

5.6.3 UAA ANALYSIS: Santa Ana-Delhi Channel

In part, the following discussion summarizes and references data and information contained in the “Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel”, CDM, August 2010 (SAD Technical Report). Maps, tables, and photographs included in the Technical Report are reproduced here directly or adapted and referenced appropriately.

5.6.3.1 Waterbody Description / Location

The Santa Ana-Delhi Channel watershed (approximately 20 mi²) is located in Orange County and includes portions of the cities of Santa Ana, Costa Mesa, and Newport Beach. See Figure SAD-1. Currently, the Santa Ana-Delhi Channel is not listed in the Basin Plan. The channel starts in the midsection of the City of Santa Ana and empties into the Upper Newport Bay State Ecological Reserve in the City of Newport Beach. The UAA addresses the Santa Ana-Delhi Channel mainstem and not its tributaries, which include the Santa Ana Gardens and Paularino Channels.

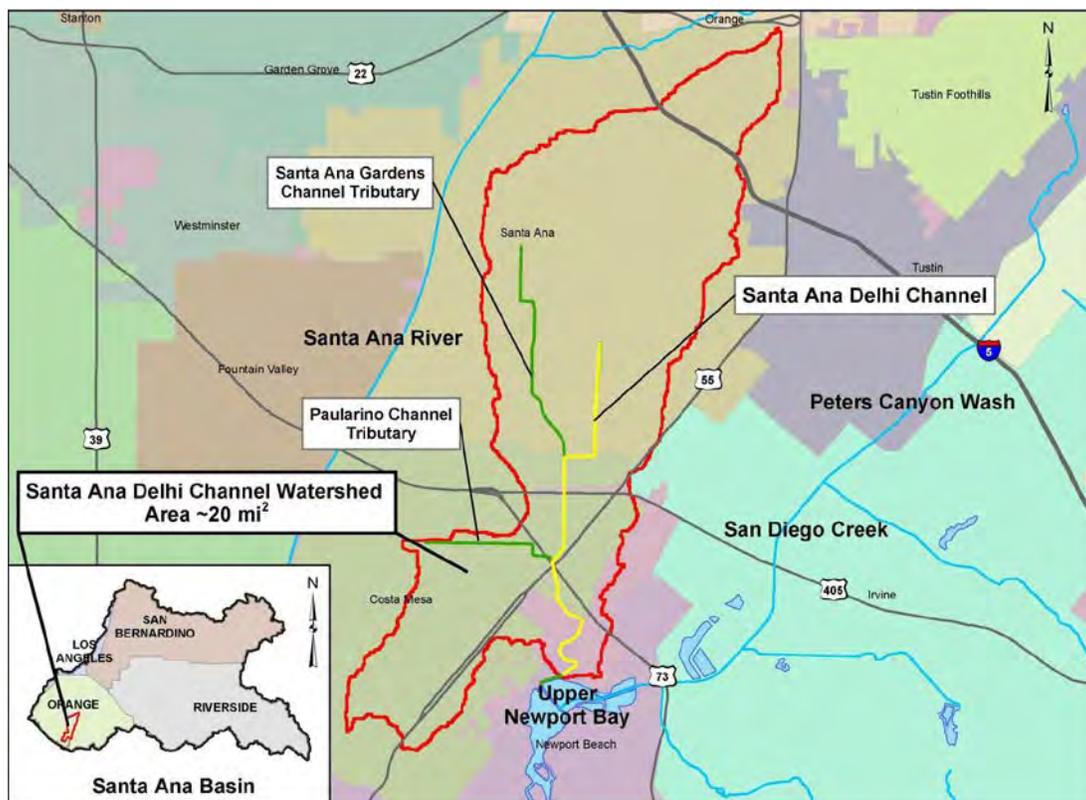


Figure SAD-1 Santa Ana-Delhi Channel Watershed (Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010 Figure 2-1)

5.6.3.2 Reach Identification

For the purpose of designating water quality standards, staff proposes that the channel be divided into a tidal prism segment and two upstream reaches, Reach 1 and Reach 2. (See also Section 5.8 of the Staff Report) Each of these areas is described below.

First, it should be noted that the analysis in the SAD Technical Report is based on subdivision of the Santa Ana-Delhi Channel mainstem into two reaches (1 and 2) (Figure 2-2, SAD Technical Report). In the SAD Technical Report, the downstream terminus of Reach 1 is approximately 450 feet upstream of the Bicycle/Pedestrian Bridge at University Drive. For descriptive purposes only, the SAD Technical Report further subdivides Reach 1 into four segments (Figures 2-3, 4 and 5, SAD Technical Report) and Reach 2 into 3 segments (Figures 2-6, 7 and 8, SAD Technical Report). Staff proposes a revised approach to reach identification, as described below and in Table SAD-1. However, the data and analyses provided in the SAD Technical Report with respect to channel morphology, surrounding land use, evidence of recreational activity, bacterial water quality, etc. in the channel are not substantively affected by this revised approach.

**Table SAD-1
Reach Identification**

Reaches	SAD Technical Report (Table 2-2, p. 2-13)	Regional Board Staff Report
Tidal Prism	Not identified	Bicycle Bridge to 1,036 ft. upstream
Reach 1	450 ft. upstream of University Drive (Bicycle Bridge) to Sunflower Avenue (Station 190+00 ⁺)	1,036 ft. upstream from Bicycle Bridge to immediately upstream of the intersection of Sunflower Avenue and Flower Street, Santa Ana (Station 209+00 ⁺)
Reach 2	Sunflower Avenue to Warner Avenue	Upstream of intersection of Sunflower Avenue and Flower Street to Warner Avenue

⁺ Station designations from Orange County Resources and Development Management Department record drawings. Following standard technical drawing convention and as an example, Station 12+34 is 1234 feet from a designated zero point.

5.6.3.3 Reach Descriptions

Channel characteristics for each of the proposed reaches are summarized in Table SAD-2. Representative photographs are included as Figures SAD-2, 3, and 4. The SAD Technical Report includes additional photographs of the channel. (See SAD Technical Report Figures 2-12 through 2-25.)

5.6.3.3.1 Tidal prism

The length of the Tidal Prism fluctuates depending on the height of the tides. While the lower downstream half of this reach very likely always consists of marine waters, the upper half of the reach has been observed to contain flowing freshwater during lower tides. For the determination of beneficial uses the length of the Tidal Prism section will be determined by the area covered with marine waters during the mean higher-high water (MHHW)¹ tide.

The downstream boundary of the proposed tidal prism segment is the pedestrian/ equestrian/ bicycle bridge (Bicycle Bridge) located at the terminus of University Drive in the City of Newport Beach. The Bicycle Bridge separates the proposed tidal prism section of the channel from the Upper Newport Bay Ecological Reserve. The upstream boundary of the tidal prism segment is 1,036 feet upstream of the Bicycle Bridge at the point where the channel turns sharply to the west (left). See Figure SAD-2. A representative photograph of the tidal prism segment is shown in Figure SAD-3. The channel characteristics of the tidal prism are identified in Table SAD-2.

The proposed tidal prism segment features a 20 ft. wide earthen bottom with an earthen side slope along the right channel bank (facing upstream from the Bicycle Bridge). The left bank is a reinforced concrete side slope adjacent to the residences along Anniversary Lane. This side slope transitions to an earthen side slope downstream to the Bicycle Bridge at University Drive. An informal equestrian training area is immediately adjacent to the right channel bank. The channel bottom is composed of dark organic muck and very fine grained silty and clay-like soil in the area of the Bicycle Bridge and upstream. In the upper section of the tidal prism, small riprap rock, likely placed for erosion control, is found in the channel bottom with sections of clay-like soil.

¹ Mean Higher-High Water tide is the highest of the two high (maxima) daily tides.



Figure SAD-2 Santa Ana-Delhi Channel, Tidal Prism Segment



Figure SAD-3. Tidal Prism Segment, looking upstream from Bicycle Bridge.
Regional Board staff photograph, June 2010.

5.6.3.3.2 Reach 1

Reach 1 extends from the upper end of the tidal prism upstream to immediately upstream of the intersection of Sunflower Avenue and Flower Street in the City of Santa Ana. This channel reach is dominated by vertical concrete walls and a concrete bottom. Reach 1 is approximately 3.4 miles in length. Channel characteristics are summarized in Table SAD-2. Note that for channel characteristic descriptive purposes only, two segments of the proposed Reach 1 are identified in Table SAD-2.

The downstream section of Reach 1 continues the 20 foot wide, earthen-bottomed channel from the upper end of the proposed tidal prism to Mesa Avenue, a distance of about ¼ mile. The right side slope, bordering a golf course, is earthen while the left side slope is reinforced concrete. At the lower end of this ¼ mile stretch, dry weather low flows create some fresh water pools before commingling with tide water. The remainder of Reach 1 consists of a reinforced concrete rectangular channel (i.e., vertical walls) where the bottom width is 55 ft with a shallow trapezoidal sided low-flow channel. See Figure SAD-4. The channel is confined in fully enclosed culverts under the SR 55 / SR 73 interchange for approximately 2100 feet, and north of Interstate 405 for approximately half a mile as the channel runs beneath a business/entertainment complex in the city of Costa Mesa. Upstream of this closed culvert, the channel resumes its open, reinforced concrete rectangular channel configuration for the short distance to the upper end of Reach 1.

