
# Welcome & Enjoy



## Table Of Contents



Understanding The Modern Dredge

## Basic Dredge & Principles

### Non-Commercial Dredges

(Suction or Vacuum Dredges > Jet Dredge)

*NOTE: The term "suction dredge" is the same as "vacuum dredge." Many dredgers are not aware of this. Many have gone on the assumption, that it was directly associated with where the power-jet intake; called a "venturi"; was placed. Example; if the power-jet was placed in the power-jet tube up closer to the sluice, it was assumed to be a vacuum dredge or if it was placed in the nozzle head, such as with the suction nozzle, it was assumed to be a suction dredge. In some instances, it has been thought to be the other way around.*

A modern dredge works materials, by means of a suction system, which draws gold-bearing materials up through the suction hose by a vacuum effect, from the use of a power-jet intake, which powers the dredge. This allows gold-bearing streambed materials, to be vacuumed up from underwater and processed through a sluice. The correct term for the modern dredge is "jet dredge." The term is derived from the power-jet intake in the dredge suction system.

There are three types of "jet" dredges; high lift, subsurface, and surface. The difference is where the sluice or other primary recovery system is placed to process materials.

**HIGH-LIFT DREDGE:** A "dredge" generally processes all materials through a sluice recovery system aboard the floating platform, but this is not always the case. With a "high lift" dredge, one has the floating platform; dredge; and suction system to draw materials up from the bottom, but can direct the materials to the shoreline to process.

This is quite unique, because it can allow one to not only use other types of "wet" recovery systems for their primary recovery, but can be processed even by a sluice with better results. This is because of its stability on the shore. A sluice out on the water for example, will move around from the currents and because there is many changes in the

amount of material build-up and water flow across the sluice itself, it will be less efficient than one stabilized.

This is very similar to that of high-banker sluices or hydromatic jig for example, that have the ability or available kits to convert them to dredge materials and process them on the shore. The main difference is where the motor and water pumps are located. The high-lift dredge places these on a floating platform, whereas the others are mounted on the shore next or attached to the recovery system.

High-lift dredges have a few advantages over these. For one, they are available in many sizes, allowing for various capacity ratings. Another is that you can work anywhere out in a waterway in the same manner as would any other dredge. This is especially helpful when working deep overburden, one has better control over the nozzle and suction hose.

The modern portable “high-lift” dredge generally range from 3 to 4 inch in size. Depending on the size or model they can transport slurries of rock, sand and gravel several hundred feet and lift material as high as 25 feet. The larger 5 to 8 inch dredge size may move materials up to 1,000 feet and as high as 100 feet or more.

Though the common jet-dredge is mainly used for the recovery of valuable materials, a design such as this provides other uses, inexpensively compared to the larger commercial “reclamation dredges”; such as, pollution control, reclamation, sand & silt removal, harvesting fish & clams, and underwater growth & plant life harvesting.

**SUBSURFACE DREDGE:** A dredge is classified as a “subsurface dredge,” when the sluice is placed below the water surface, yet firmly mounted aboard the dredge platform. When the sluice sets below the surface of the water, it reduces lift and increasing suction power on materials. This is somewhat an advantage over the standard surface sluice, yet both have their advantages and disadvantages, depending on preferences or requirements.

A subsurface dredge processes materials through a submersible sluice below the surface of a stream, river, etc. A submersible sluice is designed to process materials underwater in the same manner as submersible dredging tubes.

**SURFACE DREDGE:** Most modern dredges are designed with the sluice placed or mounted above water level; called a “surface dredge.”

The sluice design on these may vary according to the specific type; or size; of valuable, one is looking to recover. These follow into three categories; those designed especially for gem or diamond recovery, gold recovery, and coin recovery. Some sluices are designed to recover only one type, whereas some can recover both gem and precious metals with minimal adjustments. Those designed for gold recovery are called a “gold dredge.”


Photo provided by Keene Engineering, Inc.

Common dredge sizes for non-commercial dredges are 2, 2.5 , 3, 4, 5, 6, and 8 inches. Dredge size is based on diameter of intake/suction hose nozzle. The “Inch Rating” pertains to the size of the intake hose measurement. When you see a dredge being advertised, as a “2-inch” dredge, this means that the inside diameter of the suction hose that goes up to the back of the sluice box is 2 inches. It is not the diameter of the suction nozzle, as many people think. The diameter of the suction nozzle is anywhere from 1/4 inch to a full inch less than the inside diameter of the suction hose. This is so rocks of the same size won’t pass through the nozzle to continually clog up the hose.

