Sedimentation Tank Design Details

by Paroma Chakravarty and Tiange Guo

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Problem Definition

Introduction

This semester, our task is to update the sedimentation tank code. Our first priority will be taking parts of May's sedimentation tank code (see figure 1) and merging them with the current sedimentation tank code (see figure 2). Some examples of these changes are ensuring the inlet pipes are entering the tank at a ninety degree angle, making sure that the elbow and vertical pipe are buryed in concrete, and then ensuring that these changes do not effect the floc hopper. Additionally, some recent updates from Honduras need to be coded into the design. Details such as adding more feet (see figure 3) to the inlet manifold pipe, making the floc weir out of concrete, deleting the inlet manifold support platform, and burying the emergency drainage pipes in concrete need to be added to the merged code.
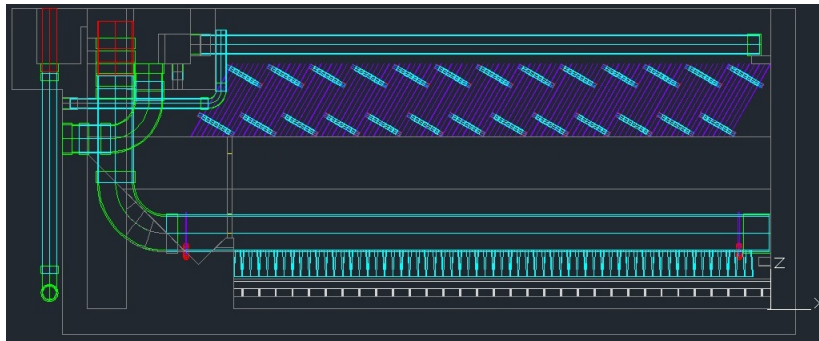
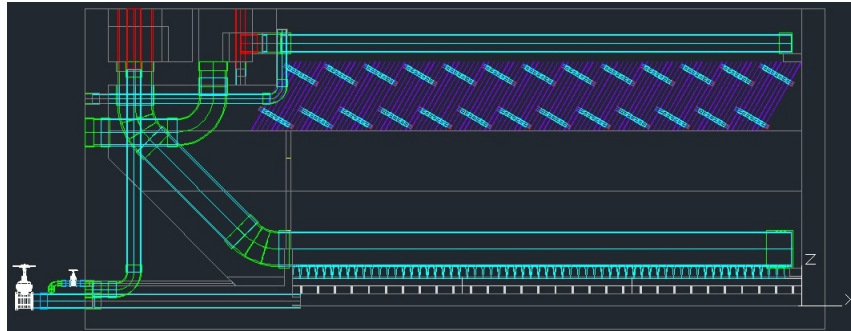

Figure 1: The Drawing of May's code

Figure 2: The drawing of the current code

Figure 3: Manifold Feet created by a AguaClara Fabrication Team

Design Details

Last semester our subteam focused on using May's sedimentation tank code to make updates such as creating feet to support the inlet manifold and shifting the inlet jet; this semester we focused on identifying the differences between May's and the current sed tank code and merging them to create a new code. An initial survey of May's code showed that there were some parts of her work that were more favorable for merging; specifically, we left the inlet and exit channels in their original form found in the current sed tank code, but altered the inlet manifold pipe to May's design. Merging those two codes needed more reference checking because simply copying the different parts from May's code to the current code was not feasible due to the different dimensions used in the design files. The challenge was in identifying which dimensions were different and why. One difference we found was in the length calculations of the pipes in the sed tanks. The dimensions in May's code tended to be shorter than the current code, so we had to standardize which dimensions to use. Because

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the current sed tanks dimensions had been used for a while and there have been no requested design changes with that specific part, we decided to use the dimensions from the current sed tank design file. After we merged the codes, we returned to the design challenges to code in updates made to the sed tank.