Table SAD-2. Santa Ana-Delhi Channel Characteristics

Reach	Description	Identification
Tidal Prism	20 ft. wide earthen bottom; earthen side slope, left bank reinforced concrete side slope adjacent to the residences along Anniversary Lane then transitioning to an earthen side slope downstream to the Bicycle Bridge	Bicycle Bridge to 1,036 ft. upstream
Reach 1 (segment 1)	20 ft. wide earthen bottom; earthen side slope along the right channel bank along the golf course; left bank reinforced concrete side slope	1,036 ft. upstream of Bicycle Bridge to Mesa Drive; a distance of approximately 0.25mile.
Reach 1 (segment 2)	Reinforced concrete rectangular channel (open with vertical walls), except for reinforced concrete box culverts (closed box) under streets and a ½ mile segment north of interstate 405. V-shaped low flow channel.	Mesa Drive to immediately upstream of intersection of Sunflower Avenue and Flower Street, Santa Ana; a distance of 3.19 miles.
Reach 2 (segment 1)	Earth trapezoidal channel with riprap sides, bottom width of 20 ft.	Sunflower Ave / Flower Street upstream 0.9 mile
Reach 2 (segment 2)	Reinforced concrete rectangular channel, with low flow swale (open with vertical walls)	0.55 mile length to Warner Ave, Santa Ana



Figure SAD-4. Reach 1 of the Santa Ana-Delhi Channel in the City of Costa Mesa.
Regional Board staff photograph, June 2010.

5.6.3.3.3 Reach 2

Reach 2 extends from upstream of the intersection of Sunflower Avenue and Flower Street to Warner Avenue (where the channel transforms into an underground culvert), a distance of 1.45 miles. The entire reach is in the City of Santa Ana. Channel characteristics are summarized in Table SAD-2. For channel characteristic descriptive purposes only, two segments of the proposed Reach are identified.

From the intersection of Sunflower Avenue and Flower Street, Reach 2 consists of an earthen trapezoidal channel with fully rip-rapped 2:1 side slopes for about 0.9 miles. The bottom is approximately 20 ft. wide. Upstream of the earthen section, Reach 2 consists of a reinforced concrete, rectangular (vertical walls) channel for approximately 0.55 mile. In this section, the low flow channel is a shallow swale in the middle of the channel. Reach 2 terminates at Warner Avenue in the City of Santa Ana.



Figure SAD-5. Reach 2 of the Santa Ana Delhi Channel at Sunflower Avenue and Flower Street, looking upstream. This earthen riprap sided segment transitions to a concrete rectangular segment approximately 0.9 mile upstream from this point. Low flows are approximately six inches deep at this point. Regional Board staff photograph, June 2010

5.6.3.4 Flow Conditions and Water Levels

Given the hydrologic patterns in Southern California, dry weather flow is the predominant condition in the Santa Ana Delhi Channel. Precipitation-derived runoff typically occurs for only relatively short, episodic periods during and shortly after rainfall events within the tributary watershed. These events typically occur almost entirely during the wet season.

Flows in the proposed tidal prism are affected by the tidal cycle. During high tides, tidal flows may fill the channel from bank to bank. Depths are greatest at the downstream terminus of the prism (at the Bicycle Bridge), where staff observed the depth to be ~7.5 ft during high tide in May 2011. Dry weather fresh water flows that reach the tidal prism, (as measured at Mesa Drive by Orange County staff (June 1- September 30, 2010), average 1.9 cubic feet per second (less than a foot deep as observed by Regional Board staff. During low tides and dry weather water, depth in the upper sections of the tidal prism at times can be about a foot deep (Regional Board staff observation).

The dominant dry weather flows in the proposed Reaches 1 and 2 create perennial flows of a few inches in depth in the channel. In the earth-bottomed sections of these reaches, dry weather

flows typically are six inches or less as observed by Regional Board staff. The sources of the dry weather flows are rising groundwater and urban runoff.

Wet weather runoff flows in these reaches can be bank to bank and within a few feet of the of the maximum channel depth, and of a high velocity. These wet weather events create flows many times greater than the dry weather flow rates. Such flows create conditions that are unsafe for recreational use. (The temporary suspension of recreational standards under certain high flow conditions is proposed; see Section 5.5 of the Staff Report).

CDM conducted detailed analyses of available flow data. Flow data for the period of 1991 through 2008 was provided by Orange County Public Works and was processed to facilitate time series plotting and frequency distribution analysis. Hydrologic data used in the analysis was developed from the depth of flow in the channel recorded at 30-minute intervals at a gage located upstream of the Irvine Avenue bridge, near Mesa Avenue (in the proposed Reach 1). (See Figure SAD-6). The channel in this area is concrete-lined, with vertical walls, characteristics that predominate in the channel as a whole.

Depth of flow has been directly measured in the channel. The relationship between depth of flow and flow rate is defined by a rating curve, which may be used to convert continuous depth records to flow rates. The rating curve for the vertical section of the Santa Ana-Delhi Channel was developed in August 2005 by field calibrations of flow at varying depths. Figure SAD-7 presents a hydrograph of mean daily flow data from 1991 to 2008.

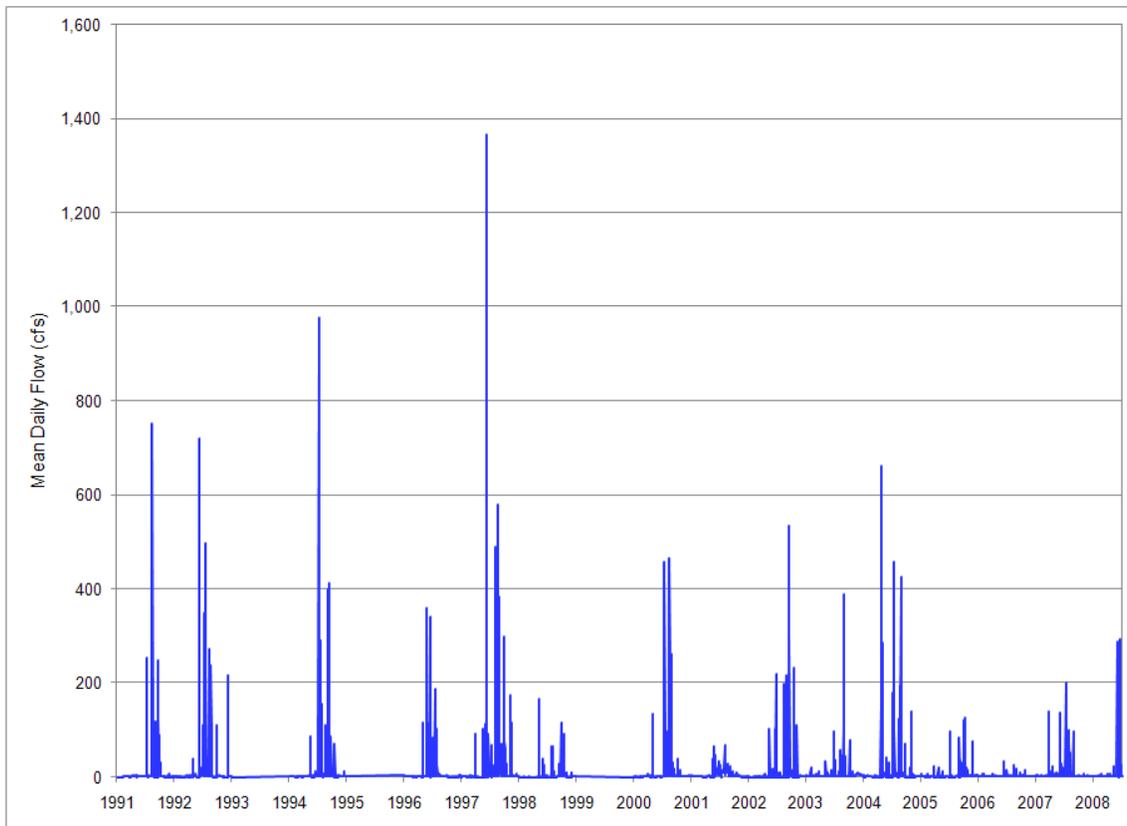


Figure SAD-6. Mean Daily Flow in the Santa Ana-Delhi Channel at Irvine Avenue (1991-2008)
 (Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Figure 4-2)

The continuous time series of measured depth and estimated flow were analyzed to assess the frequency of different conditions in the channel section. Cumulative frequency distributions show the likelihood of a particular flow condition occurring within the channel section. Cumulative frequency curves of flow rate and depth from 1991 to 2008 were generated (Figures SAD-7 and SAD-8). Frequency distributions show that more than 90 percent of the time, flow rates and depths are characteristic of dry weather flow conditions. As shown in Figure SAD-8, flow depths during 1991 to 2008 were less than 2 feet approximately 95 percent of the time and less than 1 foot approximately 90 percent of the time.

