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BY E-MAIL

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Re: Comments on the Draft EIR/EIS for the Newhall Ranch Resource Management and Development Plan (RMDP) and the Spineflower Conservation Plan (SCP) Pertaining to Water Quality and Aquatic Biological Resources

To Whom It May Concern at the U.S. Army Corps of Engineers and the California Department of Fish and Game:

On behalf of Ventura Coastkeeper, a Program of the Wishtoyo Foundation, we submit the following comments on the Draft EIR/EIS for the Newhall Ranch Resource Management and Development Plan ("RMDP") and the Spineflower Conservation Plan ("SCP") ("Project"). 1

In Summary the Draft EIR/EIS ("DEIR/DEIR") is insufficient under the California Environmental Quality Act ("CEQA") and The National Environmental Protection Act ("NEPA") because for the proposed Project (which also includes all its proposed alternatives) the DEIR/DEIS does not identify and disclose all significant impacts to water quality and biological resources; 2 fails to adequately evaluate significant impacts to water quality and biological resources or use a good faith effort to do so; does not mitigate environmental impacts to water quality and biological resources to a less than significant effect; and excludes an environmentally superior alternative to the project as a whole that would eliminate or reduce significant impacts to water quality and

biological resources, attain project's basic objectives, and that are potentially feasible 2
under CEQA and NEPA. Additionally, the DEIR/DEIS is insufficient under CEQA and
NEPA because the project as proposed can not obtain a Clean Water Act Section 401
Water Quality Certification. Therefore, the U.S. Army Corps of Engineers ("Core") and 3
the California Department of Fish and Game ("DFG") cannot adopt the DEIR/DIES in its
current form.

For thousands of years, all inhabitants of the Santa Clara River watershed have
relied on an ecologically healthy Santa Clara River ecosystem to sustain their existence
and culture. Flowing 86 miles from the headwaters of the San Gabriel Mountains to the
Pacific Ocean through a 1,600 square mile watershed, the Santa Clara River is southern
California's last and largest naturally flowing wild river system that is not heavily
damned or channelized. It is home to as many as 17 species listed as threatened or
endangered by state and federal governments, and includes critical habitat for the
Southern California Steelhead, California Red-Legged Frog, Arroyo Toad, and Least
Bell's Vireo. It provides numerous ecosystem services and aquatic ecosystem functions
to the Santa Clara River Watershed and Ventura's Coast including: habitat for 4
endangered and threatened species, groundwater recharge, clean and safe water quality
for swimmers, surfers, other recreational users, and consumers of fish and seafood.
A free flowing Santa Clara River, the ecosystem services it provides, species it supports,
and wellbeing it brings to all those who enjoy it, is a treasure for all of Southern
California, one that residents and non residents alike have a responsibility to themselves,
their children, and their communities to protect. Unfortunately, in 2005, American Rivers
named the Santa Clara River the "10th Most Endangered River" in the United States, in
part due to the threat of development in its watershed. It is thus of the utmost importance
to Ventura Coastkeeper ("VCK"), that the RMDP, SCP, and the whole Newhall Ranch
Development adequately protects the ecological integrity and water quality of the Santa
Clara River, the Santa Clara River's watershed, and the Coastal Waters of Ventura
County.

DEIR/DEIS Section 4.4 Water Quality

I. The DEIR/DEIS does not identify and disclose all significant impacts to water quality and biological resources.

An EIR must identify and focus on the "significant environmental effects" of the
proposed project. Pub Res C §21100(b)(1); 14 Cal Code Regs §§15126(a), 15126.2(a), 5
15143. A significant effect on the environment is defined as a substantial or potentially
substantial adverse change in the environment. Pub Res C §§21068, 21100(d); 14 Cal
Code Regs §15382. The "environment" refers to the physical conditions "existing within
the area which will be affected by a proposed project, including land, air, water, minerals,
flora, fauna, noise, objects of historic or aesthetic significance." Pub Res C §21060.5. The
environment affected by a project includes both natural and man-made conditions. 14 Cal

Code Regs §15360. In addition, the three additional thresholds of "significance", provided by the DEIR/DEIS pertaining specifically to water quality are:

> Significance Criteria 1: Violate any water quality standards or WDRs
>
> Significance Criteria 2: Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage system or provide substantial additional sources of polluted runoff 6
>
> Significance Criteria 3: Otherwise substantially degrade water quality

The significant effects or impacts from the RMDP and SCP on water quality that the DEIR/DEIS fails to identify or mitigate to a less than significant effect for as required by CEQA and NEPA because the meet Significance Criteria's 1-3 above and or otherwise have a significant effect on the environment include: Chronic Toxicity impacts from Stormwater runoff and the Water Reclamation Plant ("WRP") effluent discharges; 7 Biostimulatory impacts from Stormwater runoff and the Water Reclamation Plant ("WRP") effluent discharges; impacts from Pharmaceutical contained in WRP and stormwater discharges; the impacts of pollutant loading from stormwater and WRP discharges; the water quality impacts below the "dry gap" in the Santa Clara River from stormwater and WRP discharges; and the impact on water quality from stormwater and WRP discharges in Ventura Count

A. The DEIS/DEIR Must Identify Significant Water Quality Impacts Below the Dry Gap in the Santa Clara River and Mitigate these Impacts to a Less the Significant Effect

During and after storm events that create high flow conditions, stormwater discharges from the proposed Project's urban runoff and WRP effluent discharges will pass over the dry gap in the Santa Clara River, and end up and or settle in the Santa Clara River estuary, in pools adjacent to the main channel of the Santa Clara River, and in 8 Ventura County's coastal marine waters at the mouth of the Santa Clara River following breaches of the Santa Clara River, which are induced both by storm events and discharges from the City of San Buenaventura Ventura Water Reclamation Facility ("Plant") Discharge to the Santa Clara River Estuary via Discharge Outfall No. 001, Regional Board Order No. R4-2008-0011. The Santa Clara River estuary, pools adjacent to the main channel of the Santa Clara River, and the coastal marine waters at the mouth of the Santa Clara River serve as habitat for aquatic life identified in the DEIS/DEIR, 9 protected as a beneficial use in The Water Quality Control Plan for the Los Angeles Region. Some of these aquatic life species include endangered species protected under the Federal Endangered Species Act such the Southern California Steelhead, unarmored threespine stickleback, the arroyo toad, and the California red-legged frog. Additionally, 10 during periods of dry weather, discharges of urban runoff and WRP effluent discharges

may at times pass as surface water over the dry gap and end up in off channel pools, the
Santa Clara River Estuary, or Ventura County's coastal marine waters, especially during 10
the winter months were baseflow contributions to the Santa Clara River are of greater
magnitude and are more consistent. Furthermore, even if dry weather urban runoff from
the Project pass through the dry gap during non storm events, the subsurface flow of the
Santa Clara River provides hydrological connectivity between the Santa Clara River 11
reach upstream and downstream of the dry gap, so it is probable that contaminants from
urban runoff and WRP effluent discharges will end up in the Santa Clara River Estuary
and off channel or in channel pools.

The DEIS/DEIR fail to evaluate the project's effect on water quality and aquatic
organisms down stream of the Dry Gap (identified as Reach 4 in DEIS/DEIR and as 12
Reach 4 of the Santa Clara River by the Los Angeles Regional Control Board ("Regional;
Board"). Therefore, the DEIS/DEIR must identify the Project's significant direct,
indirect, and cumulative impacts to water quality and biological resources from the reach
of the Santa Clara River adjacent to the proposed Project site all the way to the estuary 13
(Regional Board Santa Clara River reaches 1 though 5), and into the coastal waters at the
mouth of the Santa Clara River. The remainder of VCK's analysis in the entirety of
VCK's comment letter regards to the DEIS/DEIRs failure to identify significant impacts
and failure to set forth adequate mitigation measures, incorporates by reference this 14
requirement to evaluate all direct, indirect, and cumulative impacts from the Project to
reaches 1 through 5 and to the coastal waters at the mouth of the Santa Clara River.

Additionally, the Water Quality Control Plan for the Los Angeles Region ("Basin
Plan") (Los Angeles Regional Water Quality Control Board, 1994, as amended),
designated WARM (warm freshwater habitat to support warm water ecosystems) and
WILD (wild habitat waters that support wildlife habitats), and recreational beneficial uses
for the Santa Clara River, Santa Clara River Estuary, and coastal waters at the mouth of
the Santa Clara river (see Basin Plan Chapter 2: Beneficial Uses, Table 2.1 pages 2-6 to 15
2-8, Table 2.3 page 2-18). Therefore, the water quality criteria from the Basin Plan and
California Toxics Rule for aquatic life and human uses apply to these waterbodies
segments below as water quality standards for determination of significant effects on
Water Quality and determination of the adequacy of mitigation measures to mitigate
significant impacts to a less than significant effect.

B. The DEIS/DEIR Must Identify the Significant Impacts to Water Quality and Aquatic Biological Resources from Pollutant Loading

The DEIS/DEIR acknowledges that pollutant loading from the Project will result
increased pollutant loading from runoff into the Santa Clara River for Ammonia-N, total 16
nitrogen, total phosphorous, Nitrate-N + Nitrite-N, Dissolved Copper, Dissolved Lead,
Dissolved Zinc, Total Aluminum, all trace metals and Chloride.[1] However, the

[1] See Attachment A

DEIS/DEIR erroneously dismisses the loading of these pollutants as not causing a
significant impact to water quality and biological resources because it states that
concentrations in receiving water (the Santa Clara River) resulting from the runoff "is the
most important indicator for the Project, given that the Project's receiving waters are
streams (moving waters) as opposed to lakes or other more static water bodies" (4.4-
88,92). Contrary to this assumption, as explained in I.A. above urban runoff and WRP 16
discharges from the project will end up in the Santa Clara River Estuary, off channel
pools, and in the Coastal Marine Waters at the mouth of the Santa Clara River after a
breaches of the Santa Clara River (which are induced both by storm events and
discharges from the City of San Buenaventura Ventura Water Reclamation Facility
("Plant") Discharge to the Santa Clara River Estuary via Discharge
Outfall No. 001, Regional Board Order No. R4-2008-0011.

Pollutant Loading in the Santa Clara River Estuary, Ventura County's Coastal
Marine Waters near the mouth of the Santa Clara River, and in the pools adjacent to the
main channel of the Santa River can cause bioaccumulation of toxic contaminants such as 17
metals and pesticides in aquatic organisms, especially amongst benthic organisms and
organisms that live and feed off the bottom of the ocean, river, or estuary floor.
Pesticides, cadmium, nickel, lead, chromium, zinc, copper, mercury, and other heavy and
trace metals found in urban runoff, stormwater discharges, and sewage treatment plant
effluent bioaccumulate in the tissue of aquatic life and contaminate aquatic ecosystem
sediment. (See Regional Board, Toxic Hotspot Clean Up Plan, available at: 18
http://www.swrcb.ca.gov/publications_forms/publications/general/docs/finalfed_appb_vol2_b.pdf.)
When aquatic organism are exposed to these loaded pollutants and consumed by other
aquatic or terrestrial organisms, the pollutants can biomagnify and end up in increased
concentrations in organisms higher up in the food chain. Therefore, the DEIS/DEIR must
identify the significant impacts to water quality and aquatic biological resources in the
Santa Clara River Estuary, coastal marine waters at the mouth of the Santa Clara River, 19
and in pools alongside the Santa Clara River downstream of the Project from pollutant
loading, such as loading from metals, pesticides, and herbicides, and provide for adequate
mitigation measures to reduce the effect of pollutant loading to a less than significant
effect.

"Eutrophication is increased nutrient loading into a waterbody and the resulting
increased growth of biota, phytoplankton, and other aquatic species. Phosphorous and
nitrogen are key nutrients for phytoplankton growth in lakes and are often responsible for
eutrophication of surface waters… The excessive plant biomass may cause increased
turbidity, altered planktonic food chains, algal blooms, reduced oxygen concentrations, 20
and increased nutrient recycling. These changes can lead to a cascade of biological
responses culminating in impaired beneficial uses…Low dissolved oxygen levels can be
stressful for fish and other organisms and may in fact lead to fish kills." (Resolution NO.
R08-006, Amendment to the Water Quality Control Plan for the Los Angeles Region to
Incorporate a Total Maximum Daily Load for Eutrophic, Algea, Ammonia, and Odors
(Nutrient) for Machado Lake, California Regional Water Quality Control Board, Los

Angeles Region). Cultural eutrophication of estuaries and coastal waters is a global
environmental issue, with demonstrated links between anthropogenic changes in
watersheds, increased nutrient loading to coastal waters, harmful algal blooms, hypoxia,
and impacts on aquatic food webs (Valiela et al. 1992). These ecological impacts of
eutrophication of coastal areas can have far-reaching consequences, including fish-kills
and lowered fishery production (Glasgow and Burkholder, 2000), loss or degradation of 20
seagrass and kelp beds (Twilley 1985, Burkholder et al. 1992, McGlathery 2001),
smothering of bivalves and other benthic organisms (Rabalais and Harper 1992),
nuisance odors, and impacts on human and marine mammal health from increased
frequency and extent of harmful algal blooms and poor water quality (Bates et al. 1991,
Trainer et al. 2002). These modifications have significant economic and social costs.
According to EPA, eutrophication is one of the top three leading causes of impairments
of the nation's waters (US EPA 2001).[2] Pollutant Loading in the Santa Clara River 21
Estuary, Ventura County's Coastal Marine Waters near the mouth of the Santa Clara
River, and in the pools adjacent to the main channel of the Santa River can cause 22
eutrophication that can deprive aquatic ecosystems of dissolved oxygen, which in turn
can kill aquatic organisms. Therefore, the DEIS/DEIR must identify the significant
impacts to water quality and aquatic biological resources from nutrient loading and 23
provide for adequate mitigation measures to reduce the effect of nutrient loading to a less
than significant effect.

C. The DEIS/DEIR Must Identify the Significant Chronic Toxicity Impacts, and Significant Acute and Chronic Toxicity Impacts in Saline Coastal Marine Waters

The California Toxics Rule (40 C.F.R. § 131.38) provides water quality criteria for toxic
pollutants in inland surface waters, enclosed bay, and estuaries with human health or aquatic life
designated uses in California. The CTR also establishes two types of aquatic life criteria:
acute and chronic. Acute criteria represent the highest concentration of a pollutant to
which aquatic life can be exposed for a short period of time without deleterious effects;
chronic criteria equal the highest concentration to which aquatic life can be exposed for
an extended period of time (four days) without deleterious effects. 24

The DEIR/DEIS states that acute criteria, rather than chronic criteria, are used as benchmarks in assessing the project runoff because acute criteria are considered to be more applicable to stormwater conditions. Furthermore, the DEIR/DEIS only uses freshwater criteria for acute toxicity benchmarks in assessing the project runoff.

During and after storm events, stormwater discharges from the Proposed Project's urban runoff and WRP effluent discharges will pass over the dry gap in the Santa Clara

[2] Southern California Bight 2008 Regional Marine Monitoring Survey (Bight'08), Coastal Wetlands and Estuaries Eutrophication Assessment Workplan, Bight'08 Estuaries and Coastal Wetlands Committee, available at: ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/BightPlanningDocuments/Bight08/Bight08_CoastalWetlandsEstuaries_Workplan.pdf

River and end up and or settle for four days or longer in the Ventura County's coastal saline marine waters, the Santa Clara River estuary, and in pools adjacent to the main channel of the Santa Clara River that serve as habitat for aquatic life identified in the DEIS/DEIR. Some of these aquatic life species include endangered species protected under the Federal Endangered Species Act such the Southern California Steelhead, unarmored threespine stickleback, the arroyo toad, and the California red-legged frog. Additionally, during periods of dry weather, discharges of urban runoff and WRP effluent
discharges may at times pass over the dry gap and end up in off channel pools, the Santa 24
Clara River Estuary, or Ventura County's coastal marine waters for a prolonged period of more than four days, especially during the winter months were baseflow contributions to the Santa Clara River are of greater magnitude and are more consistent. Furthermore, even if dry weather urban runoff from the Project pass through the dry gap during non storm events, the subsurface flow of the Santa Clara River provides hydrological connectivity between the Santa Clara River reach upstream and downstream of the dry gap, so it is probable that contaminants from urban runoff and WRP effluent discharges will end up in the Santa Clara River Estuary and off channel or in channel pools for longer than four days.

The Water Quality Control Plan for the Los Angeles Region ("Basin Plan") (Los Angeles Regional Water Quality Control Board, 1994, as amended), designated WARM (warm freshwater habitat to support warm water ecosystems) and WILD (wild habitat waters that support wildlife habitats) beneficial uses for the Santa Clara River, Santa Clara River Estuary, and coastal waters at the mouth of the Santa Clara river (see Basin Plan Chapter 2: Beneficial Uses, Table 2.1 pages 2-6 to 2-8, Table 2.3 page 2-18).

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Therefore, the DEIS/DEIR must evaluate the chronic toxicity impacts from the Project's dry weather and wet weather urban runoff, and effluent discharges from the WRP to aquatic life, using the criteria set forth under the California Toxics Rule ("CTR"). Additionally, the DEIS/DEIR must evaluate both the acute and chronic toxicity impacts of the Project to aquatic life in the saline Coastal waters around the mouth of the Santa Clara River using the salt water acute and chronic toxicity criteria. Furthermore, the DEIS/DEIR must set forth adequate mitigation measures to mitigate these impacts to a less than significant effect.

D. The DEIS/DEIR Must Identify the Significant Toxicity Impacts of The Aggregate Effect of Pollutants and the Effect of Unknown Pollutants, Including Emerging Contaminants.

Acute toxicity occurs when the mortality of an aquatic organism results from mere exposure to water with a given concentration of pollutant, thus acute criteria
represent the highest concentration of a pollutant to which aquatic life can be exposed for 26
a short period of time without deleterious effects. Chronic toxicity occurs when the morality or detrimental physiological effects, such as effects on development, reproduction, or growth, result from prolonged exposure to a contaminant at a given

concentration in a sample of water. Thus, chronic criteria equal the highest concentration 26 to which aquatic life can be exposed for an extended period of time (four days) without deleterious effects.

The Basin Plan's narrative water quality objective for toxicity necessary to protect aquatic life and the Basin Plan's beneficial uses for the Santa Clara River, Santa Clara Estuary, and Ventura County's coastal waters at the mouth of the Santa Clara River (see Basin Plan Chapter 2: Beneficial Uses, Table 2.1 pages 2-6 to 2-8, Table 2.3 page 2-18) states that "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life... There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in 27 undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established USEPA, State Board, or other protocol authorized by the Regional Board... There shall be no chronic toxicity in ambient waters outside mixing zones. To determine compliance with this objective, critical life stage tests for at least three species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive species shall then be used for routine monitoring."(Basin Plan).

The Project will discharge urban runoff with pollutants from dry weather events, wet weather events, and sewage effluent from the WRP, with unknown and emerging contaminants and a mix of pollutants which in the aggregate may cause acute and chronic impacts to aquatic organisms.[3] Thus, because these discharges may violate the Basin 28 Plan's and the CTR's water quality standards for toxicity, or may otherwise substantially degrade water quality, they may have a significant effect on water quality and their toxicity must be evaluated and adequately mitigated for under the DEIR/DEIS.

E. The DEIS/DEIR Must Identify the Significant Impacts that Pharmaceuticals Discharges from the Project will have of Water Quality and Biological Resources

The DEIR/DEIS fails to evaluate the significant environmental effect that the 29 discharges of pharmaceuticals from the WRP and urban runoff may have on water quality and aquatic life.

On average, Americans fill more than 12 prescriptions annually.[4] As much as 30 40% of prescription drugs dispensed are never used, and 50% of consumers dispose of

[3]

[4] Kaiser Family Foundation, *Prescription Drug Trends*, September 2008.

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unused drugs in the trash, while over one 33% flush them down the toilet.[5] When unused pharmaceuticals are flushed down the toilet or the drain, they enter the public sewer system directly, contaminating the drinking water supply and local waterways. When unused pharmaceuticals are thrown in the trash, they can enter local streams and rivers indirectly when the liquid that seeps out of landfills – called "leachate" – infiltrates groundwater or is intentionally released.[6] Pharmaceuticals also reach the water supply when unabsorbed medication is excreted by humans directly into the sewer system or by livestock indirectly into nearby waterways. Waste water treatment facilities are not designed to remove pharmaceuticals from the water supply. As a result, over 80% of waterways tested in the United States show traces of common medications such as acetaminophen, hormones, blood pressure medication, codeine, and antibiotics.[7]

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In 1999-2000 United States Geological Survey (USGS) conducted a "national reconnaissance" of organic wastewater contaminants looking for 95 compounds including pharmaceuticals; steroids and reproductive hormones; caffeine; and hormone disrupting chemicals commonly found in plastics, insecticides, fragrances, fire retardants and solvents.[8] Eighty percent of the water samples researchers took from 139 streams in 30 states contained at least one of the 95 contaminants under study, and there was an average of seven contaminants in each water sample.[9] The USGS concluded that the wastewater treatment steps intended to return clean water to the nation's waterways do not effectively control pharmaceuticals.[10]

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While concentrations of pharmaceutical in surface waters are typically low, pharmaceuticals are showing up in fish tissue and studies are emerging that suggest exposure to pharmaceuticals and combinations of pharmaceuticals in surface waters are adversely impacting aquatic organisms and aquatic ecosystems.[11] Additionally, because conventional wastewater treatment systems do not have the ability to remove all pharmaceuticals, water supplies downstream of municipal wastewater treatment discharges may be impacted, as many studies have found the widespread presence of pharmaceuticals in public drinking water at very low levels.[12] While the low

[5] Based on figures from the National Unused and Expired Medicine Registry; J. Bound & N. Voulvoulis, *Household disposal of pharmaceuticals as a pathway for aquatic contamination in the United Kingdom,* Environmental Health Perspectives, 113(12), pp. 1705-1711, 2005.
[6] Northwest Product Stewardship Council, *Pharmaceuticals and product stewardship*, 2006, retrieved from www.productstewardship.net/productsPharmaceuticals.html.
[7] Robin Shalinsky, *Taking the Initiative to Take-Back Medications*, America's Pharmacist, March 2009.
[8] (Barnes, K.K., Kolpin, D.W., Meyer, M.T., Thurman, E.M., Furlong, E.T., Zaugg, S.D., and Barber, L.B., 2002, Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000: U.S. Geological Survey Open-File Report 02-94, available at: http://toxics.usgs.gov/regional/emc/streams.html); more studies available at http://toxics.usgs.gov/regional/emc/streams.html).
[9] Ibid.
[10] Ibid.
[11] (See Attachment B, also available at http://pugetsoundblogs.com/waterways/files/2009/05/securemedreturn_environmentalconcerns_020109.pdf.)
[12] Ibid.

concentrations of pharmaceuticals in water supplies and surface waters are low and some
pharmaceuticals may degrade under certain conditions, the human health consequences
of ingestion may be severe and are beginning to be investigated.[13] For instance, 32
researchers have reported that human cells fail to grow normally in the laboratory when
exposed to trace concentrations of certain drugs commonly found in the water supply.[14]

Because pharmaceuticals from the Project's WRP effluent discharges and
stormwater discharges will enter the Santa Clara River and may enter groundwater
supplies in the Santa Clara River, and may have a significant effect on the water quality
and biological resources of the Santa Clara River, the DEIR/DEIS must evaluate the 33
significant environmental effect that the discharges of pharmaceuticals from the WRP
and urban runoff may have on water quality and aquatic life, and provide mitigation
measures that will mitigate these impacts to a less than significant effect.

II. The DEIR/DEIS fails to adequately evaluate significant impacts to water quality and biological resources, or use a good faith effort to do so.

A. The DEIR/DEIS Fails to Utilize the Narrative Objective for Biostimulatory Substances in the Basin Plan to assess the Effect of Nutrient Concentrations and Loadings from the Project and Improperly Evaluates the Effects of Total Nitrogen and Total Phosphorous.

The Basin Plan Water Quality Objective that applies to Total Phosphorous and
Total Nitrogen states that " water shall not contain biostimulatory substances in
concentrations that promote aquatic growth to the extent that such growth causes 34
nuisance or adversely affects beneficial uses." The Regional Board has interpreted this
narrative objective as algal cover in excess of 30% adversely affecting (i.e., not
supporting) recreational beneficial uses.[15] This criterion is applied to both floating or
bottom algae and is based on literature (Biggs 2000). During the development of the
Malibu Creek Nutrient TMDL, for instance, the LA Regional Board recommended that
waters with algae cover exceeding 30% in at least 10% of samples be considered 35
impaired by algae.[16] USEPA agreed, stating, "We believe it was appropriate to apply the
Biggs guidelines in the screening-level exercise entailed by the Section 303(d) listing
process…."[17]

[13] Ibid.
[14] Jeff Donn, Martha Mendoza, and Justin Pritchard, SF Chronicle, *Tons of drugs dumped into wastewater*, San Francisco Chronicle, September 21, 2008.
[15] USEPA, *Total Maximum Daily Loads for Nutrients: Malibu Creek Watershed* (March 2002) at 14-15.
[16] Id.
[17] *Id*.

"Eutrophication is increased nutrient loading into a waterbody and the resulting increased growth of biota, phytoplankton, and other aquatic species. Phosphorous and nitrogen are key nutrients for phytoplankton growth in lakes and are often responsible for eutrophication of surface waters… The excessive plant biomass may cause increased turbidity, altered planktonic food chains, algal blooms, reduced oxygen concentrations, and increased nutrient recycling. These changes can lead to a cascade of biological 36
responses culminating in impaired beneficial uses…Low dissolved oxygen levels can be stressful for fish and other organisms and may in fact lead to fish kills." (Resolution NO. R08-006, Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate a Total Maximum Daily Load for Eutrophic, Algea, Ammonia, and Odors (Nutrient) for Machado Lake, California Regional Water Quality Control Board, Los Angeles Region). Cultural eutrophication of estuaries and coastal waters is a global environmental issue, with demonstrated links between anthropogenic changes in watersheds, increased nutrient loading to coastal waters, harmful algal blooms, hypoxia, and impacts on aquatic food webs (Valiela et al. 1992). These ecological impacts of eutrophication of coastal areas can have far-reaching consequences, including fish-kills 37
and lowered fishery production (Glasgow and Burkholder, 2000), loss or degradation of seagrass and kelp beds (Twilley 1985, Burkholder et al. 1992, McGlathery 2001), smothering of bivalves and other benthic organisms (Rabalais and Harper 1992), nuisance odors, and impacts on human and marine mammal health from increased frequency and extent of harmful algal blooms and poor water quality (Bates et al. 1991, Trainer et al. 2002). According to EPA, eutrophication is one of the top three leading causes of impairments of the nation's waters (US EPA 2001).[18] Additionally, the 38
Regional Board Staff, in its 2008 update of the Los Angeles Regional Integrated Report for Clean Water Act Section 305(b) Report and Section 303(d) List of Impaired Waters, issued these finding in regards to eutrophication:

> "Eutrophication and nutrient enrichment problems rank as the most widespread water quality problems nationwide; for example, more lake acres are affected by nutrients than any other pollutant or stressor (EPA 2000). Eutrophication is 39
> defined by increased nutrient loading to a waterbody and the resulting increased growth of phytoplankton and other aquatic plants. Additionally, other parameters such as decreased dissolved oxygen and water clarity can also indicate eutrophic conditions. Phosphorus and nitrogen are recognized as key nutrients for the growth of phytoplankton, algae, and aquatic plants and are responsible for the eutrophication of surface waters."[19]

In the adopted Machado Lake TMDL, the Regional Board appropriately included 40
a numeric target for total phosphorus of .1mg/l that was based of the EPA Nutrient

[18] Southern California Bight 2008 Regional Marine Monitoring Survey (Bight'08), Coastal Wetlands and Estuaries Eutrophication Assessment Workplan, Bight'08 Estuaries and Coastal Wetlands Committee, available at: ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/BightPlanningDocuments/Bight08/Bight08_CoastalWetlandsEstuaries_Workplan.pdf
[19] (Attachment C.)

Criteria Technical Guidance Manual Lakes and Reservoirs (2000), which does not recommend setting a numeric target for total phosphorus greater than 0.1 mg/L. (Resolution NO. R08-006, Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate a Total Maximum Daily Load for Eutrophic, Algea, Ammonia, and Odors (Nutrient) for Machado Lake, California Regional Water Quality 40
Control Board, Los Angeles Region). Additionally, to maintain a balance of nutrients for biomass growth and prevent limitation by one nutrient or another, a ratio of total nitrogen to total phosphorus of 10 is used to derive the total nitrogen numeric target of 1.0 mg/L as a monthly average concentration (Thomann, Mueller, 1987)." (Regional Board Staff Report for Machado Lake TMDL at 35.)

While, the Basin Plan's water quality objective for nitrogen is that "Waters shall not exceed 10 mg/l nitrogen as nitrate-nitrogen plus nitrite-nitrogen, 45 mg/l as nitrate, 10 mg/l as nitrate-nitrogen, or 1 mg/l as nitrite-nitrogen or as otherwise designated in Table 3-8," during the promulgation of the Machado Lake TMDL, the Regional Board determined that the Basin Plan's water quality objective for nitrogen as applied to aquatic life:

> "is not supportive of the narrative biostimulatory substance water quality objective. ***The nitrogen objective (10 mg/L) in the Basin Plan is based on criteria acceptable for drinking water and not appropriate to address eutrophic conditions*** in the lake. A review of available data and scientific literature demonstrates that the numeric objective of 10 mg/L for nitrogen is not sufficiently 41
> protective for controlling excessive algal/macrophyte growth and the symptoms of eutrophication in the lake. Therefore, the numeric target for total nitrogen will be more stringent than the existing numeric nitrogen objective in the Basin Plan to ensure attainment of the narrative biostimulatory substances water quality objective. The TMDL and its numeric targets must be developed to ensure protection of all the beneficial uses and attainment of nutrient related water quality objectives specified in the Basin Plan." (Regional Board Staff Report for Machado Lake TMDL at 32, emphasis added).

The Regional Board Staff, in its 2008 update of the Los Angeles Regional Integrated Report for Clean Water Act Section 305(b) Report and Section 303(d) List of Impaired Waters, verified its determinations in their comment for the Machado Lake TMDL by stating:

> "The Basin Plan contains a specific nitrogen (nitrate nitrite) water quality objective, which is established at 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen. This objective is specifically set to protect drinking water beneficial uses and is consistent with the California Department Public Health nitrate drinking

> water standard. This nitrogen water quality objective does not protect waterbodies from impairments related to biostimulatory substances and eutrophication."[20] 41

Thus, this assessment resulted in the Machado Lake Nutrient TMDL including a total nitrogen numeric target of 1.0 mg/L as a monthly average concentration. In addition the current Nutrient TMDL for Malibu Creek, adopted by USEPA in 2003, provides summer season water quality objectives of 1.0 mg/l total nitrogen and 0.1 mg/l total 42 phosphorous. Other established nitrogen criteria for protection of aquatic life are significantly lower. For instance, USEPA established a guidance value for CWA section 304(a) nutrient criteria specific to the Los Angeles Region (Ecoregion III) of 0.38 mg/l total nitrogen and 0.022 mg/l total phosphorus for protection of aquatic life and recreation 43 uses. USEPA, *Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion III* (2000) (EPA 822-B-00-016).

The DEIR/DEIS states that "the estimated [Total Phosphorous] concentrations in project stormwater would be lower than existing conditions, therefore, project-related discharges would not promote (i.e. increase) algeal growth and would comply with the narrative objective for biostimulatory substances in the County Basin Plan (DEIR/DEIS 4.4-87). The DEIR/DEIS reports that with BMPs or PDFs, the average annual total phosphorous concentration and total nitrogen concentration in reach 5 of the Santa Clara River will be .26 mg/l and 2.4mg/l respectively. For the VCC project, the DEIR/DEIS 44 projects the average annual pollutant concentrations for Total Phosphorous and total nitrogen for developed conditions of the Project with Project Design Features ("PDFs") to be .36mg/l and 2.0mg/l respectively. Thus, the Project's projected discharges of Total Nitrogen and Total Phosphorous violate both the narrative objective for biostimulatory substances and established nitrogen and phosphorous criteria for protection of aquatic life, and therefore must be found to have a significant effect on the environment under significance criteria 1 and significance criteria 3 set forth in the DEIR/DEIS.

B. The DEIR/DEIS Fails to Adequately Assess the Concentrations and Loading of Chlorides that will be Discharged from the Project's WRP and Urban Runoff

The DEIS/ DEIR projections for Chloride discharges from the Project's WRP effluent discharges and urban dry weather and stormwater runoff is severely understated because it does not factor in the concentration of chloride from State Water Project ("SWP") water that will supply the project with a significant source of water. The proposed Tejon Ranch, the Nickels Water from Kern County for the Newhall Ranch, Yuba River water recently purchased by Castaic Lake Water Agency and extensive 45 storage agreements in Kern County will require water wheeling that actually results in these water deliveries being made from the SWP to the Project for residential, commercial, and industrial use that is ultimately discharged as runoff or into the WRP. Thus, the DEIS/DEIR must re-assess the concentrations and loading of chloride that will be discharged from the project's WRP and urban runoff to account for chloride

[20] (Attachment C.)

concentrations from imported SWP water. Accordingly, the DEIR/DIES thus must also re-evauate the effect that chloride concentrations from imported SWP water will have on 46
water quality, biological resources, and water supply, and set forth adequate mitigation measure to reduce any significant effects to water quality and biological resources to a less than significant effect.

C. To adequately assess impacts to water quality and biological resources the DEIR/DEIS must combine the concentrations of effluent discharges from the WRP with the Project's estimated average pollutant concentrations and pollutant loading from urban runoff, must calculate the estimated discharges from wet and dry weather events instead of averaging all storm events together, and must account for the possibility that chloride concentrations in discharges to the WRP will be too high for reuse.

The DEIR/DEIS does not combine the concentrations of effluent discharges from the WRP with the Project's estimated average pollutant concentrations and pollutant loading from urban runoff. The estimated average pollutant concentrations and pollutant 47
loading from the Project's developed conditions with PDFs should = WRP effluent discharges + urban runoff discharges, and thus the effect of environmental impacts need to be evaluated from this sum to comply with CEQA and NEPA. Just because the WRP is already permitted does not exclude it from being part of the Project's discharges. By its 48
very nature, the WRP enables and serves the Project and the roughly 77,000 people that may move into the project area.

Furthermore, to comply with CEQA and NEPA, the concentrations of these total discharges from the Project must be calculated for wet weather and dry weather events to assess whether the discharges violate the Clean Water Act, California Toxics Rule, 49
Porter-Cologne Water Quality Control Act, and or Basin Plan by causing or contributing to an exceedance of water quality standards or causing or contributing to a nuisance at any given moment in time.

Additionally, according to the DEIR/DEIS, although the WRP is only supposed to discharge during wet weather months when demand for irrigation and non potable reuse of the WRP treated effluent is not in demand, high flows will only persist for a short duration after storm events. Because storm events are generally infrequent in the Santa Clara River watershed even during winter months, more often than not, the discharge 50
from the WRP will not mix with water from the Santa Clara river when dilution capacity is at its greatest, and thus the mitigation measure stating that discharges from the WRP will be less than significant during winter months because dilution capacity is at its greatest is not feasible and will not reduce the impact from WRP discharges to a less than significant effect.

Furthermore, if water is imported from the SWP and chlorides are present in high 51
concentrations, the effluent discharge from the SWP water may not be suitable for

irrigation or non potable re-use, and thus may have to be discharged on an ongoing basis
into the Santa Clara River. Accordingly, the impacts to water quality should be evaluated 51
for this scenario and if found significant, the provisions must be included in the
DEIR/DEIS to mitigate the impact to a less than significant effect.

D. The DEIR/DEIS Fails to Adequately Evaluate the Concentrations and Loading of Bacteria that will be Discharged from the Project's Urban Runoff and its Significant Effect on Water Quality

In evaluating the environmental impacts of pathogens on water quality, the
DEIR/DEIS merely states that, "the Specific Plan build out would not result in substantial
changes in pathogen levels in the receiving waters compared to existing conditions..with
the implementation of proposed treatment BMPs and Mitigation Measures."[21] First off, a
comparison to existing conditions has no relevance as to whether urban runoff during wet
and dry weather events causes or contributes to an exceedance of water quality standards 52
or a nuisance in violation of the Clean Water Act, California Toxics Rule, Porter-Cologne
Water Quality Control Act, and or Basin Plan or otherwise exceeds the thresholds of
significance under CEQA and NEPA to qualify as a significant environmental effect. The
DEIS/DEIR provides no numerical projections as to the Projects' projected total coliform
and e-coli concentrations with and without PDFs, and must do so to adequately evaluate
the Project's effect on water quality.

Furthermore, the project's PDFs don't currently utilize LID standards with a 3%
Effective Impervious Area ("EIA") requirement to prevent stormwater from sweeping
pathogens into the Santa Clara. As set forth in the DEIR/DEIS, the Project, because it
does not incorporate adequate LID standards to protect water quality by ensuring a 3% 53
EIA standard is achieved, will result in the discharge of 141 more acre feet of water per
year into the Santa Clara River from runoff than the current land uses, with fecal
concentrations ranging from 4,500 to 7,700 MPN/100 ml (this range of concentrations
Was from the USEPA's data that indicates the median fecal concentrations from 65
stormwater programs in 17 states range from 4,500 to 7,700 MPN/100 ml for residential
and commercial uses.) [22]

E. The DEIS/DEIR methodology to Determine Significance is Flawed because it Uses an Inadequate Environmental Baseline to Determine the Project's Effect on Water Quality

A DEIR/DEIS methodology of determining if the Project may have a significant
impact on water quality, is that if the loads or concentrations resulting from the
development are predicted to stay the same or be reduced when compared to existing 54
conditions, then the Project or alternatives would not cause a significant adverse impact

[21] DEIR/DEIS 4.4-98
[22] Id at 4.4-97.

to water quality.[23] This approach is flawed because not only is a comparison to natural
non developed conditions more appropriate to determine the environmental footprint of 54
the project, but at least a comparison to existing conditions should require the existing
conditions (existing land uses) to comply with all applicable water quality regulations.
Thus, comparison to "existing conditions", which are mainly agricultural properties that
are not using BMPs, not complying with water quality standards, and/or not complying
the Waste Load Allocations prescribed by the TMDLs for the Santa Clara River
Watershed detailed in Section III below as required by the Clean Water Act, California 55
Toxics Rule, Porter-Cologne Water Quality Control Act, Basin Plan, and Endangered
Species Act to mitigate and prevent the discharge of sediment, pathogen, metals,
pesticide, and nutrients into the Santa Clara River is inadequate for determining the
significant effect of the project, because the existing conditions are illegal under State and
Federal regulations. Therefore, the DEIS/DEIR methodology for determining if the
Project may have a significant impact, as required under CEQA and NEPA, must instead
read: "if the loads or concentrations resulting from the development are predicted to stay
the same or be reduced when compared to existing conditions in compliance with all 56
applicable state and federal laws, it is concluded that the proposed Project or alternatives
would not cause a significant adverse impact to the ambient water quality of the receiving
waters for the pollutant." Accordingly, the impacts from the proposed Project's urban
runoff and WRP discharge must be re-evaluated using this correct and legal baseline
criteria for existing conditions to determine if they will be significant.

E. The DEIS/DEIR Must Compare the Project's Forecasted Concentrations of Pollutants with PDFs to the Chronic Toxicity Water Quality Standards in the CTR to Assess Whether the Project Will Have a Significant Effect on the Environment.

The California Toxics Rule (40 C.F.R. § 131.38) provides water quality criteria for toxic
pollutants in inland surface waters, enclosed bay, and estuaries with human health or aquatic life
designated uses in California. The CTR also establishes two types of aquatic life criteria:
acute and chronic. Acute criteria represent the highest concentration of a pollutant to
which aquatic life can be exposed for a short period of time without deleterious effects;
chronic criteria equal the highest concentration to which aquatic life can be exposed for 57
an extended period of time (four days) without deleterious effects.

The DEIR/DEIS states that acute criteria, rather than chronic criteria, are used as benchmarks in assessing the project runoff because acute criteria are considered to be more applicable to stormwater conditions. Furthermore, the DEIR/DEIS only uses freshwater criteria for acute toxicity benchmarks in assessing the project runoff.

During and after storm events, stormwater discharges from the Proposed Project's
urban runoff and WRP effluent discharges will pass over the dry gap in the Santa Clara 58
River and end up and or settle for four days or longer in the Ventura County's coastal

[23] DEIS/EIR at 4.4-4

saline marine waters, the Santa Clara River estuary, and in pools adjacent to the main 58
channel of the Santa Clara River that serve as habitat for aquatic life identified in the
DEIS/DEIR. Some of these aquatic life species include endangered species protected
under the Federal Endangered Species Act such the Southern California Steelhead, 59
unarmored threespine stickleback, the arroyo toad, and the California red-legged frog.
Additionally, during periods of dry weather, discharges of urban runoff and WRP effluent
discharges may at times pass over the dry gap and end up in off channel pools, the Santa
Clara River Estuary, or Ventura County's coastal marine waters for a prolonged period of
more than four days, especially during the winter months were baseflow contributions to
the Santa Clara River are of greater magnitude and are more consistent. Furthermore, 60
even if dry weather urban runoff from the Project pass through the dry gap during non
storm events, the subsurface flow of the Santa Clara River provides hydrological
connectivity between the Santa Clara River reach upstream and downstream of the dry
gap, so it is probable that contaminants from urban runoff and WRP effluent discharges
will end up in the Santa Clara River Estuary and off channel or in channel pools for
longer than four days.

The Water Quality Control Plan for the Los Angeles Region ("Basin Plan") (Los
Angeles Regional Water Quality Control Board, 1994, as amended), designated WARM
(warm freshwater habitat to support warm water ecosystems) and WILD (wild habitat 61
waters that support wildlife habitats) beneficial uses for the Santa Clara River, Santa
Clara River Estuary, and coastal waters at the mouth of the Santa Clara river (see Basin
Plan Chapter 2: Beneficial Uses, Table 2.1 pages 2-6 to 2-8, Table 2.3 page 2-18).

Therefore, the DEIS/DEIR must evaluate the chronic toxicity impacts from the
Project's dry weather and wet weather urban runoff, and effluent discharges from the
WRP on aquatic life, using the criteria set forth under the California Toxics Rule 62
("CTR"). For instance the CTR chronic criteria for copper, lead, and zinc is 9.38
micrograms per liter, 3.16-4.24 micrograms per liter, and 121.7 micrograms per liter
respectively, which would result in lead discharges from urban runoff from the Project
with PDFs violating the CTR.

Additionally, the DEIS/DEIR must evaluate both the acute and chronic toxicity
impacts of the Project to aquatic life in the saline Coastal waters around the mouth of the
Santa Clara River using the salt water acute and chronic toxicity criteria. Furthermore, 63
the DEIS/DEIR must set forth adequate mitigation measures to mitigate these impacts to
a less than significant effect.

F. The DEIS's/DEIR's Projections of the Project's Discharge of Pollutants without PDFs are Inaccurate Representations of Concentrations of Pollutants Commonly Found in Urban Runoff, and thus the DEIS/DEIR's assessment of impacts on water quality are inaccurate and must be revised.

Los Angeles County's ("County's") violations of water quality standards at mass emission stations from urban runoff, as reported in Stormwater Monitoring Reports ("SMRs") submitted in compliance with the Los Angeles County MS4 Permit demonstrate that the DEIR/DEIS projections for the concentration and loading of pollutants from the Project developed without PDFs is critically flawed and severely underestimated. For the ease of reference, a list of the County's violations at the mass emission stations as detailed in its SMRs is included Below in Tables F.1-F.4.[24] These SMRs indicate the Los Angeles County MS4 urban runoff discharges violated water 64
quality standards for: total aluminum, fecal coliform, total copper, total cadmium, total antimony, total cyanide, total zinc, total lead, total silver, sulfate, total dissolved solids, dissolved aluminum, dissolved copper, total boron, pH, chloride, dissolved oxygen, and nitrite. Assuming all of these violations were MS4 runoffs without PDFs or BMPs set forth by the Project, these violations were in excess of all projected concentrations of the discharges set forth by the DEIR/DEIS for urban runoff.

Likewise, National urban runoff stormwater data from the Center of Watershed Protection's study "Impacts of Impervious Cover on Aquatic Ecosystems" ("Center's Study")presented in Tables F.5.-F.7. below[25], demonstrate that the DEIR/DEIS projections for the concentration of pollutants from the Project developed without PDFs is critically flawed and severely underestimated. In comparison to Table F.5. for nation wide mean concentration of pollutants commonly found in stormwater, the DEIR/DEIS severely understates estimates urban runoff concentrations of copper (9.3 micrograms/l), lead (7.4 micrograms/l), (58 micrograms/l), and zinc concentrations from the Project 65
without PDFs, in comparison to the Center's Study which finds the mean concentration for copper to be 13.4 micrograms/l, for lead to be 67.5 micrograms/l, and for zinc to be 162 micrograms/l. Furthermore, in appropriate comparison to Table F.6., for the semi-arid San Diego, CA region with similar geology and rainfall patterns, all of the mean concentrations of the individual pollutants listed (TSS, Total N, Total P, Soluble P, Copper, Lead, Zinc, COD, and BOD) found in the Center's Study for stormwater pollutants during storm events greatly exceed the DEIR/DEIS's projections for the concentration of pollutants from the Project developed without PDFs.[26] Additionally, it is apparent from the findings in the Los Angeles MS4 SMRs above and the Center's Study, 66
the that the DEIR/DEIS failed to analyze the Project's environmental effects from

[24] Also available at http://dpw.lacounty.gov/wmd/NPDES/2007-08tc.cfm, http://dpw.lacounty.gov/wmd/NPDES/2006-07tc.cfm, http://dpw.lacounty.gov/wmd/NPDES/2005-06tc.cfm, and http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/los_angeles_ms4/lams4annualreport.shtml.

[25] National stormwater data are compiled from the Nationwide Urban Runoff Program (NURP), with additional data obtained from the U.S.Geological Survey (USGS), as well as initial stormwater monitoring conducted for EPA's National Pollutant Discharge Elimination System (NPDES) Phase I stormwater program. In most cases, stormwater pollutant data is reported as an event mean concentration (EMC), which represents the average concentration of the pollutant during an entire stormwater runoff event.

[26] DEIR/DEIS Section 4.4-87 to Section 4.4-108

pollutants that are commonly found in stormwater including: total cadmium, total antimony, total cyanide, total silver, sulfate, total boron, pH, and chromium. 66

Therefore, the DEIS/DEIR must revise the projection of the Project's Discharge of concentrations of pollutants for the Project without PDFs to accurately forecast the concentrations of pollutants that realistically will be discharged as urban runoff into the Santa Clara River. This will then allow the DEIS/DEIR to asses the effectiveness of its proposed mitigation measures to mitigate the environmental impacts of the Project pertaining to water quality and aquatic biological resources to a less than significant effect. 67

Table F.1.: Violations of Water Quality Standards Reported in the 2006 – 2007 Storm Water Monitoring Reports

Refer to comment No. 64

Watershed	Constituent	Date	Measurement	Units
SANTA CLARA RIVER	Fecal Coliform	12/9/2006	5,000	MPN/100 ml
	Fecal Coliform	1/30/2007	1,700	MPN/100 ml
	Fecal Coliform	2/19/2007	800	MPN/100 ml
	Fecal Coliform	2/22/2007	5,000	MPN/100 ml
	Total Aluminum	12/9/2006	6,500	µg/L
	Total Aluminum	1/30/2007	3,400	µg/L
	Total Aluminum	2/19/2007	17,800	µg/L
	Total Aluminum	2/22/2007	18,000	µg/L
	Total Copper	12/9/2006	50.3	µg/L
	Total Copper	12/16/2006	28.3	µg/L
	Total Copper	1/30/2007	38.2	µg/L
	Total Copper	2/19/2007	31.9	µg/L
	Total Copper	2/22/2007	50.5	µg/L
	Total Copper	10/31/2006	22.4	µg/L
	Total Copper	4/2/2007	22.1	µg/L
LOS ANGELES RIVER	Fecal Coliform	12/9/2006	240,000	MPN/100 ml
	Fecal Coliform	2/19/2007	22,000	MPN/100 ml
	Fecal Coliform	2/22/2007	17,000	MPN/100 ml
	Fecal Coliform	4/9/2007	2,400	MPN/100 ml
	Total Aluminum	12/9/2006	10,100	µg/L
	Total Aluminum	2/19/2007	5,200	µg/L
	Total Aluminum	2/22/2007	3,240	µg/L
	Total Antimony	12/9/2006	6.91	µg/L
	Total Cadmium	12/9/2006	5.17	µg/L
	Cyanide	11/1/2006	0.05	mg/L
	Cyanide	2/19/2007	0.033	mg/L
	Cyanide	2/22/2007	0.047	mg/L
	Cyanide	4/9/2007	0.044	mg/L
	Total Copper	12/9/2006	424	µg/L
	Total Copper	2/19/2007	76.9	µg/L
	Total Copper	2/22/2007	48.6	µg/L
	Total Copper	11/1/2006	20	µg/L
	Total Copper	4/9/2007	25.8	µg/L
	Total Lead	12/9/2006	240	µg/L
	Total Silver	12/9/2006	3.51	µg/L
	Total Zinc	12/9/2006	2,590	µg/L
	Total Zinc	2/19/2007	198	µg/L
	Total Zinc	2/22/2007	124	µg/L
SAN GABRIEL RIVER	Fecal Coliform	11/1/2006	2,100	MPN/100 ml
	Fecal Coliform	12/9/2006	14,000	MPN/100 ml
	Fecal Coliform	2/19/2007	1,300	MPN/100 ml
	Fecal Coliform	2/22/2007	2,200	MPN/100 ml
	Total Aluminum	12/9/2006	3,450	µg/L
	Total Aluminum	2/10/2007	2,430	µg/L
	Total Aluminum	2/22/2007	1,110	µg/L
	Cyanide	2/19/2007	0.027	mg/L
	Total Copper	12/9/2006	43.2	µg/L
	Total Copper	2/10/2007	32.7	µg/L
	Total Copper	2/19/2007	21.1	µg/L
	Total Copper	2/22/2007	24.5	µg/L
	Total Copper	11/1/2007	32.5	µg/L
	Total Copper	4/2/2007	23.8	µg/L
	Total Zinc	12/9/2006	138	µg/L
MALIBU CREEK	Sulfate	11/1/2006	1,086	mg/L
	Sulfate	12/9/2006	873	mg/L
	Sulfate	4/9/2007	522	mg/L
	Total Dissolved Solids	11/1/2006	2,084	mg/L
	Total Aluminum	12/9/2006	20,100	µg/L
	Total Aluminum	2/19/2007	2,480	µg/L
	Total Aluminum	2/22/2007	3,170	µg/L
	Total Cadmium	12/9/2006	14.9	µg/L
	Total Copper	11/1/2006	20.6	µg/L
	Total Copper	12/9/2006	53.3	µg/L
	Total Copper	2/19/2007	17.6	µg/L
	Total Copper	2/22/2007	22.5	µg/L
	Total Copper	4/9/2007	21.1	µg/L
	Total Zinc	12/9/2006	146	µg/L

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Table F.2.: Violations of Water Quality Standards Reported in the 2005 – 2006 Storm Water Monitoring Reports

Watershed	Constituent	Date	Measurement	Units
SANTA CLARA RIVER	Cyanide	10/17/2005	0.594	mg/L
	Fecal Coliform	10/17/2005	300,000	MPN/100 ml
	Fecal Coliform	12/31/2005	90,000	MPN/100 ml
	Fecal Coliform	1/14/2006	3,000	MPN/100 ml
	Fecal Coliform	2/17/2006	1,300	MPN/100 ml
	Total Aluminum	10/17/2005	3,410	µg/L
	Total Aluminum	12/31/2005	1,530	µg/L
	Total Aluminum	1/14/2006	1,845	µg/L
	Total Aluminum	2/17/2006	3,340	µg/L
	Total Antimony	10/17/2005	1,363	µg/L
	Total Copper	10/17/2005	37.3	µg/L
	Total Copper	4/25/2006	33.5	µg/L
	Total Zinc	10/17/2005	149	µg/L
LOS ANGELES RIVER	Cyanide	1/24/2006	0.04	mg/L
	Cyanide	2/17/2006	0.035	mg/L
	Cyanide	4/25/2006	0.057	mg/L
	Fecal Coliform	10/17/2005	24,000,000	MPN/100 ml
	Fecal Coliform	12/31/2005	50,000	MPN/100 ml
	Fecal Coliform	1/14/2006	2,400	MPN/100 ml
	Fecal Coliform	1/24/2006	500	MPN/100 ml
	Fecal Coliform	2/17/2006	16,000	MPN/100 ml
	Fecal Coliform	4/25/2006	9,000	MPN/100 ml
	Dissolved Copper	1/14/2006	14.6	µg/L
	Total Copper	10/17/2005	51.2	µg/L
	Total Copper	1/14/2006	16.4	µg/L
	Total Copper	2/17/2006	43.8	µg/L
	Total Copper	4/25/2006	19.3	µg/L
	Total Zinc	10/17/2005	249	µg/L
	Total Zinc	1/14/2006	129	µg/L
	Total Zinc	2/17/2006	178	µg/L
SAN GABRIEL RIVER	Fecal Coliform	10/17/2005	16,000,000	MPN/100 ml
	Fecal Coliform	12/31/2005	240,000	MPN/100 ml
	Fecal Coliform	1/14/2006	800	MPN/100 ml
	Fecal Coliform	1/24/2006	3,000	MPN/100 ml
	Total Aluminum	10/17/2005	2,140	µg/L
	Total Copper	10/17/2005	34.5	µg/L
	Total Copper	4/25/2006	17.6	µg/L
	Total Zinc	10/17/2005	175	µg/L
MALIBU CREEK	Sulfate	10/17/2005	658	mg/L
	Sulfate	11/9/2005	749	mg/L
	Sulfate	12/31/2005	573	mg/L
	Sulfate	1/24/2006	589	mg/L
	Sulfate	2/17/2006	507	mg/L
	Total Aluminum	10/17/2005	2,770	µg/L
	Total Copper	10/17/2005	32.6	µg/L
	Total Copper	11/9/2005	73	µg/L
	Total Copper	2/17/2006	15	µg/L
	Total Copper	4/25/2006	14.9	µg/L

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Table F.3. Violations of Water Quality Standards Reported in the 2004 – 2005 Storm Water Monitoring Reports

Watershed	Constituent	Date	Measurement	Units
SANTA CLARA RIVER	Fecal Coliform	10/17/2004	300,000	MPN/100 ml
	Fecal Coliform	10/26/2004	240,000	MPN/100 ml
	Fecal Coliform	1/7/2005	16,000	MPN/100 ml
	Fecal Coliform	3/9/2005	500	MPN/100 ml
	Dissolved Aluminum	1/7/2005	3,680	µg/L
	Total Aluminum	10/26/2004	10,343	µg/L
	Total Aluminum	1/7/2005	19,650	µg/L
	Total Aluminum	3/9/2005	7,500	µg/L
	Total Boron	11/16/2004	1,860	µg/L
	Dissolved Copper	10/26/2004	22.6	µg/L
	Dissolved Copper	1/7/2005	17.2	µg/L
	Total Copper	10/17/2004	15.7	µg/L
	Total Copper	10/26/2004	28	µg/L
	Total Copper	11/16/2004	14.4	µg/L
	Total Copper	1/7/2005	19.5	µg/L
	Total Copper	3/9/2005	18.5	µg/L
LOS ANGELES RIVER	Fecal Coliform	10/17/2004	240,000	MPN/100 ml
	Fecal Coliform	10/26/2004	50,000	MPN/100 ml
	Fecal Coliform	12/5/2004	500,000	MPN/100 ml
	Fecal Coliform	1/7/2005	160,000	MPN/100 ml
	Fecal Coliform	3/17/2005	16,000	MPN/100 ml
	Cyanide	10/26/2004	1.2	mg/L
	Cyanide	11/16/2004	0.055	mg/L
	Cyanide	3/17/2005	0.024	mg/L
	pH	11/16/2004	9.4	
	pH	12/5/2004	6.16	
	Total Aluminum	10/17/2004	1,440	µg/L
	Total Aluminum	10/26/2004	5,768	µg/L
	Total Aluminum	12/5/2004	1,790	µg/L
	Total Aluminum	1/7/2005	2,840	µg/L
	Total Copper	10/17/2004	41.5	µg/L
	Total Copper	10/26/2004	50.6	µg/L
	Total Copper	11/16/2004	25.5	µg/L
	Total Copper	12/5/2004	35.2	µg/L
	Total Copper	1/7/2005	31.1	µg/L
	Total Copper	3/17/2005	14.5	µg/L
	Total Zinc	10/17/2004	135	µg/L
	Total Zinc	10/26/2004	200	µg/L
	Total Zinc	12/5/2004	150	µg/L
SAN GABRIEL RIVER	Fecal Coliform	10/17/2004	140,000	MPN/100 ml
	Fecal Coliform	10/26/2004	17,000	MPN/100 ml
	Fecal Coliform	12/5/2004	90,000	MPN/100 ml
	Fecal Coliform	1/7/2005	2,800	MPN/100 ml
	Chloride	6/21/2005	220	mg/L
	Nitrite	10/17/2004	1.04	mg/L
	Total Aluminum	12/5/2004	1,240	µg/L
	Total Aluminum	1/7/2005	16,100	µg/L
	Total Copper	10/17/2004	22.5	µg/L
	Total Copper	12/5/2004	32.2	µg/L
	Total Copper	1/7/2005	37.9	µg/L
MALIBU CREEK	Sulfate	10/17/2004	838	mg/L
	Sulfate	10/26/2004	519	mg/L
	Sulfate	12/5/2004	515.8	mg/L
	Total Aluminum	1/11/2005	18,100	µg/L
	Total Cadmium	1/11/2005	7.9	µg/L
	Total Copper	10/17/2004	17.3	µg/L
	Total Copper	10/26/2004	15.9	µg/L
	Total Copper	11/16/2004	17.2	µg/L
	Total Copper	12/5/2004	24.2	µg/L
	Total Copper	1/11/2005	38.9	µg/L

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Table F.4. Violations of Water Quality Standards Reported in the 2003 – 2004 Storm Water Monitoring Reports

Watershed	Constituent	Date	Measurement	Units
SANTA CLARA RIVER	Fecal Coliform	10/28/2003	500	MPN/100 ml
	Fecal Coliform	10/31/2003	80,000	MPN/100 ml
	Fecal Coliform	12/25/2003	50,000	MPN/100 ml
	Fecal Coliform	1/1/2004	50,000	MPN/100 ml
	Total Aluminum	12/25/2003	7,800	µg/L
	Total Aluminum	1/1/2004	1,500	µg/L
	Total Copper	10/28/2003	13.50	µg/L
	Total Copper	10/31/2003	30.40	µg/L
	Total Copper	12/25/2003	53.30	µg/L
	Total Zinc	12/25/2003	353	µg/L
LOS ANGELES RIVER	Fecal Coliform	10/28/2003	28,000	MPN/100 ml
	Fecal Coliform	10/31/2003	170,000	MPN/100 ml
	Fecal Coliform	12/25/2003	240,000	MPN/100 ml
	Fecal Coliform	1/1/2004	1,300,000	MPN/100 ml
	Dissolved Oxygen	10/31/2003	2.5	mg/L
	pH	1/1/2004	6.3	
	Total Aluminum	10/31/2003	14,600	µg/L
	Cyanide	10/28/2003	0.057	mg/L
	Cyanide	10/31/2003	0.062	mg/L
	Cyanide	1/13/2004	0.036	mg/L
	Total Cadmium	10/31/2003	4.7	µg/L
	Total Lead	10/31/2003	1,070	µg/L
	Total Copper	10/28/2003	19.9	µg/L
	Total Copper	10/31/2003	295	µg/L
	Total Copper	12/25/2003	20.7	µg/L
	Total Copper	1/1/2004	16.2	µg/L
	Total Zinc	10/31/2003	1,030	µg/L
	Total Zinc	1/13/2004	133	µg/L
SAN GABRIEL RIVER	Fecal Coliform	10/31/2003	500	MPN/100 ml
	Fecal Coliform	12/25/2003	130,000	MPN/100 ml
	Nitrite	10/28/2003	1.93	mg/L
	Cyanide	10/28/2003	0.023	mg/L
MALIBU CREEK	Sulfate	10/28/2003	1,090	mg/L
	Sulfate	12/25/2003	701	mg/L
	Total Dissolved Solids	10/28/2003	2,060	mg/L
	Total Copper	10/28/2003	13.3	µg/L

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Table F.5. (Source: Impacts of Impervious Cover on Aquatic Ecosystems, Center for Watershed Protection, March 2003)

Table 16: National EMCs for Stormwater Pollutants

Pollutant	Source	EMCs		Number of Events
		Mean	Median	
Sediments (mg/l)				
TSS	(1)	78.4	54.5	3047
Nutrients (mg/l)				
Total P	(1)	0.32	0.26	3094
Soluble P	(1)	0.13	0.10	1091
Total N	(1)	2.39	2.00	2016
TKN	(1)	1.73	1.47	2693
Nitrite & Nitrate	(1)	0.66	0.53	2016
Metals (µg/l)				
Copper	(1)	13.4	11.1	1657
Lead	(1)	67.5	50.7	2713
Zinc	(1)	162	129	2234
Cadmium	(1)	0.7	N/R	150
Chromium	(4)	4	7	164
Hydrocarbons (mg/l)				
PAH	(5)	3.5	N/R	N/R
Oil and Grease	(6)	3	N/R	N/R
Bacteria and Pathogens (colonies/ 100ml)				
Fecal Coliform	(7)	15,038	N/R	34
Fecal Streptococci	(7)	35,351	N/R	17
Organic Carbon (mg/l)				
TOC	(11)	17	15.2	19 studies
BOD	(1)	14.1	11.5	1035
COD	(1)	52.8	44.7	2639
MTBE	(8)	N/R	1.6	592
Pesticides (µg/l)				
Diazinon	(10)	N/R	0.025	326
	(2)	N/R	0.55	76
Chlorpyrifos	(10)	N/R	N/R	327
Atrazine	(10)	N/R	0.023	327
Prometon	(10)	N/R	0.031	327
Simazine	(10)	N/R	0.039	327
Chloride (mg/l)				
Chloride	(9)	N/R	397	282

Sources: (1) Smullen and Cave, 1998; (2) Brush et al., 1995; (3) Baird et al., 1996; (4) Bannerman et al., 1996; (5) Rabanal and Grizzard, 1995; (6) Crunkilton et al, 1996; (7) Schueler, 1999; (8) Delzer, 1996; (9) Environment Canada, 2001; (10) USEPA, 1998; (11) CWP, 2001a   N/R - Not Reported

Refer to Comment No. 65

Table F.6. (Source: Impacts of Impervious Cover on Aquatic Ecosystems, Center for Watershed Protection, March 2003)

Table 18: Stormwater Pollutant Event Mean Concentration for Different U.S. Regions (Units: mg/l, except for metals which are in $\mu g/l$)

		Region I - Low Rainfall				Region II - Moderate Rainfall			Region III - High Rainfall				Snow
	National	Phoenix, AZ	San Diego, CA	Boise, ID	Denver, CO	Dallas, TX	Marquette, MI	Austin, TX	MD	Louisville, KY	GA	FL	MN
Reference	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(11)	(12)
Annual Rainfall (in.)	N/A	7.1"	10"	11"	15"	28"	32"	32"	41"	43"	51"	52"	N/R
Number of Events	3000	40	36	15	35	32	12	N/R	107	21	81	N/R	49
Pollutant													
TSS	78.4	227	330	116	242	663	159	190	67	98	258	43	112
Total N	2.39	3.26	4.55	4.13	4.06	2.70	1.87	2.35	N/R	2.37	2.52	1.74	4.30
Total P	0.32	0.41	0.7	0.75	0.65	0.78	0.29	0.32	0.33	0.32	0.33	0.38	0.70
Soluble P	0.13	0.17	0.4	0.47	N/R	N/R	0.04	0.24	N/R	0.21	0.14	0.23	0.18
Copper	14	47	25	34	60	40	22	16	18	15	32	1.4	N/R
Lead	68	72	44	46	250	330	49	38	12.5	60	28	8.5	100
Zinc	162	204	180	342	350	540	111	190	143	190	148	55	N/R
BOD	14.1	109	21	89	N/R	112	15.4	14	14.4	88	14	11	N/R
COD	52.8	239	105	261	227	106	66	98	N/R	38	73	64	112

Sources: Adapted from Caraco, 2000a: [1] Smullen and Cave, 1998; [2] Lopes et al; 1995; [3] Schiff, 1996; [4] Kjelstrom, 1995 (computed); [5] DRCOG, 1983, [6] Brush et al., 1995; [7] Steuer et al., 1997; [8] Barrett et al., 1995; [9] Barr, 1997; [10] Evaldi et al., 1992; [11] Thomas and McClelland, 1995; [12] Oberts, 1994 N/R = Not Reported; N/A = Not Applicable

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Table 19: Mean and Median Nutrient and Sediment Stormwater Concentrations for Residential Land Use Based on Rainfall Regions (Driver, 1988)

Region	Total N (median)	Total P (median)	TSS (mean)
Region I: Low Rainfall	4	0.45	320
Region II: Moderate Rainfall	2.3	0.31	250
Region III: High Rainfall	2.15	0.31	120

Table F.7. (Source: Impacts of Impervious Cover on Aquatic Ecosystems, Center for Watershed Protection, March 2003)

Table 22: EMCs for Total Suspended Solids and Turbidity

Pollutant	EMCs		Number of Events	Source
	Mean	Median		
TSS (mg/l)	78.4	54.5	3047	Smullen and Cave, 1998
	174	113	2000	USEPA, 1983
Turbidity (NTU)	53	N/R	423	Barrett and Malina, 1998

N/R = Not Reported

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III. The DEIR/DEIS cannot be approved under CEQA and NEPA because of its discharge has not been assigned Waste Load Allocations (WLA) and Compliance Schedule under a Regional Board TMDL for pollutants listed on the Clean Water Act (CWA) 303(d) list, which precludes the Regional Board from Granting the Project a Clean Water Act Section 401 Water Quality Certification.

