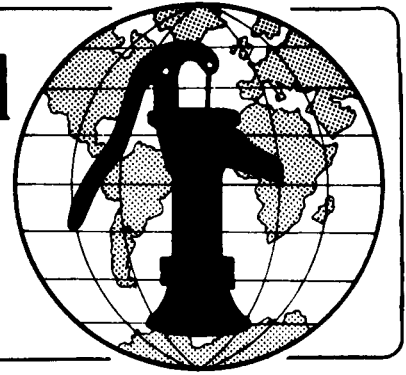


Water for the World



Constructing Driven Wells Technical Note No. RWS. 2.C.2

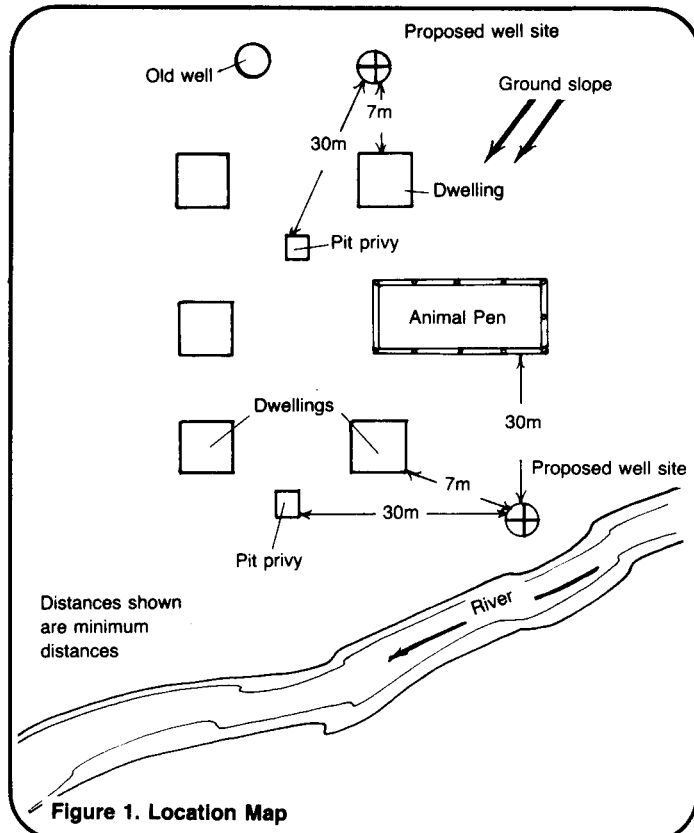
Constructing a driven well properly is important to ensure a year-round supply of water and to protect the water from contamination. Construction involves assembling all necessary personnel, materials, and tools; preparing the site; and driving the well. Finishing the well is discussed in "Finishing Wells," RWS.2.C.8.

This technical note describes how to construct a driven well. Read the entire technical note before beginning construction.

Materials Needed

The project designer must provide four papers before construction can begin:

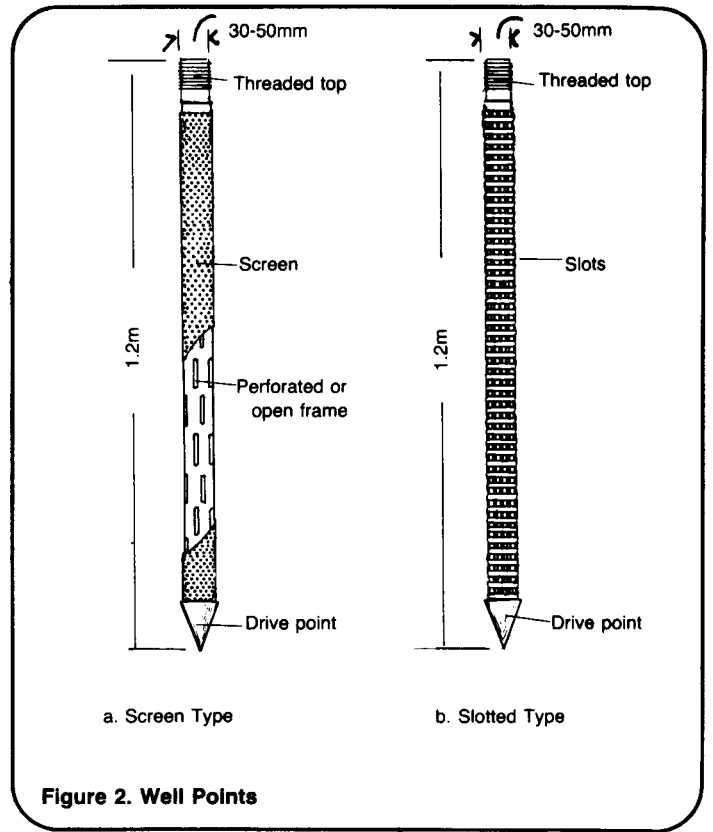
1. A location map similar to Figure 1.