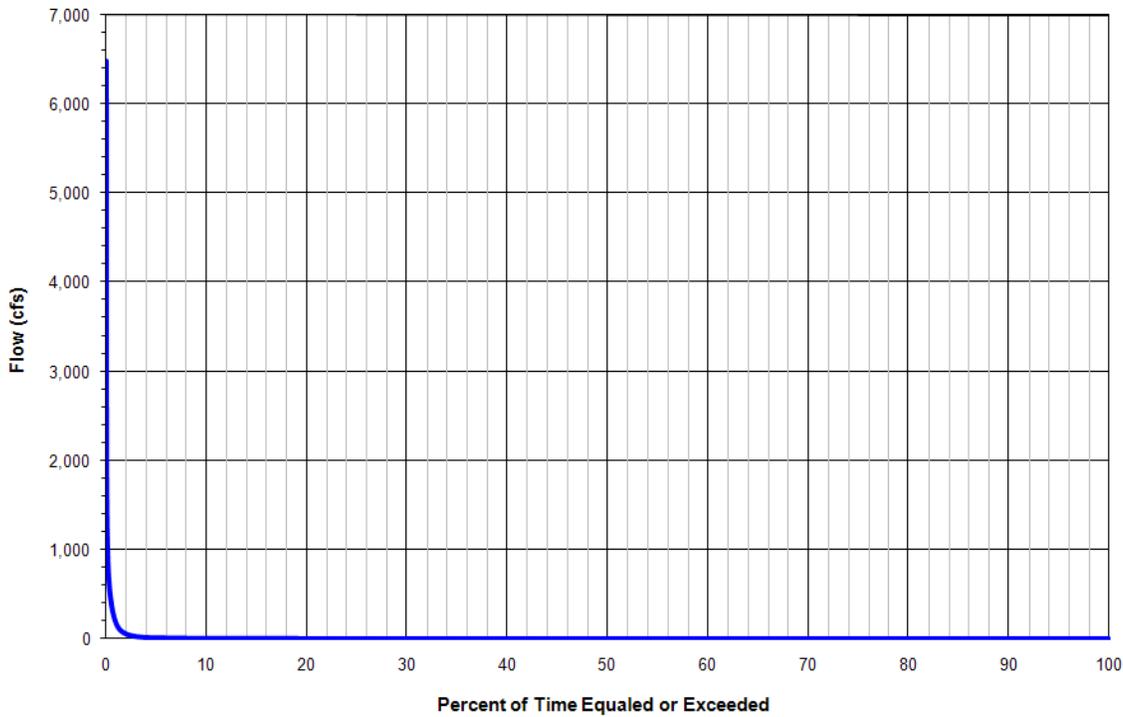


Figure SAD-7. Channel Flow Duration Curve for the Santa Ana-Delhi Channel at Irvine Avenue (1991-2008) (Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Figure 4-3)

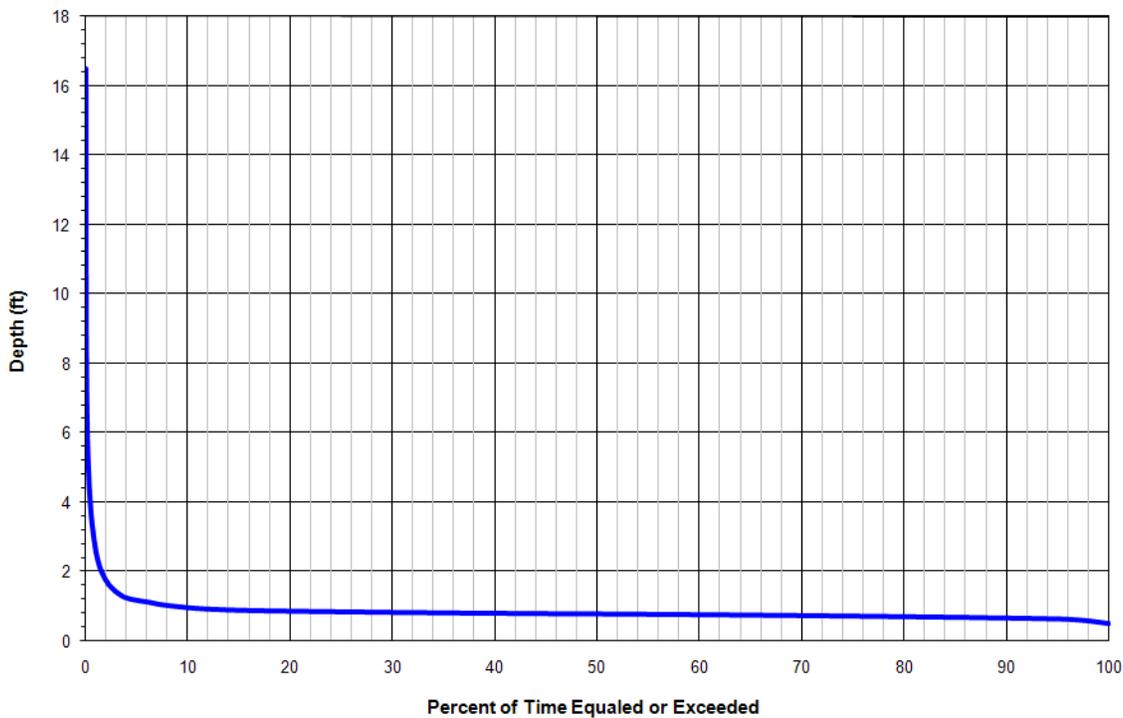


Figure SAD-8. Channel Depth Curve for the Santa Ana-Delhi Channel at Irvine Avenue (1991-2008) (Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Figure 4-4)
 Hydrographs were used to show the typical response of the Santa Ana-Delhi Channel during rain events of varying depths. Rainfall event depths were used to select specific dates to extract

the flow response from the corresponding storm event. Hydrographs resulting from 1/4", 1/2", 3/4", 1", 2", and 3" rainfall events at coupled meteorological stations were overlaid to show similarities or differences in response based on rainfall depth (see Figure SAD-9). Flows in the Santa Ana-Delhi Channel typically return to base flow conditions shortly after storm events. Analysis of the six storm events representing a range of rainfall depths showed that near-dry-weather channel velocities (and associated depths) returned in as soon as 8 hours following a storm event, ranging from 8 to 20 hours in most cases.

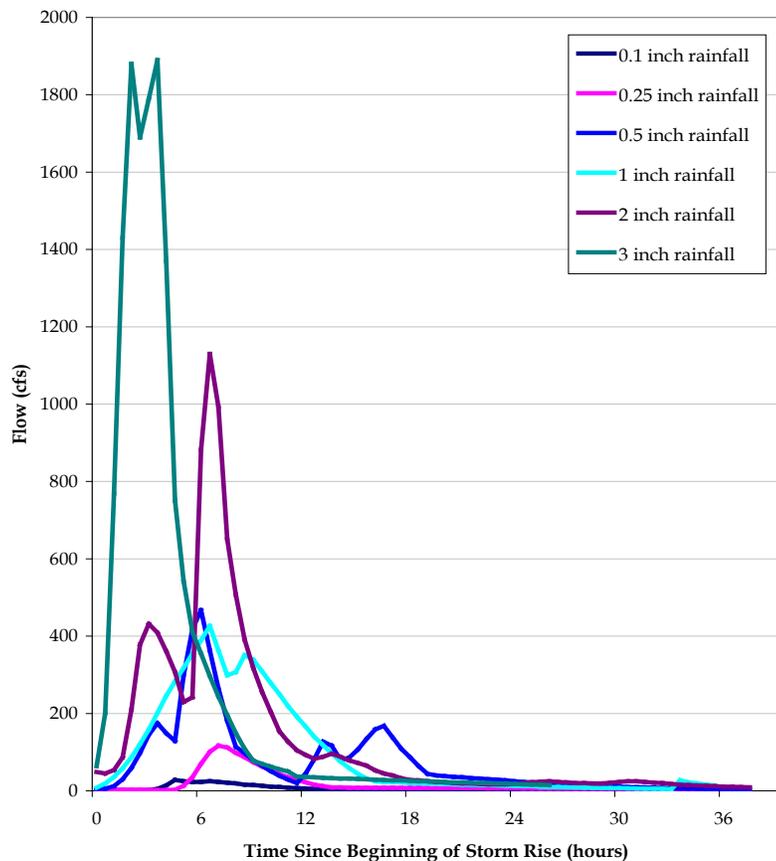


Figure SAD-9

Event Hydrographs from the Santa Ana-Delhi.

(Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Figure 4-5)

5.6.3.5 Access and Safety

The Orange County Flood Control District (OCFCD) prohibits access to the Santa Ana Delhi Channel for its entire length, which includes the three proposed reaches identified in this staff report. To prohibit access OCFCD has enclosed the channel including easements, access roads, etc., with a six foot high chain link fence and keeps access and maintenance gates locked. (See, for example, Figures SAD-3, 4 and 5). OCFCD considers public access to the channel to be unsafe. Wet weather runoff from the surrounding watershed into the channel can create very dangerous, high velocity flow conditions in the channel. (See Figure SAD-6 above)

In addition, the vertical walls that are found in much of the channel make access into the channel very difficult and dangerous. The riprap covered slopes and the short section of earthen slopes are also difficult and unsafe as a route to access the channel given their slope and rough/un-even terrain. To paddle a kayak or canoe into the tidal prism section of the channel is prohibited by Department of Fish and Game (DFG). DFG signs are posted in Upper Newport Bay warning that no water craft are allowed into the upper bay's salt marsh, the only access by water into the Channel from Newport Bay.

5.6.3.6 Adjacent Land Use

Land uses adjacent to and in the vicinity of each of the proposed reaches is shown in Figure SAD-10.

The tidal prism segment is bounded by an office complex and residences on the northwest, an informal equestrian riding area on the southeast, the upper Newport Bay Ecological Reserve to the southwest, and a golf course on the northeast. Individuals crossing the bicycle bridge at the southwest end of the segment can easily view the entire length of the tidal prism. However, it is difficult to view the channel from the east, west, and north sides because the earthen levees block the views.

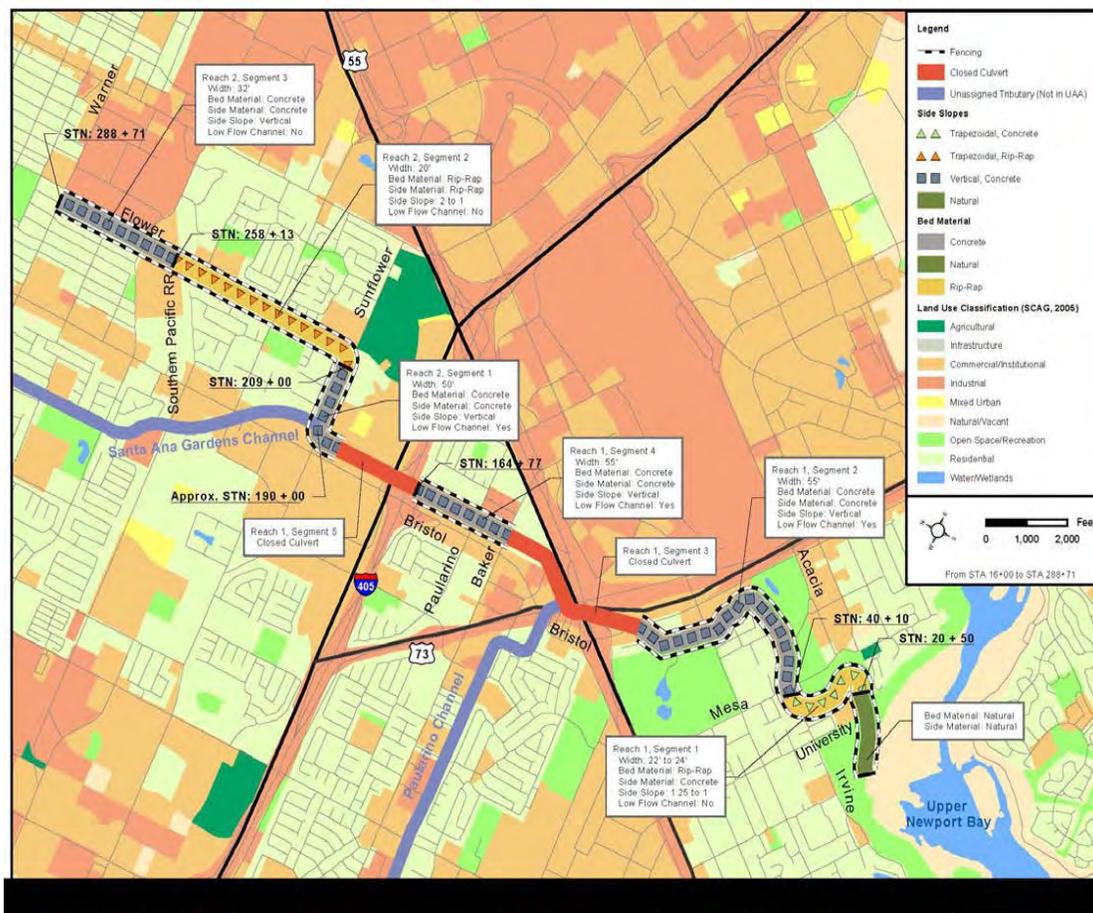


Figure SAD-10 Land Uses and Channel Characteristics

(Source: adapted from Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Figure 2-9)

Residences and sections of two golf courses border lower sections of Reach 1. The remainder of Reach 1 is mostly bordered by commercial and industrial urban uses. Most of the reach is out of the view of residences and the public. An exception is where a bicycle trail follows the channel for about 1/3 mile in the downstream section. The trail is separated from the channel by a fence.

Reach 2 is bounded by Flower Street, residences, some businesses, an elementary school, and an intermediate school. In the upstream concrete lined section, a bike trail lies adjacent the east side of the channel for about a city block. The channel is fenced.

5.6.3.7 Water Quality Conditions

The Orange County Health Care Agency (OCHCA) has performed water quality monitoring of the Santa Ana-Delhi Channel since 1973. From August 1973 through February 1976, fecal coliform grab samples were collected approximately monthly at Irvine Avenue, which is near the lower boundary of the proposed Reach 1. Beginning in 1985, the sampling site was relocated to the Santa Ana-Delhi Channel at Backbay (at the Bicycle Bridge, the lower terminus of the proposed tidal prism), where the channel transitions from a trapezoidal, riprap lined channel to a natural wetlands area (part of the Upper Newport Bay Ecological Reserve). At the Backbay location, samples were collected approximately weekly. Monitoring at this location was terminated in 2008. The data collected at the two monitoring locations were combined for analyses and comparison to the existing fecal coliform objectives.

Orange County Coastkeeper also performed *E. coli* monitoring at MacArthur Boulevard (within proposed Reach 2) and Mesa Drive (in proposed Reach 1) between 2004 and 2006. Samples were collected from one to three times per month at both sample locations.

Regional Board staff sampled at Sunflower Avenue (proposed Reach 2) for *E. coli* in June 2009. Five samples were taken in a 30 day period and a geomean was determined.

The fecal coliform and *E. coli* data collected by the OCHCA and Orange County Coastkeeper and evaluated in this report for the Santa Ana Delhi Channel are summarized in Appendix 1 of this report and Table 3-3 of the SAD Technical Report. The data collected by Regional Board staff in June 2009 are also shown in Appendix 1.

In addition to monitoring for fecal coliform and *E. coli*, the OCHCA has in recent years monitored the proposed tidal prism section of the Channel for enterococcus. Weekly monitoring data for enterococcus collected from January 4, 2010 to November 21, 2011 were evaluated to determine antidegradation targets for the proposed tidal prism section of the channel (See Section 5.2 of the Staff Report). The monitoring results are shown in Appendix 2.

For the fecal coliform data collected during 1973-2008, when 5 or more samples were collected in a 30 day period (calendar month, not rolling 30 day periods), a geometric mean (geomean) was calculated and compared to the existing REC1 fecal coliform objective (200 organisms/100mL based on five or more samples/30 day period). Where insufficient data were

available to calculate geomeans, the fecal coliform data were compared generally to that part of the existing REC1 fecal coliform objective that specifies that not more than 10% of the samples exceed 400 organisms/100mL for any 30-day period.

These fecal coliform data indicate that the existing fecal coliform objectives are consistently exceeded, with minor exceptions. Fifty-six (56) geomean fecal coliform values were calculated and all but one exceeded the geomean objective of 200 organisms/100mL. (See also SAD Technical Report, Figure 3-16). Approximately two-thirds of the grab sample results for fecal coliform exceeded the 400 fecal coliform per 100 mL objective. (See also SAD Technical Report, Figure 3-15).

The *E. coli* geomean determined from samples collected in June 2009 at Sunflower Avenue was 916 *E. coli* organisms per 100/mL, which exceeds the proposed REC 1 geomean objective of 126 *E. coli* organisms per 100 mL (based on five or more samples during a 30-day period). No geomeans based on the *E. coli* data collected by Orange County Coastkeeper from 2004-2006 were calculated since there were not at least five samples collected during a calendar month. Individual sample results ranged generally from 100 *E. coli* organisms/100mL to over 10,000 organisms per 100 mL.