Recreational dredge size(s) are considered to be 4 inches or less. Some areas of public lands available for mining, have limitations on dredge size. In some cases, dredging is restricted to recreational dredging only. The standard “dredge permit” issued from the State Fish & Game Department for use within a given States waters, is for use of 8 inch dredge size or smaller.

Recreational dredges are mainly used by those considering backpacking into remote areas for a short period or for weekenders who have little time to set up equipment as with the larger dredges. These are also used by the more experienced dredgers, to sample remote areas ahead of the larger dredge size.

The 4 and 5 inch dredge, are the most common sizes used by recreationalists and small mining operations. These dredges are designed to be easily dismantled and have the same air capability for hooka diving as the larger dredges. They also process a greater volume of materials than the “prospecting type” small dredges. Each inch in diameter of the intake greatly increases the material flow into the sluice concentrator allowing more values to be recovered in the same amount of time. The inside diameter of the suction hose, also has a direct relation to the amount of gravel that the dredge will move per hour. The general rule for this is; “if you double the inside diameter of the suction hose, you increase the capacity of the dredge by a factor of four.”

*NOTE: There*

| (1) Dredge Size | | | | | |
|---|---|---|---|---|---|
| (2) Engine Size | | | | | |
| (3) Pump Size (Gallons Per Minute) | | | | | |
| (4) Depth Capability | | | | | |
| (5) Dredge Capacity (Yards Per Hour) | | | | | |
| (6) Total Weight | | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 2" inch | 2 hp | 90 GPM | Up to 8' ft | Up to 4 YPH | Up to 45 lbs |
| 2.5" | 3-3.5 | 125-130 | 10' | 4 | 75 |
| 3" | 5 | 250-280 | 15' | 8 | 140 |
| 4" | 5 | 250-400 | 20' | 12 | 270 |
| 5" | 8-11 | 300-560 | 30' | 16 | 385 |
| 6" | 16 | 400-560 | 50' | 20 | 1,050 |
| 8" | 40-70 gas/deisel | 1,400-1,500 | 70' | 30-50 | 2,500 |

*NOTE: There are many manufacturers and designs of the modern dredge; especially of motor & jetting pump manufacturers; on the market today and a complete or detailed account of the specifications available is not necessary here in this book. It is only intended to give a general reference for those new to dredging.*

Depth capability depends greatly on many factors; size of motor & pump combination, additional equipment (such as compressor size) and accessories, whether or not the pumps are belt driven or shaft mounted, whether the pumps are "free standing" or "centrifugal" jetting pumps, manufactures intended design, height above sea level, temperature of the area, etc.

Dredge capacity depends also on the above, but includes type & size of materials worked and the depth one is working. Yardage per hour specified by a particular manufacturer, is based upon the amount of loose gravels; all the the same basic size; that a dredge's intake is capable of picking up and processing in an hours time. These figures relate to the maximum amount of materials the dredge can process under ideal conditions. Also, one has to take into account downtime, due to problems; mainly clogs in the suction system.

## Recovery Systems

A recovery system is the method used to process gold-bearing materials for its gold or other heavy mineral content. This is done by means of separators and/or concentrators. The term "separator" as used in connection with dredging, is a device employing mechanical means to screen or divide streambed materials into sizes and/or allows tight packed materials or clay to be broken up before entering the concentrator; such as a hydraulic separator. On the other hand, a "concentrator" is a device employing mechanical means to separate gold or heavy minerals from streambed materials to recover a heavy concentrate.

A "primary recovery system," is the main method of processing materials and may employ the subdividing of materials into sizes to be processed by different concentrators specifically designed for the size of materials passing through. This is seen with common dredge designs employing "double" or "triple" classifiers.

A “secondary recovery system” is a separate concentrator(s), which reprocesses materials a second time for any lost values. The primary recovery system aboard a dredge is usually a combination hydraulic separator and sluice concentrator; on the larger dredge sizes of 8 inch or larger, there may be two separate kinds of concentrators used for the primary recovery systems, such as a sluice for the larger gravels and a hydraulic jig for the smaller.

In most dredge designs or methods, where there is a secondary recovery system, the sluice is also the most common; such as with an “undercurrent sluice” (A large, flat, broad, branch sluice, placed beside or at the end of the main sluice recovery system).

Any recovery system design, has a manufacturers “capacity rating.” This is the amount of materials, which can be processed in a given amount of time. Dredge recovery systems use cubic yards per hour to specify its production rate. It is important to understand, this information is based on ideal conditions. This does not measure what should be expected in a normal operation; taking into consideration human and mechanical factors. In order for a dredge to operate at its maximum capacity, all the gravel would have to be of the correct size to enter the suction portion of the nozzle, and run a continuous flow of gravel, which is extremely unlikely. One should consider about one half to one third the rated capacity as a "probable capacity" under normal conditions.