A 401 Water Quality Certification or Issuance of a Waste Discharge Requirement for the DEIS/DEIR would authorize the discharge of pollutants to impaired water bodies from "new sources" or "new dischargers" in violation of the CWA. 40 C.F.R. § 122.4(i) explicitly prohibits discharges from these sources, stating that:

> No permit may be issued:
>
> (i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards … and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the public comment period, that: 68
>
> > (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

(40 C.F.R. § 122.4(i).) Thus, the Regional Board cannot grant a CWA Section 401 Water Quality Certification ("401 Certification") or waste discharge requirement to a new

source or new discharger if runoff or direct discharge from the new discharge adds any pollutant to discharges from the MS4 or adds any pollutant directly to a waterbody that "will cause or contribute to the violation of water quality standards" for a waterbody listed on the CWA 303(d) list as specifically impaired for that pollutant.[27] The only exception to this rule is when a TMDL has been finalized and then approved by the USEPA, and the "new source can demonstrate that, under the TMDL, the plan is designed to bring the waters into compliance with applicable water quality standards." [28]
Therefore, if a TMDL has not been completed and approved by the U.S. EPA for a 68
specified water body and pollutant listed as impaired on the CWA 303(d) list, new discharges that add pollutants that will cause or contribute to the 303(d) impairment violate water quality standards, and thus are absolutely prohibited. Additionally, unless a TMDL explicitly provides that existing discharges into the impaired water body are "subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards," issuance of a permit or water quality certification for the new discharge of the pollutant listed on the CWA 303(d) list as impaired to the 303(d) waterbody listed for that impairment, is also prohibited under 40 C.F.R. § 122.4(i).[29]

Thus, the Regional Board is prohibited from approving a permit or water quality certification that allows new sources or discharges of any pollutant to waterbodies already impaired by that pollutant, unless the permit application or a DEIS/DEIR can
show that an existing TMDL specifically provides sufficient waste load allocations for 69
the discharge, and the TMDL provides a compliance schedule designed to bring the segment into compliance with applicable water quality standards.

As shown in Table III.A below, TMDLs with WLAs and compliance schedules have not been completed or approved for these CWA Section 303(d) List of Water Quality Limited Sections: 1.) Indicator Bacteria on Santa Clara River Estuary Beach-
Surfers Knoll Coastal & Bay Shoreline; 2.) ChemA, Coliform Bacteria, Nitrogen Nitrate, 70
Toxicity, Toxaphene in the Santa Clara River Estuary; 3.) total dissolved solids and toxicity for Santa Clara River Reach 3; and 5.) Chlorodibromomethane, Coliform Bacteria, Dichlorobromomethane, Iron, and Specific Conductivity for Santa Clara River Reach 5.

Table III.A
Los Angeles Regional Water Quality Control Board
2008 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SECTIONS[30]

[27] Friends of Pinto Creek v. U.S. E.P.A., 504 F.3d 1007, 1011 (2007).
[28] *Id.*
[29] *Id*. at 1013.
[30] Available at http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/303d/2008/Revised%20303(d)/Revised_Appendix_F_08July09.pdf

Waterbody Name	Estimated Size Affected	Pollutant	TMDL Requirement Status	Expected TMDL Completion Date	USEPA Approved TMDL
Santa Clara River Estuary Beach-Surfers Knoll Coastal & Bay Shoreline	1 mile	Indicator Bacteria	A	1998	2021
Santa Clara River Estuary	49 Acres	ChemA	A	1998	2019
		Coliform Bacteria	A	1998	2019
		Nitrogen, Nitrate	A	2008	2021
		Toxaphene	A	1998	2019
		Toxicity	A	2008	2019
Santa Clara River Reach 1 (Estuary to Hwy 101 Bridge) River & Stream	10 miles	toxicity	A	2006	2019
Santa Clara River Reach 3 (Freeman Diversion to A Street) River &Stream	31 Miles	**Ammonia**	**B**	**2002**	**2004**
		Chloride	**B**	**2002**	**2002**
		Total Dissolved Solids	A	2002	2023
		Toxicity	A	2008	2021
Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	9.4 Miles	**Chloride**	**B**		**2005**
		Chlorodibromomethane	A	2021	
		Coliform Bacteria	A	2019	
		Dichlorobromomethane	A	2021	
		Iron	A	2021	
		Specific Conductivity	A	2021	

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** TMDL requirement status definitions for listed pollutants are: A= TMDL still required, B= being addressed by USEPA approved TMDL, C= being addressed by action other than a TMDL

*** Dates relate to the TMDL requirement status, so a date for A= TMDL scheduled completion date, B= Date USEPA approved TMDL, and C= Completion date for action other than a TMDL

Urban runoff from dry and wet weather events, sewage effluent from the WRP, and runoff of pesticide contaminated sediment from the Project Construction will discharge from the project either directly to an existing MS4 or directly to the Santa Clara River or one of its tributaries, and because the DEIS/DEIR and comments from VCK's comment letter demonstrates that these discharges will cause or contribute to 71 impairments for Indicator Bacteria, ChemA, Coliform Bacteria, Nitrogen Nitrate, Toxicity, Toxaphene, total dissolved solids, Chlorodibromomethane, Dichlorobromomethane, Iron, and Specific Conductivity from Santa Clara River Reach 5 to the Santa Clara River Estuary and into the Santa Clara River Estuary Beach-Surfers Knoll Coastal & Bay Shoreline, the Regional Board is prohibited from approving a 72 permit or water quality certification for the Project to discharge into an MS4 or discharge directly into the Santa Clara River. Therefore, because the Project as proposed in the DEIR/DEIS cannot meet water quality standards and cannot receive a CWA Section 401 Certification or NPDES discharge permit, the DEIR/DEIS cannot be approved under CEQA and NEPA.

IV. The DEIR/DEIS does not mitigate environmental impacts to water quality and biological resources to a less than significant effect.

A. The Standard Urban Stormwater Mitigation Plan (SUSMP) requirement used in the DEIS/DEIR is inadequate to mitigate the Project's impacts on water quality and aquatic resources to a less than significant level. Instead, substantial 73 evidence indicates that the Project must utilize Low Impact Development (LID) Standards as required by the Ventura County MS4 Permit for all new developments to mitigate the Project's impacts on quality to a less than significant effect. [31]

1.) The Standard Urban Stormwater Mitigation Plan (SUSMP) requirements used in the DEIS/DEIR is inadequate to mitigate the Project's impacts on water quality and aquatic resources to a less than significant level.

Despite ten years of stormwater permit programs with runoff volume control and erosion control measures, significant water quality problems persist in Ventura County.[32] Like the Los Angeles County SMR and nation wide urban stormwater data reports presented in Section II.F. above, in 2006 Ventura County's SMR reports indicate that: [e]levated pollutant concentrations were observed at all monitoring sites during one or more monitored wet weather storm events, and at [specific sites] during one or more dry weather events.[33] As detailed in Section III. Above, Ventura County 74 Waterbodies are impaired for: 1.) Indicator Bacteria on Santa Clara River Estuary Beach-Surfers Knoll Coastal & Bay Shoreline; 2.) ChemA, Coliform Bacteria, Nitrogen Nitrate, Toxicity, Toxaphene in the Santa Clara River Estuary; 3.) total dissolved solids and toxicity for Santa Clara River Reach 3; and 5.) Chlorodibromomethane, Coliform Bacteria, Dichlorobromomethane, Iron, and

[31] Thanks to NRDC and Dr. Richard Horner for their independent research and work conducted during the Ventura County MS4 Permit Hearings that made this section possible.

[32] See Ventura Countywide Stormwater Quality Management Program, Annual Report for Permit Year 6, Reporting Year 12 (October 2006), at 10-4.

[33] *Id*. at 9-3 (emphasis added).

Specific Conductivity for Santa Clara River Reach 5. "Development and urbanization increase pollutant loads," and that "urban development creates new pollution sources as the increased density of human population brings proportionately higher levels of vehicle emissions, vehicle maintenance wastes, municipal sewage waste, pesticides, household hazardous wastes, pet wastes, trash, and other anthropogenic pollutants." (Ventura County MS4 Stormwater Permit Tentative Order, February 24, 2009, at 5.) These conclusions are echoed by the U.S. EPA, which in emphasizing the significant role impervious surfaces found in traditional development play in creating urban runoff that pollutes and degrades out waterways states that:

> "Most stormwater runoff is the result of the man-made hydrologic modifications that normally accompany development. The addition of impervious surfaces, soil compaction, and tree and vegetation removal result in alterations to the movement of water through the environment.
> As interception, evapotranspiration, and infiltration are reduced and 75
> precipitation is converted to overland flow, these modifications affect not only the characteristics of the developed site but also the watershed in which the development is located. Stormwater has been identified as one of the leading sources of pollution for all waterbody types in the United States. Furthermore, the impacts of stormwater pollution are not static; they usually increase with more development and urbanization."[34]

The Los Angeles Regional Water Quality Control Board, in it Ventura County MS4 permit findings adopted May 7, 2009 ("Permit"), details the effect that traditional development and its accompanying impervious surfaces have on waterways by finding that:

> "The increased volume, increased velocity, and discharge duration of storm water runoff from developed areas has the potential to accelerate downstream erosion and impair stream habitat in natural drainages. Studies have demonstrated a direct correlation between the degree of imperviousness of an area and the degradation of its receiving waters.[35] Significant declines in the biological integrity and physical habitat of streams and other receiving waters have been found to occur with as little as 3-10 percent conversion from natural to impervious surfaces in a subwatershed. Percentage impervious cover is a one indicator and predictor of potential water quality degradation expected from new development. (Permit at Finding B.12.)

[34] U.S. Environmental Protection Agency (December 2007) *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, at v.

[35] *(Managing Runoff to Protect Natural Streams: The Latest Development on Investigation and Management of Hydromodification in California; Stein, E. et aI, December 2005; Effect of Increase in Peak Flows and Imperviousness on the Morphology of Southern California Streams; Coleman, D., April 2005)*

The Regional Board's ("Permit") also details how the impervious surfaces accompanying traditional development alter the natural flow of water and increases pollutant loading in runoff by stating that:

> "Development and urbanization increase pollutant loads, volume, and discharge velocity. First, natural vegetated pervious ground cover is converted to impervious surfaces (paved) such as highways, streets, rooftops and parking lots. Natural vegetated soil can both absorb rainwater and remove pollutants providing an effective natural purification process. In contrast, impervious surfaces (such as pavement and concrete) can neither absorb water nor remove pollutants, and thus the natural purification 76
> characteristics are lost. Second, urban development creates new pollution sources as the increased density of human population brings proportionately higher levels of vehicle emissions, vehicle maintenance wastes, municipal sewage waste, pesticides, household hazardous wastes, pet wastes, trash, and other anthropogenic pollutants. Development and urbanization especially threaten environmentally sensitive areas. Such areas have a much lower capacity to withstand pollutant shocks than might be acceptable in the general circumstance. In essence, development that is ordinarily insignificant in its impact on the environment may become significant in a particularly sensitive environment. These environmentally sensitive areas (ESAs) designated by the State in the Ventura County watershed are defined in Part 7 (Definitions)." (Permit at Finding B.16.)

Thus, as detailed by the Regional Board, when there is a 3%-10% conversion of natural surfaces to impervious surfaces in a subwatershed, as allowed under the SUSMP requirements, significant declines in the biological integrity, water quality, and physical habitat of streams and other receiving waters have been found to occur. In comparison to the SUSMP BMPs set forth in the DEIS/DEIR, LID as set forth in the Ventura County MS4 Permit[36] will result in substantial pollutant loading 77
reductions, increased onsite water supply, and less hyrdromodification and landscape erosion problems. Dr. Richard Horner, in his study on contract with NRDC for Ventura County MS4 permit work, demonstrated in his Ventura County-based study that using basic "treat-and release" BMPs (e.g., drain inlet filters, CDS units), for instance, would result in pollutant loading reductions of between 0% and 46%, whereas LID techniques would create reductions mostly in the 97% to 99% range.[37]

[36] Ventura County MS4 Permit, May 7, 2009, Part 4 pg 61-83.

[37] Dr. Richard Horner, INVESTIGATION OF THE FEASIBILITY AND BENEFITS OF LOW-IMPACT SITE DESIGN PRACTICES ("LID") FOR VENTURA COUNTY at 12 and 16.

2.) Substantial evidence indicates that the Project must utilize Low Impact Development (LID) Standards as required by the Ventura County MS4 Permit[38] for all new developments to mitigate the Project's impacts on quality to a less than significant effect.

LID stormwater management practices are designed to capture and retain (*i.e.*,
not discharge) stormwater runoff through infiltrating water into the soil, vaporizing it
to the atmosphere via evaporation and transpiration from vegetation, and harvesting
stormwater to put to a beneficial use such as irrigation or gray water supply.[39] By
retaining water onsite, LID attempts to restore natural conditions and results in
drastically less polluted runoff compared to conventional BMPs. LID practices can 78
reduce site runoff volume and pollutant loading to zero in many typical rainfall
scenarios. Even treating stormwater with the best-performing conventional BMPs is
much less effective than using LID practices to retain water with a low numeric
requirement for Effective Impervious Area ("EIA").[40]

Dr. Horner's study, Investigation of the Feasibility and Benefits of Low-Impact
Site Design Practices ("LID") for Ventura County, presented extensive discussion of the
viability of, and need for, a strict EIA standard to protect water quality in Ventura
County. In particular, Dr. Horner found that, in nearly all case studies, "all storm water
discharges could be eliminated at least under most meteorological conditions by
dispersing runoff from impervious surfaces to pervious areas."[41] He also found that 79
"effective Impervious Area (EIA) can practicably be capped at three percent, a standard
more protective than that proposed in the draft permit," and concluded that such a
standard is warranted: "[i]n order to protect the biological habitat, physical integrity, and
other beneficial uses of the water bodies in Ventura County, effective impervious area
should be capped at no more than three percent."[42]

Many sources of information bolster Dr. Horner's conclusion and provide more
than substantial evidence for the need for LID and an EIA standard of 3%-5% to protect
the ecological integrity of rivers and streams (See, e.g. Center for Watershed Protection
(March 2003) Impacts of Impervious Cover on Aquatic Systems; Southern California 80
Coastal Water Research Project (December 2005) Managing Runoff to Protect Natural
Streams: The Latest Developments on Investigation and Management of
Hydromodification in California, at i ("Physical degradation of stream channels . . . in the
semi-arid portions of California appears to occur between 3% and 5% impervious
cover."). Additionally, a recent EPA report noted that "LID approaches can be used to

[38] Ventura County MS4 Permit, May 7, 2009, Part 4 pg 61-83.
[39] See Letter from Richard Horner to Regional Board (April 10, 2009), at Attachment A-1 ("Horner April 10 Letter").
[40] Id, at 1. Horner April 10 Letter, at 1.
[41] Dr. Horner, Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County, at 15
[42] *Id*. at 1. Horner April 10 Letter, at 1.

reduce the impacts of *development and redevelopment* activities on water resources."[43] Similarly, a study completed for the State Water Board found that retention-based standards for LID implementation (like the 5% EIA limitation) are "appropriate models" 81
for urbanized areas where most projects will involve redevelopment.[44] The study went even further in recommending LID retrofits as "a critical need" for existing development.[45]

Further, many government agencies in California and around the U.S. have come to the same conclusions about the need for LID. The California Ocean Protection Council, recommends that, "Regulated development projects shall reduce the percentage of effective impervious area to less than five percent of total project area by draining stormwater into landscaped, pervious areas."[46] The Ocean Protection Council also strongly endorsed LID last year by "resolv[ing] to promote the policy that new developments and redevelopments should be designed consistent with LID principles" because "LID is a practicable and superior approach . . . to minimize and mitigate increases in runoff and runoff pollutants and the resulting impacts on downstream uses, 82
coastal resources and communities."[47] In Washington State, the Pollution Control Hearings Board has found that LID techniques are technologically and economically feasible and must, therefore, be required in MS4 permits.[48] The National Academy of Sciences recently issued a comprehensive report with the same recommendation for stormwater management programs: "Municipal permittees would be required under general state regulations to make [LID] techniques top priorities for implementation in approving new developments and redevelopments, to be used unless they are formally and convincingly demonstrated to be infeasible."[49]

[43] EPA cost savings report at p.2.
[44] State Board review of LID policies (LID Ctr) at pp.22-23.
[45] Id at p.23.
[46] Ocean Protection Council of California (January 2008) State and Local Policies Encouraging or Requiring Low Impact Development in California, at 27. The report found that "the importance of imperviousness cannot be under-stated and is well known as an indicator of watershed health . . . limiting effective impervious surface coverage on individual sites has emerged as the preferred regulatory instrument for limiting the effects of impervious surfaces." (Id. at 6.)

[47] California Ocean Protection Council (May 15, 2008) *Resolution of the California Ocean Protection Council Regarding Low Impact Development,* at 2.

[48] *Puget Soundkeeper Alliance et al. v. State of Washington, Dept. of Ecology et al.* (2008) Pollution Control Hearings Board, State of Washington, No. 07-021, 07-026, 07-027, 07-028, 07-029, 07-030, 07-037, Phase I Final, at 6, 46, 57-58.

[49] National Academy of Sciences, Committee on Reducing Stormwater Discharge Contributions to Water Pollution, National Research Council (2008) *Urban Stormwater Management in the United States,* at 500.

Additionally, the feasibility of onsite retention standards, like the Ventura County MS4 Permit's EIA limitation, has been recognized in other jurisdictions within California and throughout the country. The widespread implementation of onsite retention standards (several of which are more stringent than the Permit's provisions) to reduce polluted stormwater runoff indicates the broad feasibility of such standards. The following jurisdictions provide examples of standards similar to those in the Permit:

1. **Anacostia, Washington, D.C.:** Retain onsite the first one inch of rainfall and provide water quality treatment for rainfall up to the two-year storm volume;[50]

2. **Central Coast, California (RWQCB, Phase II):** Limit EIA at development projects to no more than 5% of total project area (interim 83
criteria); establish an EIA limitation between 3% and 10% in local stormwater management plans (permanent criteria);[51]

3. **Federal Buildings over 5,000 square feet** (under EPA's draft guidance for implementation of the Energy Independence and Security Act of 2007): Manage onsite (*i.e.*, prevent the offsite discharge of) the 95th percentile storm through infiltration, harvesting, and/or evapotranspiration;[52]

4. **Pennsylvania:** Capture at least the first two inches of rainfall from all impervious surfaces and retain onsite at least the first one inch of runoff (through reuse, evaporation, transpiration, and/or infiltration); at least 0.5 inch must be infiltrated;[53]

5. **Philadephia, PA:** Infiltrate the first one inch of rainfall from all impervious surfaces; if onsite infiltration is infeasible, the same performance must be achieved offsite; and[54]

[50] Anacostia Waterfront Corporation (June 1, 2007) Final Environmental Standards, at 16; See also, State Water Resources Control Board (December 2007) A Review of Low Impact Development Policies: Removing Institutional Barriers to Adoption, at 20-21.

[51] Central Coast Regional Water Quality Control Board, Letter from Roger Briggs re Notification to Traditional, Small MS4s on Process for Enrolling under the State's General NPDES Permit for Storm Water Discharges (Feb. 15, 2008) ("Central Coast Phase II Letter").

[52] See, NRDC and Heal the Bay Letter to Regional Board (April 10, 2009) at XX

[53] Pennsylvania Department of Environmental Protection (December 30, 2006) Pennsylvania Stormwater Best Management Practices Manual, Chapter 3, at 7.

[54] City of Philadelphia, Philadelphia Stormwater Regulations § 600.5; City of Philadelphia (2006) Philadelphia Stormwater Management Guidance Manual: Version 2.0, at 1-1, Appendix F.4.1.

6. **West Virginia:** Retain onsite the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation.[55] 83

Additionally, LID is economically feasible. A study analyzed one existing redevelopment site that had implemented LID, and not only was such implementation 84 possible, but the authors found that "[t]he LID option produced a better return on initial investment, as measured by improvements to water quality, than did investments in conventional controls."[56]

3.) The LID Standard Provides Significant Benefits Over Conventional BMPs and the SUSMP requirements in the DEIS

The Ventura Study and other documents and studies contained in the record detail the substantial benefits that LID and the imposition of an EIA standard provide in comparison to conventional BMPs. As noted in Dr. Horner's Ventura Study: [B]y retaining water from the site to meet a 3% EIA standard, LID practices result in drastically less polluted runoff compared to conventional BMPs (reducing site runoff volume and pollutant loading to zero in many typical rainfall scenarios). Even treating stormwater with the best-performing conventional BMPs is much less effective than using LID practices to retain water with a strong numeric requirement like 3% EIA.[57] Thus, Dr. Horner concluded, applying LID 85 in the Ventura permit approach is "feasible and practicable … [for] maintaining the natural hydrology of land being developed," and "a lower EIA [limitation] is a feasible and practicable way to eliminate the discharge of pollutants that could cause or contribute to violations of water quality standards."[58] Importantly, this conclusion is based on a site's ability to retain its *total* annual rainfall volume, as opposed to merely retaining the 85th percentile storm, as the Ventura MS4 Permit requires.

This ample evidence in the record demonstrates that The Standard Urban Stormwater Mitigation Plan (SUSMP) requirement used in the DEIS/DEIR is inadequate to mitigate the Project's impacts on water quality and aquatic resources to a less than significant level. Instead, substantial evidence indicates that the Project must utilize Low 86 Impact Development (LID) Standards as required by the Ventura County MS4 Permit for all new developments to mitigate the Project's impacts on quality to a less than significant effect.

[55] State of West Virginia (June 22, 2009) Department of Environmental Protection, Division of Water and Waste Management, General National Pollution Discharge Elimination System Water Pollution Control Permit, NPDES Permit No. WV0116025, at 13-14 ("West Virginia Permit").

[56] Cite to ECONorthwest study at 14.
[57] Horner April 10 Letter, at 1.
[58] Dr. Horner, Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County, at 15.

B. **The DEIR/DEIS does not provided for adequate mitigation measures to ensure Sediments from Construction and the contaminants that adhere to them do not have a significant effect on the water quality and aquatic life of the Santa Clara River.**

Because the Project proposes to displace and discharge roughly 19.9 million cubic yards going into the river, adequate mitigations measures need to be implemented above and beyond the basic BMP practices set forth in the NPDES General Stormwater Permit to ensure impacts to water quality and aquatic resources are mitigated to a less than significant effect. 87

C. **The DEIR/DEIS does not provided for adequate mititgation measures to ensure the Projects's PDFs or BMPs are maintained an monitored in perpetuity.**

Oversight of the Project's proposed water quality BMPs by homeowner associations is not sufficient to ensure BMP maintenance because there is no regulatory oversight to ensure maintenance in perpetuity. Therefore the maintenance of BMPs must be the developer's responsibility or the homeowners and or their associations should be mandated to sign legal contracts with government entities mandating them to perform necessary BMP maintenance, monitoring, and reporting. 88

V. The DEIR/DEIS excludes an environmentally superior alternative to the project as a whole that would eliminate or reduce significant impacts to water quality and biological resources, attain project's basic objectives, and that are potentially feasible under CEQA and NEPA.

To implement the policy of reducing significant environmental impacts, CEQA requires that an EIR identify both feasible mitigation measures and feasible alternatives that could avoid or substantially lessen the project's significant environmental effects. Pub Res C §§21002, 21002.1(a), 21100(b)(4), 21150. As discussed in IV.A. above the LID Standards for new development in the MS4 Permit should analyzed as a project wide alternative because it is an environmentally superior alternative to the project as a whole, it substantially reduce the probability of the Project's urban discharges having a significant impacts to water quality and biological resources, it would attain project's basic objectives, and it is potentially feasible under CEQA and NEPA because its economically feasible. 89

VI. The DEIS/DEIR Must use the LID mitigation measures required by the Ventura County MS4 Permit, because the Project will discharge urban runoff into the portion of the Santa Clara River just east of the Los Angeles County – Ventura County Boundary, and thus Ventura County residents and Santa Clara River biological resources will be effected by water quality pollution from the Project. 90

VII. Because the Salt Creek Portion of the "Project" lies in part in Ventura County and the other portions of the "Project" lie in Los Angeles County, the Ventura County MS4 requirements for LID must be required under CEQA and NEPA for the "Project" because they are necessary to mitigate the "Project's" impact to water quality to a less than significant effect. 91

Thank you for considering our comments. Please feel free to contact us with any questions.

Sincerely,

Jason Weiner, M.E.M
Associate Director & Staff Attorney
Ventura Coastkeeper

From: Jason Weiner <jweiner.venturacoastkeeper@wishtoyo.org>
To: NEWHALLRANCH@dfg.ca.gov; Aaron.O.Allen@usace.army.mil
Date: Tue, Aug 25, 2009 5:01 PM
Subject: Ventura Coastkeeper Comments

Please confirm receipt. Thanks and best regards, Jason Weiner

--
Jason A. Weiner
Associate Director & Staff Attorney
Ventura Coastkeeper

3875-A Telegraph Road, #423
Ventura, CA 93003

Office: (805) 658-1120
Cell: (805) 823-3301
Fax: (805) 258- 5135
jweiner.venturacoastkeeper@wishtoyo.org

-----Original Message-----
From: jweiner.venturacoastkeeper@gmail.com
[mailto:jweiner.venturacoastkeeper@gmail.com] On Behalf Of Jason Weiner
Sent: Tuesday, August 25, 2009 5:01 PM
To: Allen, Aaron O SPL; newhallranch@dfg.ca.gov
Subject: Ventura Coastkeeper Comments

Please confirm receipt. Thanks and best regards, Jason Weiner

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To whom it may concern:

Attached are the attachments accompanying VCK's comment letter that did not go through with the first email. Please confirm receipt at your earliest convenience.

Thanks and best regards,

Jason

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jweiner.venturacoastkeeper@wishtoyo.org> wrote:

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>
> --
> Jason A. Weiner
> Associate Director & Staff Attorney
> Ventura Coastkeeper
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>
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>

--
Jason A. Weiner
Associate Director & Staff Attorney
Ventura Coastkeeper

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Ventura, CA 93003

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To: Aaron.O.Allen@usace.army.mil; NEWHALLRANCH@dfg.ca.gov
Date: Tue, Aug 25, 2009 11:58 PM
Subject: Ventura Coastkeeper - Final Submittal

To Whom it May Concern:

Attached is Ventura Coastkeeper's final submission of its DEIS/DEIR comment letter with all attachments in accordance with the August 25th email deadline. Please kindly confirm upon receipt.

Thanks and best of regards,

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-----Original Message-----
From: Heather Wylie via YouSendIt [mailto:delivery@yousendit.com]
Sent: Tuesday, August 25, 2009 7:17 PM
To: Allen, Aaron O SPL
Subject: Newhall Ranch Commet Letter Appendix (large file)

<http://www.yousendit.com/en/images/email_topleft.gif>
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youSENDit <http://www.yousendit.com>
Priority Delivery
<http://www.yousendit.com/en/images/email_topright.gif>
This is the complete appendix to the SCOPE-VCK-Friends of the Santa Clara River letter.
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File will remain active for: 14 days

Link to file:
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Table 4.4-32 below shows the estimated changes in stormwater runoff volume and mean annual loads for the modeled pollutants of concern for the VCC planning area. **Table 4.4-33** below shows the estimated changes in concentration in stormwater runoff for the VCC planning area.

Table 4.4-32
Estimated Average Annual Runoff Volume and Pollutant Loads for the VCC Project

Parameter	Units	Existing Conditions	Developed Conditions w/out PDFs	Developed Conditions w/ PDFs	Change w/ PDFs
Volume	acre-ft	51	241	192	141
TSS	tons/yr	12.2	21	9.6	-2.6
Total Phosphorus	lbs/yr	68	234	186	118
Nitrate-N + Nitrite-N	lbs/yr	220	411	231	11
Ammonia-N	lbs/yr	81	576	464	383
Total Nitrogen	lbs/yr	564	2,226	1,068	504
Dissolved Copper	lbs/yr	2.0	7.0	3.6	1.6
Total Lead	lbs/yr	1.3	6.1	2.5	1.2
Dissolved Zinc	lbs/yr	26	97	30	4
Total Aluminum	lbs/yr	173	1,181	582	409
Chloride	tons/yr	1	14	11	10

Source: Geosyntec, 2008

Table 4.4-33
Estimated Average Annual Pollutant Concentrations for the VCC Project

Parameter	Units	Existing Conditions	Developed Conditions w/out PDFs	Developed Conditions w/ PDFs	Change w/ PDFs
TSS	mg/L	175	65	37	-138
Total Phosphorus	mg/L	0.49	0.4	0.36	-0.13
Nitrate-N + Nitrite-N	mg/L	1.5	0.6	0.4	-1.1
Ammonia-N	mg/L	0.58	0.9	0.89	0.31
Total Nitrogen	mg/L	4.0	3.4	2.0	-2.0
Dissolved Copper	µg/L	14	11	7	-7
Total Lead	µg/L	9.5	9.3	4.9	-4.6
Dissolved Zinc	µg/L	189	148	57	-132
Total Aluminum	µg/L	1,241	1,804	1,114	-127
Chloride	mg/L	20	43	43	23

Source: Geosyntec, 2008.

Pharmaceuticals in the Environment

The Secure Medicine Return Bill (HB 1165 / SB 5279) will create a producer-provided medicine return program that is convenient, safe and secure for residents throughout the state. Prescription and over-the-counter medicines will be collected and disposed using the safest technology currently available to help prevent accidental poisonings, drug misuse, and environmental contamination. This background document provides brief summaries and references about detection of pharmaceuticals in our environment and potential impacts on aquatic species and ecosystems.

How Pharmaceuticals get into the Environment

Medicines have been found in small amounts in our streams, groundwater and marine waterways. Medicines enter our environment in two ways:
1. Excretion from our bodies: Humans and animals pass drugs or drug metabolites through their bodies and then these chemicals pass through septic systems or wastewater treatment plants.
2. Direct disposal to sewers or landfills: Medicines can enter the environment when flushed down toilets or sinks or thrown into the garbage. They can pass through septic systems and through wastewater treatment plants.

No one knows exactly how much of the medicines in our environment come from each of these two pathways. We do know that a significant amount of medicines go unused. Unwanted waste medicines can be prevented from entering the environment through collection and safe disposal provided by pharmaceutical take-back-programs. Preventative programs are far more economical than wastewater treatment or cleanup.

Detection of Pharmaceuticals in the Environment

Numerous environmental studies document the presence of pharmaceuticals in surface water, ground water, soils, sediments, and marine waters. These studies predominantly conclude that pharmaceuticals are present wherever wastewater has been discharged. Conventional wastewater treatment systems do not do a good job of removing or destroying pharmaceuticals. No single treatment process will completely remove all of the thousands of different pharmaceutical compounds. The presence of pharmaceuticals in the environment depends upon their individual chemical structure and the frequency of their use. Some sampling studies are listed below.

- A water quality assessment of the Columbia River in 2004-2005 detected a number of pharmaceutical compounds including: acetaminophen, diphenhydramine (a widely used antihistamine), and trimethoprim (an antibiotic).
  Morace, J.L. 2006. Water-Quality Data, Columbia River Estuary, 2004-05. Data Series. U.S. Department of the Interior, U.S. Geological Survey http://pubs.usgs.gov/ds/2006/213/pdf/lcrep_data.pdf
- A recent study of sediment contaminants in the lower Columbia Basin conducted by USGS detected a number of pharmaceutical compounds including: trimethoprim, thiabendazole, diphenhydramine, diltiazem, venlafaxine, fluoxetine, citalopram and carbamazapine at

"There's no doubt about it, pharmaceuticals are being detected in the environment and there is genuine concern that these compounds, in the small concentrations that they're at, could be causing impacts to human health or to aquatic organisms."
Mary Buzby, director of environmental technology for Merck & Co. Inc, *in USA Today, March 10, 2008. "AP: Drugs found in drinking water". Online at: http://www.usatoday.com/news/nation/2008-03-10-drugs-tap-water_N.htm*

concentrations ranging from 2 to 150 ng/g sediment. Additionally, codeine, dehydronifedipine, miconazole, azithromycin and cimetidine were detected at or below the level of the lowest standard (~0.4 and 28 ng/g sediment). The highest frequency of detection for these compounds was found in the tributaries.

Nilsen, E., R. Rosenbauer, E. Furlong,M. Burkhardt, S. Werner, L. Greaser, M. Noriega. USGS. 2007. Pharmaceuticals and personal care products detected in streambed sediments of the lower Columbia River and selected tributaries. http://www.csc.noaa.gov/cz/2007/Coastal_Zone_07_Proceedings/PDFs/Tuesday_Abstracts/0000.Nilsen.pdf and http://or.water.usgs.gov/proj/Emerging_contaminants/PPCP_Poster2.pdf

- A 2004 study in the Sequim-Dungeness region of the Olympic Peninsula detected medicines in effluent from tertiary wastewater treatment plants, including: acetaminophen, codeine, metformin (a diabetes medicine), sulfamethoxazole (an antibiotic), salbutamol (albuterol), carbamazepine (anticonvulsant and bipolar disorder treatment), ranitidine (Zantac), estrone (hormone replacement therapy), trimethoprim (antibiotic), and ketoprofen (NSAID). Metformin was also found in groundwater and wells.

  Johnson, A, B Carey, and S Golding, 2004, *Results of a Screening Analysis for Pharmaceuticals in Wastewater Treatment Plant Effluents, Wells and Creeks in the Sequim-Dungeness Area.* http://www.ecy.wa.gov/biblio/0403051.html, accessed 12/30/08.

- A King County study that evaluated select endocrine disrupting compounds in surface waters detected the hormones ethynylestradiol (birth control pills) and estradiol (a natural estrogen also used in hormone replacement therapy) in some lakes and streams in King County. At some sites, measured levels of these compounds were detected within the range of levels found to cause effects on aquatic species from laboratory studies.

  King County. 2007. *Survey of Endocrine Disruptors in King County Surface Waters. Prepared by Richard Jack and Deb Lester*. Water and Land Resources Division. Seattle; WA. http://your.kingcounty.gov/dnrp/library/2007/kcr1976.pdf, accessed 01/19/09.

- A nationwide survey conducted by the USGS in 1999 studied 139 streams in 30 states for 95 organic wastewater compounds, including some pharmaceuticals. At least 1 medicine was detected in 80% of the sites surveyed. Acetaminophen was found in 23.8% of streams tested, the antibiotic trimethoprim was found in 27.4% of streams tested, codeine was found in 10.6% of streams tested. Concentrations of pharmaceuticals were generally low.

  Kolpin, D.W., et al., 2002, *Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000*, Environ. Sci. Technol. 36:1202-1211. Abstract available online at: http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2002/36/i06/abs/es011055j.html, accessed 08/25/08. *See also:* http://toxics.usgs.gov/regional/emc/streams.html

- In a 2006 USGS study, scientists detected 12 of the 22 pharmaceuticals evaluated in a Colorado watershed including: diltiazem, cotinine, and sulfamethoxazole, ranitidine, codeine, diltiazem.

  Barber LB, Murphy SF, Verplanck PL, Sanstrom MW, Taylor HE, and Furlong ET. 2006. *Chemical Loading into Surface Water along a Hydrological, Biogeochemical, and Land Use Gradient: A Holistic Watershed Approach*. Environ. Sci. Tech.. 40(2): 475-486

- A study conducted by NOAA in the Chesapeake Bay detected a number of pharmaceutical compounds and associated metabolites in surface waters including: carbamazepine, erythromycin-HO (an antibiotic degradate), trimethoprim (antibiotic), sulfamethoxazole, diltiazem (antianginal medication), fluoxetine (antidepressant) and acetaminophen.

  Pait, S, R Warner, SI Hartwell, JO Nelson, PA Pacheco, and AL Mason. 2006. Human Use Pharmaceuticals in the Estuarine Environment: A Survey of the Chesapeake Bay, Biscayne Bay and Gulf of the Farallones. NOAA Technical Memorandum NOS NCCOS 7. http://www.ccma.nos.noaa.gov/publications/HumanUsePharma.pdf

- Ground water samples from a landfill site in Oklahoma were analyzed by USGS for pharmaceuticals and other organic waste water contaminants (OWCs). Five sites, four of which are located downgradient of the landfill, were sampled and analyzed for 76 OWCs. OWCs were detected in water samples from all of the sites sampled, with 22 of the 76 OWCs being detected at least once including an antibiotic and a nonprescription drug. Because the landfill was established in the 1920s and closed in 1985, many compounds detected in the leachate plume were likely disposed of decades ago. These results indicate the potential for long-term persistence and transport of some OWCs in ground water.

Barnes, K.K., Christenson, S.C., Kolpin, D.W., Focazio, M.J., Furlong, E.T., Zaugg, S.D., Meyer, M.T., and Barber, L.B. (2004). "Pharmaceuticals and other organic waste water contaminants within a leachate plume downgradient of a municipal landfill." Groundwater Monitoring & Remediation 24(2): 119-126.

- A Florida landfill received waste in 1968 and 1969 from two large naval aviation bases. Although permitted to accept only solid waste, physical evidence suggested it could have received waste from a local hospital. Samples taken from groundwater and drinking water wells located 300 meters from the landfill in 1991 confirmed pentobarbital contamination at 1 ppb. Finding trace amounts of pentobarbital 21 years after the landfill closed and 300 meters from the landfill site, demonstrates the persistence of the pharmaceutical.

  Eckel, William, et al. (1993) Pentobarbital found in Ground Water, Ground Water, Vol. 31, Issue 5, pp 801-804.

- Robinson *et al*. provide a useful overview of the detection of pharmaceuticals in the environment, emerging information on impacts, and potential mitigation methods – which they suggest include consumer take-back programs for medicines.

  Robinson, I, Junqua, G, Van Coillie, R, Thomas, O. 2007. *Trends in the detection of pharmaceutical products, and their impact and mitigation in water and wastewater in North America.* Anal. Bioanal. Chem. 387:1143-1151.

Detection of Pharmaceuticals in Drinking Water

Public drinking water supplies are not commonly tested for pharmaceuticals. Sampling in other states has found widespread presence in public drinking water at very low levels. Conventional wastewater treatment systems cannot remove or destroy all pharmaceuticals, so water supplies which are downstream of wastewater treatment discharges from other municipalities may be impacted.

- A 2008 Associated Press story published the results of a nationwide study that found medicines in the drinking water of 24 major metropolitan areas serving 41 million Americans. Some frequently detected compounds were atenolol (heart medication), carbamazepine (mood-stabilizer), gemfibrozil (anti-cholesterol), meprobamate (tranquilizer), naproxen (pain-killer), phenytoin (anti-seizure medication), sulfamethoxazole and trimethoprinm (antibiotics).
- Seattle's drinking water supply tested negative for pharmaceuticals because it is drawn from an uninhabited, pristine watershed. This result is expected for any water supply which is protected from human activities.

  "*AP Probe Finds Drugs in Drinking Water*", Seattle Times, March 12, 2008. Available online at: http://seattletimes.nwsource.com/html/nationworld/2004271213_appharmawateri.html, accessed 08/25/08.

  "*AP: Drugs found in drinking water*", USA Today, March 10, 2008. Available online at: http://www.usatoday.com/news/nation/2008-03-10-drugs-tap-water_N.htm, accessed 11/30/08.

  "*Report: Drugs in drinking water of more Americans*:, USA Today, September 12, 2008. Available online at: http://www.usatoday.com/news/health/2008-09-12-drugs-water_N.htm, accessed 11/30/08.

  JAMA review article**:** *Traces of Drugs Found in Drinking Water: Health Effects Unknown, Safer Disposal Urged*. Bridget M. Kuehn *JAMA*. 2008;299 (17):2011-2013 (doi:10.1001/jama.299.17.2011)

Detection of Pharmaceuticals in Fish Tissue

Pharmaceuticals are also being detected in tissue of fish collected from streams.

- EPA completed the first phase of a pilot study to evaluate pharmaceuticals and personal care products (PPCPs) in fish tissue in 2008. Sampling locations were in AZ, FL, IL, NM, PA, and TX. Seven of the 24 pharmaceuticals analyzed were detected in fish tissue and included diphenylhydramine, norfluoxetine sertraline, fluoxetine (antidepressants), carbamazepine, diltiazem and gemfibrozil.

  EPA Pilot Study of PPCPs in Fish Tissue. 2008. http://www.epa.gov/waterscience/ppcp/files/fish-pilot.pdf
- Antidepressants and their associated metabolites were found in fish in Texas streams. Fluoxetine and sertraline and the SSRI metabolites norfluoxetine and desmethylsertraline were detected at levels greater than 0.1 ng/g in all tissues examined.

  Brooks BW, Chambliss CK, Stanley JK, Ramirez A, Banks KE, Johnson RD, Lewis RJ. 2005. Determination of select antidepressants in fish from an effluent dominated stream. Environ. Toxicol. Chem. 24:464-469.

Studies on Environmental Impacts of Pharmaceuticals

The environmental concentrations of pharmaceuticals are typically low; less than the recommended therapeutic doses for humans. Studies are emerging that suggest exposure to some medicines, or combinations of medicines, in surface waters are sufficient to impact aquatic organisms or ecosystems. Some studies are listed below.

- In a Boulder, Colorado study, the sex ratios of fish upstream from a wastewater treatment plant were 47% female to 53% male, while the ratios of those downstream from the plant were 83 % female to 17 % male. Researchers speculate this disturbance could be associated with endocrine-disrupting compounds, including a synthetic estrogen, found in the treatment plant effluent.

  Woodling, J. D, EM Lopez, TA Maldonado, DO Norris and AM Vajda. 2006, *Intersex and other reproductive disruption of fish in wastewater effluent dominated Colorado streams*, Comp. Biochem. Physiol.. Part C 144 (2006) 10 – 15.
- In another study, researchers exposed western mosquitofish to fluoxetine, the active ingredient in Prozac, at concentrations similar to those detected in surface waters. They observed increased lethargy enough to indicate behavior changes.

  Henry, TB, Black, MC, 2008, *Acute and Chronic Toxicity of Fluoxetine (Selective Serotonin Reuptake Inhibitor) in Western Mosquitofish.* Arch Environ. Contam. Toxicol 43:325-330. Available online at DOI 10.1007/s00244-007.9018-0.
- Another study found potential reduction in aquatic plant growth due to antibiotic exposure. Members of the fluoroquinolone, sulfonamide, and tetracycline classes of antibiotics displayed significant phytotoxicity.

  Brain, RA, DJ Johnson, SM Richards, H Sanderson, PK Sibley, KR Solomon. 2004. Effects of 25 pharmaceutical compounds to *Lemna gibba* using a seven-day static-renewal test. Environ. Toxicol. Chem.. 23(2): 371-82.

MT and HT. Phytoplankton increased in abundance and decreased in diversity (number of taxa)

Johnson, LL, DP Lomaxa, MS Myers, OP Olsona, SY Sola, S M O'Neill, J West and TK Collier 2008. Xenoestrogen exposure and effects in English sole (Parophrys vetulus) from Puget Sound, WA. Aquat. Toxicol. 88:29-38

- Changes in reproductive behavior have been found in male bluehead wrasse exposed to fluoxetine, the active ingredient in Prozac. Exposed fish were not able to compete as effectively as those not exposed.

  Perreault, H, K Semsar, J Godwin. 2003. *Fluoxetine treatment decreases territorial aggression in a coral reef fish.* Physiol. Behav. 79:719-724.

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behavioral effect concentrations were 10^4 to 10^7 times lower than previously reported Lowest

- Effect of the lipid regulatory drug gemfibrozil (GEM) was examined in goldfish over 96 hours by measuring GEM in blood plasma. A decrease in plasma testosterone by over 50% in fish from all treatments was observed. Results demonstrate that exposure to environmental levels of GEM leads to bioconcentration of the drug in plasma and the potential for endocrine disruption in fish.

  Mimeault C, Woodhouse AJ, Miao XS, Metcalfe CD, Moon TW, Trudeau VL. (2005). "The human lipid regulator, gemfibrozil bioconcentrates and reduces testosterone in the goldfish, *Carassius auratus*." Aquat. Toxicol. 73: 44-54.

  Porsbring, T, H Blanck, H Tjellström and T Backhaus. 2008. Toxicity of the pharmaceutical clotrimazole to marine microalgal communities. Aquatic Toxicology 2008 Nov 12. [Epub ahead of print]

- A 7-year, whole lake experiment at the Experimental Lakes Area in northwestern Ontario, Canada showed that chronic exposure of fathead minnow (Pimephales promelas) to low concentrations (5–6 ng/L) of the potent 17-ethynylestradiol led to feminization of males, impacts on gonadal development as evidenced by intersex in males and altered oogenesis in females, and, ultimately, a near extinction of this species from the lake. These observations demonstrate that the concentrations of estrogens and their mimics observed in freshwaters can impact the sustainability of wild fish populations.

  Kidd KA, Blanchfield PJ, Mills KH, Palace VP, Evans RE, Lazorchak JM, Flick RW.2007..Collapse of a fish population after exposure to a synthetic estrogen. Proc. Nat. Acad. Sci. 104: 8897-8901.

Potential Human Health Impacts

Scientists do not yet know the full extent and magnitude of the effects of these chemical compounds on human health. The concentrations of pharmaceuticals in the environment are low and are not likely to be an immediate human health threat. There is limited information available about the potential long-term health effects. Most pharmaceuticals degrade in the environment, but have a quality of pseudo-persistence due to the continual release of these contaminants via use, excretion, and disposal.

- One study found some cause for concern about the exposure of pregnant women and their fetuses to drinking water containing very small amounts of chemotherapy drugs.

  Johnson, A.C. T Ternes, RJ Williams, and JP Sumpterl. 2008. *Do cytotoxic chemotherapy drugs discharged into rivers pose a risk to the environment and human health? An overview and UK case study*. Jrnl. Hydrol. 348:167-175.

- Another study looked at the effect of environmentally relevant levels of a mixture of 13 drugs on human cell function. Human embryonic cells were exposed to a mixture of atenolol, bezafibrate, carbamazepine, cyclophosphamide, ciprofloxacin, furosemide, hydrochlorothiazide, ibuprofen, lincomycin, ofloxacin, ranitidine, salbutamol, and sulfamethoxazole. The drug mix inhibited the growth of human embryonic cells, with the highest effect observed as a 30% decrease in cell proliferation compared to controls. Results suggest that a mixture of drugs at ng/L levels can inhibit cell proliferation by affecting their physiology and morphology. This also suggests that water-borne pharmaceuticals can be potential effectors on aquatic life.

Pomati, F, S Castiglioni, E Zuccato, R Fanelli, D Vigetti, C Rossetti and D Calamari. 2006. Effects of a Complex Mixture of Therapeutic Drugs at Environmental Levels on Human Embryonic Cells. Environ. Sci. Technol. 40:2442-2447.

Pharmaceuticals and Puget Sound

- The Puget Sound Partnership's Action Agenda, December 2008, calls for **implementation of pharmaceutical take-back programs** under its strategy "C.1 Prevent pollutants from being introduced into the Puget Sound ecosystem to decrease the loadings from toxics, nutrients, and pathogens."
  See page 49 of the Action Agenda, December 2008, http://www.psp.wa.gov/downloads/ACTION_AGENDA_2008/Action_Agenda.pdf.
- The Puget Sound Partnership's Water Quality Discussion Paper also states "We know enough from the research conducted with English sole to have concerns about the potential for unintended consequences associated with the levels of EDCs [endocrine disrupting compounds] in wastewater and nonpoint pathways to the Sound. Efforts to reduce EDCs and other pharmaceuticals may have the potential for significant pollutant reduction prior to more costly investments in enhanced wastewater treatment systems."
  Original study: Johnson. LL DP Lomaxa, MS Myers, OP Olsona, SY Sola, S M O'Neill, J West and TK Collier 2008. . Xenoestrogen exposure and effects in English sole (*Parophrys vetulus*) from Puget Sound,WA. Aquat. Toxicol. 88:29-38
- The Washington State Department of Ecology also states on its web site: "In addition, pharmaceutical use in the general population is growing, so more unwanted drugs are generated creating increased environmental concerns." and "The treatment methods that most POTWs use fail to remove these pharmaceutical compounds from either the wastewater or the biosolids. Therefore pharmaceutical compounds pass through the treatment plant into the receiving waters or remain in the biosolids that are land applied across the state, which has a potential impact on human health and the environment."
  http://www.ecy.wa.gov/programs/hwtr/pharmaceuticals/pages/faqs.html

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Compiled 2/1/09 from literature research conducted by members of the Medicine Return Project in Washington www.medicinereturn.com, and by researchers at King County's Department of Natural Resources & Parks and Washington State Department of Ecology's Environmental Assessment Program.

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Staff Report

Los Angeles Region Integrated Report

Clean Water Act Section 305(b) Report and Section 303(d) List of Impaired Waters

2008 Update

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

Revised July 2009

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Regional Board staff appreciate the assistance given by Peter Kozelka of the United States Environmental Protection Agency and the State Water Resources Control Board Integrated Report Staff.

1 Executive Summary

This Integrated Report provides the recommendations of the staff of the California Regional Water Quality Control Board, Los Angeles Region (Los Angeles Water Board) for changes to the Clean Water Act (CWA) Section 303(d) list of impaired waterbodies and provides a draft Clean Water Act Section 305(b) report (Integrated Report). The Integrated Report includes both the list of impaired waterbodies and identified waters which are known to be meeting beneficial uses within the Los Angeles Region.

The Introduction to this Integrated Report provides the context and purpose and an overview of the approach and describes the public process that will be used for adoption of the changes to the 303(d) list and finalization of the Integrated Report. The remainder of the report describes data sources used, the objectives and criteria against which data were compared, the methodology for comparing the available data to the criteria to assess attainment of water quality standards and determine potential 303(d) listings and the methodology used to categorize waterbody segments according to beneficial use support for the 305(b) report. Results are briefly summarized and discussed following descriptions of the methodology.

Recommendations are shown in detail in the appendices. Appendix A shows the public solicitation letters requesting that the public submit any and all available data to support the assessment of water quality in the Region. Appendices B through E provide lists of waterbodies in Integrated Report categories of beneficial use support. Appendix F presents a list of all impairments by waterbody including those waterbodies in Integrated Report categories 4 and 5 (appendices D and E) which is the list referred to as the 303(d) list. Appendix G presents "fact sheets" for each waterbody-pollutant combination that was analyzed for the proposed 303(d) listing decisions. These fact sheets include at least one "Line of Evidence" describing the data and information used as a basis for each proposed decision. Appendix H presents fact sheets for other miscellaneous changes to the 303(d) list. Appendix I provides citations for all of the references used in developing the Integrated Report.

There are 68 proposed new 303(d) listings in 41 waterbodies and 30 proposed de-listings in 19 waterbodies on the Los Angeles Region 303(d) list.

Additions of new impaired waterbodies to the list ('listings') or deletions of no longer impaired waterbodies from the list ('delistings') were constrained by availability of water quality data. Many waterbodies in the Region are not sampled on a regular basis. In addition, identification of waterbodies which are not impaired by pollutants and meet all beneficial uses has also been driven by availability of data.

Regional Board staff reviewed all data available to determine impairment or the absence of impairment but staff focused on developing listing or delisting decisions and factsheets for the update and did not usually develop do-not-list or do-not-delist decisions and factsheets as these decisions would not alter the final 303(d) list.

The Los Angeles Region Integrated Report and updated 303(d) list included in this staff report is being circulated for public comments. Written comments received before June 17, 2009 will be responded to in writing. The reports and the response to comments will then be brought before the Los Angeles Water Board at a public hearing for potential approval. Public testimony will also be heard at the public hearing. After approval by the Los Angeles Water Board, the Integrated Report, including the updated 303(d) list, will be submitted to the State Water Resources Control Board (State Board) for approval along with the other Region's reports. The full State Integrated Report will then be submitted to the USEPA for approval and will then be final.

2 Introduction

The purpose of this report is to identify those surface waters in the Los Angeles Region which are impaired by pollutants or conditions which prevent them from meeting beneficial uses and to identify those waterbodies which data show are meeting beneficial uses.

An important requirement of the Clean Water Act is to identify those waters which are polluted, not meeting established standards and not supporting the uses expected of those waterbodies. With identification is the recognition of the need for action. Appropriate action after identifying a polluted waterbody is generally the development of a Total Maximum Daily Load (TMDL) but, in some cases, may also include permitting actions or prohibiting discharges to the waterbody, taking cleanup actions, or restoration projects.

2.1 Regulatory Process

The Clean Water Act (CWA) requires each State to assess the status of water quality in the State (Section 305(b)), and provide a list of impaired water bodies (Section 303(d)) to the U.S. Environmental Protection Agency (U.S. EPA) every two years. For water quality limited segments included on the 303(d) list, the state is required to develop a Total Maximum Daily Load (TMDL)or take other action to address the impairment.

The last review and update of the State's 303(d) list occurred in 2006. That review was conducted by the State Water Resources Control Board using the State Board's *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List* (Listing Policy) (SWRCB 2004) developed in 2004. The 2006 update was the first review and update to use that policy.

For the 2008 update, each Regional Water Board is conducting their own reviews of new and previous water quality data and updating the assessment and list of impaired waterbodies according to the Listing Policy.

This staff report presents this Regional Board's assessment of the current status of water quality in the Los Angeles Region for water bodies with readily available data, and identifies the methods and data used to evaluate the water quality. This report proposes additions, deletions, and changes to the 2006 303(d) list. The water quality assessments also result in the identification of water bodies where water quality standards are met or where not enough information is available to accurately assess water quality.

Certain sections of the Integrated Report require public review and approval by the Regional Board and then approval by the State Board. These sections, or categories, are the lists of water quality limited segments whether being addressed by a TMDL or action other than a TMDL or not yet being addressed (Category lists 4 and 5, the 303(d) list). The other sections of the Integrated Report, which are waters supporting beneficial uses and waters with insufficient data (Categories lists 1, 2, and 3), are provided as information and do not require Board action.

After approval by the Los Angeles Water Board, the Integrated Report will be submitted to the State Water Resources Control Board for approval along with the other Region's reports. The results of the water quality assessments will be compiled with other Regional Board reports into a statewide integrated report referred to as the 303(d)/305(b) Integrated Report by the State Board. The statewide list of all the water quality limited segments will require final approval by the USEPA. The US EPA then compiles these assessments into their biennial "National Water Quality Inventory Report" to Congress.

3 Development of the Integrated Report

3.1 Data solicitation

Federal regulation [(40 CFR § 130.7(b)(5)] states that "Each State shall assemble and evaluate all existing and readily available water quality-related data and information" when developing the 303(d) list. On December 4, 2006, Water Board staff solicited the public to submit any and all water quality data to be considered in preparation of the 2008 303(d) list and 305(b) report. This solicitation established a data submittal deadline of February 28, 2007. On January 30, 2007, staff transmitted a notice clarifying that there were no limits on the type or format of data and information that the public could provide to the Water Boards for their assessment. The notices provided to the public can be found in Appendix A of this report.

The Regional Board received 17 submissions in response to the data solicitation. In addition, staff assembled all other available data. Larger databases considered included:

- National Pollutant Discharge Elimination System (NPDES) permitting data from major NPDES discharges. These data included data collected under the Municipal Separate Storm Sewer System (MS4) NPDES permits.

- Surface Water Ambient Monitoring Program (SWAMP) data. SWAMP is a statewide monitoring effort, administered by the State Water Board, designed to assess the conditions of surface waters throughout the state of California. Monitoring is conducted in SWAMP through the Department of Fish and Game and Regional Boards monitoring contracts.

- Southern California Bight Regional Monitoring (Bight) data. The Southern California Water Research Project (SCCWRP) coordinates the efforts of many participating organization to conduct the Coastal Ecology component of the Bight regional monitoring effort. These surveys seek to determine the spatial extent of contaminant accumulation in marine sediments and assess the effects of this contamination on living marine resources. Coastal Ecology regional monitoring is conducted every five years. More than 60 organizations have participated as partners in the Coastal Ecology portion of SCCWRP's Bight regional monitoring efforts.

3.2 Listing Policy and Evaluation Criteria

The proposed 2008 303(d) list of impaired water bodies in the Los Angeles Region was developed in accordance with the Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Board Listing Policy) and the Functional Equivalent Document, both adopted by the State Water Resources Control Board in September 2004. The Listing Policy establishes a standardized approach for developing California's section 303(d) list. It outlines an approach that provides the rules for making listing decisions based upon different types of data and establishes a systematic framework for statistical analysis of water quality data.

The Listing Policy also establishes requirements for data quality, data quantity, and administration of the listing process. Decision rules for listing and delisting are provided for: chemical-specific water quality standards; bacterial water quality standards; health advisories; bioaccumulation of chemicals in aquatic life tissues; nuisances such as trash, odor, and foam; nutrients; water and sediment toxicity; adverse biological response; and degradation of aquatic life populations and communities. The listing policy specifies the frequency of exceedance of applicable water quality objectives that is necessary to make a determination that the water is impaired.

Listing and delisting decisions were made in accordance with the listing policy, using all applicable narrative and numeric water quality criteria contained in the Los Angeles Region Basin Plan and in the California and National Toxic Rules.

3.3 Standards Used in the Analysis

Beneficial Uses:
The beneficial uses for waters in the Los Angeles Region are identified in the Los Angeles Regional Water Quality Control Plan (Basin Plan). For consistency with other Regions in California and other States, six "core" beneficial uses were assessed. The designated beneficial uses in the Basin Plans fit within these six "core" beneficial uses categories, which are:

1. Aquatic Life Support
2. Drinking Water Supply
3. Fish Consumption
4. Secondary Contact
5. Shell fishing, and
6. Swimming.

