Dear Editor

Thanks for your comments

Following are the comments to the Author:
“The reviewers all suggest minor revisions, and a substantial improvement of the English and proper attention to SI units. Please prepare your revision.”

Response:

The English improved properly with a native editor as you can see the follows. All the units converted to metric system.

Order of the authors changed also, please consider that.

Numerical Analysis of the Circular Settling Tank

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Abstract. Nowadays, settling tank's removal efficiency is one of the most crucial matters for~~in~~ all Water or Wastewater Treatment Plants (WTPs or WWTPs). The unit can affect WWTP performance and improve the provided effluent quality~~ provided~~. In this paper, the geometrical aspects of a settling tank were numerically analyzed via tracer curves, the finite volume method, and Ansys-cfx software in which, the baffle depth and diameter of a settling tank were assessed. Firstly, a previous study was similarly remodeled to verify ~~the~~ simulation results. The impact of tank depth variation has been numerically assessed where the outcomes showed that a deeper tank could raise discharge time or the Hydraulic Retention Time (HRT). Thus, extensive discharge time may result in less polluted effluent degrading more solids. However, the tank should not be too deep based on costs~~considered too deep regarding economic issues~~. Moreover, the differential effect of baffle height was analyzed and indicated that lower height is more useful to boost the HRT. An i~~I~~nvestigation of tank diameter changes also revealed that wider diameters bring about a broader HRT.

Keywords: Settling Tank, Tank Depth, Tank Diameter, Tracer Curve, Finite Volume Method.

1. Introduction

Over the past decades, Water and Wastewater Treatment Plants (WWTPs) have drawn governments~~'~~ attention to water, especially, environmental hazards originating from grey and sewage runoff throughout urban areas. In this regard, treatment processes can be optimally designed and operated. Therefore, one of the most critical stages in WWTPs is sedimentation in settling tanks, ~~used ~~to degrade and ~~to ~~remove organic matters and solids. Looking at research~~Turning to the research background~~ shows that several models have~~ been addressed to~~ simulated and analyzed the sedimentation process numerically. T~~In an attempt t~~o simplify methods, some assumptions were effectively used to evaluate flow pattern movement, as well as solids and particles in settling tanks.

According to previous studies, mathematical models are often applied instead of analytical solutions~~ ones~~ to reach precise flow characteristics (Imam et al., 1983). Moreover, three methods are suggested to have an

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appropriate description of flow pattern movement and characteristics (Kynch, 1952). Firstly, the one-dimensional model is introduced in which solids vertical movement is considered (Kynch, 1952). Secondly, the two-dimensional model is presented for~~so the~~ vertical~~ly~~ and horizontal~~ly~~ solid~~s~~ movement~~ described~~. The matter which was once used to simplify the three-dimensional model (Imam et al., 1983). Ultimately, the three-dimensional model~~ is another way of description having~~ has more benefits thanks to orienting the flow pattern. Liu and Garcia ~~were ~~developed a three-dimensional (3D) numerical model to simulate large primary settling tanks in which a tracer study was used~~applied~~ to investigate the tank’s residence time (Liu and Garcia, 2010). The model was implemented on a settling tank in Chicago ~~where locates ~~in t~~T~~he Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). Through the case study, a computational fluid dynamics (CFD) model simulated solid~~s~~ removal efficiencies. The results of the research model were used to establish the design basis for tank side-water depth and~~,~~ inlet feed-well dimensions, etc. Liu and Garcia model outcomes can be capitalized on to decrease the cost of construction via optimized settling tank.

Vahidfar et al. in 2018 investigated and modeled a rectangular settling tank in full scale by CFD method to increase~~ its~~ efficiency. (Vahidfar et al. 2018). Zahabi et al. also in 2018 numerically investigated the geometry of rectangular reservoir to entrap sediments, and they found the optimum geometry (Zahabi et al. 2018).

There are a wide range of parameters which can effect~~be effective on~~ settling tank~~s'~~ performance. To illustrate that, the Reynolds number, flow viscosity, the type of hydraulic flow movement, and tank dimension and design are the most significant factors in the settling unit. Schamber and Larock ~~were ~~once used the K-ε turbulence model~~ in order~~ to simulate the settling stage applying for high Reynold's number and turbulent flow (Schamber and Larock, 1983). According to the study, coarse solids with high specific weight ~~leads to an ~~increases the~~in~~ Reynold's number; therefore, this type of model is~~s are~~ typically conducted for a settling unit. Furthermore, a study showed that the k-ε turbulence model agreed well with some experiments in a simple geometric~~geometries~~ tank (Adams and Rodi, 1990). The quality of the computations, however, deteriorates with increasing flow complexity. In fact, the effects of flow curvature are mainly applied to clarify the differences between computation and experiment, which are not a part of~~comprised in~~ the standard k-ε model. Also, a mathematical model was used to predict the velocity and particles transport pattern in secondary rectangular tanks. The particle impacts called in terms of bottom current, surface return flow, and the solids concentration distribution of density stratification on the hydrodynamics were analyzed by (Zhou and Mc Corquodale, 1992). Consequently, the model was used~~suggested~~ to simulate the so-called density waterfall phenomenon in the front end of a settling tank.

