

Hydromodification and Hydrologic Controls

Ventura County Co-Permittee Comments

April 18, 2008

Executive Summary

This set of comments focuses on Hydromodification aspects of the 2nd Draft NPDES Permit (No. CAS004002) for Ventura County. The unrecognized issues and unintended consequences of the permit language lead us to recommend new language for the permit.

1. **Unrecognized Issues:**
 - a. Sediment Balance
 - b. Magnitude of Flows in Receiving Waterway
 - c. Exemptions to help streamline permitting process
 - d. Interdependence of Hydrologic Controls
2. **Unintended Consequences -Erosion Downstream**

Our recommendations include revising the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures to include new sections on how to analyze combinations of hydrologic control measures, and to how to design hydrologic controls for Hydromodification.

Specific language changes to the permit are proposed in Attachment C.

1. Unrecognized Issues

1a. Sediment Balance

The 2nd draft permit addresses the issue of Hydromodification of natural stream channels by considering only flow rates and duration. The complimentary and necessary issue of sediment balance is ignored. Regulating the combination of flows and sediment to preserve downstream habitat and channels should be the goal of the Final Hydromodification criteria. **Attachment A** shows how both sediment and flow are related in degrading (cutting) or aggrading (building) downstream channels.

The Draft Permit has defined “sediment” as a pollutant (Part 5 F. I.) and based on this blanket definition tries to ensure its removal from the construction and land development process. The Permit should rephrase the definition with the words that “*sediment may at times contain pollutants*” and recognize that there are many areas in our watersheds where there is high natural sediment yield and the sediment yield is beneficial for a variety of uses.

It is recommended that **Finding 12** be edited to be comprehensive and recognize the current limitations of the supporting science by the changes suggested (in red) below:

The increased volume, increased velocity, and discharge duration of storm water runoff from developed areas has the potential to increase ~~greatly accelerate~~ downstream erosion and impair stream habitat in natural drainages. Likewise, reductions in

sediment transport in the outflow can create “sediment hungry” water that erodes downstream habitat and channels, and can “starve” beaches of sand. It is also recognized that there is natural Hydromodification regardless of development, when channels erode or adjust to changes in climate, vegetation, fire, or land use changes that do not increase impervious surface.

Preliminary studies on 11 watersheds from Southern California (catchments from 1 to 18 square miles) have demonstrated a direct correlation between the degree of imperviousness of an area and the degradation of its receiving waters. 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. Percentage impervious cover is one reliable indicator and predictor of potential water quality degradation expected from new development for watersheds less than 2.5 square miles (1,600 acres). Until further local research is completed, these conclusions are assumed to be appropriate for smaller areas. (Source: Derrick Coleman, et. al. April 2005. Effect of Increases in Peak Flows and Imperviousness on the Morphology of Southern California Streams. Technical Report 450. Southern California Coastal Water Research Projects (SCCWRP)).

1b. Magnitude of Flows in Receiving Waterway

The flood studies in Ventura County by FEMA show that there are some large streams that will not have their geomorphology affected by slight changes in side drainage caused by new development projects. When the 100-year flow of the receiving water is very dominant compared to side drainages, the geomorphology of the receiving water is not significantly affected by side drainage. However, in some smaller Ventura County streams, like Arroyo Simi, even low but clear (effluent) flows have caused Hydromodification effects of erosion downstream. While smaller streams like Arroyo Simi need Hydromodification analysis, larger streams could be exempted. From a review of flow records in Ventura County, streams with larger than 100-year flow of 25,000 cfs are recommended to be exempt from Hydromodification analysis. This threshold would exempt drainage to the County’s major waterways:

- Ventura River downstream of North Fork Matilija Creek
- Santa Clara River downstream of the County line,
- Piru Creek, Sespe Creek, and Santa Paula Creek, downstream of the foothills.
- Calleguas Creek downstream of Conejo Creek.

1c. Exemptions to Help Streamline Permitting Process

The Draft permit shows no exemptions for Hydromodification. To streamline Permittees processing of cases, a list of exemptions to the hydrologic controls is proposed in **Attachment C**. This list may need to be revised after the SMC study is completed for the Final Hydromodification Criteria.

1.d. Interdependence of Hydrologic Controls

The permit should recognize the interdependence of hydrologic controls and a sequencing of analysis to take this into account - beginning with what can be done with LID measures, then check for water quality mitigation and finally Hydromodification for any remaining runoff. See

recommended flow chart in **Figure 1**. The Ventura County Technical Guidance Manual and Section 5.E.III.1 should be modified to add this recognition and flow chart for hydrologic controls to the permit. Suggested language is in Attachment C.