2. A design drawing of the well point similar to Figure 2.

3. A design drawing of the driving equipment similar to Figures 3, 4, or 5.

4. A materials list similar to Table 1.



Useful Definitions

AQUIFER - A water-saturated geologic zone that will yield water to springs and wells.

GROUND WATER - Water stored below the ground's surface.

WATER TABLE - The top, or upper limit of an aquifer.

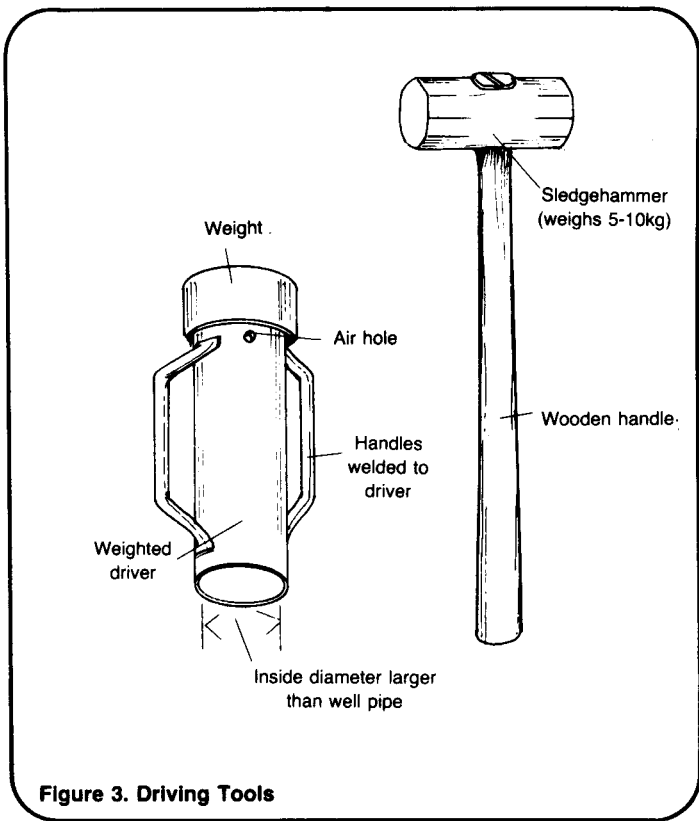


Figure 3. Driving Tools

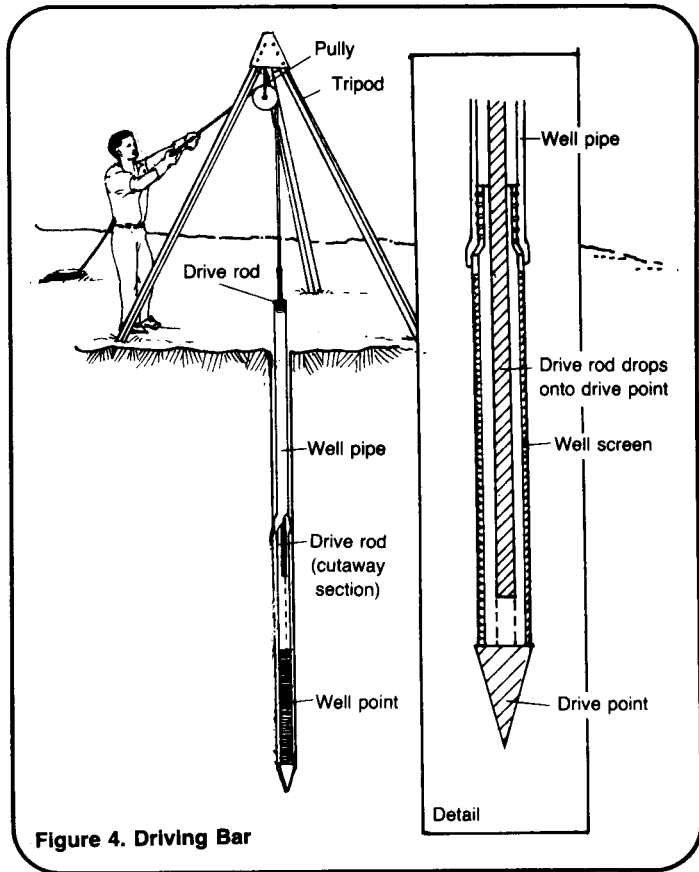


Figure 4. Driving Bar

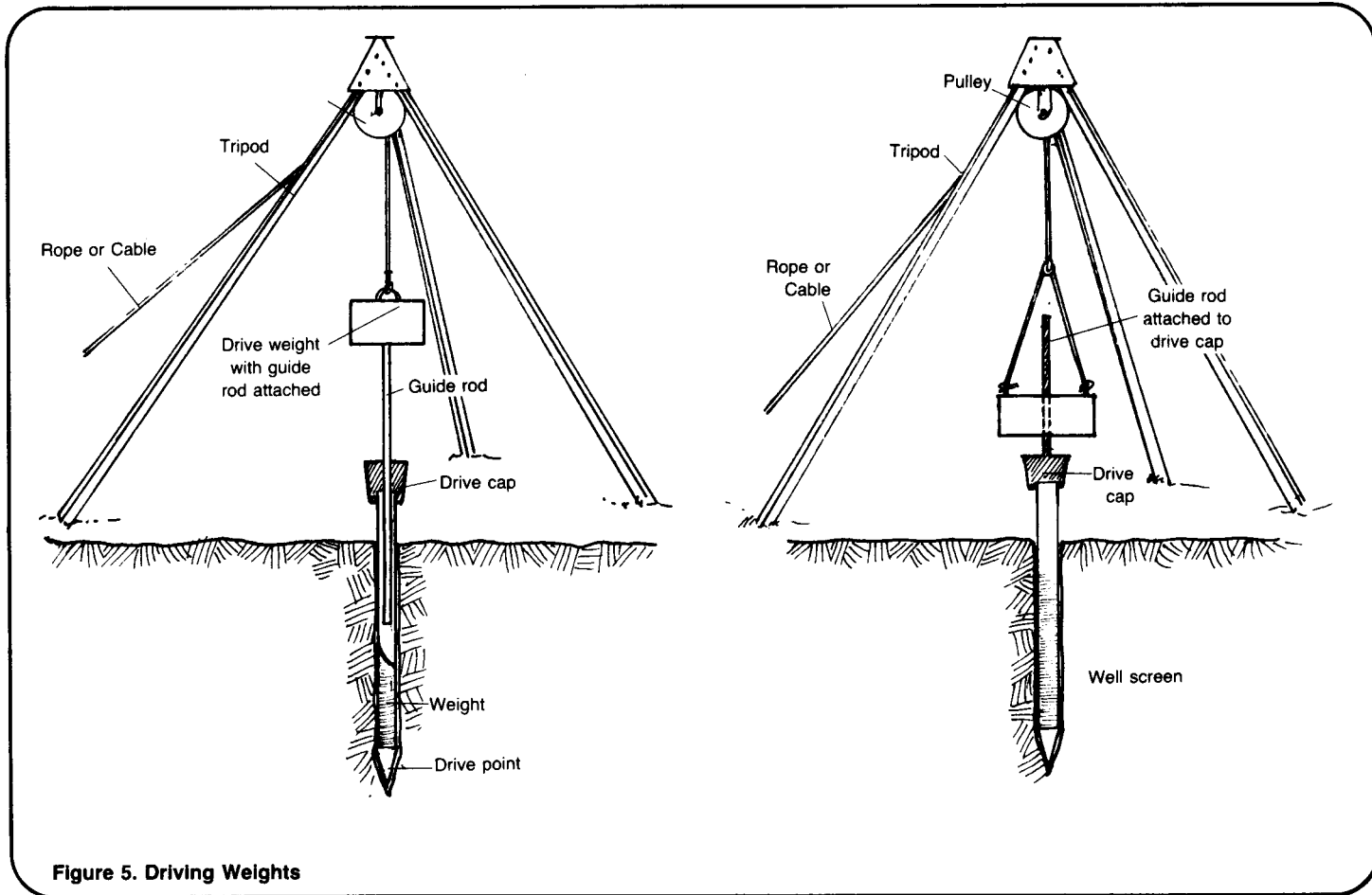


Figure 5. Driving Weights

Table 1. Sample Materials List for a Driven Well

| Item | Description | Quantity | Estimated Cost |
|------------------------------|--|----------|----------------|
| Personnel | Foreman | 1 | --- |
| | Worker, skilled in blacksmithing | 1 | --- |
| Supplies | Workers, unskilled | 2 | --- |
| | Well point | --- | --- |
| | Pipe sections (30mm diameter, 2.0m long) | --- | --- |
| | Drive cap | --- | --- |
| Tools and Equipment | Couplings | --- | --- |
| | Measuring tape | --- | --- |
| | Plumb bob and line | --- | --- |
| | Shovel | --- | --- |
| | Tripod/pulley/rope assembly | --- | --- |
| | Drive weight with attached guide rod | --- | --- |
| | Pipe cutter | --- | --- |
| | Pipe wrench | --- | --- |
| | Metal file | --- | --- |