It is suggested that effluent concentration changes by ~~the ~~velocities in the withdrawal zone (Mc Corquodale and Zhou, 1993). It is also shown~~revealed~~ that there is more upward velocity in the withdrawal zone by decreasing dens-metric Froude number for a constant discharge, showing the relationship between the dens-metric Froude number, and hydraulic and solid~~s~~ loads. The density of the waterfall can capture~~entrain~~ large volumes of the ambient fluid in the physical and numerical models (Zhou and Vitasovic, 1992). Also, the entrainment compensating flow rate is indirectly related to~~has an indirect relation with~~ the dens-metric Froude number. Furthermore, the bottom strength of the current density, the upward flow in the withdrawal zone, and the recirculation all increase as the dens-metric Froude number decrease due to~~ the~~ entrainment into the density waterfall.

Some research ~~are ~~also addressed an array of c~~C~~omputational fluid dynamics (CFD) modeling in the wastewater treatment (WWT) field (Dutta et al., 2014, Daneshfaraz et al. 2016 and Zhang et al. 2016). For instance, ~~although~~ Wicklein et al. have proposed a good modeling practice (GMP) for ~~the ~~wastewater application and it is based on general CFD procedures (Wicklein, et al., 2016, Daneshfaraz et al. 2017).

Settling basins can be divided into two categories in terms of geometry, which are cubic and cylindrical in shape~~s~~. In this regard, circular basins are better than rectangular ones, since~~ in the sense that~~ they need less area for construction.~~, which~~ This might increase rectangular basin~~s~~ hydraulic efficiency (Stamou et al., 1989). In this study, some circular basins are considered as a ~~modeled ~~three-dimensional model to simulate tank~~s'~~ geometry and stream direction. Meanwhile, continuity and momentum equations will~~are going to~~ be analyzed via the finite volume method, and the density change of the particles is ignored. Eventually, the tracer curve will be used to evaluate hydraulic efficiency in terms of basin~~s'~~ depth, and also the tank diameter variation will be studied to assess repercussions.

2. Material and Methods

An increase in settling time results in tank sedimentation efficiency in which considering the appropriate size for a tank's baffle and the weir structure are ~~the ~~two ways to improve tank efficiency~~of tanks' efficiency improvement~~. In this light, baffles may cause returning flow when flow reaches the~~to~~ baffle and weir structure, namely, extending the distance that ~~of ~~flow travels to discharge from the basin tank. In this paper, the aim is to study and evaluate the Chicago~~'s~~ basin tank which was~~were~~ evaluated in 2011 ~~so as ~~to analyze the basin's depth and diameter changes and its effects on effluent quality (Garcia, 2011). In this respect, tank properties are presented in table 1.

Table 1. Properties of settling tank

Parameters	**Unit**	**Dimension**
Tank diameter	(m)	47.24
Baffle diameter	(m)	12.8
Tank depth	(m)	3.66
Baffle height	(m)	1.52
Inlet pipe diameter	(m)	1.37
Bottom slope	-	1:12

~~**Table 1.**~~

The Chicago tank is capable of~~to~~ maintaining flow being treated into the basin by increasing retention time which happens while a~~the~~ weir is considered with a shorter height causing a longer distance for the flow to exist. Therefore, the mechanism triggers to provide more time for settling. On the other hand, the flow is turning when

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it reaches~~ to~~ the baffle wall. In this regard, the process is going to be evaluated via the CEM-CFD model. The ~~number of ~~mesh in the~~considering through~~ model is 12 million rectangular meshes (Tetra Unstructured Mesh), where the larger and shorter bases are 10 and 2 cm, respectively. The tank which was studied by Garcia, and flow lines along with the tank mesh~~es~~ system are ~~being ~~shown in F~~f~~igure 1, 2, 3, and 4. It should be added that geometrical modeling was done by Ansys cfx software in the current study. K-e turbulent model also used for simulation.

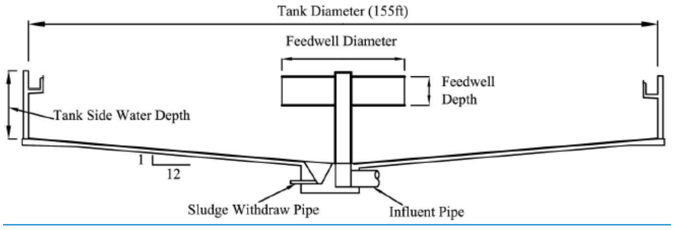

Fig 1. Chicago tank.

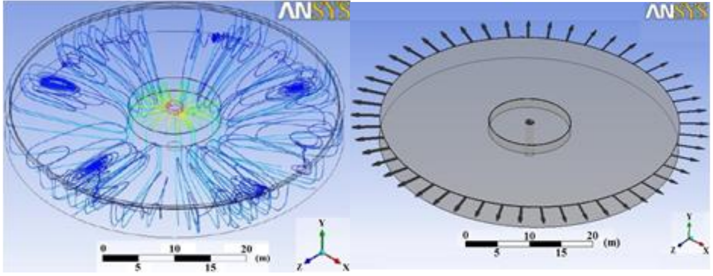

Fig 2. Flow lines and directions in the settling tank.

