Department of Pesticide Regulation

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MEMORANDUM

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SUBJECT: Review of the Surface Water Monitoring Program Design under the East San Joaquin Agricultural Waste Discharge Requirements General Order.

SUMMARY

Per the State Water Resources Control Board's (SWRCB) request, the Department of Pesticide Regulation's (DPR) Surface Water Protection Program (SWPP) staff reviewed the design of the surface water monitoring program under the East San Joaquin (ESJ) Agricultural Waste Discharge Requirements General Order (WDRs). The ultimate goal of the monitoring program is to improve water quality through identifying sources of pollution, triggering management practices, and evaluating the effectiveness of those practices. We believe that the monitoring program could benefit from a re-design to better account for surface water flows in the hydrological system. Thus, when a water quality trigger exceedance is observed at a receiving water site, the pollution sources can be effectively tracked up the watershed and management practices can be implemented to improve water quality. In addition, we believe specific approaches can be used to evaluate the spatial and temporal sufficiency of the monitoring in order to assess the pollution trend and the effectiveness of management practices.

To better achieve the goal of the monitoring program, we suggest:

- A hybrid spatial network with core sites near the outlets of watersheds and source sites near the outlets of catchments within the watersheds. The core sites should be monitored routinely. When a water quality trigger is exceeded at a core site, the corresponding source sites in that watershed should be monitored to locate the source of the pollution and to understand the pathways.

- A hybrid temporal coverage with routine monthly monitoring combined with event-based monitoring that captures storms in the winter, and with passive sampler monitoring that can integrate signals over a period of time at selected sites.
- If there are practical constraints, a subset of the core sites may be selected by randomization, rotation, prioritization, or a combination of prioritization and rotation. The selected sites should be distributed as evenly as possible across the region.

1. Background

SWRCB is currently reviewing the ESJ WDRs, in response to petitions from three groups: Asociación de Gente Unida por el Agua, et al., the California Sportfishing Alliance and California Water Impact Network, and San Joaquin County Resource Conservation District, et al. (SWRCB, 2017). SWRCB sought feedback from DPR on one particular component of the WDRs – the design of the surface water monitoring program since the majority of the constituents monitored in the program are pesticides. DPR's SWPP staff identified possible areas of improvements to the monitoring program after reviewing the current monitoring program design, the petitioners' and other environmental groups' arguments, and some historical agricultural WDR documents.

2. Current ESJ WDRs Surface Water Monitoring Program Design and Arguments from Both Sides

Under the general agricultural WDRs, all sides agreed that representative monitoring of receiving waters, as opposed to farm discharge monitoring, should be implemented for the surface water monitoring program. The program objectives are to: 1) detect exceedances of water quality trigger, 2) point towards contamination sources, 3) show water quality trends over time, and 4) link changes in management practices to water quality improvement.

The current surface water monitoring program in the ESJ WDRs is implemented on the concept of zonings, where the zones were established based on similarity of soils, hydrology, climate, and land use (i.e., crop). There are six zones in total for an area just under one million acres. Each zone has two core sites that rotate every two years (i.e., there is only one core site per zone in any given year). The core sites are monitored monthly for many constituents. If a constituent exceeds its associated water quality trigger at a core site, several represented sites in the same zone will be monitored for that particular constituent for the next two years. In the meantime, the Coalition will conduct focused outreach at both the core and represented sites (ESJ Water Quality Coalition, 2017).

