Appendix B
General Applicability of Effluent Probability Method

Some researchers have experienced concerns about the general applicability of this technique and whether or not it should be considered the standard approach for quantifying BMP efficiency. To illustrate potential issues, plots have been developed for TSS from Austin style sand filters.

Figure 1 (Scale is a little unusual in that divisions are 10, 25, 50, 100, 250...) is a plot of the TSS data, which implies that one could expect an effluent concentration of about 25 mg/L, when the influent concentration is about 400 mg/L, or 1 mg/L when the influent concentration is about 25 mg/L. This would be equivalent to a constant percent removal of about 94%. This interpretation is based on the implied relationship between influent and effluent quality that the rank order of influent and effluent concentrations is highly correlated as indicated by the arrows in Figure 1. That is, the highest influent concentration is from the same event as the highest effluent concentration.

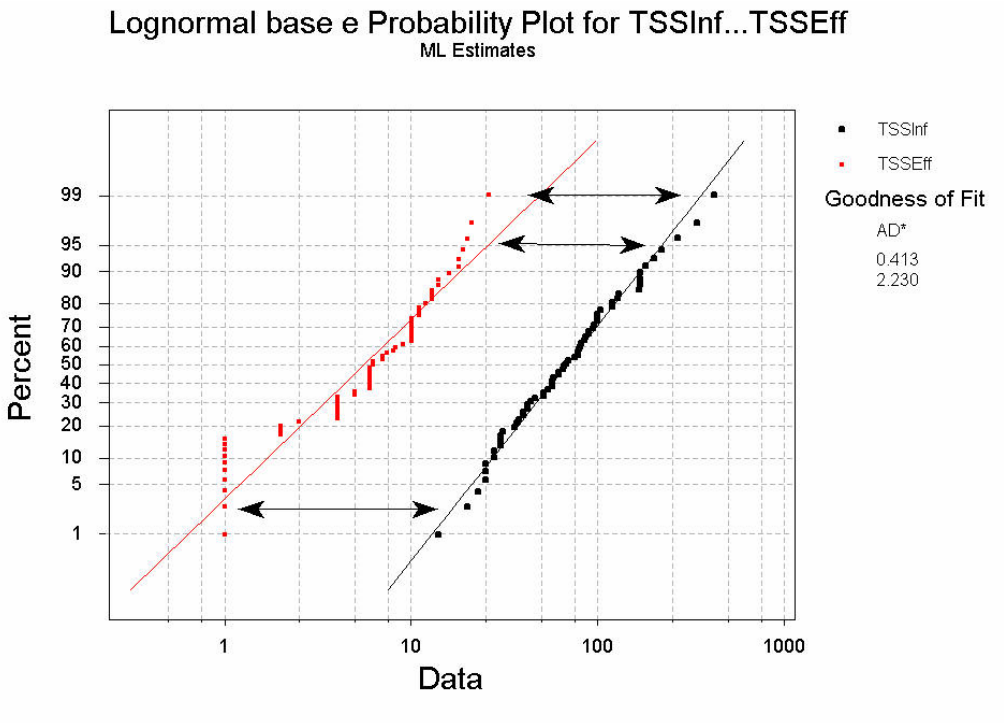

Figure 1
Implied Meaning of the Probability Plot Method

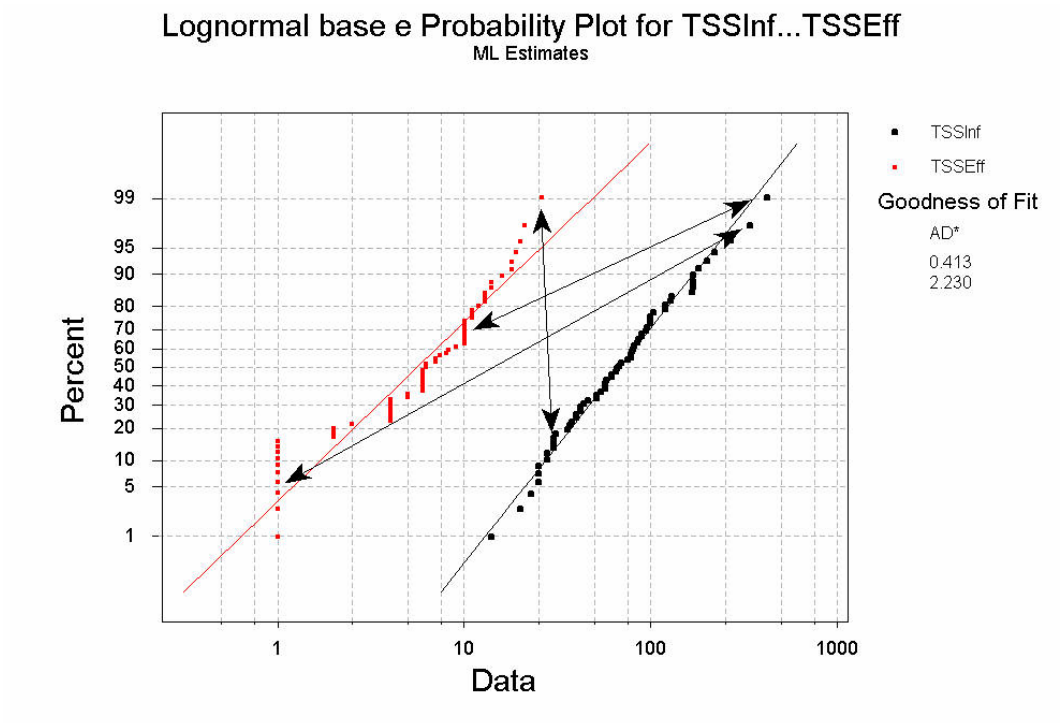

Figure 2
Probability Plot showing Actual Paired Values

This assumption is not valid for this data set. As shown in Figure 2, the arrows connect the actual paired values, so that one can see that high influent concentrations may be associated with effluent concentrations that are at or near the lowest levels observed in the study.

The paired values are plotted in Figure 3, which indicates no statistical relationship between influent and effluent concentrations – not unusual for sand filters. This type of plot indicates much more clearly that the effluent concentration is relatively constant at about 7.5 mg/L, regardless of influent concentration. This regression on EMCs, which is similar to the ROL described in the protocol seems to meet most of the requirements for linear regression, concerning residuals, etc., and better defines the expected behavior. It may be more suitable to perform the regression on concentrations, since the impact of amount of infiltration, which is a function of storm volume and antecedent moisture conditions is eliminated. In the past, the rejection of regression as a potential methodology was based on the results of single study, rather than widespread application on a number of technologies and sites. In this example, regression has been applied to a number of Caltrans BMP technologies and sites. An example where influent and effluent concentrations are correlated is shown in Figure 4 for TKN (with 90% confidence interval for mean and individual predictions).

(Note: 95% statistical certainty is a common threshold in studies to determine significance; however, because of the high variability in stormwater and the paucity of data, a 90% confidence interval has been used. It may be appropriate to raise that level as more data become available for analysis.)

