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Consulting & Equipment Supply

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PW E-Cell Treatment Report Construction – Glacial Till Silty Water

NEAT personnel completed PW E-Cell treatments on glacial Till Silt water in their shop at Kelowna, B.C. There was a large 20 gallon sample of Construction Silty water taken and during the PW E-cell treatment operations, there were a number of pictures taken of the PW Ecell treatment process.

Objective of the initial PW E-cell test was to develop a treatment procedure for treatment of Glacial Till Silt water and to see if the treated water from the PW E-cell treatment would meet the MOE and City Sewage discharge standard. NEAT has presented the following information to a number of construction managers for their review. From test results, the system will work very well and Powell Water has similar systems currently operating in the US.

Figure 1.0 - Construction Water with Glacial Till Silt in Suspension.
TSS estimated @ 8,000 mg/l and after PW Ecell treatment TSS estimated @ < 5.0 mg/l

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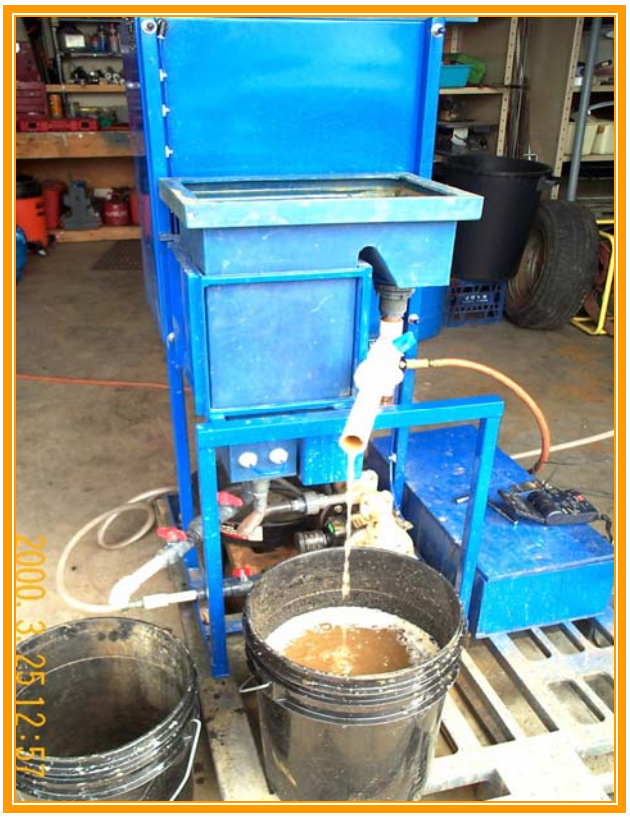

Figure 2.0 – PW 1.5 gpm Ecell Treating Glacial Till Silt Construction Water

Shown above is the PW 1.5 gpm Electrocoagulation Ecell, which is used for on-site demonstration and for testing the treatability of various types of waste waters. The unit operates on 110 v. 30 amp electrical service and uses a ½" air diaphragm pump to pump the waste water from holding area through the PW Ecell treatment chamber. The air operated pump requires at least 5 cfm @ 60 psi. It can be set up for on-site demonstration within 30 minutes, providing the electrical service and compressed air is available. NEAT will provide electrical generation and a compressed air if required.

What is Electrocoagulation :

Electrocoagulation adds electrons to the solution by passing alternating current or direct current through the solution from the power grid. The electrons destabilize the material in the water creating oxide sludge when sufficient activation energy is present. The oxide sludge repels water and filters well. The oxide sludge dewaters well, eliminating the bogging problem associated with polymer treated sewage sludges in landfills, which for years, will stick a tractor. Heavy metal ions converted to metal oxides will pass the leach tests making them non hazardous. Metal oxides can be smelted to recover the metals in a usable form.

The silty water that was treated with the PW Ecell was from a construction site with subsurface water coming into the excavation site, along with rain water. There were some heavy metals in the construction water, but were not high enough to cause concern for silt disposal. The PW Ecell treated these metals and the metals precipitated with the glacial till. The water pH was pH 6.5 and after PW Ecell treatment was pH 6.9.

Figure 3.0, shows the mix of Ecell Plates in the treatment chamber. The dark plates are the steel power plates and the other lighter coloured plates are the aluminum plates. From past PW Ecell treatments of construction glacial till silt, we have found that the mix works well for the electrocoagulation treatment of the waste water and causes the silt to quickly precipitate out of the Ecell treated water.

