Storm Water Panel Report
Deadline: 9/1/06 5pm

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September 1, 2006

Ms. Song Her, Clerk to the Board
State Water Resources Control Board
P.O. Box 100
Sacramento CA 95812-0100

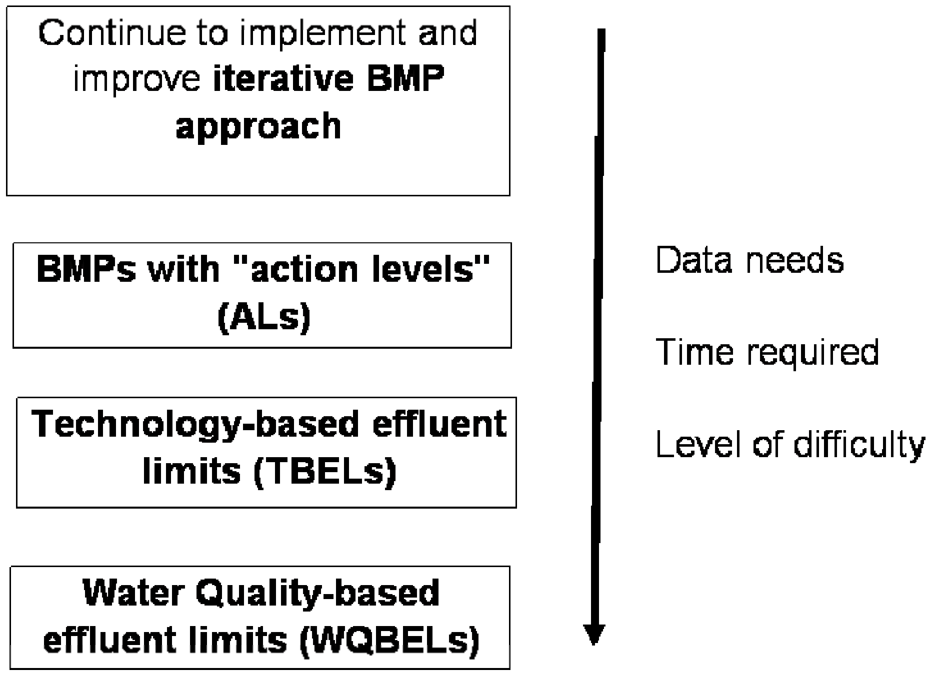
Re: Comments on the Storm Water Panel of Experts Report entitled *The Feasibility of Numeric Effluent Limits Applicable to Storm Water Discharges*
FSI 044018.2

Dear Ms. Her:

Flow Science was retained by the Western States Petroleum Association (WSPA) to comment upon the State Board Expert Panel ("Expert Panel") report entitled *The Feasibility of Numeric Effluent Limits Applicable to Storm Water Discharges*. I also provided testimony to the State Board on July 21 and July 28, 2006, and incorporate those presentations by reference. We appreciate the opportunity to comment on this report and look forward to working with the State Board as it addresses questions related to improving storm flow water quality. Many of our comments are general, and apply broadly to the municipal, industrial, and construction sectors, while others are more tailored to storm flow discharges from industrial facilities.

As detailed in Figure 1, there are four major options for the regulation of storm water. The types of data and the amount of time required for use in the State's storm water regulatory program will depend upon the type of limit to be developed, the methodology used to establish numeric limits, and the monitoring and compliance strategies to be used both to establish datasets upon which limits can be based and to evaluate compliance and improvements in water quality as a result of program implementation. The comments below first discuss major issues common to all options: storm flow characteristics, the utility of the existing dataset, and program design considerations. Finally, each type of limit is discussed in turn, including the amount and type of data and estimated time frames that would be required to develop each type of limit.

Figure 1. Options for storm water regulation.



Storm flow characteristics. Storm flows are quite different from many other types of discharges, particularly in the arid west. Most notably, storm flows exhibit highly variable flow rates, flow volumes, and constituent concentrations. Storm flow water quality is a complex function of watershed size, slope, soils, vegetation types, rainfall (storm size and intensity), antecedent conditions (a function of the time since last rainfall), land use, and climate.

Available data demonstrate that storm flow constituent concentrations can vary by an order of magnitude or more on timescales of an hour or less (see Flow Science, 2005). Constituent concentrations can also vary just as widely between storm events, and at any given time between relatively closely located sites. Analysis of existing data demonstrate quite clearly that storm flow constituent concentrations do not follow a neat, "log-normal" statistical model (see separate analysis by Dr. Gary Lorden). This is important because the procedures the State and Regional Boards currently employ to develop numeric limits for non-storm flow discharges rely upon the assumption that data are log-normally distributed. For storm flow data, this assumption is incorrect, so that new methodologies will be needed to develop numeric limits (especially WQBELs, as discussed below). Importantly, these methodologies will need to develop means to account for extreme events (e.g., high rainfall intensities, changed site conditions, etc.)

that can result in measured storm water concentrations that fall outside of the "normal" range of observations.

