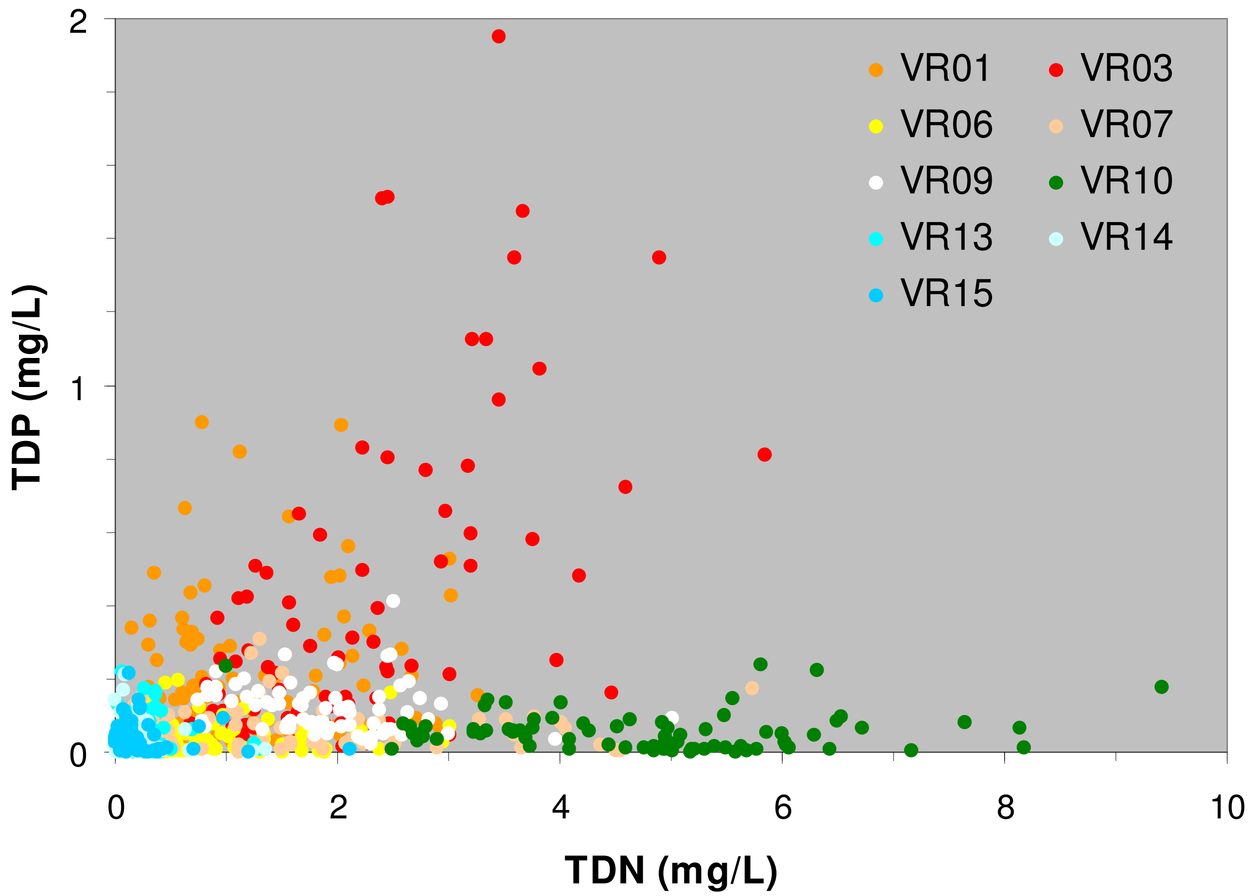