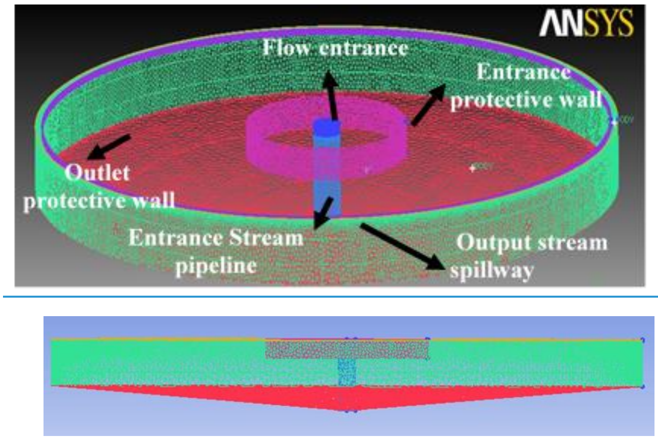

Fig 3. Modelled settling tank.

~~Fig 1.~~
~~Fig 2.~~

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~~Fig 3.~~

T~~In order t~~o simplify the model and ~~to~~ obtain an accurate result, some assumptions are considered, including that the flow pattern is steady.~~,~~ T~~t~~emperature variation is ignored, and flow temperature, density, and velocity are assumed to be constant (T=20 C^o, Flow Density=998 Kg/m^3). In addition, boundary conditions are conducted in three main terms in which the tank's surface is taken to be a~~as~~ slippery surface except for the bottom of the tank.~~,~~ The free surface is rigid and the flow pressure is calculated hydrostatically.~~,~~ R~~r~~elative pressure at the end is zero, and the inlet is velocity radial control.

One way to calculate the settling tank's efficiency is to draw a tracer curve. The method is defined as a way in which the~~a~~ pigment flow is carried out to the influent and then, when the pigment reaches the effluent, the pigment concentration is measured. Following this~~which~~, three steps are taken~~regarded~~ to draw the ~~curve t~~racer curve comprised of solving the flow equation steadily in ANYSY Solver, defining the pigment in the pre-CFXANSYS, and then checking pigment concentrations in the influent and effluent after 3 hours. It should be added that hydrodynamic conditions are expressed in terms of three laws in which the conservation of mass, the conservation of momentum (Newton's Second Law) and the conservation of e~~E~~nergy (the first law of thermodynamics) are considered.

3. Tracer curve method e~~E~~valuation

The m~~M~~aximum time of the flow discharge in the current study will be compared with Garcia outcomes in the same aspect to make~~draw~~ an evaluation (Garcia, 2011). Figure 4 shows the comparison between these two studies in the sense of tracer curves. Table 1 also shows the maximum time of the tracer curves when ~~re~~ tank depths are taken at a~~of~~ 12 foot~~eet~~ depth and two different baffle height of ~~7~~ 2.13 and ~~5~~ 1.52 m~~feet~~ to compare with Garcia's results~~studies reports~~.

Table 2. Tracer curve outcome for the two aforementioned studies

Tank depth (m)	Baffle Height (m)	Time of discharge (hours) (current study)	Time of discharge (hours) (Garcia, 2011)
3.66	1.52	1.19	1.22
3.66	2.13	1.14	1.25

~~Table 2.~~

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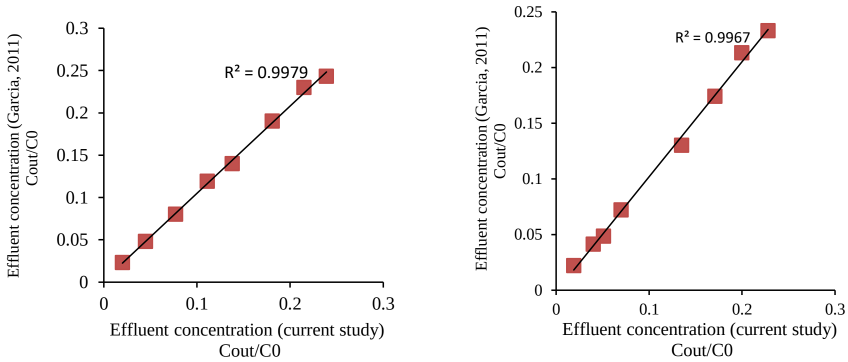

A. baffle height of 5m B. baffle height of 7m

Fig 4. Data dispersion in current and Garcia studies (2011).

~~Fig 4.~~

As ~~it is~~ observed, data dispersion (the current study) is in ~~a~~ good agreement with the Garcia study in which trend lines are going up by a 45^0 slope. Beside this, the standard deviations of both A and B graphs are close to 1. Therefore, modeling of the Chicago tank by a tracer curve is effective and accurate enough to predict other basin tank depths and baffle heights.