## Suction System

The vacuum/suction on a portable dredge is created by a power-jet “venturi principle.” A volume of water is pumped through a tapered orifice (jet), by a specially designed water pump. A high velocity jet stream is created within the jet tube producing a powerful vacuum. Gravel is dredged into the suction hose and is delivered to the sluice box hedder. As a slurry of water and gravel enters the hedder box, it is spread evenly over a classifier screen. The smaller and heavier particles drop below the classifier screen into an area of less velocity, allowing a slower and more selective classification of values. Often values are recovered and easily observed before they even enter the riffle section. The lighter non bearing values and larger aggregate are returned back into the water.

There are two types of suction systems used in modern suction dredges. One utilizes the “venturi” in the nozzle and the other in a metal tube or “power-jet.”

Systems with the “venturi” placed in the nozzle are for shallow water applications. This combination of venturi and nozzle is called a “suction nozzle.” When operating this kind of system, if the suction nozzle comes out of the water, the water pump will not lose
its prime. The suction hose will collect air, but the water force from the venturi in the suction nozzle will continue working. Simply place the suction nozzle back under the water and the suction hose will again prime itself.

Systems with the “venturi” placed in a metal tube, or power-jet, are for dredging applications of 3 feet or more. This type of system is much more powerful, because the venturi is placed just under the surface below the dredge, rather than at the nozzle. The water force is greater, because the materials are drawn up the suction hose rather than pushed up the hose. When operating this kind of system the suction tip or nozzle must be kept underwater or it will lose its prime, and may cause damage to the seal in the water pump, if the dredge motor is not shut off quickly. There is no way to prime this type of system except to shut off the motor, fill the entire length of suction hose and again prime the water pump.

The only real difference between a suction nozzle and a power-jet is that the power-jet pulls the gravel and rocks up the suction hose from the surface; the suction nozzle pushes the gravel up to the surface from below.

The venturi reduces the diameter of the water intake into the “suction system,” creating a powerful water force or “jet” stream of water. This reduction in size is done by tapering off the diameter size slowly, allowing the water force to build up greatly. This “venturi” effect is powerful enough to operate the suction system on a dredge.

A power-jet tube can have two separate power-jet intakes. This is found on the dredges utilizing twin water pumps; usually 5 inch or larger in size. There are many variations on the placement of the power-jet; especially when there is a second water pump. Depending on the depth to be worked and the size of dredge one is using, these can be placed anywhere along the length of suction hose; including two separate single jetting tubes or a single jetting tube and

suction nozzle.

## Sluice Concentrator

The sluice concentrator is the most widely used method of recovery in gold mining today, as it has been for well over 100 years. The sluice has been used in many types of equipment for the main or secondary concentrator in all phases of placer mining. Some equipment has more than one sluice or type of sluice for recovering gold.

The dredge was designed to recover gold underwater, and process the gravel through a high-pressure sluice above the deposit site with the aid of a floating platform. The basic sluice without the motorized water pump is called a “sluice box.”

The standard sluice system aboard a dredge is a single sluice. This is the most common dredge design that you will find on the market place today. It has proven to be the most cost effective way of recovering gold.

The design of the “double sluice system” allows materials to be separated by size and classified before entering the riffle section of the sluice box. The fine sand and gold drops through a classifier screen and is separated by a complete fine gold recovery system consisting of a separate set of riffles, expanded metal screen and ribbed carpet, designed to recover black sand and fine gold. The larger material passes over the classifier screen and is sluiced in a normal fashion. Some designs include “undercurrent flow control” making it possible to control the amount of water and fine gravel entering the lower sluice. Through selective classification such as this, the result is similar to the triple sluice design.

There are “double conversion classifier kits” available by most manufacturers to convert or upgrade older standard single sluice designs into “double classifier systems” at a very nominal cost. Most modern “kits” are designed for easy installation and break down quickly for clean-up.

The size 4 inch dredge and up, generally allow a choice in the type of sluice system one would like to use. Choices include a single, double or triple sluice washing/classifying system. The “triple tray” or "triple sluice" system, is one of the best available today. The additional cost is compensated by its design which allows the recovery of a greater percentage of values. Materials are separated by a classifier screen before entry into the riffle section of the sluice. The smaller materials drop through and separate into two different directions of equal length, allowing them to pass through a smaller size sluice; with smaller riffles designed especially for the recovery of fine size gold; on both sides of the platform, with the main sluice for the larger materials in the center. This is designed to balance the weight equally. This allows the recovery rate of the fine gold to increase without being processed twice.