5.6.3.7.1 Expected Water Quality Improvement

Currently, BMPs are being employed to reduce fecal indicator bacteria including fecal coliform, in the Delhi Channel and other tributaries to Newport Bay in response to the approved fecal coliform TMDL for the Bay and pertinent requirements in the Orange County Areawide Urban Storm Water Runoff Management Program NPDES permit (Order No. R8-2009-0030, NPDES No. CA8618030, as amended). BMPs evaluated by the Orange County Stormwater Program include pathogen treatment/removal BMPs, such as dry weather diversions to the sanitary sewer, wet ponds and wetlands, and source control programs, including septic system inventory and assessment and portable toilet oversight. There are 38 existing diversion facilities within Orange County, though none at the present time in the Santa Ana Delhi watershed. These dry weather diversions of flows to the sewer are considered to be 100% effective at controlling pathogens in the diverted flows, and thereby have proven to be effective in reducing exceedences of bacteria quality objectives. However, treatment plant agencies presently view dry weather diversion as a temporary, short-term practice. Full diversion of urban runoff under all weather conditions would be economically and technically infeasible. Wet ponds and wetlands can also achieve significant reductions in bacteria densities, but the use of these BMPs is limited by existing development and other physical factors. Vegetated strips and swales have been reported to have limited success in reducing bacteria densities. The area tributary to the Santa Ana Delhi Channel is sewered and septic tanks are not considered a source of bacteria inputs. Sewer system leaks have not been demonstrated to be a contributor to bacteria densities in the Channel. In short, absent dry weather diversions, significant water quality improvement that results in consistent compliance with bacteria quality objectives as the result of BMP implementation is likely to be highly problematic. Dry weather diversions, if implemented for the Channel, would be expected to improve bacteria water quality during periods of diversion. However, as noted, such diversions are regarded as only temporary.

5.6.3.8 Recreation Use Surveys

5.6.3.8.1 Evidence of Actual Recreational Use

As described in Section 5.6.2.2 (SWQSTF UAA Methodology) of the Staff Report, extensive photographic evidence was gathered to assess whether and what type of existing recreational use occurs in the Santa Ana Delhi Channel. In addition, field surveys were conducted by members of the Task Force and the consultant staff responsible for camera installation and maintenance. Information was also obtained from county personnel responsible for monitoring and channel maintenance.

5.6.3.8.2 Digital Field Observation Camera Recreation Survey

From June 2005 through July 2006, recreational use surveys were performed at the Santa Ana Delhi Channel to obtain information regarding existing levels and types of recreation use. Digital field observation cameras and data transfer technology, coupled with weekly on-location physical surveys were used to collect the data. Three locations within the Santa Ana-Delhi Channel were surveyed:

- Upper Newport Bay at mouth of Santa Ana-Delhi Channel (facing downstream from the Bicycle Bridge, away from the tidal prism segment)
- Santa Ana-Delhi Channel at Mesa Drive, facing downstream (Reach 1)
- Santa Ana-Delhi Channel at Sunflower Avenue, facing upstream (Reach 2)

It should be noted that the Upper Newport Bay location, at the mouth of the Santa Ana Delhi Channel, is outside the scope of the UAA recommendations for changes to recreation beneficial use designations. This location, just downstream of the lower boundary of the proposed Santa Ana Delhi tidal prism, was surveyed as an indication of recreation activity in an area that might be expected to receive more extensive use, given its un-fenced, natural nature



Figure SAD-11

Photo of the Camera View at the Recreational Use Survey Location for Santa Ana-Delhi Channel (Upper Newport Bay) (Source for both Figures V-SAD-11 and V-SAD-12: UAA Technical Report for Santa Ana-Delhi Channel by CDM, August 2010, Figures 3-2 and 3-3)



Figure SAD-12

Photo of the Camera View at the Recreational Use Survey Location for Santa Ana-Delhi Channel at Mesa Drive looking downstream. (Reach 1, Segment 1)



Figure SAD-13

Photo of the Camera View of the Recreational Use Survey Location for Santa Ana-Delhi Channel at Sunflower Avenue (Reach 2, Segment 1)

(Source: UAA Technical Report Santa Ana-Delhi Channel Figure 3-4 by CMD August 2010)

and its proximity to an interpretive center, biking/hiking trail and the Upper Newport Bay Ecological Reserve. This area of Upper Newport Bay is currently designated REC1; no changes to this designation are proposed. Camera views at the survey locations are shown in Figures SAD-11, 12, and 13.

The duration of the survey and number of images collected for each location on the channel are shown in Table SAD-3. At each survey location, an image was collected every fifteen minutes during daylight hours throughout the study duration unless signal strength fluctuations or equipment failures precluded collection and transmission. Images were not collected at night due to darkness.

**Table SAD-3
Recreational Use Survey Duration and Number of Images Collected**

Survey Location	Start Date	End Date	Number of Images
Upper Newport Bay	6/20/2005	6/6/2006	20,203
Mesa Drive	6/20/2005	7/13/2006	21,284
Sunflower Avenue	7/7/2005	7/9/2006	20,978

Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Table 3-1.

Any image containing a person or persons within channel fencing or boundaries was defined as a recreation event. If a person or persons were observed meeting the same conditions as above during the weekly on-site surveys, these were also considered events. An event could include one or more persons. For each event each person's activity and the estimate duration of the event were logged. If an activity was captured on only one image, an activity duration was reported as <30 minutes. Likewise, if the same activity by the same person or persons was observed in two consecutive fifteen-minute interval images, the duration was reported as <45 minutes.

Channel maintenance activities were captured in several images but not considered to be recreational use activity. These activities were observed at the Mesa Avenue and Sunflower Avenue locations and primarily consisted of crews collecting trash. One image was captured of an Orange County Coastkeeper water quality sampler (Figure 3-11 in the SAD UAA Technical Report). Images were also captured of Task Force members performing site visits at the Upper Newport Bay and Sunflower Avenue locations. These images were not considered in the analysis of recreational use activities.

Table SAD-4 presents a summary of the activity recorded at the Santa Ana-Delhi Channel survey locations over the duration of the survey. The seasonal periods defined in southern California NPDES stormwater permits were used to categorize the observations by season: dry season (April 1 to September 30) and wet season (October 1 to March 31). Figures 3-5 through Figure 3-13 in the UAA Technical Report are example photographs of observed activity. Figure 3-6, 3-7 and 3-10 are reproduced below as SAD-14, 15, and 16. The full recreational use survey information can be found in the Recreational Use Survey Data Report - Santa Ana-Delhi Channel prepared for the SWQSTF by CDM in October 2006². See www.sawpa.org for all Recreational Use Survey Data Reports.

² It should be noted that in this Recreational Use Survey Data Report (and those prepared for the other waters for which UAAs are discussed in this staff report), recreational events were differentiated as contact or non-contact events. Where it appeared that there was or might be contact activity in an image, the type of that contact was categorized as: incidental contact, contact below the ankle, contact between the ankle and waist, contact between the waist and neck, contact above the neck, or non-recreation contact. However, subsequent analyses, discussed in the SAD Technical Report, abandoned this categorization scheme. It was decided that the consultants' determination in the recreational use survey reports of whether an event should be categorized as contact or non-contact imposed a pre-determination of the nature of the event that was intended instead to be considered by the Task Force. The Recreational Use Survey Data Report- Santa Ana Delhi Channel identified three images in which water contact appeared to be indicated. In each of these three cases, the duration of the event was short (less than 30 minutes) and the potential contact was low (limited to hand or foot contact, if at all). The resolution of some photographs and/or distance from the camera to an observed individual made discerning that actual nature of the contact, if any, difficult to judge. Based on further evaluation of the nature of the recreation events depicted in these three images, the Task Force determined that the predominant activity shown in the three images was walking or sitting; there remained significant uncertainty about whether contact (hand or foot) actually occurred. As reflected in Table SAD-4, the characterization scheme employed in the SAD Technical Report employed a different approach, identifying recreation events and the type of activity witnessed, rather than asserting conclusions regarding the contact versus non-contact nature of those activities.

Table SAD-4 Recreational Activity Recorded for the Santa Ana-Delhi Channel					
Location	Number of Individuals			Estimated Duration (min)	Type of Activity
	Total	Dry Season	Wet Season		
Upper Newport Bay	38	34	4	1,170	Walking, Sitting, Boating
Mesa Drive	6	4	2	180	Walking, Bicycling
Sunflower Avenue	7	4	3	210	Walking

Source: Use Attainability Analysis Technical Report for the Santa Ana-Delhi Channel, CDM, August 2010, Table 3-2.



Figure SAD-14

Photo of Activity at Santa Ana-Delhi Channel (Upper Newport Bay), 5/19/2006 12:30

(Source: Use Attainability Analysis Technical Report for Santa Ana-Delhi Channel Figure 3-8, August 2010 by CDM)



Figure SAD-15

Photo of Activity at Santa Ana-Delhi Channel at Mesa Drive (Reach 1, Segment 1), 7/8/2006 14:30. (Source: UAA Technical Report for Santa Ana-Delhi Figure 3-7 by CDM, August 2010)



Figure SAD-16

Photo of Activity at Santa Ana-Delhi Channel at Mesa Drive (Reach 1), 7/8/2006 14:30
(Source: UAA Technical Report for Santa Ana-Delhi Figure 3-11 by CDM, August 2010)

Overall, the results of these surveys indicated a very low frequency of recreational events of any kind. Most events were observed from the Bicycle Bridge and occurred downstream of the

proposed tidal prism in the upper reaches of Upper Newport Bay, near a natural interpretive center and bike/hiking path. As reflected in Table SAD-4 the activities captured in the images entailed walking, bicycling and sitting by or in the vicinity of the water. The boating event was a canoeist paddling in the upper reaches of Upper Newport Bay, downstream of the Bicycle Bridge and the proposed tidal prism.