4. Result and discussion

4.1. The effect of tank depth variation

The tracer curves evaluate the tank performance where the tank depth (D_t) and the baffle height (D_f) change with~~in~~ a 5-second pigment injection~~ for 5 seconds~~. Then, the pigment concentrations will be measured in the inlet and outlet (effluent) over three hours to find the difference~~ in between~~. Figures 5 and 6 display the tracer curve~~s~~ results for a~~the~~ tank depth variation and baffle height of 1.52 and 2.13 meter, in which the tank diameter is equal to 47.24 meter.

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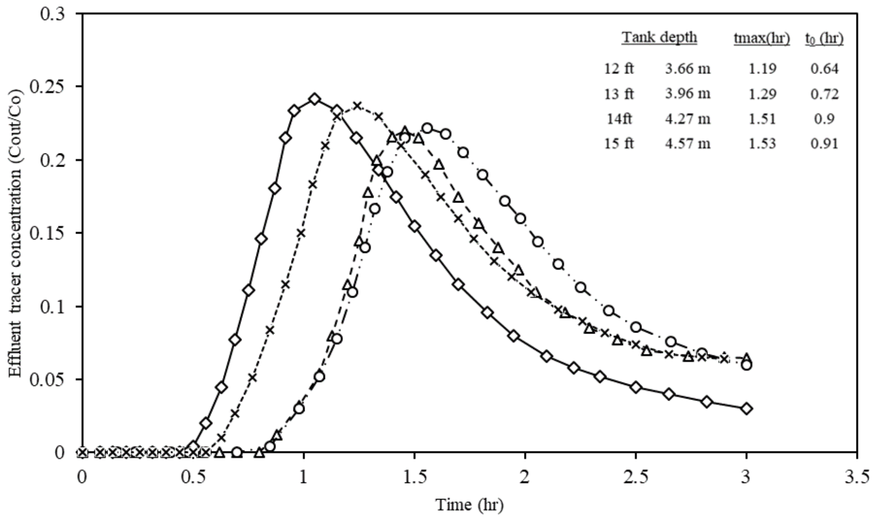

Fig 5. Effluent concentration with a baffle height of 1.52 m in tank depth variations.

~~**Fig 5.**~~

According to Fig 5, as tank depth increases, it takes more time (t_{max}) to discharge effluent. Therefore, the Hydraulic Retention Time (HRT) will rise slightly which~~that~~ is more evident in peak points~~'~~ locations. It is clear from the data given that a 0.34 hr time elapse is observed from 3.66 (1.19 hr) to 1.52 m (1.53 hr) depths peak points distance. Moreover, the greater the~~higher~~ tank depth is, the thinner the gaps between~~ among~~ peak points become~~are getting thinner~~. Particularly, the gap between 4.57 and 1.22 m tank depths is narrower compared with the gap between 3.66 and 3.96 m or even the gap between tank depths of~~though for the tank depths of~~ 3.96 and 4.27 m~~ are~~. If the tank depth is more than 4.57 m, the gap will not be noticed. Thus, tank depths which are more than 4.57 m~~,~~ are not economically beneficial because there would not be excessive time discharge for the tank.~~ and~~ This means that building larger tanks is not cost efficient because it does not have a positive impact on effluent concentration. ~~this imposes more cost to construction of bigger scale tanks which is not effective on the effluent concentration showing on the vertical axe.~~

Furthermore, the points (t_0) where the lines start to have more effluent concentration and the tank is getting filled with pollutions are different. To illustrate that, the~~ tank depths of 3.66 and 4.57m~~ starting points are 0.64 and 0.91hr, respectively, for tank depths of 3.66 and 4.57m.~~.~~ Therefore, deeper tanks get polluted later~~lately~~. Comparing the maximum points' effluent concentration indicates that the C_{out}/C_o ratio falls markedly from 3.66 to 4.57m tank depths given that the optimum tank depth is 4.57m; however, there is not a significant gap between 4.27 and 4.57m depths.

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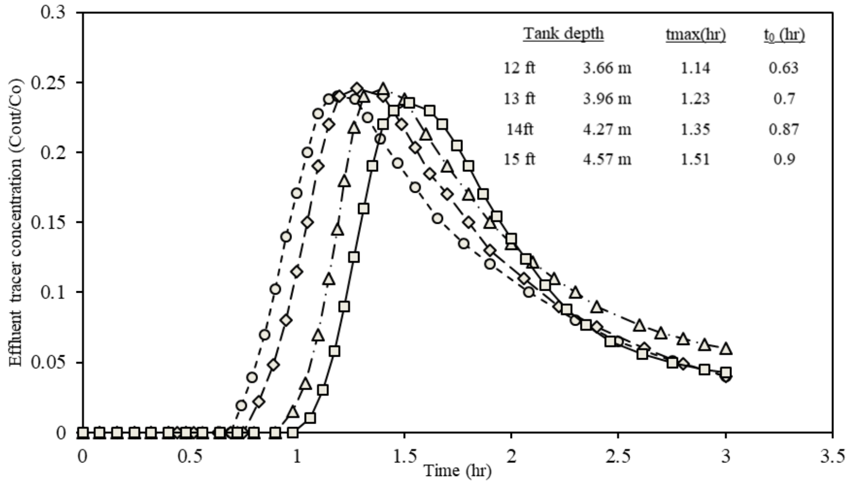

Fig 6. Effluent concentration with a baffle height of 2.13 m in tank depth variations.

