General Guidelines For Standpipe
Piezometer and Observation Well Readings

Porous-tube, and slotted-pipe piezometers, and observation wells can be grouped together since they are all read using the same basic concept and have similar equipment problems, along with similar maintenance for each. These instruments measure the level of the ground water that has passed through a slotted pipe or porous stone and has risen in an attached standpipe. This level is known as the piezometric level. These standpipe instruments can be installed in constructed embankments during or after construction; in downstream area of a dam; on either abutment of the dam. Most standpipe instruments are installed in drill holes. The porous stones used in the past were typically a porous alundum stone

Procedures for taking readings.-

General.- All standpipe type instruments require the use of the following equipment to take the readings: (1) water level depth meter, (2) pocket tape measure, (3) keys to unlock protective caps, (4) screw driver or wrenches if the protective cover is a manhole, (5) field book or data sheet to record readings.

Types of Water Level Depth Meters.- There are generally two types of depth or water level meters available. The typical water level indicator will give the operator many years of service if it is properly maintained (see maintenance section below). The indicator works on a simple principle using the water in the standpipe to complete an electrical circuit when the probe is immersed into water. A small voltage is generated and this voltage is amplified in the transistorized circuit contained in the cable reel of the meter. This voltage can be read directly on a voltage meter, or an indicating light will light, or sounder will beep. This type of indicator is manufactured by a number of manufactures.

Another indicator has a sensitivity knob which is designed to measure saline and/or contaminated water. By testing the water contained in your well, you are able to determine which setting should be used when taking readings with this meter. If the knob is set lower than necessary, the accuracy of the meter will be reduced. This type of indicator is manufactured by at least three different companies. These meters have a cable attached to a probe and the cable is marked every .01-foot for the entire length of the cable. This marking of the cable has eliminated the need for a pocket tape in taking the data.

Taking Readings. - When taking water level readings complete the follows steps:

(1) Turn the indicator switch to the BATTERY CHECK position (if available) to determine the level of charge of the battery.

(2) Check for proper operation of the unit by immersing the probe in water and noting whether the device registers a closed circuit by the voltmeter, light, or if the buzzer sounds off. For units that have a sensitivity knob, lower the probe into a seepage water location or the reservoir to adjust for the proper sensitivity setting before taking readings.

(3) Unlock and remove the piezometers' or well's protective pipe cap (usually a steel

pipe or manhole cover) on the installation. Clean away any debris from or near the stand pipe. Remove the plastic PVC pipe covers from the piezometer pipe if installed. Lower the probe into the standpipe. At the level where the circuit is closed, a buzzer sounds, or a light lights, note the length of cable required to reach this water level from the top of the standpipe (usually the plastic pipe). This is usually accomplished by grabbing the cable as it is leaving the standpipe. Sometime the steel protective pipe is used as this measuring point. These data are usually recorded to an accuracy of 0.01 feet on the correct data sheet or in a field book.

(4) Most older water level indicators are incremented every 1 foot over the entire length of cable. To take measurements to 0.01 foot, the observer must use a separate pocket tape measure. A good tape to use is a Lufkin Engineers Ultralok 12-foot W312D, which is graduated in tenths and one hundredths of a foot. When taking a reading of a water level measurement, place your hand on the electrical cable at the top of the protective pipe or piezometer pipe (always be consistent as to which pipe is used) when the probe indicates the water level. Using a pocket tape, measure the distance from the foot mark below your hand back up the cable in your hand. Add this measurement to the foot mark and you have your water depth.

(5) When there are two stand pipes in a hole, each must be identifiable so that the correct data can be determined for each piezometer. The standpipe of the lower piezometer should be cut off flush with the top of the protective pipe, and the standpipe of the upper piezometer should be cut off approximately one-half-inch above the top of the protective pipe. Another method is to color code the stand pipes. An example could be red for the lower piezometer and green for the upper piezometer. If necessary this color coding can be added to existing installations if you have questions about which instrument is at what depth. Color coding can assist a novice operator in collecting data.

