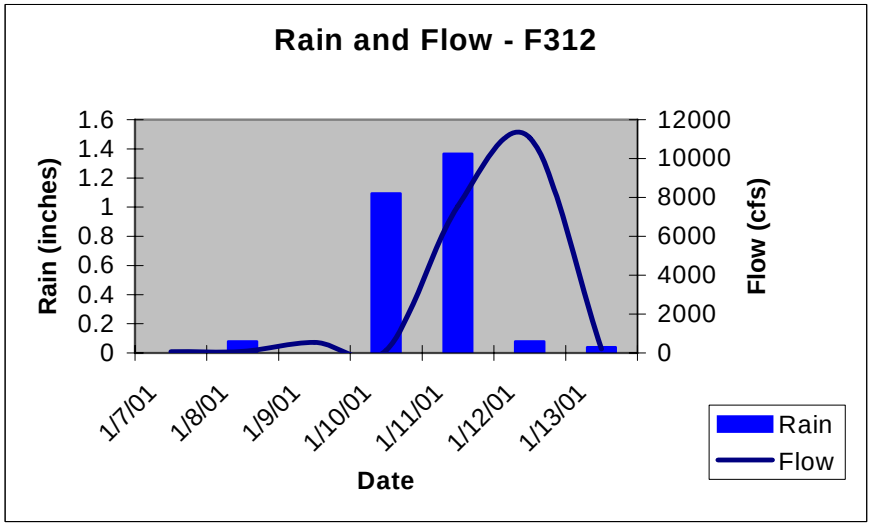
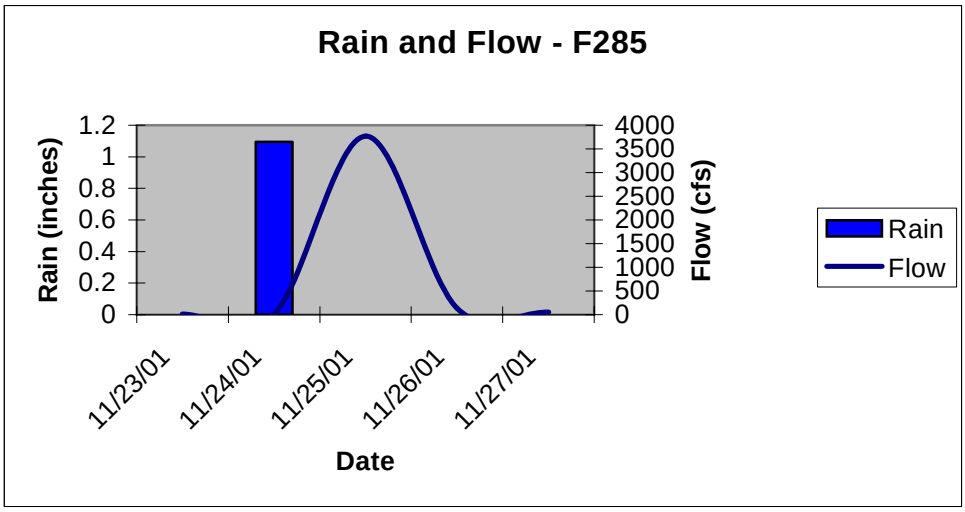


Figure 2: San Jose Channel below Seventh Ave.



APPENDIX 3: DATA ANALYIS RESULTS

Figure 3: Burbank Western Channel at Riverside Dr.



APPENDIX 3: DATA ANALYIS RESULTS

Rescue Dates, Locations and Conditions for 2001 and 2002

In Los Angeles County, protocols for locking access gates to flood control channels and preparing for possible swift-water rescues in these channels during defined storm events have been set by the Los Angeles County, California Multi-Agency Swift Water Rescue Committee. This committee is made up of the County and City Fire Departments, the Sheriff's Department, Lifeguards and the Department of Public Works. The Los Angeles County Fire Department is the chair of the committee and retains records of the locations, dates and times of historic swift-water rescues.