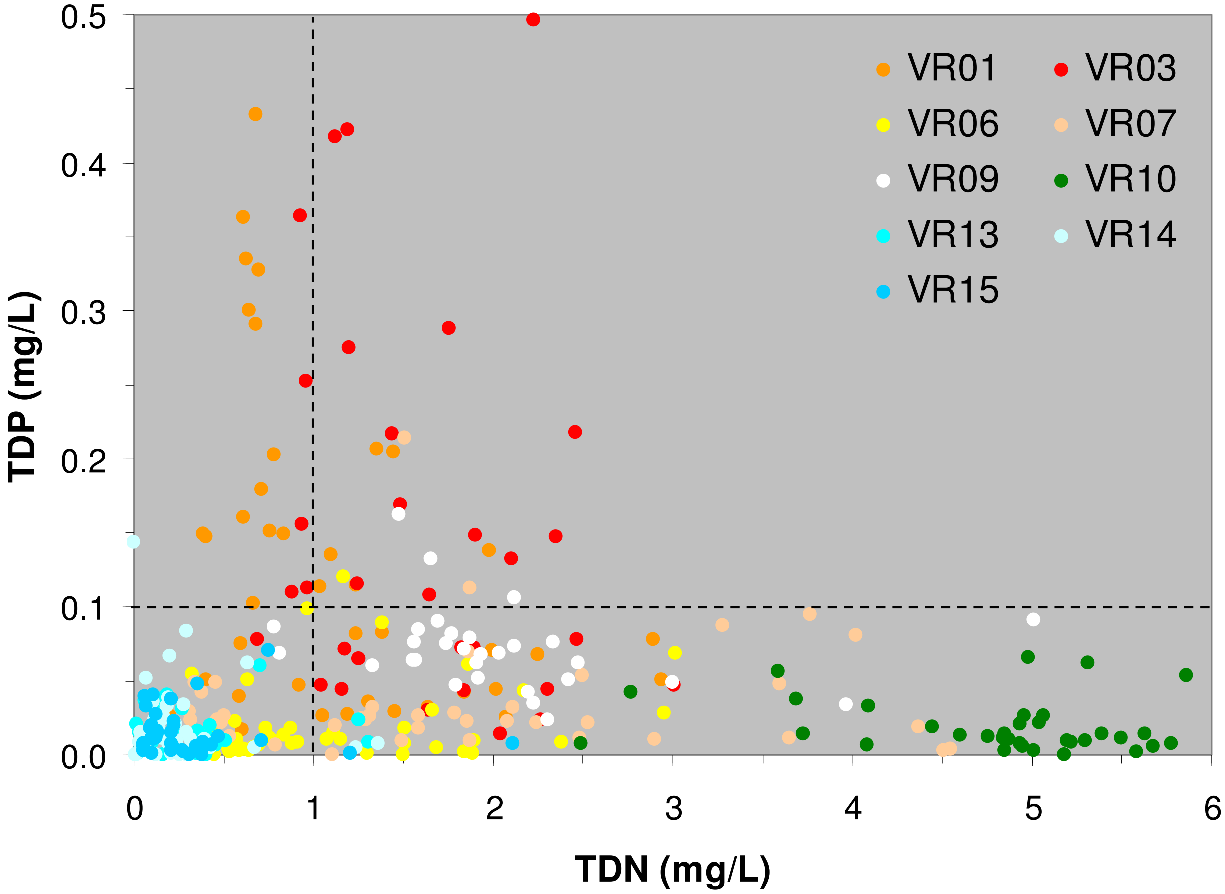