~~Fig 6.~~

Fig 6 (baffle height of 2.13 ~~ft~~m) also shows a ~~the~~ similar manner as ~~it~~ is seen ~~observed~~ in Fig 5. Although, t_{max} is slightly less than what it is in Fig 5. Plus, the effluent concentrations (C_{out}/C_o ratio) is almost~~are quite~~ equal for~~in~~ all tank depths, with a small~~bit~~ drop from tank depths of 3.66 to 4.57 m. Also, the same behavior holds for t_0 as has been~~it is~~ discussed previously.

Overall, there is no significant difference between a tank baffle of 1.52 and 2.13m. However, a tank baffle of 5m can provide more HRT or discharge time by ~~the calculation of~~ tracer curve calculations with the~~s in~~ same properties.

4.2. The effect of tank diameter variation

Tank diameter can change t_{max} and following that ~~the~~ effluent concentration may vary. ~~In this regard,~~ The effect of diameter variation ~~effect~~ on these parameters is analyzed in this part. A ~~As it is showed that~~ tank baffle of 1.52m generates~~gives~~ less effluent concentration.~~,~~ I~~i~~t is selected for the following comparison. Fig 7 and 8 display tank performances for tanks that are~~in~~ 42.67 and 51.8m in diameter, and for~~in~~ which tank depths are 3.66, 3.96, 4.27, and 4.57m, respectively.

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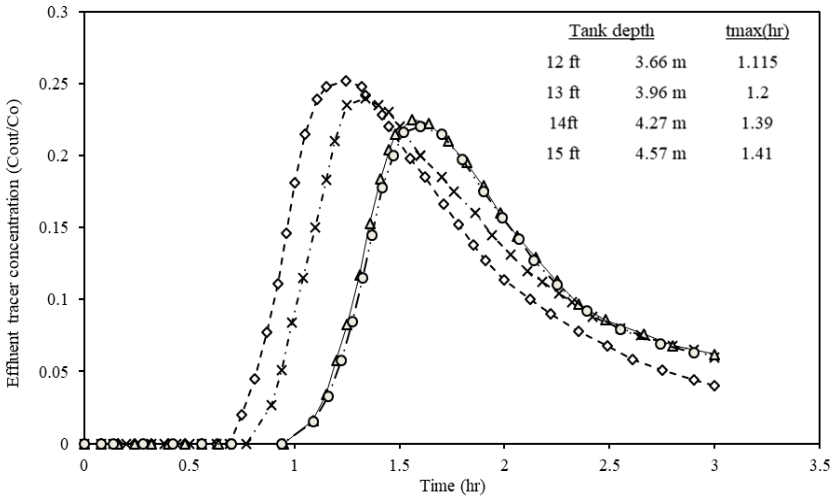
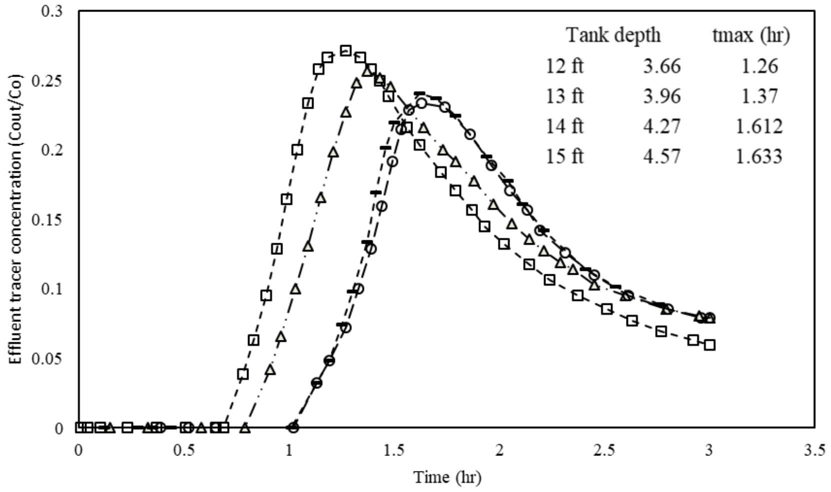


Fig 7. Effluent concentration and tmax in tank depth variations and 42.67 m diameter.



~~Fig 7.~~

Fig 8. Effluent concentration and tmax in tank depth variations and 51.82 m diameter.

~~Fig 8.~~

Fig 7 and 8 show that t_{max} changes considerably when~~re~~ the diameter increases~~extends~~ from 42.67 to 51.82m.~~,~~ t_{max} rises~~has~~ noticeably~~ risen~~. That is even more evident for a~~in~~ tank depth~~s~~ of 4.57m in two figures in which t_{max} is 1.41 and 1.63hr for~~in~~ 42.67 and 51.82m diameters, respectively. Plus, there are~~is~~ still gaps among lines which ~~are ~~get~~ting~~ narrower as~~ higher~~ tank depth increases~~s take place~~.