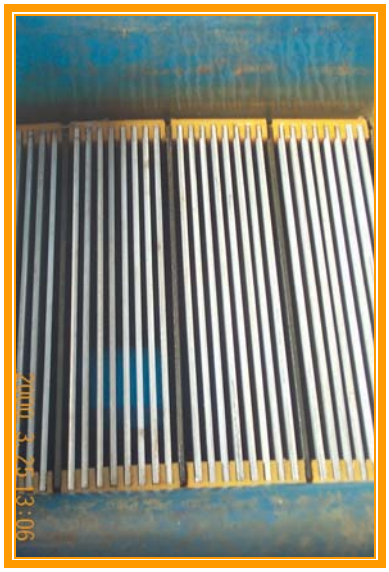

Figure 3.0 – PW Ecell Chamber with Alum Plates and using steel power plates

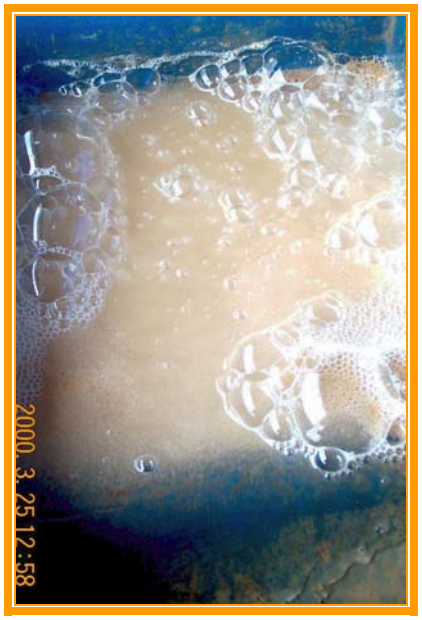

Figure 4.0 – Construction Water flowing through Alum Plates in
PW Ecell - Floc is forming as the Glacial Till water flow over the Chamber Weir to discharge

Figure 4.0, provides a view of the silty water flowing over the chamber weir after the silty water has been charged by flowing up through the steel and aluminum plates. The glacial till silt particles are forming into a floc or precipitant as it flows over the weir, which can be seen in the above picture. The air bubbles are formed from the electro-chemical reaction from the DC charge passing through the water.

Figure 5.0 – Glacial Silt on Top of water after treatment with the PW Ecell prior to discharge

Figure 5.0, is a picture of the top of the PW Ecell Chamber with the silt floc forming on the surface of the water. The ecell was shut down momentarily, in order to illustrate how quickly the silty water will floc and precipitate out of the ecell treated water. Once the glacial till and water flow over the weir into the discharge tube in the bottom of the discharge chamber, the ecell treated water will go to either a holding pond or silt settling tank or clarifier.

If the ecell treated silty water flows back to the holding pond, which the untreated water was pumped from to the PW Ecell, the ecell treated water will carry a charge back to the pond and cause precipitation of the silt in the holding pond. Often, a holding pond can be treated during the day and allowed to settle over night. The next morning the clean water can be pumped off and the silt in the bottom of the holding pond can be hauled off or left until the project is completed.

Because there is “no chemicals or polymers” added to the PW Ecell treated water and with the ecell also reducing heavy metals in the construction water, in many cases, the water can be pumped directly to either storm sewer or stream. The PW Ecell treatment of silty construction water can be continued during cold weather construction also. The electrocoagulation continues to work in close to freezing water, whereas, chemical or polymer treatments are extremely slow or cease to have the chemical reactions required for coagulation of the silt.

In construction areas such as the Mining Industry, Canadian Diamond Industry or the Heavy Oil and Tar Sands Industry, the PW Ecell Electrocoagulation has a large economical advantage over chemical or polymer silt treatment. By being able to ecell treat the silty water during winter construction, there is not a requirement for large holding ponds or shutdown of the construction project.

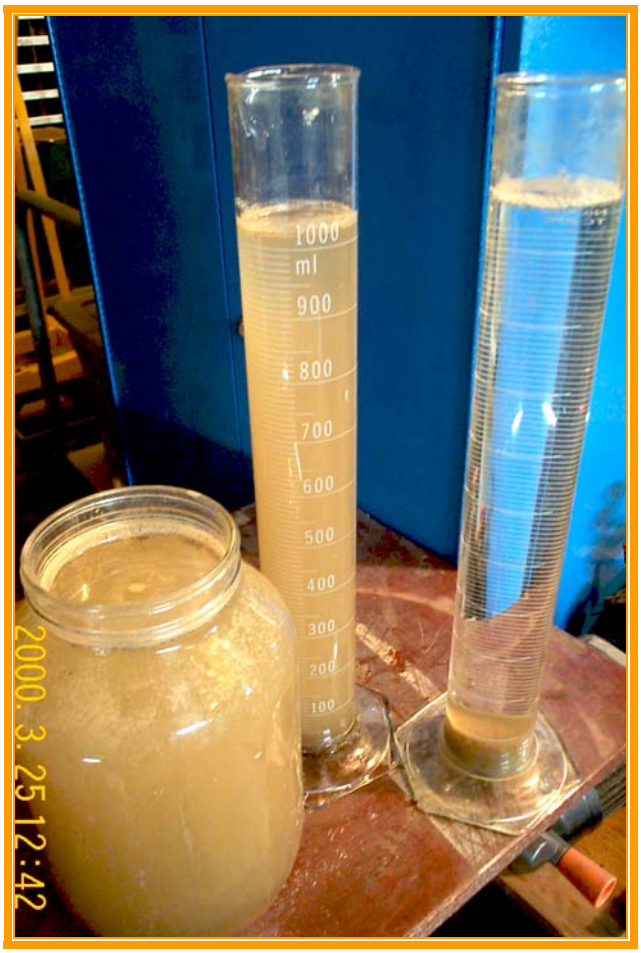

Figure 6.0 –Glacial Till Silty Construction Water – After 24 hours, no or limited settlement of glacial silt in the 2 gallon jar and 1000 ml column to the left, with clear water and glacial silt in bottom of column, within 5 mins after treatment with the PW Ecell

