UNITED STATES MARINE CORPS
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STUDENT HANDOUT

DEVELOPMENT OF A WATER SOURCE

Terminal Learning Objectives: Given a list of methods used to develop a water source and a list of purposes for the improvements, select the method of improvement that matches its purpose in accordance with FM 10-52-1. (1171.03.01)

Enabling Learning Objectives:

(1) Without the aid of references, provided a list of methods used to develop a water source, select the correct method to develop an inland surface water source in accordance with FM 10-52-1. (1171.03.01a)

(2) Without the aid of references, provided a list of methods used to develop a water source, select the correct method to develop a ground water source in accordance with FM 10-52-1. (1171.03.01b)

(3) Without the aid of references, provided a list of methods used to develop a water source, select the correct method to develop a sea water source in accordance with FM 10-52-1. (1171.03.01c)

BODY:

1. Developing a water source:

a. The purpose for developing a water source is to increase the quantity of water, improve its quality, or make it more readily available for treatment and distribution. Some of the equipment needed is listed below:

b. Intake Hoses: Several considerations should be taken in the development of intake points. All intake hoses or pipes should have a strainer or suction screen regardless of the clarity of the water. The strainer must be at least 4 inches below the water level and protected against floating debris.

c. Pumps: The practical limit of suction lift of raw water pumps issued with water purification equipment is 25 feet at sea level. Suction lift decreases at higher altitudes. Because pumps must create a partial vacuum in the suction line, the raw water intake hose must be airtight for the pump to work.

2. Development of inland surface water sources:

a. There are a number of development considerations and techniques which

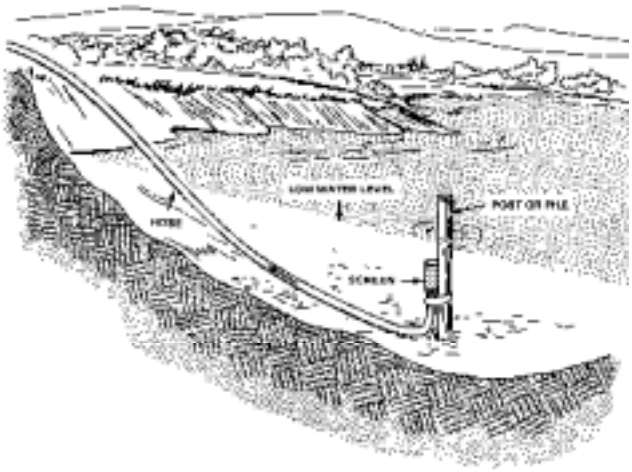
apply to inland types of water sources.

b. Surface water sources are the most accessible type, in that the source lends itself readily to the purification equipment common to engineer units. The methods of constructing intake points for surface water sources are:

(1) Rocks and stakes:

(a) If the water source is not too swift and the water is sufficiently deep, prepare an expedient intake by placing the strainer on a rock. This will prevent clogging of the strainer by the silt normally found at the bottom of the stream bed.

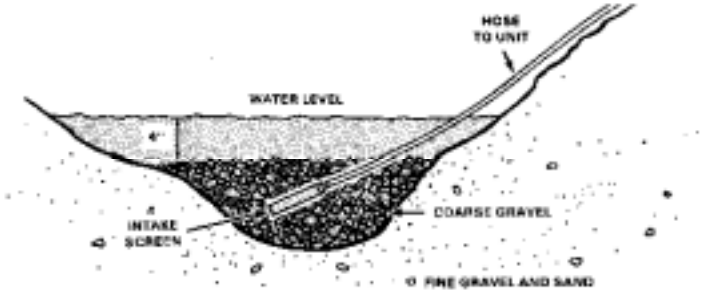
(b) If the water source is a small stream or shallow lake, secure the intake hose to a post or stack.



(c) These two methods will prevent the strainer from becoming clogged by the silt normally found at the bottom of the waterbed and providing enough water overhead to prevent the suction of air into the intake hose.