2. Unintended Consequence: Increased Erosion Downstream

An unintended consequence of the Interim Hydromodification criteria in the 2nd Draft Permit can be an increase in downstream erosion of habitat and stream channels because of ignoring the cumulative influence of LID and Treatment BMP's on sediment transport. The permit only addresses water shear forces and does not consider the sediment balance issue.

LID and Treatment BMPs in the 2nd Draft Permit dictate that post-project peak outflow from a project area be equal to or less than existing peak outflow, by allowing some storage, infiltration, consumption, or treatment. This has the effect of settling sediments so that sediment outflow with a project that has LID and/or Treatment BMPs is less than the pre-project sediment outflow. This clearer "sediment hungry" discharge created by the LID or BMPs erodes downstream habitat, stream channels, and "starves" beaches of sand. Taking this to the extreme shows the extent of the unintended consequence: to obtain the natural sediment load downstream of a LID site or Treatment BMP, sediment would have to be collected at the project site, transported downstream, and then re-injected to the stream.

For correcting past urbanization effects, watershed based studies should be encouraged to study and design channel and habitat stabilization features. This can be a recommendation to the Ventura Watershed Councils and appears to be outside the scope of the NPDES Permit.

Recommendation:

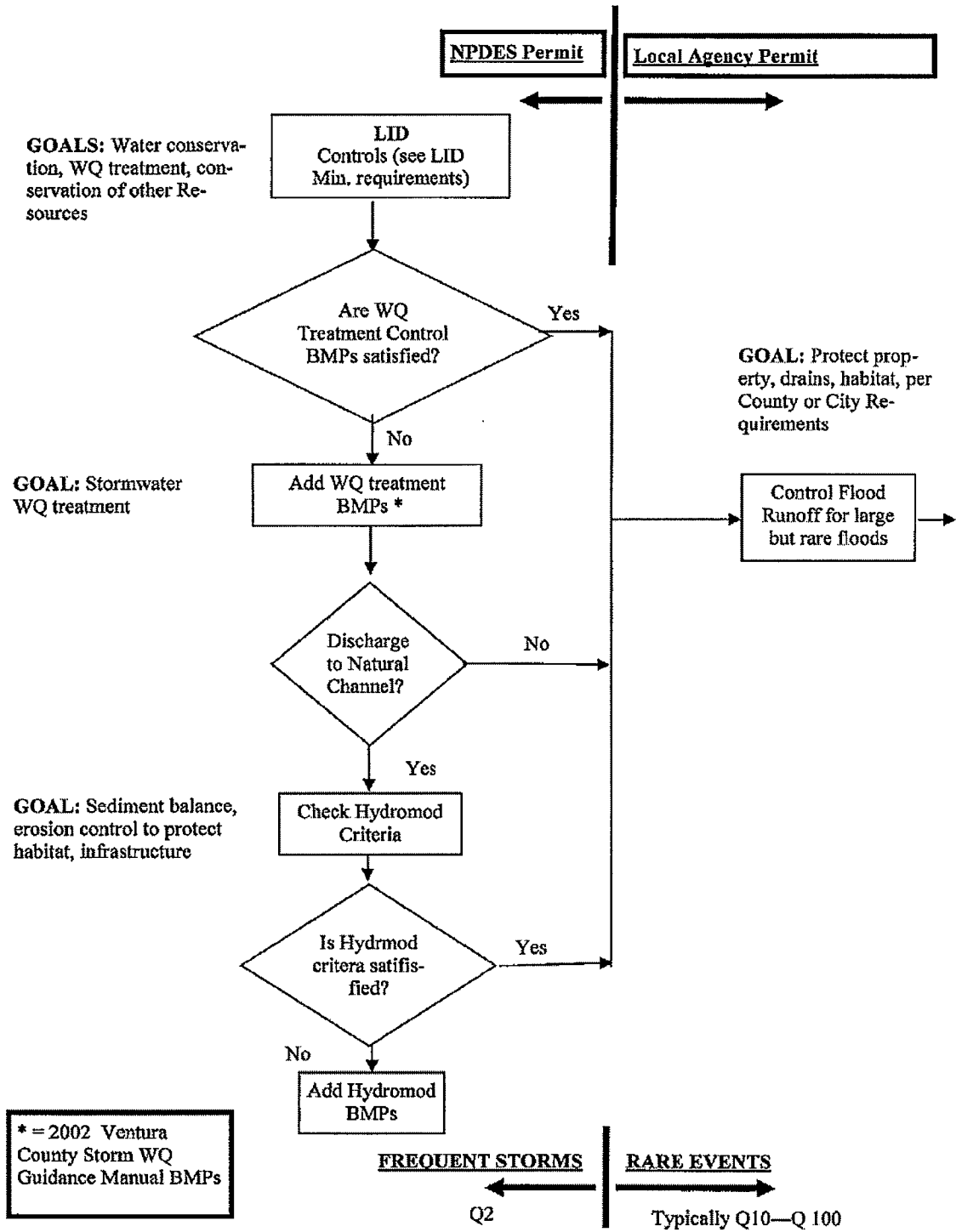
The sediment balance issue needs to be addressed in the MS4 permit in a way that compliments the LID and the Treatment BMPs. LID and Treatment BMPs are part of the permit on their own merits and are recommended for multiple reasons.