Staff analyzed two years of rescue data (water years 2001-2002) to match days on which there were swift-water rescues with corresponding flow, depth, velocity and rainfall data in several local channels. Staff concluded that 71 percent of the rescues occurred on days that were considered "unsafe".[3] Thirty-six percent of swift-water rescues from 2001 to 2002 occurred on days when the rainfall on that day or the preceding day was greater than ½ inch, while 27 percent occurred on days when the rainfall on that day or the preceding day was greater than 1 inch.[4] See Table 2 below. Table 3 provides minimum, maximum and mean statistics for the flow, velocity and depth values associated with the rescue data.

[3] Staff could not evaluate all rescue dates with respect to the USGS rule-of-thumb, since in some cases the necessary flow data was not recorded.

[4] Eighty-two percent of swift-water rescues from 2001 to 2002 occurred on days when rainfall on that day or the preceding day was greater than 0.1 inch.

APPENDIX 3: DATA ANALYIS RESULTS

Table 2: Rescue Dates, Locations[5] and Conditions for 2001 and 2002

Rescue Date	Nearest Stream-gage	Water Body	Water-shed	Total Daily Rain	Rain Day B/F	"Unsafe" V*D>10	Peak Flow	Peak Depth	Peak Velocity
01/11/01	F354	Coyote Creek	SGR	1.02	1.30	not recorded			
01/12/01	F354	Coyote Creek	SGR	0.32	1.02	not recorded			
03/05/01	F34D-R	LA River	LAR	0.39	0.039	81.82	2290.98	3.13	26.14
03/06/01	F34D-R	LA River	LAR	0.31	0.39	543.45	15216.62	5.14	105.73
04/07/01	F34D-R	LA River	LAR	0.71	0	8.42	235.70	2.13	3.95
04/27/01	F274B-R	San Dimas Wash	SGR	0	0	3.77	226.47	0.84	4.49
04/30/01	F262-R	San Gabriel R.	SGR	0	0	not recorded			
12/21/01	F64R	Rio Hondo	LAR	0.27	0.08	Gage taken off-line in 1996.			
11/30/01	F274B-R	San Dimas Wash	SGR	.078	0.24	63.33	3800	3.83	16.54
11/30/01	F274B-R	San Dimas Wash	SGR	.078	0.24	63.33	3800	3.83	16.54
12/16/02	F354	Coyote Creek	SGR	1.41	0	11.05	16200	7.81	34.57

SGR = San Gabriel River
LAR = Los Angeles River

[5] Exact locations were provided by the LACFD but are not included on this table.

APPENDIX 3: DATA ANALYIS RESULTS

Flow, Velocity and Depth Conditions during "Unsafe" Conditions, Rescues and Specified Rain Events

Staff analyzed some basic hydrologic parameters associated with select channels of concern during various weather and safety conditions. These hydrologic conditions included flow, velocity and depth. The minimum, maximum and mean peaks of these three parameters were recorded.

It is interesting to note that the averages for peak flow, peak velocity and peak depth were similar in magnitude for the "unsafe" days and for the days following a rain event greater than 1/2 inch, regardless of ground conditions (i.e. saturated vs. unsaturated). This seems to support the idea that rain events greater than 1/2 inch are a good proxy for "unsafe conditions."

The correlation between these parameters for days with rescues and days following rain events greater than 1/2 inch is not so strong. While the ranges are comparable, the averages for peak flow, peak velocity and peak depth are approximately 1.5 - 2 times larger during rescue conditions as compared to events where rain the day prior is greater than 1/2 inch. In other words, most rescue days seem to have conditions that are far more dangerous than those associated with the average 1/2-inch rain event.

