Watershed Systems

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Thomas Lippe, Esq.
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Re: Napa River Sediment TMDL

Dear Mr. Lippe:

You have asked me to review the Proposed Basin Plan Amendment: Napa River Sediment Reduction and Habitat Enhancement Plan and the Napa River Sediment TMDL Staff Report dated June 30, 2006.

I shall address the issue of whether or not this TMDL will bring the Napa River into compliance with Basin Plan standards that are currently not met due to excessive sediment or mechanisms that produce sediment, such as increases in peak flow from land use changes. I shall also address the issues related to implementation of Basin Plan standards as proposed by the Regional Board and the issue of regulation or non-regulation of headwater areas upstream from dams and reservoirs.

You asked me two questions:

1. Is the actual TMDL (i.e., 125% of background and the two numeric targets), assuming it is achieved, substantively adequate to achieve compliance with Basin Plan standards.
2. Is the Implementation Plan adequate to achieve the TMDL?

Primary Initial Concerns:

1. There is a basic flaw inherent in the implementation of a strategy of upland sediment source reduction while not simultaneously addressing the problem of peak flow induced channel incision in the mainstem Napa River and lower reaches of tributaries. This is the stated purpose or primary focus of the proposed Napa River sediment TMDL (staff report p. 48). Basically, one cannot simultaneously reduce sediment input and reduce mainstem channel incision. The river system is one that

balances sediment load and transport capacity. If the Napa River is deprived of sediment load without a simultaneous reduction in peak flows, it will incise or cut laterally to make up that sediment deficit in its lower reaches.

If, as the Regional Board Staff Report acknowledges, the Napa River is not able to meet Basin Plan standards for fish habitat due to incision of the mainstem channel and impacts to spawning and rearing habitat caused by excess fine-grained sediment in the system, a TMDL sediment reduction control strategy alone will not be sufficient to achieve Basin Plan standards for the following reasons:

a. As recognized in the background documents to the Staff Report, the numerous reservoirs and dams located on Napa Valley watercourses trap coarse sediment load that is beneficial for fish habitat and stream equilibrium, while passing fine grained sediment that is deleterious to these two benefits in the main channel system. The approach of the staff of the Regional Board is thus to try to reduce fine-grained load because they cannot readily increase the ratio of coarse to fine load. Thus the sediment TMDL must be interpreted as a fine-grained sediment TMDL, not a total sediment TMDL. It is well to remember here that the geologic work of rivers is the transport of sediment with the help of water.

b. Napa County Hillside Erosion Control Ordinances also shift the balance of coarse and fine grained sediment by trapping and reducing coarse sediment eroding from hillside vineyards and other developments while doing little to control passage of silt-sized sediments that fill, pass through, and pass under the various erosion control structures and treatments that are prescribed through the ordinances. I believe that the Regional Board errs in relying too much on county control through vineyard conversion and other erosion control ordinances that do little to reduce fine grained sediment yield and exacerbate sediment and stormflow routing.

c. The river has now incised to the point that it is no longer connected to much of its historic floodplain. This prevents the main Napa River from capturing its fine-grained sediment load through periodic overbank flooding into the wide riparian zone that is seen in the historic aerial photos. (cf Staff and Dietrich reports) To try to achieve a fluvial equilibrium of flood flows and sediment transport in the contemporary environment of increased peak flow frequency and magnitudes, we either need more sediment or we need decreased flow velocities with wide riparian corridors and contiguous floodplains to prevent scour of spawning habitat and to effect capture of fine-grained sediments.

2. There is insufficient thought given to the historic character of the Napa River and its watershed. As pointed out by several early reviewers of study drafts, there is little basis for assuming that the characteristics of the Napa River as captured in the oldest historical aerial photography are those characteristics that may have supported both Steelhead and Coho populations. Thus, the question raised by others about the advisability of trying to achieve a target condition for the Napa River and its tributaries through this TMDL that is based on the date of the earliest

aerial photography is quite valid. Based on well-accepted principles of geomorphology, it is likely that the pre-European Napa River was a meandering single-thread channel with a wide active well-vegetated floodplain. Upon introduction of cattle by Mexican and early European settlers, and later land clearing and logging, storm-period sediment yields would have increased dramatically, and the channel may have aggraded and become braided. Then as we move into the 20th century with valley-floor agriculture and vineyards and cessation of grazing and logging, there would have been economic pressure to confine the river to a single channel and an accompanying reduction in sediment yield that led to modest incision. Then, in the modern era, with expansion again onto the hillsides and intensive competition of valley-floor prime vineyards and urban lands, coupled with needs for frost protection and surface reservoirs, we moved to the present hydrologic regime.