(2) Pits:

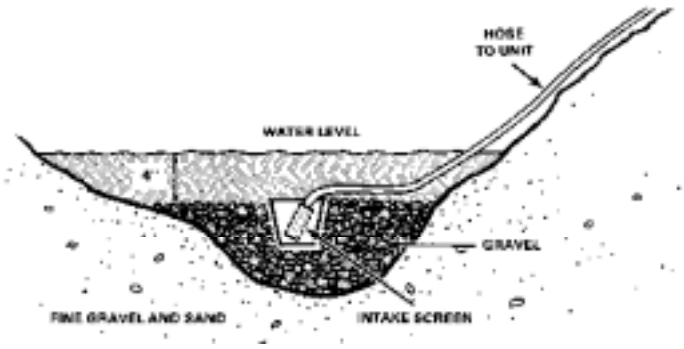
(a) When the water source is so shallow that the intake strainer is not covered by at least four inches of water, but the source must be used, a pit should be dug and the strainer laid on a rock or board



(b) placed at the bottom of the pit.

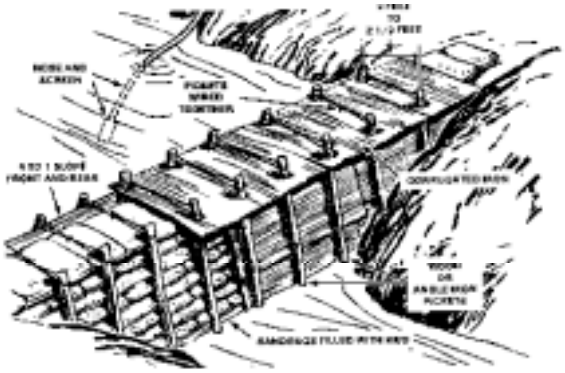
(b) Line pits that are dug in streams with clay or silt bottoms, with gravel to prevent dirt from entering the purification equipment. Surround the strainer with gravel to prevent collapsing of the sides of the pit and also to shield the strainer from damage by large floating debris.

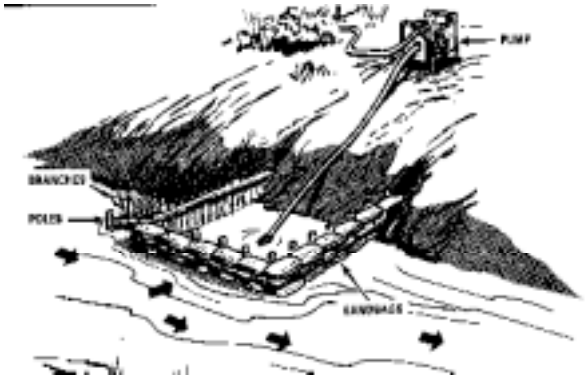
(c) A similar method, by enclosing the strainer in a bucket may also be used.



(3) Dams:

(a) Dams are used to raise the level of water in small streams to cover the intake strainer.





(b) In swift flowing streams, construct a wing or baffle to protect the intake strainer without collecting water. To construct dams the following material can be used:

1 Logs

2 Perforated wood

3 Dirt

4 Concrete

5 Steel

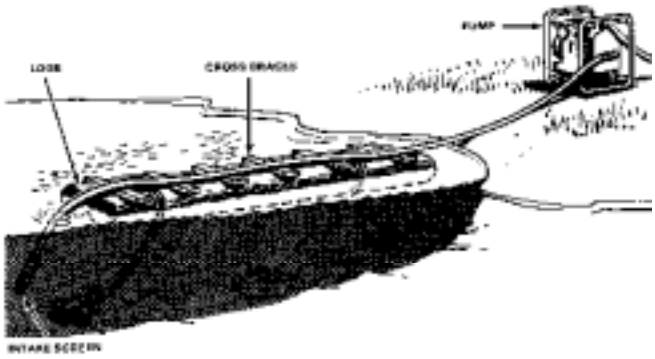
6 Sand bags

7 Any natural material

(c) These materials should be placed at the narrow part of the stream having stable banks.

(4) Floats:

(a) Floats are used to keep the suction hose off the bottom of the water source in large streams where the quantity of water varies across its width or where water is not deep enough near the banks to cover the suction strainer.



(b) Cover the hose and strainer with a minimum of water four inches of water, by anchoring or stationing the float at the deepest part of the stream.

(c) Secure the intake hose to the float, allow enough slack for movement of the float. An anchor support line should be attached and have adequate slack to allow the suction strainer to remain under water at all times if there is any changes in the water level.