5.6.3.8.3 Physical Surveys and Other Information

In addition to the weekly physical surveys associated with maintenance of the digital cameras, Task Force members conducted field surveys at the camera locations during July and August 2006. No one was observed in any of the proposed reaches of the channel, and there was no evidence of recreational activity in the channel.

Orange County Flood Control District staff who conducts maintenance activities in the channel reported seeing no one in any of the proposed reaches of the channel. Likewise, Orange County Health Care Agency staff reported that in 10 years of collecting samples (~weekly) in the proposed tidal prism and in Reach 1, no one was observed in the channel. Further, Orange County park rangers stationed in the Upper Newport Bay (Muth) Interpretative Center, close to the downstream terminus of the proposed tidal prism where it enters the Upper Bay reported never seeing anyone in the proposed tidal prism area. Finally, Regional Board staff has visited the proposed reaches of the channel for various purposes over a number of years and have not witnessed anyone in the channel.

5.6.3.8.4 Evidence re Historical Recreational Use

To collect information regarding historical recreational use, CDM conducted inquiries to local jurisdictional agencies, online searches of California newspaper archives, databases (engineering and environmental trade journals), and search engines such Google News archive and Lexis-Nexis to identify any accounts or reference to recreational activities in the Santa Ana Delhi channel. No historical use information was identified from these searches.

5.6.3.8.5 Probable Future Use

Information regarding potential future recreational uses for the Santa Ana-Delhi Channel was obtained through discussions with local agencies and review of relevant county and municipal master plans. The Cities of Costa Mesa, Newport Beach, and Santa Ana were contacted, as was the County of Orange. Based on these inquiries, proposed planned uses were documented in the SAD Technical Report, as presented below.

According to the Orange County Flood Control District, facilities that could support water contact recreation use are not planned for the channel. Areas immediately adjacent to downstream sections of the channel (proposed Tidal Prism and parts of proposed Reach 1) are included in the proposed Santa Ana Heights Regional Trail System and a trail has been planned to extend from Upper Newport Bay to the Orange County Fairgrounds. As noted previously, approximately 1/2 mile of this trail, along the channel from Santa Ana Avenue to Irvine Avenue is already in use. The trail is separated from the Channel by fencing.

The City of Santa Ana Department of Parks and Recreation Services is planning to construct a bicycle trail along the Santa Ana-Delhi Channel between Warner Avenue and Sunflower Avenue. The bicycle trail is proposed to be constructed on an existing OCFCD maintenance road between the channel and adjacent properties. Construction was expected to commence before 2010. As of early 2011, construction has not been initiated.

The City of Costa Mesa has preliminary design concept plans for a multipurpose trail to be constructed along the Santa Ana-Delhi Channel. This trail is proposed to also be constructed on the existing OCFCD maintenance road along portions of the channel within the City's jurisdiction.

In 2011, planning staff for the County provided updated planning information. While there remain plans for riding, hiking and biking trails adjacent to the channel, there are no firm plans for implementation or funding. There are no plans to provide recreational facilities that would support water contact recreation in the channel itself.

5.6.3.8.6 Summary – Evidence of Recreational Use

5.6.3.8.6.1 REC1

In summary, there is no evidence of actual current, historic, or reasonably probable future REC1 use in the proposed reaches of the Santa Ana Delhi Channel addressed by this UAA. Intensive photographic surveys, field surveys and information provided by public agency staff members who routinely visit the proposed reaches of the Channel provided no evidence of current REC1 use. Nor is there any evidence of historic use of the proposed reaches for REC1 use.

The lack of REC1 use is a reflection of the various characteristics of the channel reaches described in detail in the preceding sections of this report. These include the morphology of the channel, which is characterized by heavily modified vertical, concrete-lined walls or steep and rough rip-rap side slopes. Coupled with fencing along the length of the channel on both sides, these channel characteristics make access generally difficult and dangerous. Flow conditions in the channel reaches are very low under most conditions, making water contact leading to ingestion unlikely. High flows during storm events, which typically occur during the wet season, make recreational activity in the channel unsafe (temporary suspension of recreation standards during certain high flow conditions is proposed; see 5.5). There are residences and a school in the vicinity of some areas of the proposed reaches. However, fencing, channel morphology, flow conditions and the close proximity of recreational areas in Newport Bay and the Pacific Ocean make recreational activity in the channel itself highly unlikely. Again, this is documented by the photographic and field survey information provided above. Other areas of the proposed reaches

are adjacent to commercial/industrial land uses not conducive to visiting the channel, let alone recreational activity in it.

Again taking into consideration this suite of factors, as well as master planning information, there is no evidence that REC1 use in the future is probable.

It should be noted again that determinations regarding the appropriate recreational use designations are subject to review and revision during future triennial reviews.

5.6.3.8.6.2 REC2

Birds have been observed feeding/resting in the proposed tidal prism. Wildlife viewing opportunities are provided at the Bicycle Bridge, at the downstream terminus of the proposed tidal prism. In view of this, Board staff recommends designating the REC2 beneficial use for the proposed tidal prism.

As shown in Table SAD-4 (Recreational Activity Recorded for the Santa Ana-Delhi Channel), there are limited observations of individuals walking in or bicycling by proposed Reaches 1 and 2. Some of these observations may represent individuals conducting routine inspection/maintenance activities but whose presence in that context could not be confirmed. There is limited sight view of much of the proposed Reach 1, and much of the reach is also adjacent to commercial/industrial land uses. Therefore, Board staff recommends that REC2 not be designated for this reach. The predominant land use adjacent to the proposed Reach2 is residential. Wading birds and other wildlife can be observed by the residents and other members of the public from the sidewalks along the channel, even though separated by fencing) or from the few streets that cross the channel. Thus, Board staff recommends that this proposed Reach be designated REC2.

5.6.3.9 UAA Factor Evaluation

As discussed in 5.6.2.1 Regulatory Framework – UAAs of the Staff Report, per federal regulation at 40 CFR 131.10 (h), a designated use may be removed or modified to allow the application of less stringent water quality objectives provided that the use is not an “existing use” and that the use cannot be attained by implementing effluent limits on point source discharges and/or cost-effective and reasonable best management practices for nonpoint source control.

The preceding evidence demonstrates that REC1 is not an “existing use” for the proposed tidal prism, Reach 1 and Reach 2 of the Santa Ana Delhi Channel. There is no evidence of actual REC1 use, either now or historically. Water quality objectives to protect REC1 have not been consistently attained. Best management practices to improve water quality conditions are being implemented but the ability of these BMPs to achieve consistent compliance with the objectives (those now in the Basin Plan and those proposed herein) is highly problematic. This determination is based on evaluation of the efficacy of bacteria control BMPs in other areas (SAD Technical Report, Section 3.3.2). While diversions to the sewer are used in Orange County (though not at the present time in the Santa Ana Delhi Channel) or might be used to address potential bacteria sources and improve downstream water quality, such diversions are

considered by the sewerage agencies only as temporary measures. BMPs are being implemented in response to requirements of the applicable areawide urban stormwater NPDES permit. There are no other point source discharges of bacteria to the Delhi channel and thus there are no additional effluent limitations for bacteria that could or should be imposed to improve water quality conditions in the Channel.

Since there is no evidence that REC1 is an “existing use”, and since there is now no evidence that the use could be attained through the implementation of effluent limitations or additional cost-effective and reasonable BMPs, then one or more of the UAA factors in 131.10(g) may justify the removal of the REC1 use³. As stated previously, the 131.10(g) factors define the circumstances under which designated “swimmable” (REC1) (and “fishable”) uses may be removed or subcategorized to allow the application of less stringent water quality objectives. The UAA factor evaluation is discussed next.

The following describes the evaluation of the data and information presented above relevant to two of the UAA factors identified in 40 CFR 131.10(g). These are:

- 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. (131.10(g)(2))
- 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 modifications in a way that would result in the attainment of the use. (131.10(g)(4))

5.6.3.9.1 Natural, Ephemeral, Intermittent or Low Flow Conditions or Water Levels [40 CFR 131.10(g)(2)]

Flow data and analyses are presented above and in the SAD Technical Report (Section 4.2). The dominant dry weather flows in the proposed Reaches 1 and 2 create perennial flows of a few inches in depth in the low flow channel. In the earth-bottomed sections of these reaches, dry weather flows typically are six inches or less observed by Regional Board staff. The data collected at Irvine Avenue (within the proposed Reach1), which are considered representative of Reaches 1 and 2 of the Channel, show flow depths were less than 2 feet approximately 95 percent of the time and less than 1 foot about 90 percent of the time. Flows in the proposed tidal prism are augmented by tidal flows. There are no sources of effluent discharges that would be allowed to be discharged to augment the existing flows sufficient to attain the REC1 use, taking into account water quality impairments in Newport Bay.