| | Pipe threader | --- | --- |
| | Hammer | --- | --- |
| | Crowbar | --- | --- |
| | Wrenches, assorted sizes | --- | --- |
| Screwdrivers, assorted sizes | --- | --- | |

Total Estimated Cost = ---

Construction Schedule

Depending on local conditions, availability of materials, and skills of workers, some construction steps will require only a few hours, while others may take a day or more. Read the construction steps and make a rough estimate of the time required for each step based on local conditions. You will then have an idea of when during the construction process specific workers, materials, and tools must be available. Draw up a work plan similar to Table 2 showing construction steps.

Table 2. Sample Work Plan for a Driven Well

| Time Estimate | Day | Task | Personnel | Materials/Tools |
|---------------|-----|--|---|---|
| 1 day | 1 | Locate and prepare well site; assemble materials | Foreman (present during entire construction); 1-2 workers | Measuring tape; drawings |
| 1/2 day | 2 | Erect tripod; dig starter hole | 2-3 workers | Tripod/pulley/rope; shovels; plumb bob and line |
| 2 days | 2-4 | Drive well to aquifer | 2-3 workers | Well point; pipe sections; couplings; drive cap; driving weight; wrench |
| 1/2 day | 4 | Clean up site; cut pipe to correct height | 2-3 workers | Pipe cutter; pipe threader |

Caution!

The well must be driven in the exact location specified by the project designer.

Construction Steps

1. Using the location map and a measuring tape, locate the well site. Clear the area of any vegetation or debris that might interfere with work.

2. Assemble all laborers, materials, tools, and equipment needed to begin construction.

2a. For the driving bar or driving weight method, erect the tripod over the site and be certain that its feet are planted firmly in the ground to prevent the tripod from moving during the driving operation.

2b. For the sledgehammer or weighted driver method, set up a temporary platform or sturdy wooden crate for the worker or workers to stand on during driving operations.

3. Mark the exact point where the well will be driven. For the driving bar or driving weight method, this can be done by lowering the plumb bob and line from the tripod's pulley. Dig or auger a small hole about 0.5m deep at this point.

4. Couple the first section of pipe onto the well point, and screw the drive cap onto the pipe section. Set the well point in the hole and hold it perfectly vertical. Check the vertical line with a plumb bob and line.

5. Begin to drive the well.

5a. Sledgehammer. Stand on the temporary platform and strike the drive cap with a sledgehammer as shown in Figure 6. Be certain that the hammer