While this historical scenario has not been, and maybe cannot be, absolutely verified, it fits the available historic maps and is clearly reflected in the strata of the Napa River cut-banks that I have inspected at and above St Helena. The moderately incised mainstem river in the reach between Calistoga and St Helena exposes miles of failing riverbanks. Almost all reveal a 60 to 130 cm surface overbank silt and sand deposit that incorporates occasional logs and roots that overlie pockets of gravel and clay deposited by a meandering river within 1 to 1.5 meters of the present thalweg. The old river meandered. The present river has been remarkably stable in its position in the valley and is quite straight. The old river left floodplain deposits in riparian areas that accumulated organic-rich soils. Today those soils are largely oxidized and no longer accumulating organic-rich fine-grained sediments. If this reconstructed history of the river is accurate, then restoration to a 1940's model would be inappropriate for restoration of historical fish and aquatic wildlife habitats.

We need to accept that the proposed TMDL implementation plan may freeze in time a transitional metastable condition that is not ideal for the biotic components that are also part of the Basin Plan. I appreciate that this issue has been debated and that there are differing professional opinions. However, it is clear that upland sediment yield is only one of several factors that are currently causing sediment related impairment of the Napa River. Other major factors include channel incision caused by increases in peak flow and the resulting lack of connection between the river and its historic floodplain. Therefore, from a geomorphic standpoint, efforts focused solely on reducing future upland sediment yield are likely to be ineffective unless combined with efforts to regulate increases in peak flow and to structurally reconnect the river with its floodplain.

Observations:

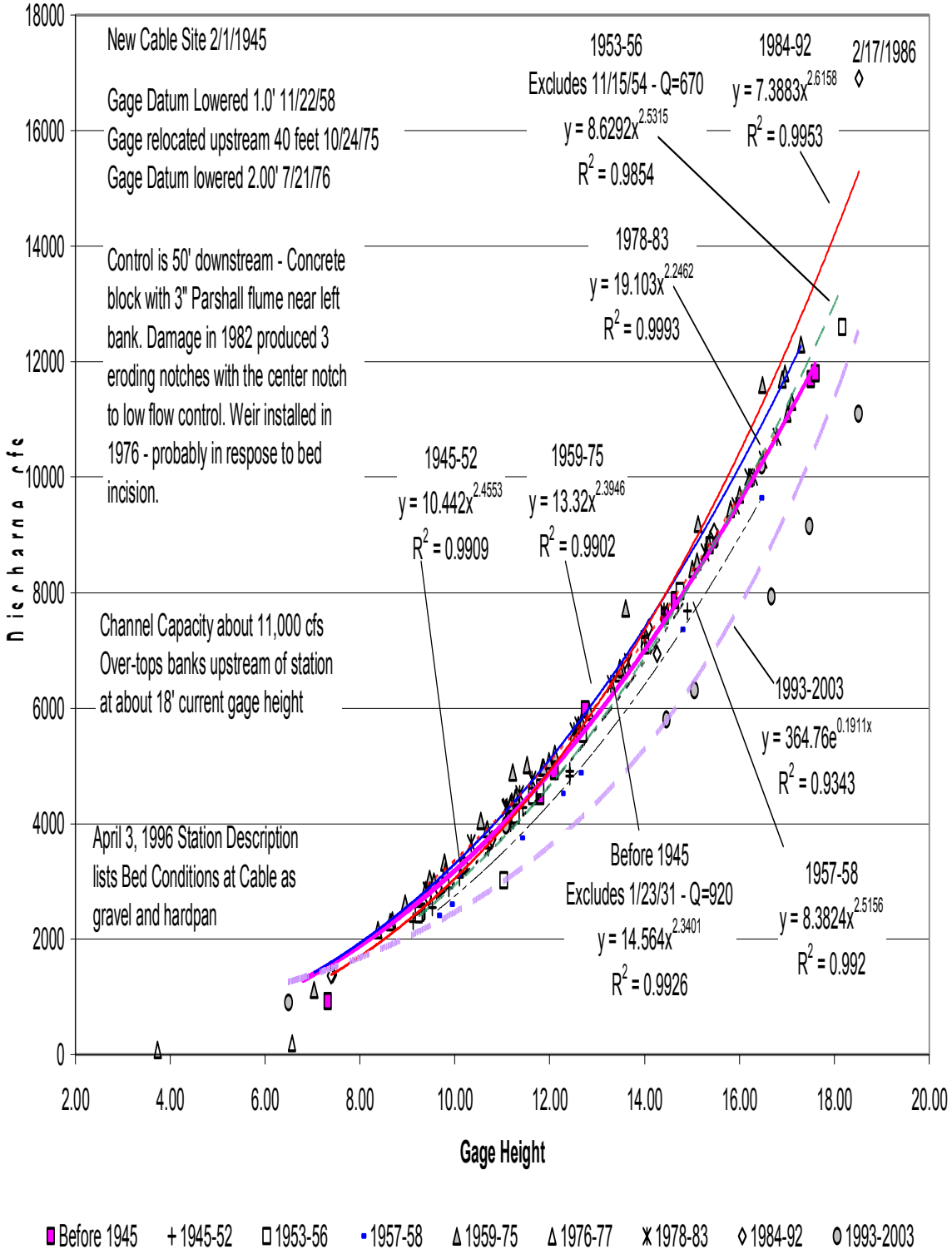
The riverbanks are eroding and failing where agricultural development has reduced or eliminated natural riparian forest and where misguided bank protection efforts have concentrated lateral erosion. This bank-cutting is caused both by the frequent channelized high flows of the river itself and by pore-water pressure in the oversteepened streambanks. Today it takes a discharge of about 11,000 cfs to overtop the channel just upstream of the St. Helena gauging station. Although this