Water Quality Objectives, Criteria and Guidelines:
The water quality objectives and criteria used in the assessments were from existing and available State Policy and Plans and included the following:

- Water Quality Control Plan, Los Angeles Region (Basin Plan)
- Statewide Water Quality Control Plans (e.g., the California Ocean Plan)
- California Toxics Rule (40 CFR 131.38)
- Maximum Contaminant Levels in California Code of Regulations, Title 22.

Narrative water quality objectives were evaluated using evaluation guidelines as allowed by the Listing Policy. When evaluating narrative water quality objectives, staff identified evaluation guidelines that represented standards attainment or beneficial use protection. Depending on the beneficial use and narrative standard, the following were used in the selection of evaluation guidelines:

1. Sediment Quality Guidelines for Marine, Estuarine, and Freshwater Sediments: When applying narrative water or sediment quality criteria, staff used guidelines developed by the U.S. EPA and other government agencies together with findings published in the scientific peer-reviewed literature to interpret data and evaluate the water quality conditions. Sediment quality guidelines published in the peer-reviewed literature or developed by state or federal agencies were used. Acceptable guidelines included selected values (e.g., effects range-median, probable effects level, probable effects concentration), and other sediment quality guidelines. Only those sediment guidelines that were predictive of sediment toxicity were used (i.e., those guidelines that have been shown in published studies to be predictive of sediment toxicity in 50 percent or more of the samples analyzed).

2. Evaluation Guidelines for Protection from the Consumption of Fish and Shellfish: Evaluation guidelines published by USEPA or OEHHA were used.

3. Evaluation Guidelines for Protection of Aquatic Life from Bioaccumulation of Toxic Substances: Evaluation values for the protection of aquatic life published by the National Academy of Science were used.

The State Listing Policy and the use of the same water quality objectives criteria and guidelines ensure that all Regions develop listing or delisting decisions in a consistent manner. Below are three pollutant categories which require some Los Angeles Region-specific elaboration

3.3.1 Indicator bacteria

For indicator bacteria listing decisions, the Los Angeles Region followed the State Listing Policy but used a Los Angeles Region-specific exceedance day approach as outlined below.

Previous iterations of the Los Angeles Region's 303(d) list included impairments for "total coliform," "enterococcus," "viruses (enteric)," "coliform," "beach closures," "swimming restrictions," "high coliform count," "bacteria indicators," and "fecal coliform." In this update, Regional Board staff have begun to categorize these impairments all as "indicator bacteria."

"Indicator bacteria" impairments can include impairments due to any sewage or fecal matter bacterial indicator including total coliform, fecal coliform, *E. coli*, and *enterococcus*.

In this update, Regional Board staff have calculated the frequency of exceedances of standards for indicator bacteria using a exceedance day approach.

Basin Plan
The Los Angeles Region Basin Plan lists bacteria water quality objectives to protect the water contact recreation and non-contact water recreation beneficial uses in marine and fresh water. The marine water objectives for bacteria are also mirrored in the State Water Resources Control Board's Water Quality Control Plan for Ocean Waters of California (Ocean Plan).

Regional Board Resolution **2002-022,** effective on July 15, 2003, to the Basin Plan included Implementation Provisions for Water Contact Recreation Bacteria Objectives which allow a reference system approach. In part, below

> *...In the context of a TMDL, the Regional Board may implement the single sample objectives in fresh and marine waters by using a 'reference system/antidegradation approach' or 'natural sources exclusion approach' as discussed below. ...*
>
> *Under the reference system/antidegradation implementation procedure, a certain frequency of exceedance of the single sample objectives above shall be permitted on the basis of the observed exceedance frequency in the selected reference system or the targeted water body, whichever is less. The reference system/anti-degradation approach ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system.*

Bacterial TMDLs and exceedance days in the Los Angeles Region
All bacterial TMDLs developed in the Los Angeles Region have used the reference system approach and have calculated the number of exceedance days at the reference system to define the reference condition. These TMDLs include the Santa Monica Bay Beaches Dry Weather Bacteria TMDL (effective 2003), the Santa Monica Bay Beaches Wet Weather

Bacteria TMDL (effective 2003), Marina Del Rey Back Basins Bacteria TMDL (effective 2004), Los Angeles Harbor Inner Cabrillo Beach and Main Ship Channel Bacteria TMDL (effective 2005), the Malibu Creek and Lagoon Bacteria TMDL (effective 2006), the Ballona Creek Bacteria TMDL (effective 2007), and the Harbor Beaches of Ventura County (Channel Islands Harbor Beaches) Bacteria TMDL (effective 2008).

With an exceedance day method, all appropriate bacterial indicators (i.e. marine or fresh water indicators) are evaluated in one analysis to determine if the waterbody is impaired as opposed to evaluating each bacterial indicator separately and then considering those two or three evaluations to determine if the waterbody is impaired.

To calculate the number of exceedance days, the number of days during a defined period during which one or more indicator bacteria exceeds the standard is an exceedance day. For example, at a freshwater, REC-1 site, a day in which *E. coli* exceeds the standard is one exceedance day, a day in which Fecal Coliform exceeds the standard is one exceedance day and a day in which *both E. coli* and Fecal Coliform exceeds the standard is also one exceedance day.

Calculating exceedance days for all applicable indicators may be in some instances a more conservative approach (i.e. more likely to find a waterbody to be impaired) than a straight indicator by indicator approach and therefore is more protective of human health.

The Listing Policy has specific listing factors for bacterial data from coastal beaches. Section 3.3 and of the Listing Policy discuss methodology for listing water bodies. For *listing* coastal beaches, "if water quality monitoring was conducted April 1 through October 31 only, a four percent exceedance percentage shall be used" (SWRCB, 2004). The 4% exceedance percentage applies to the null hypothesis for the binomial distribution formula at the bottom of Table 3.2. Section 4.3 of the Listing Policy discuss methodology for *delisting* water bodies and does not specifically describe the use of more stringent exceedance percentage for coastal beach water quality monitoring conducted April 1 through October 31 only, though one is inferred. A 19% exceedance percentage was used for water quality monitoring conducted April 1 through October 31 only when assessing delisting status. The 19% exceedance percentage applies to the null hypothesis for the binomial distribution formula at the bottom of Table 4.2. Therefore, for coastal beach datasets in which both year-round monitoring was conducted following by subsequent monitoring from April 1 to October 31 (e.g., year-round from 2000 to 2002 and April 1 to October 31 from 2003 to 2005), the datasets were evaluated in two parts due to differing exceedance percentages for assessing listing and delisting status.

Regional Board staff followed the Listing Policy methodology and exceedance percentages and calculated exceedance days by both single sample exceedances and geometric mean exceedances.

a. Single Sample

The Basin Plan lists four single sample limits for marine waters and two for fresh water. If samples tested for indicator bacteria exceed any of the indicator bacteria limits, a "single sample exceedance day" for indicator bacteria was designated.

b. Geometric Means

The Basin Plan lists three geometric mean bacteria limits for marine waters and two for fresh water. Receiving water data was evaluated based on these numeric limits and the exceedance day approach in a similar manner to single samples. As such, a calendar month approach as opposed to a rolling 30 day sample approach was used to assess geometric mean to maintain sample independence. Two or more samples were used per calendar month for calculating geometric means.

3.3.2 Invasive species

In this update, Regional Board staff propose new listings for invasive species.

Several other Region's 303 (d) lists include listings for "exotic species," which were made in recent listing updates. In the Los Angeles Region there is one listing for "exotic vegetation," a listing made prior to 1998.

Table 3-1 Listings for exotic species in the State 2006 303(d)

	Region	Number of listings	listing	notes
1	North Coast	1	exotic species	european green crab
2	San Francisco Bay	12	exotic species	ballast water
5	Central Valley	10	exotic species	source unknown
4	Los Angeles	1	exotic vegetation	Ballona Creek

For this listing update, Regional Board staff are proposing listings for "invasive species" as opposed to exotic species" Staff prefer not listing for "exotics" or "non-native" because not all exotic or non-native species are invasive or cause loss of beneficial uses and may even support beneficial uses. For example, the Department of Fish and Game has regulations to protect certain non-native species (e.g. striped bass) and mosquito fish are "non-native" but are used as a biological control by most mosquito abatement districts. In fact, in this listing update, The State Board is re-naming the "exotic species" listings as "invasive species" listings to reflect this.

Invasive species is defined as: an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. This definition is taken from United States Executive Order 13112 of February 3, 1999 on Invasive Species (USA, 1999).

However, there are still several issues inherent in listing for such a non-traditional pollutant.

> 1) While certain "biological materials" have been considered pollutants, populations of animals have not been traditionally considered "pollutants." Section 502(6) of the Clean Water Act defines "pollutants" to include "biological materials…*discharged into water*". The courts have interpreted the term "biological materials" to include "invasive" species that might be found in ballast water which is discharged. It is not clear that these Clean Water Act definitions and court interpretations would apply equally to invasive or non-native species that are already established (i.e. non-native species whose populations are not sustained or increased by ongoing discharges) as they would to invasive species that are continuing to be discharged.
>
> 2) Standards have not been written explicitly for invasives.
>
> 3) A 303(d) listing would trigger an obligation by the Regional Board to develop a program to address the "invasive" species impairment. It would be a significant challenge to develop the regulatory program to regulate a population of an established invasive species.

In this 2008 update, Regional Board staff have recommended the new listing of Malibu Creek, Medea Creek, Lindero Creek and Las Virgenes Creek in the Malibu Creek watershed and Solstice Canyon Creek in the Santa Monica Bay watershed as impaired for invasive species, specifically the New Zealand mudsnail. Factsheets for these decisions are included in Appendix G.

Cold Creek, and Triunfo Creek also have mudsnails but are not recommended for listing at this time. Factsheets for these decisions are included in Appendix G.

New Zealand mudsnails, *Potamopyrgus antipodarum,* are tiny (3-5 mm), highly invasive aquatic snails. From the Santa Monica Bay Restoration Commission/Santa Monica Baykeeper (2009):

> *In large numbers, these small snails can completely cover a stream bed and wreak havoc on local stream ecosystems. Several studies have documented NZMS [New Zealand Mud Snail] densities in streams at more than 500,000 organisms per square meter. These massive colonies simply outcompete native aquatic invertebrates that the watershed's fish and amphibians rely on for food, disrupting the entire food web. NZMS are easily transported from stream-to-stream by hitchhiking, they attach themselves to shoes (especially waders), equipment (fishing gear, bicycle tires), animals (native and non-native), and even boats. Anything that contacts a stream infested by NZMS will likely become contaminated. New Zealand mudsnails were discovered in Idaho in the mid-1980s, and have since spread to every western state except New Mexico. NZMS were first identified in benthic macroinvertebrate (BMI) samples*

> *collected in the Malibu Creek watershed in May 2005. Unfortunately, the Malibu Creek watershed samples containing NZMS were not identified until May 2006. NZMS pose a significant danger to streams throughout the Santa Monica Mountains and threaten the many efforts at habitat restoration and protection, particularly those to restore populations of the endangered steelhead trout in this region.*

The data available for mudsnails was evaluated by the State Listing Policy, Section 3.10, Trends in Water Quality, using the narrative toxicity standard in the Basin Plan as the criteria. This approach is similar to the approach taken by State Board for listing "exotic species" during the 2006 listing update and is in accordance with the Listing Policy.

For mudsnails in the Los Angeles Region specifically, a waterbody is proposed to be included on the 303(d) list as impaired for invasive species if a negative trend in water quality has been demonstrated and the Aquatic Life Support core beneficial use was not supported. Staff considered a reach to be demonstrating a negative trend in water quality if at least one site in the waterbody exhibited an increase in density of mudsnails (with at least a three years sampled). Staff considered the core beneficial use of Aquatic Life Support not to be supported if at least one site exhibited a medium or high density of mudsnails.

3.3.3 **Biostimulatory Substances- possible future impairment determinations**

In this Integrated Report and 303(d) list update, Regional Board staff have continued to determine impairments and list and de-list decisions for nitrogen compounds as in the past based on Basin Plan nitrogen compound objectives. The Basin Plan contains a specific nitrogen (nitrate nitrite) water quality objective, which is established at 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen. This objective is specifically set to protect drinking water beneficial uses and is consistent with the California Department Public Health nitrate drinking water standard.

This nitrogen water quality objective does not protect waterbodies from impairments related to biostimulatory substances and eutrophication. However, Basin Plan also contains a narrative standard for biostimulatory substances and the Regional Board recognizes the need for a clear approach for determinations of impairment under the biostimulatory substances standard in the Basin Plan.

Previous iterations of the Los Angeles Region's 303(d) list have recognized the need to determine impairment based on biostimulatory substances and eutrophication and have included impairments for 'low DO/org. enrichment,' 'algae,' 'nutrient/(algae),' 'odors, scum,' 'Eutroph,' and 'unnatural scum/foam.' In future updates, Regional Board staff is considering categorizing these impairments all as 'biostimulatory substances' using a Los Angeles Region specific, nutrient concentration/biological response method as described below. In this 2008 list update, however, no "biostimulatory substances" impairments have been included.

The biostimulatory substances water quality objective in the Basin Plan addresses water quality impairments related to nutrient enrichment (eutrophication). The Basin Plan identifies biostimulatory substances as 'nitrogen, phosphorus and other compounds that stimulate growth'. The water quality objective states:

> *Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.*

Eutrophication and nutrient enrichment problems rank as the most widespread water quality problems nationwide; for example, more lake acres are affected by nutrients than any other pollutant or stressor (EPA 2000). Eutrophication is defined by increased nutrient loading to a waterbody and the resulting increased growth of phytoplankton and other aquatic plants. Additionally, other parameters such as decreased dissolved oxygen and water clarity can also indicate eutrophic conditions. Phosphorus and nitrogen are recognized as key nutrients for the growth of phytoplankton, algae, and aquatic plants and are responsible for the eutrophication of surface waters.

A waterbody's biological response to nutrient loading is often what actually impairs beneficial uses. For example, increased nitrogen and phosphorus loading can lead to harmful algal blooms, which impair the beneficial uses of the waterbody. Therefore, it is useful to evaluate potential biostimulatory substance impairments in terms of both nutrient concentrations and biological response indicators. Key biological response indicators include the following:

Low Dissolved Oxygen (DO)
Dramatic Diurnal Variations in DO
Increased pH
Decreased Water Clarity
Increased Chlorophyll a Concentration
Increase Macro and/or Benthic Algal Biomass
Unpleasant Odors, Taste and/or Aesthetics

By evaluating both nutrient concentrations and biological response indicators together, a more direct linkage is made between water quality conditions and beneficial use impairments. This approach provides a more robust water quality assessment.

The Los Angeles Regional Water Board is considering including waterbodies on the State's 303(d) list of impaired waterbodies for biostimulatory substances when both nutrient concentrations and one or more biological response indicators are at levels which characterize eutrophic conditions and/or beneficial uses of the waterbody are impaired.

However, there are many nutrient and biological response indicator criteria that may be reviewed and applied for the purposes of placing a waterbody on the State's 303(d) list. Table 3.1 and 3.2 below present various nutrient concentrations and associated biological response indicator criteria limits. These criteria are being considered by the Regional Board to assess the biostimulatory substances water quality objective. The sources of these criteria include EPA Nutrient Criteria Technical Guidance Manual, EPA Ambient Water Quality Criteria Recommendations Nutrient Ecoregion III, and California Nutrient Numeric Endpoints. The Regional Board intends to solicit stakeholder comments regarding the criteria presented below for development of the guidelines to be used for listing in future updates of the 303(d) list.

Table 3-2 Rivers and Streams: Nutrient Concentration and Biological Response Indicators Criteria Limits

Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Benthic Algal Biomass (mg/m^2)	Percent Cover	pH	Dissolved Oxygen (mg/L)	Source
Potential Criteria to assess Biostimulatory Substances Water Quality Objective						
Rivers and Streams						
0.65	0.09	150	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA National Nutrient Criteria Technical Guidance
0.37	0.022	43.9	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA Nutrient Criteria Recommendations Ecoregion III
0.5	0.03	none	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA Nutrient Criteria Recommendations Ecoregion III: Sub -Ecoregion 6 - Southern and Central CA
0.06	0.002	150	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	Nutrient Numeric Endpoints - Malibu Creek Case Study
0.23	0.02	WARM 150 COLD 100	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	Nutrient Numeric Endpoints - SWRCB Nutrient Screening tools for 303(d) Listing
< 0.295 as SIN*	< 0.026 as SRP**	120	Floating 30% Benthic 60%	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	New Zealand Periphyton Guideline. Barry Biggs, June 2000

*Soluble Inorganic Nitrogen (SIN). **Soluble Reactive Phosphorus (SRP)
Basin Plan Water Quality Objectives are applied for pH and dissolved oxygen

Table 3-3 Lakes: Nutrient Concentration and Biological Response Indicators Criteria Limits

Potential Criteria to assess Biostimulatory Substances Water Quality Objective						
Lakes						
Total Nitrogen (mg/L)	**Total Phosphorus (mg/L)**	**Chlorophyll a (ug/L)**	**Secchi Depth (m)**	**pH**	**Dissolved Oxygen (mg/L)**	**Source**
1	0.1	14	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA National Nutrient Criteria Technical Guidance
0.4	0.017	3.5	2.8	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA Nutrient Criteria Recommendations Ecoregion III
0.51	0.172	24.6	1.9	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	EPA Nutrient Criteria Recommendations Ecoregion III: Sub - Ecoregion 6 - Southern and Central CA
0.84	0.05	20	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	Nutrient Numeric Endpoints - Malibu Creek Case Study
1.2 (summer mean)	0.1 (summer mean)	WARM 10 COLD 5	none	Shall not be < 6.5 or > 8.5 or change 0.5 units from ambient condition due to waste discharge	WARM ≥5 COLD ≥ 6 COLD & SPWN ≥ 7	Nutrient Numeric Endpoints - SWRCB Nutrient Screening tools for 303(d) Listing
Basin Plan Water Quality Objectives are applied for pH and dissolved oxygen						

3.4 Data Analysis

Water Board staff evaluated the submitted data and additional data in accordance with the Listing Policy, taking into account data quality and spatial and temporal representativeness.

LOEs. A determination that a waterbody is impaired by a particular pollutant was dependent on one or more Lines of Evidence (LOE). A Line of Evidence is the specific information for a single pollutant from a single data source in a waterbody. The LOE includes the beneficial use(s) impacted; the pollutant name(s) pertaining to that water segment and data; the water quality objective (WQO), criterion (WQC) or guideline used to assess the data; detailed information specific to that data; how the data was assessed including the type of data, the total number of samples assessed and those samples that exceeded the WQO, WQC or guideline; where and when the data was collected.

Factsheets. The factsheet includes all LOEs developed for a certain pollutant waterbody combination and the resulting listing or delisting decision.

All available data was reviewed by staff. Analyses were documented in Lines of Evidence, factsheets and listing or delisting decisions according to established priorities. All high priority factsheets were completed.

Los Angeles Region Factsheet Development Priorities

1. High Priority

a. factsheets (decision: *list*) for waterbody/pollutant combinations not on the 2006 303(d) list where an examination of the data indicate standards were not met. This factsheet may refer to more than one core beneficial use.

b. factsheets (decision: *de-list*) for waterbody/pollutant combinations on the 2006 303(d) list where an examination of the data indicate standards were met.

c. factsheets (decision: *a core use is being supported*) for waterbody/core use combination where an examination of the data indicate that all standards (for which there are data) are being met for that core use (305(b)). This factsheet may refer to more than one pollutant.

d. factsheets for waterbody/pollutant combinations on the 303(d) list where a TMDL has been completed and approved by EPA (new approved TMDLs since 2006 303(d) list).

2. Medium Priority

a. factsheets (decision *a core use is being supported)* for waterbody/core use combination where a preliminary examination of the data indicate that standards are being met for that core use (305(b)). This factsheet may refer to more than one pollutant. However, there may be a waterbody/pollutant combinations on the list impairing other core uses.

b. factsheets (decision: *clarification*) for waterbody/pollutant combinations where the name of the pollutant has changed (e.g. PAHs to become individual PAHs (e.g. aldrin, fluoranthene)) or it is advisable to make a change in the extent of the waterbody (e.g. one waterbody is broken into two or a the dividing line between two reaches is modified).

c. factsheets (decision: *do not list or do not de-list)* for waterbody/pollutant combinations where there is significant new data (new line of evidence) but a preliminary examination of the data indicate that the list status (listed or not listed) would not change.

3. Low Priority

a. factsheets for waterbody/pollutant combinations where a preliminary examination of the data indicate standards were met (the creation of a "do not list" factsheet where the waterbody is listed for some other waterbody/pollutant combination or a 305(b) supporting factsheet has been completed).

b. factsheets for waterbody/pollutant combinations where the waterbody/pollutant combination is on the 303(d) list for that waterbody/pollutant combination and a preliminary examination of the data indicate standards were not met (the creation of a "do not de-list" factsheet).

c. factsheets for waterbody/pollutant combinations where available data is of insufficient quantity or quality to make assessments.

3.5 Integrated Report Categories

In this report, each assessed waterbody segment was assigned to one of five non-overlapping categories.

First, for each core beneficial use associated with each waterbody segment, a rating of fully supporting, not supporting, or insufficient information was assigned based on the readily available data and the analyses and criteria described, above. Then each assessed water segment was placed into one of five non-overlapping categories of water bodies. These Integrated Report categories are based on the USEPA guidance for states' Integrated Reports, but contain some modifications based on the State Listing Policy. The distribution of waterbodies into these categories may not be representative of the true state of waterbodies in the Los Angles Region due to the availability of water quality data and Regional Board decision development priorities.

Category 1: A water segment that 1) supports a minimum of one Beneficial Use for each Core Beneficial Use that is applicable to the water; and 2) has no other uses impaired. (No appendix to this report has been included for this category since, at this time, the Los Angeles Region has no waterbodies for which data supports that all beneficial uses are being supported.)

Category 2 (Appendix B): A water segment that 1) supports some, but not all, of its beneficial uses; 2) can have other uses that are not assessed or lack sufficient information to be assessed; 3) cannot have uses are which not supported; and 4) in agreement with the USEPA, may be included in this category with a minimum of one pollutant assessed for one use.

Category 3: (Appendix C): A water segment with water quality information that could not be used for an assessment, for reasons such as: monitoring data have poor quality assurance, not enough samples in a dataset, no existing numerical objective or evaluation guideline, the information alone cannot support an assessment, etc. Waters completely lacking water quality information are considered "not assessed".

Category 4A (Appendix D): A water segment where ALL its 303(d) listings are being addressed; and 2) at least one of those listings is being addressed by a USEPA approved TMDL.

Category 4B: A water segment where ALL its 303(d) listings are being addressed by action(s) other than TMDL(s). (No appendix to this report has been included for this category since, at this time, the Los Angeles Region does not have waterbodies in this category.)

Category 4C: A water segment that is impacted by non-pollutant related cause(s). (No appendix to this report has been included for this category since, at this time, the Los Angeles Region does not have waterbodies in this category.)

Category 5 (Appendix E): A water segment where standards are not met and a TMDL is required, but not yet completed, for at least one of the pollutants being listed for this segment.

3.6 Information Management

All LOEs, factsheets and listing or delisting decisions were entered into the statewide *California Water Quality Assessment (CalWQA) Database.* The CalWQA database stores all LOEs, listing decisions, and beneficial use support ratings for assessed water bodies in California. This database was developed in 2007 for the purpose of storing detailed water quality assessment information. The database is designed so that this information can be easily reevaluated in future assessment updates and can be exported to the USEPA's Assessment Database at the end of each assessment update.

4 Summary of Assessment Results

A full summary of the Los Angeles Region Integrated Report is included as Table 4-1.

Table 4-1 Integrated Report Summary

Integrated Report Category Number	Integrated Report Category definition	Number of waterbodies
1	Waters Supporting All Beneficial Uses	0
2 (Appendix **B**)	Waters Supporting Some Beneficial Uses	26
3 (Appendix C)	Waters With Insufficient Information	23
4 (Appendix D)	Water Quality Limited Segments Addressed	31
5 (Appendix E)	Water Quality Limited Segments not Fully Addressed	158
Total		*238 assessed waterbodies*
(4 and 5) (Appendix F) 303(d) list	*List of All Waterbody Impairments (the updated 303 (d) list)*	*189 waterbodies on the 303(d) list*

Of the waterbodies included in the Integrated Report, a total of 68 new listings are proposed and 30 de-listings are proposed. In addition, in this update, 113 previous listings are now included in the list as 'being addressed by a TMDL' because a USEPA approved TMDL has been completed. A summary of new additions to the Integrated Report is found in Table 4-2. In this Table, decisions to List are shown in three categories. "List" is the decision to include a waterbody/pollutant combination on the 303(d) list for the first time; "List (being addressed by TMDL)" is the decision to move a waterbody/pollutant combination from the 'requires a TMDL" portion of the list to the "being addressed by a TMDL" portion of the list because a USEPA approved TMDL has been completed since the last update to the 303(d) list in 2006; "List (being addressed by action other than TMDL)" is the decision to move a waterbody/pollutant combination from the 'requires a TMDL" portion of the list to the "being addressed by action other than TMDL" portion of the list because another regulatory action(such as a permitted restoration action) is sufficient to address the impairment. Factsheets for all these decisions are found in Appendix G.

Table 4-2 Integrated Report Summary for NEW decisions in 2008 including *delist*, *do not delist, do not list and list*

New Decision in 2008	Number of waterbodies	Number of waterbody/pollutant combinations
Delist	19	30
Do Not Delist	23	29
Do Not List	50	86
List	41	68
List (being addressed by TMDL)	55	113
List (being addressed by action other than TMDL)	2	3
Total		329

The total number of waterbody/pollutant combinations in the proposed 2008 303(d) list is 829. 448 of these waterbody/pollutant combinations, or 54%, require the completion of a TMDL or other regulatory action to address the impairment. 381 of these waterbody/pollutant combinations, or 46%, are currently being addressed by an EPA approved TMDL or other regulatory action.

This was the first time that the Water Boards have prepared an Integrated 303(d)/305(b) Report under the current Listing Policy and USEPA Integrated Report Guidance and the first time that the Regional Boards have used the CalWQA database. Combining the 303(d) list update with the 305(b) report and using the same database as all other Regions added efficiency and ensured consistency, but provided challenges in terms of workload and project management. While individual assessments for potential 303(d) listings or de-listings provided valuable information for the 305(b) report, creating the overall 305(b) report using 303(d) listing decisions as the primary input also had limitations. Preparing assessment fact sheets at the level of detail required for 303(d) list changes under the Listing Policy limited the amount of data which could be developed in the manner necessary for inclusion in the CalWQA database. In addition, the readily available data are also often biased towards areas with more potential discharges, since these areas are where the bulk of the monitoring activity takes place. For these reasons, the number of waterbody segments in each Integrated Report category is not necessarily a representative sampling of all the waterbodies within the Los Angeles Region. Despite these limitations, this Integrated Report provides the most complete 305(b) report for the Los Angeles Region to date.

5 TMDL Scheduling

As part of its 1996 and 1998 regional water quality assessments, the Regional Board identified over 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWQCB, 1996, 1998). A 13-year schedule for development of TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay Inc., et al. v. Browner, et al. C 98-4825 SBA) (United States District Court, Northern District of California, 1999) approved on March 22, 1999 (USEPA/Heal the Bay Consent Decree).

For the purpose of scheduling TMDL development, the decree combined the over 700 waterbody-pollutant combinations into 92 TMDL analytical units. Proposed de-listings in this report would discharge or partially discharge 12 TMDL analytical units as specified in the USEPA/Heal the Bay Consent Decree between the U.S. EPA and Heal the Bay, Inc. et al. filed on March 22, 1999.

Staff identified the new listings as a low priority, to be started after the USEPA/Heal the Bay Consent Decree commitments are met. A possible exception to this would be if a new listing could be folded into an existing analytical unit without the need for additional resources to develop the resulting TMDL. The assignment of a low priority to these new TMDL analytical units is not a reflection on their importance, but is given because the Regional Board has first prioritized existing USEPA/Heal the Bay Consent Decree commitments before beginning new TMDLs. The maximum time that can elapse between 303(d) listing and TMDL completion is 13 years. Accordingly, staff have assigned all new listings a TMDL completion date of 2021. This does not suggest that all new listings have the same priority, but rather that the factors determining TMDL priorities have not yet been evaluated as part of this listing process.

INVESTIGATION OF THE FEASIBILITY AND BENEFITS OF LOW-IMPACT SITE DESIGN PRACTICES ("LID") FOR VENTURA COUNTY

Richard R. Horner†

ABSTRACT

The Clean Water Act NPDES permit that regulates municipal separate storm sewer systems (MS4s) in Ventura County, California will be reissued in 2007. The draft permit includes provisions for requiring the use of low impact development practices (LID) for certain kinds of development and redevelopment projects. Using six representative development project case studies, the author investigated the practicability and relative benefits of the permit's LID requirements. The results showed that (1) LID site design and source control techniques are more effective than conventional best management practices (BMPs) in reducing runoff rates; (2) Effective Impervious Area (EIA) can practicably be capped at three percent, a standard more protective than that proposed in the draft permit; and (3) in five out of six case studies, LID methods would reduce site runoff volume and pollutant loading to zero in typical rainfall scenarios.

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INTRODUCTION

The Assessment in Relation to Municipal Permit Conditions

This purpose of this study is to investigate the relative water quality and water reuse benefits of three levels of storm water treatment best management practices (BMPs): (1) basic "treat-and-release" BMPs (e.g., drain inlet filters, CDS units), (2) commonly used BMPs that expose runoff to soils and vegetation (extended-detention basins and biofiltration swales and filter strips), and (3) low-impact development (LID) practices. The factors considered in the investigation are runoff volume, pollutant loading, and the availability of water for infiltration or other reuse. In order to assess the differential impact of storm water reduction approaches on these factors, this study examines six case studies typical of development covered by the Ventura County Municipal Separate Storm Sewer System Permit.

Low-impact development methods reduce storm runoff and its contaminants by decreasing their generation at sources, infiltrating into the soil or evaporating storm flows before they can enter surface receiving waters, and treating flow remaining on the surface through contact with vegetation and soil, or a combination of these strategies. Soil-based LID practices often use soil enhancements such as compost, and thus improve upon the performance of more traditional basins and biofilters. For the study's purposes, verification of the practicability and utility of LID practices was based on a modified version of the Planning and Land Development Program (Part 4, section E) in the Draft Ventura County Municipal Separate Storm Sewer System Permit ("Draft Permit"). The Draft Permit requires that Effective Impervious Area (EIA) of certain types of new development and redevelopment projects be limited to five percent of total development project area. EIA is defined as hardened surface hydrologically connected via sheet flow or a discrete hardened conveyance to a drainage system or receiving water body. (Draft Permit p. 50) The study modified this requirement to three percent, as a way to test both the feasibility of meeting the higher, five percent standard in the draft permit and because as the lower, three percent EIA is essential to protect the Ventura County aquatic environment (see Attachment A).

The Draft Permit further requires minimizing the overall percentage of impervious surfaces in new development and redevelopment projects to support storm water infiltration. The Draft Permit also directs an integrated approach to minimizing and mitigating storm water pollution, using a suite of strategies including source control, LID, and treatment control BMPs. (Draft Permit p. 50) It is noted in this section of the document that impervious surfaces can be rendered "ineffective" if runoff is dispersed through properly designed vegetated swales. In testing the practicability of the draft permit's requirements and a three percent EIA standard, this study broadened this approach to encompass not only vegetated swales (channels for conveyance at some depth and velocity) but also vegetated filter strips (surfaces for conveyance in thin sheet flow) and bioretention areas (shallow basins with a range of vegetation types in which runoff infiltrates through soil either to groundwater or a subdrain for eventual surface discharge). The Draft Permit's stipulation of "properly designed" facilities was interpreted to entail, among other requirements, either determination that existing site soils can support runoff reduction through infiltration or that soils will be amended using accepted LID techniques to attain this objective. Finally, the study further broadened implementation options to include water harvesting (collection and storage for use in, for example, irrigation or gray water systems), roof downspout infiltration trenches, and porous pavements.

The Draft permit was interpreted to require management of EIA, other impervious area (what might be termed Not-Connected Impervious Area, NCIA), and pervious areas as follows:

- Runoff from EIA is subject to treatment control and the Draft Permit's Hydromodification Mitigation Control requirements before discharge.

- NCIA must be drained onto a properly designed vegetated surface or its runoff managed by one of the other options discussed in the preceding paragraph. To the extent NCIA runoff is not eliminated prior to discharge from the site in one of these ways, it is subject to treatment control and the Draft Permit's Hydromodification Mitigation Control requirements before discharge.

- Runoff from pervious areas is subject to treatment control and the Draft Permit's Hydromodification Mitigation Control requirements before discharge. This provision applies to pervious areas that both do and do not receive drainage from NCIA.

Where treatment control BMPs are required to manage runoff from the site, the Draft Permit's Volumetric or Hydrodynamic (Flow Based) Treatment Control design bases were assumed to apply. The former basis applies to storage-type BMPs, like ponds, and requires capturing and treating either the runoff volume from the 85th percentile 24-hour rainfall event for the location, the volume of annual runoff to achieve 80 percent or more volume treatment, or the volume of runoff produced from a 0.75 inch storm event. The calculations in this analysis used the 0.75-inch quantity. The Hydrodynamic basis applies to flow-through BMPs, like swales, and requires treating the runoff flow rate produced from a rain event equal to at least 0.2 inches per hour intensity (or one of two other approximately equivalent options).

Scope of the Assessment

With respect to each of the six development case studies, three assessments were undertaken: a baseline scenario incorporating no storm water management controls; a second scenario employing conventional BMPs; and a third development scenario employing LID storm water management strategies.

To establish a baseline for each case study, annual storm water runoff volumes were estimated, as well as concentrations and mass loadings of four pollutants: (1) total suspended solids (TSS), (2) total recoverable copper (TCu), (3) total recoverable zinc (TZn), and (4) total phosphorus (TP). These baseline estimates were based on the anticipated land use and cover with no storm water management efforts.

Two sets of calculations were then conducted using the parameters defined for the six case studies.

The first group of calculations estimated the extent to which basic BMPs reduce runoff volumes and pollutant concentrations and loadings, and what impact, if any, such BMPs have on recharge rates or water retention on-site.

The second group of calculations estimated the extent to which commonly used soil-based BMPs and LID site design strategies ameliorate runoff volumes and pollutant concentrations and loadings, and the effect such techniques have on recharge rates. When evaluating LID strategies, it was presumed that EIA would be limited to three percent and runoff from EIA, NCIA, and pervious areas would be managed as indicated above. The assessment of basins, biofiltration, and low-impact design practices analyzed the expected infiltration capacity of the case study sites. It also considered related LID techniques and practices, such as source reduction strategies, that could work in concert with infiltration to serve the goals of: (1) preventing increase in annual runoff volume from the pre- to the post-developed state, (2) preventing increase in annual pollutant mass loadings between the two development states, and (3) avoiding exceedances of California Toxics Rule (CTR) acute saltwater criteria for copper and zinc.

The results of this analysis show that:

- Developments implementing no post-construction BMPs result in storm water runoff volume and pollutant loading that are substantially increased, and recharge rates that are substantially decreased, compared to pre-development conditions.

- Developments implementing basic post-construction treatment BMPs achieve reduced pollutant loading compared to developments with no BMPs, but storm water runoff volume and recharge rates are similar to developments with no BMPs.

- Developments implementing traditional basins and biofilters, and even more so low-impact post-construction BMPs, achieve significant reduction of pollutant loading and runoff volume as well as greatly enhanced recharge rates compared to both developments with no BMPs and developments with basic treatment BMPs.

- Typical development categories, ranging from single family residential to large commercial, can feasibly implement low-impact post-construction BMPs designed in compliance with the draft permit's requirements, as modified to include a lower, three percent EIA requirement.

This report covers the methods employed in the investigation, data sources, and references for both. It then presents the results, discusses their consequences, draws conclusions, and makes recommendations relative to the feasibility of utilizing low-impact development practices in Ventura County developments.

CASE STUDIES

Six case studies were selected to represent a range of urban development types considered to be representative of coastal Southern California, including Ventura County. These case studies involved: a multi-family residential complex (MFR), a relatively small-scale (23 homes) single-family residential development (Sm-SFR), a restaurant (REST), an office building (OFF), a relatively large (1000 homes) single-family residential development (Lg-SFR) and a sizeable commercial retail installation (COMM).[1]

Parking spaces were estimated to be 176 sq ft in area, which corresponds to 8 ft width by 22 ft length dimensions. Code requirements vary by jurisdiction, with the tendency now to drop below the traditional 200 sq ft average. About 180 sq ft is common, but various standards for full- and compact-car spaces, and for the mix of the two, can raise or lower the average.[2] The 176 sq ft size is considered to be a reasonable value for conventional practice.

Roadways and walkways assume a wide variety of patterns. Exclusive of the two SFR cases, simple, square parking lots with roadways around the four sides and square buildings with walkways also around the four sides were assumed. Roadways and walkways were taken to be 20 ft and 6 ft wide, respectively.

Single-family residences were assumed each to have a driveway 20 ft wide and 30 ft long. It was further assumed that each would have a sidewalk along the front of the lot, which was calculated to be 5749 sq ft in area. Assuming a square lot, the front dimension would be 76 ft. A 40-ft walkway was included within the property. Sidewalks and walkways were taken to be 4 ft wide.

Exclusive of the COMM case, the total area for all of these impervious features was subtracted from the total site area to estimate the pervious area, which was assumed to have conventional landscaping cover (grass, small herbaceous decorative plants, bushes, and a few trees). For the COMM scenario, the hypothetical total impervious cover was enlarged by 10 percent to represent the landscaping, on the belief that a typical retail commercial establishment would typically be mostly impervious.

Table 1 (page 5) summarizes the characteristics of the six case studies. The table also provides the recorded or estimated areas in each land use and cover type.

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[1] Building permit records from the City of San Marcos in San Diego County provided data on total site areas for the first four case studies, including numbers of buildings, building footprint areas (including porch and garage for Sm-SFR), and numbers of parking spaces associated with the development projects. While the building permit records made no reference to features such as roadways, walkways, and landscaping normally associated with development projects, these features were taken into account in the case studies using assumptions described herein. Larger developments were not represented in the sampling of building permits from the San Marcos database. To take larger development projects into account in the subsequent analysis, the two larger scale case studies were hypothesized. The Lg-SFR scenario scaled up all land use estimates from the Sm-SFR case in the ratio of 1000:23. The hypothetical COMM scenario consisted of a building with a 2-acre footprint and 500 parking spaces. As with the smaller-scale cases, these hypothetical developments were assumed to have roadways, walkways, and landscaping, as described herein.

[2] J. Gibbons, *Parking Lots*, NONPOINT EDUCATION FOR MUNICIPAL OFFICERS, Technical Paper No. 5 (1999) (http://nemo.uconn.edu/tools/publications/tech_papers/tech_paper_5.pdf).

Table 1. Case Study Characteristics and Land Use and Land Cover Areas

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
No. buildings	11	23	1	1	1000	1
Total area (ft^2)	476,982	132,227	33,669	92,612	5,749,000	226,529
Roof area (ft^2)	184,338	34,949	3,220	7,500	1,519,522	87,120
No. parking spaces	438	-	33	37	-	500
Parking area (ft^2)	77,088	-	5808	6512	-	88,000
Access road area (ft^2)	22,212	-	6097	6456	-	23,732
Walkway area (ft^2)	33,960	10,656	1362	2078	463,289	7,084
Driveway area (ft^2)	-	13,800	-	-	600,000	-
Landscape area (ft^2)	159,384	72,822	17,182	70,066	3,166,190	20,594

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential;
REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial

METHODS OF ANALYSIS

Annual Storm Water Runoff Volumes

Annual surface runoff volumes produced were estimated for both pre- and post-development conditions for each case study site. Runoff volume was computed as the product of annual precipitation, contributing drainage area, and a runoff coefficient (ratio of runoff produced to rainfall received). For impervious areas the following equation was used:

$$\mathbf{C = (0.009)\ \mathit{I} + 0.05}$$

where *I* is the impervious percentage. This equation was derived by Schueler (1987) from Nationwide Urban Runoff Program data (U.S. Environmental Protection Agency 1983). With *I* = 100 percent for fully impervious surfaces, C is 0.95.

The basis for pervious area runoff coefficients was the Natural Resource Conservation Service's (NRCS) Urban Hydrology for Small Watersheds (NRCS 1986, as revised from the original 1975 edition). This model estimates storm event runoff as a function of precipitation and a variable representing land cover and soil, termed the curve number (CN). Larger events are forecast to produce a greater amount of runoff in relation to amount of rainfall because they more fully saturate the soil. Therefore, use of the model to estimate annual runoff requires selecting some event or group of events to represent the year. A 0.75-inch rainfall event was used in the analysis here for the relative comparison between pre- and post-development and applied to deriving a runoff coefficient for annual estimates, recognizing that smaller storms would produce less and larger storms more runoff.

To select CN for the pre-development case, an analysis performed in the area of the Cedar Fire in San Diego County was used in which CN was determined before and after the 2003 fire.[3] In the San Diego analysis, CN = 83 was estimated for the pre-existing land cover, which was generally chaparral, a vegetative cover also typical of Ventura County. As indicated below, soils are also similar in Ventura and San Diego Counties, making the parameter selection reasonable for use in both locations. For post-development landscaping, CN = 86 was selected based on tabulated data in NRCS (1986) and professional judgment.

Pre- and post-development runoff quantities were computed with these CN values and the 0.75-inch rainfall, and then divided by the rainfall to obtain runoff coefficients. The results were 0.07

[3] American Forests, *San Diego Urban Ecosystem Analysis After the Cedar Fire* (Feb. 3, 2006) (http://www.ufei.org/files/pubs/SanDiegoUrbanEcosystemAnalysis-PostCedarFire.pdf).

and 0.12, respectively. Finally, total annual runoff volumes were estimated based on an average annual precipitation in the City of Ventura of 14.71 inches.[4]

Storm Water Runoff Pollutant Discharges

Annual pollutant mass discharges were estimated as the product of annual runoff volumes produced by the various land use and cover types and pollutant concentrations typical of those areas. Again, the 0.75-inch precipitation event was used as a basis for volumes. Storm water pollutant data have typically been measured and reported for general land use types (e.g., single-family residential, commercial). However, an investigation of low-impact development practices of the type this study sought to conduct demands data on specific land coverages. The literature offers few data on this basis. Those available and used herein were assembled by a consultant to the City of Seattle for a project in which the author participated. They appear in Attachment B (Herrera Environmental Consultants, Inc. undated).

Pollutant concentrations expected to occur typically in the mixed runoff from the several land use and cover types making up a development were estimated by mass balance; i.e., the concentrations from the different areas of the sites were combined in proportion to their contribution to the total runoff.

The Effect of Conventional Treatment BMPs on Runoff Volume, Pollutant Discharges, and Recharge Rates

The first question in analyzing how BMPs reduce runoff volumes and pollutant discharges was, What BMPs are being employed in Ventura County developments under the permit now in force? This permit is open-ended and provides regulated entities with a large number of choices and few fixed requirements. These options presumably include manufactured BMPs, such as drain inlet inserts (DIIs) and continuous deflective separation (CDS) units. Developments may also select such non-proprietary devices as extended-detention basins (EDBs) and biofiltration swales and filter strips. EDBs hold water for two to three days for solids settlement before releasing whatever does not infiltrate or evaporate. Biofiltration treats runoff through various processes mediated by vegetation and soil. In a swale, runoff flows at some depth in a channel, whereas a filter strip is a broad surface over which water sheet flows. Each of these BMP types was applied to each case study, although it is not clear that these BMPs, in actuality, have been implemented consistently within Ventura County to date.

The principal basis for the analysis of BMP performance was the California Department of Transportation's (CalTrans, 2004) BMP Retrofit Pilot Program, performed in San Diego and Los Angeles Counties. One important result of the program was that BMPs with a natural surface infiltrate and evaporate (probably, mostly infiltrate) a substantial amount of runoff, even if conditions do not appear to be favorable for an infiltration basin. On average, the EDBs, swales, and filter strips lost 40, 50 and 30 percent, respectively, of the entering flow before the discharge point. DIIs and CDS units do not contact runoff with a natural surface, and therefore do not reduce runoff volume.

The CalTrans program further determined that BMP effluent concentrations were usually a function of the influent concentrations, and equations were developed for the functional

[4] Ventura County Watershed Protection District (http://www.vcwatershed.org/fws/specialmedia.htm). The City of Ventura is considered to be representative of most of the developed and developing areas in Ventura County. However, there is some variation around the county, with the maximum precipitation registered at Ojai (annual average 21.32 inches). Ojai is about 15 miles inland and lies at elevation 745 ft at the foot of the Topatopa Mountains, the orographic effect of which influences its meteorology. Ojai's higher rainfall was taken into account in the calculations, and the report notes the few instances where it affected the conclusions.

relationships in these cases. BMPs generally reduced influent concentrations proportionately more when they were high. In relatively few situations influent concentrations were constant at an “irreducible minimum” level regardless of inflow concentrations.

In analyzing the effects of BMPs on the case study runoff, the first step was to reduce the runoff volumes estimated with no BMPs by the fractions observed to be lost in the pilot study. The next task was estimating the effluent concentrations from the relationships in the CalTrans report. The final step was calculating discharge pollutant loadings as the product of the reduced volumes and predicted effluent concentrations. As before, typical pollutant concentrations in the mixed runoff were established by mass balance.

Estimating Infiltration Capacity of the Case Study Sites

Infiltrating sufficient runoff to maintain pre-development hydrologic characteristics and prevent pollutant transport is the most effective way to protect surface receiving waters. Successfully applying infiltration requires soils and hydrogeological conditions that will pass water sufficiently rapidly to avoid overly-lengthy ponding, while not allowing percolating water to reach ground-water before the soil column captures pollutants.

The study assumed that infiltration would occur in surface facilities and not in below-ground trenches. The use of trenches is certainly possible, and was judged to be an approved BMP by CalTrans after the pilot study. However, the intent of this investigation was to determine the ability of pervious areas to manage the site runoff. This was accomplished by determining the infiltration capability of the pervious areas in their original condition for each development case study, and further assessing the pervious areas’ infiltration capabilities if soils were modified according to low impact development practices.

The chief basis for this aspect of the work was an assessment of infiltration capacity and benefits for Los Angeles’ San Fernando Valley (Chralowicz et al. 2001). The Chralowicz study posited providing 0.1-0.5 acre for infiltration basins to serve each 5 acres of contributing drainage area. At 2-3 ft deep, it was estimated that such basins could infiltrate 0.90-1.87 acre-ft/year of runoff in San Fernando Valley conditions. Soils there are generally various loam textures with infiltration rates of approximately 0.5-2.0 inches/hour. The most prominent soils in Ventura County, at least relatively near the coast, are loams, sandy loams, loamy sands, and silty clay loams, thus making the conclusions of the San Fernando Valley study applicable for these purposes.[5] This information was used to estimate how much of each case study site’s annual runoff would be infiltratable, and if the pervious portion would provide sufficient area for infiltration. For instance, if sufficient area were available, the infiltration configuration would not have to be in basin form but could be shallower and larger in surface area. This study’s analyses assumed the use of bioretention areas rather than traditional infiltration basins.

Volume and Pollutant Source Reduction Strategies

As mentioned above, the essence of low-impact development is reducing runoff problems before they can develop, at their sources, or exploiting the infiltration and treatment abilities of soils and vegetation. If a site’s existing infiltration and treatment capabilities are inadequate to preserve pre-development hydrology and prevent runoff from causing or contributing to violations of water quality standards, then LID-based source reduction strategies can be implemented, infiltration and treatment capabilities can be upgraded, or both.

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[5] Cabrillo Port Liquefied Natural Gas Deepwater Port Draft EIS/EIR (Oct. 2004) (http://www.cabrilloport.ene.com/files/eiseir/4.05%20%20-Agriculture%20and%20Soils.pdf).

Source reduction can be accomplished through various LID techniques. Soil can be upgraded to store runoff until it can infiltrate, evaporate, or transpire from plants through compost addition. Soil amendment, as this practice is known, is a standard LID technique.

Upgraded soils are used in bioretention cells that hold runoff and effect its transfer to the subsurface zone. This standard LID tool can be used where sufficient space is available. This study analyzed whether the six development case study sites would have sufficient space to effectively reduce runoff using bioretention cells, assuming the soils and vegetation could be amended and enhanced where necessary.

Conventional pavements can be converted to porous asphalt or concrete or replaced with concrete or plastic unit pavers or grid systems. For such approaches to be most effective, the soils must be capable of infiltrating the runoff passing through, and may require renovation.

Source reduction can be enhanced by the LID practice of water harvesting, in which water from impervious surfaces is captured and stored for reuse in irrigation or gray water systems. For example, runoff from roofs and parking lots can be harvested, with the former being somewhat easier because of the possibility of avoiding pumping to use the water and fewer pollutants. Harvesting is a standard technique for Leadership in Energy and Environmental Design (LEED) buildings.[6] Many successful systems of this type are in operation, such as the Natural Resources Defense Council offices (Santa Monica, CA), the King County Administration Building (Seattle, WA), and two buildings on the Portland State University campus (Portland, OR). This investigation examined how water harvesting could contribute to storm water management for case study sites where infiltration capacity, available space, or both appeared to be limited.

RESULTS OF THE ANALYSIS

1. "Base Case" Analysis: Development without Storm Water Controls

Comparison of Pre- and Post-Development Runoff Volumes

Table 2 (page 9) presents a comparison between the estimated runoff volumes generated by the respective case study sites in the pre- and post-development conditions, assuming implementation of no storm water controls on the developed sites. On sites dominated by impervious land cover, most of the infiltration that would recharge groundwater in the undeveloped state is expected to be lost to surface runoff after development. This greatly increased surface flow would raise peak flow rates and volumes in receiving water courses, raise flooding risk, and transport pollutants. Only the office building, the plan for which retained substantial pervious area, would lose less than half of the site's pre-development recharge.

[6] New Buildings Institute, Inc., *Advanced Buildings* (2005) (http://www.poweryourdesign.com/LEEDGuide.pdf).

Table 2. Pre- and Post-Development without BMPs: Distribution of Surface Runoff Versus Recharge to Groundwater

Annual Volume (acre-ft)	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
Precipitation[b]	13.4	3.72	0.95	2.60	162	6.37
Pre-development runoff[c]	0.94	0.26	0.07	0.18	11	0.45
Pre-development recharge[d]	12.5	3.46	0.88	2.42	150	5.92
Post-development impervious runoff[c]	8.48	1.59	0.44	0.60	69	5.50
Post-development pervious runoff[c]	0.54	0.25	0.06	0.24	11	0.07
Post-development total runoff[c]	9.02	1.83	0.50	0.84	80	5.57
Post-development recharge[d]	4.39	1.88	0.45	1.76	82	0.80
Post-development recharge loss (% of pre-development recharge)	8.08 (65%)	1.57 (46%)	0.43 (49%)	0.66 (27%)	68 (45%)	5.12 (86%)

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential;
COMM—retail commercial
[b] Volume of precipitation on total project area
[c] Quantity of water discharged from the site on the surface
[d] Quantity of water infiltrating the soil; the difference between precipitation and runoff

Pollutant Concentrations and Loadings

Table 3 presents the pollutant concentrations from the literature and loadings calculated as described for the various land use and cover types represented by the case studies. Landscaped areas are expected to release the highest TSS concentration, although relatively low TSS mass loading because of the low runoff coefficient. The highest copper concentrations and loadings are expected from parking lots. Roofs, especially commercial roofs, top the list for both zinc concentrations and loadings. Landscaping would issue by far the highest phosphorus, although access roads and driveways would contribute the highest mass loadings.

Table 3. Pollutant Concentrations and Loadings for Case Study Land Use and Cover Types

Land Use	Concentrations				Loadings			
	TSS (mg/L)	TCu (mg/L)	TZn (mg/L)	TP (mg/L)	Lbs. TSS/ acre-year	Lbs. TCu/ acre-year	Lbs. TZn/ acre-year	Lbs. TP/ acre-year
Residential roof	25	0.013	0.159	0.11	79	0.041	0.503	0.348
Commercial roof	18	0.014	0.281	0.14	57	0.044	0.889	0.443
Access road/driveway	120	0.022	0.118	0.66	380	0.070	0.373	2.088
Parking	75	0.036	0.097	0.14	237	0.114	0.307	0.443
Walkway	25	0.013	0.059	0.11	79	0.041	0.187	0.348
Landscaping	213	0.013	0.059	2.04	85	0.005	0.024	0.815

The CTR acute criteria for copper and zinc are 0.0048 mg/L and 0.090 mg/L, respectively. Table 3 shows that all developed land uses are expected to discharge copper above the criterion, based on the mass balance calculations using concentrations from Table 3. Any surface release from the case study sites would violate the criterion at the point of discharge, although dilution by the receiving water would lower the concentration below the criterion at some point. Even if copper mass loadings are reduced by BMPs, any surface discharge would exceed the criterion initially, but it would be easier to dilute below that level. In contrast, runoff from some land covers would not violate the acute zinc criterion. Because of this difference, the evaluation considered whether or not the zinc criterion would be exceeded in each analysis, whereas there was no point in this analysis for copper. There are no equivalent water quality criteria for TSS and TP; hence, their concentrations were not further analyzed in the different scenarios.

Table 4 shows the overall loadings, as well as zinc concentrations, expected to be delivered from the case study developments should they not be fitted with any BMPs. As Table 4 shows, all cases are forecast to exceed the 0.090 mg/L acute zinc criterion, and the retail commercial development does so by a wide margin. Because of its size, the large residential development dominates the mass loading emissions.

Table 4. Case Study Pollutant Concentration and Loading Estimates without BMPs

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
TZn (mg/L)	0.127	0.123	0.128	0.133	0.123	0.175
Lbs. TSS/year	1321	345	125	242	15016	853
Lbs. TCu/year	0.46	0.074	0.032	0.045	3.21	0.37
Lbs. TZn/year	3.09	0.607	0.174	0.301	26.4	2.64
Lbs. TP/year	6.58	2.39	0.72	1.78	104	3.36

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial

2. "Conventional BMP" Analysis: Effect of Basic Treatment BMPs

Effect of Basic Treatment BMPs on Post-Development Runoff Volumes

The current permit allows regulated parties to select from a range of BMPs in order to treat or infiltrate a given quantity of annual rainfall. The range includes drain inlet inserts, CDS units, and other manufactured BMPs, detention vaults, and sand filters, all of which isolate runoff from the soil; as well as basins and biofiltration BMPs built in soil and generally having vegetation. Treatment BMPs that do not permit any runoff contact with soils discharge as much storm water runoff as equivalent sites with no BMPs, and hence yield zero savings in recharge. As mentioned above, the CalTrans (2004) study found that BMPs with a natural surface can reduce runoff by substantial margins (30-50 percent for extended-detention basins and biofiltration).

With such a wide range of BMPs in use, runoff reduction ranging from 0 to 50 percent, and a lack of clearly ascertainable requirements, it is not possible to make a single estimate of how much recharge savings are afforded by maximal implementation of the current permit. We made the following assumptions regarding implementation of BMPs. Assuming natural-surface BMPs perform at the average of the three types tested by CalTrans (2004), i.e., 40 percent runoff reduction, the estimate can be bounded as shown in Table 5 (page 11). The table demonstrates that allowing free choice of BMPs without regard to their ability to direct water into the ground forfeits substantial groundwater recharge benefits when hardened-surface BMPs are selected. Use of soil-based conventional BMPs could cut recharge losses from half or e more of the full potential to about one-quarter to one-third or less, except with the highly impervious commercial development. This analysis shows the wisdom of draining impervious to pervious surfaces, even if those surfaces are not prepared in any special way. But as subsequent analyses showed, soil amendment can gain considerably greater benefits.

Table 5. Pre- and Post-Development with Conventional BMPs: Distribution of Surface Runoff Versus Recharge to Groundwater

Annual Volume (acre-ft)	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
Precipitation[b]	13.4	3.72	0.95	2.60	162	6.37
Pre-development runoff[c]	0.94	0.26	0.07	0.18	11	0.45
Pre-development recharge	12.5	3.46	0.88	2.42	150	5.92
Post-development impervious runoff[c, d]	5.09-8.48	0.95-1.59	0.26-0.44	0.36-0.60	41-69	3.30-5.50
Post-development pervious runoff[c, d]	0.32-0.54	0.15-0.25	0.04-0.06	0.14-0.24	6.6-11	0.04-0.07
Post-development total runoff[c, d]	5.41-9.02	1.10-1.83	0.30-0.50	0.50-0.84	48-80	3.34-5.57
Post-development recharge[d, e]	4.39-7.99	1.88-2.62	0.45-0.65	1.76-2.10	82-114	0.80-3.03
Post-development recharge loss (% of pre-development recharge) [d, e]	4.51-8.08 (36-65%)	0.84-1.57 (24-46%)	0.23-0.43 (26-49%)	0.32-0.66 (13-27%)	36-68 (24-45%)	2.89-5.12 (49-86%)

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial. Ranges represent 40 percent runoff volume reduction, with full site coverage by BMPs having a natural surface, to no reduction, with BMPs isolating runoff from soil.
[b] Volume of precipitation on total project area
[c] Quantity of water discharged from the site on the surface
[d] Ranging from the quantity with hardened bed BMPs to the quantity with soil-based BMPs
[e] Quantity of water infiltrating the soil; the difference between precipitation and runoff

Effect of Basic Treatment BMPs on Pollutant Discharges

Table 6 (page 12) presents estimates of zinc effluent concentrations and mass loadings of the various pollutants discharged from four types of conventional treatment BMPs. The manufactured CDS BMPs in this table, which do not expose runoff to soil or vegetation, are not expected to drop any of the concentrations sufficiently to meet the acute zinc criterion at the discharge point. The loading reduction results show the CDS units always performing below 50 percent reduction for all pollutants analyzed, and most often in the vicinity of 20 percent, with zero copper reduction.

When treated with swales or filter strips, effluents from each development case study site are expected to fall below the CTR acute zinc criterion. All but the large commercial site would meet the criterion with EDB treatment. These natural-surface BMPs, if fully implemented and well maintained, are predicted to prevent the majority of the pollutant masses generated on most of the development sites from reaching a receiving water. Only total phosphorus reduction falls below 50 percent for two case studies. Otherwise, mass loading reductions range from about 60 to above 80 percent for the EDB, swale, and filter strip. This data indicates that draining impervious to pervious surfaces, even if those surfaces are not prepared in any special way, pays water quality as well as hydrologic dividends.

Table 6. Pollutant Concentration and Loading Reduction Estimates with Conventional BMPs

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
Effluent Concentrations:						
CDS TZn (mg/L)[a]	0.095	0.095	0.098	0.102	0.095	0.131
EDB TZn (mg/L)[a]	0.085	0.086	0.084	0.084	0.086	0.098
Swale TZn (mg/L)	0.055	0.054	0.055	0.056	0.054	0.068
Filter strip TZn (mg/L)	0.039	0.039	0.039	0.041	0.039	0.048
Loading Reductions:						
CDS TSS loading reduction	15.7%	19.9%	22.0%	24.0%	19.9%	16.9%
CDS TCu loading reduction	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CDS TZn loading reduction	22.7%	22.4%	22.9%	23.1%	22.4%	25.1%
CDS TP loading reduction	30.6%	41.5%	40.7%	45.9%	41.5%	20.3%
EDB TSS loading reduction	68.1%	73.7%	79.0%	81.1%	73.7%	71.7%
EDB TCu loading reduction	61.9%	55.7%	66.2%	63.0%	55.7%	66.8%
EDB TZn loading reduction	59.7%	59.6%	60.4%	61.9%	59.6%	66.6%
EDB TP loading reduction	61.9%	69.7%	69.1%	72.9%	69.7%	54.5%
Swale TSS loading reduction	68.8%	71.1%	73.1%	73.9%	71.1%	69.4%
Swale TCu loading reduction	72.5%	68.5%	78.2%	73.3%	68.5%	75.8%
Swale TZn loading reduction	78.4%	78.1%	84.3%	78.8%	78.1%	80.7%
Swale TP loading reduction	66.3%	70.7%	67.2%	76.2%	70.7%	55.0%
Filter strip TSS loading reduction	69.9%	75.4%	80.6%	82.6%	75.4%	72.3%
Filter strip TCu loading reduction	74.4%	69.1%	78.2%	75.4%	69.1%	78.7%
Filter strip TZn loading reduction	78.3%	77.9%	78.4%	78.7%	77.9%	80.9%
Filter strip TP loading reduction	48.4%	53.1%	63.7%	59.8%	53.1%	34.6%

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial; CDS— continuous deflective separation unit; EDB—extended-detention basin

3. LID Analysis: Development According to Modified Draft Permit Provisions

(a) Hydrologic Analysis

The LID analysis was first performed according to the Draft Permit provisions under the Planning and Land Development Program (Part 4, section E). In this analysis, however, EIA was limited to three instead of five percent, under the reasoning presented in Attachment A. All runoff from NCIA was assumed to drain to vegetated surfaces, as provided in the Draft Permit.

One goal of this exercise was to identify methods that reduce runoff production in the first place. It was hypothesized that implementation of source reduction techniques could allow all of the case study sites to infiltrate substantial proportions of the developed site runoff, advancing the hydromodification mitigation objective of the Draft Permit. When runoff is dispersed into the soil instead of being rapidly collected and conveyed away, it recharges groundwater, supplementing a resource that maintains dry season stream flow and wetlands. An increased water balance can be tapped by humans for potable, irrigation, and process water supply. Additionally, runoff volume reduction would commensurately decrease pollutant mass loadings.

