Residuals Management

December 12, 2011

Abstract

The AguaClara facilities produce residuals from the entrance tank and sedimentation tank, high turbidity waste water from back washing the filter, and chemical waste from preparing chlorine solutions. These waste streams have been ignored by AguaClara because they are largely innocuous. Previous research excluded the possibility of on-site residuals treatment, but some sort of management plan should be selected before issues of scale arise with larger AguaClara plants. As yet, the most environmentally sound option is to reduce erosion at residual drain outlets using rock-lined pipe outlet protection structures. These designs need to be improved and then implemented, with feedback from Honduras indicating whether these structures should become part of the AguaClara design tool.

students 0.5 to 1

skills 4540

1 Introduction

Research during the fall of 2011 indicated that lagoon or drying bed dewatering of AguaClara plant residuals is not feasible, due to the poor dewaterability of alum sludge, large amounts of influent rainfall, lack of polymeric coagulants, lack of a natural freeze/thaw cycle, and concern about the possible provision of breeding habitat for disease-spreading mosquitoes. Irrigation using residuals flows was also deemed infeasible, due to issues with soil phosphorus limitation, possible aluminum toxicity, and the lack of any nearby crops that need to be watered. Full explanations of this research can be found in the Fall 2011 Residuals Management Research Report.

It was determined that rock-lined pipe outlet protection structures would be an inexpensive, simple addition to AguaClara design that could minimize the erosive energy contained in residuals flows, reducing the chance of spike inputs to nearby receiving waters. A design procedure similar to that used by several United States Departments of Transportation was used to approximate the necessary dimensions of the structure and of the required stone, but work must be done to prevent downhill flow reconcentration and erosion of the uphill

wall of the structure. It may be easiest to build one structure at an existing plant and analyze performance before moving forward.

2 Tasks

1. Analyze the pipe outlet protection structure design process and decide how best to reconcile the differences between the dimensions predicted by the process (which is meant for flows much larger than those that AguaClara experiences) and what is actually required. Overdesign could result in wasted labor, as mentioned in the Fall 2011 research report.

2. Assess the possible design difficulties that may arise by placing a pipe outlet protection structure on a slope, such as:

   (a) Erosion of the uphill wall of the structure, which could introduce outside soil into the rock spaces or cause a collapse sufficient to block the residuals drainpipe exit.

   (b) Flow reconcentration at the downhill end of the structure, which could neutralize the beneficial effect of the structure by causing further downslope erosion.

3. Advise the construction of a pipe outlet protection structure at an existing AguaClara plant in Honduras, preferably at a site with a relatively low design flow and a sufficient amount of rock located on-site.

4. Communicate with AguaClara and APP engineers in Honduras in order to gauge the performance, and, ultimately, the necessity of the structure. Determine whether the beneficial effects are able to more than offset the costs of labor and construction.

5. Make any necessary corrections to the pipe outlet protection structure Mathcad file, add a description of our guidelines to the design specifications document delivered by the AguaClara design tool, and if there are additions to the design, then create the necessary drawing scripts.