When LID and/or Treatment BMP's are used, then a sediment balance study must be included when evaluating erosion potential, not the Hydromodification criteria in the 2nd Draft Permit. For the Interim, and because of the complexity of this analysis, we recommend only developments greater than 50 acres would require the sediment balance analysis until the SCCWRP studies are completed and design tools are developed. This is similar to the recent San Diego MS4 Permit (**See Attachment B**).

We request updating the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures, and revising Section 5.E.III.1 to include new sections on how to analyze combinations of hydrologic control measures and to address the sediment balance.

Figure 1:

Ventura County HYDROLOGIC CONTROLS



Attachment A:

Relationship of Sediment and Flow

Increasing Flow or Decreasing Sediment Load Cause Degradation of Channel

Four Variables that affect the channel erosion or aggradation:

Water Flow = Q_w

Bed material sediment load = Q_s

Sediment size = D_{50}

Slope = S

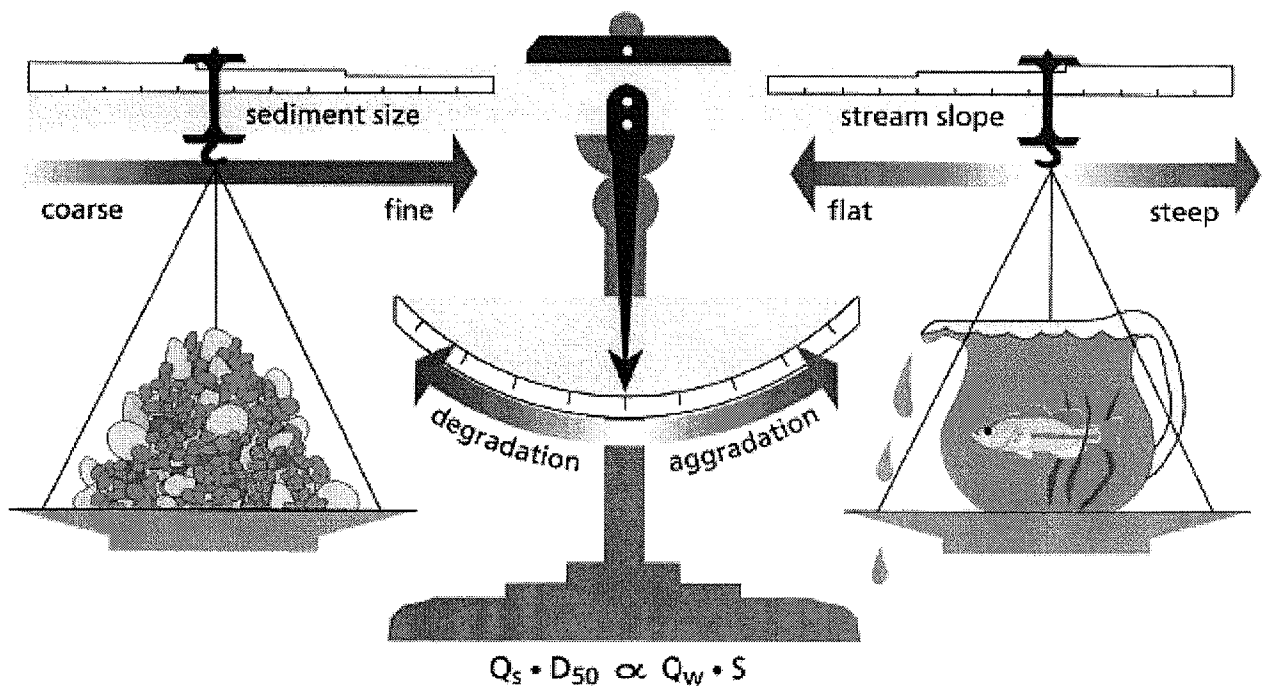


Figure 1.13: Factors affecting channel degradation and aggradation. The "size" of the channel is determined by the stream's energy, the slope, and the flow of water in balance with the size and quantity of the sediment particles the stream moves.

Source: Rosgen (1996), from Lane, *Proceedings*, 1955. Published with the permission of American Society of Civil Engineers.