³ Since the Santa Ana Delhi Channel is not now listed in the Basin Plan, the REC1 use has not been formally designated for the channel. However, pursuant to federal law and regulation, REC1 is presumed to be a beneficial use of the channel, unless demonstrated otherwise through a UAA.

The predominant low flows in the Channel render the REC1 use unattainable, especially when considered in concert with the other relevant factors discussed above (access, safety, proximity to recreational areas, etc.).

5.6.3.9.2 Dams, Diversions or Other Types of Hydrologic Modifications [40 CFR 131.10(g)(4)]

The Santa Ana Delhi Channel has been significantly modified for flood control purposes. As described above and summarized in Table SAD-2, the channel is comprised of vertical, trapezoidal and closed culvert segments, with segments of significant widening and permanent armoring. Representative photographs of the modified channel are shown in this report in Figures SAD-12 through 16; additional images are provided in the SAD Technical Report (Figure 2-2 and Figures 14-25 show modified (straightened) segments of the channel; Figures 2-17, 2-19 and 2-20 show portions of the channel that have been permanently placed underground (closed culverts and conduits). Given the level of development in the vicinity of the channel and the ongoing need to provide flood protection, it is not considered feasible to restore the channel to its original condition or to operate the channel so as to attain the REC1 use.

5.6.3.10 Conclusions and Recommendations

The preceding evidence and analyses demonstrate that:

- REC1 is not an “existing” use in the proposed tidal prism, Reach 1 or Reach 2 of the Santa Ana Delhi Channel and the use cannot be attained by implementing effluent limits on point source discharge and/or cost-effective and reasonable best management practices for nonpoint source control.
- The REC1 use designation is not appropriate for the proposed tidal prism, Reach 1 or Reach 2 of the Santa Ana Delhi Channel because flow conditions and hydrologic modifications preclude the use. Flow conditions cannot be compensated for by effluent discharges, nor is it feasible to restore the water body or operate the hydrologic modifications of the Channel in order to attain the use [40 CFR 131.10 (g) (2) and (4)].
- It is appropriate to designate the proposed tidal prism and Reach 2 REC2, given that the channel in these areas is visible to the public, which may use these areas for wildlife observation and walking.
- The REC2 designation is not justified for the proposed Reach 1.

Recommendations regarding the REC1 and REC2 designations for the proposed tidal prism, Reach 1 and Reach 2 of the Santa Ana Delhi Channel are summarized in Table SAD-5.

Table SAD-5

	Reaches ⁺	Reach Boundaries ⁺	REC1	REC2	Current Beneficial Use Designations
Santa Ana-Delhi Channel	Tidal Prism	Upper Newport Bay to 1036 ft. upstream	No	Yes	Not listed In the Basin Plan; Assumed REC1
	Reach 1	Tidal prism to Sunflower Ave. /Flower St.	No	No	
	Reach 2	Sunflower/Flower to Warner Avenue	No	Yes	

5.6.3.11 References

California Regional Water Quality Control Board, Santa Ana Region. January 12, 2012. Staff Report. Basin Plan Amendments – Revisions to Recreational Standards for Inland Fresh Surface Waters in the Santa Ana Region.

CDM. October 10, 2006. Technical Memorandum: Recreational Use Survey Data Report – Santa Ana Delhi Channel.

CDM. August 2010. Santa Ana Watershed Project Authority. Use Attainability Analysis Technical Report For Santa Ana-Delhi Channel.

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Appendix 1 – Fecal Coliform and *E. coli* Data for the Santa Ana Delhi Channel

Table 3-3 ⁴				
Summary of Monthly <i>E. coli</i> and Fecal Coliform at the Santa Ana Delhi Channel 1974-2008				
Month and Year	Numbers of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
Santa Ana Delhi Channel at Back Bay				
Fecal Coliform				
12/1985	1	700	700	
1/1986	4	1,300	5,000	
2/1986	4	110	7,000	
3/1986	5	400	30,000	2,862
4/1986	4	200	50,000	
5/1986	4	200	1,300	
6/1986	5	200	160,000	1,542
7/1986	4	800	22,000	
8/1986	4	80	200	
9/1986	5	20	17,000	422
10/1986	4	4,000	160,000	
11/1986	3	20	1,700	
12/1986	5	400	160,000	7,767
1/1987	4	200	1,300	
2/1987	4	300	7,000	
3/1987	5	200	24,000	842
4/1987	4	200	200	
5/1987	4	200	700	
6/1987	5	20	400	145
7/1987	3	200	400	
8/1987	4	80	2,300	
9/1987	4	400	3,000	
10/1987	4	800	160,000	
11/1987	5	500	2,300	933
12/1987	4	20	7,000	
1/1988	4	20	2,400	
2/1988	5	20	8,000	264

⁴ Source: UAA Technical Report for Santa Ana Delhi by CDM, August 2010

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
3/1988	3	20	500	
4/1988	4	80	8,000	
5/1988	1	20	20	
6/1988	5	40	1,100	354
7/1988	4	400	800	
8/1988	5	600	50,000	3201
9/1988	4	1,300	3,000	
10/1988	5	800	3,000	1739
11/1988	4	80	160,000	
12/1988	2	1,300	2,400	
1/1989	4	800	13,000	
2/1989	3	3,000	7,000	
3/1989	3	800	5,000	
4/1989	3	2,200	8,000	
5/1989	5	1,300	22,000	5,430
6/1989	3	300	50,000	
7/1989	3	2,200	17,000	
8/1989	4	5,000	50,000	
9/1989	2	11,000	160,000	
10/1989	4	110	30,000	
11/1989	4	2,300	160,000	
12/1989	3	800	13,000	
1/1990	4	2,300	5,000	
2/1990	3	80	3,000	
3/1990	3	7,000	22,000	
4/1990	4	130	5,000	
5/1990	4	300	160,000	
6/1990	4	1,700	160,000	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
7/1990	4	700	13,000	
8/1990	3	40	300	
9/1990	4	130	800	
10/1990	5	300	5,000	710
11/1990	3	70	30,000	
12/1990	3	300	3,000	
1/1991	3	270	1,100	
2/1991	3	500	1,300	
3/1991	2	3,000	5,000	
4/1991	2	1,400	13,000	
5/1991	1	800	800	
6/1991	1	300	300	
7/1991	3	800	160,000	
8/1991	1	5,000	5,000	
10/1991	4	500	160,000	
11/1991	4	800	90,000	
12/1991	2	20	16,000	
4/1992	1	300	300	
6/1992	2	110	2,300	
8/1992	1	30,000	30,000	
9/1992	2	170	220	
1/1993	1	230	230	
8/1993	1	16,000	16,000	
9/1993	2	800	16,000	
10/1993	4	230	5,000	
11/1993	3	3,000	5,000	
12/1993	2	5,000	13,000	
1/1994	5	80	1,100	280