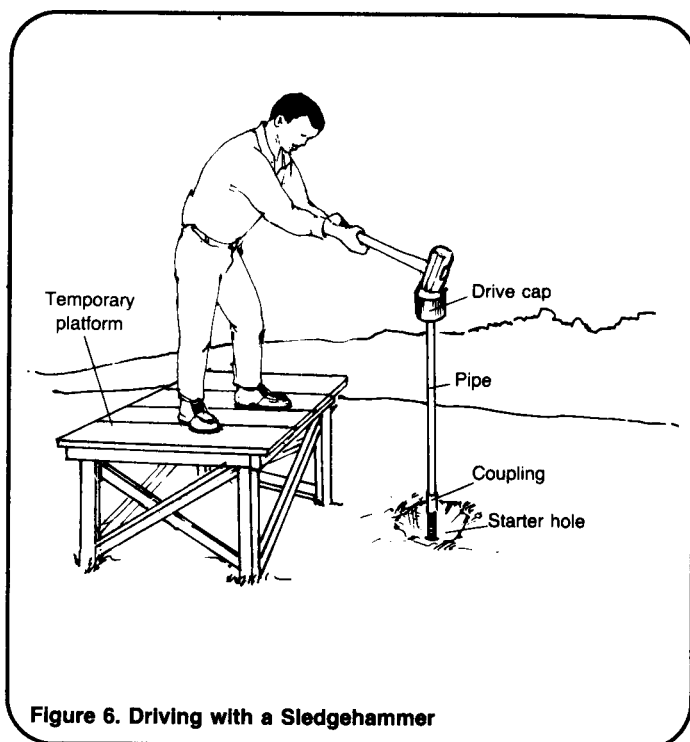


Figure 6. Driving with a Sledgehammer

squarely hits the drive cap. Avoid glancing blows. Use less than full force until the well point has been driven firmly into the ground.

5b. Weighted driver. Two workers must stand on boxes or platforms and face each other over the well pipe, as shown in Figure 7. Together, they raise and drop the driver squarely on the drive cap. Use less than full force until the well point has been driven firmly into the ground.

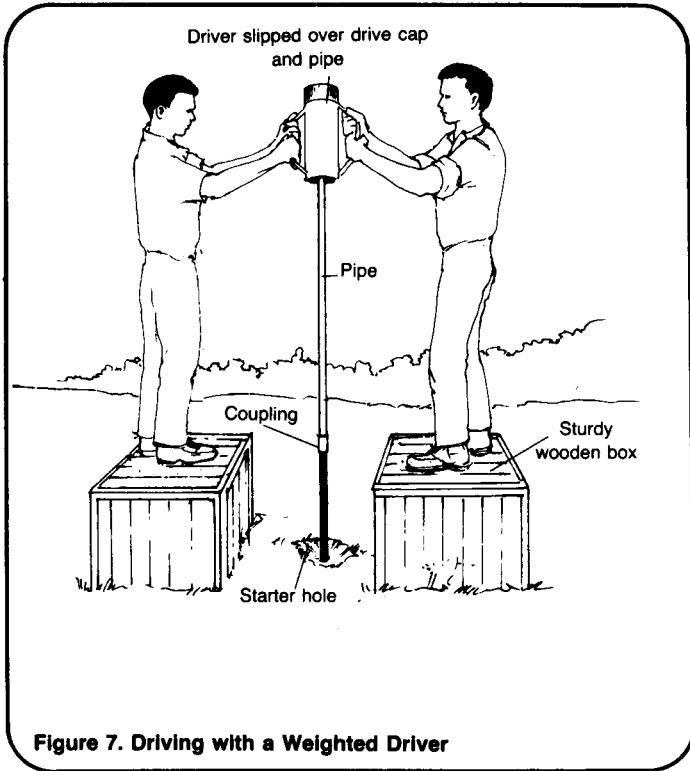


Figure 7. Driving with a Weighted Driver

5c. Driving bar. Slide the driving bar into the well pipe and lower it until it rests on the drive point. Raise the bar and let it fall onto the point. Raise the bar only part way until the well point has been driven firmly in the ground. See Figure 8.

5d. Driving weight. Depending on the equipment, either slide the guide rod into the well pipe, or slide the weight down over the guide rod. Raise the weight and let it fall onto the drive cap. Raise the weight only part way until the well point has been driven firmly in the ground. See Figure 9.