Source: Stream Corridor Restoration, USDA, Part 653 of the National Engineering Handbook 1998

Attachment B:

Interim Hydromodification Criteria from San Diego Permit

Order No. R9-2007-0001

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January 24, 2007

(6) Interim Hydromodification Criteria for Projects Disturbing 50 Acres or More

Within 365 days of adoption of this Order, the Copermittees shall collectively identify an interim range of runoff flow rates for which Priority Development Project post-project runoff flow rates and durations shall not exceed pre-project runoff flow rates and durations (Interim Hydromodification Criteria), where the increased discharge flow rates and durations will result in increased potential for erosion or other significant adverse impacts to beneficial uses, attributable to changes in flow rates and durations. Development of the Interim Hydromodification Criteria shall include identification of methods to be used by Priority Development Projects to exhibit compliance with the criteria, including continuous simulation of the entire rainfall record. Starting 365 days after adoption of this Order and until the final Hydromodification Management Plan standard and criteria are implemented, each Copermittee shall require Priority Development Projects disturbing 50 acres or more to implement hydrologic controls to manage post-project runoff flow rates and durations as required by the Interim Hydromodification Criteria. Development Projects disturbing 50 acres or more are exempt from this requirement when:

- (a) The project would discharge into channels that are concrete-lined or significantly hardened (e.g., with rip-rap, sackcrete, etc.) downstream to their outfall in bays or the ocean;
- (b) The project would discharge into underground storm drains discharging directly to bays or the ocean; or
- (c) The project would discharge to a channel where the watershed areas below the project's discharge points are highly impervious (e.g. >70%).

Attachment C:

Recommended Changes to 2nd Draft Permit Hydromodification Criteria

Proposed Preamble to Hydromodification Criteria

Suggested language to insert under Section 5.E.III.3 on page 52 of 115.

Coordination with LID and Water Quality Mitigation: All requirements for LID (Section 5.E.III.2) and Water Quality Mitigation BMPs (Section 5.E.III.4) need to be designed prior to analysis for Hydromodification, and their impacts accounted for in the design of any Hydromodification controls required.

Hydromodification Control Exemptions. Permittees may exempt the following New Development and Redevelopment projects from implementation of Hydromodification controls where assessments of downstream channel conditions and proposed discharge hydrology indicate that adverse Hydromodification effects to present and future beneficial uses of Natural Drainage Systems are unlikely:

- A. All projects that disturb less than one acre.
- B. Projects that are replacement, maintenance or repair of a Permittee's existing flood control facility, storm drain, or transportation network.
- C. Redevelopment Projects in the Urban Core that do not increase the effective impervious area or decrease the infiltration capacity of pervious areas compared to the pre-project conditions.
- D. Projects that have any increased discharge go directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q100) of 25,000 cfs or more, or other receiving water that is not susceptible to Hydromodification impacts;
- E. Projects that discharge directly or via a storm drain into concrete or improved (not natural) channels (e.g., rip rap, sackcrete, etc.), which, in turn, discharge into receiving water that is not susceptible to Hydromodification impacts (as in D above).

Proposed Changes to Section 5.E.III.3.(a).(2). on Pg 54 of 115

(A) The Interim Hydromodification Control Criteria to protect natural drainage systems until Permittees complete Hydromodification Control Plans (HCPs) are as follows:

(i) Projects disturbing land areas of less than 50 acres will be subject to LID and/or source or treatment BMPs as addressed in this permit. The combined effects of LID and the treatment BMPs are

considered adequate for Hydromodification control for projects that disturb less than 50 acres.

(ii) Projects disturbing land areas of fifty acres or greater

shall develop and implement a Hydromodification Analysis Study (HAS) that demonstrates that post development conditions are expected to approximate the pre-development erosive effect of sediment transporting flows in receiving waters. The HAS must lead to the incorporation into the project design features intended to approximate, to the extent feasible, an Erosion Potential value of 1 or any alternative value that can be shown to be reasonably protective of the natural drainage systems from erosion, incision, and sedimentation that can occur as a result of flow increases from impervious surfaces and damage stream habitat in natural drainage systems, or

(I) Alternatively, project proponents in this category may elect to develop, in partnership with Permittees, an equivalent implementation method based on flow duration control and sediment balance in the form of nomographs relating planned impervious area and local soil type (infiltration rates) to determine Hydromodification control BMP volume and land area requirements for the proposed project. The nomographs shall be derived from continuous simulation modeling¹ using Ventura County specific rain gauge records and soil types, and calibrated using data from a local undeveloped watershed with similar conditions or

(II) Alternatively, the Co-Permittees may revise the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures to address projects that disturb more than 50 acres.

¹ The Permittees may use an alternative method to the continuous simulation modeling pending prior approval by the Executive Officer.