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
2/1994	3	500	8,000	
3/1994	5	500	24,000	2,429
4/1994	3	1,300	160,000	
5/1994	3	1,100	5,000	
8/1994	5	170	3,000	723
9/1994	3	170	2,400	
10/1994	4	130	1,400	
11/1994	5	230	16,000	3,506
12/1994	3	800	16,000	
1/1995	1	3,000	3,000	
6/1997	4	800	16,000	
7/1997	5	700	5,000	1,820
8/1997	4	230	1,700	
9/1997	5	700	90,000	4,169
10/1997	5	300	50,000	2,966
11/1997	3	3,000	8,000	
12/1997	5	230	13,000	2,182
1/1998	4	170	2,300	
2/1998	2	9,000	13,000	
3/1998	5	300	13,000	1,175
4/1998	4	500	3,000	
5/1998	4	500	5,000	
6/1998	4	80	800	
7/1998	5	130	17,000	1,276
8/1998	5	500	5,000	1,075
9/1998	4	700	5,000	
10/1998	4	230	160,000	
11/1998	4	529	24,192	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Numbers of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100mL)
12/1998	5	100	57,940	8,676
1/1999	4	10,462	24,192	
2/1999	4	74	241,920	
3/1999	5	100	111,985	1,848
4/1999	4	7,490	92,080	
5/1999	4	110	141,360	
6/1999	5	52	46,110	417
7/1999	4	100	241,920	
8/1999	5	410	2,098	808
9/1999	4	637	24,192	
10/1999	4	187	24,192	
11/1999	5	108	24,192	2,295
12/1999	4	52	5,794	
1/2000	4	74	24,192	
2/2000	5	10	12,033	928
3/2000	4	98	24,192	
4/2000	4	121	9,804	
5/2000	4	173	327	
6/2000	4	181	211	
7/2000	4	228	723	
8/2000	6	20	24,192	312
9/2000	4	379	8,164	
10/2000	4	145	359	
11/2000	5	109	855	210
12/2000	4	146	536	
1/2001	5	187	24,192	751
2/2001	4	110	5,172	
3/2001	4	187	19,863	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
4/2001	5	340	3,200	845
5/2001	4	140	880	
6/2001	4	130	500	
7/2001	5	800	6,600	1,572
8/2001	4	440	3,200	
9/2001	4	400	3,800	
10/2001	5	870	12,000	2,466
11/2001	4	12,000	12,000	
12/2001	4	640	12,000	
1/2002	5	180	15,400	629
2/2002	4	760	2,000	
3/2002	4	130	18,800	
4/2002	5	280	2,200	725
5/2002	4	400	930	
6/2002	4	340	1,000	
7/2002	5	320	5,000	940
8/2002	4	400	2,000	
9/2002	5	220	7,600	937
10/2002	4	570	13,000	
11/2002	4	880	6,000	
12/2002	4	330	2,800	
1/2003	4	200	340	
2/2003	4	70	1,190	
3/2003	4	380	1,010	
4/2003	4	230	800	
5/2003	4	530	3,800	
6/2003	5	220	4,600	1,677
7/2003	4	600	2,400	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
8/2003	4	130	7,800	
9/2003	5	10	2,000	284
10/2003	4	240	460	
11/2003	3	250	1,000	
12/2003	4	120	7,200	
1/2004	4	60	15,000	
2/2004	4	100	4,200	
3/2004	5	140	270	203
4/2004	4	110	5,600	
5/2004	4	80	270	
6/2004	6	250	1,000	417
7/2004	4	140	1,000	
8/2004	5	170	5,000	484
9/2004	4	310	1,000	
10/2004	3	250	7,000	
11/2004	5	430	25,000	3,502
12/2004	3	240	290	
1/2005	5	260	19,000	1,679
2/2005	4	570	12,000	
3/2005	3	320	520	
4/2005	2	470	13,000	
5/2005	5	100	760	316
6/2005	4	140	190	
7/2005	3	420	4,600	
8/2005	3	570	18,000	
9/2005	3	400	1,010	
10/2005	4	390	2,600	
11/2005	4	560	1,170	

**Table 3-3
Summary of Monthly *E.coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
12/2005	4	250	3,800	
1/2006	5	70	14,000	362
2/2006	4	130	3,600	
3/2006	4	200	440	
4/2006	4	150	4,600	
5/2006	5	390	15,000	2,215
6/2006	4	390	2,000	
7/2006	4	510	8,200	
8/2006	4	1,000	2,800	
9/2006	3	900	7,600	
10/2006	5	700	5,000	2,249
11/2006	3	310	1,030	
12/2006	4	590	21,400	
1/2007	5	210	490	267
2/2007	4	180	12,000	
3/2007	4	80	17,000	
4/2007	5	50	5,400	478
5/2007	3	280	530	
6/2007	4	100	1,650	
7/2007	5	240	390	316
8/2007	4	240	2,200	
9/2007	2	480	4,000	
10/2007	5	290	3,600	1,412
11/2007	4	380	11,000	
12/2007	4	100	2,000	
1/2008	5	150	18,000	1,265
2/2008	4	40	720	
3/2008	4	40	270	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi
Channel 1974-2008**

Fecal Coliform				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN /100ml)	Geometric Mean (MPN/100ml)
4/2008	4	50	200	
5/2008	4	80	2,000	
6/2008	4	130	2,200	
7/2008	4	120	560	
8/2008	3	190	300	
9/2008	4	100	10,000	
10/2008	4	170	390	
11/2008	3	130	290	
12/2008	5	390	14,000	1,84
Santa Ana Delhi Channel at Irvine Avenue				
8/1973	1	46,000	46,000	
4/1974	2	43	930	
6/1974	1	43	43	
7/1974	1	430	430	
8/1974	1	39	39	
9/1974	1	210	210	
10/1974	1	460	460	
12/1974	2	430	4,300	
1/1975	1	90	90	
3/1975	1	75	75	
4/1975	2	43	23,000	
5/1975	1	930	930	
6/1975	1	430	430	
7/1975	1	230	230	
8/1975	1	1,100	1,100	
9/1975	1	460	460	
10/1975	1	9,300	9,300	
11/1975	2	460	93,000	
12/1975	1	430	430	
2/1976	1	460	460	

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi Channel 1974-2008**

<i>E. coli</i>				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN/100ml)	Geometric Mean (MPN/100ml)
Santa Ana Delhi Channel at MacArthur Boulevard				
3/2004	2	100	100	
4/2004	1	310	310	
6/2004	1	100	100	
7/2004	1	630	630	
8/2004	1	100	100	
10/2004	1	2,130	2,130	
11/2004	1	740	740	
12/2004	1	3,050	3,050	
1/2005	2	278	300	
2/2005	2	630	700	
3/2005	1	310	310	
4/2005	1	740	740	
5/2005	1	4,130	4,130	
6/2005	1	833	833	
7/2005	1	472	472	
8/2005	1	1,080	1,080	
11/2005	1	200	200	
12/2005	2	1,100	1,560	
1/2006	2	100	1,480	
2/2006	1	1,610	1,610	
3/2006	3	410	4,040	
Santa Ana Delhi Channel at Sunflower Avenue and Flower Street (completed by Regional Board Staff)				
6/2009	5	200	3500	722

**Table 3-3
Summary of Monthly *E. coli* and Fecal Coliform at the Santa Ana Delhi Channel (1974-2008)**

<i>E. Coli</i>				
Santa Ana Delhi Channel at Mesa Drive				
Month and Year	Number of Samples Collected	Minimum Value (MPN/100ml)	Maximum Value (MPN/100ml)	Geometric Mean (MPN/100ml)
3/2004	3	100	100	
4/2004	1	100	100	
5/2004	1	310	310	
6/2004	1	310	310	
7/2004	3	100	100	
8/2004	1	100	100	
10/2004	2	2,180	2,180	
11/2004	1	100	100	
12/2004	2	100	4,160	
1/2005	2	100	135	
2/2005	2	1,590	5,794	
3/2005	2	100	12,590	
4/2005	1	630	630	
5/2005	1	5,610	5,610	
6/2005	1	63	63	
7/2005	1	447	447	
8/2005	1	100	100	
11/2005	1	100	100	
12/2005	2	520	1,040	
1/2006	2	10	1,340	
2/2006	1	850	850	
3/2006	3	100	4,950	

Appendix 2
Monitoring Results for Enterococcus
Santa Ana-Delhi Channel
Newport Beach Back Bay at Bicycle Bridge
Data Provided by: OC Health Care Agency-
Environmental Health Division

Date	Enterococcus (CFU/100 mL)
1/4/2010	70
1/11/2010	160
1/25/2010	400
2/1/2010	400
2/8/2010	800
2/16/2010	56
2/22/2010	8400
3/1/2010	3200
3/8/2010	1000
3/15/2010	120
3/22/2010	150
3/29/2010	70
4/5/2010	208
4/19/2010	289
4/26/2010	261
5/3/2010	98
5/10/2010	170
5/17/2010	240
5/24/2010	150
6/1/2010	400
6/7/2010	800
6/14/2010	240
6/21/2010	200
6/28/2010	230
7/6/2010	1000
7/12/2010	354
7/19/2010	2200
7/26/2010	400
8/2/2010	190
8/9/2010	140
8/16/2010	291
8/23/2010	96
8/30/2010	82

Date	Enterococcus (CFU/100 mL)
9/7/2010	400
9/13/2010	60
9/20/2010	2000
9/27/2010	110
10/4/2010	1000
10/12/2010	800
10/18/2010	6800
10/26/2010	1000
11/1/2010	1000
11/8/2010	19000
11/15/2010	198
11/22/2010	2000
11/29/2010	2200
12/6/2010	19000
12/15/2010	1000
12/27/2010	2400
1/4/2011	2000
1/10/2011	180
1/18/2011	42
1/24/2011	64
1/31/2011	12000
2/7/2011	234
2/16/2011	11000
2/23/2011	600
3/1/2011	42
3/8/2011	20
3/14/2011	140
3/23/2011	2000
3/28/2011	<200
4/4/2011	140
4/11/2011	86
4/18/2011	88
4/25/2011	28

Date	Enterococcus (CFU/100 mL)
5/2/2011	34
5/9/2011	78
5/23/2011	283
5/31/2011	82
6/6/2011	110
6/13/2011	337
6/20/2011	251
6/27/2011	220
7/5/2011	86
7/11/2011	251
7/18/2011	64
7/25/2011	200
8/1/2011	1000
8/8/2011	1000
8/15/2011	400
8/22/2011	800
8/29/2011	130
9/6/2011	140
9/12/2011	1000
9/19/2011	600
9/26/2011	88
10/11/2011	400
10/17/2011	66
10/24/2011	1000
10/31/2011	800
11/7/2011	6000
11/16/2011	1000
11/21/2011	28600