site is not natural and unaltered, it appears to have overtopped at substantially smaller flows (as little as 5000 cfs, or close to the 2-yr return interval) 50 years ago. This opinion is based on an analysis of the complicated gauging records for the Napa River near St. Helena US Geological Survey station (Figure 1, *spreadsheet available on request*). Significantly, the trends of aggradation and incision in the main Napa River channel have not been consistent. Major floods have altered and even reversed briefly the channel cutting trends, as have channel maintenance activities (based on review of all historic meeting notes of past Supervisors' meetings up to 1996). However, the trend today is toward deeper channel incision and some channel widening.

Revised

Napa River near St. Helena

Peak Discharge vs.Stage, Adjusted for Datum Changes



Without addressing the mainstem channel equilibrium problems, the proposed 125% of background limit for the sediment TMDL cannot restore sediment-impaired habitat in that channel. It may be effective in tributaries that are important for spawning habitats if this TMDL is adequately implemented. Sediment sources that supply the mainstem are not limited to tributaries. As can be readily seen in the cutbanks of the Napa River between Calistoga and St. Helena, a significant source of fine-grained sediment is being added from erosion of cleared fields. These are "recycled" overbank flood deposits and old backwater deposits that are now eroding into the channel. These sediment sources are particularly damaging to in-stream gravels because they may be added to the river when it is not in flood flow and cannot readily transport them. Seasonal high winter water tables and bank storage water contribute to the failures of the fine-grained stream bank materials at non-flood times. This sediment is then simply redistributed in the immediate vicinity of the bank failures to fill pools and impair streambed permeability. It creates a short-term localized transient sediment load that is difficult to monitor and control, and is underestimated in the Regional Board models. This difficulty was acknowledged in the Limiting Factors Analysis as quoted below.

Another observation is that on-stream reservoirs become very turbid during episodic intense rainstorms of 5-inches or more that fall within 1-to-3 consecutive days. That turbid water passes through the smaller reservoirs and into lower tributaries to be discharged into the mainstem river. These 5-inch storms often fill small (1-acre or less) sumps and detention basins installed below hillside vineyards to catch sand sand-sized material, after which runoff from a later sequential storm is not trapped at all. It is not possible to clean these sumps and return the captured sediment to fields and vineyards during the wettest times of the winter, and thus the erosion control structures are often ineffective during wet winters.