Constituents enter storm flows from a variety of sources, including both natural sources (site soils, airborne dust, wildfire ash, combustion products, etc.) and manmade sources (atmospheric deposition of anthropogenic origin, such as automobile exhaust and road dust, building materials, site activities and practices, application of pesticides, etc.). Available data suggest that, for many constituents, the bulk of the storm flow concentration and loading may arrive from atmospheric deposition (see, e.g., Sabin et al. (2004), Sabin et al. (2005)). These considerations are important because it may prove easier and more cost-effective to control pollutants at the source rather than to treat and remove pollutants from storm flows.

Strategies available to improve storm water quality range from best management practices (BMPs) to storage and treatment approaches. All approaches are challenged by the high volumes and flow rates of storm flows, which necessitate hydrologic design criteria, such as a "design storm" or other hydrologic specifications. As noted by the Expert Panel, exceedances of limits can be expected to occur several or more times per year, based largely on hydrologic considerations alone.

Existing data. Most of the available data on storm flow quality, both from individual sites and in receiving waters, are in the form of a single grab sample per storm event, and generally for a relatively limited number of constituents. Thus, it has not been possible to date to develop relationships between parameters that affect storm flow quality (rainfall amount and intensity, antecedent conditions, site conditions, etc.) or to predict or explain the full range of variability observed in storm flows.

Data have been collected as required by the State's General Industrial Permit for four constituents: total suspended solids (TSS), conductivity, oil and grease or organic carbon, and pH. These data are in the form of grab samples collected once per storm. There is little information in the database on storm size or intensity, site conditions, BMP and treatment measures in place, and other factors that affect storm water constituent concentrations. To date, there has not been a broad, controlled program of data collection that would allow us to compare water quality concentrations between facility types, regions, or in response to hydrologic influences.

Data are available for additional constituents from a small sampling of individual facilities, but are generally in the form of grab samples. Very few data are available to describe variations in concentrations during a storm or in the form of event mean concentrations (EMCs, or composite samples), and, to our knowledge, the few data that are available do not represent discharge water quality but rather were collected interior to a site. To implement, for example, CTR criteria in the form of numeric limits applicable to storm flows would require data on a similar temporal scale to the objectives (e.g., acute criteria are expressed as one-hour averages, requiring data on a one-hour or shorter timescale; see also comments by Dr. Gary Lorden).

The degree to which the variability of storm flows must be characterized will depend upon the type of limit to be adopted, and the actions triggered by observed exceedances of those limits. For this reason, fewer data would be required to establish ALs than for TBELs, and fewer data would be required for TBELs than for WQBELs.

Program design considerations. As described below, existing data may be sufficient to establish Action Levels for a handful of constituents, including those for which data are available as a result of data collection undertaken pursuant to the State's General Industrial Permit (TSS, conductivity, oil and grease, organic carbon, pH). Additional study will be required to determine if these data are sufficient for this purpose, and the answer may depend upon the way in which Action Levels are to be established and how they are to be used.

In any case, future data collection would be required to establish numeric limits or other quantitative measures of compliance. The type and quantity of data to be collected are very much dependent upon the type of limit to be developed, the methodology to be used to compute limits, and the monitoring and compliance strategies to be used after limits are established. For example, if compliance with numeric limits is to be determined using grab samples, then the data collection effort necessary to develop limits would likely be more data-intensive, so that those grab samples can be related to variations in concentration within a storm or to EMCs (flow-weighted composite concentrations).

Options for storm water regulation.

Continue to implement and improve the iterative BMP approach. As shown in Figure 1, the first option is to continue to implement and improve the existing approaches to managing storm flows using an iterative BMP process. As noted by the Expert Panel, improvements can be made in this process, including utilizing BMP performance data and knowledge about the impairments or constituents of concern in a receiving water to select better and more efficient BMPs. With this option, compliance and enforcement would be based upon selection of appropriate BMPs, then continued implementation and maintenance of the selected option. Examples of additional data and information that could be collected to improve the iterative BMP approach include:

- Development of a list of BMP options
- Data collection and research into BMP unit design and efficiency
- BMP design criteria (a "design storm" or other hydrologic design criteria)
- Information on gross receiving water quality (identification of constituents of concern and flow characteristics, etc.)
- Detailed analysis of maintenance and enforcement options

This program could begin immediately. In effect, the program itself could be iterative, with improvements made pursuant to a coordinated, well-designed program of data collection and subsequent development of program guidance, likely at the direction of the State Board.