(6) Replace all caps and lock the protective cap.

(7) Record the reservoir and tail water levels at the time of the observation.

(8) Once all readings have been taken, the probe of the water-level meter should be cleaned and the cable should be dried off with a cloth.

Problems with readout equipment and stand pipes.-- The typical water level indicator will give the operator many years of service if it is properly maintained (see maintenance section below). The indicator works on a simple principle as described above.

Some problems that have occurred with the **water level instrument** are as follows:

1) If the water level meter probe has been damaged, then they will give false reading of water level depths. This damage may occur if the probe gets hung up within the piezometer well and a wire is broken within the cable. With extended use, the probe on the meter could also become worn and give false readings. The probe should be checked periodically for correct reading. An easy way to check a meter is to take a sample of seepage water or river discharge in a container

or bucket, place the probe into the container. If the meter uses sensitivity knob set that knob to the same setting as used to collect the usual water level readings. The meter should sound as the probe is lower into the container when the circuit closes. Measure the distance from the top of the container to the water level with a rule, this distance should be the same as measured with water-level meter.

2) If a water level meter probe has to be replaced on a cable, care should be taken not to shorten the length of the cable in this process. If the cable has been damaged, the amount of cable that has to be removed should be recorded on the meters' wheel and in a field book or data sheet. This record needs to be kept with the meter so that future readings can be compared without the error in cable length becoming a problem.

3) Most water level indicators are incremented every 1 foot over their length. To take measurements to 0.01 foot, the observer must use a separate pocket tape measure as described above. This measurement becomes difficult if the water level meter is marked every 5-feet as some indicators are marked. The five foot distance at times is difficult to measure with a separate tape.

Problems with **stand pipes** are as follows:

1) When measuring water levels in piezometers that are not vertical (greater than +/- 15° from vertical), condensation will build up within the stand pipe. This condensation will give the observer a false water depth reading. The sensitivity switch on the water level indicator can be set at a low setting which will allow the probe to pass this condensation and read the water level, but the depth reading could still be inaccurate.

2) Another problem related to measuring accurate water depths is caused by chemicals that have entered the stand pipe. Chemicals like diesel fuel or oil will enter the water if they have been used in an attempt to retard the setting of Bentonite pellets used to seal a piezometer in the drill hole. These chemicals will float on the water level within the stand pipe and give false readings. These chemicals have been bailed out, blown out, and even wiped out with little success. The 3M company produces an absorbent material which can be used to soak up the diesel fuel and remove it from the well. This material comes in sheets, 18 inches by 18 inches, and needs to be cut to fit into the standpipe. The model is No. T-156, 3M Company absorbent materials. The absorbent should be lowered into the stand pipe by means of 1/4-inch steel rods with the absorbent attached. Many attempts may be required to remove these chemicals.

Another method to solve the problem of chemicals floating in the water column is to install at bubblier system. A bubblier installation is described at the end of this section.

3) The elevation at the top of the standpipe can settle during the life of the project which requires periodic resurvey. The original elevation should always be determined after installation of the piezometer. When a structural deformation survey is conducted at the dam, always the top of pipe elevations should be checked. The new piezometer stand pipe elevations should be entered onto the piezometer data sheets.

4) Plugging of the stand pipes has caused problems and if the pipes are small diameter it become difficult to remove a blockage. Depending on the location of the blockage within the piezometer, near the piezometers tip elevation or some depth within the standpipe its self, water or air pressure can be used to jet out the blockage. Review the zone material where the piezometer is installed and if it is within a zone 1 material, the pressures used to remove the blockage should be kept as low as possible. Typically a blockage occurs at the tip elevation caused by pore water pressure being fines into the piezometers filter and causing the blockage. If this is occurring than jetting out the tip elevation with water is only a temporary repair and it will plug again in the future. If the plug is occurring within the standpipe typically at a pipe joint that wasn't completely sealed during installation this two can be removed temporary.