Accordingly, the analysis considered the practicability of more than one scenario by which the draft permit's terms could be met, as modified to reflect three percent EIA. In one option, all roof runoff is harvested and stored for some beneficial use. A second option disperses runoff into the soil via roof downspout infiltration trenches. The former option is probably best suited to cases like the large commercial and office buildings, while distribution in the soil would fit best with residences and relatively small commercial developments. The analysis was repeated with the assumptions of harvesting OFF and COMM roof runoff for some beneficial use and dispersing roof runoff from the remaining four cases in roof downspout infiltration systems.

Expected Infiltration Capacities of the Case Study Sites

The first inquiry on this subject sought to determine how much of the total annual runoff each property is expected to infiltrate. This assessment tested the feasibility of draining all but three percent of impervious area to pervious land on the sites. Based on the findings of Chralowicz et al. (2001), it was assumed that an infiltration zone of 0.1-0.5 acres in area and 2-3 ft deep would serve a drainage catchment area in the size range 0-5 acres and infiltrate 0.9-1.9 acre-ft/year. The conclusions of Chralowicz et al. (2001) were extrapolated to conservatively assume that 0.5 acre would be required to serve each additional five acres of catchment, and would infiltrate an incremental 1.4 acre-ft/year (the midpoint of the 0.9-1.9 acre-ft/year range). According to these assumptions, the following schedule of estimates applies:

Pervious Area Available for Infiltration	Catchment Served acres	Infiltration Capacity
0.5 acres	0-5 acres	1.4 acre-ft/year
1.0 acres	5-10 acres	2.8 acre-ft/year
1.5 acres	10-15 acres	4.2 acre-ft/year
(Etc.)	...	...

As a formula, infiltration capacity ≈ 2.8 x available pervious area. To apply the formula conservatively, the available area was reduced to the next lower 0.5-acre increment before multiplying by 2.8.

As shown in Table 7, five of the six sites have adequate or greater capacity to infiltrate the full annual runoff volume from NCIA and pervious areas where EIA is limited to three percent of the total site area (four at the higher Ojai rainfall). Indeed, five of the six development types have sufficient pervious area to infiltrate *all* runoff, including runoff from EIA areas. With the most representative rainfall, only the large commercial development, with little available pervious area, falls short of the needed capacity to infiltrate all rainfall, but it still has the capacity to meet the terms of the draft permit, as modified for this analysis. These results are based on infiltrating in the native soils with no soil amendment. For any development project at which infiltration-oriented BMPs are considered, it is important that infiltration potential be carefully assessed using site-specific soils and hydrogeologic data. In the event such an investigation reveals a marginal condition (e.g., hydraulic conductivity, spacing to groundwater) for infiltration basins, soils could be enhanced to produce bioretention zones to assist infiltration. Notably, the four case studies with far greater than necessary infiltration capacity would offer substantial flexibility in designing infiltration, allowing ponding at less than 2-3 ft depth.

Table 7. Infiltration and Runoff Volume With 3 Percent EIA and All NCIA Draining to Pervious Areas

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
EIA runoff (acre-ft/year)	0.38	0.11	0.03	0.07	4.6	0.18
NCIA + pervious area runoff (acre-ft/year)	**8.63**	**1.73**	**0.47**	**0.76**	**75.0**	**5.39**
Total runoff (acre-ft/year)	9.01	1.84	0.50	0.83	79.6	5.57
Pervious area available for infiltration (acres)	3.66	1.67	0.39	1.61	72.7	0.47
Estimated infiltration capacity (acre-ft/year)[b]	**9.8**	**4.2**	**1.4**	**4.2**	**203**	**1.4**
Infiltration capacity [c]	> 100%[d]	> 100%	> 100%	> 100%	> 100%	~26% [d]

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial;
[b] Based on Chralowicz et al. (2001) according to the schedule described above
[c] Compare runoff production from NCIA + pervious area (**row 3**) with estimated infiltration capacity (**row 6**)
[d] At Ojai rainfall levels, capacity would be ~78 percent at the MFR site and ~18 percent at the COMM site.

As Table 7 shows, five of the six case study sites have the capacity to infiltrate *all* runoff produced onsite by draining impervious surfaces to pervious areas. Even runoff from the area assumed to be EIA could be infiltrated in most cases based on the amount of pervious area available in typical development projects. By showing that it is possible under normal site conditions and using native soils to retain *all* runoff in typical developments, these results demonstrate that a three percent EIA requirement, which would not demand that all runoff be retained, is feasible and practicable.

Additional Source Reduction Capabilities of the Case Study Sites: Water Harvesting Example

Infiltration is one of a wide variety of LID-based source reduction techniques. Where site conditions such as soil quality or available area limit a site's infiltration capacity, other source LID measures can enhance a site's runoff retention capability. For example, soil amendment, which improves infiltration, is a standard LID technique. Water harvesting is another. Such practices can also be used where infiltration capacity is adequate, but the developer desires greater flexibility for land use on-site. Table 8 shows the added implementation flexibility created by subtracting roof runoff by harvesting it or efficiently directing it into the soil through downspout dispersion systems, further demonstrating the feasibility of meeting the draft permit's proposed requirements, as modified to include a three percent EIA standard.

Table 8. Infiltration and Runoff Volume Reduction Analysis Including Roof Runoff Harvesting or Disposal in Infiltration Trenches (Assuming 3 Percent EIA and All NCIA Draining to Pervious Areas)

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
EIA runoff (acre-ft/year)	0.38	0.11	0.03	0.07	4.6	0.18
Roof runoff (acre-ft/year)	4.92	0.93	0.09	0.20	41	2.33
Other NCIA + pervious area runoff (acre-ft/year)	**3.71**	**0.79**	**0.39**	**0.56**	**35**	**3.06**
Total runoff (acre-ft/year)	9.01	1.84	0.50	0.83	79.6	5.57
Pervious area available for infiltration (acres)	3.66	1.67	0.39	1.61	72.7	0.47
Estimated infiltration capacity (acre-ft/year)[b]	**9.8**	**4.2**	**1.4**	**4.2**	**203**	**1.4**
Infiltration capacity [c]	> 100%	> 100%	> 100%	> 100%	> 100%	~45% [d]

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial;
[b] Based on Chralowicz et al. (2001) according to the schedule described above
[c] Comparison of runoff production from NCIA + pervious area (**row 3**) with estimated infiltration capacity (**row 6**)
[d] If the higher rainfall at Ojai is assumed, capacity would be ~32 percent of the amount needed for the COMM case.

Effect of Full LID Approach on Recharge

Table 9 (page 15) shows the recharge benefits of preventing roofs from generating runoff and infiltrating as much as possible of the runoff from the remainder of the case study sites. The data show that LID methods offer significant benefits relative to the baseline (no storm water controls) in all cases. These benefits are particularly impressive in developments with relatively high site imperviousness, such as in the MFR and COMM cases. In the latter case the full LID approach (excluding the common and effective practice of soil amendment) would cut loss of the potential water resource represented by recharge and harvesting from 86 to 37 percent.

Table 9. Comparison of Water Captured Annually (in acre-ft) from Development Sites for Beneficial Use With a Full LID Approach Compared to Development With No BMPs

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
Pre-development recharge[b] (acre-ft)	12.5	3.46	0.88	2.42	150	5.92
No BMPs:						
post-development recharge [b] (acre-ft)	4.39	1.88	0.45	1.76	82	0.80
post-development runoff (acre-ft)	8.08	1.57	0.43	0.66	68	5.12
post-development % recharge lost	65%	46%	49%	27%	45%	86%
Full LID approach:						
post-development runoff capture (acre-ft)[c]	12.5	3.46	0.88	2.42	150	3.73
post-development runoff (acre-ft)	0	0	0	0	0	2.19
post-development % recharge lost	0%	0%	0%	0%	0%	37%

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial
[b] Quantity of water infiltrating the soil; the difference between precipitation and runoff
[c] Water either entirely infiltrated in BMPs and recharged to groundwater or partially harvested from roofs and partially infiltrated in BMPs. For the first five case studies, EIA was not distinguished from the remainder of the development, because these sites have the potential to capture all runoff.

(b) Water Quality Analysis

As outlined above, it was assumed that EIA discharges, as well as runoff from all pervious surfaces, are subject to treatment control. For purposes of the analysis, treatment control was assumed to be provided by conventional sand filtration. This choice is appropriate for study purposes for two reasons. First, sand filters can be installed below grade, and land above can be put to other uses. Under the Draft Permit's approach, pervious area should be reserved for receiving NCIA drainage, and using sand filters would not draw land away from that service or other site uses. A second reason for the choice is that sand filter performance data equivalent to the data used in analyzing other conventional BMPs are available from the CalTrans (2004) work. Sand filters may or may not expose water to soil, depending on whether or not they have a hard bed. This analysis assumed a hard bed, meaning that no infiltration would occur and thus there would be no additional recharge in sand filters. Performance would be even better than shown in the analytical results if sand filters were built in earth.

Pollutant Discharge Reduction Through LID Techniques

The preceding analyses demonstrated that each of the six case studies could feasibly comply with the draft permit's requirements, as modified to include a more protective three percent EIA standard. Moreover, for five of the six case studies, *all* storm water discharges could be eliminated at least under most meteorological conditions by dispersing runoff from impervious surfaces to pervious areas. Therefore, pollutant additions to receiving waters would also be eliminated. This demonstrates not only that a lower EIA (three percent) is a feasible and practicable approach to maintaining the natural hydrology of land being developed, as discussed above, but that a lower EIA is a feasible and practicable way to eliminate the discharge of pollutants that could cause or contribute to violations of water quality standards.

While the high proportion of impervious area present on the large commercial site relative to pervious area would not allow eliminating all discharge, harvesting roof water and draining NCIA to properly-prepared pervious area would substantially decrease the volume discharged. Deployment of treatment control BMPs (e.g. sand filter treatment) could cut contaminant discharges from pollutants in the remaining volume of runoff to low levels.

Table 10 presents the pollutant reductions from the untreated case achievable through the complete LID approach described above in comparison to conventional treatments (from Table 6). Assuming EIA still discharges through sand filters, pollutant loadings from the untreated condition are expected to decrease by more than 96 percent for all but the COMM case. In that challenging case loadings would still fall by at least 89 percent for TSS and the metals and by 83 percent for total phosphorus, assuming City of Ventura rainfall levels, and slightly less assuming the higher Ojai rainfall levels. Thus, the Draft Permit's basic premise of disconnecting most impervious area, supplemented by specially managing roof water, is shown by both water quality and hydrologic results to be feasible and to afford broad and significant environmental benefits.

Table 10. Pollutant Loading Reduction Estimates With a Full LID Approach Relative to Conventional BMPs

	MFR[a]	Sm-SFR[a]	REST[a]	OFF[a]	Lg-SFR[a]	COMM[a]
Conventional TSS loading reduction[b]	15.7-69.9%	19.9-75.4%	22.0-80.6%	24.0-82.6%	19.9-75.4%	16.9-72.3%
Conventional TCu loading reduction[b]	0.0-74.4%	0.0-69.1%	0.0-78.2%	0.0-75.4%	0.0-69.1%	0.0-78.7%
Conventional TZn loading reduction[b]	22.7-78.4%	22.4-78.1%	22.9-84.3%	23.1-78.8%	22.4-78.1%	25.1-80.9%
Conventional TP loading reduction[b]	30.6-66.3%	41.5-70.7%	40.7-69.1%	45.9-76.2%	41.5-70.7%	20.3-55.0%
LID TSS loading reduction[c]	99.4%	99.3%	99.5%	99.4%	99.3%	89.0% [d]
LID TCu loading reduction[c]	98.1%	96.7%	98.0%	96.2%	96.7%	90.6% [d]
LID TZn loading reduction[c]	99.1%	98.8%	98.9%	98.3%	98.8%	94.8% [d]
LID TP loading reduction[c]	98.1%	98.6%	98.8%	98.7%	98.6%	83.1%[d]

[a] MFR—multi-family residential; Sm-SFR—small-scale single-family residential; REST—restaurant; OFF—office building; Lg-SFR—large-scale single-family residential; COMM—retail commercial; CDS— continuous deflective separation unit; EDB—extended-detention basin; NCIA—not connected impervious area; EIA—effective (connected) impervious area

[b] Range from Table 6 represented by treatment by CDS unit, EDB, biofiltration swale, or biofiltration strip

[c] Based on directing roof runoff to downspout infiltration trenches (MFR, Sm-SFR, REST, and Lg-SFR) or harvesting it (OFF and COMM), draining other NCIA to pervious areas, and treating EIA with sand filters

[d] If the higher rainfall at Ojai is assumed, reduction estimates for TSS, TCu, TZn, and TP would be 84.0, 86.3, 92.5, and 75.5 percent, respectively.

SUMMARY AND CONCLUSIONS

This paper demonstrated that common Ventura County area residential and commercial development types subject to the Municipal NPDES Permit are likely, without storm water management, to reduce groundwater recharge from the predevelopment state by approximately half in most cases to a much higher fraction with a large ratio of impervious to pervious area. With no treatment, runoff from these developments is expected to exceed CTR acute copper and zinc criteria at the point of discharge and to deliver large pollutant mass loadings to receiving waters.

Conventional soil-based BMP solutions that promote and are component parts of low-impact development approaches, by contrast, regain about 30-50 percent of the recharge lost in development without storm water management, although commercially-manufactured filtration and hydrodynamic BMPs for storm water management give no benefits in this area. It is expected the soil-based BMPs generally would release effluent that meets the acute zinc criterion at the point of discharge, although it would still exceed the copper limit. Excepting phosphorus, it was found that these BMPs would capture and prevent the movement to receiving waters of the majority of the pollutant loadings considered in the analysis.

It was found that a three percent Effective Impervious Area standard can be met in typical developments, and that by draining all site runoff to pervious areas, runoff can be eliminated entirely in most development types. This result was reached assuming the use of native soils. Soil enhancement (typically, with compost) can further advance infiltration. Draining impervious surfaces onto the loam soils typical of Ventura County, in connection with limiting directly connected impervious area to three percent of the site total area, should eliminate storm runoff from some development types and greatly reduce it from more highly impervious types. Adding roof runoff elimination to the LID approach (by harvesting or directing it to downspout infiltration trenches) should eliminate runoff from all but mostly impervious developments. Even in the development scenario involving the highest relative proportion of impervious surface, losses of rainfall capture for beneficial uses could be reduced from more than 85 to less than 40 percent, and pollutant mass loadings would fall by 83-95 percent from the untreated scenario when draining to pervious areas was supplemented with water harvesting. These results demonstrate the basic soundness of the Draft Permit's concept to limit directly connected impervious area and drain the remainder over pervious surfaces.

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ATTACHMENT A

JUSTIFICATION OF PROPOSED EFFECTIVE IMPERVIOUS AREA LIMITATION

Summary

The literature shows that adverse impacts to the physical habitat and biological integrity of receiving waters occur as a result of the conversion of natural areas to impervious cover. These effects are observed at the lowest levels of impervious cover in associated catchments (two to three percent) and are pronounced by the point that impervious cover reaches five percent. To protect biological productivity, physical habitat, and other beneficial uses, effective impervious area should be capped at no more than three percent.

I. Impacts to physical habitat of California receiving waters observed at three percent impervious cover

Stein *et al*.[7] note that while studies from parts of the country with climates more humid than California's indicate that physical degradation of stream channels can initially be detected when watershed impervious cover approaches 10%, biological effects, which may be more difficult to detect, may occur at lower levels (CWP 2003).[8] Recent studies from both northern and southern California indicate that intermittent and ephemeral streams in California are more susceptible to the effects of hydromodification than streams from other regions of the US, with stream degradation being recognized when the associated catchment's impervious cover is as little as 3-5% (Coleman *et al*. 2005).[9] Furthermore, supplemental landscape irrigation in semi-arid regions, like California, can substantially increase the frequency of erosive flows (AQUA TERRA Consultants 2004).[10]

Coleman, *et al*.[3] report that the ephemeral/intermittent streams in southern California (northwestern Los Angeles County through southern Ventura County to central Orange County) appear to be more sensitive to changes in percent impervious cover than streams in other areas. Stream channel response can be represented using an *enlargement curve*, which relates the percent of impervious cover to a change in cross-sectional area. The data for southern California streams forms a relationship very similar in shape to the enlargement curves developed for other North American streams. However, the curve for southern California streams is above the general curve for streams in other climates. This suggests that a specific enlargement ratio is produced at a lower value of impervious surface area in southern California than in other parts of North America. Specifically, the estimated threshold of response is approximately 2-3% impervious cover, as compared to 7-10% for other portions of the U.S. It is important to note that this conclusion applies specifically to streams with a catchment drainage area less than 5 square miles.

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[7] Stein, E.D., S. Zaleski, (2005) *Managing Runoff to Protect Natural Streams: The Latest Developments on Investigation and Management of Hydromodification in California*. (Proceedings of a Special Technical Workshop Co-sponsored by California Stormwater Quality Association (CASQA), Stormwater Monitoring Coalition (SMC), University of Southern California Sea Grant (USC Sea Grant), Technical Report #475).

[8] Center for Watershed Protection (CWP), (2003) *Impacts of Impervious Cover on Aquatic Systems*. Ellicott City, MD.

[9] Coleman, D., C. MacRae, and E.D. Stein, (2005) *Effect of Increases in Peak Flows and Imperviousness on the Morphology of Southern California Streams.* Southern California Coastal Water Research Project Technical Report #450, Westminster, CA.

[10] AQUA TERRA Consultants, (2004) *Urbanization and Channel Stability Assessment in the Arroyo Simi Watershed of Ventura County CA*. FINAL REPORT. Prepared for Ventura County Watershed Protection Division, Ventura CA.

This study concludes that disconnecting impervious areas from the drainage network and adjacent impervious areas is a key approach to protecting channel stability. Utilizing this strategy can make it practical to keep the effective impervious cover (*i.e*. the amount hydrologically connected to the stream) equal to or less than the identified threshold of 2-3%.

II. Impacts to biological integrity of receiving waters observed with any conversion from natural to impervious surface

Two separate studies conducted by Horner *et al*.[11,12] in the Puget Sound region (Washington State), Montgomery County, Maryland, and Austin, Texas built a database totaling more than 650 reaches on low-order streams in watersheds ranging from no urbanization and relatively little human influence (the reference state, representing "best attainable" conditions) to highly urban (>60 percent total impervious area, "TIA"). Biological health was assessed according to the benthic index of biotic integrity (B-IBI) and, in Puget Sound, the ratio of young-of-the-year coho salmon (*Oncorhynchus kisutch*), a relatively stress-intolerant fish, to cutthroat trout (*Oncorhynchus clarki*), a more stress-tolerant species. The following discussion summarizes the results and conclusions of these two studies.

There is no single cause for the decline of water resource conditions in urbanizing watersheds. Instead, it is the cumulative effects of multiple stressors that are responsible for degraded aquatic habitat and water quality. Imperviousness, while not a perfect yardstick, appears to be a useful predictor of ecological condition. However, a range of stream conditions can be associated with any given level of imperviousness. In general, only streams that retain a significant proportion of their natural vegetative land-cover and have very low levels of watershed imperviousness appear to retain their natural ecological integrity. It is this change in watershed land-cover that is largely responsible for the shift in hydrologic regime from a sub-surface flow dominated system to one dominated by surface runoff.

While the decline in ecological integrity is relatively continuous and is consistent for all parameters, the impact on physical conditions appears to be more pronounced earlier in the urbanization process than chemical degradation. It is generally acknowledged, based on field research and hydrologic modeling, that it is the shift in hydrologic conditions that is the driving force behind physical changes in urban stream-wetland ecosystems.

Multiple scales of impact operate within urbanizing watersheds: landscape-level impacts, including the loss of natural forest cover and the increase in impervious surface area throughout the watershed; riparian corridor-specific impacts such as encroachment, fragmentation, and loss of native vegetation; and local impacts such as water diversions, exotic vegetation, stream channelization, streambank hardening, culvert installation, and pollution from the widespread use of pesticides and herbicides. All of these stressors contribute to the overall cumulative impact.

The researchers found that there is no clear threshold of urbanization below which there exists a "no-effect" condition. Instead, there appears to be a relatively continuous decline in almost all measures of water quality or ecological integrity. Losses of integrity occur from the lowest levels of TIA and are already pronounced by the point that TIA reaches 5 percent.

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[11] Horner, R. R., C. W. May, (2002) *The Limitations of Mitigation-Based Stormwater Management in the Pacific Northwest and the Potential of a Conservation Strategy based on Low-Impact Development Principles*. (Proceedings of the American Society of Engineers Stormwater Conference, Portland, OR).
[12] Horner, R.R., E. H. Livingston, C. W. May, J. Maxted, (2006) *BMPs, Impervious Cover, and Biological Integrity of Small Streams*. (Proceedings of the Eighth Biennial Stormwater Research and Watershed Management Conference, Tampa, FL).

Similarly, the Alliance for the Chesapeake Bay[13] reports that small-watershed studies by the Maryland Department of Natural Resources Biological Stream Survey have shown that some sensitive species are affected by even low amounts of impervious cover. In one study, no brook trout were observed in any stream whose watershed had more than 2 percent impervious cover, and brook trout were rare in any watershed with more than 0.5 percent impervious cover.

III. Ventura County's watersheds include biologically-significant water bodies

The literature discussed above is relevant to the watersheds of Ventura County, which contain rivers and streams that currently or historically support a variety of beneficial uses that may be impaired by water quality degradation and stream hydromodification as a result of storm water runoff from impervious land cover. Unlike some Southern California watersheds, Ventura County still has many natural stream systems with a high degree of natural functionality.

For instance, the Ventura River watershed in northwestern Ventura County "supports a large number of sensitive aquatic species,"[14] including steelhead trout, a federally-listed endangered species. Although "local populations of steelhead and rainbow trout have nearly been eliminated along the Ventura River" itself, the California Department of Fish and Game has "recognized the potential for the restoration of the estuary and enhancement of steelhead populations in the Ventura River."[15] Steelhead may also be present in tributaries such as San Antonio Creek.[16] Thriving rainbow trout populations exist in tributaries of the Ventura River including Matilija Creek and Coyote Creek.[17] The Ventura River either does or is projected to support the following beneficial uses: warm freshwater habitat; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; migration of aquatic organisms; and spawning and reproduction.[18] Furthermore, the Ventura River Estuary also supports commercial fishing, shellfish harvesting, and wetland habitat.[19] The Ventura River receives municipal storm drain discharges from Ojai, San Buenaventura, and unincorporated areas of Ventura County.[20]

The Santa Clara River watershed in northern Ventura County "is the largest river system in southern California that remains in a relatively natural state."[21] Sespe Creek is one of the Santa Clara's largest tributaries, and "supports significant steelhead spawning and rearing habitat."[22] Other creeks in the Santa Clara River watershed that support steelhead are Piru Creek and Santa Paula Creek. Sespe Creek and the Santa Clara River also provide spawning habitat for the Pacific lamprey. Rainbow trout populations exist in tributaries of the Santa Clara River including Sespe Creek.[23] The creeks and the Santa Clara river do or are projected to support the following beneficial uses: warm freshwater habitat; cold freshwater habitat; wildlife habitat; preservation of biological habitats rare, threatened, or endangered species; migration of aquatic organisms; and spawning and reproduction.[24] Los Padres National Forest covers much of the Santa Clara River watershed, but increasing development in floodplain areas has been

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[13] Karl Blankenship, BAY JOURNAL,"It's a hard road ahead for meeting new sprawl goal: States will try to control growth of impervious" (July/August 2004), at http://www.bayjournal.com/article.cfm?article=66.
[14] Los Angeles Region Water Quality Control Plan (1994) p. 1-18 ("Basin Plan").
[15] Basin Plan, p. 1-16; Ventura County Environmental & Energy Resources Division, "Endangered Steelhead Trout in Ventura County: Past, Present, and Future," available at http://www.wasteless.org/Eye_articles/steelhead.htm.
[16] Ventura County Environmental & Energy Resources Division, "Steelhead Spawning in Ventura County," (2005), available at http://www.wasteless.org/Eye_articles/steehead2005.html.
[17] Ventura County Environmental & Energy Resources Division, "Endangered Steelhead Trout in Ventura County: Past, Present, and Future," available at http://www.wasteless.org/Eye_articles/steelhead.htm.
[18] Basin Plan, Table 2-1.
[19] Basin Plan, Table 2-4.
[20] Ventura County Watershed Protection District, *Report of Waste Discharge* (January 2005) at p. 3.
[21] Basin Plan, p. 1-16.
[22] Basin Plan, p. 1-16.
[23] Ventura County Environmental & Energy Resources Division, "Endangered Steelhead Trout in Ventura County: Past, Present, and Future," available at http://www.wasteless.org/Eye_articles/steelhead.htm.
[24] Basin Plan, Table 2-1.

identified as a threat to the river system's water quality.[25] Furthermore, the Santa Clara estuary supports the additional beneficial uses of shellfish harvesting and wetlands habitat.[26] The Santa Clara River receives municipal storm drain discharges from Fillmore, Oxnard, San Buenaventura, Santa Paula, and unincorporated areas of Ventura County.[27]

The Calleguas Creek watershed "empties into Mugu Lagoon, one of southern California's few remaining large wetlands."[28] It supports or is projected to support the following beneficial uses: estuarine habitat; marine habitat; wildlife habitat; preservation of biological habitats; rare, threatened, or endangered species; migration of aquatic organisms; spawning and reproduction; shellfish harvesting; and wetlands habitat.[29] Historically, Calleguas Creek drained largely agricultural areas. But this watershed has been under increasing pressure from sedimentation due to increased surface flow from municipal discharges and urban wastewaters, among other sources.[30] Increasing residential developments on steep slopes has been identified as a substantial contributing factor to the problem of accelerated erosion in the watershed (and sedimentation in the Lagoon). Calleguas Creek receives municipal storm drain discharges from Camarillo, Moorpark, Simi Valley, Thousand Oaks, and unincorporated areas of Ventura County.[31]

Ventura County's coastal streams also support a variety of beneficial uses:[32]

- Little Sycamore Canyon Creek in southern Ventura County (warm freshwater habitat; wildlife habitat; rare, threatened or endangered species; and spawning and reproduction);
- Lake Casitas tributaries (warm freshwater habitat; cold freshwater habitat; wildlife habitat; rare, threatened or endangered species; spawning and reproduction; and wetland habitat);
- Javon Canyon and Padre Juan Canyon (warm freshwater habitat; cold freshwater habitat; wildlife habitat; and spawning and reproduction); and
- Los Sauces Creek in northern Ventura County (warm freshwater habitat; cold freshwater habitat; wildlife habitat; migration of aquatic species; and spawning and reproduction).

IV. Conclusion

In order to protect the biological habitat, physical integrity, and other beneficial uses of the water bodies in Ventura County, effective impervious area should be capped at no more than three percent.

[25] Basin Plan, pp. 1-16, 1-18.
[26] Basin Plan, Table 2-4.
[27] Ventura County Watershed Protection District, *Report of Waste Discharge* (January 2005) at p. 3.
[28] Basin Plan, p. 1-18.
[29] Basin Plan, Table 2-1.
[30] Basin Plan, pp. 1-16, 1-18.
[31] Ventura County Watershed Protection District, *Report of Waste Discharge* (January 2005) at p. 3.
[32] Basin Plan, Table 2-1.

ATTACHMENT B

POLLUTANT CONCENTRATIONS FOR URBAN SOURCE AREAS (HERRERA ENVIRONMENTAL CONSULTANTS, INC. UNDATED)

Source Area	Study	Location	Sample Size (n)	TSS (mg/L)	TCu (ug/L)	TPb (ug/L)	TZn (ug/L)	TP (mg/L)	Notes
Roofs									
Residential	Steuer, et al. 1997	MI	12	36	7	25	201	0.06	2
Residential	Bannerman, et al. 1993	WI	~48	27	15	21	149	0.15	3
Residential	Waschbusch, et al. 2000	WI	25	15	n.a.	n.a.	n.a.	0.07	3
Residential	FAR 2003	NY		*19*	*20*	*21*	*312*	*0.11*	4
Residential	Gromaire, et al. 2001	France		*29*	*37*	*493*	*3422*	*n.a.*	5
Representative Residential Roof Values				**25**	**13**	**22**	**159**	**0.11**	
Commercial	Steuer, et al. 1997	MI	12	24	20	48	215	0.09	2
Commercial	Bannerman, et al. 1993	WI	~16	15	9	9	330	0.20	3
Commercial	Waschbusch, et al. 2000	WI	25	18	n.a.	n.a.	n.a.	0.13	3
Representative Commercial Roof Values				**18**	**14**	**26**	**281**	**0.14**	
Parking Areas									
Res. Driveways	Steuer, et al. 1997	MI	12	157	34	52	148	0.35	2
Res. Driveways	Bannerman, et al. 1993	WI	~32	173	17	17	107	1.16	3
Res. Driveways	Waschbusch, et al. 2000	WI	25	34	n.a.	n.a.	n.a.	0.18	3
Driveway	FAR 2003	NY		*173*	*17*		*107*	*0.56*	4
Representative Residential Driveway Values				**120**	**22**	**27**	**118**	**0.66**	
Comm./ Inst. Park. Areas	Pitt, et al. 1995	AL	16	110	116	46	110	n.a.	1
Comm. Park. Areas	Steuer, et al. 1997	MI	12	110	22	40	178	0.2	2
Com. Park. Lot	Bannerman, et al. 1993	WI	5	58	15	22	178	0.19	3
Parking Lot	Waschbusch, et al. 2000	WI	25	51	n.a.	n.a.	n.a.	0.1	3
Parking Lot	Tiefenthaler, et al. 2001	CA	5	36	28	45	293	n.a.	6
Loading Docks	Pitt, et al. 1995	AL	3	40	22	55	55	n.a.	1
Highway Rest Areas	CalTrans 2003	CA	53	*63*	*16*	*8*	*142*	*0.47*	7
Park and Ride Facilities	CalTrans 2003	CA	179	*69*	*17*	*10*	*154*	*0.33*	7
Comm./ Res. Parking	FAR 2003	NY		*27*	*51*	*28*	*139*	*0.15*	4
Representative Parking Area/Lot Values				**75**	**36**	**26**	**97**	**0.14**	

Landscaping/Lawns									
Landscaped Areas	Pitt, et al. 1995	AL	6	33	81	24	230	n.a.	1
Landscaping	FAR 2003	NY		*37*	*94*	*29*	*263*	n.a.	4
Representative Landscaping Values				**33**	**81**	**24**	**230**	**n.a.**	
Lawns - Residential	Steuer, et al. 1997	MI	12	262	n.a.	n.a.	n.a.	2.33	2
Lawns - Residential	Bannerman, et al. 1993	WI	~30	397	13	n.a.	59	2.67	3
Lawns	Waschbusch, et al. 2000	WI	25	59	n.a.	n.a.	n.a.	0.79	3
Lawns	Waschbusch, et al. 2000	WI	25	122	n.a.	n.a.	n.a.	1.61	3
Lawns - Fertilized	USGS 2002	WI	58	n.a.	n.a.	n.a.	n.a.	2.57	3
Lawns - Non-P Fertilized	USGS 2002	WI	38	n.a.	n.a.	n.a.	n.a.	1.89	3
Lawns - Unfertilized	USGS 2002	WI	19	n.a.	n.a.	n.a.	n.a.	1.73	3
Lawns	FAR 2003	NY	3	*602*	*17*	*17*	*50*	*2.1*	4
Representative Lawn Values				**213**	**13**	**n.a.**	**59**	**2.04**	

Notes:

Representative values are weighted means of collected data. Italicized values were omitted from these calculations.

1 - Grab samples from residential, commercial/institutional, and industrial rooftops. Values represent mean of DETECTED concentrations

2 - Flow-weighted composite samples, geometric mean concentrations

3 - Geometric mean concentrations

4 - Citation appears to be erroneous - original source of data is unknown. Not used to calculate representative value

5 - Median concentrations. Not used to calculate representative values due to site location and variation from other values.

6 - Mean concentrations from simulated rainfall study

7 - Mean concentrations. Not used to calculate representative values due to transportation nature of land use.

The Economics of Low-Impact Development: A Literature Review

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EXECUTIVE SUMMARY

Low-impact development (LID) methods can cost less to install, have lower operations and maintenance (O&M) costs, and provide more cost-effective stormwater management and water-quality services than conventional stormwater controls. LID also provides ecosystem services and associated economic benefits that conventional stormwater controls do not.

The available economic research on some of these conclusions is preliminary or limited in scope. For example, most economic studies of LID describe the costs of installing LID, or compare the costs of installing LID with the costs of installing conventional controls. Few reports quantify the economic benefits that LID can provide in addition to managing stormwater. Fewer researchers report results of studies that measure at least some costs *and* at least some benefits of LID vs. conventional controls.

The costs and benefits of LID controls can be site specific and will vary depending on the LID technology (e.g., green roof vs. bioswale), and local biophysical conditions such as topography, soil types, and precipitation. Including developers, engineers, architects and landscape architects early in the design process can help minimize the LID-specific construction costs.

Despite the fact the LID technologies have been promoted and studied since the early 1990s, for many stormwater managers and developers, LID is still a new and emerging technology. As with most new technologies, installation and other costs of LID are highest during the early phases of development and adoption. Over time, as practitioners learn more about the technology, as the number of suppliers of inputs expands, and as regulations adapt to the new technology, costs will likely decline.

Combined sewer overflows (CSO), and the resulting biophysical and economic consequences, are major concerns for municipal stormwater managers. LID can help minimize the number of CSO events and the volume of contaminated flows by managing more stormwater on site and keeping flows out of combined sewer pipes. Some preliminary evidence exists that LID can help control CSO volumes at lower cost than conventional controls.

Many municipalities have zoning and building-inspection standards in place that were adopted many years ago, long before LID was an option. Municipalities with outdated stormwater regulations typically require that builders file variances if they want to use LID controls. This can increase a builder's design and regulatory costs, which delays construction and can increase a builder's financing costs. Updating building regulations to accommodate LID can help reduce the regulatory risk and expense that builders face.

The large majority of the economic studies on LID focus on the costs of including LID in new construction. Replacing curbs, gutters and stormwater pipes with bioswales, pervious pavers and other LID controls can reduce construction costs. Protecting a site's existing drainage patterns can reduce the need for pipe infrastructure and a developer may be able to do away with surface stormwater ponds, which also increases the number of developable lots. Some researchers report that developments that emphasize LID controls and protected natural grass and forest drainage areas cost less to develop and sell for more than traditionally-developed lots with conventional stormwater controls.

Few studies considered the economic outcomes of including LID in urban redevelopment projects. Some evidence exists that LID controls cost more than conventional controls under these conditions, however, these studies excluded O&M costs of the two alternatives and the economic benefits that the LID controls can provide.

I. INTRODUCTION

Conventional stormwater controls collect stormwater from impervious surfaces, including roads, parking lots and rooftops, and transport the flow off site through buried pipes to treatment facilities or directly to receiving bodies of water. This approach efficiently collects and transports stormwater, but also can create high-velocity flows polluted with urban contaminants, including sediment, oil, fertilizers, heavy metals, and pet wastes. Such flows can erode stream banks and natural channels, and deposit pollutants that pose ecosystem and public health risks (Kloss and Calarusse 2006).The resulting ecosystem and public health consequences can create significant economic costs.

A study of the biophysical and public health damages and associated economic costs of stormwater runoff in the Puget Sound estimates these costs at over $1 billion during the next decade (Booth et al. 2006). These costs include flood-related property damage and financial losses, capital costs of new stormwater infrastructure, cleaning up stormwater-polluted water resources, and habitat restoration and protection efforts. The Natural Resources Defense Council (Kloss and Calarusse 2006) describes similar impacts attributed to conventional controls across the U.S.: stormwater sewers collect and discharge untreated stormwater to water bodies, while combined sewer and stormwater systems overflow during heavy rains, discharging both untreated sewage and stormwater into the nation's rivers and lakes. Both contribute to impaired water quality, flooding, habitat degradation, and stream bank erosion. The U.S. Environmental Protection Agency (EPA) estimates the costs of controlling combined sewer overflows (CSO) throughout the U.S. at approximately $56 billion. Developing and implementing stormwater-management programs and urban-runoff controls will cost an additional $11 to $22 billion (Kloss and Calarusse 2006).

In contrast to conventional stormwater controls, low-impact development (LID) techniques emphasize on-site treatment and infiltration of stormwater. The term low-impact development encompasses a variety of stormwater-management techniques. Examples include bioswales, rain gardens, green streets, and pervious pavers (U.S. EPA 2000). The name LID came into use around the late 1990s, however stormwater managers employed LID techniques prior to this. Technicians in Prince George's County, Maryland were some of the first to install what eventually became known as LID techniques in the early 1990s as an alternative to conventional stormwater controls. Soon after, a few communities in the Chesapeake Bay area followed, experimenting with a number of LID demonstration projects. Over time, interest in LID as an alternative or complement to conventional controls grew, and so did the number of LID demonstration projects and case studies across the United States. The EPA reviewed the early literature on LID and described their assessment of this literature in a report released in 2000 (U.S. EPA and Low Impact Development Center 2000). Their review assessed the availability and reliability of data on LID projects and the effectiveness of LID at managing stormwater. While this report focused primarily on the potential stormwater-management benefits of LID, it concluded that LID controls can be more cost effective and have lower maintenance costs than conventional stormwater controls. In December of the following year, the Center for Watershed Protection published one of the earliest studies that focused primarily on the economic aspects of "better site design," which included many LID principles (Center for Watershed Protection 2001).

The amount of information available on the economics of managing stormwater using LID has grown since the publication of these first reports. Most studies describe the costs of installing LID, or compare the costs of installing LID with the costs of installing conventional controls. Other reports focus on the economic benefits that LID can provide in addition to managing stormwater. These benefits include mitigating flooding, improving water-quality, and providing amenity values for properties adjacent to LID, such as green streets. A few—very few—researchers report results of studies that attempt to characterize at least some costs *and* at least some benefits of LID vs. conventional controls in a *single* study. In this report we summarize our review of the literature on the economic costs and benefits of managing stormwater by LID.

This literature review has three objectives. First, to describe briefly, and in plain language, the methods economists use when measuring the costs and benefits of LID and conventional stormwater controls. This information provides the reader with a context for the economic descriptions of costs and benefits that follow. Second, to summarize the literature that identifies and measures the economic costs and benefits of managing stormwater using LID, or that compares costs or benefits, or both, between LID and conventional controls. Third, to organize and present this information in a way that non-economist municipal officials, stormwater managers, ratepayer stakeholders and others can use as they consider and deliberate stormwater-management plans.

This literature review differs from literature reviews that accompany academic studies. Typically, academic literature reviews provide an introduction and a context for an analysis of a specific economic issue, e.g., a new analytical technique that measures economic benefits. In this case, the literature review is a stand-alone document that summarizes information on the broad issue of economic costs and benefits of LID. Academic literature reviews also target academic and professional economists. This literature review targets non-economist readers.

The technical effectiveness of LID stormwater controls is outside the scope of our review. Our analysis assumes that the LID techniques described in the economic studies that we reviewed provide the necessary or expected stormwater controls. As we understand, there is a growing body of literature on LID effectiveness, and we include some of these references in the Appendix to this report. Also, the more general topic of the economic values of ecosystem services, while somewhat related, was outside the scope of our review. Our analysis focused on the values of ecosystem services as affected by LID techniques.

We began our search for relevant literature by developing a list of key words with which to find reports or articles that contained relevant information. After a cursory search of LID literature, we identified LID- and economics-related key words that researchers and practitioners use when describing LID projects and analyses. The list includes words often used synonymously with LID (i.e., source control, natural drainage systems, sustainable stormwater management), or that describe a set of conservation-design strategies that include LID techniques (i.e., green infrastructure and conservation development). We also searched the literature using economics-related terms (i.e., costs, benefits, and savings). Table 1-1 lists the LID- and economics-related search terms we used in our search of the literature.

Using the terms listed in Table 1-1, we searched databases that contained the widest-possible range of sources including academic literature, reports produced by government agencies and non-profit organizations, news coverage, and articles in the popular press. These databases include information published in peer-reviewed articles, books, reports, conference papers and presentations, and web pages. Table 1-2 lists the databases included in our search.

Table 1-1: Search Terms

LID-Related Search Terms	Economics-Related Search Terms
Low-impact development	Economics
Source control	Benefits, economic benefits
Green infrastructure	Costs, economic costs
Natural drainage systems	Cost comparison
Sustainable stormwater management	Savings
Conservation development	Benefit cost analysis, cost benefit analysis
Alternative stormwater management	Cost effectiveness
Better site design	
Low-impact urban design and development	

Source: ECONorthwest

Table 1-2: Databases

Database	Description
Academic Search Premier	Index of 8,000 academic journals in the social sciences, humanities, and general science, back to 1965.
Article First	Index of 16,000 journal titles in business, humanities, popular culture, science, social science, and technology, back to 1990.
Econlit	American Economic Association's index of economic research, back to 1969.
Environmental Protection Agency (EPA) website	Database of studies, reports, educational material, and newsletters authored or supported by the EPA.
Environmental Valuation Reference Inventory (EVRI)	Database of empirical studies conducted internationally on the economic values of ecosystem services.
Google	Source for non-peer reviewed reports, articles, websites and other publications.
Journal Storage (JSTOR)	Index of over 100 major research journals in a variety of academic disciplines, some back to 1870.
Web of Science	Index of science and social science journals, back to 1975.
WorldCat	Index of bibliographic records of books, journals, manuscripts, etc. archived in university, public and private library catalogs around the world.

Source: ECONorthwest

We reviewed potential sources for relevance. If a source contained LID-related cost or benefit information, we indexed it in our own database, summarized the information on costs or benefits, and reviewed its bibliography for additional sources of information.

This report of our review of the literature is organized as follows. The next two sections provide background information to the discussion of the economic costs and benefits of managing stormwater. This background information provides a context or economic frame-of-reference that will help the reader consider the descriptions of costs and benefits that follow.

In **Section II** we list the range of benefits associated with LID, as identified in the LID literature, along with illustrations of the values of these benefits as reported in the economic literature. We found that many more reports simply list these benefits rather than quantify them.

In **Section III** we describe two of the more common methods of measuring the economic costs and benefits of stormwater controls: the cost-effectiveness and benefit-cost methods. As the names imply, cost-effectiveness studies compare alternatives looking exclusively at the alternatives' costs. This method assumes away benefits or holds them constant across alternatives. A benefit-cost analysis considers the range of costs and benefits for each alternative. The benefit-cost method has greater data demands and can be more expensive than the cost-effectiveness approach—primarily because it adds benefits into the analysis—but it can also yield a more accurate economic picture of the full range of economic consequences of implementing the alternatives.

In **Section IV** we summarize the literature that considers the costs and benefits of LID. The large majority of these studies focus exclusively on the costs of installing LID, or compare the costs of installing LID with the costs of installing conventional controls. Some studies look beyond installation costs to include operations and maintenance costs. Few studies consider both the costs and benefits of LID or compare costs and benefits of LID with conventional controls.[1] When the literature allowed, we described the economic aspects of adopting LID from the perspective of municipal decisionmakers, ratepayer stakeholders, and private developers.

In **Section V** we describe LID from the perspective of property developers. As with other new technologies, adopting LID includes opportunities and risks. We describe the risks and challenges that developers face when they include LID controls in their projects and the successes developers have had adopting LID.

In **Section VI** we discuss areas of future research that would increase our understanding of the economics of LID. For example, limited information exists on the life-cycle costs of LID, the economic benefits of LID beyond stormwater control, and the economic impacts of installing LID in urban-redevelopment settings.

The **Bibliography** lists the references we cite in this report. During our search for information on the economic aspects of LID, we encountered non-economic information that supports the use of LID. We list this information in the **Appendix** to this report.

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[1] We list the reported dollar amounts of costs and benefits without converting to current, 2007-year, dollars because in most cases, the available information prevented such a conversion.

II. ECOSYSTEM SERVICES PROVIDED OR ENHANCED BY LOW-IMPACT DEVELOPMENT

Conventional controls and LID techniques both manage stormwater flows. By promoting stormwater management on site using a variety of techniques, LID controls can provide a range of ecosystem services beyond stormwater management. Braden and Johnston (2004), Coffman (2002), and the Natural Resources Defense Council (Lehner et al. 2001) list and describe the kinds of ecosystem services that LID can provide or enhance. Taken together, these researchers describe the following ecosystem services: reduced flooding, improved water quality, increased groundwater recharge, reduced public expenditures on stormwater infrastructure, reduced ambient air temperatures and reduced energy demand, improved air quality, and enhanced aesthetics and property values. We briefly describe each of these services below.

Reduced Flooding

Braden and Johnston (2004) studied the flood-mitigation benefits of managing stormwater on site, including reduced frequency, area, and impact of flooding events. In a follow-up study, Johnston, Braden, and Price (2006) focus on the downstream benefits accrued from flood reduction accomplished by greater upstream on-site retention of stormwater. These benefits include reduce expenditures on bridges, culverts and other water-related infrastructure.

Improved Water Quality

Brown and Schueler (1997), Center for Watershed Protection (1998), U.S. EPA and Low Impact Development Center (2000), and Braden and Johnston (2004) describe the water-quality benefits that LID stormwater controls can provide. These benefits include effectively capturing oil and sediment, animal waste, landscaping chemicals, and other common urban pollutants that typically wash into sewers and receiving water bodies during storm events. Plumb and Seggos (2007) report that LID controls that include vegetation and soil infiltration, e.g., bioswales, can prevent more stormwater pollutants from entering New York City's harbor than conventional controls.

Increased Ground Water Recharge

On-site infiltration of stormwater helps recharge groundwater aquifers. According to a report by American Rivers, the Natural Resources Defense Council, and Smart Growth America (Otto et al. 2002), areas of impervious cover can significantly reduce ground water recharge and associated water supplies. The study found that impervious surfaces in Atlanta reduced groundwater infiltration by up to 132 billion gallons each year—enough water to serve the household needs of up to 3.6 million people per year.

Braden and Johnston (2004) distinguish between two services associated with increased groundwater recharge: the increased volume of water available for withdrawal and consumption, and maintaining a higher water table, which reduces pumping costs and increases well pressure.

Reduced Public Expenditures on Stormwater Infrastructure

The Center for Watershed Protection (1998), Lehner et al. (2001), and U.S. EPA (2005) report that LID techniques, such as bioswales, rain gardens, and permeable surfaces, can help reduce the demand for conventional stormwater controls, such as curb-and-gutter, and pipe-and-pond infrastructure. Braden and Johnston (2004) report that retaining stormwater runoff on site reduces the size requirements for downstream pipes and culverts, and reduces the need to protect stream channels against erosion.

Two recent studies by the Natural Resources Defense Council (Kloss and Calarusse 2006) and Riverkeeper (Plumb and Seggos 2007) report that by managing stormwater on site, LID techniques can help reduce combined sewer overflows. Combined sewer systems transport both sewage and stormwater flows. Depending on the capacity of the pipes and the amount of rainfall, the volume of combined sewer and stormwater flows can exceed the capacity of the pipes when it rains. When this happens, overflows of sewage and stormwater go directly to receiving bodies of water untreated. LID helps to keep stormwater out of the combined system, which reduces CSO events. Thurston (2003) found that decentralized stormwater controls, such as LID, can control CSO events at a lower cost than conventional controls.

Reduced Energy Use

LID techniques, such as green roofs and shade trees incorporated into bioswales and other controls can provide natural temperature regulation, which can help reduce energy demand and costs in urban areas. Plumb and Seggos (2007) estimate that covering a significant amount of the roof area in New York City with green roofs could lower ambient air temperatures in summer by an estimated 1.4 degrees Fahrenheit. The U.S. EPA and Low Impact Development Center (2000) report that the insulation properties of vegetated roof covers can help reduce a building's energy demand, and notes that green roofs in Europe have successfully reduced energy use in buildings.

Improved Air Quality

Trees and vegetation incorporated into LID help improve air quality by sequestering pollutants from the air, including nitrogen dioxide, sulfur dioxide, ozone, carbon monoxide, and particulate matter (American Forests 2000-2006). In a study by Trees New York and Trees New Jersey, Bisco Werner et al. (2001) report similar air-quality benefits of trees and vegetation in urban areas. Plumb and Seggos (2007) cite one study that found that a single tree can remove 0.44 pounds of air pollution per year.

Enhanced Aesthetics and Property Values

Several studies including Lacy (1990), Mohamed (2006), U.S. Department of Defense (2004), and Bisco Werner et al. (2001) report that the natural features and vegetative cover of LID can enhance an area's aesthetics, and increase adjacent property values. The U.S. Department of Defense (2004) highlights how LID can improve the aesthetics of the landscape and increase adjacent property values by providing architectural interest to otherwise open spaces. On commercial sites, Bisco Werner et al. (2001) found that LID on commercial sites provided amenities for people living and working in the area and complemented the site's economic vitality, which improved its competitive advantage over similar establishments for customers and tenants.

III. Economic Framework: Measuring Costs and Benefits of Low-Impact Development

Researchers and practitioners assess the economic aspects of LID using several methodologies. These methodologies range from rough cost evaluations, that compare a subset of costs of LID against the same costs for conventional management techniques, to benefit-cost analyses, that compare a range of costs and benefits of LID to the same for conventional stormwater controls. This section examines the differences in these methodologies.

Most economic evaluations of LID reported in the literature emphasize costs. The overwhelming majority of these studies confined their analyses to measuring installation costs. Evaluators prefer this method perhaps because from a developer's perspective, installation cost is one of the most important considerations when choosing between LID or conventional controls. LID can compare favorably with conventional controls in a side-by-side analysis of installation costs (*see for example* Foss 2005; Conservation Research Institute 2005; U.S. EPA 2005; Zickler 2004), however, focusing on installation costs misses other relevant economic information. For example, such a focus excludes operation and maintenance (O & M) costs, differences in the effectiveness of LID versus conventional systems, and the environmental and economic benefits that LID can provide, but which conventional controls cannot.

Evaluating projects based on installation costs has advantages of costing less than studies that include other economic factors, e.g., O & M costs, taking less time than more extensive analyses, and relying on readily available construction-cost data. The tradeoff for stormwater managers is an incomplete and possibly biased description of economic consequences, especially over the long term.

Some researchers look beyond comparisons of installation costs and evaluate LID and conventional controls using a method know as a life-cycle cost analysis (LCCA) (Powell et al. 2005; Sample et al. 2003; Vesely et al. 2005). This approach considers a comprehensive range of stormwater-management costs including planning and design costs, installation costs, O & M costs, and end-of-life decommissioning costs. An LCCA method requires more data than a comparison of installation costs, and this data, particularly data on lifetime O & M costs, may not exist or is difficult and costly to obtain. The tradeoff for policy makers is more accurate information on the cost implications of alternative stormwater-management options. However, LCCA, like more limited cost comparisons, excludes measures of economic benefits.

Another limitation of cost comparisons is that they ignore differences in effectiveness between LID and conventional controls. For this reason, researchers recommend that LCCA should compare projects that provide the similar levels of services (Powell et al. 2005). Brewer and Fisher (2004), Horner, Lim, and Burges (2004), and Zielinski (2000) found, however, that LID approaches can manage stormwater quantity and quality more effectively than the conventional approaches, either controlling more flow, or filtering more pollutants, or both. In these cases, an LCCA study could conclude that an LID option costs more than the conventional control, without accounting for the fact that the LID option can manage a larger volume of stormwater.

The benefit-cost approach overcomes the limitations of simple cost comparisons or LCCA by considering the full range of costs and benefits of alternative management options. The tradeoff is that the benefit-cost approach requires more data than cost comparison, which increases the time and costs of conducting the economic analysis.

The benefit-cost approach evaluates the net economic benefits of a project, or compares outcomes among projects, by comparing relevant costs with relevant economic benefits (Boardman et al. 2005; Field and Field 2006; Gramlich 1990; Kolstad 2000). Economic researchers in academic, business, and public-policy sectors have for many years conducted benefit-cost analyses in a wide variety of applications. Since at least the middle of the twentieth century, economic evaluations of large-scale public projects included some type of benefit-cost analysis, and since 1981, the federal government required that new programs and regulations include a benefit cost analysis (Freeman 2003). The U.S. Office of Management and Budget (OMB) considers the benefit-cost method the "recommended" technique when conducting formal economic analyses of government programs or projects (U.S. OMB 1992). Over the years, the technique has grown more sophisticated, especially with respect to measuring and incorporating non-market goods and services, such as the values of ecosystem services (Croote 1999).

The economic literature on benefit-cost analysis is voluminous and growing, but the basic process can be broken into four steps (Field and Field 2006).[2]

1. The first step defines the scope of the analysis, including the population that will experience the benefits and costs, and the elements of the project, including location, timing, and characteristics of the work to be done.

2. The second step determines a project's full range of inputs and effects, from the planning and design phase through the end of the project's lifespan.

3. The third step identifies and, where possible, quantifies the costs and benefits resulting from the project's inputs and effects. Where quantification is not possible, qualitatively describe the cost or benefit in as much detail as possible, including degree of uncertainty and expected timing of impacts (long-term or short-term).

4. The final step compares the benefits and costs of the project, either in terms of net benefits (the total benefits minus the total costs) or in terms of a benefit-cost ratio (the amount of benefits produced per unit of cost). If relevant, compare results among alternative projects.

We found few benefit-cost evaluations of LID projects. The large majority of studies estimate installation costs, a few consider additional costs, such as O & M costs, and a handful compared some measures of costs against some measures of benefits. The reported benefit-cost studies of LID include Bachand (2002) and Fine (2002),[3] Devinny

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[2] For a more complete discussion of benefit-cost analysis, see Field and Field (2006), Gramlich (1990) and Harberger and Jenkins (2002).

[3] We reviewed summaries of Bachand (2002) and Fine (2002) because we were unable to acquire copies of the full articles.

et al. (2005), and Doran and Cannon (2006). Data limitations may explain part of the reason for the limited number of benefit-cost analyses of LID. This is especially true for lifetime O & M costs and the economic importance of LID benefits. Sample et al. (2003), Powell et al. (2005), Johnston, Braden, and Price (2006), and Conservation Research Institute (2005), among others, describe the need for more research quantifying the benefits of LID practices.

Another reason may be that economic benefits or lifetime O & M costs have no relevance to a given economic study. For example, property developers pay installation costs of stormwater controls, but not lifetime O & M costs. Nor do they benefit directly from the ecosystem services that LID can enhance or provide. Economic results reported by developers will therefore likely focus exclusively on installation costs of LID or compare installation costs for LID and conventional controls.

Using the benefit-cost approach has challenges that the other analytical methods do not. However, benefit-cost analysis has advantages in that it can provide decisionmakers, ratepayers and other stakeholders with a more complete picture of the economic consequences of stormwater-management alternatives than other analytical methods. This is especially true for costs and benefits of alternatives over the long term. In situations in which time, budget, or other information constraints limit quantifying economic benefits or costs, the next best alternative is identifying the range of costs and benefits, quantifying what can be measured and describing the remaining impacts qualitatively. The federal government takes this approach in that the OMB recommends that when benefits and costs cannot be quantified, agencies should provide qualitative descriptions of the benefits and costs. These qualitative descriptions should include the nature, timing, likelihood, location, and distribution of the unquantified benefits and costs (U.S. OMB 2000).

IV. COSTS AND BENEFITS OF LOW-IMPACT DEVELOPMENT

The large majority of literature that describe economic assessments of LID focus on the costs of installing the technology. Most studies report the costs of building LID stormwater controls, or compare the costs of installing LID to the costs of conventional controls. The organization of this section reflects this emphasis in the literature. We begin by summarizing studies that list the costs of installing various LID techniques. Most of these reports describe the outcomes of case studies of LID installed as new or developing stormwater-management technologies. We then discuss studies that compare the costs of building LID controls with the costs of building conventional controls.

A number of researchers looked beyond installation costs and considered the impacts that operations and maintenance costs can have on economic evaluations of LID. Analysts sometimes refer to these as life-cycle studies because they consider the relevant costs throughout the useful life of a technology. We summarize three studies that took this approach with LID evaluations.

Combined sewer overflows, and the resulting biophysical and economic consequences, are major concerns for municipal stormwater managers. LID can help minimize the number of CSO events and the volume of contaminated flows by managing more stormwater on site and keeping flows out of combined sewer pipes. We summarize five studies that evaluated the costs of managing CSO events using LID.

A relatively small percentage of the economic evaluations of LID reported in the literature include assessments of the economic benefits of the technology. We summarize a number of these reports at the end of this section.

A. Cost of Low-Impact Development

Brown and Schueler (1997) surveyed construction costs for different methods of managing stormwater in urban areas. Their survey emphasized conventional controls but also included a number of LID techniques. At the time of their study, LID techniques were considered "next generation" best-management practices (BMPs). The report lists construction costs for sixty-four BMPs including wet and dry stormwater ponds, bioretention areas, sand filters and infiltration trenches. The authors' major conclusion is that a BMP's construction cost increases with the volume of stormwater the BMP stores. The report's construction costs may be out-of-date, however they provide insights into relative cost differences between LID and other controls listed in the report.

In a more recent study, Tilley (2003) reports construction costs for LID case studies implemented in Puget Sound and Vancouver, B.C. The report describes a range of case studies from small-scale projects implemented by homeowners to large installations completed by universities, developers and municipal governments. The LID techniques studied include rain gardens, permeable pavement and green roofs. The amount of cost information varies by case study. In some cases the report lists per-unit costs to install an LID, e.g., a pervious concrete project cost $1.50 per square foot for materials (excluding labor). Other descriptions report costs generally, but not costs specific to the case study described, e.g., the cost for pervious concrete is typically $6 to $9 per square foot. Some descriptions have no cost information, and others list total construction costs without a detailed breakdown of cost components.

The U.S. Department of Defense (DoD) (2004) developed a manual of design guidelines to incorporate LID into DoD facilities. The manual describes 13 stormwater-management techniques and their most appropriate uses, maintenance issues, and cost information. The list of LID techniques includes bioretention, grassed swales, and permeable pavers. The manual describes costs in some detail but also notes the site-specific nature of construction costs and factors that can influence construction costs for certain LIDs.

Liptan and Brown (1996) describe one of the earliest comparisons of construction costs for LID with that for conventional controls.[4] They focus on two projects in Portland, Oregon, which they refer to as the OMSI and FlexAlloy projects, and the Village Homes development in Davis, California. In all cases, the LID option cost less. The LID design implemented at the OMSI project saved the developer $78,000 in construction costs by reducing manholes, piping, trenching, and catch basins. At the FlexAlloy site, the City of Portland conducted a retrospective study of LID vs. conventional development, after the builder installed conventional controls. The City calculated that the developer could have saved $10,000 by implementing the LID option. The description of the FlexAlloy case study includes a detailed comparison of construction costs for the two options. The Village Homes case study concluded that by using vegetated swales, narrow streets, and a cluster layout of building lots, the developer saved $800 per lot, or $192,000 for the development. The Village Homes description includes no additional details on construction costs for the two options. The report also includes brief descriptions of other LID case studies, some with cost comparisons for LID vs. conventional controls. The authors conclude that involving developers, engineers, architects and landscape architects early in the design of a development that includes LID can help minimizing the LID-specific construction costs.

Hume and Comfort (2004) compared the costs of constructing conventional roads and stormwater controls with the costs of building LID options, such as bioretention cells and pervious pavement. The researchers added complexity to some of their comparisons by paring the same conventional and LID controls, e.g., infiltration trench (conventional) vs. bioretention cell (LID) on a different soil types and with different sources of stormwater runoff (e.g., driveway vs. roof top) to see how this affected construction costs. In some comparisons the LID option cost more than the conventional option, in other cases the results were opposite. These comparisons illustrate the site-specific nature of LID construction costs. Local conditions, e.g., less pervious soils, can influence the costs of LID controls.

In some cases, LID can help lower construction costs by making use of a site's existing or undisturbed drainage conditions in ways that conventional controls cannot. Planners of a 44-acre, 80-lot residential development in Florida took advantage of the site's natural drainage patters to help lower stormwater-management costs (PATH 2005). The site's low-lying areas convey the large majority of stormwater runoff to forested basins. The developer minimized disturbing natural drainage patterns by clustering building sites and connecting sites with narrow roads. Relying on natural infiltration and drainage patterns help the developer save $40,000 in construction costs by avoiding the costs of constructing stormwater ponds.

[4] In this Section we describe some of the developments associated with costs comparisons reported in the LID literature. The next Section focuses on LID from the perspective of property developers and contractors. In that Section we list results for a larger number of cost comparisons

Comparing construction costs between LID and conventional options, while informative, provides no information on the relationship between the cost and effectiveness. For example, in cases where the LID option costs more to build, it may also control a larger volume of stormwater relative to the conventional option. LID that keeps stormwater out of pipes and treatment facilities help lower operations and maintenance (O & M) costs, and help extend the useful life of the infrastructure, which can reduce future construction costs. The relative importance of construction or O & M costs depends on who pays for them. Builders likely focus exclusively on construction costs, however, cost and effectiveness information would help stormwater managers better evaluate control options and plan for future demands on stormwater infrastructure.

Brewer and Fisher (2004) report the results of four case studies that compared the cost and effectiveness of LID to that of conventional controls. The case studies modeled stormwater costs and conditions on four developments: high- and medium-density residential, an elementary school, and a commercial development. In both residential developments LID controls cost less than conventional controls. LID cost more for the school and commercial development. However, in all four cases, the LID option managed a larger volume of stormwater than the conventional option. We reproduce Brewer and Fisher's results in Table 4-1.

Table 4-1: Comparison of Runoff Controlled and Cost Savings for Conventional and LID Design.

