Float Calculation

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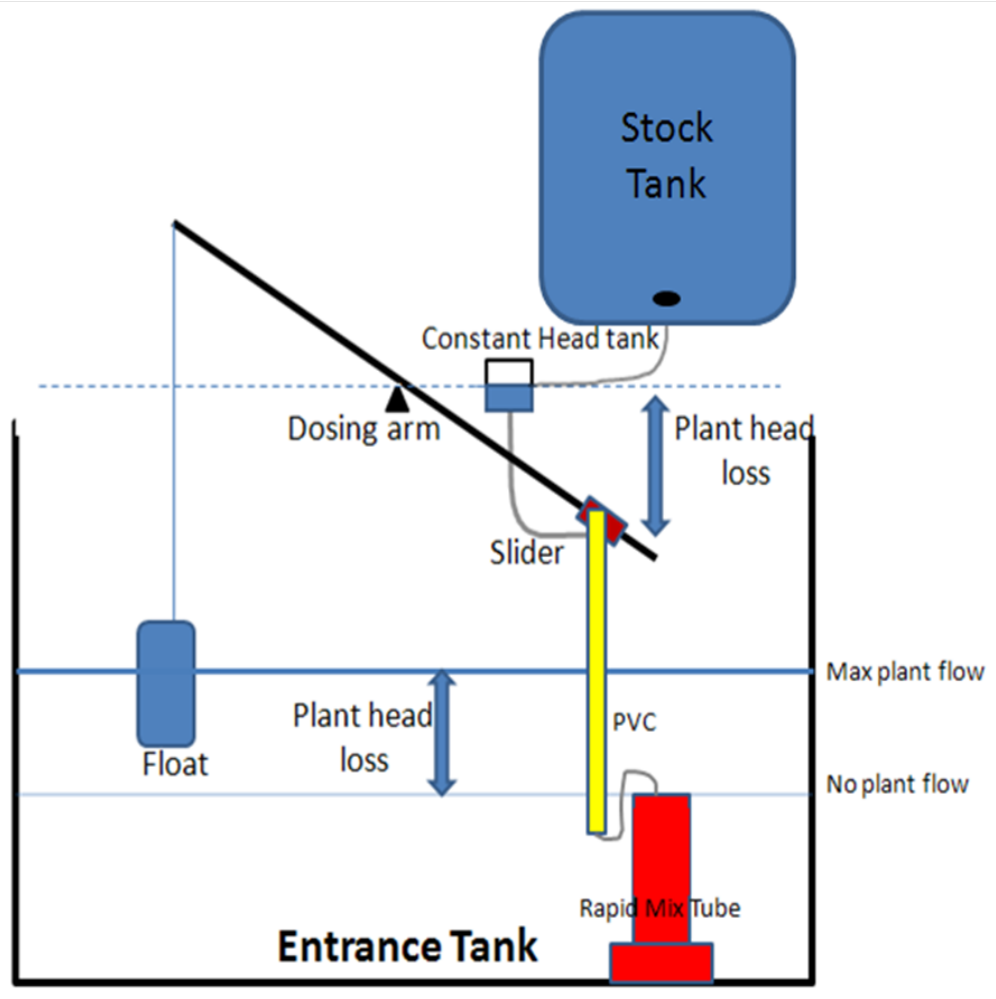

Figure 1: Lever arm/float orientation

Abstract

In the fall semester of 2009, the Non-linear Chemical Doser team developed a Mathcad file to help plant operators choose a float given a non-linear dosing system. This float will ensure that the angle of the lever arm will be kept at the proper position to ensure the accurate dosing of alum as the plant flow rate is varied.

Method

An essential element in the calculation of float parameters is determining the weight of the float in the dosing system. The proper float weight is important since it ensures the stability of the float in the entrance tank. As in any stable hull, the force of buoyancy of the displaced water needs to be above the center of gravity on the same vertical line. This concept is shown in the figure below:

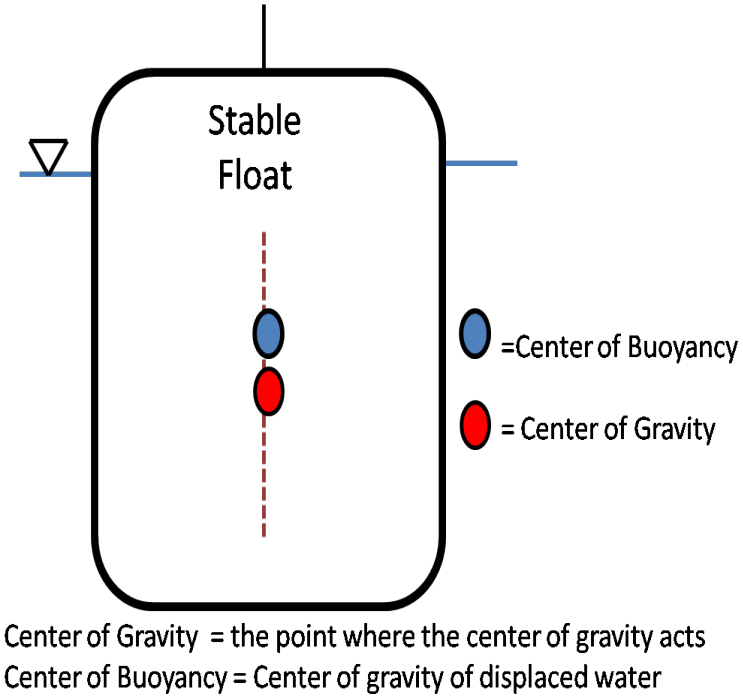

Figure 2: A stable float

In order to perform a quantitative analysis of the float parameters, the float used in Agalteca will be analyzed to determine the how much soil needs to be added to the float to center of gravity below the center of buoyancy. The diameter of the float is 6 inches with its height being 6 inches as well. The more weight is added to the bottom of the float the center of gravity moves down in response. Additionally, as more weight is added to the float it becomes more submerged and the center of buoyancy shifts upwards. A stable float will allow for there to be more turbulence in the entrance tank without causing float instability.
Without any soil added to the float, the center of gravity is well above the center of buoyancy and would cause an unstable float. If 1.75 pounds of dirt is added the center of gravity should just be below the center of buoyancy. The upper bound to the amount of soil added is the submergence of the float. If around 4.1 pounds of soil is added the float will be completely submerged and would sink in the water rather than floating.

Conclusion

In order to make the center of gravity be below the center of buoyancy, to increase stability, it is recommended to add 1.75 pounds of dirt to the float. Any additional weight of dirt will contribute to its stability but will result in increased levels of submergence. If too much dirt is added, above roughly 4.1 pounds, the float will sink.