This graph is in response to a question by Diana asking whether or not I've ever plotted Channelkeeper monthly nutrient data in an N-P space, i.e., with nitrogen on one axis and phosphorus on the other. Diana thought the results just might say something profound. The short answer is no, I never have. One, because it's a lot of data and I'm pretty lazy, and two, I didn't think it would tell me anything I didn't already know.

But hey, nothing ventured, nothing gained, so I decided to give it a shot. This is the result – not exactly a eureka moment is it? In order to simplify handling the data I've eliminated all locations that often go dry (VR04, 06, 11 & 12), that seem insignificant (VR08) or that I regard as redundant (VR02). The remaining data shows things we probably already knew: the relatively pristine Matilija sites are grouped close to the zero-zero origin; high phosphate is found below the Sewage Treatment Plant (VR03 & 01) and in urban waters coming out of Ojai (VR09); and the highest nitrate waters are found in locations dominated by agriculture (VR10, and further downstream, VR07).

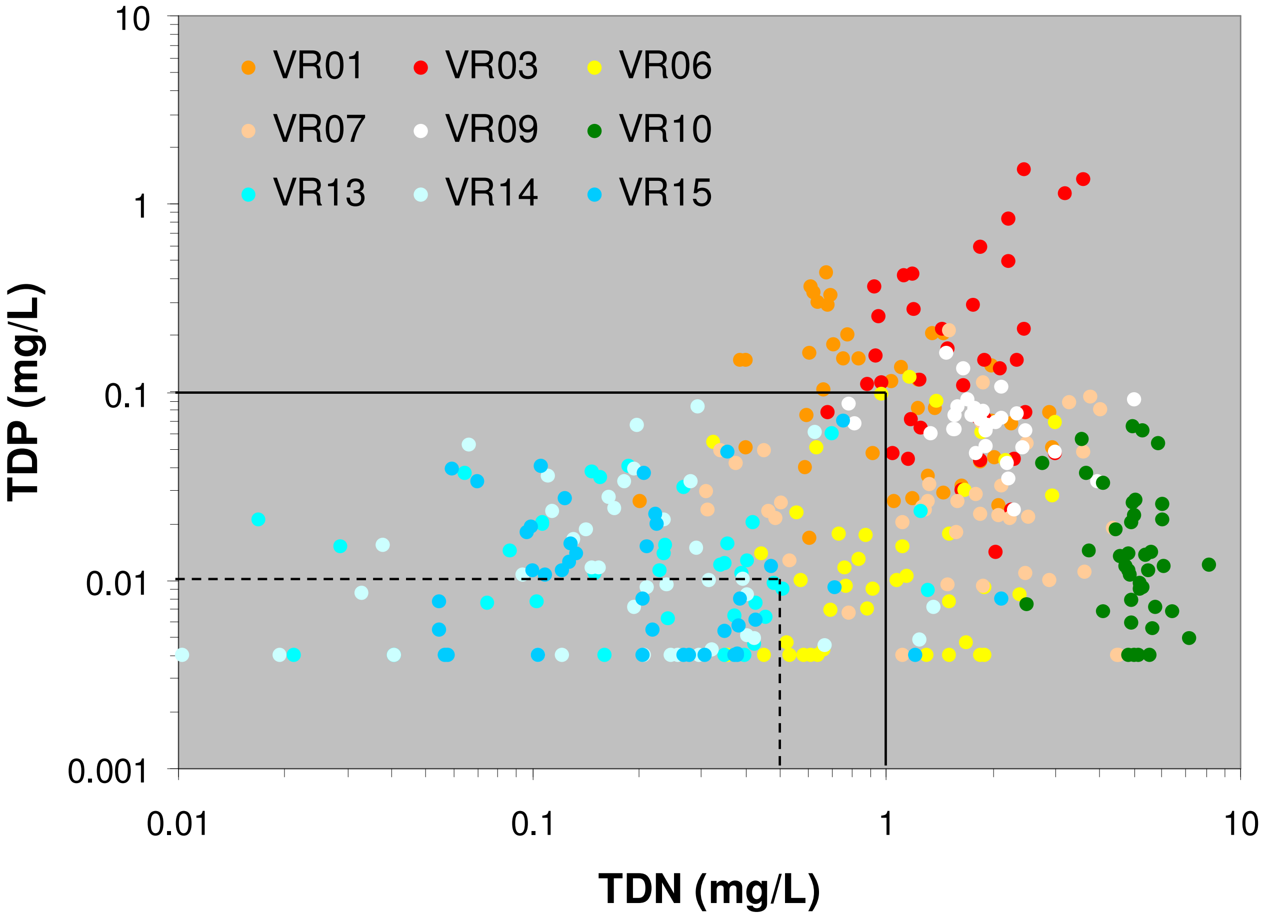
Before taking a closer look I decided to further reduce the mass of data points. The UCSB-LTER lab has difficulty with the total dissolved phosphorus analysis. One problem is that a significant number of samples end up having total phosphorus concentrations lower than those of phosphate (which is analyzed separately). The other problem is that phosphorus and phosphate concentrations showed an, as yet, unexplained step decrease after the big storms of January 2005.