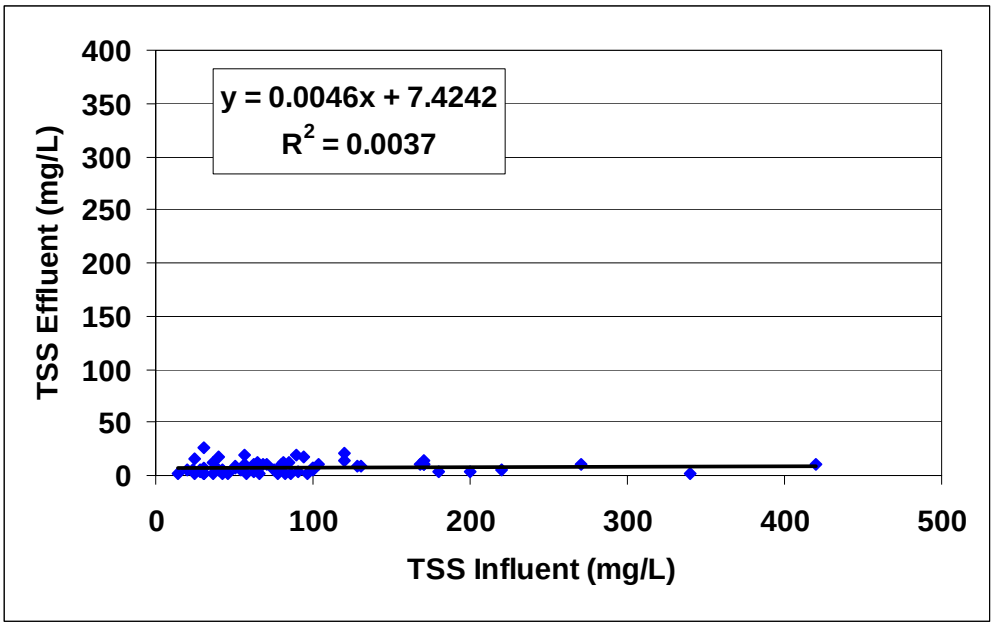

Figure 3
Relationship between Influent and Effluent TSS Concentrations

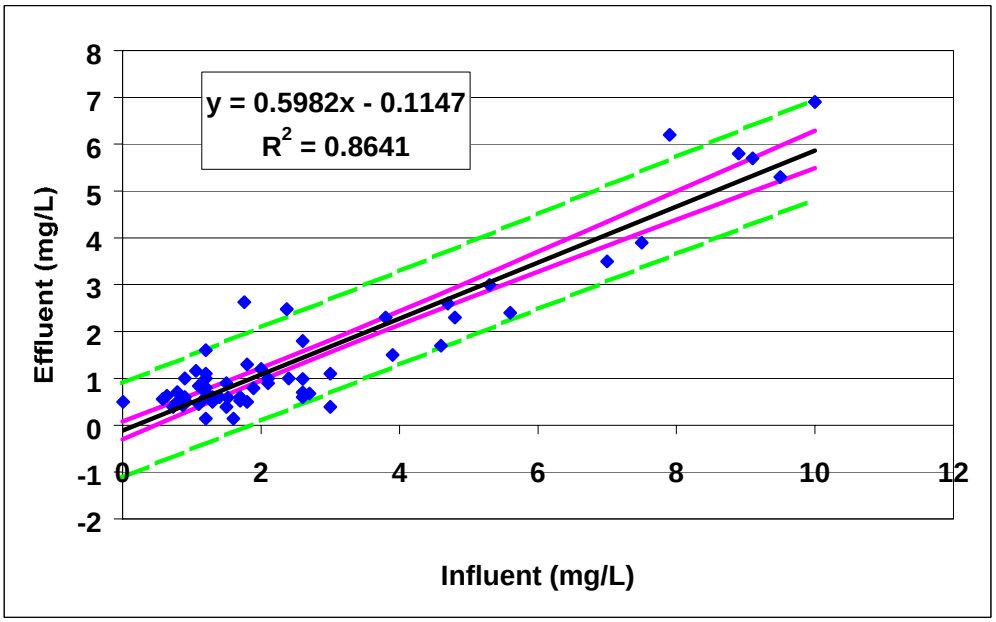

Figure 4
Relationship between Influent and Effluent TKN Concentrations

Another concern is that the effluent probability plot alone does not necessarily provide sufficient information for BMP selection. In Texas and other areas, there are regulations that require removal of 80% of the TSS resulting from development. Using the effluent probability plot alone, it may be difficult to see how one would determine if a BMP was capable of meeting this standard or other performance standard.