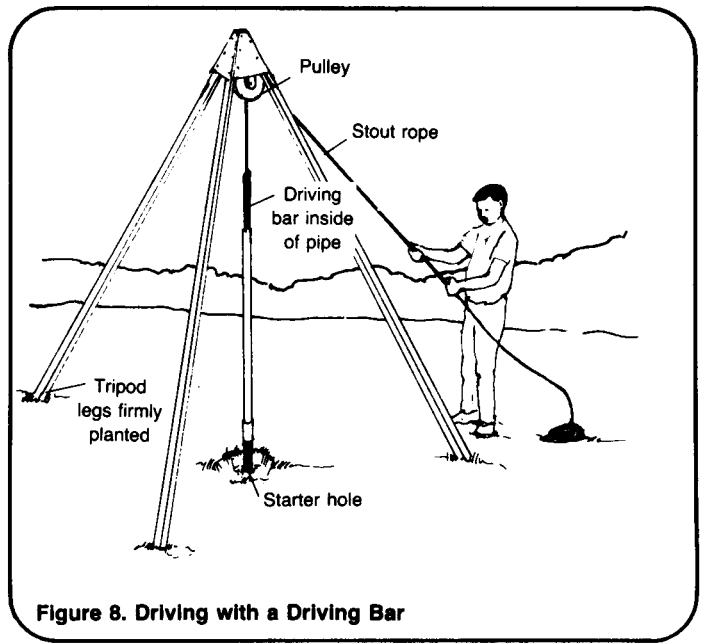


Figure 8. Driving with a Driving Bar

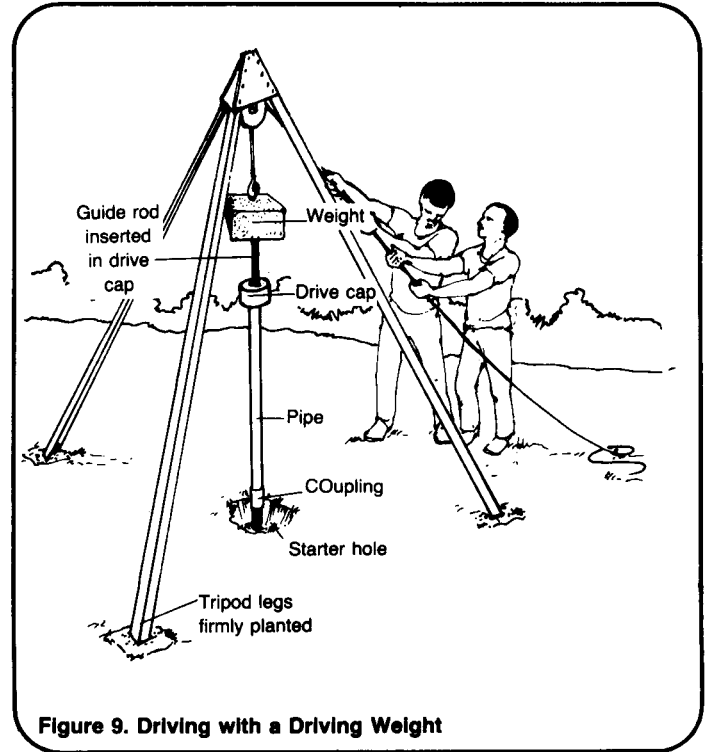


Figure 9. Driving with a Driving Weight

6. After each blow of the driving equipment, use a plumb bob and line to be certain that the well point and pipe are being driven perfectly vertical. Make minor adjustments as necessary. Also after each blow, use a pipe wrench to turn the pipe a fraction of a turn clockwise. This will ensure that the

couplings are well set and watertight. See Figure 10. If the well point and pipe get too far out of vertical, correct with minor adjustments, pull them out of the ground (see step 10) and re-start the driving operation.

7. Continue to drive the pipe. In the sledgehammer and weighted driver methods, the workers will eventually step down off the platform and drive while standing on the ground. When the pipe has been driven so far that further driving is impossible, add another section of pipe. See Figure 11.

7a. Sledgehammer and weighted driver. Unscrew the drive cap. Couple a section of pipe onto the section protruding from the ground. Screw the drive cap on top. Resume driving operations.

7b. Driving bar. Raise the driving bar and lift it out of the well pipe. Couple a section of pipe onto the sec-