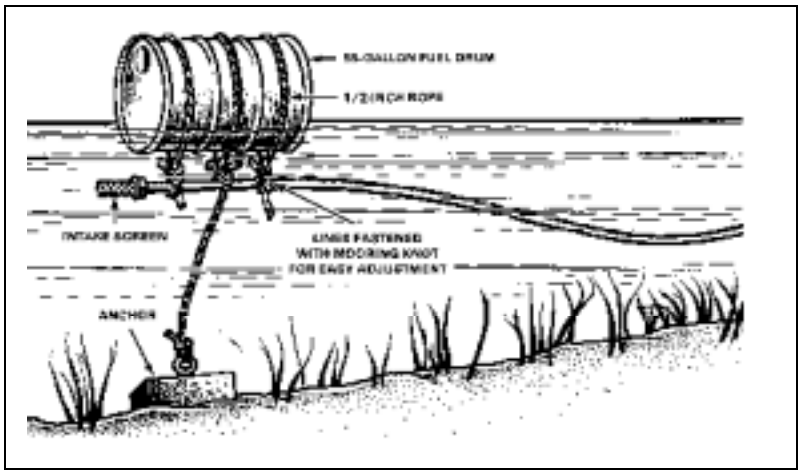
(d) Floats may be constructed from the following:

1 Empty drums

2 Logs and lumber

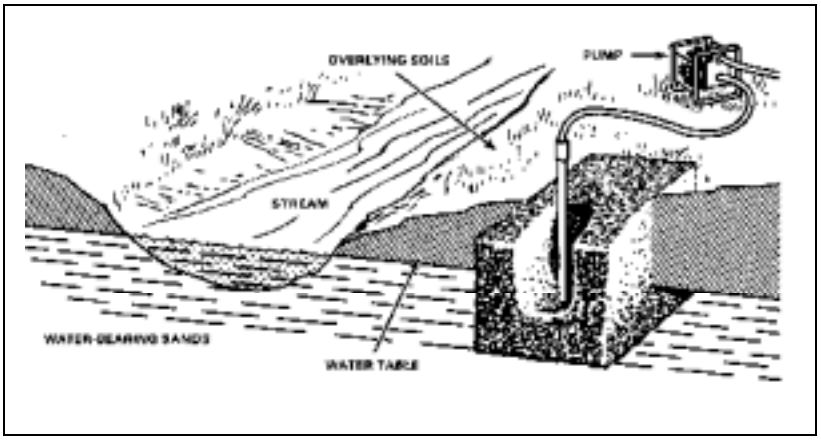
3 Sealed cans

4 May also be manufactured.



(5) Galleries:

(a) The quality of water may be improved from a muddy or extremely turbid water source by digging intake galleries along the bank.



(b) To construct a gallery perform the following:

1 Dig a trench along the bank of the water source. The trench must be deep enough to allow water from the source to seep into it and to intercept ground water flowing toward the stream.

2 Then fill the trench with gravel to keep the sides from collapsing.

3 Then place the intake hose with strainer in the gravel below the waterline.

NOTE: A Gallery requires a lot of work, but it may be worth it. It reduces the amount of chemicals needed for coagulations, it extends the life of cartridges filter, and extends the filter run between backwashing.

3. Development of ground water sources:

a. When surface water supplies are inadequate or unusable, develop

ground water supplies. Ground water is available below the earth's surface in most regions of the world. The depth depends largely on the type of rocks and soil, the amount of rainwater, and the topography of the land.

b. Aquifers: Layer of rock below the water table from which you obtain water. It is sometimes referred to as a water-bearing formation or water-bearing stratum. Aquifers can be found in almost any area.

c. Springs: Water which emerges at the surface naturally with a distinct current. When a distinct current is not present, the flow is called a seep. Most springs and seeps represent water from rain or snow on some near by higher ground which moves underground to where it comes up out of the ground. Its underground course depends on the type of soil it moves through. There are different types of springs.

(1) Artesian springs: Springs where water bubbles up with a measurable force, indicating that it is under pressure.

(a) Thermal springs: Springs having a temperature higher than the yearly average temperature for a given region.