There are two primary concerns on the design of this monitoring program: (1) the sufficiency of spatial density of the monitoring program namely the representativeness of the core site for the condition in a zone, and (2) the sufficiency of temporal density of the monitoring program (ESJ Water Quality Coalition, 2017; Environmental Groups, 2017). On the spatial density of the monitoring program, the Environmental Groups stated that the ESJ region has far less sampling sites per unit agricultural area compared to that of other regions (it is 17 times less than the spatial monitoring density in the Central Coast Region). The ESJ Water Quality Coalition argued that the condition in a zone should be similar such that one core site per zone should be representative. The ESJ Water Quality Coalition provided one example of a paired core and represented sites in a zone that have very similar results. Those two sites are upstream and downstream from each other. However, in another example that the Coalition used to demonstrate outreach effort, the core and represented sites did not behave similarly. The Coalition did not provide information on the relative locations of those two sites in the hydrological system. SWRCB's preliminary data analysis indicated that there can be significantly varied monitoring results from core sites to represented sites even if they have similar physical site characteristics, possibly due to variability in field-by-field practices (SWRCB, 2017). In addition, SWRCB argued that it was not clear that there was sufficient spatial density even with combined core and represented sites to be able to reasonably identify exceedances throughout the watershed. There is also a concern with the sufficiency of the temporal density of the monitoring program. The ESJ Coalition argued that monthly monitoring was effective to determine the effect of pesticides applications on water quality because the growers would not alter pesticide application schedule to avoid detection by monitoring.

3. Assessment

The ultimate goal of the monitoring program is to improve water quality through identifying the sources of the pollution, triggering management practices, and evaluating the effectiveness of those practices. The program is able to achieve its ultimate goal if: 1) it has sufficient spatial/temporal coverage to detect the pollution and assess trend, 2) the locations of the monitoring sites align well with the hydrological system to allow tracking of the pollution sources upstream (Hill et al., 2015), and 3) outreach actually results in growers implementing effective management practices. The first two requirements can be addressed by proper design of the surface water monitoring program.

Based on the principles listed in the paragraph above, we believe that the surface water monitoring program should rely on locations that are relevant to the hydrological system. The "core" sites located near the outlet of watersheds should be routinely monitored. When any constituent exceeds the water quality trigger at a core site, "source" sites near the outlet of catchments inside the particular watershed should be monitored to narrow down the sources and understand the pathways so that effective management practices can be implemented. The watershed and catchment are defined in the USGS's National Hydrography Dataset (https://nhd.usgs.gov/). The sufficiency of the spatial coverage is a function of the spatial variability in the constituents' signals in the entire region. That variability can be roughly estimated from existing monitoring data at sites that are the outlet of watersheds. However, different constituents may have varying spatial variability. One approach is to limit this evaluation to the few constituents that have the highest potential to exceed water quality trigger based on existing monitoring data and/or SWPP's Surface Water Monitoring Prioritization Model (Luo 2015). On the other hand, it is difficult to estimate the temporal variability of the signal using existing monitoring data that were collected monthly. Compare to other surface water monitoring programs, monthly sampling at core sites is a reasonable intensity during the dry season. The addition of stormwater monitoring, especially the "first flush" in the wet season, would further strengthen the design. To supplement the monthly sampling, passive samplers that can integrate signals over a period of time can be implemented at a few core sites of larger watersheds. Passive samplers are novel tools for monitoring surface water contaminants. Such samplers usually employ a sorbent material allowing the partition of target contaminants from the water column to the sorbent phase. Analysis of the samples would provide information on the integrative or average concentration in the water column over the period of time that the sampler is deployed in water (Xue et al., 2017).

There are also practical constraints. First of all, the limited budget may not allow a comprehensive monitoring program as described above. If the budget only allows monitoring at a subset of the core sites, they can be selected by randomization, rotation, prioritization, or a combination of prioritization and rotation such that a few monitoring sites identified by prioritization will be monitored constantly while the other possible candidate sites will be monitored on rotating schedule. Prioritization can be done using monitoring data or SWPP's Surface Water Monitoring Prioritization Model (Luo, 2015). Secondly, the ESJ Water Quality Coalition emphasized that some sites are disqualified due to difficulty of access by the sampling crew or confounding load contributions from urban areas (ESJ Water Quality Coalition, 2017). However, the spatial distribution of the selected core sites should be as even as possible across the entire region. Inclusion of a core site with some urban contribution is not an issue with a hybrid network of "core" and "source" sites because data from source sites can be used to distinguish signals from agricultural and urban area.

4. References

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