Documented Progress

Inlet Pipe and Diffuser Length

To ensure the inlet pipes were entering the sedimentation tank at 90 degrees, we eliminated the 45 degrees inlet pipes and two elbows in the current sed tank code. This created the issue of an incorrect length calculation of the inlet manifold. Going back to the current sed tank design file, we found that the length calculation was correct intially in the file, so our task centered around identifying where later in the design file or code the length was redefined. We found the issue in the area where the inlet pipe used to follow the concrete slope of the tank. The length of the entire pipe had been recalculated to account for the sloping part of the inlet pipe, so eliminating this calculation allowed for a correct length calculation. Once the horizontal part of the inlet pipe was coded, we noticed that we needed to code in a 90 degree angled elbow and a vertical inlet pipe. May's code also calculated the length of the diffusers in a different way than the current sed tank reference file; Monroe editted the current reference file later in the semester, so his method was used in the merged reference file. These additions were easily added from May's code with dimension calculations from the current design file. With the addition of a smaller coupling than currently found in the sed tank, our inlet manifold was finished.

Support Feet

As with last semester, the feet do not quite fit flush against the slopes of the sedimentation tank. We worked with Julia on determining alternate methods of calculating geometrically feet lengths, but the new methods did not seem to function better than what was already written. After working with the code for a few days, we determined that the current calculations were sufficient and that the exact feet lengths would have to be determined during construction (Figure 4). Since the manifold pipe is quite rigid, there was no need to array more feet and putting them only at both ends was sufficient. Specifically, the other pair of feet should be put on the right side of the floc weir since buring the left side part of the manifold under the concrete will make it pretty stable. Once the feet were in place, a support platform that kept the manifold upright was no longer needed, so we simply deleted it under the "Sedimentation Tank Concrete" section.
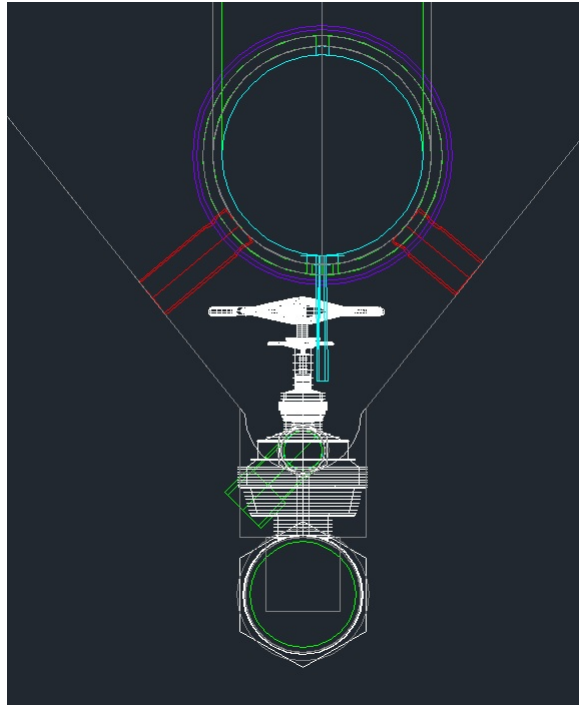
Figure 4: The current feet

Sedimentation Exit Launder, Skimmer Pipe, Exit, and Inlet Channel Fittings

After correcting the inlet manifold, the coupling for the launder was in the middle of the exit channel and should have connected to the sedimentation launder and be flush with the inner side of the wall. The fitting for the inlet and exit channels and the length of the skimmer pipe were also off. Fixing these issues was a matter of determining where in the code each piece was drawn and ensuring the correct dimension was being used. Using the dimensions and drawing methods from the current sed tank design file, the issues were corrected. This, with the feet and inlet pipe, created the new design (figure 5).
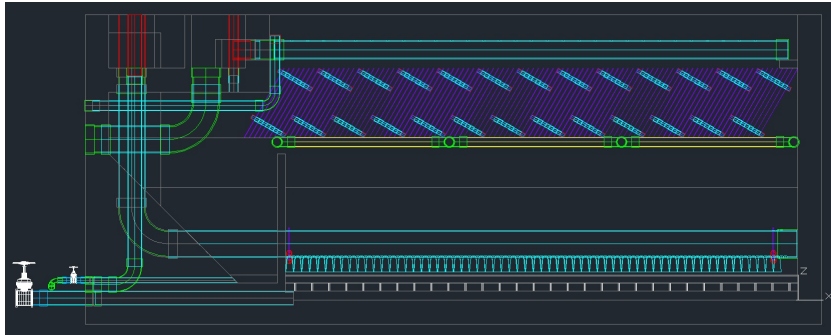
Figure 5: The updated current sedimentation tank

