

SolarBee Team believes the standardization of the definition of sludge and the procedure to measure sludge is important when analyzing pond performance in a wastewater treating facility.

When more than one person is involved, measuring sludge depth quickly becomes confusing, frustrating, and suspect. Every person has his or her own idea of what sludge is, what it looks like, and the depth where it starts in the pond. The SolarBee Team has developed a definition of sludge and a sludge measurement procedure. With these standards we can compare sludge measurements from year to year, or from pond to pond. We have a high confidence level in the accuracy of the values regardless of the individual who measured the sludge.

Sludge Definition: We divide the sludge into two categories; (a) the **slurry**, and (b) the **weight-bearing sludge**. We chose a submerged weight of 0.25 pounds per square inch (psi) as the dividing line between slurry and weight bearing sludge. If the sludge density is light and cannot support 0.25 psi, then we consider it slurry. If the sludge density is high enough that it will support 0.25 psi, then we consider it weight-bearing sludge. Our experience has shown that both kinds of sludge exist in most primary and some secondary treatment ponds during normal operations.

The slurry is not self-leveling over large areas and can be brown, gray, green or black in color. The weight bearing sludge is usually dark brown or black in color and very dense.

Equipment Required: Modifications to this equipment list will be made as technology changes or we improve our sludge measurement procedure.

One(1) portable sampler pump that includes peristaltic pump head with clear tubing, control panel, reversible flow and prime/purge function, single-turn potentiometer for speed control, on indicator and three-position power/reversing switch, rechargeable battery encased in a high-visibility yellow housing. 1/4" I.D. X 25' of clear tubing. This clear tubing required for use in peristaltic pump head. Will wear out due to pump action.

1/4" I.D. X 25' of clear braided PVC tubing with markings every 6". Length required dependent on pond depth.

One(1) 0.25 psi (submerged) weight.

Quick connect fittings for weight and tubing.

One(1) blunt end pole. Length required dependent on pond depth.



Water Samples at Various Levels in a Primary Wastewater Lagoon

Algae in the top 6"

Clear water at 8'4".

Slurry at 8'5".

Notice the distinct difference in color between the water and the slurry.

SLUDGE TESTING IN PONDS CONTINUED

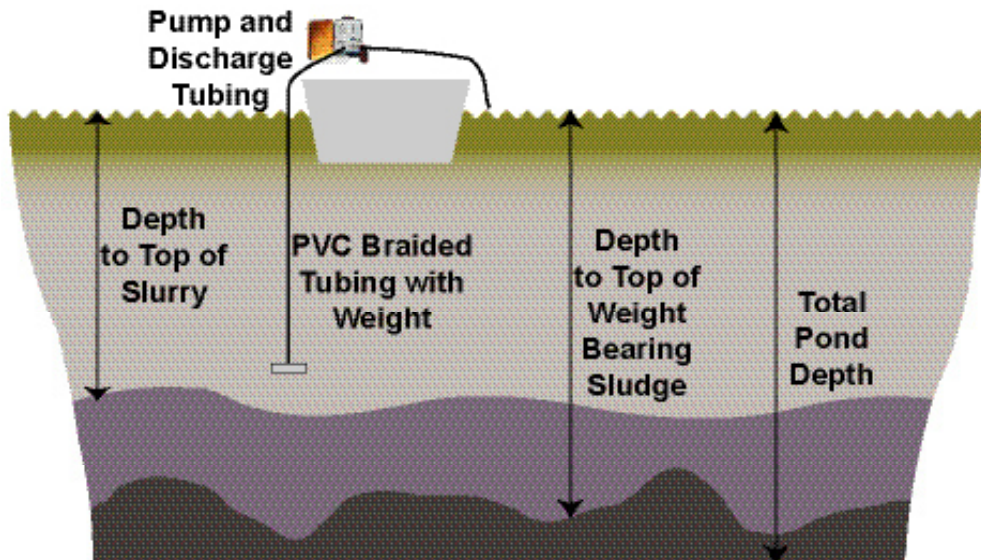
Sludge Measurement Procedure: Our SolarBee installation and service crews always measure sludge depths at multiple locations in the pond. The equipment listed above is connected and tested on shore, placed in our boat and moved to different locations in the pond. We use the following sludge measurement procedure at each location.