To handle the first problem the graphs show what I term *modified* TDP – TDP concentrations for samples where analysis results show TDP > phosphate, and phosphate concentrations where phosphate > TDP. Thus "modified TDP" underestimates, to some extent, the actual total phosphorus concentrations, but this underestimation is typically small. To address the second problem I've simply eliminated all pre-2005 data. (I have addressed both these problems in mind-numbing detail elsewhere; I'll be happy to send details to anyone masochistic enough to be interested.



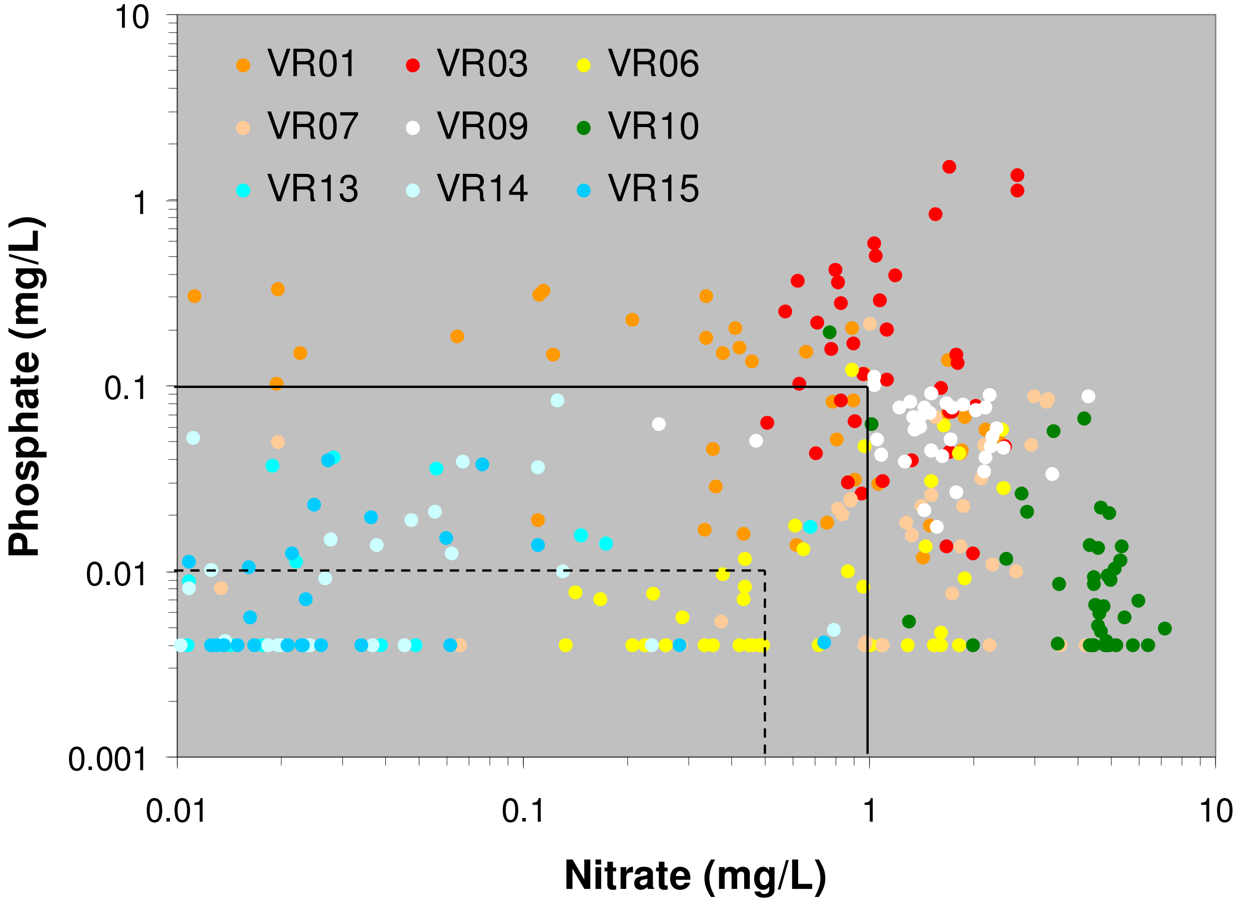
This second graph shows only data collected after the beginning of calendar year 2005. Along with removing slightly more than half the points I've enlarged the scale (losing a couple of extreme values in the process) to better show the data. The overall picture remains unchanged.