Site Example	Runoff Storage (acre-feet)		LID Net Cost or Savings
	Conventional	LID	
Medium Density Residential	1.3	2.5	$476,406
Elementary School	0.6	1.6	$(48,478)
High Density Residential	0.25	0.45	$25,094
Commercial	0.98	2.9	$(9,772)

Source: Brewer and Fisher 2004

We calculated the economic value of the additional storage provided by the LID designs reported in Brewer and Fisher (2004), using data on the national average of construction costs as reported by American Forests. American Forests' CITYgreen analyses calculate the national-average cost of storing 1 acre-foot of runoff at $87,120.[5] American Forests uses a value of $2.00 per cubic foot of storage, obtained from national estimates of stormwater construction costs. This amount represents the avoided costs of not building stormwater detention ponds. This value may vary, depending on a project's location. In some of its analyses, American Forests uses local estimates of construction costs, which can be lower or higher than the national average. For example, American Forests uses

[5] *See, for example,* American Forests. 2003. *Urban Ecosystem Analysis: San Diego, California*. July. Retrieved August 2, 2007, from http://www.americanforests.org/downloads/rea/AF_SanDiego.pdf, American Forests. 2003. *Urban Ecosystem Analysis: Buffalo-Lackawanna Area, Erie County, New York*. June. Retrieved August 2, 2007, from http://www.americanforests.org/downloads/rea/AF_Buffalo.pdf.

$0.66 per cubic foot of storage in Houston, TX,[6] $5.00 per cubic foot of storage in the Washington D.C. Metro Area,[7] and $6.00 per cubic foot of storage in Portland, OR.[8] Table 4-2 shows the results of our calculation.

Table 4-2: Value of the Difference in Runoff Storage Provided by LID Designs.

Site Example	Runoff Storage (acre-feet)			Runoff Storage Difference (cubic-feet)[a]	Value of Difference in Runoff Storage ($2/cf)
	Conventional	LID	Difference		
Medium Density Residential	1.3	2.5	1.2	52,272	$104,544
Elementary School	0.6	1.6	1	43,560	$87,120
High Density Residential	0.25	0.4 5	0.2	8,712	$17,424
Commercial	0.98	2.9	1.92	83,635	$167,270

Source: ECONorthwest
Notes: [a] To convert from an acre foot to cubic feet, multiply by 43,560 (the number of cubic feet in an acre-foot).

Based on the results reported in Table 4-1, and taking the perspective of a builder, LID is the higher-cost alternative for the school and commercial development. Including the results from Table 4-2, and taking the perspective of a municipal stormwater manager—that is, considering construction costs and the cost savings associated with reductions in stormwater volume in our example calculation above—the LID option dominates the conventional choice in all four cases. The LID options control a larger volume of stormwater, which helps avoid municipal expenditures on stormwater management.

Doran and Cannon (2006) studied the relationship between construction costs of LID and conventional controls and effectiveness as measured by improvements in water quality. They studied the impacts of incorporating LID into a downtown redevelopment project in Caldwell, Idaho. The analysis modeled construction costs and improvements to water quality as measured by reduced concentrations of sediment and phosphorus in stormwater runoff. The LID techniques used in the project included permeable pavers, bioretention swales, riparian wetlands, and plantings of restored native vegetation. The study evaluated the LID and conventional controls using the cost of a 1-percent reduction in sediment and phosphorus concentrations. Conventional stormwater controls had lower

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[6] American Forests. 2000. *Urban Ecosystem Analysis for the Houston Gulf Coast Region*. December. Retrieved August 2, 2007, from http://www.americanforests.org/downloads/rea/AF_Houston.pdf.

[7] American Forests. 2002. *Urban Ecosystem Analysis: The District of Columbia*. February. Retrieved August 2, 2007, from http://www.americanforests.org/downloads/rea/AF_WashingtonDC2.pdf.

[8] American Forests. 2001. *Regional Ecosystem Analysis for the Willamette/Lower Columbia Region of Northwestern Oregon and Southwestern Washington State*. October. Retrieved August 2, 2007, from http://www.americanforests.org/downloads/rea/AF_Portland.pdf.

installation costs, but also had a lesser impact on water quality. Conventional controls cost $8,500 and reduced sediment and phosphorus concentrations by 5 percent, or $1,700 per percent reduction. LID stormwater controls cost more, $20,648, but had a greater impact on water quality, reducing sediment by 32 percent and phosphorus by 30 percent. The authors calculated a cost of $645 per percent reduction for the LID option. The LID option produced a better return on initial investment, as measured by improvements to water quality, than did investments in conventional controls.

As the previous two studies illustrate, comparing LID and conventional controls based on costs may bias the assessment against the most effective management option, and the option that yields the greatest return on investment. LID may cost more to build, but from an investment perspective, it may also control more stormwater and better improve water quality. The studies above considered separately LID effectiveness as measured by volume of stormwater managed and improvements in water quality of stormwater runoff. A more complete and accurate assessment of effectiveness and costs would consider the impacts on both in a single study. That is, compare LID and conventional controls based on costs and effectiveness as measured by volume of stormwater *and* water quality. We found no such studies in the literature.

Looking beyond construction costs to O & M and other costs gives a more complete description of the economic consequences of adopting LID or conventional controls. Sample et al. (2003) promotes evaluating stormwater BMPs using life-cycle-cost (LCC) analysis. LCC analysis includes the initial capital expenditures for construction, planning, etc., and the present value of lifetime O & M costs, and the salvage value at the end of the BMP's useful life. In addition, the authors suggest including the opportunity cost of land in the cost analysis. BMPs that occupy more land area have a higher opportunity cost valued at the next-best use for the land, e.g., residential value.

Vesely et al. (2005) compared the LCC for LID controls in the Glencourt Place residential development in Auckland, New Zealand with LCC results for conventional controls. The LID option had the added benefit of reusing stormwater collected on site as grey water for laundry, flushing toilets and irrigation. The LID option had LCCs that were 4 to 8 percent higher than the conventional option, depending on the discount rate and number of years in the analysis. These results do not account for the value of recycled stormwater. Including the avoided cost associated with water saved by recycling stormwater as household gray water, the LCC for the LID option were 0 to 6 percent higher, again, depending on the discount rate and number of future years in the analysis. The authors conclude that accounting for the value of water saved, the LID option was cost competitive with the conventional approach, as measured by the LCC method.

Data constraints on this study included difficulty estimating current and future maintenance costs and future decommissioning costs. Accounting for the opportunity cost of land also proved challenging give the available data. Data limitations also prevented the authors from considering the economic aspects of environmental externalities associated with the LID and conventional options.

LCC evaluations are an improvement over comparisons of construction costs in that they provide a more comprehensive assessment of relevant costs. On the other hand, LCC analyses require more data and results are sensitive to the discount rate applied to future values and the number of years of the analysis. Powell et al. (2005) underscore these advantages and challenges associated with LCC analysis. They recommend a checklist of factors to consider when conducting a LCC for LID and conventional controls. The checklist includes *quantitative* assessments of the components of LCC costs including acquisition, construction, O & M, and salvage value. Also included are *qualitative* assessments of the effectiveness of managing stormwater and the benefits attributed to the management option. The authors note that effectively and accurately implementing LCC analyses for LID will require more research into the costs of LID design, construction and O & M. Further research is also need in assessing the monetary benefits of LID controls.

Despite the fact that LID technologies have been promoted and studied since the early 1990s, in many ways, and to many stormwater managers, LID is still a new and emerging technology (Coffman 2002). As with most new technologies, installation and other costs for LID are highest during the early phases of development and adoption. Over time, as practitioners learn more about the technology, as the number of suppliers of inputs increases, and as regulations adapt to the new technology, costs will likely decline.

Foss (2005) describes this relationship between a learning curve and construction costs for greenstreet technology in Seattle. The city spent $850,000 implementing a greenstreet pilot project, known as the “Street Edge Alternative” (SEA) street. The City’s street planners expect that based on their experience with the pilot project, building greenstreets in the future will cost substantially less. Foss quotes the manager of the City’s surface water program on this point:

> *“You could take $200,000 off the price just from what we didn’t know. … The pilot phases that we are currently in are more expensive, but as the project becomes institutionalized, all the costs will come down. Even still, these projects are less expensive than standard projects.” (p. 7)*

B. Costs of Managing Combined Sewer Overflows By Low-Impact Development

One of the earliest studies of the economic aspects of managing combined sewer overflows by LID evaluated a project that disconnected downspouts as a means of reducing the number of CSO events and costs (Kaufman and Wurtz 1997). In 1994, the Beecher Water District (BWD) near Flint, Michigan, provided free downspout diversions from home sites to sanitary-sewer pipes for the 6,020 residential customers in their service area. The purpose of the program was to reduce the volume of sewer flows from the BWD to the City of Flint’s stormwater facility—and reduce the fees that BWD paid the city to manage these flows—and reduce the number and volume of CSO events in the BWD.

The program was a success on many levels and is an example of a small-scale and inexpensive approach that effectively managed CSO events. Disconnecting downspouts cost the BWD just over $15,000. After the diversions, the mean volume of sewer flows measured across all precipitation events decreased 26 percent. The program saved the BWD over $8,000 per month in reduced fees to the City of Flint’s stormwater facility, and in reduced costs of managing CSO events. The program paid for itself in two months. Other benefits included reduced CSO-related customer complaints, improved recharge of groundwater and reduced pollution of the Great Lakes, the receiving waters for CSO from the District.

In another study looking at controlling CSO events on a smaller scale, Thurston et al. (2003) modeled the costs of CSO controls for a small watershed in Cincinnati, Ohio. The modeling exercise was part of a study that evaluated the theoretical considerations of developing a market for tradable stormwater credits as a means of reducing CSO events and costs. One part of the study compared the construction costs of controlling CSO events by building tunnels and storage vaults with the costs of building LID controls on each of the 420 mostly-residential lots in the study area.

They calculated that building the tunnel and vault option would cost between $8.93 to $11.90 per cubic foot of storage capacity. Building LID controls on individual lots would cost $5.40 per cubic foot of capacity. Based on these results the researchers suggest that the costs of managing CSOs by implementing LID throughout the watershed would cost less than building a large centralized tunnel and vault system to store excess flows. They also note, however that their analysis does not include the opportunity cost of land that the LID controls would occupy, and so the cost of the LID option would be higher than they report. Their analysis also excludes O & M costs for both options, as well as the costs of education and outreach to property owners, and managing the construction of a large number of dispersed LID projects as components of the LID option. The project also excludes the economic benefits of the LID option.

Kloss and Calarusse (2006) developed a set of policy guidelines for decisionmakers interested in implement LID controls as a means of reducing CSO events in their jurisdictions. Regarding the costs of LID controls, the authors distinguish between new and retrofit construction projects. In new developments, they conclude, LID typically cost less than conventional stormwater controls. They note, however, that retrofit developments in urban areas that include LID typically cost more than conventional controls. This is especially true for individual, small-scale retrofit projects. The relative costs of LID controls can be reduced when they are incorporated into larger-scale redevelopment projects. The report provides conclusions with limited details on cost information. The report also describes the experiences of nine municipalities across the country that include LID in their policies to control CSO events and related costs.

Montalto et al. (2007) described the relationship between public agencies tasked with controlling CSO events, and private land owners on whose property the large majority of LID controls would be sited. The public agencies benefit from the reduced stormwater flows and CSO events that LID provides. The land owner, however, pays the LID installation and O & M costs, but may see little benefit beyond reduced stormwater fees or increased property values from LID such as greenstreets. These benefits may not outweigh the costs to the land owner, and so they may choose not to install LID controls. Given this disconnect, the authors note the benefits of public policies, incentives and subsidies to promote LID adoptions by private-property owners.

In an effort, in part, to measure the amount of subsidy that may be required, the authors developed a model to assess the cost-effectiveness of mitigating CSO events in urban areas using LID. They applied their model to a case study in the Gowanus Canal area of Brooklyn, NY. The case study compared the costs of installing porous pavement, green roofs, wetland developments and other LID throughout the study area to the costs of installing storage tanks to catch excess stormwater flows. As part of their analysis they collected and report installation and O & M costs for a range of LID techniques.

They conclude that under a range of cost and performance assumptions, LID installed throughout the study area could potentially reduce the number of CSO events and volume at a cost that would be competitive or less than the costs of the conventional storage-tank option. They note that they could improve the performance of their model if more data were available on LID performance, costs and public acceptance.

Plumb and Seggos (2007) studied the impacts of diverting monies currently designated to building storage tanks and other conventional CSO controls for New York City to building LID controls throughout the city. They compared the effectiveness of storage tanks and LID controls based on gallons of stormwater managed per $1,000 invested. We reproduce their results in Table 4-3 below. Except for greenroofs, the LID options control more stormwater per $1,000 invested than the conventional storage-tank option.

Table 4-3: Gallons of Stormwater Managed per $1,000 Invested.

Stormwater Control	Gallons per $1,000 Invested
Conventional Storage Tanks	2,400
Greenstreet	14,800
Street Trees	13,170
Greenroof	810
Rain Barrel	9,000

Source: Plumb and Seggos 2007

They describe their analysis as a simple and preliminary cost comparison and conclude that their results demonstrate that LID controls can be cost competitive with conventional controls, if not more so. The authors recommended further detailed study of the issue. Their analysis focused on the costs of LID vs. conventional controls and did not consider economic benefits of the LID techniques.

C. Economic Benefits of Low-Impact Development

Many reports and articles describe the potential benefits that LID stormwater controls can provide—benefits that conventional controls can not offer.[9] Very few studies, however, quantify these benefits, either in biophysical measures or in dollar amounts. A study by CH2MHill (2001) is a typical example. The analysis compared the costs and benefits of managing stormwater in two residential developments using LID or conventional controls. The cost analysis included detailed information for the LID and conventional controls. In this case, results of the cost analysis were mixed. In one development the LID option cost less to build and in the other development the conventional control cost less. In both cases the LID option had higher maintenance costs but homeowners would benefit from lower stormwater and water fees.

[9] We list a number of these sources in Section II of this report.

The analysis of benefits included much less detailed information. The study lists the benefits that the LID option would provide, benefits that the conventional approach would not. These benefits include reduced auto traffic, increased open space, improved downstream water quality, and increased groundwater recharge. However, the benefits were not quantified in dollar amounts.

In another example, Bachand (2002) studied the costs and benefits of developing wetlands as a stormwater management option. The analysis described the construction and O & M costs associated with the wetlands option, and the benefits including adding new recreational opportunities, increased wildlife habitat and increase property values for near-by homeowners. However, they did not measure the benefits in economic terms. An accompanying study by Fine (2002) quantified some of the recreational benefits that derive from wildlife watching in the wetlands, but left unquantified the benefits of other direct uses of the wetlands, as well as the value of habitat improvements and other non-use benefits.[10]

When researchers cite the needs for further research into LID-related topics, quantifying benefits and measuring their economic importance invariably makes the list. For example, Sample et al. (2003) cites the need for more research into measuring the technical and economic benefits of LID, including benefits to downstream receiving waters. Powell et al. (2005) note the need for more research into monetary measures of the benefits of LID, e.g., the impact that a greenstreet can have on adjacent property values. Vesely et al. (2005) state that future studies should include not only the economic benefits of LID but also the negative economic impacts of conventional controls. Failing to do so will continue biasing management decisions in favor of conventional controls:

> *"Exclusive reliance on profitability and market value will favour [sic] the conventional approach to stormwater management by disregarding both the negative environmental externalities associated with this approach, and the positive environmental externalities associated with the low impact approach." (page 12)*

A number of studies do measure some of the economic benefits of on-site stormwater controls. For example, Braden and Johnson (2004) studied the economic benefits that on-site stormwater management could have on properties downstream. The researchers first estimated the impacts that on-site stormwater controls could have on the frequency and extent of downstream flooding. Using information reported in the literature on the extent to which property markets discount the value of properties in a floodplain, they approximated the economic value of reduced flooding attributed to on-site management of stormwater. They then calculated the value of avoided flood damage as a percentage of property values. They estimate that a marginal reduction in flooding would increase property values 0 to 5 percent for properties in a floodplain, depending on the extent to which the on-site controls reduce stormwater runoff.

They then took a similar approach to valuing improvements in water quality. Based on values reported in the literature, they estimate that the benefits of improved water quality could reach 15 percent of market value for properties that border the water body at issue

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[10] We were unable to obtain a copy of the full report. We base our description on a summary of the analysis.

if water quality improves significantly. The increase is much less for smaller improvements in water quality, for undeveloped properties, and for properties not adjacent to the water body.

They conclude with a best-guess estimate of a 2 to 5 percent increase in property values for properties in a floodplain from on-site management of stormwater. Other benefits that could not be quantified or valued given available information include reduced infrastructure expenditures for culverts, bridges and other drainage infrastructure.

In a follow-up case study, Johnston, Braden, and Price (2006) applied the analytical method developed in the previous study to properties in the one-hundred-year floodplain portion of a watershed in the Chicago area. They estimate the economic benefit of avoided flooding two ways and extend the analysis to approximate reduced municipal expenditures on culverts.

Applying the 0 to 5 percent impact on property values calculated in the previous study to properties in the case study, the researchers estimated an economic benefit of $0 to $7,800 per acre of increased property value attributed to reduced flooding. They also calculated the economic benefit of reduced flooding based on the avoided flood damage to structures and contents for properties in the floodplain. This analytical method included data compiled by the U.S. Army Corps of Engineers on the relationship between flooding and damages to properties in floodplains. This approach yields an economic benefit of avoided flooding of $6,700 to $9,700 per acre for properties in the floodplain.

The researchers approximate that for the case-study portion of the watershed, conservation-design practices such as LID techniques that retain more stormwater on site and reduce flooding could generate $3.3 million in avoided costs for road culverts.

The estimated economic benefit of increased on-site management of stormwater for properties in the case study for both avoided flooding and reduced municipal expenditures on culverts is $380 to $590 per acre.

A series of analyses by American Forests (2000-2006) report the economic benefits of stormwater services provided by trees in various cities and regions throughout the United States. These reports describe results from American Forests' CITYgreen model, which calculates the volume of stormwater absorbed by existing tree canopies and estimates the avoided costs in stormwater management that the trees provide. The model includes city-specific per-unit stormwater-management costs when available. The model substitutes national per-unit costs when city-specific data are not available. In Table 4-4 below we report the results for some of American Forests' city and regional analyses. The dollar amounts represent the costs of expanding stormwater infrastructure to manage the stormwater that existing trees otherwise absorb and transpire.

Table 4-4: Avoided stormwater-construction costs attributed to trees, as measured by the American Forests' CITYgreen model.

Urban Area	Amount that trees save in one-time stormwater-construction costs
Houston, Texas	$1.33 billion
Atlanta, Georgia	$2.36 billion
Vancouver, Washington/ Portland-Eugene, Oregon	$20.2 billion
Washington D.C. Metro Area	$4.74 billion
New Orleans, Louisiana	$0.74 billion
San Antonio, Texas	$1.35 billion
San Diego, California	$0.16 billion
Puget Sound Metro Area, Washington	$5.90 billion
Detroit, Michigan	$0.38 billion
Chesapeake Bay Region	$1.08 billion

Source: American Forests 2000-2006

The Bisco Werner et al. (2001) analysis of the economic benefits of trees attributed to stormwater management also employed the CITYgreen model. Researchers applied the CITYgreen model to a case study that included the commercial corridor along a major highway through central New Jersey. The analysis modeled the change in tree canopy between 1975 and 1995, and calculated the value of lost stormwater services. During this time, the value of services declined from $1.1 million to $896,000, a 19-percent reduction. If existing trends continue, the expected value in 2015 will be $715,000, a 35-percent reduction relative to the value of services available in 1975. As services supplied by street trees declines, demand on municipal stormwater controls, and associated costs, increase.

The researchers extended their study to include the economic benefits of tree cover attributed to removing air pollutants. This portion of their analysis studied the tree cover at a number of commercial properties in the New York and New Jersey area. In this case the CITYgreen model calculated avoided stormwater-construction costs associated with stormwater services provided by trees on site and, using values reported in the literature, the amounts of air pollutants absorbed by trees, and the per-unit value for each pollutant.

In one case study of a shopping mall, the analysis estimated that the trees currently on the site manage approximately 53,000 cubic feet of stormwater. The CITYgreen model estimated the value of the associated avoided infrastructure costs at just over $33,000. The value of air-pollutant removed is estimated at $1,441 per year. The report lists results for fifteen such case studies.

Wetlands that absorb stormwater runoff can help minimize stormwater-related management and infrastructure costs. Depending on their location and makeup, wetlands may provide other benefits, such as wildlife habitat and recreational opportunities. Fine (2002)[11] studied the recreational benefits provided by wetlands proposed as part of the Treasure Island redevelopment in San Francisco Bay. The analysis assumes that the wetlands will attract visitors year round, with the winter months providing the best opportunity to view migratory birds. Based on recreational expenditures for similar sites in the San Francisco Bay area, Fine calculates that area visitors will spend $4 to $8 million annually. Other benefits that Fine was unable to quantify and value include fisheries enhancement and water-quality services.

Devinny et al. (2005) developed a first-approximation of a benefit-cost analysis of complying with water-quality requirements throughout Los Angeles County using LID and other stormwater BMPs. They present their analysis as an alternative to the approach described by Gordon et al. (2002), which relies on collecting and treating the county's stormwater using conventional controls. The Devinny et al. approach assumes widespread adoption of LID and other on-site stormwater BMPs.

The Devinny et al. analysis accounts for the fact that the density of existing development will limit the extent to which LID and other BMPs can be retrofitted into developments. As an alternative they propose a combination of LID and BMPs along with directing stormwater to regional wetlands and other infiltration systems. As the density of development increases, so does the size and costs of developing regional wetlands.

This study differs from other benefit-cost analyses of stormwater-management options in that the researchers quantify a range of potential benefits associated with the approach that emphasizes on-site treatment of stormwater. They estimate the cost of their approach at $2.8 billion if disbursed LID and other on-site BMPs sufficiently control stormwater quality. Costs increase to $5.7 to $7.4 billion if regional wetlands and other infiltration systems are needed. This approach costs less than the estimated cost of $44 billion to implement the option that emphasizes conventional controls (California Department of Transportation 2005).

The estimated value of the economic benefits of implementing LID, other on-site BMPs and regional wetlands range from $5.6 to $18 billion. Benefits include the economic aspects of reduced flood control, increased property values adjacent to new greenspaces and wetlands, additional groundwater supplies, improved beach tourism, and reduced sedimentation of area harbors. The conventional approach would provide none of these economic benefits.

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[11] We were unable to obtain a copy of the full report. We base our description on a summary of the analysis.

V. Developers' Experiences With Low-Impact Development

Baring regulations that mandate LID controls, developers adopt LID because they help reduce construction costs, increase sales, boost profits, or some combination of the three. These deliberations focus primarily on the extent to which local property markets account for the direct costs and benefits that LID can provide. Typically these deliberations do not include indirect costs and benefits and the potential non-market impacts of LID that may be important to others such as municipal stormwater managers and area residents. These non-market impacts may include reduced downstream flooding, improved water quality and habitat of water bodies that receive stormwater, reduced CSO events, or impacts on the costs of operating municipal-stormwater infrastructure.

In this section we summarize developers' experiences installing LID. As with other new technologies, adopting LID includes opportunities and risks. We begin by describing the risks and challenges that developers face by including LID in their projects. These risks include uncertain construction delays as the developer applies for variances to local zoning codes because the codes do not explicitly recognize LID as an accepted stormwater control.

Next, we describe some of the efforts by municipal governments to reduce the developers' regulatory risk and uncertainty of using LID. Finally, we list some of the successes developers have had adopting LID and the resulting impacts on construction costs, sales, and profits.

A. Challenges Developers Face Using LID

Much of the general public is still unaware of LID attributes, the benefits they can provide, or their O & M costs. As such, they may not understand or appreciate why a developer included LID in a project. This may give developers pause because they supply products that they believe their customers—homebuyers—want and will purchase. Potential buyers may shy away from homes that include an unfamiliar technology.

A general lack of understanding of LID may concern developers in part because including on-site treatment of stormwater will also require on-site management of stormwater facilities, the LID technologies. Homeowners unfamiliar with LID likely will have no understanding of their maintenance requirements (Lewis 2006; England 2002; Foss 2005). For example, a bioswale clogged with sediment may not control stormwater volume or quality, which could negatively reflect on the builder. Another concern has to do with the lack of understanding as to the life-expectancy of LID controls (Lewis 2006). A builder may be concerned that an untimely failure of stormwater controls could negatively affect their reputation.

Similar to the public's general lack of understanding of LID, many builders are also unfamiliar with the technology. A builder may not be able to identify the most effective and least-cost LID technology for a given development from the wide variety of possible LID controls (Foss 2005; Lewis 2006). A related point is that construction costs for LID technologies are site specific. For example, not all soils can support LID technologies that emphasize stormwater infiltration. Assessing a site and designing LID technologies that will function on the site may also increase a builder's design costs (Coffman 2002; Strassler et al. 1999).

A much-mentioned impediment to builders' adoption of LID is building codes that do not account for LID as stormwater controls. Many municipalities have zoning and building-inspection standards in place that were adopted many years ago, long before LID was an option (Coffman 2002; NAHB Research Center Inc. 2003; Foss 2005; Lewis 2006). These standards emphasize conventional stormwater controls that collect stormwater and transport it off site to a receiving body of water or to a treatment facility. Municipalities with outdated stormwater regulations typically require that builders file variances if they want to use LID controls. Filing variances for LID increases design and regulatory costs, which delays construction and can increase a builder's financing costs (Clar 2004; Coffman 2002; Lewis 2006; NAHB Research Center Inc. 2003).

A related constraint in some jurisdictions with outdated regulations is a lack of technical expertise or understanding by regulators regarding LID stormwater controls. In some cases, regulators unfamiliar with LID technology must be convinced of their effectiveness, which also increases a builder's design and regulatory costs (Coffman 2002; NAHB 2003; Lewis 2006).

B. Municipal Actions To Increase LID Adoption On Private Developments

Some jurisdictions help promote LID adoption on private lands and take steps that reduce the regulatory uncertainty and risk that builders face when including LID in private developments. These jurisdictions may have CSO problems, or are trying to extend the useful life of their stormwater infrastructure in the face of increasing population and economic activity. In any case, they recognize the importance of managing as much stormwater on site as possible and keeping it out of the jurisdiction's stormwater pipes.

One way that jurisdictions promote LID adoption on private lands is by updating their zoning codes and building-inspection standards to explicitly address LID stormwater controls (Coffman 2002; NAHB Research Center Inc. 2003; Foss 2005; Lewis 2006). This helps reduce a builder's regulatory risk because it eliminates the need to file variances. Rather than spending time convincing regulators as to the desirable stormwater attributes or effectiveness of LID controls, builders can instead proceed with their development.

Granting density bonuses for developments that install LID stormwater controls is another way jurisdictions encourage the proliferation of LID techniques. In this case, the jurisdiction grants the developer a greater number of individual building lots than would have been allowed if the development relied on conventional stormwater controls (Coffman 2002; NAHB Research Center Inc. 2003). This type of incentive not only reduces a builder's regulatory risk, and associated costs, but also increases the number of lots that can be sold, which can increase the builder's revenue and profits. Jurisdictions also promote LID installation on private lands by reducing development-related fees, such as inspection fees (Coffman 2002; NAHB Research Center Inc. 2003).

C. Benefits To Developers of Including LID Controls in Their Projects

Developers who accept the regulatory uncertainty and other challenges of adopting LID do so with the expectation that controlling stormwater on site can have economic advantages. These advantages include increasing the number of developable lots and reducing expenditures associated with stormwater infrastructure. Managing stormwater on site using LID controls can mean doing away with stormwater ponds, thus increasing a site's developable area (Coffman 2002; NAHB Research Center Inc. 2003). Selling additional lots can increase a builder's revenues and profits. Replacing curbs, gutters and stormwater pipes with bioswales, pervious pavers and other LID controls reduces construction costs for some developers (Coffman 2002; NAHB Research Center Inc. 2003; Center for Watershed Protection 2001).

An analysis of a development in Prince George's County, Maryland, documented the impacts that controlling stormwater on site with LID can have on the site's buildable area and construction costs. The Somerset Community development installed rain gardens, grass swales along streets, and other LID controls. Substituting LID for conventional controls saved the developer approximately $900,000. Doing away with the site's stormwater ponds gave the developer six additional lots (Foss 2005).

A study of the Pembroke Woods Subdivision in Frederick County, Maryland found similar results (Clar 2004). The developer substituted LID for conventional controls, doing away with curbs, gutters, sidewalks, and eliminated two stormwater ponds. Eliminating the curbs and gutters saved the developer $60,000. Installing narrower streets eliminated impervious area and reduced paving costs by 17 percent. Excluding the stormwater ponds saved $200,000 in construction costs and added two developable lots, valued at $45,000 each. Other economic benefits to the developer include reduced costs of clearing land for development of $160,000, and adding 2.5 additional acres of open space, which reduced the developer's wetland-mitigation requirements.

Conservation subdivisions take a comprehensive approach to stormwater management by combining LID controls with a site design that takes advantage of existing drainage patterns. Narrow streets and clustered building lots make maximum use of natural stormwater controls, thus reducing construction costs (Center for Watershed Protection 2001). A study of ten subdivisions found that conservation subdivisions that emphasized LID and protected natural drainage patterns cost, on average, thirty-six percent less than subdivisions that relied on conventional stormwater controls (Conservation Research Institute 2005).

Researchers note that some conservation subdivisions have an additional benefit in that there's greater demand for lots in these subdivisions compared with the demand for lots in conventional subdivisions. Greater demand for lots means the developer can charge more for the lot and lots may sell faster (Center for Watershed Protection 2001).

A case study of conservation and conventional subdivisions in South Kingstown, Rhode Island quantified the market benefits of conservation developments. The study compared the costs of developing the lots and the market value of the lots (Mohamed 2006). Results show that conservation lots cost less to develop and sell for a higher price. On average, conservation lots cost $7,400 less to produce than lots in conventional subdivisions, and sold for 12 to 16 percent more, per acre, than conventional lots. Lots in the conservation subdivision also sold in approximately half the time as lots in conventional subdivisions.

Another study of cluster developments in New England found that houses in these types of developments appreciate faster than houses in conventional developments (Lacy 1990). Lacy identified developments in Concord and Amherst, Massachusetts that were characterized by smaller individual lots surrounded by natural open space, limited lot clearing, and narrower streets. He compared these with nearby conventional developments. The Concord cluster development appreciated 26 percent more than conventional developments over an eight-year study period. The Amherst cluster development also yielded a higher rate of return on investment over a 21-year study period, compared to nearby conventional development.

In Tables 5-1 and 5-2 below we summarize the results of studies that compared construction costs using LID vs. conventional stormwater controls for residential and commercial developments (respectively). We included information in the tables if a study described the source of the cost difference, e.g., substituting a bioswale for curbs and gutters saved $Z. We excluded studies that reported a cost difference, but did not describe the details of the cost comparison. We found many studies in the literature that did not provide details of cost comparisons.

We distinguish between study results for built developments from results for proposed or modeled developments. In some cases the studies report total cost savings for a development but not savings per lot in the development. In these cases we calculated the per-lot cost savings. We recognize that the cost savings values reported below are in dollars from different years, and so comparisons of cost savings between examples may not be appropriate. We found insufficient data in most case studies to convert all values to the same-year dollars.

The large majority of studies listed in Tables 5-1 and 5-2 describe LID installed or proposed to be installed in new developments. We found very few studies that measured the economic outcomes of including LID stormwater controls in urban, redevelopment projects. We identified these studies as “retrofits” in the tables.

Table 5-1: Cost savings attributed to installing LID stormwater controls in residential developments.

Location	Description	LID Cost Savings[a]
Meadow on the Hylebos Residential Subdivision Pierce County, WA	9-acre development reduced street width, added swale drainage system, rain gardens, and a sloped bio-terrace to slowly release stormwater to a creek. Stormwater pond reduced by 2/3, compared to conventional plan. (Zickler 2004)	LID cost 9% less than conventional
Somerset Community Residential Subdivision Prince George's Co., MD	80-acre development included rain gardens on each lot and a swale drainage system. Eliminated a stormwater pond and gained six extra lots. (NAHB Research Center Inc. 2003)	$916,382 $4,604 per lot
Pembroke Woods Residential Subdivision Frederick County, MD	43-acre, 70-lot development reduced street width, eliminated sidewalks, curb and gutter, and 2 stormwater ponds, and added swale drainage system, natural buffers, and filter strips. (Clar 2004; Lehner et al. 2001)	$420,000 $6,000 per lot[b]
Madera Community Residential Subdivision Gainesville, FL	44-acre, 80-lot development used natural drainage depressions in forested areas for infiltration instead of new stormwater ponds. (PATH 2005)	$40,000 $500 per lot[b]
Prairie Crossing Residential Subdivision Grayslake, IL	667-acre, 362-lot development clustered houses reducing infrastructure needs, and eliminated the need for a conventional stormwater system by building a natural drainage system using swales, constructed wetlands, and a central lake. (Lehner et al. 2001; Conservation Research Institute 2005)	$1,375,000- $2,700,000 $3,798-$7,458 per lot[b]
SEA Street Retrofit Residential street retrofit Seattle, WA	1-block retrofit narrowed street width, installed swales and rain gardens. (Tilley 2003)	$40,000
Gap Creek Residential Subdivision Sherwood, AK	130-acre, 72-lot development reduced street width, and preserved natural topography and drainage networks. (U.S. EPA 2005; Lehner et al. 2001; NAHB Research Center Inc. 2003)	$200,021 $4,819 per lot
Poplar Street Apartments Residential complex Aberdeen, NC	270-unit apartment complex eliminated curb and gutter stormwater system, replacing it with bioretention areas and swales. (U.S. EPA 2005)	$175,000
Kensington Estates* Residential Subdivision Pierce County, WA	24-acre, 103-lot hypothetical development reduced street width, used porous pavement, vegetated depressions on each lot, reduced stormwater pond size. (CH2MHill 2001; U.S. EPA 2005)	$86,800 $843 per lot[b]
Garden Valley* Residential Subdivision Pierce County, WA	10-acre, 34-lot hypothetical development reduced street width, used porous paving techniques, added swales between lots, and a central infiltration depression. (CH2MHill 2001)	$60,000 $1,765 per lot[b]
Circle C Ranch Residential Subdivision Austin, TX	Development employed filter strips and bioretention strips to slow and filter runoff before it reached a natural stream. (EPA 2005)	$185,000 $1,250 per lot

Location	Description	LID Cost Savings[a]
Woodland Reserve* Residential Development Lexana, KS	Reduced land clearing, reduced impervious surfaces, and added native plantings. (Beezhold 2006)	$118,420
The Trails* Multi-Family Residential Lexana, KS	Reduced land clearing, reduced impervious surfaces, and added native plantings. (Beezhold 2006)	$89,043
Medium Density Residential* Stafford County, VA	45-acre, 108-lot clustered development, reduced curb and gutter, storm sewer, paving, and stormwater pond size. (Center for Watershed Protection 1998b)	$300,547 $2,783 per lot[b]
Low Density Residential* Wicomico County, MD	24-acre, 8-lot development eliminated curb and gutter, reduced paving, storm drain, and reforestation needs. Eliminated stormwater pond and replaced with bioretention and bioswales. (Center for Watershed Protection 1998b)	$17,123 $2,140 per lot[b]

Source: ECONorthwest, with data from listed sources.
Notes: * indicates hypothetical or modeled project, not actually constructed.
[a] Dollar amounts as reported at the time of study.
[b] Per-lot cost savings calculated by ECONorthwest.

Table 5-2: Cost savings attributed to installing LID stormwater controls in commercial developments.

Location	Description	LID Cost Savings[a]
Parking Lot Retrofit Largo, MD	One-half acre of impervious surface. Stormwater directed to central bioretention island. (U.S. EPA 2005)	$10,500-$15,000
Old Farm Shopping Center* Frederick, MD	9.3-acre site redesigned to reduce impervious surfaces, added bioretention islands, filter strips, and infiltration trenches. (Zielinski 2000)	$36,230 $3,986 per acre[b]
270 Corporate Office Park* Germantown, MD	12.8-acre site redesigned to eliminate pipe and pond stormwater system, reduce impervious surface, added bioretention islands, swales, and grid pavers. (Zielinski 2000)	$27,900 $2,180 per acre[b]
OMSI Parking Lot Portland, OR	6-acre parking lot incorporated bioswales into the design, and reduced piping and catch basin infrastructure. (Liptan and Brown 1996)	$78,000 $13,000 per acre[b]
Light Industrial Parking Lot* Portland, OR	2-acre site incorporated bioswales into the design, and reduced piping and catch basin infrastructure. (Liptan and Brown 1996)	$11,247 $5,623 per acre[b]
Point West Shopping Center* Lexana, KS	Reduced curb and gutter, reduced storm sewer and inlets, reduced grading, and reduced land cost used porous pavers, added bioretention cells, and native plantings. (Beezhold 2006)	$168,898
Office Warehouse* Lexana, KS	Reduced impervious surfaces, reduced storm sewer and catch basins, reduced land cost, added bioswales and native plantings. (Beezhold 2006)	$317,483
Retail Shopping Center*	9-acre shopping development reduced parking lot area, added porous pavers, clustered retail spaces, added infiltration trench, bioretention and a sand filter, reduced curb and gutter and stormwater system, and eliminated infiltration basin. (Center for Watershed Protection 1998b)	$36,182 $4,020 per acre[b]
Commercial Office Park*	13-acre development reduced impervious surfaces, reduced stormwater ponds and added bioretention and swales. (Center for Watershed Protection 1998b)	$160,468 $12,344 per acre[b]
Tellabs Corporate Campus Naperville, IL	55-acre site developed into office space minimized site grading and preserved natural topography, eliminated storm sewer pipe and added bioswales. (Conservation Research Institute 2005)	$564,473 $10,263 per acre[b]
Vancouver Island Technology Park Redevelopment Saanich, British Columbia	Constructed wetlands, grassy swales and open channels, rather than piping to control stormwater. Also used amended soils, native plantings, shallow stormwater ponds within forested areas, and permeable surfaces on parking lots. (Tilley 2003)	$530,000

Source: ECONorthwest, with data from listed sources.
Notes: * indicates hypothetical or modeled project, not actually constructed.
[a] Dollar amounts as reported at the time of study.
[b] Per-acre cost savings calculated by ECONorthwest.

VI. Directions for Future Research

Despite the increasing use of LID stormwater controls, and the growing number of economic studies of this technique, our literature review found areas for further research. These areas include:

- Additional research that quantifies the costs and benefits of stormwater management. This includes economic research on the lifetime O & M costs for LID and conventional controls, as well as, studies that quantify the economic benefits of LID methods.

- More detailed information on costs associated with LID. Specifically, information on the factors that contribute to cost savings or cost increases of LID relative to conventional controls.

- Economic studies of LID and conventional methods that control for the effectiveness of the techniques regarding managing stormwater volumes and improving water quality. Comparing LID techniques that cost more to install than conventional methods, but control larger amounts of stormwater, is an apples-to-oranges comparison.

- The large majority of economic studies of LID methods apply to new construction. More research is needed on the economic outcomes of including LID methods in urban redevelopment projects.

- Some preliminary evidence exists that LID can help control CSO volumes at a lower cost than conventional controls. Stormwater managers and public-policy decisionmakers would benefit from additional economic research on this topic.

- Economic studies that model theoretical LID and conventional controls, while informative, may be less convincing to some stormwater managers, decisionmakers and ratepayer stakeholders than retrospective studies of installed controls.

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APPENDIX: ADDITIONAL LOW-IMPACT DEVELOPMENT RESOURCES

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April 10, 2009

Chair Lutz and Board Members
Los Angeles Regional Water Quality Control Board
320 4th Street, Suite 200
Los Angeles, CA 90013

Dear Chair Lutz and Members of the Board:

I have previously submitted a study to the Los Angeles Regional Water Quality Control Board that reports on my findings regarding the feasibility and water quality benefits of Low Impact Development ("LID") implementation in Ventura County. LID is an extremely effective way of addressing a root cause of stormwater pollution: the unnaturally high degree of impervious surface in urban areas which not only conveys significant pollutant loadings to receiving waters, but also has related and deleterious water resources impacts. Because it addresses a root cause of stormwater pollution, LID is not merely one of many theoretically co-equal best management practices, but rather one that is central to stormwater pollution control today. For this reason, the technical adequacy of the Ventura County MS4 Permit's ("Ventura County Permit" or "Permit") new development and redevelopment provisions, and the degree to which they integrate clear LID requirements tied to numeric performance metrics, is essential to the function and success of the Permit.

Summary

By way of summary, my study, "Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County," provided to you when the Draft Permit was first issued in 2007, examined the practicability of retaining storm water onsite through LID BMPs based on a performance standard ("effective impervious area") that drafts of the Permit contained. My analysis took into account local soil and rainfall conditions and examined a range of development types. The analysis showed that by retaining water from the site to meet a 3% EIA standard, LID practices result in drastically less polluted runoff compared to conventional BMPs (reducing site runoff volume and pollutant loading to zero in many typical rainfall scenarios). Even treating stormwater with the best-performing conventional BMPs is much less effective than using LID practices to retain water with a strong numeric requirement like 3% EIA. Pollutant loads would also be significantly diminished through the use of these LID techniques, especially in comparison to conventional BMPs. Based on my analysis, LID implementation, anchored to an EIA or volume-based design storm, is both feasible and far preferable to the use of conventional BMPs from a water quality and quantity perspective.

The Permit Omits Practicable Control Requirements and Would Impose Standards Weaker than Other Jurisdictions

Overall, the Permit's requirements are notable in that they do not adopt a 3% EIA standard, notwithstanding local technical verification of this approach, and also do not adopt another equivalent storm water retention requirement for all regulated development and redevelopment projects. This makes the permit's critical development and redevelopment provisions out-of-step with common approaches to LID implementation nationally and with recent studies in the field, in which I have participated. Many other stormwater management documents around the country have adopted onsite retention standards with larger design storm volumes than the Ventura County Permit. These precedents can be compared to conditions in Ventura County, which generally has rainfall patterns that make retention-based LID approaches even more practicable than many other regions. I have enclosed as Attachment A my analysis ("Assessment of Evaporation Potential with Low-Impact Development Practices") of how these other examples from around the country support similar or stronger requirement in Southern California.

The Exemption from EIA for All Redevelopment is Unjustified Technically

Of particular significance, in reviewing the new draft of the Ventura County Permit, I note that its provisions appear to allow the use of conventional BMPs on any redevelopment site. As I demonstrated in my studies, LID implementation focused on onsite retention is feasible in a wide range of development typologies, and the pollution-reducing and volume-reducing benefits of LID practices far exceed conventional BMPs. In cases where retention of the design storm is not possible, standard practice in the field today offers a development applicant the opportunity to achieve the same performance in part offsite, which permits flexibility but returns predictable, superior water quality performance in the watershed or subwatershed. The Permit, however, dispenses with prior requirements to meet an EIA standard in redevelopment contexts, unless doing so can be shown by rigorous analysis to be technically infeasible.

There is no technical justification in the Permit for this exemption for redevelopment from meeting the EIA requirements. This exemption is, at minimum, substantially overbroad as now formulated. My research has shown that there is, in fact, no need for such blanket exemptions at all. Thus, from a technical standpoint, in this way also the Permit would require a level of performance considerably inferior to that which my Ventura County analysis demonstrated is feasible.[1]

[1] The authors of "Low Impact Development Metrics in Stormwater Permitting" ("the report") drew certain negative (and not always well-founded, as explained in Attachment

This conclusion based on specific Ventura County analysis is bolstered also by my work and that of my colleagues, including the Regional Board's Xavier Swamikannu, who participated in the preparation of an expert report for the National Academy of Sciences. We found that LID techniques must be a top priority for implementation at new development *and* redevelopment projects covered by stormwater permits, unless their use can be formally and convincingly demonstrated to be infeasible. In keeping with the NAS report and my research, the Ventura County Permit should recognize the critical importance of using LID not only in "green field" applications, but also during redevelopment, so as to address urbanized landscapes that are today the chief source of storm water pollution and associated hydromodification of local streams. Based both on local work, work elsewhere in the field, and my investigations as part of the NAS team, I believe the exemption for redevelopment from a technical standpoint simply cannot be squared with technical practicability or what the best science tells us is necessary to address both polluted runoff and broad-scale changes to hydrogeology as a result of the current level of urban development.

Hydromodification

The Permit now waives interim hydromodification requirements for all projects under 50 acres, thereby excluding a great majority of the development and redevelopment activity in Ventura County. As a technical matter, this risks degradation to Ventura County watersheds because hydromodification is not just caused by a few large projects, but typically (more typically) by many smaller ones. Moreover, most LID BMPs are not sufficient to attenuate the peak storms that cause a great deal of hydromodification. Thus, the Permit's reliance on LID provisions is not a technically adequate solution to the hydromodification problem and appears to be based on a misunderstanding of the role and function of LID BMPs sized and designed to reduce pollution generated through smaller storms, on the one hand, and the approaches necessary to address watershed scale hydromodification, on the other hand. I note also that since the LID approach in the Permit does not actually require LID BMPs for redevelopment projects, let alone those

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B) conclusions about a maximum 3-5 percent effective impervious area ("EIA") site design criterion. However, notably the results of the report's analysis overall contribute to the growing consensus that implementing LID according to a numeric metric is technically feasible in both new development and redevelopment contexts. The results thus buttress my findings in analyses performed earlier for San Diego and Ventura Counties and for the San Francisco Bay Area and support the feasibility of meeting a 3-5% EIA standard in southern California. However, the report's suggestion that a "delta volume" standard be adopted would depart from standard and well-accepted practice in the United States, resulting in significantly greater volumes of stormwater with concomitant, significant increases in the mass volume of a range of pollutants in stormwater.

sized to address the water quality design storm, the approach of relying on LID BMPs to address hydromodification is further unjustified (and, in this instance, illusory).

Conclusion

In summary, based on my Ventura County-specific study, my work in the field, and my knowledge of the state of practice in California and nationally, I conclude that the Permit's current scheme will not result in effective, feasible mitigation of the various problems caused by stormwater runoff, and it will certainly allow a significant amount of pollution, which could feasibly be reduced through LID techniques, to be discharged to receiving waters.

Sincerely,

Richard R. Horner

Dr. Richard Horner

Attachment A

ASSESSMENT OF EVAPORATION POTENTIAL WITH LOW-IMPACT DEVELOPMENT PRACTICES

RICHARD R. HORNER

BACKGROUND

Low-impact development ("LID") stormwater management practices are designed to capture and retain (i.e., not discharge) stormwater runoff through infiltrating water into the soil, vaporizing it to the atmosphere via transpiration from vegetation and evaporation, and harvesting to put rainwater to a beneficial use like irrigation or gray water supply. Jurisdictions in various locations around the United States have adopted stormwater management regulations requiring elimination of surface runoff discharge in storms up to specified sizes, and hence in effect requiring application of LID methods. An issue raised in California regarding such requirements is the potential of the evapotranspiration component of runoff attenuation, in the event infiltration is limited by soil, high groundwater, or subsurface contamination and insufficient demand exists for harvested water. The opinion has been advanced that evapotranspiration potential must be low, because most California rainfall occurs in the months with least evaporation. To explore this issue the author compared rainfall and evaporation at five California locations and four sites elsewhere in the nation where limitations on urban stormwater discharge are in effect.

METHODS OF ANALYSIS

Examples of surface discharge limitations are found, or are being considered by regulatory authorities, in the states of Georgia, Tennessee, West Virginia, Pennsylvania, and New Jersey and the cities of Philadelphia and Washington, DC (Anacostia River watershed). Data from long-term evaporation pan measuring devices are available for Georgia, Tennessee, and Pennsylvania (including Philadelphia), as well as for California. In the analysis Georgia was represented by Atlanta, Tennessee by Nashville, and Pennsylvania by State College in central PA (Centre County), as well as Philadelphia. Evaporation data were not found for New Jersey, Washington, DC, and West Virginia. However, Philadelphia is adjacent or very close to New Jersey and Washington and represents those locations well. Fayette County in southwestern Pennsylvania has such data and is very close to Morgantown, WV; this location represented a West Virginia case. Precipitation data were readily available for all of the locales offering evaporation data. Table 1 presents data sources.

Table 1. Sources of Precipitation and Evaporation Data

Location	Data[a]	Source
Atlanta	Evaporation	http://climate.engr.uga.edu/evaporation.html
Nashville	Evaporation	http://www.nashville.gov/stormwater/docs/pdfs/stw/vol2/swmanual12_vol2_chapter8.pdf
Philadelphia, Central PA, Fayette County (for Morgantown, WV)	Precipitation, evaporation	http://www.pa.nrcs.usda.gov/technical/Engineering/PaRainEvapRunoff.pdf
California cities except Ventura	Evaporation	http://www.calclim.dri.edu/ccda/comparative/avgpan.htm
Ventura	Precipitation, evaporation	http://portal.countyofventura.org/portal/page?_pageid=876,1686932&_dad=portal&_schema=PORTAL (El Rio – UWCD Spreading Grounds [Revolon Slough])

[a] Precipitation data are from http://www.met.utah.edu/jhorel/html/wx/climate/normrain.html except as noted.

Rainfall and evaporation were tabulated for the three highest and six highest months of precipitation at each location. The excess or deficit of evaporation for these periods was then calculated as the difference between evaporation and precipitation.

RESULTS

Table 2 shows the three highest and six highest months of precipitation for each location assessed. The southern cities experience their highest precipitation in the earlier months of the year, the northeastern locations in the warmest months, and the California cities during the winter and just before and after it. Snow is not a factor in any location, in that the California cities receive no snow, and snow in the southern cities comes rarely and in small quantities in the months of high precipitation.

Table 2. Months with the Highest Precipitation Totals

Location	Three Highest Months of Precipitation	Six Highest Months of Precipitation
Atlanta	January-March	February-July
Nashville	March-May	December-May
Philadelphia	May-July	April-September
Central PA	May-July	April-September
Morgantown, WV	May-July	March-August
Los Angeles	December-February	November-April
Long Beach	December-February	November-April
San Diego	December-February	November-April
Ventura	January-March	November-April
San Francisco	November-January	November-April

Figures 1 and 2 exhibit the rainfall and evaporation totals, respectively, in the three and six highest rainfall months. The southern cities receive the most rain in these periods, the northeastern locations slightly less, and the California cities roughly half of the southern totals. Evaporation does not differ much among the sites in the three highest rainfall months, excepting San Francisco's somewhat lower amount. Philadelphia and environs and southern California are very similar in evaporation in their respective six highest months of precipitation. During this period, evaporation at San Francisco and Nashville is somewhat lower than in southern California and Philadelphia, and Atlanta has the highest quantity.

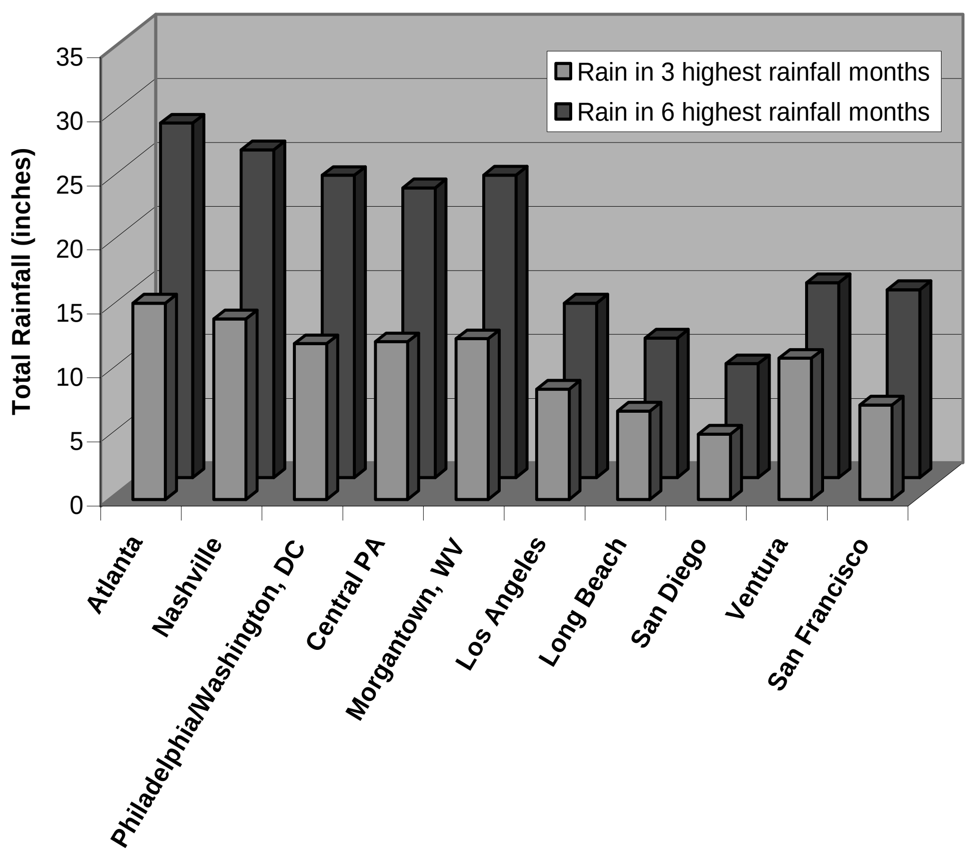

Figure 1. Rain in Highest Rainfall Months

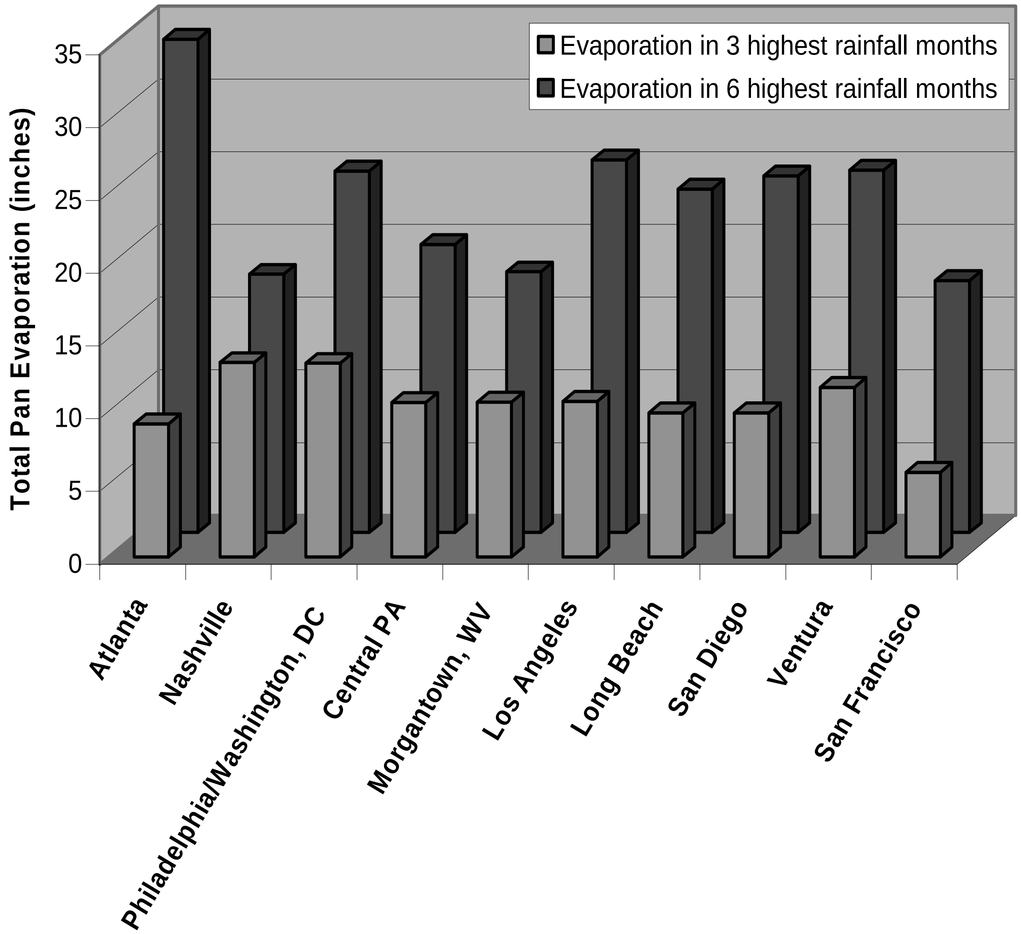

Figure 2. Evaporation in Highest Rainfall Months

Figure 3 offers the most telling portrait of the potential of evaporation to cut surface runoff discharge using LID techniques in California. Southern California locations exhibit a substantial excess of evaporation over precipitation in the six highest months of precipitation. Only Philadelphia has any excess in the three highest rainfall months, and the southern California cities' excess is about two to four times as large as Philadelphia's in these months. Therefore, even though southern California's wet season coincides with its period of lowest evaporation, its generally warm, sunny winters give it an advantage over other locations in the nation that have adopted runoff retentive LID measures. San Francisco has an evaporation excess in its six rainiest months, although a small deficit in its three wettest ones. Atlanta has a much larger deficit in this period. Inland areas in the San Francisco Bay region are generally warmer than the city itself and likely have somewhat higher evaporation. However, data were not available to verify this hypothesis. Ventura is represented by the place closest to the main urban concentration in the county offering evaporation data, the El Rio – UWCD Spreading Grounds.
As one illustration of the potential offered by LID, Berghage et al. (2007) performed green roof research at Pennsylvania State University, located in State College, PA. They found over 50 percent of annual stormwater volume to be retained and not discharged, even with as little as 20 mm (under 1 inch) of storage capacity, and peak discharge rate attenuation to no more than the pre-development level for the 2-, 25-, and 100-year frequency events. Figure 3 shows that all of the California cities assessed are in a more favorable position than State College in implementing green roofs, and hence would be expected to increase runoff retention to well over 50 percent with this LID technique.

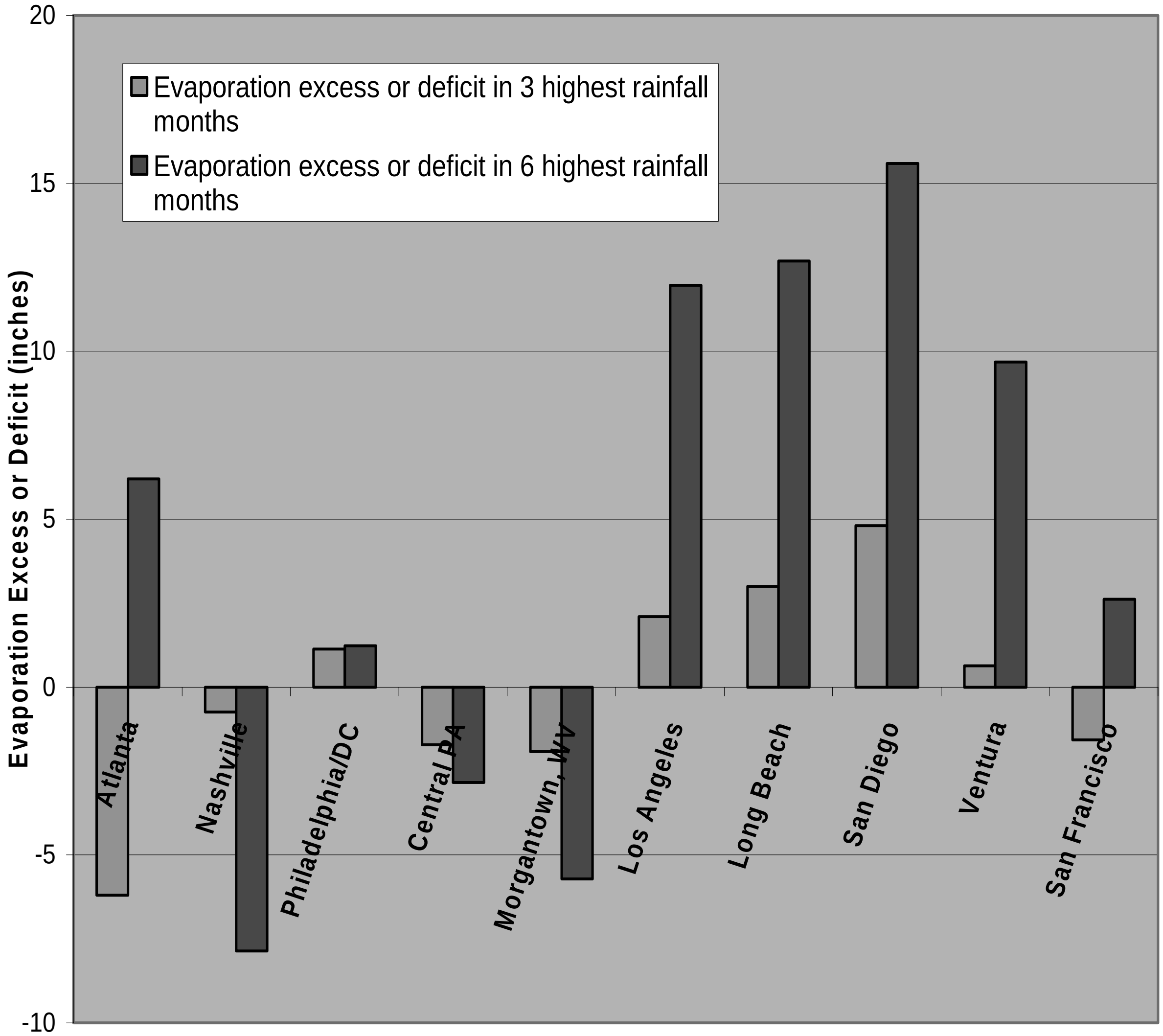

Figure 3. Evaporation Excess or Deficit in Highest Rainfall Months

CONCLUSIONS AND RECOMMENDATIONS

Southern California has considerably greater potential to reduce the discharge of contaminated urban runoff through evaporation in LID stormwater management practices than other locations in the United States that have already adopted and mandated those practices or are considering regulatory proposals to do so. The San Francisco Bay Area's potential to utilize evaporation in LID stormwater management is equal to or higher than those other locations in the U.S. Furthermore, most locations can infiltrate much or even all runoff produced by typical water quality design storms and need not rely on evaporation. In addition, harvesting rainwater for beneficial uses can further subtract from surface discharge. California is unique among the locations considered in this analysis in having some reclaimed water distribution systems in place. These systems could be expanded to take harvested rainwater, and many unexplored opportunities exist to put runoff to good purposes to help solve the state's water supply problems. Recognizing all these points, the fact that California experiences most of its nominal annual rainfall during winter months is not a factor that technically justifies imposing relatively weaker runoff retention requirements than other jurisdictions nationally, such as West Virginia or Anacostia, Washington, D.C. Instead, in a number of California cities, evaporation potential, all things being equal, actually feasibly enables stronger requirements. For all of these reasons, California Regional Water Quality Control Boards feasibly can require capture and full retention of stormwater runoff produced by design events in new developments and redevelopments through LID methods. Boards should set thorough, objective criteria that a development project proponent must use to demonstrate inability to satisfy these requirements on-site. For those cases where such a demonstration can be convincingly made, the Boards should require and provide for installing compensating, equivalent LID works off-site, so as to ensure that practicable storm water pollution reduction is achieved on a watershed or sub-watershed basis in those circumstances when it cannot be achieved fully on-site.