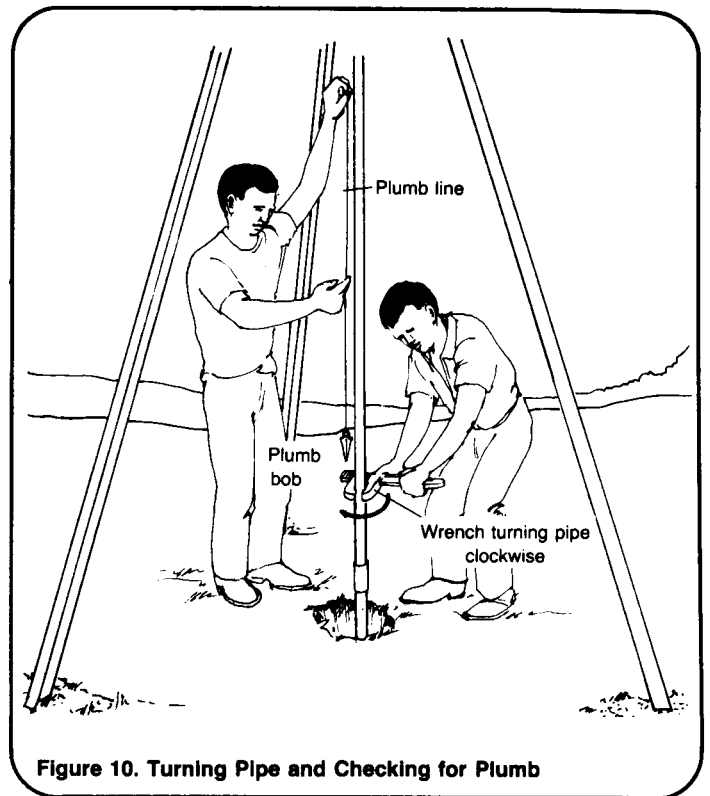


Figure 10. Turning Pipe and Checking for Plumb

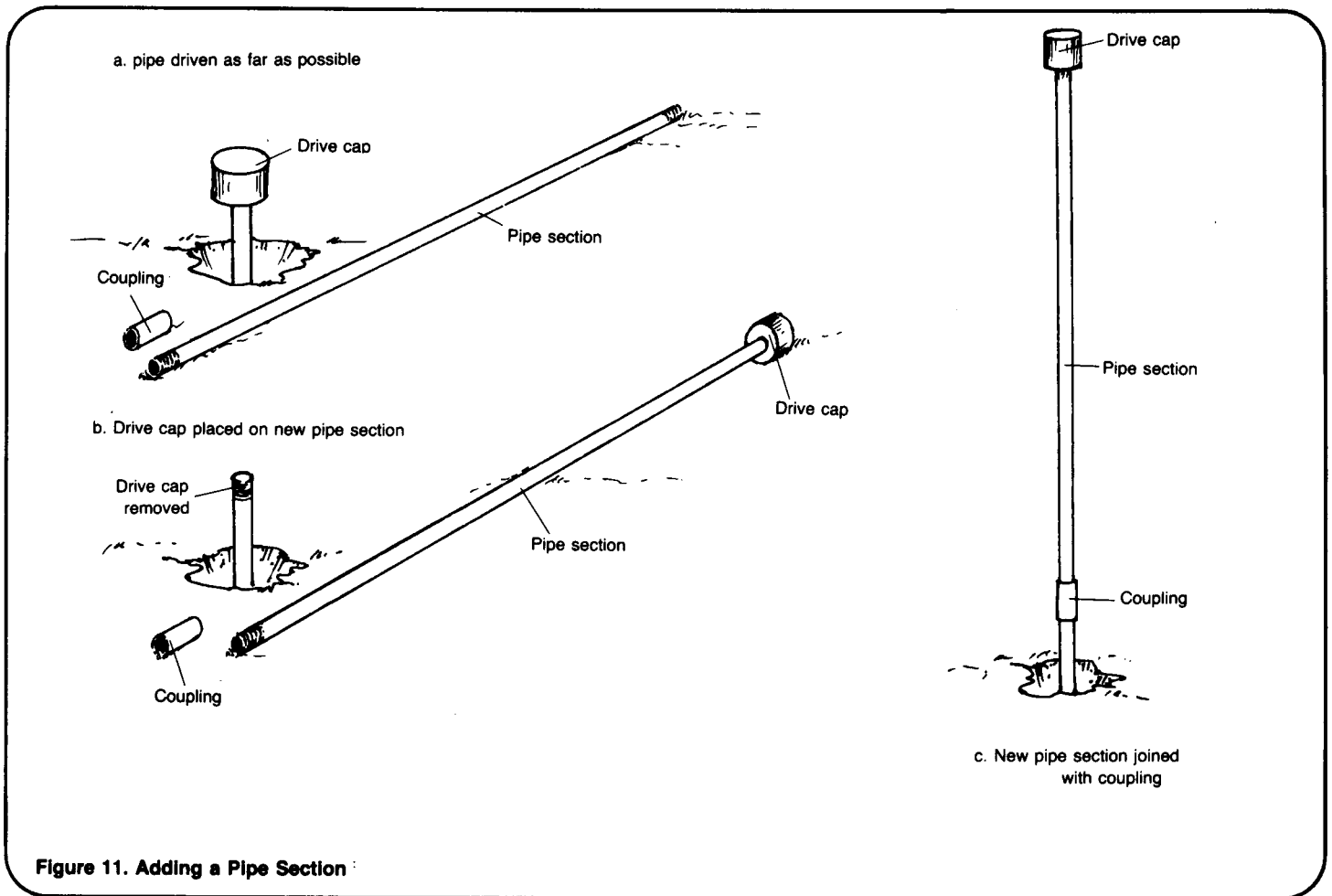


Figure 11. Adding a Pipe Section

tion protruding from the ground. Re-insert the driving bar into well pipe and resume driving operations.