Implementation:

The Implementation Plan cannot achieve the stated goal of fine-grained sediment reduction to 125% of background for several reasons. First, we do not have a very good idea of what background levels are. The short dry-year sampling that was done, through no fault of the investigators, simply cannot be used to establish a baseline. Sediment transport is episodic with the first large storm of the season and the first rising flood-stage flush of flow as the primary transport media. Not only were the two sampling periods not representative of the 5-20-year return period primary sediment transport events, but they missed the early season concentrated flows. Analysis to demonstrate that the sampling captured mean annual flow events, while a good academic exercise, is not indicative of representative sediment loads.

As pointed out in that Limiting Factors Analysis, Final Technical Report, 2002, § 6.2.1:

> We did not perform a sediment source analysis, and therefore do not know if potential significant sources of fine sediment and clays (dirt roads, freshly ploughed agricultural fields, etc.) were exposed during the period of measurement. Within the time frame of

this study, no turbidity effects were found, despite our examination of 17 tributaries and 7 sites on the mainstem Napa River. This suggests that there is not a permanently elevated chronic source of sediment causing deleterious turbidity levels. However, our results reflect conditions during only two water years and may not have captured the effects of episodic or rare phenomena such as periods with higher rates of land conversion or road construction or infrequently-occurring natural events, such as landslides or extremely large storms.

Second, by assuming that the watershed areas above reservoirs and dams are not necessary to consider for reduced fine-grained sediment management and regulation, a significant contribution may be missed. I believe I understand the reasoning behind the assumptions made in developing the TMDL models to assess sediment sources. The East Side hillsides underlain by Tertiary volcanic rocks are assumed less erodible source areas and the reservoirs trap sediments. These volcanic flow rocks are mapped as covering about 27 percent of the entire Napa watershed area. But most of the reservoirs are small enough to allow passage of fine grained sediment through them during characteristic intense winter storms and the East Side Sonoma Volcanic rocks are not really all bedrock at the surface. There is a mantle of fine-grained volcanic ash 2 or more feet deep under the chaparral that originally mantled these volcanic lands. As a geologist, we always map what we believe to be the bedrock, and that is primarily dense volcanic rock as shown on the bedrock geology map figure for this TMDL. But that is not what is exposed when lands are initially cleared, or planted in vineyards or converted for grazing. The soil maps recognize a fine-grained loam or even clay-loam where the geologists say dense volcanic bedrock. They are both correct, but it is the soil mantle that must be managed to reduce fine-grained sediment flux. The mantling of geologically young volcanic ash is not recognized in the tabulation and maps of geologic substrates that were a basis for modeling the sediment yield of various parts of the watershed (see Table 3-3 in the Limiting Factors Analysis). To this end, it does not seem prudent to dismiss or underestimate sediment yields from East Side areas, even those above smaller reservoirs.

The Staff Report of June, 2006, is well organized and comprehensive. It acknowledges many of the basic problem issues that must be addressed by the TMDL and Basin Plan Amendments such as riparian zone restoration, flood routing problems contributing to high peak flows, low-flow problems as the affect fish habitat, and channel incision. But it does not attempt to develop an implementation strategy that addresses these fundamental and overriding issues. It acknowledges that channel incision can be regulated but then proposes only an unenforceable implementation standard of ≤15 cm scour. Our abilities to measure scour during winter floods are very limited and not very accurate and the measures necessary to reduce or offset such scour are limited to long-term extraordinary watershed-wide control of peak runoff.

The Increased Runoff problem:

- A subset of the implementation issues involves increases in peak flows. The Staff Report acknowledges that increased peak flow storm runoff contributes to in-channel erosion and channel instability. With the exception of urban areas

with stormwater management plans, this problem is not addressed by the simplified approach of attempting to regulate sediment to 125% of background. The entire issue of upland sediment non-point source control to achieve the target sediment yield level is not adequately addressed. If dirt roads are seen as a primary source of sediment, how does the Regional Board expect the County and private landowners to regulate this source? If road miles are seen as a proxy for rural development, then that development itself needs to be regulated because focusing only of overland sheet flow from roads will be ineffective.