REFERENCE

Berghage, R., A. Jarrett, D. Beattie, K. Kelley, S. Husain, F. Rezai, B. Long, A. Negassi, and R. Cameron. 2007. Quantifying Evaporation and Transpirational Water Losses from Green Roofs and Green Roof Media Capacity for Neutralizing Acid Rain. Pennsylvania State University, University Park, PA.

Attachment B

Critique of Certain Elements of "Low Impact Development Metrics in Stormwater Permitting"

By Richard Horner

GENERAL CONCLUSION

While the authors drew certain negative (and not always well-founded, as explained below) conclusions about a maximum 3-5 percent effective impervious area ("EIA") site design criterion, the results of the report's analysis overall contribute to the growing consensus that implementing LID according to a numeric metric is technically feasible in both new development and redevelopment contexts. The results thus buttress my findings in analyses performed earlier for San Diego and Ventura Counties and for the San Francisco Bay Area (Horner 2006; 2007a, b) and support the feasibility of meeting a 5% EIA standard in southern California. However, the report's suggestion that a "delta volume" standard be adopted would depart from standard and well-accepted practice in the United States, resulting in significantly greater volumes of stormwater with concomitant, significant increases in the mass volume of a range of pollutants in stormwater.

CRITIQUE OF WATER QUALITY TREATMENT DESIGN BASIS

The authors of Low Impact Development Metrics in Stormwater Permitting ("the report") propose and employ in their case studies a quantity they term "excess stormwater runoff," which forms the basis for their sizing and designing of low impact development ("LID") facilities to treat stormwater runoff. In footnote 21 on page 31, the authors have defined "excess stormwater runoff" as the volume of post-development runoff minus pre-development runoff for the 85th percentile storm event (or for an equivalent water quality design event). However, using the differential volume ("delta volume") between pre- and post-development conditions breaks the long-standing national and state precedent of using the full volume of stormwater discharged from the developed site as the basis for stormwater best management practices ("BMPs") that store runoff for longer than a few minutes.

The virtually universal adoption (see examples below) of the full water quality volume instead of the delta volume occurred for good reasons. The total runoff volume from the 85th percentile event—the prevailing design standard in southern California—was determined through objective analysis to represent the point above which substantially diminishing returns in water quality improvement would accompany considerable size enlargement and, therefore, cost (Guo and Urbonas 1996). The analysis identified the *full* volume generated by the 85th percentile event—not some lesser quantity like the delta volume—as the appropriate threshold at which the decrease in benefits accelerates.

The use of a differential hydrologic measure that compares pre- and post-development states is common in the management of storm runoff quantity (i.e., hydromodification). The pre- vs. post-development measure is appropriate in that situation because successfully matching preand post-development hydrologic characteristics causes no modification in the hydrologic status of the receiving water and, hence, no negative physical effects. When managing water quality, in contrast, any untreated volume (in the delta volume scenario, this would be the amount that originally flowed from the undeveloped land) would deliver to the receiving water the many pollutants characteristic of urban runoff. There, these pollutants would create negative physical, chemical, and biological effects. On the other hand, if the appropriate water quality volume is used (i.e., no less than the full volume of the 85th percentile event), the LID-based stormwater management BMPs should deliver no pollutants to the receiving water, since the retention and reuse or infiltration of that volume is practicable and achievable, as I have demonstrated separately by analyzing a range of development scenarios in southern California.

The loss in treatment capacity from using the delta volume measure, and hence the loss in water quality protection, would vary depending on climatology and the characteristics of the undeveloped parcel and the developed site (type of pervious and impervious land cover, soil, slope, etc.). In the Walnut Village and 60 California case studies presented in the report, the difference ranged from 15 to 20 percent and could be higher in different scenarios. This difference is not small, considering that the National Stormwater Quality Database (Pitt, Maestre, and Morquecho 2004) shows that pollutants like solids, metals, nutrients, and bacteria are typically present in urban runoff at concentrations two to five times as high as in storm flow from undeveloped land. Discharging the pre-development volume, contaminated by urban pollutants without any water quality treatment, would subject human users and aquatic life to substantial runoff quantities with pollutant mass loadings and potentially acutely toxic pollutant concentrations. These loadings and concentrations would be increased by factors of approximately two to five, compared to the pre-development state, thus compromising the beneficial uses of the water body that existed before development. It is essential for resource protection that the full post-development volume be retained onsite through infiltration, evapotranspiration, and/or harvesting for reuse.

As pointed out above, adopting a volumetric basis for stormwater treatment design and then subjecting that full volume to onsite retention or treatment has been the rule in the United States. Jurisdictions take differing approaches to defining that volume, but, once it is set, they utilize the entire quantity as the basis for BMP design. Common approaches include the storm percentile method: a storm event of selected frequency and duration is chosen, which correlates to a certain depth of precipitation spread over a watershed area. In addition to southern California, Georgia provides an example of the first approach (http://www.georgiastormwater.com/vol2/1-3.pdf at 1.3-1):

> Treat the runoff from 85% of the storms that occur in an average year. For Georgia, this equates to providing water quality treatment for the runoff resulting from a rainfall depth of 1.2 inches.

The state of Washington employs a second approach, actually in relation to a storm percentile analysis (http://www.ecy.wa.gov/pubs/0510029.pdf at 2-28):

> Water Quality Design Storm Volume: The volume of runoff predicted from a 24-hour storm with a 6-month return frequency (a.k.a., 6-month, 24-hour storm). Wetpool

> facilities are sized based upon the volume of runoff predicted through use of the Natural Resource Conservation Service curve number equations in Chapter 2 of Volume III, for the 6-month, 24-hour storm. Alternatively, the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model may be used.

Numerous jurisdictions, such as Maine, use the precipitation depth approach (http://www.maine.gov/dep/blwq/docstand/stormwater/stormwaterbmps/vol3/chapter2.pdf at 2-12):

> Stormwater management facilities must be designed to treat the first 1 inch of runoff ...

Maryland (http://www.mde.state.md.us/assets/document/chapter2.pdf at 2.1):

> P= rainfall depth in inches and is equal to 1.0" in the Eastern Rainfall Zone and 0.9" in the Western Rainfall Zone ...

Pennsylvania (http://www.depweb.state.pa.us/watershedmgmt/cwp/view.asp?a=1437&q=529063&watershedmgmtNav=| at 3.3.4):

- Stormwater facilities shall be sized to capture at least the first two inches (2") of runoff from all contributing impervious surfaces.
- At least the first one inch (1.0") of runoff from new impervious surfaces shall be permanently removed from the runoff flow – i.e., it shall not be released into the surface Waters of this Commonwealth. Removal options include reuse, evaporation, transpiration, and infiltration.

and North Carolina (http://h2o.enr.state.nc.us/su/documents/BMPManual_WholeDocument_CoverRevisedDec2007.pdf at 2-2):

> Non-coastal counties: Control and treat the first 1.0" of rain. (Note: a more complex basis applies to coastal counties.)

In none of these cases does the stormwater treatment design basis involve a delta volume computation such as advocated by the authors of the report.

CRITIQUE OF CASE STUDIES

Even though the report forthrightly demonstrates technical feasibility, it nonetheless takes a somewhat negative stance by overemphasizing difficulties and high costs, both of which are poorly justified. The report, moreover, is devoid of estimates of the benefits that accrue from reducing the discharge of pollutants to receiving waters, recharging groundwater through infiltration, conserving water through harvesting and reuse, and decreasing hydromodification of receiving waters. I made such estimates in my previous reports, and these benefits are very significant. For example, I concluded that (Horner 2007a):

> Draining impervious surfaces onto the loam soils typical of Ventura County, in connection with limiting directly connected impervious area to three percent of the site total area, should eliminate storm runoff from some development types and greatly reduce it from more highly impervious types. Adding roof runoff elimination to the LID approach (by harvesting or directing it to downspout infiltration trenches) should eliminate runoff from all but mostly impervious developments. Even in the development scenario involving the highest relative proportion of impervious surface, losses of rainfall capture for beneficial uses could be reduced from more than 85 to less than 40 percent, and pollutant mass loadings would fall by 83-95 percent from the untreated scenario when draining to pervious areas was supplemented with water harvesting.

Failure to include a discussion of such important benefits inappropriately biases the report against feasible LID numeric performance standards such as an EIA limitation. There is a somewhat grudging admission that LID based on an EIA limitation can be implemented, but this is countered with assertions that doing so will take some extra work and cost too much. Both of these negative claims should not be given much weight for the reasons stated below. Furthermore, neglecting the aforementioned very real and important benefits of robust LID implementation omits the counterbalancing consideration that the aquatic environment will be better protected with an improved site design paradigm.

Additionally, the report fails to take into account two aspects of LID that are at least relatively cost-neutral or, in many configurations, even cost-saving. First, landscaping is a normal part of developed and redeveloped sites and can serve stormwater management purposes, as well as aesthetic purposes, with little or no extra cost. Second, most LID practices primarily utilize soft infrastructure instead of more expensive hard infrastructure like extensive piping and concrete. While the cost analyses presented in the report were poorly detailed in the first place, as discussed in greater depth below, it appears that these financially mitigating factors were not even considered.

Walnut Village

The report's presentation of the multi-family residential Walnut Village redevelopment project reflects the general criticisms noted above. It demonstrates the technical feasibility of implementing LID practices according to an EIA limitation (in fact, the authors achieved an EIA of zero), stating, "this result ... illustrates that LID benefits can be achieved by both extensive implementation (i.e., routing of runoff to vegetated systems) and more intensive design of active landscaping (i.e., greater retention depth) where opportunities exist."

Nevertheless, the authors put a negative spin—unjustified, in my opinion—on this success. In one negative passage the report declares, "the 14-17 inches of retention required to capture the delta 2-year volume is much less feasible, as it would require a combination of fairly deep amended soils and significant surface storage." I contend that providing 14-17 inches of storage in surface ponding and soil pores is entirely feasible. For instance, 18 inches of amended soils with 33 percent porosity would provide 6 inches of storage, which could be supplemented by 8-11 inches of above-grounded temporarily ponded volume, a thoroughly feasible design. Elsewhere, the report characterizes decreasing EIA from 18 to 0 percent as “difficult,” although this decrease merely involves converting non-essential hardscape to landscaping. The reader is left to wonder why any developer would choose to buy and install *non-essential* asphalt or concrete (almost certainly more expensive than LID landscaping) rather than constructing vegetated BMPs that would be an asset in more ways than one. In my opinion, it is more “difficult” from fiscal and marketing perspectives to justify the use of pavement for no reason. In any case, whatever impression one has of this issue, from a technical, objective perspective, the report does not contain a reasonably complete and even-handed assessment of costs, significantly undercutting its claims of infeasibility. Likewise, subjective and undefined assertions regarding the “difficulty” of meeting even relatively high volumes (such as the two-year storm) are presented without supporting analysis or justification which, once again, limits the utility of the report.

Further, with regard to landscaping, the final sentence in the case study states, “landscape plans typically include features that restrict usage of landscaping for runoff control (e.g., tree choice can limit inundation depths and duration), therefore, it is unreasonable to assume that all landscaping may be available.” There is no reason why landscaping plans should be incompatible with vegetative LID practices, however. Bioretention cells and similar LID features routinely include trees, which serve several important hydrologic roles (rainfall interception, advancing infiltration by opening conveyance pathways through soil, water storage in tissues, and transpiration). It is no challenge for landscape designers to select trees that are not limited by moisture conditions in such BMPs.

The Walnut Village site has hydrologic group B soils, to which the authors assigned an infiltration rate of 0.2 inch/hour, assuming that the soils would be “compacted”. They thereby ignore a fundamental LID practice: guarding against the removal and compaction of soils outside the active building area during construction (Hinman 2005). While infiltration rates vary depending on the specific soil type within a hydrologic soil group, B soils overall have rates much above the authors’ assumption; i.e., 0.5-1 inch/hour (http://www.vcstormwater.org/documents/workproducts/landuseguidelines/appC.pdf). The National Resource Conservation Service (2007) observes that, “Soils that are deeper than 100 centimeters [40 inches] to a water impermeable layer or water table are in Group B if the saturated hydraulic conductivity of all soil layers within 100 centimeters [40 inches] of the surface exceeds 4.0 micrometers per second (0.57 inches per hour) but is less than 10.0 micrometers per second (1.42 inches per hour).” It would be irresponsible building practice anywhere, and certainly in a development that is implementing LID practices, to permit such indiscriminant soil disturbance that across the landscape the infiltration rate is decreased to as little as 15 percent of its natural magnitude.

The infiltration rate assumption has consequences for the analysis and the authors’ interpretation of their results. While the report shows that adequate volume attenuation could be accomplished to meet the case study’s stated objectives, with the 0.2 inch/hour infiltration rate, active landscaping drain times could exceed the recommended 72-hour maximum and approach 83 hours. If the infiltration rate were just slightly higher at 0.3 inch/hour, though, drawdown would occur 50 percent faster and easily lower the drain time beneath the maximum. Avoiding the drastic diminution in hydraulic conductivity that the authors have assumed is eminently achievable on the site's B soils and would produce an even more optimistic picture than the already successful Walnut Village hypothetical design.

The authors observe that imposing a fixed EIA standard alone promotes the routing of runoff to vegetated systems but does not boost the companion strategy of pursuing more intensive design of active landscaping. In so doing, the authors provide a valuable service in pointing out that a design basis must accompany the EIA limitation for real effectiveness. An example of such a comprehensive standard is:

> Limit effective impervious area to 3 percent. Impervious surfaces can qualify as "ineffective" only when the entire volume of runoff (based on the design storm) from those areas is captured onsite through infiltration, evapotranspiration, and/or harvesting for beneficial use. In the rare circumstance in which onsite compliance is infeasible according to established criteria, the permittee or developer shall identify opportunities for off-site mitigation in the same sub-watershed that will achieve the overall goal of reducing effective impervious area to no more than the 3 percent design standard.

60 California

Like the Walnut Village case study, the authors' presentation of the 60 California multi-use commercial/retail redevelopment project also tends in an overall manner to support my own analyses and conclusions regarding the practicability of meeting the 5% EIA standard. This case study, too, demonstrates the technical feasibility of meeting a maximum 5 percent EIA standard, in this case by employing a green roof and water harvesting on a highly constrained site. Once again, though, the authors put forth some negative interpretations that are, in my opinion, unjustified.

One such claim is that green roofs and cisterns are generally beyond the level of BMP implementation in common practice in the United States nowadays. In fact, both practices are no longer at all unusual. Without attempting any comprehensive literature review of applications, I would note that Chicago has numerous green roofs in place, most prominently on its city hall (http://www.artic.edu/webspaces/greeninitiatives/greenroofs/main_map.htm). In Seattle, green roofs top a growing number of public and private buildings (http://www.seattle.gov/DPD/GreenBuilding/OurProgram/Resources/TechnicalBriefs/DPDS_009485.asp#case). Seattle's city hall also harvests rain for graywater supply and irrigation, as does the county administration building and a neighborhood environmental education center (http://www.harvesth2o.com/seattle.shtml). The Texas Water Development Board (2005) prepared an excellent, practical manual on water harvesting at all scales, complete with examples in place and design calculations. The manual covers the entire state of Texas, whose western areas have rainfall conditions very much like southern California's. Hence, little adaptation is needed to use the manual's recommendations here.

The report also claims that the suitability of green roofs for southern California is not well understood and that, "during the rainiest times of the year in southern California, the potential evapotranspiration is the lowest, meaning that the ability to regenerate storage capacity between storms is low." It is true that the potential is lowest during the wettest season, but, given the frequent sun and relative warmth during dry intervals in the southern California winter, the regenerative ability is still not "low." Berghage et al. (2007) performed green roof research at Pennsylvania State University (PSU). They found that over 50 percent of annual stormwater volume was retained and not discharged, even with as little as 20 mm (under 1 inch) of storage capacity, and the site reduced peak discharge rates to no more than the pre-development level for the 2-, 25-, and 100-year frequency events. PSU is located in Centre County, PA, where precipitation is not highly seasonal but tends to be slightly greater in the summer, compared to other months. Pan evaporation rates there range from 3.3 to 4.2 inches/month during June-September (http://www.pa.nrcs.usda.gov/technical/Engineering/PaRainEvapRunoff.pdf). The November-February Los Angeles pan evaporation range is 3.5 to 4.0 inches (http://www.calclim.dri.edu/ccda/comparative/avgpan.html). Therefore, Los Angeles has as much evaporation potential in the months when it most needs that potential as locations with successful green roofs elsewhere. Similar research should be performed in California, but enough encouraging evidence exists to begin establishing full-scale projects, which can be monitored to confirm performance and refine design guidance for the region.

A final negative point made by the report is that green roofs and water harvesting may conflict with existing building and health codes. Codes should not be regarded as an unbending constraint on moving to new, more environmentally beneficial technologies. As experience in the growing number of applications of both practices shows, building safety and health are not being compromised. If constraints do exist in a jurisdiction's codes, they should be examined to assess their justification and revised if no overriding reasons exist to maintain them. Indeed, it is my understanding that municipal separate storm sewer permits often if not always require that local codes be amended to support implementation of programs and approaches to reduce stormwater pollution.

Redevelopment of Kmart Site

The Kmart site redevelopment case study was based on the use of vegetated filter strips and infiltration trenches. Its primary purpose was to estimate costs for these practices by apparently taking a challenging site with relatively poor soils. As an initial manner, the decision to evaluate only one site to reach a conclusion about costs of LID practices is suspect. This is particularly the case when, as here, the report's conclusions tend to contradict mainstream evaluations of the cost of implementing LID. Such studies, including an analysis of several projects by the U.S. Environmental Protection Agency, report significant cost savings compared to traditional water quality approaches across the vast majority of building sites.

More specifically, there are several flaws in the foundation of this case study. The authors developed estimates of runoff volume in pre-development and post-development conditions by using the Natural Resources Conservation Service's Curve Number Method, which is well-known to overestimate the pre-development hydrologic characteristics and thus set the wrong targets for post-construction designs. The site has hydrologic group C soils. The authors performed calculations assuming an infiltration rate of 0.5 inch/hour, higher than the rate used for B soils in the Walnut Village case study (an unexplained discrepancy). There appears to have been no consideration of organically amending soils to increase water storage and improve infiltration. Soil amendment for these purposes is a very common LID practice, especially in group C soils. The authors appear to have given some thought to other LID practices (tree boxes, bioretention, pervious pavement, green roofs, and water harvesting) but rejected all of them for unexplained reasons. Failure to use a broader pallet of alternatives and soil amendment indicates that the case study may not have been based on the most technically effective and/or cost-effective choices.

This case study fails to convincingly meet its objective of demonstrating what the LID designs would cost, in large part because the authors give no detail whatsoever regarding how the cost figures were derived. The per-acre and percentage-of-redevelopment costs are simply not credible unless their derivation can be traced and confirmed. The cost analysis also suffers from the general criticisms stated above regarding costs: it implicitly assigns all landscaping costs to the filter strips, although these areas would be landscaped anyway at roughly the same cost; the analysis further fails to recognize that stormwater runoff must be conveyed and managed in some way, and those obligations carry costs, which are probably higher if performed conventionally through the use of large quantities of piping and concrete. With these shortcomings in analysis, it is assuredly not justified to say, as the case study conclusions do, that, "[i]t is clear from the Kmart case study cost estimates that the proposed draft permit requirements would significantly increase the drainage costs of urban redevelopment projects." And although more difficult to monetize, environmental benefits—and their economic value to society—are entirely neglected in this case study, as in the others.

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Texas Water Development Board. 2005. The Texas Manual on Rainwater Harvesting. Texas Water Development Board, Austin, TX.

49. Letter from Ventura Coastkeeper (Jason Weiner, M.E.M.), dated August 25, 2009

Response 1

This comment states that the comments on the Draft EIS/EIR (EIS/EIR) for the Newhall Ranch Resource Management and Development Plan (RMDP) and the Spineflower Conservation Plan (SCP) (Project) are submitted on behalf of Ventura Coastkeeper (VCK), a program of the Wishtoyo Foundation. Because the comment does not address the adequacy or content of the Draft EIS/EIR, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 2

The comment states the opinion of the commentor that the EIS/EIR is insufficient under the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA), because it does not identify, disclose, and adequately evaluate significant impacts to water quality and biological resources, does not mitigate environmental impacts to a less-than-significant effect, and excludes an environmentally superior alternative to the Project as a whole. The EIS/EIR has been prepared in accordance with the requirements of CEQA and NEPA. The commentor's specific comments about the sufficiency of the EIS/EIR are addressed in **Responses 5 through 91**, below.

Response 3

The comment states the opinion of the commentor that the EIS/EIR is insufficient under CEQA and NEPA because the Project as proposed cannot obtain a Clean Water Act (CWA) section 401 Water Quality Certification (Water Quality Certification), and, thus, the U.S. Army Corps of Engineers (Corps) and the California Department of Fish and Game (CDFG) cannot adopt the EIS/EIR in its current form. In the opinion of the Corps, the proposed Project is in compliance with sections 301 and 401 of the CWA. Please see **Responses 68 through 72**, below.

Response 4

The comment describes the Santa Clara River watershed and states that the Santa Clara River is southern California's last and largest naturally flowing river system that is not heavily dammed or channelized, is home to up to 17 species listed as threatened or endangered, and has been named the 10th most endangered river by American Rivers. Thus, the comment states it is important to Ventura Coastkeeper that the RMDP, SCP, and the Newhall Ranch development adequately protect the ecological integrity and water quality of the Santa Clara River.

The Draft EIS/EIR provided extensive information about the existing environmental conditions along the River Corridor, with an emphasis on describing existing conditions and environmental resources located on the Project site. For example, please refer to Draft EIS/EIR **Section 4.4**, Water Quality; **Section 4.5**, Biological Resources; and **Section 4.6**, Jurisdictional Waters and Streams, for information regarding the existing environmental conditions along the River Corridor. In addition, information regarding past, present, and reasonably foreseeable urban development in the Santa Clara River watershed is provided in Draft EIS/EIR **Section 6.0**, Cumulative Impacts. Extensive evaluation of the Project's impacts to threatened and endangered species and their habitat, along with the Project's water quality impacts are also provided in **Section 4.5** of the Draft EIS/EIR. In addition, for further responsive information, please refer to revised **Sections 4.4**, **4.5**, **4.6**, and **6.0** of the Final EIS/EIR.

We acknowledge the commentor's statement regarding the American Rivers 2005 designation of the Santa Clara River as one of the nation's ten most endangered rivers. The comment will be included as part of the record and made available to the decision makers prior to a final decision on the proposed Project.

Response 5

The comment states that an EIR must identify "significant environmental effects" of the proposed Project and provides definitions from the state code and regulations. The Draft EIS/EIR evaluated the significant environmental effects of the proposed Project. This comment will be included as part of the record and made available to decision makers prior to a final decision on the proposed Project.

Response 6

The comment reiterates the three thresholds of significance set forth in the EIS/EIR. This comment provides context for the commentor's following remarks, which are addressed below. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 7

The comment states that significant impacts from the RMDP and SCP on water quality that the Draft EIS/EIR fails to identify or mitigate to a less-than-significant effect include:

1. Chronic Toxicity impacts from stormwater runoff and the Water Reclamation Plant ("WRP") effluent discharges;
2. Biostimulatory impacts from stormwater runoff and the WRP effluent discharges;
3. Impacts from pharmaceuticals contained in WRP and stormwater discharges;
4. Impacts of pollutant loading from stormwater and WRP discharges;
5. Impacts below the "Dry Gap" in the Santa Clara River from stormwater and WRP discharges; and
6. Impacts on water quality from stormwater and WRP discharges in Ventura County.

Specific comments are made regarding each of these impacts in **Comments 8 through 44**. Responses to the commentor's specific remarks about chronic toxicity are provided in **Responses 24 through 28**; biostimulation in **Responses 34 through 44**; pharmaceuticals in **Responses 29 through 33**; pollutant loading in **Responses 16 through 23**; impacts below the Dry Gap in **Responses 8 through 15**; and impacts on water quality from WRP discharges and stormwater in Ventura County in **Responses 47 through 51** and **Responses 90** and **91**, respectively. Extensive analysis of water quality impacts downstream of the Project site in Ventura County was also provided by the Draft EIS/EIR. Responses to specific comments related to downstream stormwater and WRP discharges are provided below, including **Responses 8 through 28**.

In addition, for further responsive information concerning the issues identified above, please refer to revised **Section 4.4**, Water Quality, of the Final EIS/EIR.

Comments 8 through 15 are under the heading: *"The DEIS/DEIR Must Identify Significant Water Quality Impacts Below the Dry Gap in the Santa Clara River and Mitigate those Impacts to a Less than Significant Effect"*

Response 8

The comment states that during and after storm events that create high flow conditions, stormwater discharges and WRP effluent discharges will pass over the Dry Gap and end up or settle in the Santa Clara River Estuary, in pools adjacent to the main channel of the Santa Clara River and Ventura County coastal marine waters at the mouth of the Santa Clara River. The comment states that breaches in the Santa Clara River are induced by both storm events and discharges from the City of San Buenaventura Ventura Water Reclamation Facility (Plant) Discharge to the Santa Clara River Estuary via Discharge Outfall No. 001, Regional Board Order No. R4-2008-0011.

The Santa Clara River is perennial from the existing Valencia WRP downstream to a point approximately 3.5 miles downstream of the Los Angeles County/Ventura County line (western limit of the Project boundary) near Rancho Camulos. Throughout the Santa Clara River channel, complex surface water/groundwater interactions lead to areas of alternating gaining and losing river segments. In particular, downstream of the Los Angeles County/Ventura County line, the Santa Clara River flows through the Piru groundwater basin where surface flows in the river are lost to groundwater. This reach of the River is referred to as the "Dry Gap."

As described in the Draft EIS/EIR, beginning on page 4.4-21, and in Draft EIS/EIR, **Appendix 4.4**, the Santa Clara River watershed encompasses approximately 1,600 square miles within Los Angeles County and Ventura County. The Project area lies approximately 40 miles upstream of the Santa Clara River Estuary within Santa Clara River Reach 5. At the downstream end of the Project area (coincident with the Ventura County line), the watershed area is approximately 640 square miles. The Project area comprises approximately 3.5 percent of the Santa Clara River watershed upstream of the Los Angeles County/Ventura County line and 1.4 percent of the total Santa Clara River watershed. The size of the Project area in comparison to both the 1,618 square mile total Santa Clara River watershed area and the expected total impervious area in the watershed in the existing conditions and at build-out is small. It is estimated, based on the land use data from adopted General Plans within the watershed, that the Specific Plan projects would comprise approximately five percent of the total impervious area in the Santa Clara River watershed above the Specific Plan area at ultimate planned build-out for the watershed. Therefore, stormwater discharges from the Project area that pass over the Dry Gap during high flows would comprise a very small portion of the total flow in the River, and would not cause a violation of water quality standards or substantially degrade surface or groundwater quality, or otherwise result in a significant impact. (See Impact Significance Criteria at p. 4.4-45-46 of the Draft EIS/EIR.)

As described on page 4.4-107 of the Draft EIS/EIR, treated effluent from the Newhall Ranch WRP would be used to supply distribution of recycled water throughout the Specific Plan area in the form of irrigation of landscaping and other approved uses. In an average rainfall year, all tertiary-treated wastewater from the Newhall Ranch WRP would be recycled for irrigation and other non-potable uses, except in the wet weather months. During these months in average rainfall years, approximately 286 to 1,025 acre-feet of tertiary-treated wastewater would not be needed to meet estimated non-potable demand and, therefore, would be discharged to the Santa Clara River. During years one and two of the Newhall Ranch WRP operation, the WRP would operate at a maximum of 2 million gallons per day (mgd), with an estimated average discharge flow rate of 0.2 mgd during the five-month period of November through March. No sooner than year three, the WRP would be expanded to 6.8 mgd, with an approximate average discharge flowrate of 0.6 mgd during this five-month wet period. Therefore, discharge periods would coincide with peak wet months when dilution capacity is maximal (*i.e.*, instream flows are highest). The average November through March instream flowrate at U.S. Geological Survey (USGS) station 11109000 (Newhall Bridge, approximately 2.5 miles downstream of the County line) is 188 cubic feet per second (cfs), or 121 mgd, based on measured average daily flow data for water years 1977-2006. Therefore, the WRP discharges that would pass over the Dry Gap during high flows would comprise a very small portion (less than one percent) of this average flow in the River and water quality in the Santa Clara River would not be significantly affected by the discharges.

When the Santa Clara River discharge is low, sediment moved onshore by wave action forms a barrier that closes the mouth of the River (Stillwater Sciences, 2007). Water in the Santa Clara River Estuary is supplied predominantly by flow from the Santa Clara River and effluent from the City of San Buenaventura Water Reclamation Facility, with local agricultural runoff and wave overwash also contributing to the overall supply (Stillwater Sciences, 2007). During the summer and fall months, average daily effluent discharge from the City of San Buenaventura Water Reclamation Facility greatly exceeds river discharge and can cause the sand barrier at the river mouth to breach when it would not under natural conditions. The Santa Clara River discharge is very low most of the year (less than 1 cfs) (Stillwater Sciences, 2007). At the mouth of the Santa Clara River, the City of San Buenaventura Water Reclamation Facility discharges an average of 8.4 mgd, which is equivalent to an average year round stream flow of approximately 14 cfs (Stillwater Sciences, 2007).

The mouth of the River re-opens during winter months when higher tidal ranges, wave action, and river discharge combine (Stillwater Sciences, 2007). Thus, during and after storm events that create high flow conditions, the very small portion of the flow in the River that is composed of the Project's stormwater runoff and WRP discharges would flow through the Estuary to the ocean. It is unlikely that these flows would "settle in the Santa Clara River Estuary and Ventura County coastal waters at the mouth of the Santa Clara River." As described by Stillwater Sciences (2007), sediment inflows discharged from the Santa Clara River is transported down coast via longshore transport as a part of the Santa Barbara Littoral Cell. Littoral cells are discrete coastal regions that can be considered closed systems within which sediment is transported. The Santa Barbara Littoral Cell, which is associated with the Santa Barbara Channel, extends from Point Conception to Point Mugu submarine canyon. In response to prevailing wind direction in the area of the Santa Clara River mouth and wave shelter from offshore islands, the longshore current generally flows down coast in a southeasterly direction.

For further responsive information, please refer to revised **Section 4.4**, Water Quality, of the Final EIS/EIR.

References

The following reference was used or relied upon, is available for public review upon request to the Corps or CDFG, and is incorporated by reference:

Stillwater Sciences, 2007. Santa Clara River Parkway Floodplain Restoration Feasibility Study: Assessment of Geomorphic Processes for the Santa Clara River Watershed, Ventura and Los Angeles Counties, California. Prepared by Stillwater Sciences for the California State Coastal Conservancy.

Response 9

The comment states that the Santa Clara River Estuary, pools adjacent to the main channel of the Santa Clara River, and marine waters adjacent to the Santa Clara River serve as habitat for aquatic life as identified in the Draft EIS/EIR, protected as a beneficial use in the Water Quality Control Plan for the Los Angeles Region (Basin Plan). This comment states that these water bodies additionally serve as habitat for endangered species. **Section 4.5**, Biological Resources, of the Draft EIS/EIR provides analysis regarding the Project's effects to the special-status species identified by this comment including southern steelhead, unarmored threespine stickleback, arroyo toad, and California red-legged frog. The Draft EIS/EIR evaluated the potential impacts of the Project and alternatives including potential downstream effects resulting from changes in water quality.

The Draft EIS/EIR concluded that impacts to unarmored threespine stickleback, arroyo toad, and California red-legged frog would be less than significant with the implementation of mitigation. The Draft EIS/EIR also determined that impacts to steelhead were considered less than significant as the species are not expected to occur in the Project area and the site does not support suitable breeding substrate and cool water temperatures required for breeding. There is no historical record of steelhead use of the Santa Clara River or tributaries upstream of Piru Creek and the Dry Gap. However, southern steelhead is known to occur in the lower Santa Clara River and a subset of Ventura County tributaries including Santa Paula Creek (Puckett and Villa 1985; ENTRIX 1994, 1995, 1996, 1998, 1999).

The document also identified potential impacts to biological resources in downstream reaches of the Santa Clara River. However, to clarify for the commentor, the arroyo toad, California red-legged frog, and unarmored threespine stickleback are not known to currently occur in the Santa Clara River downstream of the Dry Gap. As described in **Section 4.5**, Biological Resources, of the Draft EIS/EIR, both the arroyo toad and California red-legged frog are known to occur from Piru Creek, a downstream tributary to the Santa Clara River, but have not been documented in or along the River itself. The unarmored threespine stickleback is restricted to three sections of the upper Santa Clara River, including Newhall Ranch, which represents the downstream limit of its distribution; this species does not occur downstream of the Dry Gap (ENTRIX 2009). The Draft EIS/EIR concluded that effects to these species would be less than significant and that alteration of flow regimes and changes to water quality would not result in adverse effects to these species.

The Corps and CDFG appreciate your concern regarding these species and this comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

ENTRIX, Inc. 1994. *Results of Fish Passage Monitoring at the Vern Freeman Diversion Facility, Santa Clara River*. Prepared for United Water Conservation District, Santa Paula, California. December 2, 1994.

ENTRIX, Inc. 1995. *Results of Fish Passage Monitoring at the Vern Freeman Diversion Facility, Santa Clara River*. Prepared for United Water Conservation District, Santa Paula, California. October 11, 1995.

ENTRIX, Inc. 1996. *Results of Fish Passage Monitoring at the Vern Freeman Diversion Facility, Santa Clara River*. Prepared for United Water Conservation District, Santa Paula, California. December 26, 1996.

ENTRIX, Inc. 1998. *Vern Freeman Diversion Fish Passage Study, 1998 Fish Handling and Data Collection Protocols*. Prepared for United Water Conservation District, Santa Paula, California. April 7, 1998.

ENTRIX, Inc. 1999. *Results of Fish Passage Monitoring at the Vern Freeman Diversion Facility, Santa Clara River, 1997.* Prepared for United Water Conservation District, Santa Paula, California. September 15, 1999.

ENTRIX, Inc. 2009. *Focused Special-Status Fish Species Habitat Assessment—Santa Clara River and Tributary Drainages, Newhall Ranch, Los Angeles County, California.* Prepared for Newhall Land. Ventura, California: ENTRIX.

Puckett, L.K., and N.A. Villa. 1985. *Lower Santa Clara River Steelhead Study*. CDFG, report prepared under Interagency Agreement B54179 with the California Department of Water Resources.

Response 10

The comment states that during periods of dry weather, discharges of urban runoff and WRP effluent discharges may at times pass over the Dry Gap and end up in the Santa Clara River Estuary and adjacent marine pools waters, especially during the winter months when baseflow contributions to the Santa Clara River are of greater magnitude and are more consistent.

As described on page 4.4-104 of the Draft EIS/EIR, the treatment Best Management Practices (BMPs) for the Project (bioretention areas, vegetated swales, filter strips, and extended detention basins) will prevent dry weather urban runoff surface discharges from the Project site through infiltration and evapotranspiration. Subregional extended detention basins would incorporate infiltration trenches and dry wells to promote infiltration of treated flows where natural soil infiltration rates do not support infiltration. Collectively, these vegetated treatment facilities, in combination with Low Impact Design (LID) techniques, are expected to provide significant reduction in wet weather runoff volume and to eliminate all dry weather flows. As no dry weather urban runoff would be discharged to the Santa Clara

River from the Project area, discharges of urban runoff from the Project would not pass over the Dry Gap and end up in the Santa Clara River Estuary and adjacent marine pools waters, even during the winter months. Additionally, discharges would not contaminate groundwater, as discussed in Draft EIS/EIR **Subsection 4.4.6.2.4**.

As described in **Subsection 4.2.3.1.6** of the Draft EIS/EIR, the Dry Gap is an ephemeral section of the Santa Clara River; this part of the Santa Clara River contains surface flows only when rainfall events create sufficient stormwater runoff. The analysis contained in **Appendix 4.2** of the Draft EIS/EIR, "Assessment of Future Surface Water Conditions in the Dry Gap of the Santa Clara River" (GSI Water Solutions, April 2008), determined that future Newhall Ranch WRP flows would not cause flows through the Dry Gap to become perennial. Thus, future discharges from the Newhall Ranch WRP are not expected to pass over the Dry Gap during dry weather conditions, even during the wet season, because surface flows are not present except in response to rainfall events that create sufficient stormwater runoff. Analysis in **Appendix 4.2** specifically found that:

1. Historical increases in the river baseflow upstream of the dry gap have not appreciably changed conditions in the dry gap, where there is little vegetation and little, if any, water (except during storm runoff periods).
2. The dry gap has never closed permanently in the past (*i.e.*, become perennial), even with the onset of, and increase in, WRP flows into the river (to present-day volumes of about 23,000 AF/yr). The historical discharges from the upstream WRPs are 80 times greater than the average incremental contribution (286 AF/yr) that will be added to the river from the Newhall Ranch WRP.
3. Discharges from the future Newhall Ranch WRP will be small compared with other flows entering the Piru groundwater basin from the Santa Clarita valley (storm flows, groundwater baseflow, and discharges from the two existing WRPs that lie upstream of the future Newhall Ranch WRP).

Thus, during periods of dry weather, WRP effluent discharges would not pass over the Dry Gap and end up in the Santa Clara River Estuary and adjacent marine pools waters, even during the winter months.

Please see **Response 16**, below, for a discussion of water quality effects of stormwater runoff in the Santa Clara River, including Newhall Ranch WRP discharges.

For further responsive information, please refer to revised **Section 4.4**, Water Quality, of the Final EIS/EIR.

Response 11

The comment states that even if dry weather urban runoff from the Project passes through the Dry Gap during non-storm events, subsurface flow of the Santa Clara River provides hydrological connectivity between the Santa Clara River reach upstream and downstream of the Dry Gap, thus allowing contaminants from urban runoff and WRP discharges to end up in Santa Clara River Estuary and pools.

As discussed in **Response 10**, above, no dry weather urban runoff would be discharged to the Santa Clara River from the Project area. Discharges of treated dry weather urban runoff to groundwater within the

Project that may occur through infiltration in the treatment BMPs would not significantly impact groundwater quality (see **Subsection 4.4.6.2.7** of the Draft EIS/EIR and Section 7.8 of **Appendix 4.4**) and, thus, would not impact water quality of subsurface flows in the Santa Clara River through the Dry Gap.

Discharges to the Santa Clara River that may occur from the Newhall Ranch WRP during the five month period of November through March in average rainfall years would comply with the individual National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements (WDRs) for the Newhall Ranch WRP (Order No. R4-2007-0046), thus would not significantly impact surface water or groundwater quality in surface or subsurface flows in the Santa Clara River, including the main stem and adjacent pools, through the Dry Gap to the Santa Clara River Estuary and on to the coastal waters at the mouth of the Santa Clara River. The NPDES Permit contains effluent limitations that would control the amount of conventional, nonconventional, and toxic pollutants discharged to the Santa Clara River. These effluent limits include water quality-based limits (per 40 C.F.R. section 122.44, subd. (d)) that are protective of water quality and the beneficial uses designated in the Basin Plan for the Santa Clara River all the way through the Santa Clara River Estuary to the coastal waters at the mouth of the Santa Clara River..

Response 12

The comment states that the EIS/EIR fails to evaluate the Project's effect on water quality and aquatic organisms downstream of the Dry Gap (Reach 4).

The scope of the surface water and groundwater quality impact analysis corresponds with Santa Clara River Reach 5, which extends from Interstate 5 (I-5) to the "Blue Cut," and downstream within Reach 4 to the "Dry Gap" in the Santa Clara River. (EIS/EIR **Subsection 4.4.2**.) Impacts to surface water quality in the Santa Clara River Corridor outside the footprint of the Project area, including Reaches 1 through 4 and the estuary, are evaluated as secondary impacts. (See, for example, EIS/EIR **Subsection 4.4.6.2.3**.) Direct water quality impacts (impacts resulting from the construction and operation of infrastructure facilities included in the proposed RMDP and SCP) and indirect water quality impacts (impacts resulting from urban development facilitated by the implementation of the RMDP and SCP) of the Project to Santa Clara River Reach 5 are analyzed in **Subsection 4.4.6** of the Draft EIS/EIR. This analysis finds that potential direct and indirect impacts would be reduced to a less-than-significant level under Significance Criteria 1 through 3 within the Project boundary. The EIS/EIR also concludes that there would be less than significant impacts to surface water quality under Significance Criteria 1 through 3 in the Santa Clara River Corridor outside the footprint of the project area. (EIS/EIS **Subsection 4.4.6.2.3**) and underlying aquifer downgradient of the Project boundary.

Response 13

The comment states that the Draft EIS/EIR must identify impacts due to the Project from the reach of the Santa Clara River adjacent to the Project site all the way to the Santa Clara River Estuary.

The Draft EIS/EIR evaluated impacts to water quality downstream from the Project boundary. Please refer to **Response 12** for additional discussion of impact analysis. In addition, analysis of the cumulative water quality effects of past, present and reasonably foreseeable urban development in the Santa Clara

River watershed is provided in Draft EIS/EIR **Section 6.0**, Cumulative Impacts. The geographic scope used for the analysis of cumulative water quality impacts is explained in EIS/EIR **Subsection 6.4** and shown on **Figure 6.0-1**. The northern boundary was defined by the Los Padres National Forest, the eastern boundary by pending annexations to the city of Santa Clarita, the southern boundary by the ridge line of the Santa Susana Mountains, and the western boundary by the pending annexations to the city of Santa Paula in Ventura County.

The analysis of cumulative impacts provided on page 6.0-83 of the Draft EIS/EIR states:

> "Development on the Specific Plan, Entrada, and VCC project sites will comply with applicable regulatory requirements for both construction and post-development surface runoff water quality, which ensures that Project-related development will not result in significant water quality impacts. These regulatory requirements include PDFs; MS4 Permit and SUSMP requirements; Construction General Permit requirements; General Dewatering Permit requirements; and benchmark Basin Plan water quality objectives, CTR criteria, and TMDLs issued by the Los Angeles RWQCB and Los Angeles County. Any future urban development occurring in the Santa Clara River watershed must also comply with these requirements. Therefore, cumulative impacts on surface water quality of receiving waters from the proposed Project and future urban development in the Santa Clara watershed would be addressed through compliance with the applicable regulatory requirements that are intended to be protective of beneficial uses of the receiving waters."

The analysis of cumulative impacts provided in the Draft EIS/EIR concluded:

> "Other cumulative projects will be required to comply with federal, state, and local water quality regulations, including implementation of BMPs and PDFs to minimize and mitigate each project's potential water quality impacts. In addition, the Newhall Ranch WRP, like the existing Saugus and Valencia WRPs, is required to comply with the terms of its NPDES permit and WDRs, which would ensure that the Newhall Ranch WRP's contribution to cumulative impacts is rendered less than cumulatively considerable. Because each cumulative project will be subject to this rigorous regulatory regime, cumulative water quality impacts are considered to be less than significant, following mitigation."

The analysis of cumulative impacts indicated that projects located within the geographic scope of the cumulative analysis, as well as other future urban development in the Santa Clara River watershed, would be required to comply with regulatory requirements that are intended to be protective of beneficial uses of the receiving waters. Compliance with regulatory requirements by development projects located in the Santa Clara River watershed, along with implementation of mitigation measures identified for the proposed Project, would ensure that the proposed Project's contribution to cumulative water quality impacts downstream of the Project site would not be cumulatively considerable. (See Draft EIS/EIR **Subsection 6.5.4**.)

For further responsive information, please refer to revised **Section 4.4**, Water Quality, and revised **Section 6.0**, Cumulative Impacts, of the Final EIS/EIR.

Response 14

The comment states that the remainder of VCK's analysis in the entirety of VCK's comment letter incorporates by reference this requirement to evaluate all direct, indirect, and cumulative impacts from the Project to Reaches 1 through 5 and to the coastal waters at the mouth of the Santa Clara River. Please refer to **Responses 9**, **12**, and **13** regarding the evaluation of downstream water quality effects, impacts to biological resources, and the evaluation of cumulative impacts.

Response 15

The comment states that the Basin Plan designated WARM, WILD and recreational beneficial uses to the Santa Clara River, Santa Clara River Estuary, and coastal waters at the mouth of the Santa Clara River, and thus the water quality criteria from the Basin Plan and the California Toxics Rule (CTR) for these beneficial uses must be applied to Project discharges.

The criteria used to evaluate the significance of a potential impact for each pollutant of concern in the Project discharges included receiving water Total Maximum Daily Loads (TMDLs) and receiving water quality objectives and criteria from the Basin Plan and CTR, as suggested in this comment. The applicable TMDLs, Basin Plan objectives, and CTR criteria are summarized in **Table 4.4-11** and **Appendix 4.4**. Comparison of post-development water quality concentrations in the runoff discharge with benchmark numeric and narrative receiving water quality criteria, as provided in the Basin Plan and the CTR, facilitated analysis of the potential for runoff to result in exceedances of receiving water quality standards, adversely affect beneficial uses, or otherwise degrade receiving waters. Please see **Responses 12** and **13**, above, for a discussion of water quality impacts downstream of the Dry Gap, including cumulative and project-specific impacts.

Comments 16 through 23 are under the heading: *"The DEIS/DEIR Must Identify the Significant Impacts to Water Quality and Aquatic Biological Resources from Pollutant Loading"*

Response 16

The comment states that the EIS/EIR erroneously dismisses predicted increases in loadings of several pollutants as not causing a significant impact to water quality and biological resources resulting from urban runoff and WRP discharges. The comment further states that discharges from the project, including the Newhall Ranch WRP, induced both by storm events and discharges from the City of San Buenaventura Ventura Water Reclamation Facility, would end up in the Santa Clara River Estuary, off channel pools, and in the coastal marine waters at the mouth of the Santa Clara River after the river breaches seasonal sandbars.

The water quality model used to evaluate water quality impacts predicts post-development stormwater volumes, pollutant concentrations, and pollutant loads in stormwater runoff from the Project area, not instream pollutant concentrations and loads.

As described in Draft EIS/EIR **Subsection 4.4.6.2.7**, Total Impacts Alternative 2, runoff volume and all pollutant loads, with the exception of total suspended solids (TSS) and nitrate + nitrite-N, are predicted to increase in stormwater discharges from the Project to the Santa Clara River. However, concentrations of all modeled constituents (except for dissolved copper) are predicted to decrease under proposed conditions when compared to existing conditions. The modeled concentrations in runoff from the Project area are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy, and compliance with Standard Urban Stormwater Mitigation Plan (SUSMP), Construction General Permit, and General De-Watering Permit requirements. The predicted change in stormwater runoff loads to the Santa Clara River at the Project location would not significantly change the pollutant load in the Santa Clara River during wet weather, either at the Project location or in downgradient reaches of the River. Long-term impacts to water quality in the Project area would be less than significant after mitigation. (EIS/EIR **Subsection 4.4.6.2.7**.) Long-term secondary impacts to water quality in the Santa Clara River, including the Santa Clara River Estuary, off channel pools, and the coastal marine waters, would also be less than significant. (See **Responses 8 through 15**, above, and EIS/EIR **Subsection 4.4.6.2.7**.)

Response 17

The comment is an introductory statement regarding the impacts of bioaccumulation to aquatic organisms as a result of pollutant loading in the Santa Clara River Estuary. Please see **Response 19**, below, regarding commentor's specific concerns about bioaccumulation. This comment does not raise any specific concerns regarding the analysis provided by the Draft EIS/EIR, but will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 18

The comment is a statement regarding the potential sources and pollutants which contribute to bioaccumulation.

The Draft EIS/EIR identified pollutants of concern as including any pollutants with the potential to bioaccumulate in organisms (Draft EIS/EIR, p. 4.4-60.) **Table 4.4-11** identifies bioaccumulation as a water quality condition of concern and lists the Basin Plan objective for it. The potential for bioaccumulation impacts associated with the Project build-out is discussed on page 4.4-105 of the Draft EIS/EIR. Please refer to **Response 19**, below, regarding the potential for the proposed Project to result in significant off-site bioaccumulation impacts.

Response 19

The comment states that the EIS/EIR must identify bioaccumulation impacts to the Santa Clara River Estuary, coastal marine waters at the mouth of the Santa Clara River, and in pools alongside the Santa Clara River downstream of the Project caused by pollutant loading, such as loading from metals, pesticides, and herbicides, and provide adequate mitigation measures to reduce impacts to less than significant.

As discussed in **Response 16**, above, the predicted change in stormwater runoff loads to the Santa Clara River at the Project location would not significantly change the pollutant load in the Santa Clara River during wet weather, either at the Project location or in the Santa Clara River Estuary, coastal marine waters at the mouth of the Santa Clara River, or in pools alongside the Santa Clara River downstream of the Project.. Pollutants in runoff from the Project area are predicted to be below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy, and compliance with SUSMP, Construction General Permit, and General De-Watering Permit requirements. Although pesticides and metals would be observed at elevated concentrations in untreated urban runoff, the proposed Project includes post-development runoff treatment control BMPs, including extended detention basins, bioretention, vegetated swales and cartridge media filtration devices and thus would not discharge untreated stormwater. Compliance with NPDES permit conditions would ensure that Newhall Ranch WRP discharges would be consistent with water quality objectives and criteria that are protective of aquatic life, including bioaccumulation. See **Response 29**, below, for additional discussion. The types of post-development runoff treatment control BMPs discussed above, and the Newhall Ranch WRP treatment processes are effective for treating these pollutants (*i.e.*, metals, pesticides and herbicides). Legacy pesticides would be prevented from leaving the site during construction through the implementation of a Construction SWPPP in compliance with the most recent Construction General Permit. The placement of impervious surfaces would stabilize soils and prevent their transport from the development sites, reducing the discharge of sediments to which historical pesticides may have. BMPs that will prevent impacts to water quality by currently-used and future pesticides include the implementation of an Integrated Pest Management (IPM) Program for common area landscaping in commercial areas, multi-family residential areas, and parks, and the removal of pesticides in runoff treatment control BMPs for the Project. Thus, the Project would not have a significant impact on water quality in the Santa Clara River at the Estuary, mouth, and off-channel pools for bioaccumulation of metals and pesticides. (Draft EIS/EIR **Subsection 4.4.6.2.7**.)

Response 20

The comment summarizes the commentor's understanding of the processes and impacts of eutrophication within ecosystems as a result of increased nutrient loading. The comment is introductory for other, more specific comments which are addressed separately. This comment would be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 21

The comment mentions economic and social costs of eutrophication, stating that eutrophication is one of the top three leading causes of impairments of the nation's waters. In a U.S. Environmental Protection Agency (USEPA) report on impairments in the nation's waters,[1] nutrient impairments are prevalent, ranking 4th in the cause of impairments nationwide, with 6,862 waterbodies listed as impaired for nutrients in the United States. In California, nutrients are also the 4th highest cause of impairments,[2] with 140 waterbodies listed as impaired by nutrients. Additionally, "organic enrichment/oxygen depletion," side effects of eutrophication, and "algal growth" rank 10th and 20th as the cause of impairments in California, with 47 and 16 impaired waterbodies, respectively.

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1 See http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#causes_303d (last visited June 7, 2010).

2 See http://iaspub.epa.gov/waters10/state_rept.control?p_state=CA&p_cycle=2006#IMP (last visited June 7, 2010).

Nitrites, nitrates, and ammonia are all biostimulatory substances that contribute to eutrophication. The Los Angeles Region 2008 Integrated Report and updated 303(d) list was approved by the Los Angeles Regional Board in July 2009. The Integrated Report, including the updated 303(d) list, was submitted to the State Water Resources Control Board (SWRCB) for approval along with the other Region's reports. The full State Integrated Report will be submitted to the USEPA for approval and would then be final. Although a new impairment is listed for nitrate in the Santa Clara River Estuary, ammonia, nitrate and nitrite are proposed for delisting in Santa Clara River Reach 5 and ammonia is proposed for delisting in Santa Clara River Reach 6 due to the successful implementation of the Santa Clara River Nitrogen Compounds TMDL. As stated in the Santa Clara River TMDL for Nitrogen Compounds Staff Report,[3] stormwater sources are considered minor loads of ammonia, nitrite, and nitrate to the Santa Clara River.

As described in Draft EIS/EIR **Subsection 4.4.6.2.7**, Total Impacts Alternative 2, pollutant loads of nitrate + nitrite-N are predicted to decrease in stormwater discharges from the Project to the Santa Clara River. In addition, concentrations of all nitrogen compounds are predicted to decrease under proposed conditions when compared to existing conditions. The modeled concentrations in runoff from the Project area are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy, and compliance with SUSMP, Construction General Permit, and General De-Watering Permit requirements. The predicted change in stormwater runoff loads to the Santa Clara River at the Project location would not significantly change the pollutant load in the Santa Clara River during wet weather, either at the Project location or in downgradient reaches of the River. Long-term impacts to water quality in the Project area would be less than significant after mitigation. (Draft EIS/EIR **Subsection 4.4.6.2.7**.) Long-term secondary impacts to water quality in the Santa Clara River, including the Santa Clara River Estuary, off-channel pools, and the coastal marine waters, would also be less than significant. (See **Responses 8 through 15**, above, and EIS/EIR **Subsection 4.4.6.2.7**.)

Response 22

The comment is an introductory statement regarding the impacts of eutrophication to ecosystems as a result of increased nutrient loading. Please see **Response 23**, below, regarding the Project's impact on water quality as a result of pollutant loading. This comment does not raise any specific concerns regarding the analysis provided by the Draft EIS/EIR, but will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 23

The comment states that the EIS/EIR must identify the significant impacts caused by nutrient loading and provide mitigation measures to reduce significant effects to less than significant.

Section 4.4 of the Draft EIS/EIR assesses the potential for impacts from nutrient concentrations in stormwater runoff from the Project build-out (pages 4.4-87 through 4.4-90).

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3 See http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/2003-011/03_0523/StaffReport06-16.pdf (last visited June 7, 2010).

The Santa Clara River Nitrogen Compounds TMDL staff report[4] acknowledges that point sources contribute almost all of the ammonia, nitrite, and phosphorus loads in the nutrient-impaired segments of the Santa Clara River watershed. The TMDL also states that the source of nitrate in impaired segments is combination of point, nonpoint, and groundwater sources, and that nonpoint sources contribute due to groundwater accretion. However, the pollutant concentrations in the Santa Clara River are dominated by four wastewater water treatment plants, and the TMDL staff report states (p 61):

> "Minor point sources are not considered to contribute loads of ammonia, nitrite, or nitrate to the Santa Clara River that would have a significant effect on achievement of numeric targets. However, because these sources can potentially have localized effects on water quality, they are allocated concentration-based wasteloads equivalent to the water quality objective. These wasteloads will be implemented through the individual NPDES permits and the Monitoring and Reporting Programs associated with those permits."

The predicted increase in nitrogen loading in Project area runoff would not degrade water quality and would be minor when compared to the nutrient loading in existing wastewater treatment plants' discharges to the Santa Clara River prior to TMDL implementation. The load estimates for the wastewater treatment plants, based on analysis performed for the TMDL, are listed in Table 1 below (Table 21 from the Santa Clara River Nutrient TMDL Staff Report) and are compared with the predicted nitrogen loads in Project area stormwater runoff in Table 2 below.

Table 1
Nutrient Loads from Santa Clara River POTWs from the TMDL Staff Report

POTW	Current Load					
	NH3 (kg/d)	NO2 (kg/d)	NO3 (kg/d)			
Saugus	41.5	2.1	145.2			
Valencia	75.6	4.3	289.4			
Santa Paula + Fillmore	25.9	1.3	103.7			
TOTAL	143	7.7	538.3			

Shading represents conversion to ton/yr from kg/d [(kg/d)*365 (d/yr) / 907 (kg/ton)]

4 Los Angeles Regional Water Quality Control Board (RWQCB), 2003. Santa Clara River Total Maximum Daily Loads for Nitrogen Compounds Staff Report. California Regional Water Quality Control Board Los Angeles Region. June 16, 2003.

Table 2
Comparison between Predicted Project Stormwater Nutrient Loads and POTW Nutrient Load from the TMDL Staff Report

Constituent	Total Combined Current Load from POTW (ton/yr)	Predicted Load from Modeling Results (ton/yr)	Predicted Project Load as % of Current POTW load
NH_3	57.5	2.3	4%
$NO_3 + NO_2$	219.7[1]	3.7	2%

[1] The sum of $NO_3 + NO_2$ from Table 1.

As stated in **Response 21**, above, ammonia, nitrate and nitrite are proposed for delisting in Santa Clara River Reach 5 and ammonia is proposed for delisting in Santa Clara River Reach 6 due to the successful implementation of the Nitrogen Compounds TMDL by the Saugus and Valencia wastewater treatment plants. Pollutant loads of nitrate + nitrite-N are predicted to decrease in stormwater discharges from the Project to the Santa Clara River. In addition, concentrations of all nitrogen compounds are predicted to decrease under proposed conditions when compared to existing conditions. The modeled concentrations in runoff from the Project area are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River, as will be the discharges from the Newhall Ranch WRP. The predicted increase in ammonia and total nitrogen loading in Project area runoff would be minor and would not substantially degrade water quality. As nutrient loading would not be a significant effect of the proposed Project on water quality in Santa Clara River Reach 5, it would also not be a significant effect of the proposed Project in the Santa Clara River downstream of Reach 5 or in the estuary.

Finally, as discussed in **Responses 12** and **19**, above, the Project area is a small percentage of the watershed as a whole and is located 40 miles upstream of the Santa Clara River Estuary. The proposed Project area comprises a small fraction of the Santa Clara River watershed and impervious area upstream of the Los Angeles County/Ventura County line and 1.4 percent of the total Santa Clara River watershed. Thus, as discussed in the Draft EIS/EIR, in this response, and in **Responses 16 through 21,** above, based on the comprehensive site design, source control BMPs, and treatment control BMPs and the comparison with Basin Plan benchmark objectives and wasteload allocations, potential impacts associated with nutrients are considered less than significant under Significance Criteria 1 through 3 and no mitigation measures are required. (EIS/EIR **Subsections 4.4.6.2.2** and **4.4.6.2.3**.)

Comments 24 through 25 are under the heading: *"The DEIS/DEIR Must Identify the Significant Chronic Toxicity Impacts, and Significant Acute and Chronic Toxicity Impacts in Saline Coastal Marine Waters"*

Response 24

The comment states that the CTR provides water quality criteria for toxic pollutants in inland surface waters, enclosed bays, and estuaries with designated human health or aquatic life uses, and also establishes two types of aquatic life criteria: acute and chronic. Acute criteria represent the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without deleterious effects; chronic criteria equal the highest concentration to which aquatic life can be exposed for an extended period of time (four days) without deleterious effects. The comment points out that the Draft EIS/EIR only uses freshwater criteria for acute toxicity benchmarks in assessing the Project runoff. The comment asserts that proposed Project's urban runoff and discharges from the WRP could pass over the Dry Gap in the Santa Clara River and end up or settle for four days or longer in the Ventura County's coastal saline marine waters, the Santa Clara River estuary, and in pools adjacent to the main channel of the Santa Clara River.

The water quality model used to predict post-development stormwater pollutant concentrations models stormwater runoff from the Project area, not pollutant concentrations and loads in the receiving water after mixing with the discharges from the Project. Water quality criteria are considered benchmarks for comparison purposes only, as such criteria apply within receiving waters, such as the Santa Clara River, as opposed to applying directly to runoff discharges. Narrative and numeric water quality objectives contained in the Basin Plan apply to the project's receiving waters. Water quality criteria contained in the CTR provide concentrations that are not to be exceeded in receiving waters more than once in a three year period for those waters designated with aquatic life or human health related uses. Projections of stormwater runoff water quality are compared to the acute form of the CTR criteria (as discussed above), because stormwater runoff is associated with episodic events of limited duration, whereas chronic criteria apply to 4-day exposures which do not describe typical storm events in the Project area, which last 11 hours on average. If pollutant levels in runoff are not predicted to exceed receiving water benchmarks, it is one indication that impacts resulting from Project development would be less than significant.