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5. Conclusion

In this study, a tracer curve is used to analyze settling tank performance in which the given tank is firstly evaluated with the previous study. The results of the evaluation were homogenized with the study and similar outcomes were generated~~hand in~~. Then, the effect of tank depth variation, baffle height, and tank diameter were investigated. It was determined that a greater~~ in which higher~~ tank depth increases the discharge time. Also, when~~re~~ the tank depth is higher, the effluent concentration is lower. Comparing baffle heights of 1.52 and 2.13m showed that the discharge time is wider with a~~ where~~ baffle height of 1.52 m~~5ft~~. Therefore, smaller baffle heights are effective in~~to~~ delaying the ~~time of~~ effluent discharge time~~ing~~. Tank diameter variation analysis indicated that a larger tank diameter results in a greater discharge time~~give in more time to discharge~~, which is evident for a~~in~~ tank depth of 51.82m compared with~~ing to~~ 45.72m. The time in which a tank gets~~is getting~~ polluted and the effluent becomes~~is~~ concentrated~~,~~ also depends on tank depth and diameter. That is more when the tank depth and diameter are considered for~~in~~ larger sizes.

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Reference:

Adams, E. W., & Rodi, W.: Modeling flow and mixing in sedimentation tanks. Journal of Hydraulic Engineering, 116(7), 895-913. https://doi.org/10.1061/(ASCE)0733-9429(1990)116:7(895), 1990.

Daneshfaraz, R., Joudi, A. R., Ghahramanzadeh, A., & Ghaderi, A.: Investigation of flow pressure distribution over a stepped spillway. Advances and Applications in Fluid Mechanics, 19(4), 811. http://dx.doi.org/10.17654/FM019040805, 2016.

Daneshfaraz, R., & Ghaderi, A.: Numerical investigation of inverse curvature ogee spillway. Civ. Eng. J, 3, 1146-1156. http://dx.doi.org/10.28991/cej-030944, 2017.

Dutta, S., Tokyay, T. E., Cataño-Lopera, Y. A., Serafino, S., & Garcia, M. H.: Application of computational fluid dynamic modelling to improve flow and grit transport in Terrence J. O'Brien Water Reclamation Plant, Chicago, Illinois. Journal of Hydraulic Research, 52(6), 759-774. https://doi.org/10.1080/00221686.2014.949883, 2014.

Imam, E., McCorquodale, J. A., & Bewtra, J. K.: Numerical modeling of sedimentation tanks. Journal of hydraulic engineering, 109(12), 1740-1754, https://doi.org/10.1061/(ASCE)0733-9429(1983)109:12(1740), 1983.

Kynch, G. J. :A theory of sedimentation. Transactions of the Faraday society, 48, 166-176. DOI: 10.1039/TF9524800166, 1952.

Liu, X., & García, M. H.: Computational fluid dynamics modeling for the design of large primary settling tanks. Journal of Hydraulic Engineering, 137(3), 343-355. https://doi.org/10.1061/(ASCE)HY.1943-7900.0000313, 2010.

McCorquodale, J. A., & Zhou, S.: Effects of hydraulic and solids loading on clarifier performance. Journal of hydraulic research, 31(4), 461-478. https://doi.org/10.1080/00221689309498870, 1993.

Schamber, D. R., & Larock, B. E.: Particle concentration predictions in settling basins. Journal of Environmental Engineering, 109(3), 753-764. https://doi.org/10.1061/(ASCE)0733-9372(1983)109:3(753), 1983.

Stamou, A. I., Adams, E. W., & Rodi, W.: Numerical modeling of flow and settling in primary rectangular clarifiers. Journal of hydraulic research, 27(5), 665-682. https://doi.org/10.1080/00221688909499117, 1989.

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Vahidifar, S., Saffarian, M. R., & Hajidavalloo, E.: Introducing the theory of successful settling in order to evaluate and optimize the sedimentation tanks. Meccanica, 53(14), 3477-3493. https://doi.org/10.1007/s11012-018-0907-2, 2018.

Wicklein, E., Batstone, D. J., Ducoste, J., Laurent, J., Griborio, A., Wicks, J., ... & Nopens, I.: Good modelling practice in applying computational fluid dynamics for WWTP modelling. Water Science and Technology, 73(5), 969-982. https://doi.org/10.2166/wst.2015.565, 2016.

Zahabi, H., Torabi, M., Alamatian, E., Bahiraei, M., & Goodarzi, M.: Effects of Geometry and Hydraulic Characteristics of Shallow Reservoirs on Sediment Entrapment. Water, 10(12), 1725. https://doi.org/10.3390/w10121725, 2018.

Zhou, S., & McCorquodale, J. A.: Modeling of rectangular settling tanks. Journal of hydraulic engineering, 118(10), 1391-1405. https://doi.org/10.1061/(ASCE)0733-9429(1992)118:10(1391), 1992.

Zhang, J., Liu, X. I. A. O. F. E. N. G., Tejada-Matinez, A., & Zhang, Q. I. O. N. G.: Computational Fluid Dynamics: A promising Tool for Analysis and Design of Water and Waste-water treatment. Hydrolink. Hidraulics of Wastewater Treatment, 2, 2016.