The dashed lines represent water quality thresholds from California's 303b Report on coastal waters and wadeable streams. These are not adopted standards, merely guidelines, but they are reasonably close to EPA nutrient recommendations for this area and provide a convenient yardstick. Waters are regarded as high quality if total nitrogen (TN) is less than 0.05 mg/L and total phosphorus (TP) less than 0.01 mg/L; low quality waters are those that exceed 1 mg/L TN or 0.1 mg/L TP. Waters that fall between these limits are considered of moderate quality. Samples that meet the moderate and high quality criteria fall within the box in the lower left-hand quarter. Those that fall without have either excessive nitrogen or excessive phosphorus, or both.



These are the same post-2005 data, but plotted on a log-log scale. I've set limits on minimum TDN and TDP to eliminate zero values, setting concentrations for these samples to roughly one half the detection limit: 0.003 mg/L for TDN, 0.004 mg/L for TDP (i.e., samples showing these minimum concentrations in the chart had undectable amounts of that nutrient – note the line of data points at TDP = 0.004). Using the 303b criteria, waters defined as high quality have nutrient concentrations below and to the left of the dashed line; low quality waters are above and to the right of the solid line; those that fall in-between are of moderate quality.

The conclusions remain the same: Matilija waters are of high quality with regards to nitrogen, of high to moderate quality for phosphorus; upper San Antonio Creek and the river below the treatment plant can be considered low quality with regard to both (with agricultural influenced waters having the highest nitrogen, urban waters the highest phosphorus); and water quality at Foster Park (VR06) is moderate. The removal of nutrients by algae and aquatic plants with downstream flow during the dry-season is shown by the improvement in water quality at VR01 (over VR03) and VR07 (over VR09 &10) – samples from these sites lie on both sides of the solid line. Similarly, algal uptake of dry-season phosphorus on the Matilija branches is probably responsible for the position of these samples on both sides of the dashed line.



Finally, this last graph shows post-2005 data, with non-detect sample concentrations set at half the detection limits, in nitrate-phosphate space. The differences between this graph and the previous one are minor: very low concentrations tend to be spread out in more of a cloud, and transition sites – those further downstream from the primary sources of high nutrient concentrations, like VR01 and VR07, also show greater variation. The reasons are straight-forward, samples with high TN or TP concentrations almost always contain high percentages of nitrate or phosphate whereas shifting percentages of organic forms dominate samples of low concentration. And sites were algal and plant uptake play an important role show a dry-season shift as nitrate and phosphate are transformed into organic forms – which is why we see nitrate and phosphate concentrations at VR01 and VR07 going, at times, to near-zero.