Attachment 2
Non-Action Informational Water Quality Issues
March 2005

At the December Board meeting, we listed the following items as bigger picture water quality topics:

- Riparian Buffer Zones
- Low impact development
- Innovative storm water management
- Fire management
- Endangered Species management
- Salts management in critical Basins
- Residual pesticides
- Newly emerging pesticides
- Endocrine disruptors
- Pharmaceuticals and other emerging chemicals impacting water quality
- Innovative monitoring tools
- Sub-lethal toxic effects
- Biocriteria
- Bioengineering
- CCAMP monitoring results
- Local research findings

The Board directed staff to pursue the first three topics (Riparian Corridors, Low Impact Development, and Storm Water) as action items, and to come back to the Board quarterly with updates on progress and objectives. Today's staff report provides that information. The Board also asked us to provide a couple paragraphs on the remaining topics to explain what they are. Two of the above topics ("Endocrine disruptors," and "Pharmaceuticals and other emerging chemicals impacting water quality") are discussed below in the section titled, "xenobiotics." We will provide some brief information on the remaining topics in later reports to the Board.

Xenobiotics

Xenophobia is the fear of anything that is strange or foreign. A xenobiotic is a compound that is foreign to a living organism. So, in fact, this is a broadly encompassing term that in practice is typically applied to trace organic compounds including endocrine disruptors, pharmaceutically active compounds, and even personal care products. Most of these products are unregulated and have only recently begun to be measured in the environment. Is it realistic to be concerned about these poorly understood chemicals in the relatively un-urbanized Central Coast region? What tools do we have to detect these chemicals?

In the arid west, water managers are encouraged to reuse wastewater wherever possible. However, wastewater can contain trace levels of any number of chemicals used as medicines, personal care products, or other purposes. Some streams in the Central Valley have shown levels of steroid hormones rivaling wastewater (http://www.estuarynewsletter.com/2004_10/cover.php). As laboratory methods improve, we are now able to detect some of these chemicals at relatively low levels. However, most tests are very specialized, especially those for pharmaceuticals, and have not been incorporated into commercial or regulatory laboratories. Maximum Contaminant

Levels (MCLs) have not been set for most of these chemicals; only 85 chemicals are regulated by drinking water standards. Development of standards for any single chemical is a lengthy and expensive process, complicated by availability of adequate analytical methods, complex interactions and synergies with other chemicals, and economic considerations. MCL development is driven reactively by data showing occurrence in drinking water sources, population exposure estimates and associated cost-benefits analysis.

Understanding risks associated with xenobiotics is limited in great part by the availability of adequate laboratory tests and regulatory guidelines for protection of human health. Perhaps even less is known about the impacts of these various chemicals in the environment. Researchers have hypothesized that the feminization of alligators and fish is related to exposure to effluent dominated waterways. Some chronic toxicity tests evaluate test specimens for reproductive abnormalities, growth abnomalities, and other low level effects. Though these tests can help discern where problems exist, understanding the source of the problem can be complex and expensive. The San Francisco Estuary Institute recently released a study focused on identifying unknown chemical peaks on gas chromatographs from existing samples taken from the estuary, and dating back for several decades:
(http://www.sfei.org/rmp/reports/unidentified_contaminants/unidentifiedcont.pdf).

One of the peaks identified was PBDE, discussed in more detail below. A number of pharmaceuticals, personal care products, and other xenobiotics were also identified. USGS recently monitored for a suite of 95 "nontraditional" chemicals in streams throughout the nation, particularly in systems dominated by wastewater:
(http://pubs.acs.org/hotartcl/est/es011055j_rev.html).

Again, this study showed widespread presence of a number of organic chemicals. One or more wastewater contaminants were found in 80% of the 139 streams sampled. Three groups (detergent metabolites, plasticizers, and steroids) contributed almost 80% of total concentrations measured in the study.

Some chemicals that are considered xenobiotics have received a great deal of attention recently, and are coming into the "mainstream", in terms of monitoring and regulation. Perchlorate is an example. This chemical interferes with iodine uptake in the thyroid and can be considered an endocrine disruptor. Because of detection in important groundwater supplies (including the southern Santa Clara Valley), this chemical has received significant publicity, and is being addressed as a high priority cleanup issue in the Region.

For years, traditional testing programs have focused on organochlorine pesticides and PCBs; these chemicals tend to bioaccumulate and still cause environmental and health damage. Analytical methods for these chemicals are commonly available. PBDEs, or polybrominated diphenyl ethers, are related to PCBs and dioxin in chemical structure and also bioaccumulate in tissue, but have not been typically included in the standard suite of organochlorine chemicals measured by laboratories. These chemicals have fire retardant properties, and are used in products such as mattresses, cushions, and other padding, as well as in hard plastics. This chemical group has gained increasing attention in California following the release of several Bay Area studies. In 2003, the nonprofit Environmental Working group announced findings showing that women's breast milk in the San Francisco Bay Area contained levels of PBDE that exceeded any in Europe or Japan by three to ten-fold. PBDE was found in every woman tested. PBDEs can impair brain function (particularly in infants), cause memory and learning impairment, alter thyroid hormones, decrease sperm count and possibly cause cancer. Levels of PBDEs in striped bass in the Delta have tripled since 1997, and have doubled in California halibut. In a study by

the Department of Toxic Substances Control, harbor seals in the Bay Area were found to have some of the highest levels of this chemical seen anywhere in the world, with levels increasing by nearly 100-fold in the last two decades (and doubling every 1.8 years between 1989 and 1998).