Clearing the blockage. - The following methods should be attempted to clear blockages. Special attention needs to be paid to the zone or type of material the piezometer is installed in. If the piezometer is installed in zone 1 material that has a low permeability than the blockage should be removed by using air pressure. If the piezometer is installed in high permeability materials (zone 2 or foundation gravel) than water should be used to remove the blockage. When water is used in a low permeability zoned piezometer, it could take years for the water to dissipate. A small diameter pipe or tube should be lowered to just above the blockage and either pressure medium should be applied to the blockage. Once the blockage has been removed test the total depth of piezometer well with a water level indicator. For ½-inch diameter stand pipes use 3/8-inch nylon tubing, and for 3/4-inch diameter stand pipes use 1/4-inch schedule 80 PVC pipe with external screw on couplings. Attach the tubing or pipe that is being used to a hand pump or air tank and apply pressure to the blockage. Slowly lower the pipe till it has passed the blockage and then removes the pipe or tubing. Test the standpipe with a water level indicator. Several pasts may be required till the blockage has been removed. If water is being used the blockage will be washed from the standpipe. When using air the blockage will fall to the current water level within the piezometer and hopefully not cause a future blockage. **Always remember to keep a good grip on the pipe as it is within the piezometer standpipe so that it is not lost down the standpipe.**

c. **Maintenance**.-- The only maintenance that should be required with most water level indicators are changing the batteries and keeping the electrical cable clean and in good condition. Always turn off units to save battery life. When cleaning the probes on the end of the indicators never use solvent or other harsh cleaners. Always use a clean dry rag and wipe along the length of the cable and indicator probe. Never turn the rag around the cable or probe when the probe is being held in a rigid position. If this is done often, the wires attaching the probe to the cable will tend to break or slip out of the end of the probe.

d. **Bubblier System**.-- A bubblier system can be installed within a piezometer stand pipe to measure the water levels. The advantage of this system is that it allows for measurements in a piezometer well that will not allow a conventional water meter to work because of the well contains chemicals within the water as described above. It can also be used in a stand pipe that is partially blocked and the water meter probe is to large and cannot be lowered to the water level, yet the bubblier tube can be pushed past the blockage. By installation of a bubblier system, data can still be collected from piezometers with these problems.

The bubblier system consists of 1/8-inch diameter plastic tubing, 1/8-inch electrical fish tape, a small instrumentation hand air pump with a section of hose attached, and a pressure gauge marked in feet of water. The fish tape is used to lower the plastic tubing into the piezometer pipe and hold it in place. The end of the plastic tubing is left open so the water column can enter the tubing. The tubing is taped to the fish tape at 20 foot intervals so that the tubing will stay in place during and after installation. At the collar of the piezometer installation, the fish tape should be bent over so that it holds the bubblier tubing in place within the piezometer pipe. A tubing union should be added to the top of the tubing so that the hand pump can easily be attached for taking readings. The length of tubing placed in the well should be measured. The length is than subtracted from the elevation of the top of the piezometer pipe and the elevation of the bubblier tube within the well is known.

To take readings, attached the hand pump and pressure gauge to the 1/8-inch tubing at the tubing union. Pump up the pressure in the tubing using the hand pump. Observe the pressure on the pressure gauge. The pressure should raise to a point equal to the pressure or water head within the well and then exceed it by the length of the tubing added during installation within the well, usually 2.5 feet of water. Once the pressure raises to its highest reading, bubbles start leaving the end of the tubing at the bottom end, the pressure should drop. The pressure should than stay steady. Record this reading. Typically, two readings should be taken at this time to verify the reading. To accomplish this, vent the pump of a small amount of pressure and pump it up again. Average the two readings made. The pressure head measured is than added to the elevation of the bottom of the bubblier tube and that provides the elevation of the water within the well.