Burying the Emergency Drainage Pipe

Our visit to Honduras showed us that the emergency drainage pipe was drawn too close to the wall and that during construction it was difficult to plaster around it. It was decided that the easiest solution to this issue would be to bury the pipe in concrete and eliminate the need to reach behind it. In order to do that, we coded a box around it under the "Sedimentation Tank Concrete" section. The box is unioned with existing tank concrete. For the x-origin of two vertexes of the box, the higher vertex was set to be plant origin minus sed tank length and the lower vertex was set to be plant origin minus sed tank length plus inlet channel width and wall thickness because the box was supposed to have the same width as that of the inlet channel and it should also be against the side tank wall. Similar placement methods were used to place the y and z origins of the box (Figure 6,7).
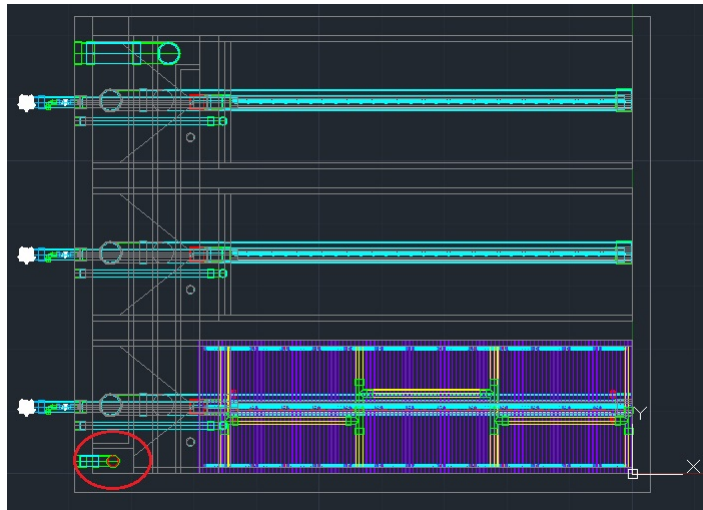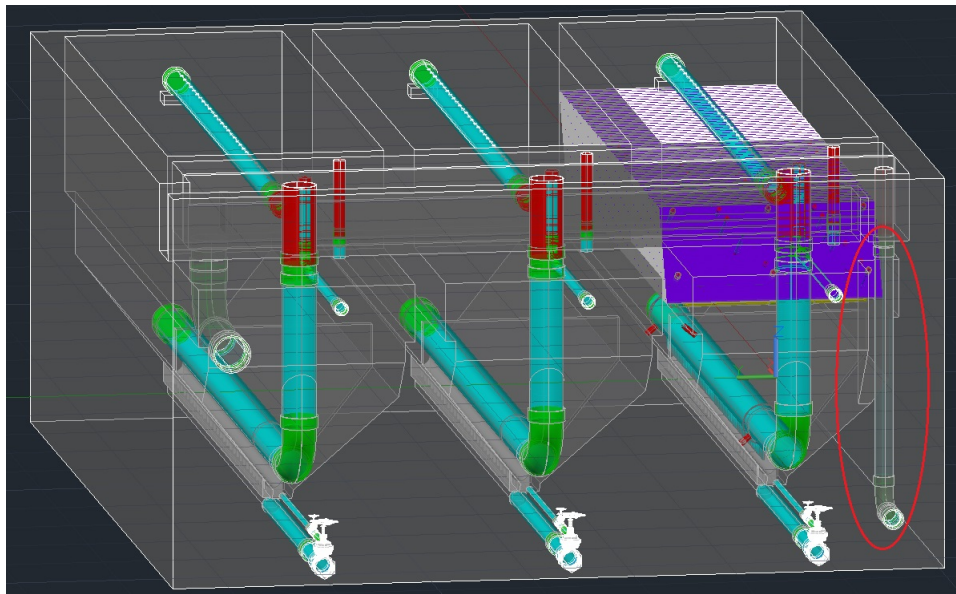
Figure 6: top-view of the drainage pipe box

Figure 7: x-ray view of the drainage pipe box within the sed tank

Positions of the Manifold Vertical Pipe and the Launder

Since we shifted the inlet manifold over using our new space variable, the positions of the manifold vertical pipe and the launder were a little off compared

to the manifold from the side view in the AutoCAD drawing. In order to fix positions of the manifold vertical pipe and its fittings, we changed the y-origins to the same as that of the manifold pipe. The launder should be in the middle of the bay, so we summed up y-origins of two vertexes of the support platform concrete box and divided by 2, which was be the y-origin of the launder and its couplings.