~~**Table 1. Properties of settling tank**~~

~~**Parameters**~~	~~**Unit**~~	~~**Dimension**~~
~~Tank diameter~~	~~(m)~~	~~47.24~~
~~Baffle diameter~~	~~(m)~~	~~12.8~~
~~Tank depth~~	~~(m)~~	~~3.66~~
~~Baffle height~~	~~(m)~~	~~1.52~~
~~Inlet pipe diameter~~	~~(m)~~	~~1.37~~
~~Bottom sSlope~~	~~-~~	~~1:12~~

~~**Table 2. Tracer curve outcome for the two aforementioned studies**~~

~~Tank depth (m)~~	~~Baffle Height (m)~~	~~Time of discharge (hours) (current study)~~	~~Time of discharge (hours) (Garcia, 2011)~~
~~0.3~~	~~0.127~~	~~1.19~~	~~1.22~~
~~0.3~~	~~0.18~~	~~1.14~~	~~1.25~~

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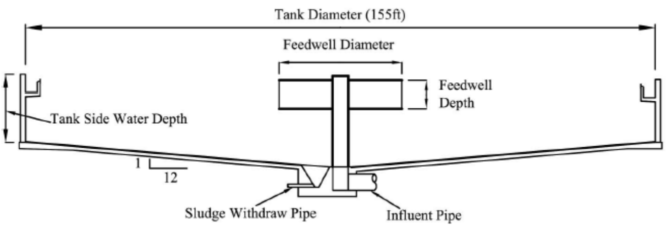
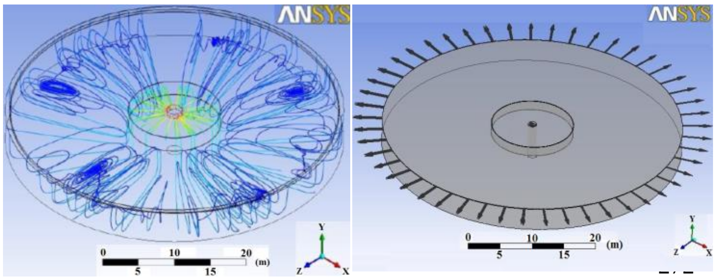
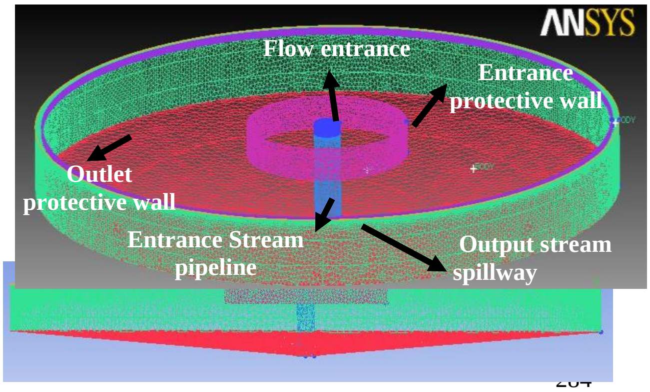