The picture above in Figure 6.0, illustrates how the construction water that has been contaminated with Glacial Till Silt will not precipitate or settle out of the water, even after it is allowed to sit in containment for 24 to 48 hours. It will not meet the Total Suspended Solids Discharge standard established by most Cities and Provincial Ministry of Environment.

By taking the same construction water and treating it with the PW Ecell, the glacial till silt will start to precipitate out within seconds of the electrocoagulation treatment. Within minutes, the silt will have precipitated out of the water, leaving TSS @ < 5 mg/L in most cases.

As an extra added value, if the soils on the construction site have heavy metals such as arsenic, the PW Ecell will treat and precipitate the heavy metals out of the water with the silt. If there is a hydrocarbon concentration in the silty water, the PW Ecell in most cases will cause a break down of the hydrocarbon chain, allowing for discharge.

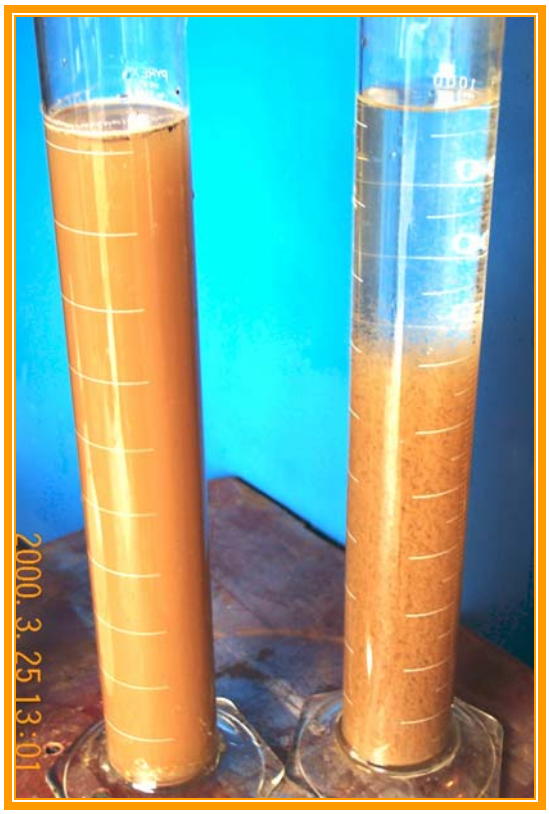

Fig. 7.0 – Construction Glacial Till Silt water on left
and the same water after PW Ecell treatment and after 45 to 60 seconds the amount of precipitation.

The PW Ecell unit was operated @ 2 chambers with the Aluminum and Steel plate mix during treatment of the Glacial Till Silty Construction water. The PW Ecell chamber can be set up to treat various waste water streams with 1 chamber, 2 chamber and 4 chambers. Each will provide a combination of chambers and voltage usage during the waste water treatment.

The power usage will vary to each construction site. NEAT would provide either; on site testing or bench test treatment of the silty construction water to verify the best set up of the Ecell chambers, type of plates to use and the power usage.

The set up of the PW Ecell chamber and the power usage will depend on the concentrations of the TSS, TDS, Heavy metals, hydrocarbons and other chemical factors. These can be worked with by doing Lab analysis and by doing either on-site or bench test treatments. The following power requirement was used during the PW Ecell treatment.

Power usage is shown below :

2 chamber @ 50v. x 5 amp used during treatment

Estimated cost of PW E-Cell Treatment of Effluent :

Power Costs : $0.08 per KwHr. **Gal. / hr :** 1000

Plates - Fe Costs : $0.68 per lb. @ 0.2 lbs / 1000 gallons

Power Required : 50 Volts @ 5 amps 60 mins

Flow rate of the commercial test unit in gpm 1.5 gpm

Volts x amps = 250 Watts **Watts divided by GPH** 2.778 Watt / Gal

KWH/1000 Gallons 2.77778 Kw / 1000 gallons

Kw x Cost / Kw = $0.21 per 1000 gallons treated

Steel Costs = $0.14 per 1000 gallons treated

$0.34 per 1000 gallons treated

Figure 8.0 – Estimated power usage and cost per 1000 gallons of Glacial Till Silty Construction Water Treated

The PW E-Cell tests were very successful and the Glacial Till Silt water treated easily at the construction water pH that was collected from the site. There was no Lab analysis competed on this site, for TSS was the only target that the construction company was required to meet for discharge.

NEAT personnel can provide cost estimates for the PW Ecell treatment on request by the Construction or Engineering Firms.

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