(b) Gravity springs: Springs that subsurface water flows by gravity from a high point of intake to a lower point of issue. The two most important types are:

1 Water table springs and seeps: Springs where the water table comes near or intersects the surface of the ground. These springs can be normally found around the margin of depressions, along the slope of valleys, and the foot of an alluvial fans.

2 Contact springs and seeps: Springs along an exposed contact point, like along hillside. These springs appear along slopes but may be found at almost any elevation, depending on the position of the rock formation.

3 Development of springs:

a Enlarge the oulet of the spring by building a dam and guiding the water to storage.

b To reduce possible pollution, clear a spring of all debris, undergrowth, top soil, loose rocks, and sand.

c Improve springs by building collection boxes or digging ditches and tunnels. Collection boxes or basins can be made of wood, tile, or concrete. They collect water which flows from rocks under the force of gravity. The box should be large enough to hold most of the flow.

d Place the box below ground level so that only the top is slightly above the surface. Tightly cover the box to prevent contamination and decrease evaporation.

e Design the inlet to keep out surface drainage and prevent pollution. Fence the area and provide proper drainage.

f A screen on the overflow pipe keeps out insects and small animals. A strainer on the intake pipe or hose will keep large suspended particles from being taken by the raw water pump.

g To get water from a seep or contact spring, dig deep, narrow ditches leading from the spring to the collection piont. Large diameter pipe is more suitable for this purpose.

(2) Artesian well: Wells that has been drilled into an aquifer.

NOTE: IF SUCH A WELL, HAD ENOUGH PRESSURE TO BRING THE WATER ABOVE THE GROUND SURFACE, IT IS CALLED A FLOWING ARTESIAN WELL; IF THE WATER RISES ONLY TO AN INTERMEDIATE LEVEL, IT IS A NONFLOWING ARTESIAN WELL. WHENEVER A NATURAL OUTLET OCCURS IN AN ARTESIAN AQUIFER, AN ARTESIAN SPRING IS FORMED.

(3) Man-Made Wells: Wells are classified into five types, according to their method of construction. The five types are:

(a) Dug: A dug well is one in which the excavation is made by the use of picks, shovels, spades, or digging equipment, such as sand buckets or clamshell buckets.

(b) Bored: A bored well is one in which the excavation is made by the use of hand or power augers.

(c) Driven: A driven well is constructed by driving a pointed screen, referred to as a drive point, into the ground. Casings or lengths of pipe are attached to the drive point as it is being driven into the ground.

(d) Jetted: A jetted well is one in which the excavation is made by the use of a high velocity jet of water. However, in some regions of the Arctic, steam is used for jetting instead of water.

(e) Drilled: A drilled well is one in which the excavation is made by either percussion or rotary drills. The excavated material is brought to the surface by means of a boiler, sand pump, suction bucket, hollow drill tool, or hydraulic pressure.

1 Hydraulics of wells: Before a well is pumped, the water level is the same as the level of the surrounding water table. Measure the depth from the ground surface to the water level. The following definitions apply to hydraulics of wells.

a Static level: Depth from the ground surface to the water level. Thus if the water in a well is 25 feet below ground level, the static water level is 25 feet.

b Pumping level: When a well is pumped, the static water level drops. After several hours of pumping at a constant rate, it stabilizes in a lower position. This is called the pumping level or dynamic water level for this rate of pumping.

4. Development of seawater sources:

a. When development of inland or ground water sources are not available, the development of seawater sources may become necessary. Some of the factors to be considered in developing seawater sources are: surf action, saltwater corrosion, living organisms, surface oil along beaches, suspended sand and silt, and the rise and fall of water level with the tide

b. Saltwater Wells: Beach wells are preferred to offshore intakes. Wells can be dug to tap brackish or salt ground water. This eliminates the problems caused by tides, surf, and shallow water close to the shore. A disadvantage is the possibility of hydrogen sulfides in the raw water, causing fouling problems with RO membranes and taste and odor problem in drinking water.

c. Offshore Intakes: Offshore intakes are sometimes required due to lack of time, personnel, or equipment needed to develop beach wells. Also, coral formation sometimes prevent construction of wells. You can use intakes of either the rigid pipe or float type. If possible, locate it in deep water beyond the surf action in a vertical position.

REFERENCES:

FM 10-52-1