Willard Says……

Spiffy stuff to know about hydraulic dredging.

The Discharge Pipeline—An Introduction

Each **WillardSays** topic explores some facet of dredge operation and explores ways to equip and operate a dredge so as to make it more efficient and productive. Now we will examine the discharge pipeline and provide some guidance as to how to make it function efficiently. This component, the dredge pipeline, usually soaks up most of the energy expended in operating a dredge system. It is not uncommon to find that as much as 85 percent of the total horsepower consumed by a dredge is spent maintaining flow in the discharge pipeline.

The cost of energy is claiming an ever-increasing portion of the total expense of operating a dredge system so it is becoming even more important to keep the cost per ton of dredged solids as low as possible. That means that overall dredge system efficiency has to be maintained at the highest level possible. If the pipeline is soaking up the lion's share of the energy then it must be operated in a manner that will result in moving the most solids for the least cost.

A dredge pipeline is a conduit; an enclosed pathway that contains a flowing mixture of solids and water called slurry. It extends from point "A", the dredge pump discharge port where the slurry is pressurized and begins its journey to point "B", the discharge point where the discharge pressure subsides to zero—atmospheric pressure. Point "A" is where the solids come from and Point "B" is where they go.

The slurry flowing in the dredge pipeline is, of necessity, mostly water, however, pumping excess water is very costly. While dredge operation is all about moving solids it is not practical to pump a mixture that is too dense such as can be seen issuing out the end of a concrete pump discharge hose because that will result in pipeline plugging.

The goal must be to minimize the amount water and maximize the amount of solids within the limits of practicality. The ideal—the most efficient and most productive—slurry density lies somewhere between the two extremes: Too few solids and too many solids. Our goal is to help you determine and maintain the most efficient flow of slurry in your dredge system.

A working pipeline is not a very dynamic. It does not move around much and the sounds that it makes could be described as murmurs with overtones of muted bells with an occasional screech. One can conclude, after watching a dredge pipeline in operation, that there is almost no detectable indication of how well it is functioning.

> The sole function of the operator, dredge pump, digger, power unit, winches, instruments and controls as well as all other dredge system components is to cause slurry with the maximum practical density to flow continuously through the discharge pipeline at the target velocity.

How then can a dredger equip and operate his dredge system to obtain maximum performance in terms of production and efficiency? There are two parts to the answer. 1. The dredge and pipeline must be suitable for the application. 2. The operator must have the proper instruments and controls and know how to use them.

Suitable Dredge & Pipeline

The Dredge

Other **Willardsays** papers deal with the necessity of having the correct digging attachment on the suction inlet and using the proper digging procedures. Some stress the need to arrange the dredge so that it has the capability of raising solids into the pump inlet at a satisfactory rate and the ability to maneuver the suction inlet effectively. Other papers stress the importance of instruments and automation systems. The need to have sufficient power on the pump and pamper the operator in a comfortable environment and with convenient controls is detailed in other papers.

Since the focus here is on discharge pipeline function let us assume the pipeline is always connected to an ideal dredge that possesses all the essential qualities and capabilities one could hope for.

The Pipeline

Steel or HDPE Plastic?

These are the two main choices. You could use hose made of various materials or pipe made of cast iron or aluminum or various other plastic materials. Experience indicates that either steel or HDPE plastic will provide the most economical service. See **WillardSays**…*Pipeline—Steel or Plastic?* to find out which is best for you.

Inside Diameter

It cannot be stressed too strongly—the only discharge pipe diameter that matters when it comes to dredge system performance is the ***inside diameter***. Steel pipe is available in a relatively limited range of inside diameters. HDPE plastic pipe is available in a wide range of inside diameters, however, beware of the dreaded "tiny pipeline" syndrome. See **WillardSays**…Pipeline—*Inside Diameter* for the ins and outs of pipe sizes.

Length

What is the distance from Point "A" to Point "B"? How long will that distance become over time? Most pipeline dredges move further away from the initial discharge point as they mine the nearby solids and have to add pipe to the pipeline as they go. Eventually the length of the pipeline will limit the ability of the dredge to move solids to the discharge point at the desired rate of production. See **WillardSays**…Pipeline…*How Far Can a Pump Pump?* to get some idea of how far you can expect to pump productively.

Joint Connections

There are a few good ways to connect sections of pipe correctly and some that are troublesome. See **WillardSays**…*Pipeline—Connections* for help in sorting out the various ways to connect pipe sections.

Floats

All steel and some plastic pipes have to be supported so that they will remain on or above the surface of the water at all times. See **WillardSays**…*Pipeline—Flotation* and learn of various ways to float steel and plastic pipelines. You may find that if you have a plastic pipeline you can just let'er sink.

Static Lift

Static lift is the vertical distance from the water surface to the point where the discharge pipe is open to the atmosphere. The discharge pipeline must rise to the discharge point so the static lift is not usually subject to variance. We consider static lift to be an important feature of the dredge pipeline because it can have a significant effect on a dredge's pumping "range"—the distance it can pump. If there is a practical way to minimize static lift without adversely affecting other functions, it should be done.

Instruments, Controls & Know-How

Velocity Meter
Pipeline operation requires that velocity be controlled. Before velocity can be controlled the speed at which the slurry is flowing inside the pipe has to be measured. The only way to know how fast the slurry is moving inside the pipeline is to use a velocity meter with the speed indicating meter installed on the operator's console. See **WillardSays**…*Use a Velocity Meter,* **WillardSays***…Controlling Pipeline Velocity* and **WillardSays**…*The Velocity Meter As a Scale* for more information about the importance of a velocity meter.

Vacuum Gauge
The flow of solids into the dredge system must be regulated. The only way to regulate the intake of solids is to install and use a vacuum gauge on the inlet of a hullpump or a LADDERVAC suction inlet gauge on a ladderpump. See **WillardSays**…*Vacuum* for an explanation of the importance of the vacuum gauge.

Suction Bypass System
The operator uses the information provided by the vacuum gauge as a guide in maneuvering the suction inlet to regulate solids production. Very often he cannot, despite best effort, respond to changing conditions quickly enough to prevent an interruption in production. A responsive, modulating bypass valve system such as Twinkle Co's CONVAC S^4 Suction Side Stability System prevents interruptions and affords the means to closely regulate the rate of solids production. See **WillardSays**…*On The Importance of a Bypass Valve* for more information about how production can be maximized using this system.

Density Meter
A density meter is an instrument that measures, displays and records the rate at which solids are being produced. It is particularly useful when the dredge pipe discharges into the open and there is no practical way of measure production. When the dredge pipe discharges into a process plant the rate of solids production can be determined by measuring plant output.

A density meter cannot be used to provide real time dredge production control because its readout is delayed. It is useful to provide guidance and to measure and record production over time.

Pump Speed Control
See **WillardSays**…*The Velocity Meter As a Scale* for information about how to maintain a constant velocity in the discharge pipeline.

Know-How

The dredge operator must understand how to operate his dredge or production will not happen. It is not uncommon for the operator to be assigned to his job and then left to figure out how to make the dredge produce.

Management has the responsibility to make sure that their operator knows his job, assess his performance against stated goals, identify problems that detract from or interfere with production and correct them whether they are mechanical or operational (mental).

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