Floc Weir Concrete

To make a permanently installed floc weir out of concrete, we deleted the entire "Floc Weir Baffle and Slot" section and coded the floc weir concrete under the "Sedimentation Tank Concrete" section. The concrete floc weir is drawn as a box which has the thickness of inlet channel wall thickness (5 cm) and the width of a bay plus two times the inlet channel wall thickness. The box is at the height of the floc weir with its bottom at the same height as the manifold pipe. This created an issue over whether to include our space variable from last semester or not. After some observations of the nearby pieces and how they were drawn, we decided not to change the height of the box bottom (Figure8, 9). A part of this design update included ensuring that a person could fit between the floc weir and the bottom of the inlet and exit channels. To measure this distance in the code, we took the height of the inlet and exit channels minus the thickness of the channels and the height of the floc weir. This distance was about 38 cm, so it should be enough for an operator to fit in between the two concrete sections.
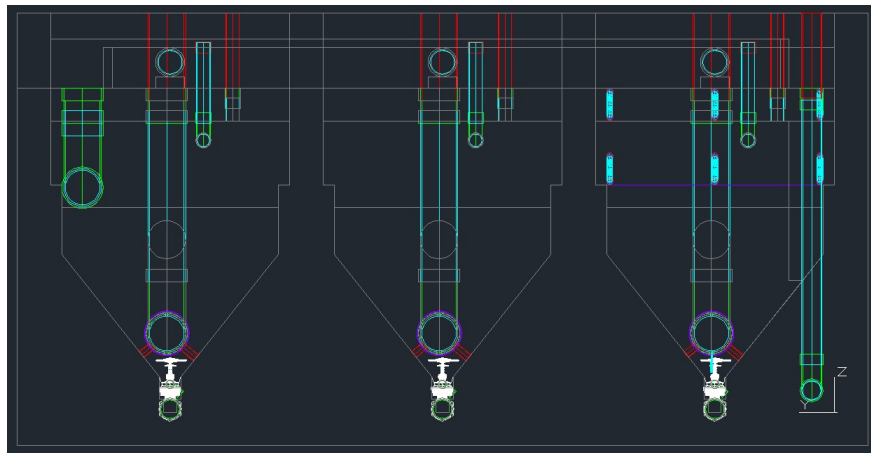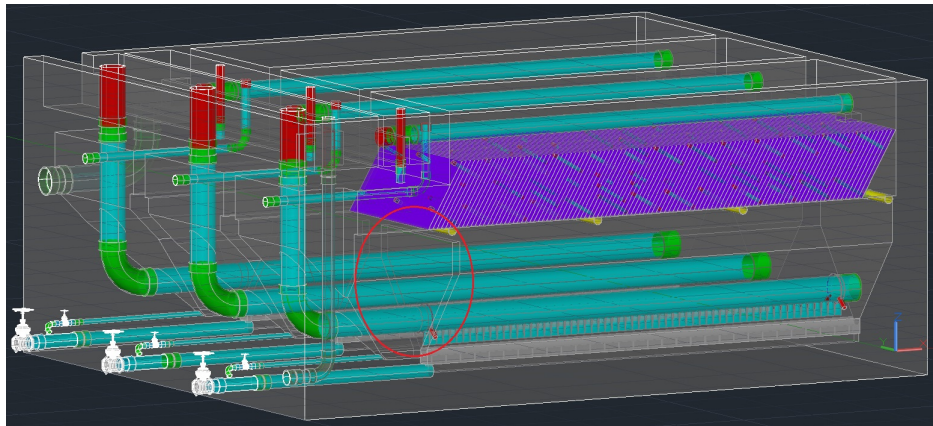

Figure 8: Floc Weir Concrete

Figure 9: Floc Weir Concrete in X-Ray View

Future Work

The sed tank is continually evolving and updating, so future teams should focus on implementing these changes in the code. The first change should be to taper the inlet channel to prevent flocs settling at the end of it where the velocity is low.