Project stormwater runoff is unlikely to affect pollutant concentrations in the Santa Clara River based on the comparison of predicted runoff concentrations to observed Santa Clara River water quality and the size of the Project area in comparison to the watershed area. Comparison of the estimated runoff metal concentrations and the acute CTR criteria for dissolved copper, total lead, and dissolved zinc are shown in Draft EIS/EIR **Table 4.4-28**, along with the range of observed concentrations in Santa Clara River Reach 5. The predicted average annual metals concentrations in Project area runoff fall within or very near the range of existing pollutant concentrations in the Santa Clara River. Since the proposed Project area comprises a very small percentage of the Santa Clara River watershed area and impervious area upstream of the Los Angeles County/Ventura County line and 1.4 percent of the total Santa Clara River watershed, the runoff from the Project area would not significantly change the concentration or load of these pollutants in the Santa Clara River.

The comment additionally states that during periods of dry weather, discharges of urban runoff and WRP effluent discharges may at times pass over the Dry Gap and end up in off-channel pools, the Santa Clara River Estuary, or Ventura County's coastal marine waters for a prolonged period of more than four days, especially during the winter months when baseflow contributions to the Santa Clara River are of greater magnitude and are more consistent.

As discussed in **Response 11**, above, no dry weather urban runoff would be discharged to the Santa Clara River from the Project area. Discharges to the Santa Clara River that may occur during the five month period of November through March in average rainfall years from the Newhall Ranch WRP treatment facility must comply with the individual NPDES Permit and Waste Discharge Requirements for the Newhall Ranch WRP (Order No. R4-2007-0046), which contains effluent limits for acute and chronic toxicity per the requirements of the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy or SIP). The SIP became effective on April 28, 2000 with respect to the priority pollutant criteria promulgated for California by the USEPA through the National Toxics Rule and to the priority pollutant objectives established by the RWQCB in the Basin Plan. The SIP became effective on May 18, 2000 with respect to the priority pollutant criteria promulgated by the USEPA through the CTR. The SWRCB adopted amendments to the SIP on February 24, 2005 that became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for acute and chronic toxicity control. The effects of the Project are sufficiently diminished as fresh waters reach the mouth of the Santa Clara River (the Project is located 40 miles from the mouth of the River) such that it would be speculative to apply salt water toxicity criteria. The analysis in the Draft EIS/EIR provides a sufficient degree of analysis to enable decision makers to take intelligent account of these effects.

Response 25

The comment states that the Basin Plan designated WARM and WILD beneficial uses to the Santa Clara River, Santa Clara River Estuary, and coastal waters at the mouth of the Santa Clara River and, therefore, the Draft EIS/EIR must evaluate chronic toxicity impacts from urban runoff and WRP discharge, must evaluate acute and chronic toxicity impacts to the saline Coastal waters around the mouth of the Santa Clara River using salt water acute and chronic criteria, and must set forth adequate mitigation measures to address potential significant effects from chronic and acute toxicity.

Section 4.4 of the Draft EIS/EIR correctly and adequately assesses the impacts of the Project's stormwater runoff for the potential for acute toxicity impacts, as discussed in **Response 24**, above. As the Project's receiving waters are a fresh water reach of the Santa Clara River, fresh water acute CTR criteria were correctly used as benchmarks. The CTR establishes two types of aquatic life criteria: acute and chronic. Acute criteria represent the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without deleterious effects; chronic criteria equal the highest concentration to which aquatic life can be exposed for an extended period of time (four days) without deleterious effects. Due to the intermittent nature of stormwater runoff (especially in southern California), the acute criteria are considered to be more applicable to stormwater conditions than chronic criteria. For example, the average storm duration in the 38-year Newhall gage rainfall record is 11.3 hours. The Newhall Ranch WRP would comply with the requirements of Order No. R4-2007-0046, which contains effluent limits for acute and chronic toxicity

Further, as discussed in **Responses 12** and **19**, above, the Project area is a small percentage of the watershed as a whole and the impervious area within the watershed and is located 40 miles upstream of the Santa Clara River Estuary. Thus, as discussed in the Draft EIS/EIR and **Response 24**, above, based on the comprehensive site design, source control BMPs, and treatment control BMPs and comparison with CTR benchmark objectives, potential impacts associated with toxicity are considered less than significant under Significance Criteria 1 through 3 and no mitigation measures are required.

Comments 26 through 28 are under the heading: *"The DEIS/DEIR Must Identify the Significant Toxicity Impacts of The Aggregate Effect of Pollutants and the Effect of Unknown Pollutants, Including Emerging Contaminants"*

Response 26

The comment restates the definition of acute and chronic toxicity. Because the comment does not address the adequacy or content of the Draft EIS/EIR, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 27

The comment states the Basin Plan's narrative water quality objective for toxicity. Because the comment does not address the adequacy or content of the Draft EIS/EIR, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project. See **Response 24**, above, for a discussion on toxicity.

Response 28

The comment states that the Project will discharge urban runoff with pollutants from dry weather events, wet weather events, and sewage effluent from the WRP, with unknown and emerging contaminants and a mix of pollutants which in the aggregate may cause acute and chronic impacts to aquatic organisms. Thus, because these discharges may violate the Basin Plan's and the CTR's water quality standards for toxicity, or may otherwise substantially degrade water quality, they may have a significant effect on water quality and their toxicity must be evaluated and adequately mitigated for under the Draft EIS/EIR.

As discussed in **Response 11**, above, no dry weather urban runoff would be discharged to the Santa Clara River from the Project area.

As described on page 4.4-60, in order to assess the potential impacts of the Project stormwater runoff on surface water quality, the following assessment methods were utilized for surface water pollutants of concern:

- A water quality model to predict average annual pollutant loads and concentrations for selected constituents for pre- and post-development conditions;
- Qualitative evaluations of constituents with insufficient data for modeling; and
- Comparison of estimated runoff pollutant concentrations in the post-development condition with Project Design Features (PDFs) and benchmark receiving water quality criteria as provided in the Basin Plan, the CTR, and TMDL wasteload allocations.

Surface water pollutants of concern consist of any pollutants that exhibit one or more of the following characteristics: (a) current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water; (b) elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein; or (c) the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna. The pollutants of concern for the water quality analysis are those that are anticipated or potentially could be generated by the Project at concentrations, based on water quality data collected in Los Angeles County from land uses that are the same as those included in the Project, that exhibit these characteristics. Identification of the pollutants of concern also considered Basin Plan beneficial uses and water quality objectives, CTR criteria, and current section 303(d) impaired water listings and TMDLs in the Santa Clara River. Assessment of the potential impacts for the pollutants of concern for the Project showed that none of the quantitatively or qualitatively assessed constituents are expected to significantly impact receiving waters due to the implementation of comprehensive site design, source control BMPs, and treatment control BMPs in compliance with the Municipal Separate Storm Sewer (MS4) permit and SUSMP requirements. Therefore, after application of the BMPs and PDFs described in the Draft EIS/EIR and required by Mitigation Measures SP-4.2-7 and WQ-1, potential impacts from Project build-out on receiving water quality would not be significant under Significance Criteria 1 through 3.

The comment states that the Project's discharge may contain a mix of pollutants which in the aggregate may cause acute and chronic impacts to aquatic organisms. The primary constituents of concern in urban runoff that may affect toxicity are metals, pesticides, and volatile hydrocarbons (*e.g.*, polycyclic aromatic hydrocarbons or PAHs). These pollutants were assessed in the Draft EIS/EIR (Draft EIS/EIR **Subsection 4.4.6.2.2**, page 4.4-98). The toxicity of a constituent is influenced by the form of the constituent. In stormwater runoff where there is elevated TSS, some constituents would adsorb or otherwise be associated with the particulates, which reduced their bioavailability. Thus, it is the dissolved form of constituents that is regulated under the California Toxics Rule. Moreover the presence of dissolved organic carbon can result in the formation of dissolved complexes, which further reduces the bioavailability of the dissolved fraction. Some researchers suggest that it is only the free ionic form of constituents that are bioavailable and in this respect the CTR criteria can be quite conservative (Timperly, 1999).

The constituent(s) responsible for toxicity can be identified through a Toxicity Identification Evaluation (TIE) which allows removal of potential constituents from a sample and reanalysis of the sample for toxicity. If the sample is no longer toxic, it is presumed that the constituent that was removed was a primary cause of the observed toxicity. TIEs conducted in the San Gabriel River (2004-2006) suggested that nonpolar organic constituents, such as diazinon or surfactants, were possible toxicants. TIE results from the analysis of stormwater samples taken from Ballona Creek and Malibu Creeks indicated that metals were the likely toxicants, however, although dissolved copper and zinc concentrations were near toxic levels in many of the Ballona Creek samples, no significant correlation between toxicity and metals concentrations could be established given the limited number of data points (Bay et al, 1997). A TIE study of simulated rainfall runoff from a parking lot indicated that the primary cause of toxicity was likely metals, and dissolved zinc in particular. There is, thus, ample evidence that untreated stormwater runoff may often be found to be toxic, and that pesticides, metals, and other constituents can contribute to toxicity.

There have been few direct studies of the effectiveness of treatment BMPs on whole effluent toxicity reduction (although there are many studies on the effectiveness of treatment BMPs at reducing concentrations of toxic pollutants). Treatment BMPs, to be effective at removing toxics, must address the dissolved fraction of the toxicity-causing constituent. The treatment controls proposed as Project PDFs incorporate various treatment processes, some of which address constituents associated with particulates and some which are effective in addressing dissolved constituents (Strecker et al, 2005). Unit processes that address dissolved constituents include biological uptake and adsorption, processes that would be incorporated into many of the proposed treatment BMPs. As discussed in the Draft EIS/EIR, most of the treatment BMPs would contain vegetation and organic matter to enhance the treatment of dissolved constituents that could contribute to toxicity in the runoff from the project site.

The WRP is prohibited from discharging effluent that has the potential to cause toxic effects. See **Response 24**, above.

In summary, stormwater runoff from the Project is not expected to significantly impact receiving waters due to implementation of a comprehensive set of site design, source control BMPs, and treatment control BMPs in compliance with the MS4 permit and SUSMP requirements. Therefore, after application of the BMPs and PDFs described in the Draft EIS/EIR and required by Mitigation Measures SP-4.2-7 and WQ-1, potential impacts on toxicity in receiving waters would not be significant under Significance Criteria 1 through 3.

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

Bay, S, Greenstein D, Jirik A (1997) Toxicity of Stormwater from Ballona and Malibu Creeks. In. Weisberg (ed) Southern California Coastal Water Research Project: Annual Report 1996. Southern California Coastal Water Research Project, Westminster, CA, pp 96-104.

Katznelson, R, and T. Mumley, 1997. Diazinon in surface waters in the San Francisco Bay Area, Occurrence and Potential Impact; Woodward Clyde Consultants and California Regional Water Quality Control Board.

Schiff, Kenneth C and LL Tiefenthaler, 2003. Contributions of Organophosphorous pesticides from residential land uses during dry and wet weather. Southern California Coastal Water Research Project, Technical Report 406, June.

Strecker, Eric, W Huber, J Heaney, D Bodine, J Sansalone, M Quigley, M Leisenring, D Pankani, A Thayumanavan, Critical Assessment of Stormwater Treatment and Control Selection Issues, Water Environment Research Federation, Report 02-SW-1.

Timperly, M. 1999. Contaminant Bioavailability in Urban Stormwaters, ASCE Engineering Foundation Comprehensive Stormwater and Aquatic Ecosystem Conference Papers.

Comments 29 through 33 are under the heading: *"The DEIS/DEIR Must Identify the Significant Impacts that Pharmaceuticals Discharges from the Project will have of Water Quality and Biological Resources"*

Response 29

The comment states that the EIS/EIR fails to evaluate potential significant impacts caused by discharge of pharmaceuticals from the WRP and urban runoff. A discussion of the potential for pharmaceuticals to be present in WRP and stormwater discharges is presented below.

Pharmaceuticals and Personal Care Products (PCPPs)

Pharmaceuticals are classified as emerging contaminants in wastewater treatment plant discharges. Emerging contaminants are chemicals that were not previously considered pollutants of concern, but have recently been found to have adverse effects on ecological systems at certain concentrations. Many emerging contaminants arise from household use and may be present in wastewater treatment plant discharges because they are not completely removed during wastewater treatment processes. A number of studies have shown that pharmaceuticals are present at very low levels in some wastewater treatment plant discharges. With respect to urban stormwater discharges, a search of the literature for studies that identify the presence of pharmaceuticals in runoff did not find any applicable studies, and the comment did not include a specific citation. While pharmaceuticals have been detected in urban streams, specific point sources have been identified as wastewater treatment plant discharges, agricultural irrigation runoff, and/or agricultural stormwater runoff. Urban stormwater runoff has not been demonstrated to be a point source of pharmaceutical contaminants to receiving waters.

Pharmaceuticals and Personal Care Products (PCPPs) encompass a broad array of chemicals, including antibiotics and other prescription drugs, pain relievers, fragrances, lotions, sunscreen agents, and other products. These chemicals are commonly found in sanitary sewer waste, as they are typically excreted or washed off by consumers into the sewer system. Conventional wastewater treatment plants may not be able to fully biodegrade these complex synthetic chemicals, and they subsequently may be discharged in wastewater treatment plant effluent to receiving waters. Some of these chemicals are endocrine disrupters that can affect the reproductive cycle of aquatic animals.

Studies have demonstrated that a large majority of pharmaceuticals are acutely toxic (by design) at concentrations greater than one milligram per liter (mg/L), which is much greater than concentrations of pharmaceuticals observed in natural streams (Crane, 2006; Cunningham, 2006; Kolpin, 2002). However, knowledge of potential chronic effects of low levels of non-lethal pharmaceuticals is insufficient due to only recent technological advances in detection and analysis of such compounds (Crane, 2006). Thus, such investigations are being widely conducted by universities and the USEPA to further understand the potential for adverse effects.[5]

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[5] See http://www.epa.gov/ppcp/work2.html for a list of USEPA funded research projects on PCPPs (last visited June 7, 2010).

Newhall WRP Treatment Processes

Treatment of synthetic organic compounds in wastewater treatment plants has been widely studied. While many studies agree that conventional wastewater treatment is not adequate to remove these compounds, a number of advanced treatment methods are effective at removing compounds by more than 90 percent, to very low (nanogram per liter (ng/L)) levels (Kim, 2007; Snyder et al., 2007; Kosutic, 2007; Ozaki, 2008; Radjenovic, 2008). Treatment at the Newhall WRP would consist of screening, activated sludge secondary treatment with membrane bioreactors (MBRs), nitrification/denitrification, ultraviolet disinfection, and partial reverse osmosis (see Draft EIS/EIR page 4.4-107).

Studies have generally found that MBRs provide higher removal of emerging contaminants than conventional aerated sludge systems for a number of compounds, including estrogenic compounds, anionic detergents, herbicides, and others (Lyko, 2005; Melin, 2006). Additionally, since MBR treatment results in fewer particulates in effluent, greater removal rates are generally expected (Lyko, 2006). However, removal efficiencies of PCPPs by MBRs may vary. A literature review by Onesios (2009) showed that studies on lab and pilot scale MBRs had varying removal efficiencies for a wide range of PCPPs. High removal efficiencies were seen for a number of antibiotics and common over-the-counter drugs, including acetaminophen, ibuprofen, and caffeine, though low removal efficiencies were also seen for some prescribed pharmaceuticals. A study by Kim (2007) demonstrated high removal efficiencies for hormones and certain pharmaceuticals (99 percent removal of a number of pharmaceuticals was observed), but the same study demonstrated that MBRs were ineffective at removing a number of other emerging contaminants. A study by Snyder *et. al*. (2007) also demonstrated that MBR systems are effective at removing a number of pharmaceuticals and estrogenic compounds, tending to correspond with those compounds that are the most rapidly biodegraded.

Reverse osmosis (RO) and nanofiltration membrane processes have shown excellent removal rates for a variety of PCPPs in two studies, with one study demonstrating that MBR followed by RO effectively removed all compounds analyzed in the study to ng/L levels or lower (Kim, 2007; Snyder, 2007). Additional studies conducted recently have shown similarly high removal efficiencies of PCPPs, with typical measured removal efficiencies of 90 percent or greater (Kosutic, 2007; Ozaki, 2008; Radjenovic, 2008). A widely used example of a water reclamation plant that employs RO membrane technology with good success is the Orange County Groundwater Replenishment System.[6]

Based on the studies referenced herein, the Newhall Ranch WRP treatment processes, including membrane bioreactors and partial RO, would have good removal efficiencies of PCPPs and other emerging contaminants that might arise in the Specific Plan build-out wastewater. Additionally, the Newhall Ranch Sanitation District (Newhall Ranch Water Reclamation Plant) NPDES permit (Order # R4-2007-0046; NPDES # CA0064556) is protective of beneficial uses and water quality and aquatic life. The permit has provisions for acute and chronic toxicity along with prohibitions against all discharges of contaminants at concentrations which cause detrimental physiological responses in human, animal, or aquatic life.

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6 For more information, visit http://www.gwrsystem.com/about/index.html (last visited June 7, 2010.).

Extensive monitoring is required to ensure that all discharged WRP effluent would meet the NPDES Permit provisions; additionally, the NPDES Permit terms effectively require the WRP to address all known toxic concentrations of contaminants that could be found in the effluent. Thus, as further studies are concluded and more is known regarding chronic toxicity effects of PCPPs, the WRP must ensure that the treatment processes are adequate to meet protective treatment standards.

In summary, based on required compliance with state and federal water quality requirements, as discussed and analyzed in the project-level analysis contained in the Newhall Ranch Specific Plan Program EIR, the analysis contained in the Draft EIS/EIR, and the information above, and the implementation of previously adopted Mitigation Measures SP-5.0-52 through 5.0-56, which are related to the construction and operation of the WRP, potential impacts from the Newhall Ranch WRP on receiving water quality would not be significant under Significance Criteria 1 through 3.

Response 30

The comment states that unused pharmaceuticals, pharmaceuticals leached from landfills, and excreted pharmaceuticals can contaminate the water supply and local waterways. The comment also states that "over 80% of waterways tested in the United States show traces of common medications such as acetaminophen, hormones, blood pressure medication, codeine, and antibiotics" [Robin Shalinsky, Taking the Initiative to Take-Back Medications, America's Pharmacist, March 2009].

As the Project does not include the construction of a landfill, landfill leachate would not be discharged by the Project. Pharmaceuticals and personal care products (PCPPs) are found in sanitary sewer waste and may be incompletely removed by conventional wastewater treatment plants. See **Response 29**, above, for a discussion of this point.

The reference to "80% of waterways tested in the United States" is incorrectly cited and summarized. The reference cited in the comment is a newsletter that references a 1999-2000 U.S. Geological Survey (USGS) reconnaissance study. The USGS study (and corresponding Environmental Science and Technology journal article (Kolpin, 2002)) is a more accurate reference. Additionally, the study is incorrectly summarized. The study is not representative of United States waterways and was not exclusive to common medications; a number of other organic wastewater contaminants (OWCs), which arise from industrial and agricultural sources, along with municipal sources, were included. As stated in Kolpin (2002):

> "The compounds detected represent a wide range of residential, industrial, and agricultural origins and uses with 82 of the 95 OWCs being found during this study"… "One or more OWCs were found in 80% of the 139 streams sampled for this study. The high overall frequency of detection for the OWCs is likely influenced by the design of this study, which placed a focus on stream sites that were generally considered susceptible to contamination (i.e., downstream of intense urbanization and livestock production). In addition, select OWCs (such as cholesterol) can also be derived from nonanthropogenic sources. Furthermore, some of the OWCs were selected because previous research (28) identified them as prevalent in the environment. Thus, the results of this study should not be considered representative of all streams in the United States. A previous investigation of streams downstream of German municipal sewage treatment

> plants also found a high occurrence of OWCs (31). A large number of OWCs (82 out of 95) were detected at least once during this study (Table 1). Only eight antibiotics and five other prescription drugs were not detected in the samples analyzed (Table 1). Measured concentrations were generally low (median detectable concentrations generally <1 big/L, Table 1), with few compounds exceeding drinking water guidelines, health advisories, or aquatic-life criteria (Table 1)."

Undoubtedly the detection of these compounds is concerning. However, the study speaks for itself, and should be correctly referenced and summarized.

Response 31

The comment addresses the USGS study, also cited in **Response 30**, above, which tested a number of organic wastewater contaminants in 139 streams nationwide. The comment states that the study found an average of seven contaminants in each water sample. The study, in fact, found a median of seven contaminants in each water sample. For a further discussion of this study, refer to **Response 30**, above.

Response 32

This comment discusses the potential for trace levels of pharmaceuticals in the water supply to impact aquatic organisms, aquatic ecosystems, and human health. Pharmaceuticals do have the potential to affect human health and have been shown to be incompletely removed from conventionally treated wastewater treatment plant discharge. However, the Newhall Ranch WRP is not using conventional treatment methods; the Newhall Ranch WRP would employ a membrane bioreactor system and reverse osmosis, both of which have been shown to have higher removal efficiencies than conventional treatment systems. Additionally, the NPDES permit that the WRP must comply with is protective. See **Response 29**, above, for a further discussion of this topic. This comment does not address the adequacy or content of the EIS/EIR and, therefore, no further response is necessary. The comment would be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 33

The comment states that the EIS/EIR must address significant impacts caused by discharges of pharmaceuticals in WRP effluent discharges and stormwater discharges, including impacts to groundwater, and provide mitigation measures for these discharges. See **Response 29**, above, for a discussion on the potential for impacts caused by discharges of pharmaceuticals in WRP effluent discharges and stormwater discharges. As stated in **Response 29**, pharmaceuticals are not expected to be present in stormwater discharges from urban development, and, therefore, discharges of stormwater to groundwater would not impact groundwater quality for pharmaceuticals. Moreover, based on the studies referenced in **Response 29**, the Newhall Ranch WRP treatment processes, including membrane bioreactors and partial RO, would have good removal efficiencies of PCPPs and other emerging contaminants that might arise in the Specific Plan build-out wastewater. Thus, after treatment in the WRP processes described above and in the Draft EIS/EIR, and implementation of Mitigation Measures SP4.2-7 (compliance with regulatory requirements such as NPDES, Los Angeles County Urban Storm Water Mitigation Plan, SWPPP, *etc*.), WQ-1 (implementation of specified best management practices), and Specific Plan mitigation measures related to the development, operation and maintenance of the

Newhall Ranch WRP (Specific Plan Mitigation Measures SP-5.0-52 through SP-5.0-56) , build-out of the Project would not result in significant long-term indirect groundwater quality impacts under Significance Criterion 4. No further mitigation measures are required.

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

Crane, M.; C. Watts; T. Boucard. Chronic aquatic environmental risks from exposure to human pharmaceuticals. *Science of the Total Environment*. 2006, 376, 23-41

Cunningham, V; M. Buzby; T. Hutchinson; F. Mastrocco; N. Parke; N. Rode. Effects of Human Pharmaceuticals on Aquatic Life: Next Steps. *Environmental Science and Technology*. June 1, 2006

Lyko, S.; T. Wintgensl T. Melin. Estrogenic trace contaminants in wastewater – possibilities of membrane bioreactor technology. *Desalination.* 2005, 178 95-105.

Kim, S.; J. Cho; I. Kim; B. Vanderford; S. Snyder. Occurrence and removal of pharmaceuticals and endocrine disruptors in Southe Korean surface, drinking and waste waters. *Water Research.* 2007, 41, 1013-1021.

Kolpin, D.; E. Furlong; M. Meyer; E. M. Thurmanl; S. Zaugg; H. Buxton. Pharmaceuticals, Hormones, and other organic wastewater contaminants in US Streams, 1999-2000: A national reconnaissance. *Environmental Science and Technology*. 2002, 36, 1202-1211.

Kosutic, K.; D. Dolar; D. Asperger; B. Kunst. Removal of antibiotics from a model wastewater by RO/NF membranes. *Separation and Purification Technology.* 2007, 53, 244-249.

Melin, T.; B. Jefferson; D. Bixio; C. Thoyey; W. De Wilde; J. De Koning; J. van der Graaf; T. Wintgens. Membrane bioreactor technology for wastewater treatment and reuse. *Desalination.* 2006, 187, 271-282.

Onesios, K.; J. Yu; E. Bouwer. Biodegradation and removal of pharmaceuticals and personal care products in treatment systems: a review. *Biodegradation.* 2009, 20, 441-466.

Ozaki, H.; N. Ikejima, Y. Shimizu, K. Fukami, S. Taniguchi, R. Takanami, R. R. Giri and S. Matsui. Rejection of pharmaceuticals and personal care products (PPCPs) and endocrine disrupting chemicals (EDCs) by low pressure reverse osmosis membranes. *Water Science & Technology*. 2008, 58 (1), 73-8.

Radjenovic, J.; F. Ventura; D. Barcelo. Rejection of pharmaceuticals in nanofiltration and reverse osmosis membrane drinking water treatment. Water Research. 2008, 42, 3601-3610.

Snyder, S.; s. Adham; A. Redding; F. Cannon; J. DeCarolis; J. Oppenheimer; E. Wert; Y. Yoon. Role of membranes and activated carbon in the removal of endocrine disruptors and pharmaceuticals. Desalination. 2007, 202, 156-181.

Comments 34 through 44 are under the heading: *"The DEIR/DEIS Fails to Utilize the Narrative Objective for Biostimulatory Substances in the Basin Plan to assess the Effect of Nutrient Concentrations and Loadings from the Project and Improperly Evaluates the Effects of Total Nitrogen and Total Phosphorous"*

Responses 34 and 35

The comment summarizes the Basin Plan water quality objective for biostimulatory substances. Additionally, the comment references the Malibu Creek TMDL, in which the RWQCB states that a waterbody is impaired by biostimulatory substances if there is algal cover in excess of 30 percent. This comment is an introduction to the comments that follow and does not address the adequacy of the document. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Regarding the reference to the Malibu Creek TMDL,[7] the nutrient numeric targets included in this TMDL are not relevant to the Santa Clara River. The Malibu Creek TMDL Staff Report explicitly states [p. 19 of TMDL for Nutrients, Malibu Creek Watershed Staff Report]:

> "EPA stresses that these [nutrient] numeric target values are proposed only for waters in the Malibu Creek watershed. The inclusion of these numeric target values for Malibu watershed is not intended to reflect any judgments about the numeric targets needed for other nutrient TMDLs needed in California."

Response 36

The comment quotes a statement from the Machado Lake TMDL that addresses the impacts to waterbodies associated with eutrophication. Refer to **Response 21** for further discussion related to eutrophication. The comment does not address the adequacy or content of the Draft EIS/EIR. It will be included as part of the record and made available to decision makers prior to a final decision on the Project.

This comment (**Comment 36)** and **Comments 40 through 44** reference the Machado Lake TMDL, implying that potential nutrient concentration and load impacts to the Santa Clara River would be similar to potential biostimulatory impacts to a lake or reservoir. As described in the Draft EIS/EIR and the Santa Clara River Parkway Floodplain Restoration Feasibility Study (Stillwater and URS, 2007; Stillwater, 2007), the Santa Clara River is a dynamic semi-arid ecological system driven primarily by periodic short duration, high intensity flood events. The channel borders between meandering and

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[7] Los Angeles Regional Water Quality Control Board (RWQCB), 2004. Total Maximum Daily Loads for Bacteria Malibu Creek Watershed. January 29, 2004 (http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/santa_monica/04_0129/Final_Staff_Report.pdf).

braided river forms, as defined by the gradient, discharge, and bed material grain size. The result is an unusual compound channel morphology that is essentially braided at lower flows but more akin to a low sinuosity meandering channel during large flood discharges. The channel morphology is affected primarily by large flood flows rather than by the moderate discharges frequently used to characterize channel form response in temperate climates. In addition, throughout the Santa Clara River channel, complex surface water/groundwater interactions lead to areas of alternating gaining and losing river segments. In particular, downstream of the Los Angeles County/Ventura County line, the Santa Clara River flows through the Piru groundwater basin where surface flows in the river are lost to groundwater. These factors result in a mosaic of riparian vegetation that shifts in extent, structure, and composition in response to deposition, scour, and inundation by large flood flows. This continual shift of channel form, vegetation, and movement of substrate and water greatly reduces the potential for nutrient loads to accumulate, such as that would be expected to occur in a lake or reservoir, in a manner that would stimulate the growth of algae.

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

Stillwater Sciences, 2007. Santa Clara River Parkway Floodplain Restoration Feasibility Study: Assessment of Geomorphic Processes for the Santa Clara River Watershed, Ventura and Los Angeles Counties, California. Prepared by Stillwater Sciences for the California State Coastal Conservancy. August 2007.

Stillwater Sciences and URS, 2007. Santa Clara River Parkway Floodplain Restoration Feasibility Study: Riparian Vegetation Mapping and Preliminary Classification for the Lower Santa Clara River and Major Tributaries Ventura County, California. Prepared by Stillwater Sciences and URS Corporation for the California State Coastal Conservancy. August 2007.

Response 37

The comment lists findings of a number of studies regarding the impacts of eutrophication to marine ecological systems. Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project. Refer to **Response 21**, above, for a discussion related to eutrophication.

Response 38

This comment makes a statement regarding eutrophication that is also part of **Comment 21**. Please refer to **Response 21**, above.

Response 39

The comment cites the RWQCB's 2008 update of the 305(b) report and 303(d) list of impaired waters, which includes a discussion of the prevalence of eutrophication of waterbodies, particularly lakes. Because the comment does not address the content of the document, no additional response is provided.

This comment will be included as part of the record and made available to the Corps and CDFG decision makers prior to a final decision on the Project.

Refer to **Response 21**, above, for a discussion related to eutrophication. In addition, as stated in **Response 21**, nitrate and nitrite are proposed for delisting in Santa Clara River Reach 5 and ammonia is proposed for delisting on the 2008 303(d) list in Santa Clara River Reach 6 due to the successful implementation of the Santa Clara River Nitrogen Compounds TMDL.

Response 40

The comment states the Machado Lake TMDL phosphorous numeric target developed as a response to impairments in Machado Lake for algae and eutrophic conditions. Machado Lake is additionally listed for ammonia and odors (nutrient). Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Refer to **Response 36**, above, for a discussion on the relevance of the Machado Lake TMDL and its nutrient targets to the Santa Clara River.

Response 41

The comment states that the Los Angeles Regional Integrated Report for Clean Water Act section 305(b) Report and section 303(d) List of Impaired Waters state that the Basin Plan standard for nitrogen is a drinking water standard and does not protect waterbodies from biostimulatory impairments and eutrophication.

The RWQCB, in the same report, also acknowledges that their current standard for biostimulatory substances is a narrative standard and clear approach for determination of biostimulatory impairment must be developed. Notably, the Santa Clara River is not listed for biostimulatory impairments such as eutrophic conditions, algae, or nutrient odors as Machado Lake is. Additionally, past listings for nutrient impairments are being addressed in the Santa Clara River by the Nitrogen Compounds TMDL, which the Project complies with.

New approaches to determine impairment by biostimulatory substances have not been developed by the RWQCB, nor have any non-site specific Basin Plan nutrient standards been updated. The Project must use the numeric objectives currently in place, namely the Basin Plan and the Santa Clara River Nutrient TMDL, as the basis for assessment of impacts. Additionally, it is expected that the Santa Clara River Nutrient TMDL, developed by the RWQCB, would comply with the Board's own objective for biostimulatory substances.

Response 42

The comment lists the water quality objectives listed in the Nutrient TMDL for Malibu Creek. Refer to **Response 34** for a discussion of the applicability of the Malibu Creek TMDL numeric targets to the Project.

Response 43

The comment cites the USEPA guidance values for CWA section 304(a) nutrient criteria[8] specific to the Los Angeles Region (Ecoregion III) of 0.38 mg/l total nitrogen and 0.022 mg/l total phosphorus for protection of aquatic life and recreation uses. The State Water Resources Control Board (SWRCB) has departed from USEPA's large scale Eco-Region approach using nutrient concentrations as sole indicators of beneficial use impairment and is in the process of developing a California Nutrient Numeric Endpoint (NNE) Framework. The NNE Framework is based on benthic algal biomass density (mg chl-*a* /m^2) thresholds that distinguish Beneficial Use Risk Categories (BURCs)9 . This approach is further supported by the San Francisco Bay Regional Water Quality Control Board in guidance for developing nutrient TMDLs, in which they state: "*numerous studies have found that setting numeric targets for nutrient concentrations can be difficult or impossible due to temporal issues and site specific factors discussed above….*" (Krottje and Whyte, 2003).

A survey paper on stream trophic state based on an analysis of data from 286 stream sites indicated a benthic chlorphyl-a threshold of about 150 mg/m^2 represents nuisance levels in streams (Dodds *et al*, 1998). This level agrees with the screening level values being considered in the State of California NNE development.

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

Krottje, Peter and D Whyte, 2003. Conceptual Approach for Developing Nutrient TMDLs for San Francisco Bay Area Waterbodies, prepared by California Regional Water Quality Control Board, San Francisco Bay Region staff, June.

Dodds, Walter K, JR Jones, EB Welch, 1998. Suggested Classifications of Stream Trophic State: Distribution of Temperate Stream Types by Chlorophyll, Total Nitrogen, and Phosphorus, Water Resources, Vol. 32, No. 5, pp 1455-1462.

Response 44

The comment states that the Project's projected discharges of Total Nitrogen and Total Phosphorous violate both the narrative objective for biostimulatory substances and established nitrogen and phosphorous criteria for protection of aquatic life, and therefore must be found to have a significant effect on the environment under Significance Criteria 1 and Significance Criteria 3 set forth in the Draft EIS/EIR. The water quality model used to predict post-development stormwater concentrations applies to stormwater runoff and does not predict instream pollutant concentrations and loads. Water quality

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8 USEPA, Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion III (2000) (EPA 822-B-00-016)

9 See: http://www.waterboards.ca.gov/academy/courses/wqstandards/materials/mod12/12nutconundrum.pdf.

criteria are considered benchmarks for comparison purposes only, as such criteria apply within receiving waters as opposed to applying directly to runoff discharges. There are no benchmark numeric objectives for total phosphorous or total nitrogen in the Basin Plan. A narrative objective for biostimulatory substances in the Basin Plan states: "waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses." Numeric targets and other criteria cited in **Comments 40 through 43** are inapplicable to the Santa Clara River for reasons explained in **Responses 36**, **41**, and **43**, above.

Section 4.4 and **Appendix 4.4** of the Draft EIS/EIR assess the potential direct and indirect impacts of the Project's discharges on total nitrogen and total phosphorous. Potential impacts are assessed by both comparing the predicted average annual pollutant loads and concentrations for pre- and post-development conditions and comparing the predicted average annual pollutant concentration for post-development conditions to receiving water benchmarks and existing water quality conditions. For total phosphorous, because much of the total phosphorus load is associated with sediments and sediment concentrations are predicted to decrease with development, total phosphorous average annual concentration and load are also predicted to decrease. In addition, the predicted total phosphorus concentration is at the low end of the range of observed concentrations in Santa Clara River Reach 5. For total nitrogen, the average annual concentration of total nitrogen is predicted to decrease, total nitrogen loads are predicted to increase slightly (0.2 percent), and the predicted total nitrogen concentration is at the low end of the range of observed concentrations in Santa Clara River Reach 5. Since the current levels of total phosphorous and total nitrogen are not causing biostimulatory impacts to the Santa Clara River, and these levels are not predicted to increase significantly, impacts associated with biostimulation from total phosphorous and total nitrogen are considered less than significant under Significance Criteria 1 through 3.

Comments 45 through 46 are under the heading: *"The DEIR/DEIS Fails to Adequately Assess the Concentrations and Loading of Chlorides that will be Discharged from the Project's WRP and Urban Runoff"*

Response 45

The comment states that the EIS/EIR underestimates discharge of chloride in the Project's WRP effluent discharges and urban dry weather and stormwater runoff because inputs of chloride from the State Water Project (SWP) are not accounted for. The level of chloride in the water supply would not affect the concentration of chloride in stormwater runoff. The event mean concentrations used to estimate chloride concentration in Project runoff were measured in Los Angeles County and reflect the same water supply chloride levels. Additionally, no dry weather urban runoff would be discharged to the Santa Clara River from the Specific Plan area.

SWP water intended for use by the Castaic Lake Water Agency (CLWA) is conveyed through the West Branch of the California Aqueduct to Quail and Pyramid Lakes and then to Castaic Lake, the terminus for the West Branch. Chloride concentrations in SWP water at Castaic Lake have been consistently below 80 mg/L since 2004 based on data collected by CLWA (see Figure 1 below). This water quality is well below the recently adopted conditional Site Specific Objectives for Santa Clara River Reach 5 (*e.g.*, 150 mg/L as a 12-month rolling average) and the lower reaches of the Santa Clara River (*e.g.*, 117 mg/L as a 3-month rolling average at Reach 4B, downstream of Blue Cut) and below the current TMDL wasteload allocation of 100 mg/L.

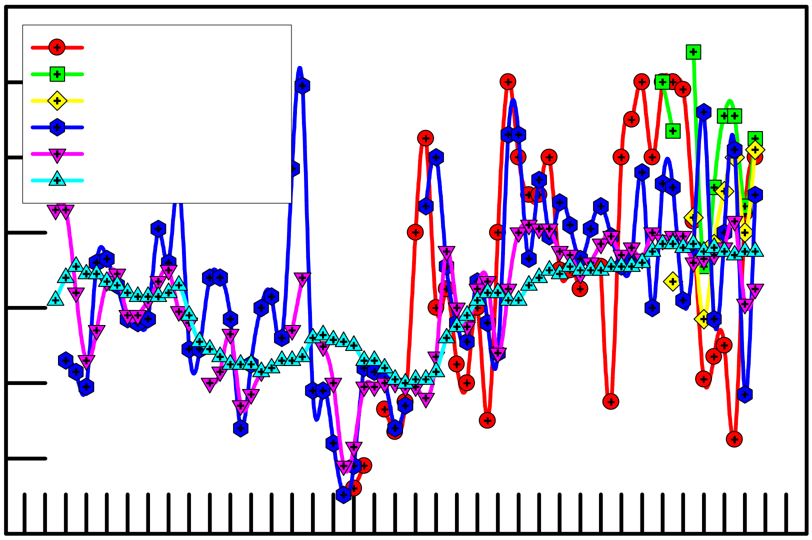

Figure 1: Chloride Concentrations in Locations throughout the State Water Project

A groundwater-surface water interaction (GSWI) model was developed by the Upper Santa Clara River Chloride TMDL stakeholders to assess the linkage between chloride sources and instream water quality and to quantify the assimilative capacity of Santa Clara River Reaches 4A, 4B, 5, and 6 and the groundwater basins underlying those reaches (RWQCB, 2008). GSWI was then used to predict the effects of WRP discharges on chloride loading to surface water and groundwater under a variety of future hydrology, land use, and water use assumptions, including future discharges from the proposed Project, in order to determine appropriate wasteload allocations (WLAs) and load allocations (LAs). The linkage analysis demonstrates that beneficial uses can be protected through a combination of site specific objectives (SSOs) for surface water and groundwater and reduction of chloride levels from the Valencia WRP effluent through advanced treatment (RWQCB, 2008). The watershed chloride reduction plan would be implemented through NPDES permits for the Valencia WRP and a new NPDES permit for discharge into Reach 4A.

The Newhall WRP must comply with its NPDES Permit, which contains an effluent limitation for chloride that is protective of water quality and beneficial uses in the Santa Clara River. Therefore, based on required compliance with state and federal water quality requirements, as discussed and analyzed in the project-level analysis contained in the Newhall Ranch Specific Plan Program EIR and the information above, and the implementation of previously adopted Specific Plan mitigation measures related to the development, operation and maintenance of the Newhall Ranch WRP (Mitigation Measures SP-5.0-52 through 5.0-56), , potential impacts from the Newhall Ranch WRP on chloride would not be significant under Significance Criteria 1 through 3.

References

The following reference was used or relied upon, is available for public review upon request to the Corps or CDFG, and is incorporated by reference:

RWQCB, 2008. Upper Santa Clara River Chloride TMDL Reconsideration and Conditional Site Specific Objectives for Chloride and Interim Wasteload Allocations for Sulfate and Total Dissolved Solids Staff Report. California Regional Water Quality Control Board - Los Angeles Region, November 24, 2008.

Response 46

The comment states that the Draft EIS/EIR must also re-evaluate the effect that chloride concentrations from imported SWP water would have on water quality, biological resources, and water supply, and set forth adequate mitigation measure to reduce any significant effects to water quality and biological resources to a less-than-significant effect. The Draft EIS/EIR accurately evaluated the impacts related to chloride concentrations. See **Response 45**, above.

Comments 47 through 51 are under the heading: *"To adequately assess impacts to water quality and biological resources the DEIR/DEIS must combine the concentrations of effluent discharges from the WRP with the Project's estimated average pollutant concentrations and pollutant loading from urban runoff, must calculate the estimated discharges from wet and dry weather events instead of averaging all storm events together, and must account for the possibility that chloride concentrations in discharges to the WRP will be too high for reuse"*

Response 47

The comment states that the Draft EIS/EIR needs to evaluate the combined effects of effluent discharges from the WRP and urban runoff to comply with CEQA and NEPA. Environmental review for both the Specific Plan and the WRP was conducted by Los Angeles County, pursuant to CEQA. In the environmental documentation, the Specific Plan was evaluated at a "program" level, and the Newhall Ranch WRP was analyzed at a "project" level. The County's Board of Supervisors certified the adequacy of the Newhall Ranch Specific Plan Program EIR on May 27, 2003. After certification, the Board of Supervisors adopted the required resolution, findings, and conditions approving the Specific Plan, WRP, and other associated local project approvals.

Subsection 6.5.3 of the Draft EIS/EIR qualitatively analyzes the cumulative water quality effects of the proposed Project in conjunction with past, present, and probable or reasonably foreseeable future projects causing related impacts; and examines reasonable and feasible options for mitigating or avoiding the Project's contribution to any significant cumulative effects. The Newhall WRP, Saugus WRP, and Valencia WRP are included in the cumulative water quality impact analysis (see pages 6.6-80 through 6.6-84). Additional quantitative cumulative analysis is provided below.

Table 3, below, shows the predicted changes in stormwater runoff volume and mean annual loads for the modeled pollutants of concern for the Project, for the WRP effluent, and the combination of the stormwater runoff and WRP effluent. In an average rainfall year, all tertiary treated wastewater from the Newhall Ranch WRP would be recycled for irrigation and other non-potable uses, except in the wet weather months. During these months, in average rainfall years, approximately 286 to 1,025 acre-feet of tertiary-treated wastewater would not be needed to meet estimated non-potable demand and, therefore, would be discharged to the Santa Clara River. Table 3 below assumes that 1,025 acre-feet of treated effluent would be discharged annually. WRP effluent concentrations were assumed to be equal to the maximum monthly average concentrations in effluent from the Valencia WRP in 2008 for all constituents except TSS and chloride. TSS and chloride concentrations were assumed to be equivalent to the maximum permissible effluent limits listed in the Newhall WRP NPDES Permit (Draft EIS/EIR **Table 4.4-31**) as data from the Valencia WRP was not available for these constituents. Table 4 below shows the predicted change in concentration in stormwater runoff for the Project, in the WRP effluent, and the combination of stormwater runoff with the WRP effluent.

Annual Project runoff plus WRP discharge volume and all pollutant loads, with the exception of TSS, in the combined Project runoff and WRP discharge are predicted to increase under proposed conditions when compared to existing conditions. Concentrations of TSS, total phosphorous, nitrate-N + nitrite-N, total nitrogen, total lead, dissolved zinc, and total aluminum are predicted to decrease under proposed conditions when compared to existing conditions. Concentrations of ammonia-N, dissolved copper, and chloride in runoff and WRP discharges are predicted to increase.

The estimated average annual TSS, nutrient, and chloride concentrations in the total discharge (stormwater and WRP discharge) from the Project are compared to water quality criteria in Table 5 below. Although discharge volume and pollutant loads are predicted to increase with build-out of the Project and the WRP (except for TSS), the concentrations are predicted to be below all benchmark criteria and within the range of observed concentrations in Santa Clara River Reach 5. With the implementation of Mitigation Measure WQ-1, the comprehensive site design, source control, and treatment control strategy, summarized in Draft EIS/EIR **Table 4.4-12**, the predicted decrease in runoff concentrations, and the comparison with Basin Plan benchmark objectives and existing water quality, potential cumulative impacts, after treatment *via* PDFs, from the total Project on TSS, nutrient, and chloride receiving water quality would not be significant under Significance Criteria 1 through 3.

Table 3
Estimated Average Annual Runoff Volume and Pollutant Loads for Specific Plan, VCC, and Entrada Planning Areas and WRP Effluent

Parameter	Units	Stormwater Existing Conditions	Stormwater Developed Conditions w/out PDFs	Stormwater Developed Conditions w/ PDFs	Stormwater Change w/ PDFs	WRP Effluent[1]	Total Discharge[2]	Total Change[3]
Volume	acre-ft	1,408	4,315	3,742	2,334	1,025	4,767	3,359
TSS	tons/yr	600	603	366	-234	21[4]	387	-213
Total Phosphorus	lbs/yr	2,642	3,891	2,679	37	0[5]	2,679	37
Nitrate-N + Nitrite-N	lbs/yr	13,127	9,966	7,468	-5,659	10,257	17,725	4,598
Ammonia-N	lbs/yr	1,873	5,580	4,587	2,714	4,237	8,824	6,951
Total Nitrogen	lbs/yr	22,550	36,502	23,820	1,270	17,170	40,990	18,440
Dissolved Copper	lbs/yr	30	111	84	54	32[6]	116	86
Total Lead	lbs/yr	32	87	64	32	0.3	64	32
Dissolved Zinc	lbs/yr	307	753	399	92	129[6]	528	221
Total Aluminum	lbs/yr	3,194	9,918	6,020	2,826	2,091[7]	8,111	4,917
Chloride	tons/yr	31	87	74	43	139[4]	213	182

Notes:

1 Wet weather WRP Effluent loads were calculated based on an assumption of 1,025 acre-feet of discharge per year at concentrations equivalent to the Valencia WRP 2008 effluent maximum monthly average concentrations except where noted.

2 Total Discharge = Stormwater Developed Conditions w/PDFs + WRP Effluent.

3 Total Change = Stormwater Change w/ PDFs + Annual WRP Effluent

4 TSS and chloride concentrations were assumed to be equivalent to the maximum permissible effluent limits listed in the Newhall WRP NPDES Permit (**Table 4.4-31**) as data from the Valencia WRP was not available for these constituents.

5 Total phosphorus is not included in Valencia monitoring or in the Newhall WRP Permit effluent limits; it has been shown be reduced to negligible levels in tertiary-treated wastewater treatment plant effluent (EPA, 2007)

6 WRP concentrations for total metals were conservatively assumed to be equivalent to dissolved metals concentrations as dissolved metals concentrations were not available.

7 Aluminum concentration in WRP effluent was assumed to be equivalent to the National Ambient Water Quality Criteria (NAWQC) criterion, since Valencia WRP data was not available for this constituent and an effluent limit for aluminum was not included in the WRP permit.

Table 4
Estimated Average Annual Pollutant Concentrations for Runoff from the Specific Plan, VCC, and Entrada Planning Areas and WRP Effluent

Parameter	Units	Stormwater Existing Conditions	Stormwater Developed Conditions w/out PDFs	Stormwater Developed Conditions w/ PDFs	Stormwater Change w/PDFs	WRP Effluent[1]	Total Discharge Concentration[2]	Total Discharge Change
TSS	mg/L	313	103	72	-241	15[3]	60	-253
Total Phosphorus	mg/L	0.69	0.33	0.26	-0.43	0	0.21	-0.48
Nitrate-N + Nitrite-N	mg/L	3.4	0.8	0.7	-2.7	3.7	1.4	-2.0
Ammonia-N	mg/L	0.49	0.48	0.45	-0.04	1.52	0.68	0.19
Total Nitrogen	mg/L	5.9	3.1	2.3	-3.6	6.2	3.2	-2.7
Dissolved Copper	µg/L	7.9	9.5	8.3	0.4	11.5[4]	9.0	1.1
Total Lead	µg/L	8.3	7.4	6.3	-2	0.1	5.0	-3.3
Dissolved Zinc	µg/L	80	64	39	-41	46[4]	41	-39
Total Aluminum	µg/L	834	845	591	-243	750[5]	626	-208
Chloride	mg/L	16	15	15	-1	100[3]	33	17

Notes:

1 WRP effluent concentrations were assumed to be equivalent to the Valencia WRP 2008 effluent maximum monthly average concentrations except where noted.

2 Total discharge concentration is equal to the combined stormwater from developed conditions with PDFs and WRP effluent and is calculated from the loads and volumes in Table 3.

3 TSS and chloride concentrations were assumed to be equivalent to the maximum permissible effluent limits listed in the Newhall WRP NPDES Permit (**Table 4.4-31**) since data from the Valencia WRP was not available.

4 WRP concentrations for total metals were conservatively considered to be equivalent to dissolved metals concentrations, as dissolved metals concentrations were not available.

5 Aluminum concentration in WRP effluent was assumed to be equivalent to the NAWQC criterion, since Valencia WRP data was not available and an effluent limit for aluminum was not included in the WRP permit.

Table 5
Comparison of Estimated TSS, Nutrients, and Chloride Concentrations for the Specific Plan, VCC, and Entrada Planning Area Runoff and WRP Effluent with Water Quality Objectives, TMDLs, and Observed Concentrations in Santa Clara River Reach 5

Nutrient	Estimated Average Annual Concentration (mg/L)	Basin Plan Water Quality Objectives (mg/L)	Wasteload Allocations for MS4 Discharges into the Santa Clara River Reach 5 (mg/L)	Range of Observed[1] Concentrations in Santa Clara River Reach 5 (mg/L)
TSS	60	Water shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.	NA	32 - 6,591
Total Phosphorus	0.21	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.	NA	0.18 - 13.4
Nitrate-N + Nitrite-N	1.4	5	6.8[2]	0.5 - 4.8
Ammonia-N	0.68	2.2[3]	1.75[4]	<0.005 - 1.1
Total Nitrogen	3.2	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.	NA	<0.04 - 46[5]
Chloride	33	100	100	3 - 121

Notes:
1 Range of concentrations observed in the Santa Clara River during wet weather (Stations S29, NR1, and NR3).
2 30-day average.
3 Four-day average, ELS present, 90th percentile pH and temperature pairing observed at USGS Monitoring Station 11108500.
4 30-day average in Reach 5 below Valencia.
5 Observed values for TKN (ammonia plus organic nitrogen).

Comparison of the estimated runoff metal concentrations and the acute CTR criteria for dissolved copper, total lead, and dissolved zinc are shown in Table 6 below, along with the range of observed concentrations in Santa Clara River Reach 5. Although the trace metal loadings are predicted to increase and the estimated average concentration of dissolved zinc is above the observed range in Santa Clara River Reach 5, the comparison of the post-developed with PDFs condition to the benchmark CTR values shows that the dissolved copper, total lead, and dissolved zinc concentrations are below the benchmark CTR criteria. The estimated dissolved copper and total lead concentrations are within the range of observed concentrations in Santa Clara River Reach 5.

There is no CTR criterion for aluminum, although there is a National Ambient Water Quality Criteria (NAWQC) criterion (750 μg/L (acute) for a pH range of 6.5 to 9.0) in the form of acid soluble aluminum

(USEPA, 1988). It is not possible to compare the estimated aluminum concentration to this criterion directly, as the available monitoring data used for modeling are for either dissolved aluminum or total aluminum. Acid soluble aluminum (which is operationally defined as the aluminum that passes through a 0.45 µm membrane filter after the sample has been acidified to a pH between 1.5 and 2.0 with nitric acid) represents the forms of aluminum toxic to aquatic life or that can be converted readily to toxic forms under natural conditions. The acid soluble measurement does not measure forms of aluminum that are included in total aluminum measurement such as aluminum that is occluded in minerals, clays, and or is strongly adsorbed to particulate matter which are not toxic and are not likely to become toxic under natural conditions. The estimated mean total aluminum concentration (626 mg/L) is less than the NAWQC benchmark criterion for acid soluble aluminum, is predicted to decrease in the post-development condition, and is within the range of observed concentrations in Santa Clara River Reach 5.

Table 6
Comparison of Estimated Trace Metal Concentrations in Stormwater from the Specific Plan, VCC, and Entrada Planning Areas and WRP Effluent with Water Quality Criteria and Observed Concentrations in Santa Clara River Reach 5

Metal	Estimated Average Annual Concentration (µg/L)[1]	California Toxics Rule Criteria[2] (µg/L)	Range of Observed[3] Concentrations in Santa Clara River Reach 5 (µg/L)
Dissolved Copper	9.0	32	3.3 - 22.6
Total Lead	5.0	260	0.6 - 40
Dissolved Zinc	41	250	3 - 37
Total Aluminum	626	N/A	131 - 19,650

Notes:
1 Concentrations are for combined effluent with WRP except for Total Aluminum.
2 Hardness = 250 mg/L, based on minimum observed value at USGS Station 11108500. Lead criteria is for total recoverable lead.
3 Range of concentrations observed in the Santa Clara River during wet weather (Stations S29, NR1, and NR3).

Given the predicted increase in trace metals loads and dissolved copper concentration, Project impacts from metals would be significant; however, with the implementation of proposed PDFs, required by Mitigation Measure WQ-1, including the comprehensive site design, source control BMPs, and treatment BMPs and the comparison with the instream water quality monitoring data and benchmark water quality criteria, build-out of the Project and the WRP would not have significant cumulative water quality impacts resulting from trace metals under Significance Criteria 1 through 3.

For the qualitatively assessed pollutants of concern, concentrations of hydrocarbons and methylene blue activated substances (MBAS) are expected to increase in runoff and WRP discharges, while concentrations of pathogens, pesticides, trash and debris, and cyanide may increase under proposed conditions when compared to existing conditions, which could be a significant impact to water quality under Significance Criteria 1 through 3. However, none of the qualitatively assessed constituents are expected to significantly impact receiving waters due to the implementation of PDFs required by Mitigation Measure WQ-1, including a comprehensive site design, source control, and treatment control strategy in compliance with the MS4 permit and SUSMP requirements, as well as compliance with the WRP NPDES Permit effluent limitations. Therefore, cumulative impacts from build-out of the Project and the WRP on hydrocarbons, pathogens, pesticides, trash and debris, MBAS, and cyanide receiving water quality would not be significant under Significance Criteria 1 through 3.

The Basin Plan groundwater quality objective for nitrate-nitrogen plus nitrite-nitrogen is 10 mg/L (which is more stringent than the objective for nitrate-nitrogen alone (10 mg/L) and for nitrite-nitrogen alone (1 mg/L)). The estimated nitrate-nitrogen plus nitrite-nitrogen concentration in runoff after treatment from the total Project area and the WRP is 1.4 mg/L, which is well below the groundwater quality objective.

Irrigation water for the Specific Plan, VCC, and Entrada projects is anticipated to be recycled water. As the WRP NPDES Permit effluent limitation for nitrate-nitrogen plus nitrite-nitrogen is 5 mg/L (average monthly), the WRP irrigation water supply that would serve the proposed Project would be well below the groundwater quality objective of 10 mg/L.

Therefore, through the implementation of the proposed PDFs described in **Section 4.4** of the Draft EIS/EIR and Mitigation Measure WQ-1, the build-out of the Specific Plan, VCC, and Entrada projects in combination with the WRP would not result in significant long-term indirect groundwater quality cumulative impacts under Significance Criterion 4.

Please also see revised **Section 4.4**, Water Quality, of the Final EIS/EIR.

References:

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

USEPA, 1988. Ambient Water Quality Criteria for Aluminum – 1988. EPA 440/5-86-008. August 1988.

EPA, 2007. Advanced Wastewater Treatment to Achieve Low Concentration of Phosphorus. USEPA Region 10, April 2007.

Response 48

The comment states that the WRP should not be excluded from the Project discharges on the basis of its already permitted status. The Newhall Ranch WRP impact assessment is provided on page 4.4-107 of **Section 4.4** of the Draft EIS/EIR. Discharges from the Newhall WRP, Saugus WRP, and Valencia WRP were included in the Draft EIS/EIR's analysis of cumulative impacts. See **Response 47**, above.

This comment also indicates that the proposed Project would be occupied by roughly 77,000 residents. Please note that Draft EIS/EIR **Subsection 4.19.6.2.2** of the Socioeconomics and Economics section indicates that it is estimated that approximately 57,903 people would occupy the Newhall Ranch Specific Plan portion of the Project site after it is built out. Using a unit occupancy rate similar to that of the Specific Plan project site, approximately 4,778 people would occupy the 1,725 residential units proposed for the Entrada planning area. No residential units would be provided in the VCC portion of the Project site. Therefore, approximately 62,681 people could reside on the Project site after it is built out.

Response 49

The comment states that the discharges from wet and dry weather must be calculated for compliance with regulatory standards as required by CEQA and NEPA. As discussed in **Response 24**, above, Project stormwater runoff is unlikely to affect pollutant concentrations in the Santa Clara River based on the comparison of predicted runoff concentrations to observed Santa Clara River water quality and the size of the Specific Plan area in comparison to the watershed area. Since the proposed Project area comprises a small percent of the Santa Clara River watershed area and impervious area upstream of the Los Angeles County/Ventura County line and 1.4 percent of the total Santa Clara River watershed, the runoff from the Specific Plan area would not significantly change the concentration or load of these pollutants in the Santa Clara River.

As discussed in **Response 11**, above, no dry weather urban runoff would be discharged to the Santa Clara River from the Specific Plan area.

Discharges to the Santa Clara River that may occur during the five month period of November through March in average rainfall years from the Newhall Ranch WRP treatment facility must comply with the individual NPDES Permit and Waste Discharge Requirements for the Newhall Ranch WRP (Order No. R4-2007-0046) which contains effluent limits that are protective of water quality objectives and beneficial uses in the receiving water. In addition, discharge periods would coincide with peak wet months when dilution capacity is maximal (*i.e.*, instream flows are highest). Newhall WRP effluent would represent less than one percent of the average November through March instream flowrate at USGS station 11109000 (Newhall Bridge, approximately 2.5 miles downstream of the County line), based on measured average daily flow data for water years 1977-2006.

Thus, potential impacts from the combination of urban wet weather discharges and Newhall WRP discharges on water quality would not be significant under Significance Criteria 1 through 3.

Response 50

The comment states that discharges from the WRP would not mix with Santa Clara River water when dilution capacity is greatest due to infrequency of storms and short durations of high flow in the river, leading to undiluted discharges. The Newhall WRP must comply with its NPDES Permit, which contains effluent limitations that are protective of water quality and beneficial uses in the Santa Clara River. Therefore, based on required compliance with state and federal water quality requirements, as discussed and analyzed in the project-level analysis contained in the Newhall Ranch Specific Plan Program EIR and the information in the Draft EIS/EIR, and the implementation of previously adopted mitigation measures related to the development, operation and maintenance of the Newhall Ranch WRP (Mitigation Measures SP-5.0-52 through 5.0-56), potential impacts from the Newhall Ranch WRP on water quality would not be significant under Significance Criteria 1 through 3.

Response 51

The comment states that chloride inputs from the State Water Project in recycled water from the WRP may cause recycled water to be unfit for reuse, causing more discharge of pollutants into the Santa Clara River. The Newhall WRP would include partial reverse osmosis treatment process to remove chloride to levels that allow for its use for irrigation supply water and to meet the chloride effluent limitation in the NPDES Permit.

Comments 52 through 53 are under the heading: *"The DEIR/DEIS Fails to Adequately Evaluate the Concentrations and Loading of Bacteria that will be Discharged from the Project's Urban Runoff and its Significant Effect on Water Quality"*

Response 52

The comment states that a comparison to existing conditions has no relevance as to whether urban runoff during wet and dry weather events causes or contributes to an exceedance of water quality standards or otherwise exceeds the thresholds of significance under CEQA and NEPA to qualify as a significant environmental effect. The comment additionally states that the Draft EIS/EIR must provide numerical projections as to the Project's total coliform and e.coli concentrations with and without PDFs to adequately evaluate the Project's effect on water quality.

The Draft EIS/EIR analyzes whether sizeable additional sources of polluted runoff may result from the Project based on the results of water quality modeling and qualitative assessments that take into account water quality controls or BMPs that are considered Project Design Features (PDFs). Any increases in pollutant concentrations or loads in runoff resulting from the development of the Specific Plan area are considered an indication of a potentially significant adverse water quality impact. If loads and concentrations resulting from development are predicted to stay the same or to be reduced when compared with existing conditions, it is concluded that the project would not cause a significant adverse impact to the ambient water quality of the receiving waters for that pollutant.

If pollutant loads or concentrations are expected to increase, then for both the post-development and construction phases, potential impacts are assessed by evaluating compliance of the project, including PDFs, with applicable regulatory requirements of the MS4 Permit, including SUSMP requirements, the Construction General Permit, and the General Dewatering Permit. Further, post-development increases in pollutant loads and concentrations are evaluated by comparing the magnitude of the increase to relevant benchmarks, including receiving water TMDLs and receiving water quality objectives and criteria from the Basin Plan and CTR. Comparison of post-development water quality concentrations in the runoff discharge with benchmark numeric and narrative receiving water quality criteria as provided in the Basin Plan and the CTR facilitates analysis of the potential for runoff to result in exceedances of receiving water quality standards, adversely affect beneficial uses, or otherwise degrade receiving waters. Water quality criteria are considered benchmarks for comparison purposes only, as such criteria apply within receiving waters as opposed to applying directly to runoff discharges.

Post-development stormwater runoff water quality impacts associated with pathogen indicators were addressed based on literature information and professional judgment because available data were not deemed sufficient for modeling. Human pathogens are usually not directly measured in stormwater monitoring programs because of the difficulty and expense involved; rather, indicator bacteria such as fecal coliform or certain strains of E. Coli are measured. Unfortunately, these indicators are not very reliable measures of the presence of pathogens in stormwater, in part because stormwater tends to mobilize pollutants from many sources, some of which contain non-pathogenic bacteria. For this reason, and because holding times for bacterial samples are necessarily short, most stormwater programs do not collect flow-weighted composite samples that potentially could produce more reliable statistical estimates of concentrations. Fecal coliform or E. Coli are typically measured with grab samples, making it difficult to develop reliable Event Mean Concentrations (EMCs).