Phthalates are another class of chemicals of increasing public concern and visibility. Phthalates are used as "plasticizers", or chemicals that soften polyvinyl chloride products. They are also commonly found in cosmetics, pesticides, medical devices, and other products. A study by the U.S. Center for Disease Control in 2000 (http://ehp.niehs.nih.gov/docs/2000/108p972-982blount/abstract.html) found phthalate compounds in humans at levels that were higher and more widespread than originally expected. Levels were particularly high in women between the ages of 20 and 40, possibly related to use of personal products such as hairspray, perfume, deodorant, and nail polish. These chemicals are endocrine disruptors and are also potentially carcinogenic. Exposure to phthalates can cause damage in utero to male reproductive organs, can reduce sperm count, and can reduce testosterone levels. In Puerto Rico, girls from age 6 months to 8 years exposed to elevated levels of phthalates have shown premature breast development.

Recently introduced legislation (SB 600) reflects the concern of the Legislature regarding these problems and is intended to initiate a biomonitoring program in California to clarify some of the risks to human health related to these substances. An excerpt from the text of the legislation is provided below:

> "(b) Chronic diseases carry enormous costs to California. For example, the estimated total cost of asthma in California is approximately $1.27 billion annually. For individuals born in 1988 with one or more of the 18 most common birth defects, estimated lifetime costs for medical treatment and lost productivity exceed $1 trillion. Special education for the estimated 1 million California children with learning disabilities, carries an annual price tag of $12 billion.
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> (c) An estimated 85,000 chemicals are registered for use today in the United States. Another 2,000 chemicals are added each year. Some toxicological screening data exists for only 7 percent of these chemicals. More than 90 percent of these chemicals have never been tested for their effects on human health. Large numbers of these chemicals are found in cosmetics, personal care products, pesticides, food dyes, cleaning products, fuels, and plastics. Because of their ubiquity in modern life, Californians are commonly exposed to multiple chemicals every day. Many of these chemicals persist in the environment, and accumulate and remain in body fat, and have been shown to be toxic.
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> (d) Biomonitoring studies have scientifically demonstrated that human exposure to a multitude of persistent chemicals is both chronic and widespread. The Centers for Disease Control and Prevention has documented the presence of 116 environmental chemicals in the blood and urine of Americans of all ages and races. More than 200 synthetic chemicals have been detected in breast milk, many of which are known to cause mammary tumors in animals."

There is much to think about and potentially be concerned about regarding xenobiotics. The problem appears somewhat overwhelming, given the many hundreds of chemicals potentially involved. Because of our much smaller population, our Region may benefit from seeing emerging issues in larger urban areas, and we should be proactive in following up on these issues locally. Studies have shown that many xenobiotics are substantially reduced as wastewater treatment level is increased, so continuing to move towards secondary and higher levels of treatment should remain a priority. Chronic toxicity tests that screen for growth and reproductive

abnormalities in aquatic species may become increasingly important monitoring tools for us to consider as part of standard monitoring requirements. We also need to watch for new monitoring techniques associated with chemicals of concern, to ensure that wherever possible we are applying state-of-the-art science to water quality decision-making.

A discharger will propose to address the potential presence of dioxin in municipal wastewater discharged to the Pacific Ocean at the May 13, 2005 Board meeting. Proposed Order R3-2005-0003 provides for the City of Santa Cruz to monitor its effluent for two 30-day periods every year with a Semi-Permeable Membrane Device, an integrative high-volume sampler. These samplers accumulate all target pollutants from a waste stream that is split from the main wastewater flow. Target pollutants include dioxins, as well as PCBs and organochlorine pesticides, all of which bioaccumulate in the food chain and, if unchecked, can disrupt the endocrine systems of animals and can cause mutations and cancers. Integrative sampling allows dioxin to be measured for the first time at levels below the effluent limitation developed from the Ocean Plan. The average dioxin concentration in the effluent is determined from the mass of dioxin on the membrane and the wastewater volume, which are accurately measured. Monitoring the discharge for 60 days throughout the year (i.e. more than 15 percent of the time) provides data much more representative of the discharge as a whole than an occasional grab sample. As described in more detail in the Fact Sheet for the proposed Order, if monitoring finds effluent dioxin at levels greater than the effluent limitation, the Order requires the Discharger to develop a Pollutant Minimization Program (PMP). The PMP would likely recommend, among other actions, that the City conduct a public education program to reduce disposal of waste materials containing dioxin, such as bleached toilet tissue, into the sanitary wastewater.

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