Step 1: Stop boat and install the 1/4" clear tubing in the pump head with enough tubing to discharge fluid back into the pond. Turn peristaltic pump on.

Step 2: While the pump is running, slowly lower the 0.25 psi weight into the pond fluid with the 1/4" braided tubing. (NOTE: The 1/4" braided tubing is attached to the 0.25 psi weight with a quick connect fitting.)

Step 3: As the weight is lowered observe the color of the fluid in the tubing before it enters the peristaltic pump. At some point the water color will suddenly change, usually dark brown or nearly black. This is the top of the slurry depth. Turn off pump.

Step 4: Continue lowering the weight slowly until sludge supports the weight. This is the top of weight bearing sludge.



Step 5: Pick up weight above slurry depth, turn pump on and circulate fluid. Repeat Steps 3 and 4 to verify slurry depth.

Step 6: Pull weight above slurry and purge tubing contents.

Step 7: Pull weight above fluid surface. Turn peristaltic pump off and put equipment in boat.

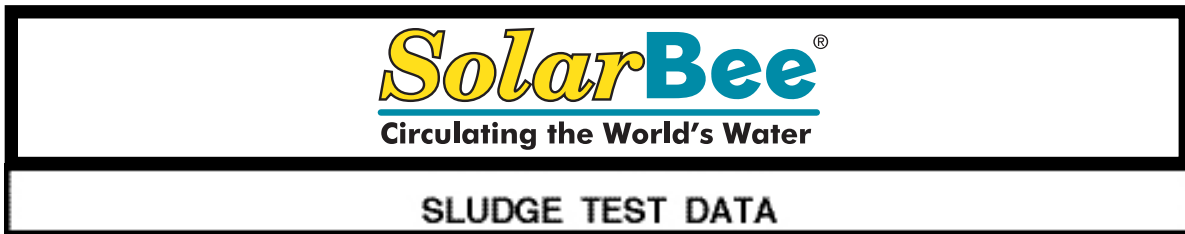
Step 8: Pick up blunt end pole and jab through weight bearing sludge to bottom of pond. This is the bottom of pond depth.

Step 9: Move boat to next sludge measurement location and repeat Steps 1 through 8.

Additional benefits also occur from monitoring and observing the fluid in the suction and discharge tubing as well as the discharge fluid pumped back into the pond while the weight is lowered. First, we are obtaining a visual profile of what the pond fluid looks like from the surface down to the top of the weight bearing sludge. Second, if desired we can obtain fluid samples from the discharge tubing at different depths for later analysis. Obtaining this information at different depths can be a tremendous aid in determining the condition of a pond.

SLUDGE TESTING IN PONDS CONTINUED

Sludge Test Data Report: The following data sheet is an example of a Sludge Test Data Report that would be submitted by our SolarBee installation and service crew. We perform this testing and submit these reports on all SolarBee installations in wastewater pond systems.



LOCATION: Your City, Your State
 DATE: 4/3/03
 CELL #: Pond #1

** ALL MEASUREMENTS TAKEN FROM POND SURFACE AND RECORDED IN INCHES*

TEST POINT:	#1	#2	#3	#4	#5	#6
TOP OF SLURRY:	42	44	46	48	47	47
TOP OF WEIGHT-BEARING SLUDGE:	64	56	66	58	67	59
BOTTOM OF POND:	72	74	73	72	74	73
POND AVERAGE:						
FREE WATER:	42	44	46	48	47	47
THICKNESS OF SLURRY:	22	12	20	10	20	12
THICKNESS OF SLUDGE:	8	18	7	14	7	14
TOTAL POND DEPTH:	72	74	73	72	74	73

POND AVERAGE:	
FREE WATER:	45.7
THICKNESS OF SLURRY:	16.0
THICKNESS OF SLUDGE:	11.3
TOTAL POND DEPTH:	73.0

SLURRY COLOR:	Brown
SLUDGE COLOR:	Dark Black
SECCH:	10*

COMMENTS:
