Willard Says…

Absolutely fascinating information about practical hydraulic dredging.

How To Use the Dredge Production Cost Spreadsheet

This program guide describes the various dredge operating cost parameters and how they relate on the *Willardsays* Dredge Production Cost Analysis Excel spreadsheet. No warranty accrues from the use of this analysis. It is only a guide.

There are two sheets, Diesel and Electric, identified by tabs at the bottom of the sheet.

Each **Run Number** (Vertical Columns 1 through 5) is independent of the others. The cost shown at the bottom of a particular column reflects the total estimated cost per short (2000 lb.) ton or cubic yard if the dredge is operated as described by the values entered in that column only.

Each row of the program is explained below.

Note: Enter values ONLY in rows with items enclosed in (parentheses). DO NOT make entries on rows with italicized green print or bold red print. These are calculated values—entries made on these rows WILL ERASE formulas.

1. **Yearly Production, Tons**. Enter the estimated total annual dredge production of solids. Dredge production capacity is based on the total tons of solids moved through the system. Make allowance for solids wasted or otherwise not processed into a saleable product.

2. **Hourly Production, Tons Per Hour**. Enter the range of possible and desired production in tons per hour.

3. **Hours Per Year**. The calculated value of Row 1 divided by Row 2.

4. **Total Investment in dollars**. Enter the total value of dredge, booster, pipeline and all other equipment directly related to the dredge mining and delivery system.

5. **Annual Cost of Ownership**. The calculated value equal a 5 percent

interest rate on cost of investment on the value entered in Row 4.

6. **Ownership Cost, $ Per Ton Produced**. The calculated value in Row 5 divided by the value in Row 1.

7. **Total Applied Horsepower**. Enter the total horsepower required to accomplish production including the main dredge engine, accessory engine and booster pump engine. Choose an average value considering projected pipeline size, pumping distance and slurry density.

Diesel 8. **Fuel Consumption, Gallons per Hour**. The calculated fuel consumption taken to be 0.38 lb. of fuel per hour per applied horsepower.

Electric 8. **Power Used, kW per hour.** The calculated power consumption taken to be 0.7457 kW per applied horsepower.

Diesel 9. **Fuel Cost, Dollars per Gallon**. Enter the actual or projected cost of diesel fuel.

Electric 9. **Power Cost, kWhr.** Enter the actual or projected cost of the electric power source. Adjust upward to include demand charges and other fees.

Diesel 10. **Fuel Cost, $ per Hour**. The calculated value of Row 9 multiplied by the value in Row 8.

Electric 10. **Power Cost, $ per Hour.** The calculated value of Row 9 multiplied by the value in Row 8.

Diesel 11. **Fuel Cost, $ per Ton**. The calculated value of Line 10 divided by the value in Row 2.

Electric 11. **Power Cost, $ per Ton.** The calculated value of Line 10 divided by the value in Row 2.

12. This row is omitted.

13. **Wage Cost, $ per Hour**. Enter the *total* per hour wage cost of dredge operating employees.

14. **Labor Cost, $ per Hour**. The calculated value of Row 13 times one and a half. This accounts for the fact that additional personnel are at times required to assist the operator.

15. **Labor Cost per Ton, $ per Ton**. The calculated value of Row 14 divided by the value in Row 2.

Diesel 16. **Engine Maintenance, $ per Hour**. Enter an estimate of the cost of makeup oil, filters and other periodic maintenance for all diesel engines operating in the dredge system.

Electric 16. **Drive Maintenance, $ per Hour.** Enter an estimate of the cost of routine maintenance on the electric drive components.

Diesel 17. **Engine Overhaul Allowance, $ per Hour**. Enter an estimate, perhaps 8,000 hours life with a cost equal to one half of new engine price.

Electric 17. **Drive Repair, $ per Hour.** Enter an estimate of cost to rebuild or replace the electric drive components.

Diesel 18. **Total Engine Cost, $ per Ton.** The calculated value obtained by dividing the sum of Rows 16 and 17 by the value in Row 2.

Electric 18. **Total Power Cost, $ per Ton.** The calculated value obtained by dividing the sum of Rows 16 and 17 by the value in Row 2.

19. **Pump Wear Parts Cost.** Enter the cost of a complete set of new dredge pump wear parts for every pump in the system.

19A. **Pump Wear Parts Life, Tons.** Estimate how many tons will go through the pump before they are worn out. Pump wear rates per ton decrease as the density of the slurry (rate of production) increases.

20. **Dredge Pump Wear, $ per Ton**. The calculated value of Row 19 divided by Row 19A.

21. **Cutterhead/Digger Chain Maintenance Cost, $ per Ton**. Enter the estimated cost of maintenance for the digger device on the ladder.

22. **Pipeline Cost, $ per Foot**. Enter the per foot cost to purchase and install the discharge pipeline.

23. **Pipeline Length, Feet**. Enter the total length of pipe required for system operation.

24. **Total Pipeline Cost, $**. The calculated value of Row 22 multiplied by the value in Row 23.

25. **Pipeline Life, Tons**. Enter the expected service life expectancy of the pipeline in terms of the amount of tons that will pass through it before it must be replaced.

26. **Pipeline Cost, $/Ton**. The calculated value on Row 24 divided by the value on Row 25.

27. **Miscellaneous Cost, $ per Ton**. Enter a value to account for miscellaneous costs not otherwise itemized in this analysis.

28. **Total Yearly Cost of Operation, $.** The total projected expense to operate the dredge for one year.

29. **Total Operating Cost, $ per Ton**. The sum of Rows 6, 11, 15, 18, 20, 21, 26 and 27.

30. **Total Operating Cost, $ per Cubic Yard.** A cubic yard is taken to equal 1.35 tons.

31. **Production, Cubic Yards per Hour.** A cubic yard is taken to equal 1.35 tons.

Suggestions:

This spreadsheet provides a means to examine how changing ONE dredging variable (parameter) in each Run while holding others constant affects production costs. The spreadsheet shows how an incremental increase in the hourly rate of production (Row 2) affects the cost of production (Row 29).

A 50% increase in the hourly production rate shown on the spreadsheet is not impossible. These numbers are typical for a 10-inch dredge and there are many such dredges operating at the rates shown. Producing at the rate of 300 tph instead of 200 tph results in a significant cost savings.

Many parameters that contribute to the cost of a given dredge operation vary only slightly while others such as the hourly rate of production can vary widely and have a serious affect on the cost of production. The hourly production rate of most dredges can be increased substantially if management exercises the determination to identify and correct the problems that stand in the way. Often relatively inexpensive measures will

result in a significant increase in production.

The spreadsheet also reveals that "expensive" improvements that bring about a 20 to 40% increase in the rate of production will quickly pay for themselves in reduced cost per ton. Profit can be pocketed once that is accomplished.

Note that wages and fuel costs vary very little on an hourly basis. These costs account for a significant portion of the total per-ton cost when the rate of production is low. If these hourly cost can be applied to a greater number of tons per hour the cost per ton will decrease. Labor gets paid whether they produce 50 tons or 200 tons per hour. Fuel consumption will increase modestly with an increase in the solids content of the slurry, however, most of the fuel is burned to move water through the dredge system.

The values shown on the spreadsheet represent those that might describe a typical 10-inch pipeline dredge. All values must be adjusted if a different size dredge system is being analyzed.

The formulas used to calculate the values shown are locked and cannot be changed by the user.