7c. Driving weight (with guide rod attached). Raise the weight and lift guide rod out of pipe. Uncouple the drive cap, couple a section of pipe into the section in the ground, and couple the drive cap on top. Lower the weight and re-insert the guide rod. Resume driving operations.

7d. Driving weight (with hole for guide rod). Raise the weight and lift it off the guide rod. Uncouple the guide rod and drive cap, couple a section of pipe onto the section in the ground, and couple the guide rod and drive cap on top. Lower the weight onto the guide rod and resume driving operations.

8. Occasionally lower the plumb line into the pipe to determine whether the aquifer has been reached and ground water is entering the pipe. The well point should be driven as far below the water table as possible and still

remain within the aquifer. The driving conditions will indicate the type of subsurface soil being penetrated as shown in Table 3.

9. When you have driven the well to the desired depth, remove the driving equipment. Use a pipe cutter to cut off the top section of pipe to the desired height. Thread the top end with a pipe threader to receive the base of a pump. To finish the well, see "Finishing Wells," RWS.2.C.8.

10. If you drive beyond the aquifer, you will want to raise the pipe and the well point back into it. If you do not reach water at the limits of your driving capabilities, you will want to raise the pipe and well point completely out of the ground. In either case, attach a pipe clamp to the pipe and use jacks or a lever to raise the pipe as shown in Figure 12. Once the pipe starts to come out of the ground, it can be raised the rest of the way by hand. Turning the pipe clockwise will help to raise it.

Table 3. Driving Conditions and Subsurface Soil

| Type of formation | Driving conditions | Rate of descent | Sound of blow | Rebound | Resistance to rotation |
|---------------------|---|--|---------------|-----------------------------------|---|
| Soft moist clay | Easy | Rapid | Dull | None | Slight but continuous |
| Tough hardened clay | Difficult | Slow but steady | None | Frequent | Considerable |
| Fine sand | Difficult | Varied | None | Frequent | Slight |
| Coarse sand | Easy (especially when saturated with water) | Unsteady, irregular penetration for successive blows | Dull | None | Rotation is easy and accompanied by a gritty sound |
| Gravel | Easy | Unsteady, irregular penetration for successive blows | Dull | None | Rotation is irregular and accompanied by a gritty sound |
| Boulder and rock | Almost impossible | Little or none | Loud | Sometimes of both hammer and pipe | Depends on type of formation |

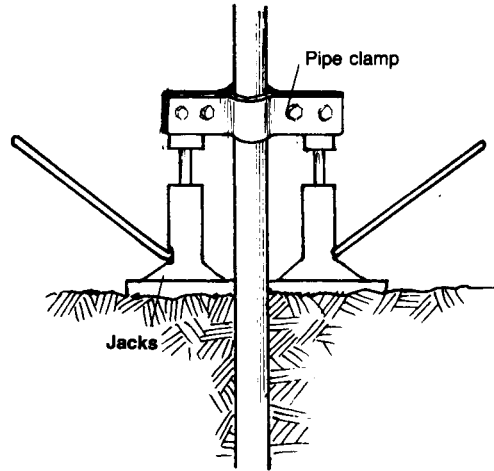
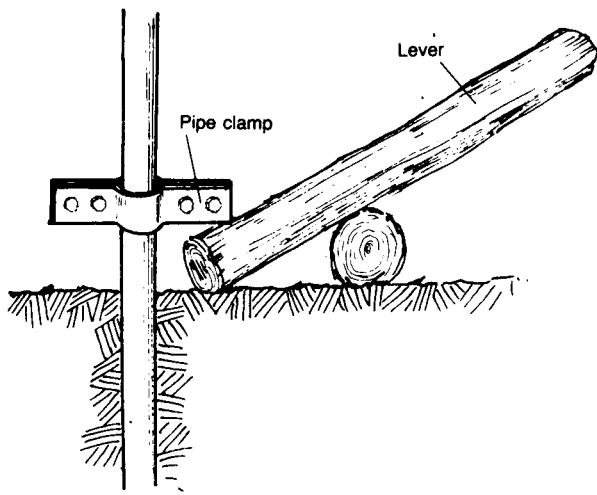


Figure 12. Raising a Pipe