**HEDDER BOX:** Hedder boxes are standard equipment with surface dredges. They are a form of hydraulic separator, in that the hedder box cleans and breaks up materials before they enter the sluice system. A hedder box may or may not include a grill or screen to size materials. Its main function is to clean, wash and break up cemented materials, hardpan, and clay packed gravels.

The modern hedder box aboard a dredge, is also called a “baffle box,” because it actually deflects incoming materials. Materials are shot up through the suction hose and generally enters into the hedder box at a 45 degree angle. When it hits the back wall of the box, it is forced into a circular pathway, which creates a “churning” effect. The first step in this hydraulic classifier, is to allow materials to slam; at high speed; against the back wall. There are some dredgers who weld in a metal wedge at this point, to further material break-up. Not only does hardpacked materials loosen up from the impact, but further materials are slammed into them as well. The design of the hedder box is to allow materials to swirl around; thus furthering their break up; then drop down to the lower back portion of the box.

At this time, the water flow is traveling much faster, than that of the main section of sluice; where the riffles are. The design of the hedder box at this point, forces the materials; which are shooting down the back side at high speed; over a classifier screen. This screen divides and sizes materials before entering the sluice and does the most important thing; spread the materials evenly and by doing this, slows them down to the appropriate speed for the riffle design.

The classifier screen does not necessarily screen materials for separation; such as with double classifiers or triple tray sluices; but in effect allows materials to spread out properly. Without this, materials coming out of the hedder box, would not be forced slow enough for a proper mixture of water & material flow through the sluice; called “current level.”

The larger materials are allowed to pass over the surface of the classifier screen, whereas the smaller size materials; containing the majority of gold; pass through and under. This allows the smaller materials to enter the sluice along the bottom of the material flow at a much reduced speed; which better corresponds to their size. Most all the gold entering the riffle section will remain on the first few riffles. This is taken advantage of, by allowing the separation of sizes. Before the gold has a chance to gain back the speed according to the rest of the flow over the riffles, it is trapped.

**MATTING:** Almost all sluices used today have a mat lining the bottom of the sluice, underneath the riffles. Most riffle systems with mats are made for easy cleaning, and can be lifted out entirely. The mat helps retain the smaller, fine sizes of gold or other precious metal particles, allowing them to stick to the mat. A mat called “miner’s carpet” is one of today's favorites. It is inexpensive and works great, especially on even the finest sizes of gold. A lot of the equipment today using a sluice recovery system come with this type of mat. “Nomad matting (Miner’s moss) is the ultimate matting in any sluicing system. It is a little thicker mat designed for medium and larger sluices. The Nomad matting traps the heavy values inside the woven vinyl fibers. It is used mainly in the front section of the riffle system of the smaller sluices, leaving the rest of the sluice to the standard carpet mat. Other great mattings are the the ribbed Ozite and Dupont matting.

There are many types of mats that are good to use. Anything and everything has been tried by today's miners; burlap, corduroy, door mats, and woven plastics to name just a few. Mats have proven to be very successful in helping retain the fine-size heavy minerals, especially gold.

**RIFFLES:** Sluices in most cases use a riffle system. The riffles or “riffle bars” (also called “gold traps”) in most modern sluice boxes are of a design called “Hungarian Riffles.” This type of riffle design has proven to be the most efficient gold recovery system. A riffle system is designed to help slow down the movement of the heavier mineral and metal through the sluice. The riffles help create an undertow behind each riffle bar to allow more time for the gold to settle and catch. As material flows over the riffles, a vortex, or eddy current is formed between each riffle opening. This force allows the heavier material to settle out of suspension and the lighter, non value bearing material to be washed away. This continuous self cleaning principal, allows a dredge to be operated for prolonged periods of time. Normal conditions require a sluice box to be cleaned only once or twice a day.

This riffle system is set up for different factors; water pressure, the size of materials being processed, and the amount of materials to pass through the sluice at any given time. The tilt or angle of the riffles; generally 10 degrees to 30 degrees; allow a curl of water behind each riffle, creating an undertow and allowing time for gravity to settle the heavier materials. Water action caused by water flow against the riffles is called a “curl.”

The angle of the riffle may in some cases be enhanced by an additional bend in the design.

The height of the riffles allows for larger or smaller sizes, depending on what is desired to be processed and collected. The water flow over the riffles depends on how much material can be processed in a given time period. The water pressure has to be enough to pass the lighter waste materials over these riffles and out of the sluice. One must take care not to provide too much water pressure.