APPENDIX 3: DATA ANALYIS RESULTS

Table 3: Flow, Velocity and Depth Conditions during "Unsafe" Events, Days with Rescues and Specified Rain Events (Los Angeles River, San Gabriel River and Ballona Creek Sites)

Condition	Peak flow (range & average)	Peak velocity (range & average)	Peak depth (range & average)
Days "unsafe"	(117.31 - 12,483.72) 2,143.29	(4.06 - 121.31) 13.15	(0.19 - 9.33) 2.59
Days w/ rescues	(226.47 - 16,200.00) 5,967.11	(3.95 - 105.73) 28.90	(0.26 - 7.81) 3.37
Days following rain>0.5	(27.02 - 12,483.72) 2,150.59	(0.42 - 58.83) 12.44	(0.37 - 9.33) 2.57
Days following rain >1.0	(27.02 - 12,483.72) 3059.68	(0.42 - 58.83) 15.34	(0.37 - 9.33) 3.10

APPENDIX 3: DATA ANALYIS RESULTS

Summary of Days of Rainfall ≥1/2 inch and ≥1 inch plus the 24-hours following based on Historical Records

At each of four rain gage stations in Los Angeles and Ventura Counties, rainfall greater than or equal to 1/2 inch occurred an average of 18 days per year over the periods of record. This number drops to 7.75 days, where the rainfall criterion is greater than or equal to 1 inch. In percentages, 4.75% of the 365 days per year were days over the rain criterion of 1/2 inch. The percentage drops to 2.25% when using the criterion of 1.0 inch of rainfall.

The ranges and medians are broken down by station in the two tables below. Table 4 applies to the 1/2-inch threshold. Table 5 applies to the 1-inch threshold.

The significance of these tables is that they indicate the number of days per year that the high flow suspension of the REC-1 and REC-2 beneficial uses would apply.

APPENDIX 3: DATA ANALYIS RESULTS

Table 4: Summary of Days of Rainfall ≥ ½ Inch plus the 24 Hours Following Based on Historical Records[6]

Rain Gage	Max No. of Days / year (% of Year)	No. of Days in 1993 (% of Year)	Min No. of Days / year (% of Year)	Median No. of Days / year (% of Year)
LAX[7]	48 (13%)	26 (7%)	2 (0.5%)	16 (4%)
Ojai – Stewart	64 (18%)	Not calculated	0 (0%)	22 (6%)
Simi	56 (15%)	Not calculated	2 (0.5%)	18 (5%)
VD	34 (9%)	Not calculated	0 (0%)	16 (4%)

Notes: The Max, Min, and Median numbers may be overestimates because staff has assumed that no day with rainfall greater than or equal to ½ inch was followed by a second consecutive day of rainfall greater than or equal to ½ inch. If one or more days of rainfall greater than or equal to ½ inch were followed consecutively by a day(s) of rainfall greater than or equal to ½ inch, these numbers would be smaller. The number of days in 1993 is an exact calculation.

Table 5: Summary of Days of Rainfall ≥ 1 Inch plus 24 Hours Following Based on Historical Records[8]

Rain Gage	Max No. of Days / year (% of Year)	No. of Days in 1993 (% of Year)	Min No. of Days / year (% of Year)	Median No. of Days / year (% of Year)
LAX[9]	24 (7%)	15 (4%)	0 (0%)	6 (2%)
Ojai – Stewart	38 (10%)	Not calculated	0 (0%)	12 (3%)
Simi	30 (8%)	Not calculated	0 (0%)	8 (2%)
VD	18 (5%)	Not calculated	0 (0%)	7 (2%)

Notes: The Max, Min, and Median numbers may be overestimates because staff has assumed that no day with rainfall greater than or equal to 1 inch was followed by a second consecutive day of rainfall greater than or equal to 1 inch. If one or more days of rainfall greater than or equal to 1 inch were followed consecutively by a day(s) of rainfall greater than or equal to 1 inch, these numbers would be smaller. The number of days in 1993 is an exact calculation.

[6] Note that the period of record for the LAX analysis was from 1948 to 2000. For the Ventura Downtown (VD) and Ojai-Stewart gages the period of record was 1956 to 2001. For the Simi gage the period of record was 1956 to 1971.
[7] Note that the water year used for the LAX analysis was from November 1 through October 31st. The rest of the rain gage analyses were based on a water year that runs from October 1 through September 30th.
[8] See Footnote 6 above.
[9] See Footnote 7 above.