- To simply focus on primary sediment sources without simultaneously looking at control of increased peak flow frequency and magnitude does not provide the tools for adequate implementation of this TMDL. The North Coast Regional Board has determined that peak flow increases are proper targets for regulation (see North Coast Regional Board Freshwater Creek resolution R1-2006-40, § 19b and 39-67).
- The Central Coast Regional Board has is proposing to adopt a "land disturbance" regulation to achieve their sediment TMDL for the Pajaro River watershed (Resolution R3-2005-0132). That TMDL implementation plan requires compliance with a new land disturbance prohibition for sediment within the Pajaro watershed. In that case, multiple county jurisdictions and differing county concerns may have led that Regional Board to choose this different implementation strategy. However, the basic issues of legacy sediment sources and inadequate county expertise are the same, and an overlay of Regional Board monitoring and review of Napa County ordinance implementation seems necessary to achieve Basin Plan goals.
- Road-related upland sediment sources may include both dispersed sheet-flow erosion from dirt roads and concentrated road-ditch and road prism erosion. The Staff report recognizes these but does not propose an implementation plan that can effectively deal with remote rural roads.
- The Staff report recognizes the necessities of a riparian zone focus to protect and enhance mainstem and lower tributary riparian zones and establish functional setbacks to reduce sediment input and protect spawning gravels. This could be done with an implementation plan that focuses of streamside restoration and riparian setbacks. Such a plan should be at least as important as the almost impossible goal of reducing private dirt road runoff contributions.
- Upland road-related sediment source control and road-related flood routing are not readily regulated. If the County requires lined ditches and lots of culverts on rural dirt roads, they will then exacerbate faster flood routing and greater channel scour, while trying to reduce fine sediment discharge. The best fine sediment control is a reconnection of the floodplain to trap sediment at the bottoms of tributaries.

CONCLUSIONS

The proposed sediment TMDL is the result of comprehensive good research but its focus on in-channel fine-grained sediment to the exclusion of other more easily regulated parameters such as riparian zone stabilization, reconnecting flood plains to the mainstem river and peak flow increases creates serious doubts about the

effectiveness of the TMDL to meet Basin Plan goals and standards. The Regional Board's approach as explained in the Staff Report summary statement is "*To achieve the 125% of background sediment TMDL controllable sediment delivery resulting from human actions needs to be reduced by 50% from the current proportion of the total load.*" The key word there is "controllable". The approach chosen is to address primarily erosion control at the source rather than capture in the valley. This approach is difficult to implement and enforce, and a multipronged approach of sediment source reduction, including reduction of sediment generated by peak flow effects on channel stability, coupled with restoration of natural riparian system functions to trap and disperse sediment has a much higher probability of success. The Staff Report concludes that funding for channel restoration is difficult to obtain and thus fall back to upland sediment source reduction. It does, however, recognize that:

> *Problems associated with channel incision, related rapid bank erosion, and loss of essential habitat features, reflect and integrate multiple historical and ongoing disturbances, some of which are local and direct, and others are indirect and distal. Effectively addressing these issues will require cooperative and coordinated actions by multiple landowners, working with public agencies, over significant distances along the river. The most effective means of controlling channel incision and related fine sediment delivery to the river is a channel restoration program that reestablished width-to-depth ratios and sinuosity values conducive to formation of alternate bars and a modest floodplain. The Water Board will work with stakeholders along Napa River, through local stewardship groups, to implement such channel restoration/habitat enhancement projects.*

This is good language and good intent and does address the real issues. But it is not part of the TMDL implementation program. It should be.

The basic standard of 125% of background is reasonable as presented, but the estimates of background are based on USLE models that were not verified in the time frame for development of this TMDL and probably underestimate actual long-term background for highly episodic sediment runoff events. Thus, the actual numbers and the estimate of 50% of human contributions are potentially far outside of the range necessary to restore biotic and water quality parameters.

The models used to estimate background sediment contributions appear to underestimate inputs from channel bank erosion. Those estimates were based on 1980's grain size distributions for bed and bank deposits collected at several locations along Napa River (Staff Report, p 26) and do not appear to represent the more recent trends in riparian zone clearing and *de facto* attempts to stabilize channels.

Respectfully Submitted

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