To clarify the intent of the Pathogens discussion, and in response to a comment received from the Los Angeles Regional Board, the Pathogens discussion (pages 4.4-96 though 4.4-98) has been revised in the Final EIS/EIR, revised **Section 4.4**, Water Quality, pages 4.4-101 to 4.4-102, as follows:

> "In summary, stormwater discharges from the proposed Project could potentially exceed the REC-1 Basin Plan standard for FIB [fecal indicator bacteria] and, therefore, impacts from FIB may be significant prior to mitigation, or the incorporation of FIB source and treatment controls as PDFs. However, the FIB concentrations in runoff from the Project would be reduced through the implementation of source and treatment control PDFs, which are incorporated as components of the proposed Project. The proposed Project build-out will incorporate a number of source controls specific to managing FIB, including education of pet owners, education regarding feeding (and, therefore, attracting) of waterfowl near waterbodies, and providing products and disposal containers that encourage and facilitate cleaning up after pets. The proposed Project will not include septic systems and the sewer system will be designed to current standards, which minimizes the potential for leaks. The proposed Project development, consistent with the MS4 permit requirements, includes a comprehensive set of source and treatment control PDFs, including treatment BMPs (*i.e.*, extended detention basins, bioretention, and media filtration), selected to manage pollutants of concern, including pathogen indicators. With these PDFs, proposed Project build-out would not result in substantial changes in pathogen levels, would not cause a violation of waste discharge requirements, would not create runoff that would provide substantial additional sources of bacteria, or otherwise substantially degrade water quality in the receiving waters. Water quality impacts related to pathogens would be reduced to less than significant under Significance Criteria 1 through 3 with the implementation of proposed treatment BMPs and Mitigation Measure SP-4.2-7 (subsequent tract map development projects must comply with applicable County requirements, such as NPDES, Urban Storm Water Mitigation Plan, and a Storm Water Pollution Prevention Plan) and Mitigation Measure WQ-1 (subsequent tract map development projects must implement best management practices and project design features identified in a Standard Urban Stormwater Mitigation Plan)."

Response 53

The comment states that the project's PDFs do not utilize LID standards with a 3 percent Effective Impervious Area (EIA), resulting in discharge of 141 more acre feet of water per year and fecal concentrations ranging from a most probable number (MPN) of 4,500 to 7,700 /100 ml.

Over the past decade, the USEPA, the SWRCB, and the Regional Boards have begun promoting and requiring the preferential use of LID strategies to protect and improve water quality from new development and redevelopment projects. LID may be defined as site design Best Management Practices (BMPs) that strive to more closely mimic natural hydrology so as to reduce pollutant loads in post-development discharges and reduce hydromodification impacts. LID begins with functional conservation of watershed resources, reducing impacts of development, and then using innovative management practices to meet stormwater objectives; it is not the use of the management practices alone (SWRCB, 2007). Site preservation practices coupled with BMPs that rely on the environmental services of vegetation and soils or systems that mimic these services comprise the LID approach.

As listed in Draft EIS/EIR **Table 4.4-13**, Newhall Land Low Impact/Site Design BMPs, and described on pages 4.4-73 through 4.4-75, the proposed PDFs for Project build-out include LID techniques. In addition, the treatment control BMPs listed on pages 4.4-76 and 4.4-77 include many LID BMPs, such as bioretention areas, vegetated swales, and filter strips. As described on page 4.4-104 of the Draft EIS/EIR, the bioretention areas, vegetated swales, filter strips, and extended detention basins that would be used for stormwater treatment would incorporate vegetation to promote pollutant removal and runoff volume reduction through infiltration and evapotranspiration. Subregional extended detention basins would also incorporate infiltration trenches and dry wells to promote infiltration of treated flows where natural soil infiltration rates do not support infiltration. Collectively, these vegetated treatment facilities, in combination with the LID techniques, are expected to provide significant reduction in wet weather runoff volume and to eliminate dry weather flows.

The LID BMPs that would be incorporated into the Project build-out were not modeled as it is unknown at this time where they may be located within the specific project areas. Detention basins have been modeled as the water quality treatment PDF for the majority of the Project, as this PDF represents a conservative assumption for the level of infiltration and treatment that would be provided. An analysis of the monitored inflow and outflow data contained in the International Stormwater BMP Database showed a volume reduction on the order of 38 percent for biofilters and 30 percent for extended detention basins. Based on this analysis, a conservative estimate of 25 percent of the inflow to the vegetated swales and 20 percent of the inflow to extended detention basins was assumed to infiltrate and/or evapotranspire in the water quality model. The low impact/site design BMPs would provide for greater volume and pollutant load reduction than the modeled treatment control PDFs. In this respect, the modeling results are conservative, i.e., tend to overestimate the post-development runoff volume.

References

The following reference was used or relied upon, is available for public review upon request to the Corps or CDFG, and is incorporated by reference:

SWRCB, 2007. *A Review of Low Impact Development Policies: Removing Institutional Barriers To Adoption.* Commissioned and sponsored by the California State Water Resources Control Board Stormwater Program and The Water Board Academy. December 2007.

Comments 54 through 56 are under the heading: *"The DEIS/DEIR Must Compare the Project's Forecasted Concentrations of Pollutants with PDFs to the Chronic Toxicity Water Quality Standards in the CTR to Assess Whether the Project Will Have a Significant Effect on the Environment"*

Response 54

The comment suggests that the analysis of the Project's impacts on water quality is flawed. The comment recommends comparing loads and concentrations resulting from development to "natural non developed conditions" rather than existing land uses and suggests that any comparison to existing land uses should assume that such uses comply with all applicable water quality regulations.

CEQA requires an EIR to analyze the significant effects on the environment of the proposed project. (Pub. Resources Code, § 21100.) The "environment" is the "physical conditions *which exist within the area* which will be affected by a proposed project . . ." (Pub. Resources Code, § 21060.5 [italics added].) "In assessing the impact of a proposed project on the environment, the lead agency should normally limit its examination to changes in the existing physical conditions in the affected area as they exist at the time the notice of preparation is published, . . ." (Cal. Code Regs., tit. 14, § 15126.2, subd. (a).) The existing physical condition is the environmental setting, which constitutes the baseline by which the lead agency determines whether an impact is significant. (Cal. Code Regs., tit. 14, § 15125.) The Specific Plan area currently consists of primarily agricultural land uses (farming and grazing), oil and gas operations, and undeveloped property. Project areas designated with the existing land use "Mineral Extraction- Oil and Gas" were divided into open space land use (85 percent) and light industrial land use (15 percent) to better define the origin of stormwater runoff and pollutants. High country areas would not be developed and would continue to discharge to the Santa Clara River; therefore, these areas and the Santa Clara River Corridor were not included in the water quality modeling. The modeled project area was 7,003 acres or roughly 58 percent of the total Specific Plan area. Table 3 provides the existing condition land uses and areas for Specific Plan area as well as the land use category for water quality modeling, percent impervious value, and runoff coefficient used for the land uses. The modeled land uses were based on the most representative land use within the available data sets (see Appendix B of Draft EIS/EIR **Appendix 4.4** for further detail).

Table 3
Modeled Existing Conditions

Land Use	Area (acres)	Land Use Category for Modeling	% Impervious[1]	Runoff Equation Type
Open Space	3,825.8	Open	1	Undeveloped
Oil and Gas Extraction	1309.6	Light Industrial/ Open Space[2]	10	Undeveloped[3]
Agriculture – Dry	1,016.3	Agriculture	2	Developed
Agriculture - Irrigated	810.9	Agriculture	2	Developed
SR-126	40.4	Transportation	100	Developed
High Country	4234.3	Not Modeled		
River Corridor	761.9	Not Modeled		
Total Modeled	7,003.0			
Total	11,999.2			

1 Percent impervious values are based on the LA County Hydrology Manual.

2 Areas zoned Oil and Gas Extraction were assumed to be 85% vacant land use with 1% imperviousness and 15% light industrial land use with 60% imperviousness, equivalent to 10% composite imperviousness.

3 Areas zoned Oil and Gas Extraction were modeled using the undeveloped runoff coefficient since the oil and gas pads (modeled as light industrial) are well distributed and are a small portion (15%) of the total land use area. Overall, it was assumed that the total land use area is best represented by the undeveloped runoff coefficient.

The analysis of water quality impacts provided by the Draft EIS/EIR complied with the requirements of NEPA and CEQA by comparing post-Project conditions to existing water quality conditions and applicable regulatory standards and environmental thresholds. NEPA and CEQA do not require that a project's impacts be compared to "natural non-developed" conditions or to assume that existing land uses that may be contributing to existing water quality conditions are in compliance with applicable regulatory requirements.

Response 55

The comment states that a comparison to agricultural properties that are not complying with water quality standards and/ or Santa Clara River TMDL is inadequate for determining significant effects of the project because existing conditions are illegal under state and federal regulations. The agricultural land uses in the Specific Plan area are in compliance with the Agricultural Waiver Program, which is the applicable water quality regulation for agricultural lands in California. Agricultural lands are exempt from the provisions of the federal Clean Water Act. Please also refer to **Response 54**, above.

Response 56

The comment states that the EIS/EIR methodology should read "if the loads or concentrations resulting from the development are predicted to stay the same or be reduced when compared to existing conditions in compliance with all applicable state and federal laws, it is concluded that the proposed Project or alternatives would not cause a significant adverse impact to the ambient water quality of the receiving waters for the pollutant." Additionally, the comment states that significant impacts should be reevaluated using said methodology.

As stated in **Response 54**, above, the methodology suggested by this comment is not required by NEPA or CEQA. Existing conditions on the Project site include a mix of agricultural land uses (farming and grazing), oil and gas operations, and undeveloped property, all of which are in compliance with applicable water quality regulations. The suggested revision is not necessary and will not be included in the Final EIS/EIR.

Comments 57 through 63 are under the heading: *"The DEIS/DEIR Must Compare the Project's Forecasted Concentrations of Pollutants with PDFs to the Chronic Toxicity Water Quality Standards in the CTR to Assess Whether the Project Will Have a Significant Effect on the Environment"*

Response 57

The comment correctly states that the EIS/EIR uses acute criteria, rather than chronic criteria, as benchmarks in assessing project runoff, and only freshwater criteria for acute toxicity are used as benchmarks. See **Responses 24** and **25**, above, for further discussion of this issue.

Response 58

The comment states that during and after storm events, Project discharges will pass over the Dry Gap and end up or settle for four days or longer in Ventura County coastal waters, the Santa Clara River estuary, and in pools adjacent to the main channel of the Santa Clara River. As discussed in **Response 8**, above, stormwater discharges from the Project area that pass over the Dry Gap during high flows would comprise a very small portion of the total flow in the River and would have a less-than-significant impact on the Santa Clara River watershed downstream of the Dry Gap. Please see **Response 8**, above, for further discussion of this issue.

Response 59

The comment reiterates the commentor's statements that the aquatic life in the Santa Clara River Estuary and Ventura coastal waters are endangered and are protected under the federal Endangered Species Act (ESA). This includes species such as the southern California steelhead, unarmored threespine stickleback, the arroyo toad, and the California red-legged frog. As described above in **Response 9**, above, only the southern steelhead is known to occur in the Santa Clara River downstream of the Project area and the Dry Gap. The arroyo toad and California red-legged frog are known from Piru Creek, a tributary to the Santa Clara River, but not from the River itself. The unarmored threespine stickleback is only known from the upper Santa Clara River, with Newhall Ranch as its downstream geographic limit. Please note that **Section 4.5**, Biological Resources, provides an evaluation of the Project's impacts to these species, including potential water quality-related impacts. Specifically, the Draft EIS/EIR determined that impacts of the proposed Project or Alternatives would not result in significant impacts to southern steelhead as this species is not expected to occur in the Project area. In addition, the Draft EIS/EIR determined that with the implementation of mitigation, the construction of the proposed Project would not result in significant impacts to water flows, velocities, depth, sedimentation, or floodplain and channel conditions within the Santa Clara River downstream of the Project area. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 60

The comment states that discharges from the Project may also pass the Dry Gap during dry weather and settle in the Santa Clara River Estuary and pools for more than four days or longer than four days. As discussed in **Responses 11** and **24**, above, no dry weather urban runoff would be discharged to the Santa Clara River from the Project area. Discharges to the Santa Clara River that may occur during the five month period of November through March in average rainfall years from the Newhall Ranch WRP treatment facility must comply with the individual NPDES Permit and Waste Discharge Requirements for the Newhall Ranch WRP (Order No. R4-2007-0046), which contains effluent limits for acute and chronic toxicity per the requirements of the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy or SIP). See **Responses 11** and **24**, above, for further discussion of this issue.

Response 61

The comment states that the Basin Plan has designated Santa Clara River with beneficial uses of WARM and WILD. These beneficial use designations were described starting on page 4.4-13 of the Draft EIS/EIR. Because the comment does not address the adequacy of the document, no additional response is provided. This comment will be included as part of the record and made available to the Corps and CDFG prior to a final decision on the Project.

Response 62

The comment states that the EIS/EIR must evaluate chronic toxicity impacts from Project discharge based on the beneficial use designations stated in **Comment 61**, above. Due to the intermittent nature of stormwater runoff (especially in southern California), the acute criteria are considered to be the CTR criteria applicable to stormwater conditions, not chronic criteria, as the average storm duration in the 38-year Newhall gage rainfall record is 11.3 hours. The comment additionally states that the Project discharges of copper, lead and zinc violate the CTR. As shown in **Section 4.4**, **Table 4.4-35**, the Project discharges of copper, lead, and zinc would not exceed the CTR criteria. The Newhall Ranch WRP would comply with the requirements of Order No. R4-2007-0046, which contains effluent limits for acute and chronic toxicity.

Response 63

The comment states that the EIS/EIR must evaluate acute and chronic effects using saline criteria and set forth adequate mitigation measures. The Project does not involve discharges to which acute or chronic saline criteria would be applicable. For further discussion of applicability of saline criteria to Project discharge refer to **Response 25**, above.

Comments 64 through 65 are under the heading: *"The DEIS's/DEIR's Projections of the Project's Discharge of Pollutants without PDFs are Inaccurate Representations of Concentrations of Pollutants Commonly Found in Urban Runoff, and thus the DEIS/DEIR's assessment of impacts on water quality are inaccurate and must be revised."*

Response 64

The comment states that EIS/EIR projections for the concentration and loading of pollutants from the Project developed without PDFs is flawed because County violations of water quality standards at mass emission stations were in excess of all predicted concentrations in Project runoff. The comment includes Table F.1: Violations of Water Quality Standards Reported in the 2006-2007 Storm Water Monitoring Reports.

Table F.1 is a misrepresentation of the Los Angeles County mass emissions station data. To only include violations in a data set greatly skews data and cannot be considered characteristic. A list of water quality violations measured at mass emissions stations does not provide a statistical representation of water quality at those stations. Additionally, the comment is comparing violations of water quality standards reported from instream data at a point in the Santa Clara River watershed with a vastly different combination of urban and non-urban land uses with the predicted average annual stormwater runoff concentrations predicted from the Project's land uses. Therefore, the comparisons provided by this comment are not appropriate and do not accurately reflect the potential impacts of the proposed Project.

The water quality model used to predict pre- and post-development runoff pollutant loads and concentrations is an empirical, volume-based pollutant loads model. The model uses Los Angeles County EMC data for land use-based runoff concentrations, in addition to rainfall and runoff analysis based on 32 years of record from the National Climatic Data Center (NCDC) Newhall rain gauge, and soils data from Los Angeles County. The Los Angeles County EMC database is an extensive and comprehensive database containing monitoring data from land use specific drainage areas, and is also representative of the semiarid conditions in southern California and specifically the Project location (Los Angeles County). For detailed information on the model, see Appendix B of the Newhall Ranch Specific Plan Sub-Regional Stormwater Mitigation Plan (**Appendix 4.4** of the Draft EIS/EIR).

Response 65

The comment states that the EIS/EIR projections for concentration of pollutants from the Project developed without PDFs is flawed because nationwide mean concentrations of pollutants from the Center for Watershed Protection are higher than Project predictions for metals and San Diego mean concentrations are higher than Project predictions for most pollutants.

The pollutant concentrations that are projected by the water quality model are not flawed. Please refer to **Response 64**, above, for a discussion of the water quality model used for the quantitative assessment. The comment also includes a comparison of the projected pollutant concentrations to other stormwater monitoring datasets, which the comment states do not match with the Project predicted concentrations. A comparison of datasets is provided below.

The comment compares the predicted model concentrations with two different datasets, a national dataset and one from San Diego. The comment mentions the pollutants which the commentor perceives to be at odds with Project's model predictions, but the comment does not mention any of the similarities between the model results and the highlighted datasets. This exclusion of a portion of the dataset unfairly misrepresents the relationship between the datasets and the Project predictions.

To address the national dataset first, it must first be said that the national urban runoff stormwater data from the Center for Watershed Protection's database averages thousands of events for each constituent, undoubtedly from very different watershed conditions, land uses, climatic conditions, and geographic locations across the nation. It is generally not recommended to compare predictions from a specific location to such a broad scale database. Despite this caveat, predictions for pollutant concentrations in runoff from the Project without PDFs match fairly closely with EMCs in Table F.5. Nutrients and TSS concentrations from the national database are equal to or less than predictions from Project without PDFs. Though copper and zinc concentrations are higher in the national database than the predictions from the Project, this can generally be attributed to the conversion from total metals to dissolved metals. The metals are presumably represented as total portions in Table F.5., whereas copper and zinc are expressed as dissolved portions in model predictions for the Project. The ratio between the national database total metals concentrations and the Project predicted dissolved metals concentrations are within the range of total dissolved metals concentrations for observed concentrations in the Santa Clara River.

Thus, the only anomaly between the national database and the available model predictions is total lead. This is most likely due to the fact that in much of the country, lead was prevalent in both paint and gasoline, contributing to surface and groundwater pollution. Lead based paints were banned in 1978 and lead additives in gasoline were phased out beginning in 1973 through 1996. Since much of the Santa Clara River watershed was agricultural or undeveloped and has only recently been more developed, lead concentrations would not be expected to be as high as the national average. In conclusion, the predicted concentrations from the Project without PDFs are not severely underestimated based on the national database as the comments suggest.

Regarding the regional dataset, it is unclear how a dataset from San Diego could be construed as being more representative of untreated urban stormwater discharges in the Project area than data collected in Los Angeles County and Ventura County. Stormwater monitoring data collected by the Los Angeles Department of Public Works (DPW) was used to derive estimates of pollutant concentrations in runoff from urban land uses. Stormwater monitoring data collected by Ventura County was used to estimate stormwater pollutant concentrations for agricultural land use.

Recent and regional land-use based stormwater quality monitoring data was collected through the Los Angeles County Stormwater Monitoring Program. This program was initiated with the goal of providing technical data and information to support effective watershed stormwater quality management programs in Los Angeles County. Specific objectives of this Project included monitoring and assessing pollutant concentrations from specific land uses and watershed areas. In order to achieve this objective, the County undertook an extensive stormwater sampling project that included eight land use stations and five mass emission stations (located at the mouths of major streams and rivers), which were tested for 82 water quality constituents. These data are presented in Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report, 2000 and Los Angeles County 2000-2001 Stormwater Monitoring Report, 2001. The monitored land uses stations are listed in Table 4 with a brief description of the site and when the monitoring data were collected.

Table 4
LA County Land Use Monitoring Stations Available for Water Quality Modeling

Station Name	#	Modeled Land Use	Site Description	Years Monitoring Conducted
Santa Monica Pier	S08	Commercial	The monitoring site is located near intersection of Appian Way and Moss Avenue in Santa Monica. The storm drain discharges below the Santa Monica Pier. Drainage area is approximately 81 acres. The Santa Monica Mall and Third St. Promenade dominate the watershed with remaining land uses consisting of office buildings, small shops, restaurants, hotels and high-density apartments.	1995-1999
Sawpit Creek	S11	Open Space (& Parks)	Located in Los Angeles River watershed in City of Monrovia. The monitoring station is Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location. Drainage area is approximately 3300 acres.	1995-2001
Project 620	S18	Single Family Residential	Located in the Los Angeles River watershed in the City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Avenue. Land use is predominantly high-density, single-family residential. Drainage area is approximately 120 acres.	1995-2001
Project 1202	S24	Light Industrial	Located in the Dominguez Channel/Los Angeles Harbor Watershed in the City of Carson. The monitoring station is near the intersection of Wilmington Avenue and 220th Street. The overall watershed land use is predominantly industrial.	1995-2001

Table 4
LA County Land Use Monitoring Stations Available for Water Quality Modeling

Station Name	#	Modeled Land Use	Site Description	Years Monitoring Conducted
Dominguez Channel	S23	Freeway (Roadways)	Located within the Dominguez Channel/Los Angeles Harbor watershed in Lennox, near LAX. The monitoring station is near the intersection of 116th Street and Isis Avenue. Land use is predominantly transportation and includes areas of LAX and Interstate 105.	1995-2001
Project 474	S25	Education (Schools)	Located in Los Angeles River watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Avenue, one block south of Nordoff Street. The station monitors runoff from the California State University of Northridge. Drainage area is approximately 262 acres.	1997-2001
Project 404	S26	Multi-Family Residential	Located in Los Angeles River watershed in City of Arcadia. The monitoring station is located along Duarte Road, between Holly Ave and La Cadena Ave. Drainage area is approximately 214 acres.	1997-2001

As part of its NPDES permit, the Ventura County Watershed Protection District conducts monitoring to determine the water quality of stormwater runoff from areas with specific land uses. One monitoring station, Wood Road at Revolon Slough (site A-1), drains the approximately 350-acre Oxnard Plain, which is comprised almost entirely of agricultural land (primarily row crops), including a small number of farm residences and ancillary farm facilities for equipment maintenance and storage. Data from the Wood Road station was used to estimate pollutant concentrations in stormwater runoff for agricultural land use.

Land use runoff sampling for the Ventura County stormwater monitoring program originally began during the 1992/93 monitoring season, with up to several samples collected at each site during each storm season. For the A-1 site, the period of record begins during the 1996/97 storm season, and continues through the 2003/04 season. All land use monitoring sites are equipped with automated monitoring equipment, including flow meters (with area-velocity probes and level sensors) and refrigerated auto-samplers which enable the collection of flow-weighted composite samples.

The County of Los Angeles Department of Public Works (DPW) has monitored stormwater runoff quality from various land uses throughout the County on an annual basis beginning in 1995 through 2001. For each year of monitoring several storm event mean concentrations (EMCs) are reported and included in the County's annual water quality report to the Los Angeles RWQCB. The convention for dealing with the censored data (*e.g.*, data only known to be below the analytical detection limit) is to substitute ½ of the detection limit for all non-detects. Los Angeles County has followed this convention when providing summary arithmetic statistics of the stormwater monitoring data. This method tends to introduce bias into the estimate of the mean and standard deviation and the summary statistics are not believed to be robust or adequately account for non-detects. To further complicate matters, the detection limit for dissolved copper and total lead has changed during the period stormwater monitoring was conducted by DPW.

In an effort to provide more reliable and accurate estimates of land use EMCs for the Specific Plan water quality modeling, a robust method of estimating descriptive statistics for censored data with multiple detection limits was employed. The plotting position method described in Helsel and Cohn (1988) was used to estimate censored values using the distribution of uncensored values. Descriptive statistics were then estimated using the parametric bootstrap method suggested by Singh, Singh, and Engelhardt (1997). Table 5 summarizes the resulting arithmetic means. These data represent the land use specific pollutant EMCs used in the water quality model.

Table 5
Arithmetic Means from Lognormal Statistics for Modeling Pollutant Concentrations

Land Use	TSS	TP	NH3	NO3	NO2	TKN	Diss Cu	Tot Pb	Diss Zn	Cl
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L
Commercial	63.5	0.364	0.913	0.505	0.115	2.81	11.5	9.55	152	44.5
Education	92.1	0.289	0.295	0.575	0.088	1.61	11.4	3.23	70.9	24.0
Light Industrial	151	0.265	0.345	0.563	0.071	2.19	10.4	7.34	268	9.38
Transportation	72.4	0.478	0.338	0.666	0.086	1.75	30.8	8.17	205	5.80
Multi-Family Residential	35.4	0.218	0.442	1.29	0.098	1.65	6.92	3.66	67.7	15.6
Single Family Residential	110	0.381	0.457	0.665	0.083	2.75	8.81	9.57	19.7	4.97
Agriculture (Ventura County)	998	3.00	1.81	13.8	0.120	7.54	19.7	27.3	37.0	49.6
Vacant / Open Space	159	0.083	0.064	1.12	0.021	0.860	0.237	1.06	8.61	6.62
Golf Course	104	0.494	0.357	0.672	0.021	2.88	0.237	1.06	8.61	6.62

Response 66

The comment states that the EIS/EIR failed to analyze pollutants commonly found in stormwater, including total cadmium, total antimony, total cyanide, total silver, sulfate, total boron, pH and chromium.

Pollutants of concern, as defined in the Los Angeles County SUSMP Manual, consist of any pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna. The pollutants of concern for the water quality analysis are those that are anticipated or potentially could be generated by the Project at concentrations, based on water quality data collected in Los Angeles County from land uses that are the same as those included in the Newhall Ranch Specific Plan (Specific Plan), that exhibit these characteristics. Identification of the pollutants of concern also considered Basin Plan beneficial uses and water quality objectives, CTR criteria, and current 303(d) listings and TMDLs in the Santa Clara River, as well as pollutants that have the potential to cause toxicity or bioaccumulate in the receiving waters. **Table 4.4-11** of the Draft EIS/EIR lists the pollutants of concern, the basis for their selection, and the significance criteria applied to each.

Copper, lead, and zinc are the most prevalent metals typically found in urban runoff. Other trace metals, such as cadmium, chromium, antimony, and silver are typically either not detected in urban runoff or are detected at very low levels (DPW, 2000).

Cyanide is qualitatively analyzed in the EIS/EIR on p 4.4-103.

Mineral quality in natural waters is largely determined by the mineral assemblage of soils and rocks near the land surface. Elevated mineral concentrations could impact beneficial uses; however, the minerals listed in the Basin Plan Table 3-8, except chloride and nitrogen, are not believed to be constituents of concern due to the absence of river impairments and/or, as with TDS, anticipated post-development runoff concentrations well below the Basin Plan objectives (Table 6). Therefore, these constituents are not considered pollutants of concern for the Project.

Table 6
Comparison of Mineral Basin Plan Objectives with Mean Measured Values in LA County

Mineral	Los Angeles Basin Plan Water Quality Objective for SCR Reach 5 (mg/L)	Range of Mean Concentration in Urban Runoff[1] (mg/L)
Total Dissolved Solids	1000	53 - 226
Sulfate	400	7 - 35
Boron	1.5	0.16 – 0.25
Sodium Absorption Ratio[2]	10	0.4 – 1.9

[1] Land uses include SFR, MFR, commercial, education, transportation, light industrial, and mixed residential.
[2] Sodium adsorption ratio (SAR) predicts the degree to which irrigation water tends to enter into cation-exchange reactions in soil.
Source: DPW, 2000.

The hydrogen ion activity of water (pH) is measured on a logarithmic scale, ranging from 0 to 14. While the pH of "pure" water at 25 ºC is 7.0, the pH of natural waters is usually slightly basic due to the solubility of carbon dioxide from the atmosphere. Aquatic organisms can be highly sensitive to pH. The Basin Plan objective for pH is:

> "the pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge."

Mean runoff concentrations in the Los Angeles County stormwater monitoring data ranged from 6.5 for mixed- and single-family residential land uses to 7.0 for commercial land use. Therefore, pH in the Santa Clara River is not expected to be affected by runoff discharges from the Project.

In conclusion, the Draft EIS/EIR identified and analyzed the pollutants of concern that are anticipated or potentially could be generated by the project at concentrations, based on water quality data collected in Los Angeles County from land uses that are the same as those included in the Project, that could potentially impact receiving waters.

Response 67

The comment states that the EIS/EIR must revise the projection of the Project's discharge without PDFs to accurately forecast the concentrations of pollutants that would be discharged into the Santa Clara River.

The predicted concentrations match with the datasets presented by the comment which can be reasonably compared with Project predictions. See **Responses 64**, **65**, and **66**, above. In addition, the predicted post-development without PDFs values are not used for the impact assessment, it is the predicted post-development with PDFs values that are used. The water quality model calculates the amount of stormwater runoff that is captured by the treatment BMPs for each storm event, taking into consideration the intensity of rainfall, duration of the storm, and duration between storm events. The mean effluent water quality for treatment BMPs was based on the International Stormwater BMP Database (ASCE/EPA, 2003). The International Stormwater BMP Database was used because it is a robust, peer reviewed database that contains a wide range of BMP effectiveness studies that are reflective of diverse land uses.

Comments 68 through 72 are under the heading: *"The DEIR/DEIS cannot be approved under CEQA and NEPA because of its discharge has not been assigned Waste Load Allocations (WLA) and Compliance Schedule under a Regional Board TMDL for pollutants listed on the Clean Water Act (CWA) 303(d) list, which precludes the Regional Board from Granting the Project a Clean Water Act Section 401 Water Quality Certification."*

Response 68

The comment states that the RWQCB cannot grant a Water Quality Certification under section 401 of the Clean Water Act (CWA) to a new source or new discharger if runoff or direct discharge from the new discharge adds any pollutant to discharges from the MS4 or adds any pollutant directly to a waterbody that will cause or contribute to the violation of water quality standards for a 303(d) listed waterbody.

The comment states that the only exception to this rule is when a TMDL has been finalized and approved by USEPA.

The RWQCB has issued an NPDES permit (waste discharge requirements) for the Project's WRP ("WRP NPDES Permit"). *See* Order R4-2007-0046 (NPDES Permit No. CA0064556). The WRP NPDES Permit contains effluent limits and provisions to ensure that discharges would not cause or contribute to exceedance of water quality standards, and ensuring compliance with the Antidegradation Policy. Provisions addressing consistency with the Chloride TMDL are included in the permit.

Construction-related discharges to waters of the United States would be covered by the General Permit issued by the SWRCB, recently amended on September 2, 2009 ("Construction Stormwater NPDES General Permit"). (SWRCB Order No. 2009-0009-DWQ.) The Construction Stormwater NPDES General Permit already includes provisions protecting against discharges causing or contributing to violations of water quality standards, protection of water quality in sediment-impaired water bodies listed on the 303(d) list, compliance with any sediment-related TMDLs, and satisfaction of the Antidegradation Policy.

Stormwater discharges from municipal separate storm sewers (MS4s) would be covered by the MS4 Permit already issued by the RWQCB to the County of Los Angeles and incorporated cities in the County (Los Angeles County MS4 Permit), as it may be amended from time to time. See Order No. 01-182, NPDES Permit No. CAS004001, as amended by Order R4-2006-0074 and by Order R4-2007-0042. The Los Angeles County MS4 Permit contains requirements addressing protection of receiving waters from violations of water quality standards, specific requirements for new development, and findings demonstrating compliance with the Antidegradation Policy.

There is no evidence that the Project would constitute a significant degradation to waters of the United States. In any event, the federal Antidegradation Policy of 40 C.F.R. § 131.12, and the state's Antidegradation Policy which incorporates the federal policy, SWRCB Res. No. 68-16, addresses degradation of high-quality waters, where quality meets or exceeds (is better than) water quality standards. The Antidegradation Policy does not apply to the conditions of impairment cited in the comment letter. Further, the Antidegradation Policy does not prohibit permits from allowing reduction of water quality, but expressly allows such reductions where necessary to accommodate important economic or social development in the area in which the waters are located, provided that waste discharge requirements would result in the best practicable treatment or control necessary to avoid pollution or nuisance and maintain the highest quality consistent with the maximum benefit to people of the state.

There is no reason to assume that the permits issued by the RWQCB would allow discharges to cause or contribute to violation of water quality standards. The WRP and construction discharges would be subject to NPDES permit provisions prohibiting such violations. The MS4 Stormwater Permit and Project design would minimize discharges of pollutants from municipal runoff, and the MS4 Permit restricts violations of the water quality standards. See Finding 18; Part 2 (Receiving Water Limitations); Part 4(D) Development Planning Program (p. 40-48) § 2.

The footnotes (on the bottom of page 27) cite the *Friends of Pinto Creek* case as not allowing any new discharges to water bodies listed as impaired for pollutants likely to be found in their discharges, due to restrictions found in 40 C.F.R. § 122.4, subd. (i). In its Response to Significant Comments relating to the adoption of the Construction Stormwater General Permit, the SWRCB explained why that permit adequately addresses this issue for discharges from construction projects, responding to this allegation, as follows:

> [Comment 23:] Pursuant to *Friends of Pinto Creek v. EPA*, 504 F.3d 1007 (9th Cir. 2007), the permit cannot authorize any new discharges to water bodies listed as impaired by any pollutant likely to be found in stormwater discharges associated with construction or land disturbing activities.
>
> [SWB Response:] *Friends of Pinto Creek* does not apply to this permit because the permit already prohibits stormwater discharges and authorized non-storm water discharges from causing or contributing to an exceedance of any applicable water quality objectives or water quality standards. Moreover, the permit does not allow any amount of sediment in excess of the predevelopment discharges of sediment to be discharged into receiving waters.

See SWRCB Response to Significant Comments, p. 21. Similar comments have been made to RWQCB issuances of MS4 general permits, and have been rejected in each case because the permits adequately address MS4 discharges carrying pollutants from new development, while the non-industrial, non-construction sources discharging into the systems are not required to be issued permits at all, making 40 C.F.R. § 122.4, subd. (i) irrelevant to them. For example, the RWQCB rejected the argument in the following response to Natural Resources Defense Council (NRDC) in the Ventura MS4 Permit Proceeding, Response to Comments (RWQCB April 2009):

> "The various construction projects and restraints thereon in the construction and MS4 permits are not regulated directly as NPDES facilities under CWA section 402 subds. (a) and (b), but rather, under subparts (p)(2)(E) and (p)(3) because they may contribute pollutants to stormwater that is discharged from a point source to waters of the United States - not because they are themselves point source discharges of pollutants to waters of the United States. As such, the *Friends of Pinto Creek* case is not on point. NPDES permits are not required for all specific new sources of pollutants, and the MS4 permit is not issued for those that require specific permitting."

In sum, where NPDES permits are required for runoff and WRP discharges, they already do, and would continue to comply with 40 C.F.R. §122.4, subd. (i). To the extent that NPDES permits are not required, as for placement of fill regulated under section 404, or for specific residential or commercial discharges into MS4 systems, 40 C.F.R. § 122.4, subd. (i) simply does not apply.

Response 69

The comment states that the RWQCB is prohibited from approving a permit or Water Quality Certification that allows new discharges of any pollutant to waterbodies impaired by that pollutant unless there is an existing TMDL for that pollutant. See **Response 68**, above.

Response 70

The comment lists impairments of waterbodies in the Santa Clara River Watershed for which TMDLs with waste load allocations (WLAs) and compliance schedules have not yet been completed (see correct list in Table 7 below). Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

The Los Angeles Region 2008 Integrated Report and updated 303(d) list was approved by the Los Angeles RWQCB in July, 2009. The Integrated Report, including the updated 303(d) list, would be submitted to the SWRCB for approval along with the other Region's reports. The full State Integrated Report would then be submitted to the USEPA for approval and would then be final. The Santa Clara River impairments in the draft 2008 303(d) list are summarized in Table 7 below.

Table 7
Proposed 2008 CWA Section 303(d) List of Water Quality Limited Segments -- Santa Clara River

SCR Reach	Geographic Description	Pollutants	TMDL Status/Proposed or USEPA Approved TMDL Completion Date	Potential Sources
5	Blue Cut Gaging Station to West Pier Hwy 99	1) Coliform Bacteria 2) Chloride 3) Iron	1) Requires TMDL/2019 2) Approved TMDL/2005 3) Requires TMDL/2021	1) Nonpoint and Point Sources 2) Nonpoint and Point Sources 3) Source Unknown
3	Freeman diversion dam to "A" street	1) Total Dissolved Solids 2) Ammonia 3) Chloride 4) Toxicity	1) Requires TMDL/2023 2) Approved TMDL/2004 3) Approved TMDL/2005 4) Requires TMDL/2021	1) Nonpoint and Point Sources 2) Source Unknown 3) Nonpoint and Point Sources 4) Source Unknown
1	Estuary to Highway 101 Bridge	1) Toxicity	1) Requires TMDL/2019	1) Source Unknown
--	Estuary	1) ChemA[1] 2) Coliform Bacteria 3) Toxaphene 4) Nitrate 5) Toxicity	1) Requires TMDL/2019 2) Requires TMDL/2019 3) Requires TMDL/2019 4) Requires TMDL/2021 5) Requires TMDL/2021	1) Source Unknown 2) Nonpoint Source 3) Nonpoint Source 4) Source Unknown 5) Source Unknown

[1] ChemA suite of chlorinated legacy pesticides include: Aldrin, chlordane, Dieldrin, Endosulfan I/II, Endrin, gamma-BHC, heptachlor, heptachlor epoxide, and Toxaphene.

Response 71 and 72

The comment states that the Project would discharge into an existing MS4 or into the Santa Clara River or one of its tributaries, and additionally that the Draft EIS/EIR and comment letter demonstrate that the Project would cause or contribute to impairments for a number of pollutants, the RWQCB is prohibited from approving a permit or Water Quality Certification for the Project to discharge into an MS4 or into the Santa Clara River, and the EIS/EIR cannot be approved under CEQA/NEPA.

Section 4.4 of the Draft EIS/EIR and responses to this comment letter show that the Project discharges would not cause or contribute to an impairment in the Project's receiving waters and that the proposed Project and alternatives would not result in any significant water quality impacts. Specifically, please see Response 68.

Comments 73 through 86 are under the heading: ***"The Standard Urban Stormwater Mitigation Plan (SUSMP) requirement used in the DEIS/DEIR is inadequate to mitigate the Project's impacts on water quality and aquatic resources to a less than significant level. Instead, substantial evidence indicates that the Project must utilize Low Impact Development (LID) Standards as required by the Ventura County MS4 Permit for all new developments to mitigate the Project's impacts on quality to a less than significant effect."***

Response 73

The comment states that the SUSMP requirement used in the EIS/EIR is inadequate to mitigate the Project's impacts on water quality and aquatic resources to a less-than-significant level. Instead, the comment states that LID standards as required by the Ventura County MS4 Permit are required to mitigate the Project's impacts on quality to a less-than-significant effect.

Over the past decade, the USEPA, SWRCB, and the RWQCBs have begun promoting and requiring the preferential use of LID strategies to protect and improve water quality from new development and redevelopment projects. LID may be defined as site design BMPs that strive to more closely mimic natural hydrology so as to reduce pollutant loads in post-development discharges and reduce hydromodification impacts. LID begins with functional conservation of watershed resources, reducing impacts of development, and then using innovative management practices to meet stormwater objectives; it is not the use of the management practices alone (SWRCB, 2007). Site preservation practices coupled with BMPs that rely on the environmental services of vegetation and soils or systems that mimic these services comprise the LID approach.

As listed in Draft EIS/EIR **Table 4.4-13**, Newhall Land Low Impact/Site Design BMPs, and described on pages 4.4-73 through 4.4-75, the proposed PDFs for Project build-out include LID techniques. In addition, the treatment control BMPs listed on pages 4.4-76 and 4.4-77 include many LID BMPs, such as bioretention areas, vegetated swales, and filter strips. The LID/site design, source control, treatment control, and hydromodification control PDFs included in the Newhall Ranch Specific Plan Sub-Regional Stormwater Mitigation Plan (Draft EIS/EIR **Appendix 4.4**) far exceed the standard Los Angeles County SUSMP requirements. The sub-regional Stormwater Mitigation Plan was developed by Newhall Land, consistent with the Los Angeles County MS4 Permit, to set forth the urban runoff management program that would be implemented for the Newhall Ranch Specific Plan subregion. Stormwater management, including planning for water quality and hydromodification control, is central to assuring the long-term viability of beneficial uses, including important habitat systems and species dependent upon those systems.

Section 4.4 of the Draft EIS/EIR concludes that the proposed Project and alternatives would not result in any significant water quality impacts due to the comprehensive site design/LID, source control, and treatment control strategy.

References

The following reference was used or relied upon, is available for public review upon request to the Corps or CDFG, and is incorporated by reference:

SWRCB, 2007. *A Review of Low Impact Development Policies: Removing Institutional Barriers To Adoption.* Commissioned and sponsored by the California State Water Resources Control Board Stormwater Program and The Water Board Academy. December 2007.

Response 74

The comment states that Ventura County experiences significant water quality problems despite ten years of stormwater permit programs with runoff volume control. Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 75

The comment quotes the Ventura County MS4 Stormwater Permit Tentative Order (Ventura Tentative Order) in its discussion of the impacts of uncontrolled runoff from new development. The comment states that development and urbanization increase pollutant loads and create new pollutant sources, increase volume, velocity and discharge duration of stormwater runoff and results in declines in the biological integrity and physical habitat of streams and receiving waters. Please note that the Draft EIS/EIR also indicates that urban development can increase pollutant loads and result in hydrologic modifications. For example, Draft EIS/EIR **Table 4.4-11**, Surface Water Pollutants of Concern and Water Quality Standards, describes specific sources of pollutants that are likely to result from the development of the proposed Project. **Table 4.4-12**, Standard Urban Stormwater Mitigation Plan Requirements and Corresponding Specific Plan Project Design Features, indicates that urban development can result in increased stormwater runoff discharge rates. Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 76

The comment quotes the Ventura Tentative Order, stating that development and urbanization increase pollutant loads, volume, and discharge velocity by replacing natural pervious ground cover with impervious surfaces and creating new pollutant sources with increased density of human population and associated anthropogenic pollutants. Because the comment does not address the content of the Draft EIS/EIR, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project. Please also refer to **Response 75**, above.

Response 77

The comment states that when there is a 3%-10% conversion of natural surfaces to impervious surfaces in a subwatershed, as allowed under the SUSMP requirements, significant declines in the biological integrity, water quality, and physical habitat of streams and other receiving waters have been found to occur. Note that the Los Angeles County SUSMP requirements do not "allow the conversion of natural surfaces to impervious surfaces" (that is allowed under land use code) but instead require that new development and redevelopment projects collect and infiltrate or treat the runoff from 100 percent of the developed area using treatment control BMPs that address the pollutants of concern. In addition, the studies that have related imperviousness to stream impacts occurred in watersheds that did not include stormwater mitigation facilities, or may have included flood control facilities or minimal treatment control BMPs that were not designed to the standards proposed for the Specific Plan build-out.

There is much discussion about the reliability of imperviousness as a "predictor" of potential impacts from new development. In fact, the effects of imperviousness on stream impacts are much more complicated than a simple correlation with imperviousness. Pursuant to Schueler's *Cautionary Note* (Schuler and Holland, 2000), while the research on impervious cover and stream quality is compelling, it is doubtful whether it can serve as the sole foundation for legally defensible regulatory actions at this time. Key reasons include: (1) the research has not been standardized, so different investigators have used different methods to define and measure/estimate imperviousness; (2) researchers have employed a wide number of techniques to measure stream quality characteristics that are not always comparable to each other; (3) most of the studies have been confined to a few ecoregions, and few studies have been conducted in Southern California; (4) the absolute measure of watershed imperviousness that could cause stream instability depends on many factors, including watershed area, land cover, vegetative cover, topography, and soil type; development impervious area and connectedness; longitudinal slope of the river; channel geometry; and local boundary materials, such as bed and bank material properties and vegetation characteristics; and (5) none of the studies has yet examined the effect of widespread application of stormwater treatment, LID controls and/or hydromodification control practices on impervious cover/stream quality relationships.

That comment also states that, in comparison to the SUSMP BMPs set forth in the Draft EIS/EIR, LID as set forth in the Ventura County MS4 Permit would result in substantial pollutant loading reductions, increased onsite water supply, and less hydromodification and landscape erosion problems. Dr. Richard Horner, in his study on contract with NRDC for Ventura County MS4 permit work, demonstrated in his Ventura County-based study that using basic "treat-and release" BMPs (*e.g.*, drain inlet filters, CDS units), for instance, would result in pollutant loading reductions of between 0 percent and 46 percent, whereas LID techniques would create reductions mostly in the 97 percent to 99 percent range. As listed in Draft EIS/EIR **Table 4.4-13**, Newhall Land Low Impact/Site Design BMPs, and described on pages 4.4-73 through 4.4-75, the proposed PDFs for the Specific Plan build-out include LID techniques. In addition, the treatment control BMPs listed on pages 4.4-76 and 4.4-77 include many LID BMPs, such as bioretention areas, vegetated swales, and filter strips. Basic "treat-and-release" BMPs such as inlet filters and CDS units would only be used as pretreatment devices for the removal of trash, debris, and sediment in concert with the vegetated treatment BMPs that are listed. These BMPs would treat 100 percent of the developed area, significantly reducing the post-developed runoff volumes and pollutant loads from the Specific Plan area and preventing adverse water quality impacts to the receiving waters.

Finally, Project-related impacts related to changes in biological integrity and physical habitat of streams and receiving waters were evaluated extensively in Draft EIR **Section 4.5**, Biological Resources; and **Section 4.6**, Jurisdictional Waters and Streams. Please also see revised **Sections 4.5** and **4.6** of the Final EIS/EIR.

Response 78

The comment states that LID practices, which are designed to capture and retain stormwater runoff on site rather than discharge, attempt to restore natural conditions and, in doing, so can reduce site runoff volume and pollutant loading to zero in many typical rainfall scenarios. Because the comment does not address the content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 79

The comment states that a study by Horner found that in nearly all case studies all storm water discharges could be eliminated under most conditions by dispersing runoff from impervious surfaces to pervious surfaces, and additionally that EIA can practicably be capped at three percent to protect biological habitat and beneficial uses of water bodies in Ventura County.

Currently, there is intense discussion among the regulatory agencies, regulated communities, and environmental groups as to an appropriate metric for ensuring reasonable consideration and implementation of LID by new development and redevelopment projects. Recent MS4 permits in California (*i.e.*, Ventura County, North Orange County, and the Bay Area Municipal Regional Permit) have created an opportunity to further the discussion. Note that the Ventura Permit is the only recently adopted MS4 Permit that uses the EIA metric to measure LID implementation.

Geosyntec evaluated the Horner study "Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County" to assess the assumptions used in the analysis related to runoff volume control and the findings of feasibility related to capping EIA (Geosyntec, 2008 **Appendix F4.4**). Overall, the evaluation found that the findings of the Horner study do not appear to fully support the stated conclusions related to volume reduction and feasibility of meeting a 3 percent EIA standard lower. The study relied upon many simplifications which would support placing limitations on the findings. For example, the study might more reasonably support the conclusion that LID is feasible in new development up to a certain level of density, where pervious area is appropriately located on the development site, native infiltration rates are sufficient, and where statutory limitations on infiltration are not present.

Effective impervious area as a metric for LID BMP implementation has serious limitations; however, the use of EIA as a planning principle may be relevant to overall watershed protection goals. In 2003, the Water Environment Research Foundation (WERF) published a report entitled "Physical Effects of Wet Weather Flows on Aquatic Habitats: Present Knowledge and Research Needs" (Roesner and Bledsoe, 2003). This report emphasized the limitations of current attempts to link stream impacts to gross measures of development such as imperviousness, observing that these measures provide little meaningful information to understand key processes and to create practical strategies for mitigation. The authors contended that conveyance and storage facilities in urban drainage systems exert a strong influence on runoff hydrology, but this fact is not recognized in studies that attempt to relate stream impacts to gross imperviousness only. They stressed that predictive models of reach-scale habitat changes must account for the connectivity and conveyance of the drainage system and relevant stormwater controls. Moreover, more recent research on the effects of development on aquatic habitat indicates that the preferred metrics rely on hydrologic measures that reflect the watershed response to not only changes in imperviousness, but effects of the drainage infrastructure and stream conditions (WERF, 2008).

References

The following references were used or relied upon, are available for public review upon request to the Corps or CDFG, and are incorporated by reference:

Geosyntec, 2008. Review of Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County. Technical Memorandum to Mark Grey, Building Industry Association of Southern California. May 28, 2008.

Roesner, L.A., and Bledsoe, B.P., 2003. Physical Effects of Wet Weather Flows on Aquatic Habitats: Present Knowledge and Research Needs, Water Environment Research Foundation, 00-WSM-4.

Water Environment Research Federation (WERF), 2008. Protocols for Studying Wet Weather Impacts and Urbanization Patterns. Water Environment Research Foundation 03WSM3.

Response 80

The comment states that the Horner study cited in **Comment 79**, above, is supported by a number of other reports, including reports authored by CWP, SCWRP, and USEPA. Please see **Response 70**, above, for further discussion of the Horner study. Because the comment does not address the adequacy or content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 81

The comment states that LID retrofits are a critical need for redevelopment and existing development. Please see **Response 77**, above, for further discussion of LID under the Project. Because the comment does not address the adequacy or content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 82

The comment states that a number of government agencies in California and the United States support LID, including the California Ocean Protection Council, Washington State, and the National Academy of Sciences. Please see **Response 77**, above, for further discussion of LID under the Project. Because the comment does not address the adequacy or content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project. See also **Response 73**, above.

Response 83

The comment states that a number of jurisdictions in addition to Ventura County have implemented on-site retention standards in order to reduce runoff discharges. Because the comment does not address the adequacy or content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 84

The comment states the LID implementation is economically feasible and in one case produced a better return on investment than conventional controls. Please see **Response 77**, above, for further discussion of LID under the Project. Because the comment does not address the adequacy or content of the document, no additional response is provided. This comment will be included as part of the record and made available to decision makers prior to a final decision on the Project.

Response 85

The comment states that applying LID practices with 3 percent EIA is a feasible and practicable approach for maintaining the natural hydrology of the land being developed, when total annual rainfall volume is retained. See **Responses 73** and **79**, above, regarding the Project's use of LID. The proposed Project and alternatives would not result in any significant water quality impacts due to the required comprehensive site design/LID, source control, and treatment control strategy. (Draft EIS/EIR **Section 4.4**.) Therefore, no further mitigation is required. (Cal. Code Regs., tit. 14, § 15126.4, subd. (a).)

Response 86

The comment states that the SUSMP requirement used in the EIS/EIR is inadequate to mitigate the Project's impacts on water quality to a less-than-significant level, and that the Project must utilize LID standards as required by the Ventura County MS4 Permit to mitigate Project impacts to less than significant.

The Los Angeles Municipal Code, chapter 12.84, requires the use of LID standards in development projects. (See Draft EIS/EIR **Section 4.4**, pages 4.4-18 - 4.4-20.) This chapter applies to all development within the unincorporated area of the County after January 1, 2009, except for those developments that filed a complete discretionary or non-discretionary permit application with the Los Angeles County Department of Regional Planning, Public Works, or any County-controlled design control board, prior to January 1, 2009. In addition, the Los Angeles County DPW has developed a LID Standards Manual that outlines stormwater runoff quantity and quality control development principles, technologies, and design standards for achieving the LID standards of Chapter 12.84.

A technical memorandum has been developed and included in the Final EIS/EIR (**Appendix F4.4**) that evaluates the LID performance of the BMPs in the NRSP Sub-Regional SWMP. Page 4.4-104 of the Draft EIS/EIR has been revised in **Section 4.4**, Water Quality, of the Final EIS/EIR, at page 4.4-111, as follows:

> ~~The treatment control PDFs would be sized to infiltrate, evapotranspire, and/or capture and detain the water quality design volume in compliance with the LID Ordinance and~~

> ~~LID Standards Manual, the MS4 permit and the SUSMP requirements.~~The low impact/site design BMPs and treatment control PDFs would be sized to infiltrate, evapotranspire, and/or capture and detain 80 percent of the average annual runoff volume, which is the performance standard established in the Sub-Regional Plan. This performance standard is equivalent to or exceeds the LID goals and volumetric runoff retention requirements of the DPW LID Manual when applied to the Project (Geosyntec, 2010).

The proposed Project and alternatives would not result in any significant water quality impacts due to the required comprehensive site design/LID, source control, and treatment control strategy. (Draft EIS/EIR **Section 4.4**.) Therefore, no further mitigation is required. (Cal. Code Regs., tit. 14, § 15126.4, subd. (a).)

Response 87

The comment states that adequate mitigation measures "above and beyond" basic BMP practices must be implemented to mitigate potential construction-phase impacts. The Project would implement all BMPs that are needed to be protective of the receiving waters during construction. These BMPs include the following, as appropriate:

- Erosion Control
  - Physical stabilization through hydraulic mulch, soil binders, straw mulch, bonded and stabilized fiber matrices, compost blankets, and erosion control blankets (i.e., rolled erosion control products).
  - Limiting the area and duration (<14 days) of exposure of disturbed soils.
  - Soil roughening of graded areas (through track walking, scarifying, sheepsfoot rolling, or imprinting) to slow runoff, enhance infiltration, and reduce erosion.
  - Vegetative stabilization through temporary seeding and mulching to establish interim vegetation.
  - Wind erosion (dust) control through the application of water or other dust palliatives as necessary to prevent and alleviate dust nuisance.
- Sediment Control
  - Perimeter protection to prevent sediment discharges (silt fences, fiber rolls, gravel bag berms, sand bag barriers, and compost socks).
  - Storm drain inlet protection.
  - Sediment capture and drainage control through sediment traps and sediment basins.

- Velocity reduction through check dams, sediment basins, and outlet protection/velocity dissipation devices.
- Reduction in off-site sediment tracking through stabilized construction entrance/exit, construction road stabilization, and entrance /exit tire wash.
- Slope interruption at permit-prescribed intervals (fiber rolls, gravel bag berms, sand bag berms, compost socks, biofilter bags)

- Waste and Materials Management
  - Management of the following types of materials, products, and wastes: solid, liquid, sanitary, concrete, hazardous and equipment-related wastes. Management measures include covered storage and secondary containment for material storage areas, secondary containment for portable toilets, covered dumpsters, dedicated and lined concrete washout/waste areas, proper application of chemicals, and proper disposal of all manners of wastes.
  - Protection of soil, landscaping and construction material stockpiles through covers, the application of water or soil binders, and perimeter control measures.
  - A spill response and prevention program will be incorporated as part of the SWPPP and spill response materials will be available and conspicuously located at all times on-site.
- Non-stormwater Management
  - BMPs or good housekeeping practices to reduce or limit pollutants at their source before they are exposed to stormwater, including such measures as: water conservation practices, vehicle and equipment cleaning and fueling practices, and street sweeping. All such measures will be recorded and maintained as part of the project SWPPP.
- If construction dewatering or discharges from other specific construction activities such as water line testing, and sprinkler system testing are required, comply with the requirements of the Los Angeles Regional Water Quality Control Board's General NPDES Permit and General Waste Discharge Requirements (WDRs) (Order No. R4-2003-0111, NPDES No. CAG994004) governing construction-related dewatering discharges (the "General Dewatering Permit").
- Training and Education
  - Inclusion of General Permit defined "Qualified SWPPP Developers" (QSD) and "Qualified SWPPP Practitioners" (QSP). QSDs and QSPs shall have required certifications and shall attend State Board sponsored training.
  - Training of individuals responsible for SWPPP implementation and permit compliance, including contractors and subcontractors.

    - Signage (bilingual, if appropriate) to address SWPPP-related issues (such as site cleanup policies, BMP protection, washout locations, etc).

- Inspections, Maintenance, Monitoring and Sampling

    - Performing routine site inspections and inspections before, during (for storm events > 0.5 inches), and after storm events.
    - Preparing and implementing Rain Event Action Plans (REAPs) prior to any storm event with 50% probability of producing 0.5 inches of rainfall, including performing required preparatory procedures and site inspections.
    - Implementing maintenance and repairs of BMPs as indicated by routine, storm-event, and REAP inspections.
    - Implementation of the Construction Site Monitoring Plan for non-visible pollutants, if a leak or spill is detected.
    - Sampling of discharge points for turbidity and pH, at minimum, three times per qualifying storm event and recording and retention of results.

The significance criteria for the project construction phase is implementation of BMPs consistent with Best Available Technology Economically Achievable and Best Conventional Pollutant Control Technology (BAT/BCT), as required by the Construction General Permit and the general waste discharge requirements in the Dewatering General WDRs. The Project would reduce or prevent erosion and sediment transport and transport of other potential pollutants from the Project site during the construction phase through implementation of BMPs meeting BAT/BCT in order to prevent or minimize environmental impacts and to ensure that discharges during the Project construction phase would not cause or contribute to any exceedance of water quality standards in the receiving waters. All discharges from qualifying storm events would be sampled for turbidity and pH and results would be compared to Numeric Action Levels (250 NTU and 6.5-8.5, respectively) to ensure that BMPs are functioning as intended. If discharge sample results fall outside of these action levels, a review of causative agents and the existing site BMPs would be undertaken, and maintenance and repair on existing BMPs would be performed and/or additional BMPs would be provided to ensure that future discharges meet these criteria.

These BMPs would assure effective control of not only sediment discharge, but also of pollutants associated with sediments, such as and not limited to nutrients, heavy metals, and certain pesticides, including legacy pesticides. In addition, compliance with BAT/BCT requires that BMPs used to control construction water quality are updated over time as new water quality control technologies are developed and become available for use. Therefore, compliance with the BAT/BCT performance standard ensures mitigation of construction water quality impacts to less than significant throughout the life of the Project.

Response 88

The comment states that to ensure adequate BMP maintenance, the developers should be responsible for maintenance or homeowners associations should be mandated to sign legal contracts requiring them to perform necessary BMP maintenance, monitoring and reporting.

Depending on the type and location of the BMP, either the County, a Landscape Maintenance District (LMD), Geologic Hazard Abatement District (GHAD), Home Owners Association (HOA), or other similar government or quasi-government agency would be responsible for maintenance. LMD(s), GHAD(s), or other similar government or quasi-government agency would be formed prior to turnover of stormwater facilities, prior to the first home sale. Maintenance and inspection agreements would be established as the treatment facilities are approved and built. HOA maintenance agreements would incorporate a list of HOA responsibilities. The LMD(s), GHAD(s), or other similar government or quasi-government agency would have a mechanism and staffing to monitor, maintain, and enforce BMP maintenance. The County would have the right to inspect and maintain the BMPs that are maintained by the HOA, LMD, GHAD, or other similar agency at the expense of the HOA, LMD, GHAD, or other similar agency, if they are not being properly maintained. (Draft EIS/EIR **Section 4.4**, **Table 4.4-12**.)

Response 89

The comment states that LID standards for new development should be analyzed as a project wide environmentally superior alternative that is economically feasible; the comment also states that the EIS/EIR excludes an environmentally superior alternative to the Project as a whole.

CEQA requires the evaluation of a reasonable range of feasible alternatives to the project that would feasibly attain most of the basic objectives of the project and avoid or substantially lessen the significant effects of the project. (Cal. Code Regs., tit. 14, § 15126.6, subd. (a).) CEQA does not require alternatives to individual components of a project, only to the project as a whole. (See *Big Rock Mesas Prop. Owners Ass'n v. Board of Supervisors* (1977) 73 Cal.App.3d 218, 277; see also *No Oil, Inc. v. City of Los Angeles* (1987) 196 Cal.App.3d 223, 235.) Commentor's suggestion to analyze different LID standards for new development in the MS4 permit is an alternative to a component of the project, or a mitigation measure, not an alternative to the project as a whole. The Draft EIS/EIR analyzed a reasonable range of alternatives that reduce or avoid the significant impacts of the proposed Project in compliance with CEQA and NEPA, and the proposed Project already includes the implementation of LID features as described in Draft EIS/EIR **Table 4.4-13**, Newhall Land Low Impact/Site Design BMP's, and as required by proposed Mitigation Measure WQ-1. These requirements would reduce the Project's impact on water quality to less than significant, and no further mitigation is required to reduce this impact. (Cal. Code Regs., tit. 14, § 15126.4.) Therefore, there is no requirement to analyze different LID standards as a Project alternative. Additionally, the EIS/EIR identified an environmentally superior alternative (Alternative 7) in compliance with California Code of Regulations, section 15126.6, subdivision (e)(2). (Draft EIS/EIR, **Subsection 5.10**.)

Response 90

The comment states that the EIS/EIR must use LID measures required by the Ventura County MS4 permit since the Project would discharge runoff into the Santa Clara River east of the county border, thus affecting Ventura County residents and biological resources. The Project is not one of the permitted parties under the Ventura County MS4 NPDES permit, and is located in Los Angeles County. Therefore, the Project is not subject to the Ventura County MS4 Permit and is not required to comply with the new development provisions in that permit. The Project is consistent with the Los Angeles County MS4 NPDES permit. (Draft EIS/EIR, **Section 4.4**.) The Draft EIS/EIR analyzed Project water quality impacts on portions of the Santa Clara River located in Ventura County and concluded that impacts would be less than significant. (Draft EIS/EIR, **Section 4.4.**)

Response 91

The comment states that the Ventura County MS4 requirements for LID must be required under CEQA/NEPA because the Salt Creek and other portions of the project lie in part in Ventura County.

The Project is located in Los Angeles County and is consistent with the Los Angeles County MS4 NPDES permit. The Project is not subject to the Ventura County MS4 Permit and is not required to comply with the new development provisions in that permit. Please see **Response 90** for further discussion of this issue. The Draft EIS/EIR considered the impact of the Project on Salt Creek Canyon and determined that no significant impacts to that drainage area would occur because the Salt Creek watershed has been designated as permanent open space, and no development is proposed within Salt Creek area as part of the Specific Plan. (Draft EIS/EIR, **Subsection 4.4.4.2**.)