BMPs with "Action Levels" (ALs). As envisioned by the Expert Panel, ALs would serve to identify "bad actors" (those discharges or sites with a propensity, based on monitoring data, to contribute disproportionately to high concentrations of constituents in receiving waters) and to trigger an iterative management approach. The Expert Panel presents three options for the development of ALs. To proceed with implementation of ALs, Flow Science would recommend that the State Board would first identify both the methodology to be used to establish ALs and to clarify how measurements would be compared to ALs and the actions that would be triggered. As discussed above, existing data in the database compiled pursuant to the General Industrial Permit may be sufficient to establish ALs for those limited constituents, again depending upon the methodology to be used. Examples of additional data that would be required to develop and implement ALs are:

- Development of a list of BMP options
- Data collection and research into BMP unit design and efficiency
- BMP design criteria (a "design storm" or other hydrologic design criteria)
- Information on gross receiving water quality (identification of constituents of concern and flow characteristics, etc.)
- Process and procedures for establishing ALs
- Actions required when ALs are exceeded at a certain frequency
- Data on effluent constituent concentrations for those constituents that will have ALs

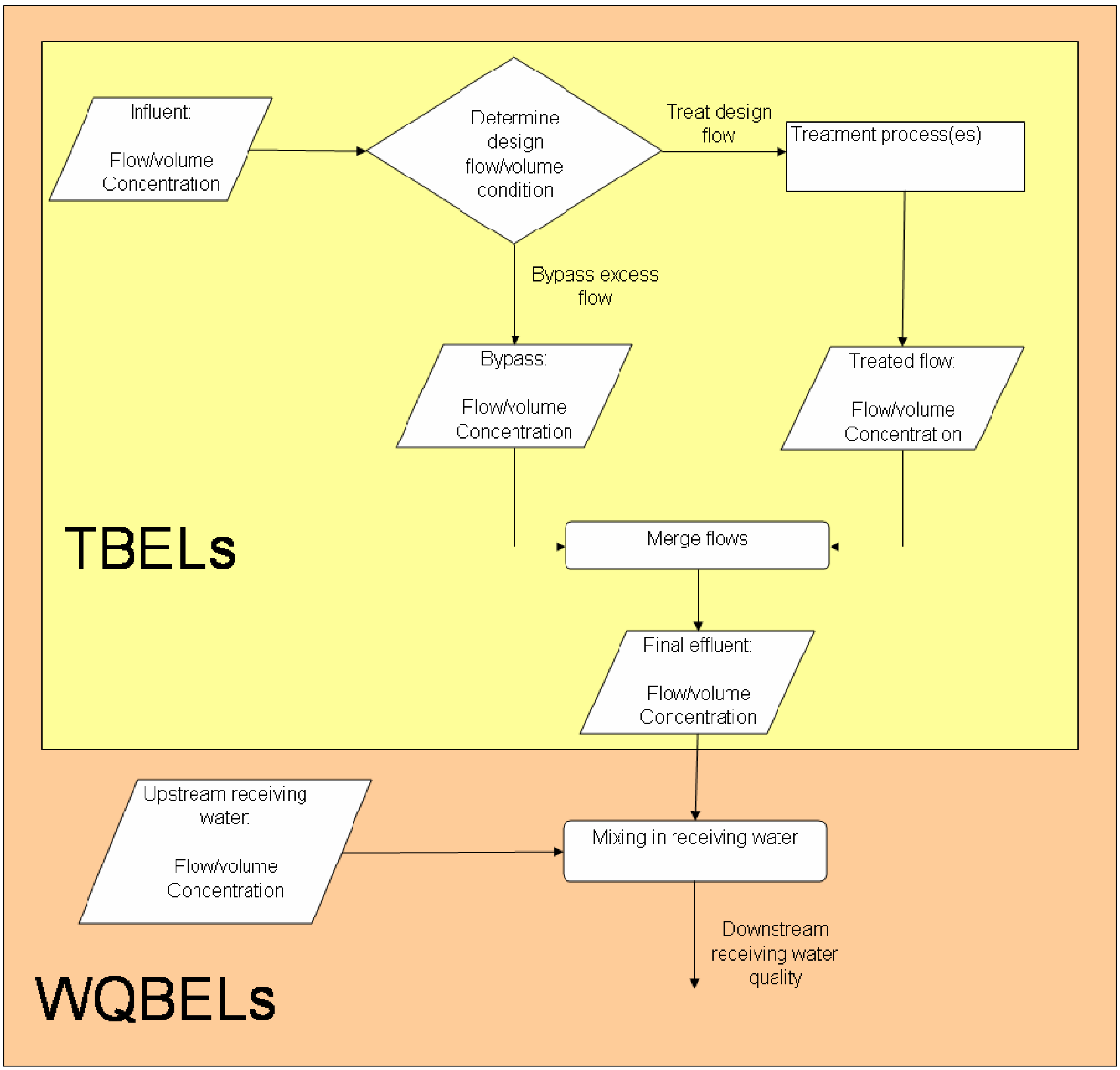
AL development could be staged, so that – if data are sufficient – ALs would be developed in the near-term for industrial discharges for some subset of the four constituents (TSS, conductivity, oil & grease or organic carbon, and pH) for which grab sample data are available. A second phase could involve collection of data for additional constituents and development of ALs for those constituents. We estimate that development and implementation of ALs could take from 0-3 years for constituents with readily available data, and 3 or more years for constituents for which additional data collection will be required.