The sluice concentrator is considered the best wet-recovery system on the market today. The modern advances in special riffle designs, mattings and classifying systems has kept the sluice #1. Riffle systems are designed to catch gold and other precious metals in the first few riffles; in most cases the first three riffles. This allows one to occasionally check these first riffles for the amount of gold recovery during operation.

A sluice concentrator, if set-up properly and monitored, will rarely allow gold to pass farther down the riffles. The design of a sluice allows gold to be caught anywhere within the riffle section. The extra length of riffles in the sluice allows for any exceptions of loss from the first few and is for gathering the float gold which needs a longer time to settle. Exceptions are clay-packs and hardpans not broken up in the dredge hedder box, grizzly, trommel, or simply the first section of the sluice. These may tumble through the riffle section and break up releasing the gold. Another exception is the occasional rock build-up that redirects the water flow allowing the possibility of gold to skip a few or more riffles.

## Gas & Oil

**"Getting The Days Supplies"**

It is best to keep all gas & oil a safe distance from your camp, yet not too far that you can't keep an eye on it. Without it your dredge does not work, so keep track of how much you are using and refill before you completely run out. It is also a good idea to keep it in the shade, out of direct sunlight, with the lid a little loose. Many smaller size gas cans have been ruined because of the gas swelling inside them from heat. All normal safety precautions should be taken as in any flammable chemical storage.

Small gas cans can also swell, if they are transported up or down mountains where there is a great change in altitude. The altitude has allot to due with how a motors carberator is set. There should be a noticeable change in the way a car functions or drives, anytime someone drives up or down a large mountain range. This is due to the oxygen difference in altitude. If a dredge motor is set and running great at home, that is not in the mountains and transports it to the higher elevations, there may need to be some miner carberator adjustments; mainly the air intake screws.

The most common gas can, would be that of the GI style 5 gallon. These are of the right size to hand carry around; one can easily carry two gas cans, equaling 10 gallons just about anywhere; though it may not always be as easy as it is said.

Many miners working deep canyons with no vehicle access, have converted backpacks to accept a single 5-gallon gas can. The most common has been the "boy scout" backpack. These are designed of aluminum, with a nice size lip on the bottom portion, which holds the can in place easily. They might not be the best backpack for adults, but the frame design is great for carrying these can around and saves the destruction of many a good backpack trying to convert them.

For the miners who have vehicle access and do not want to siphon off gas from their vehicle, it would be best to invest in metal drums of the size 20 to 40 gallon; anything larger than 40 gallons in size, becomes too heavy for use in the field in most situations. These are great though they are much heavier. A hand pump designed for use with gasoline is usually attached and can refill the smaller size cans when needed. It is best not to transport from camp anything that you could not use in one day. This not only keeps the load lighter, but keeps any accidents to a minimum. Gas cans can be damaged easily, when either bumped against rocks during transportation between camp and the dredge site or if set down to hard on rocks. If a leak were to go unnoticed, else than a fire hazard, if it reached the waterway and comes in contact with anyone in diving suits, they can be chemically burned. It is for this reason, it is best not to have anything more than needed at the dredge site.

It is a good idea to bring along enough oil for at least a few oil changes. With a dredge motor or any other motor running most of the day, almost every day, it will need changing often. One should check the owners manual for "hours of operation," between oil changes. Never the less, one should always see for themselves how the oil is doing during each refill. If it is dark gray or black and smells burnt, change it immediately. Other wise do things according to your owners manual, and if you do not have one, and you do not already know yourself from experience, you could either talk with the

local chainsaw/lawnmower shops or call a dealer.

**TRANSPORTING MOTORS:** In most cases, the transport of motors; dredge, pump, wench, power-plant, etc.; is not a problem. One simply makes room in the back of a pick-up truck or such, where it can transported in its normal position. On the other hand, if you are in an access area with rough dirt roads, you might consider draining the oil; gasoline is not a problem. Not only is this for safety of possible oil spills or leaks inside the vehicle or onto other equipment, from the motor being thrashed around a bit, but there is a more important reason.

Oil can splash around and get into the carburetor and piston, which can cause the motor to be harder to start and possibly lead to a longer warm up period, before it is ready for use. This can also happen during loading and unloading, and transportation between the dredge site or shoreline and vehicle; the same works in reverse. To keep this from happening, it would be best to drain all the oil and place it into a safe container, until it is ready for use. As far as a dredge motor is concerned, it would be best to wait until the entire dredge is assembled and ready to float out on the waterway, before refilling it.





E-Mail Us! webmaster@goldminershq.com