STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

STAFF SUMMARY REPORT
MEETING DATE: MAY 18, 2005

ITEM: 9

SUBJECT: **Watershed Changes and Stormwater Consequences - Status Report on Stormwater Permit Implementation** [Larry Kolb 622-2372~~,~~ lkolb@waterboards.ca.gov]

DISCUSSION: This Board has been actively involved in stormwater quality for over 15 years. In that time we have come to realize that problems with stormwater quality are inseparably linked to rainfall and its fate. When rain falls, it can end up three possible places:

- Some runs off, sometimes carrying harmful pollutants directly from the land surface to storm drains, creeks, and the Bay,
- Some falls on vegetation or the root zone of soil, from which it is subject to evaporation and transpiration to the atmosphere (called evapo-transpiration, or ET), and
- Some sinks more deeply into the soil and becomes part of the groundwater supply, from which it can also supply creeks and riparian vegetation.

In a natural, undeveloped watershed, the amount of runoff can be as low as 1 percent of total rainfall, and is usually in the 10 to 20 percent range. The rest of the rainfall infiltrates into the soil. The lowest runoff percentage is from forested land.

Almost all human activities tend to decrease the amount of rainfall that is absorbed into the ground, and therefore increase the amount of rainfall that runs off. Grazing compacts soils to reduce wet season infiltration; cultivated land becomes compacted below the root zone due to use of farm equipment; and conversion to urban uses creates impervious surfaces, such as roads and roofs, where almost all rainfall quickly runs off. These typically amount to 50 to 90 percent of the total urban surface area.

The result is always the same: with more intense human use, less of rainfall remains on or percolates into the land, and more runs off. Conversion of natural land to urban use typically increases the amount of rainfall that ends up as runoff by factors of two to tenfold. Creek channels that have evolved over time for the undeveloped flow regime cannot handle the dramatically higher flows brought on by urbanization, and we almost always see damage or destruction of natural channels as a result. This higher volume of runoff also results in other costs, such as increases in downstream flooding, threats to property from creek bank erosion, and increases in flood control sediment removal costs, also from increases in creek bank erosion due to the higher flows.

These problems of channel destruction and flooding, both brought about by higher creek flows due to less infiltration, tend, sooner or later to result in public pressures to “do something.” In traditional civil engineering, this has meant building a new channel with concrete sides and bottom, or more commonly, the construction of a concrete box culvert where the channel is put underground, with total loss of natural values. These projects are constructed, maintained, and ultimately rebuilt as needed with public money.

The decrease in rainfall infiltration as the landscape is developed also means that less water replenishes the groundwater supply, so that new development increases water demand while decreasing water supply. Finally, this greater amount of rainfall that runs off means a greater volume of stormwater to treat, and a greater amount of pollutants to impact the aquatic environment.

The problems cited above are not beyond control. They can be greatly mitigated by designing new development or redevelopment with features like vegetated swales that promote infiltration of rainfall on site. Infiltration can also be greatly increased by means of regional solutions such as retention basins, where stormwater runoff can be infiltrated into the soil, or at least temporarily stored to mitigate for the construction of new impervious surface. This solution is similar to the regional detention basins that have historically been used to mitigate flooding impacts. However, one major advantage of designs that infiltrate stormwater is that pollutant removal is very high. Soils are very efficient at removing pollutants through physical, chemical, and biological processes.

The Board's current generation of stormwater permits refers to this problem of ever-increasing stormwater flows as <u>hydromodification</u>, and requires permittees to develop Hydromodification Management Plans, or HMPs. Essentially, these plans are intended to maintain existing runoff patterns by implementing a combination of the kinds of measures just mentioned into new and redevelopment projects. At this point, we have received the final HMP proposal from the Santa Clara stormwater program, and staff will be bringing this for Board review on the June agenda. We have also received draft versions of HMPs from the Contra Costa, San Mateo, and Alameda programs.

The key issue for all these plans is how to maintain or reduce the creek erosion caused by changes in runoff. The plans all incorporate a menu of measures such as reducing impervious surfaces (e.g., by narrowing streets and increasing density), implementing many smaller infiltration measures distributed throughout a project—or a few larger regional facilities—and, appropriately restoring creeks prior to a project, to accept increased flows.

Common challenges that are faced include specifying easy-to-use design criteria for the smaller infiltration measures and regional basins, identifying how soil types and groundwater levels might limit the implementation of some measures, and defining what sort of creek work may be acceptable, as compared to work that would, overall, impact a creek's habitat and beneficial uses. The Santa Clara and Alameda programs are adapting an existing model used in Washington State so that project proponents can easily see what goal their controls must meet. The Contra Costa program is clearly defining how controls must be designed, so that implementation will meet a common standard without use of such a model. For example, it will specify orifice sizes and soil types for a variety of controls, such that the controls would be expected to meet the goal of maintaining the site's runoff hydrograph.

Overall, the HMPs represent the next key step in addressing hydromodification impacts. Implementation will provide the next set of challenges, including ensuring that the proposed measures are being appropriately designed and constructed, and are meeting their goal of limiting creek erosion.

RECOM-
MENDATION: This is a status report, and no action is required at this time.