Technology-Based Effluent Limits (TBELs). TBELs are numeric limits based upon available technology and the treatment efficiency of those technologies. For storm flows, TBELs would need to be developed in consideration of the volume or flow rate to be treated, the efficiency of the treatment process, and the quality of storm flow influent to the treatment process. As shown in Figure 2, the final effluent stream will be a mixture of treated effluent and untreated effluent (i.e., effluent beyond the hydraulic capacity of the treatment system). Data requirements for TBELs may include:

- Detailed characterization of influent (raw) water quality

- BMP and treatment system performance data, which would be required for a range of influent concentrations and under field, not laboratory, conditions
- Process for setting TBELs that would recognize the variability of storm water flow rates/volumes and constituent concentrations
- Monitoring and compliance options (e.g., grab v. composite samples, sampling frequency, etc.)

Figure 2. Considerations in development of TBELs and WQBELs.



An important consideration with TBELs is that an initial dataset used to establish limits may not capture the full range of conditions that may occur during the life of a project. Any TBELs, or the compliance and enforcement program associated with TBELs, would need to define both an allowable frequency of exceedance and a process for handling water quality excursions due to extreme events. Based on available information, we estimate that a total of at least 4 to 6 years would be required to establish appropriate TBELs. This estimate is derived as follows: we estimate that 1-2 years would be required to design the data collection program and to develop the methodology for calculating TBELs; a minimum of 2-3 years would be required for data collection; and at least one additional year would be required to calculate limits and place them into permits. Design and construction of controls and treatment systems may require additional time. Note that these timelines would depend upon the process used for limit development and could further be influenced by the availability of funding for monitoring, development of work groups, advisory committees, and peer review and notice/workshop/hearing processes, among other factors.

Water Quality-Based Effluent Limits (WQBELs). WQBELs must consider both effluent and receiving water quality in the limit development process. To date, the methods available for developing WQBELs are based on relatively simple, idealized data distributions – e.g., normal or lognormal data distributions. However, as discussed above, storm flow data do not follow these idealized distributions, but rather are "heavy-tailed" or "extreme value" distributions. For these reasons, existing WQBEL methodologies are inappropriate for storm flows, and new methodologies must be developed. As shown in Figure 2, variability in effluent quality and flows and variability in receiving water quality and flows all contribute to final receiving water quality, and these variables are a function of both time and space. Either dynamic modeling or statistical approaches could be considered to incorporate these considerations into limit calculation procedures, as described briefly in EPA's Technical Support Document (U.S. EPA, 1991). Data that would be required to calculate WQBELs may include:

- Detailed (hourly or sub-hourly) effluent quality and flow data
- Detailed receiving water quality and flow data
- Information on the means of compliance to be employed
- Methodology for determining reasonable potential ("RPA") and for calculating effluent limits
- Development of monitoring strategies and enforcement options
- Means to relate TMDLs to WQBELs

Note that it is usually envisioned that TMDLs would be implemented in permits as WQBELs. However, all the same considerations would apply to WQBELs calculated from TMDLs as to WQBELs calculated in water bodies or for constituents where TMDLs have not been established. In other words, concentration-based TMDL allocations should not be inserted directly into permits as numeric limits; rather, the same calculation methodology used to establish WQBELs should apply to development of WQBELs based on TMDLs.

We estimate that <u>at least 7-10 years</u> would be required for WQBEL development, which was derived as follows: $\geq$ 2-3 years to design the program and develop the methodology for calculating limits; $\geq$ 3-5 years for data collection; $\geq$ 2 years to calculate and implement limits. Again, design and construction of controls could require additional time.

Note that all of the above timelines are our best estimates, and they would depend upon the process used for limit development and could further be influenced by the availability of funding for monitoring, development of work groups, advisory committees, and peer review, and notice/workshop/hearing processes, among other factors.

We appreciate the opportunity to comment on this issue, and we look forward to working with the State Board in the future. Please contact us if you have any questions.

Sincerely,

Susan C. Paulsen, Ph.D., P.E.
Vice President and Senior Scientist

References

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