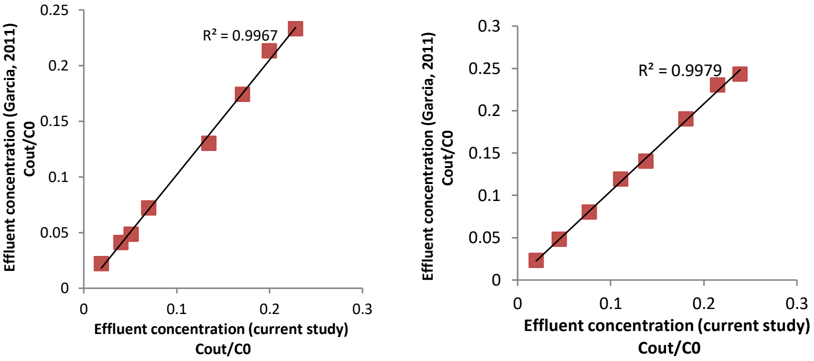
~~Fig 1. Chicago tank.~~



~~Fig 2. Flow lines and directions in the settling tank.~~



~~Fig 3. Modelled settling tank.~~



~~A. baffle height of 5m~~ ~~B. baffle height of 7m~~

~~Fig 4. Data dispersion in current and Garcia' studies (2011).~~

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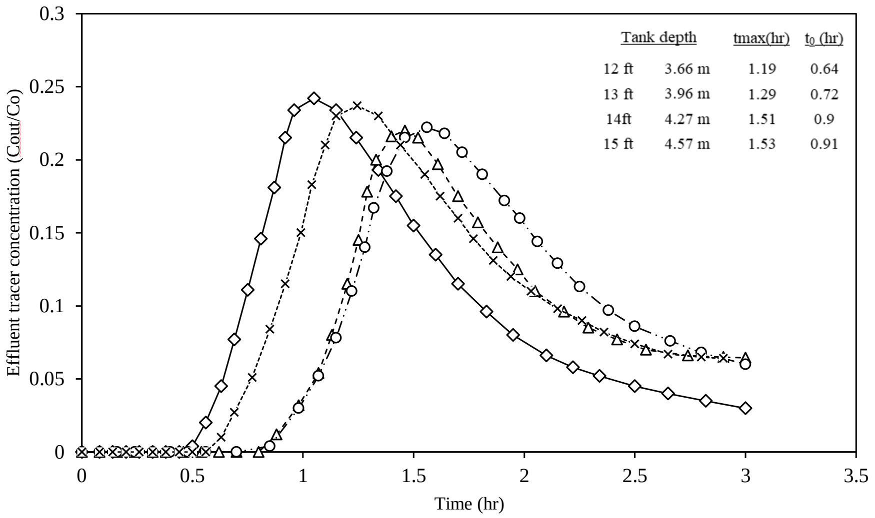
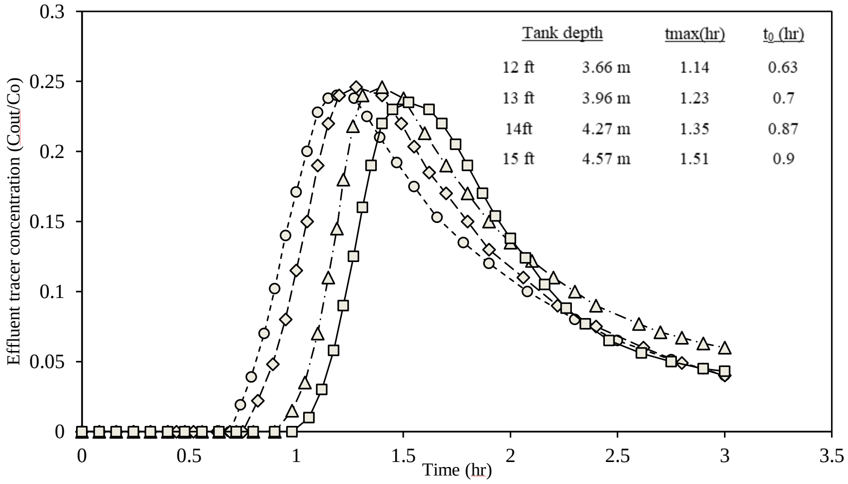


~~Fig 5. Effluent concentration with a baffle height of 5 feet in tank depths variations.~~



~~Fig 6. Effluent concentration with a baffle height of 7 ft in tank depths variations.~~

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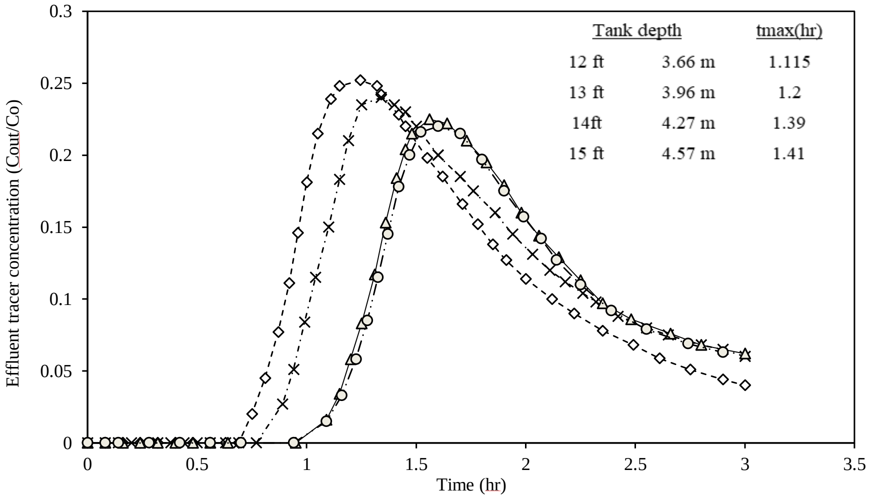

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~~Fig 7. Effluent concentration and tmax in tank depths variations and 140 feet diameter.~~

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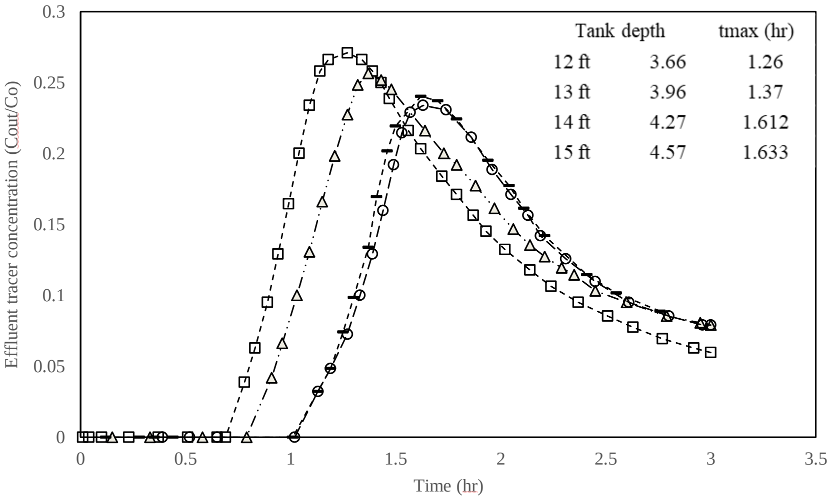

~~Fig 8. Effluent concentration and tmax in tank depths variations and 170 feet diameter.~~

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