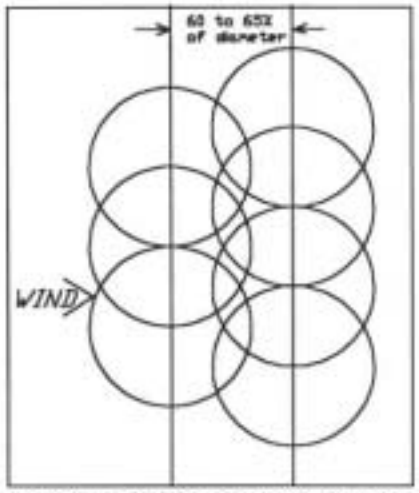
NELSON BIG GUN/QC VALVE DESIGN GUIDE

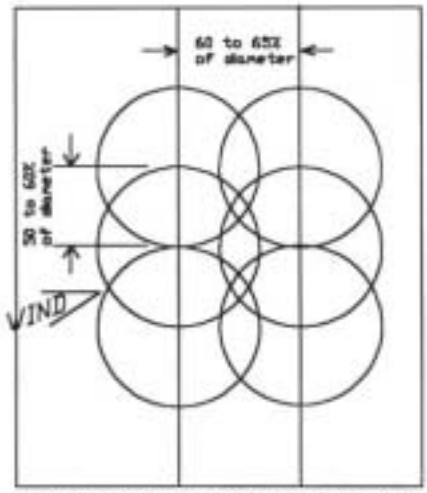
UNIFORMITY

Spacing criteria

The spacing distance between the Big Gun sprinkler locations will effect the uniformity of water distribution in the quick coupling (QC) valve system. Normally, spacing between guns is 60% of the sprinkler diameter. Closer spacings result in generally higher uniformity and may be very beneficial in areas of high wind speed.



EXAMPLE OF TRIANGULAR SPACING



EXAMPLE OF RECTANGULAR SPACING

Figure 1

Rectangular or triangular layout

Rectangular or triangular layout is one of the first design decisions that must be made. Figure 1 shows these layout choices. The triangular layout is generally the best choice unless farming operations require that the sprinkler and valve line up in the cross row direction.

Wind is a major factor

Wind is the major cause of water distribution uniformity problems. To the extent possible it is recommended the gun layout be set to avoid a wide spacing exposure to the predominate wind direction. See Figure 1 for the recommended orientation and follow the orientation as near as practicable.

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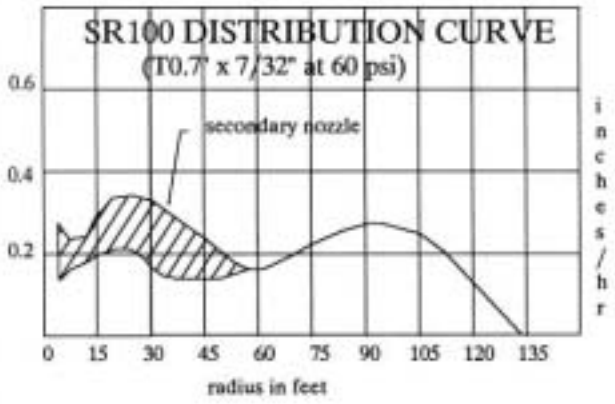

Figure 2

Secondary nozzles

Secondary nozzle in the sprinkler is important for adding the required water close to the sprinkler. Figure 2 is a plot of the distribution of water from the sprinkler showing the added water delivered by the secondary nozzle. The secondary nozzle should be sized to deliver approximately 10% of the total flowrate of the sprinkler. One point to recognize is the increased chance of plugging the smaller secondary nozzle if debris is in the water. If plugging does occur then additional labor will be required to keep the secondary nozzle open.

APPLICATION RATE

How to calculate

Application rate of the water must not be excessive or runoff may occur. Runoff of water can be a serious cause of reduced irrigation efficiency. The soil must be able to intake the water at the rate it is applied. To calculate the total average application rate within a sprinkler pattern it is best to assume that all sprinklers will be operated at the same time. The average application rate in inches per hour and can be calculated with the following equation:

$$\text{AVERAGE APPLICATION RATE (in/hr)} = \frac{96.3 \times \text{gpm of one gun}}{\text{SPACING BETWEEN GUNS} \times \text{SPACING BETWEEN LINES}}$$

Be sure to include the flowrate (gpm) of both the primary and secondary nozzle. The spacings must be in the equation in feet.

If the soil has a low water intake rate the application rate can be reduced by running only one gun at a time. This results in a reduced application rate of nearly 60% of that found with the Average Application Rate equation.

Full circle vs. part circle operation

Full circle or part circle operation of the sprinkler has a great influence on the application rate. A gun set to operate in a half circle arc will double the application rate. Avoid over irrigation by running part circle guns for less irrigation time or using a smaller nozzle if necessary.

PRESSURE REQUIRED

What is ideal

Selection of the correct pressure is an important part of the system design. The ideal pressure to target is 70 PSI at the gun. This pressure will result in good general performance of the system with a gun flowrate of 100-140 gpm (0.6"-0.7" nozzle size). The minimum pressure should never be below 60 psi in this flowrate range.

Why is adequate pressure important

Adequate pressure is necessary to achieve optimum performance of the Nelson 100 series guns. Avoid poor stream break-up and distribution pattern problems by designing for proper pressure. When the pressure on the gun is less than the minimum recommended above, the stream does not break apart and soil or crop damage can occur from the water intensity; also, the throw distance of the stream will be less than required for good uniformity.

Taper nozzle or ring nozzle

Taper or ring nozzle choice give field adjustability to the design. The taper nozzle is best to achieve maximum throw of the stream and the ring nozzle is best to break-up the stream and give easy change of nozzle size. The ring nozzle throw is 6% less than the taper nozzle. See the Big Gun catalog for actual throw distances.

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RISER ASSEMBLY

What is important about the assembly

Risers hold the QC valve and stabilize the Big Gun during operation. The riser must be vertical, stable against vibration, and have low turbulence. Where risers are exposed to machinery or livestock abuse, a rugged assembly is required. The recommended alternatives are listed in the "Installation details and options" section of this manual.

The 2-elbow swing assembly

The 2-elbow swing assembly is the simplest method used to plumb in riser assemblies. It is used where height adjustability is not critical. The lowest turbulence and friction loss results when this assembly is used. This plumbing is not recommended for the QC valve in box installation option as shown in the "Installation details and options" section of this manual.

The 3-elbow swing assembly

The 3-elbow swing assembly is the most flexible installation. The 3-axis swing will flex if necessary to limit the potential damage which may occur if the riser is hit by machinery. This option is the best choice for the QC "valve in box installation option ". The friction loss and turbulence generated with-in the riser assembly is more than the 2-elbow swing assembly. Refer to the "Friction loss through the riser assembly" (Table 2) in the following section for details.

HYDRAULICS

What does hydraulics effect

Hydraulic design must allow for adequate water delivered to each riser assembly with a minimum of flow turbulence. The pipe purchase and installation is a capital cost that will be fixed but energy costs and low pressure problems will endure through the life of the system. Consider using the latest hydraulic design tools, computer programs, looping pipe networks ,etc to get the best design possible.

Friction loss through the valve

The QC Valve has a center flow design to have a minimum of friction loss and turbulence. The following table gives the friction loss of water flowing through the QC valve and key coupled to an SR100:

Table 1
QC VALVE FRICTION LOSS

Flow (gpm)	Loss (psi)
80	0.6
100	1.2
120	1.6
140	2.4
160	3.4
180	4.4

Friction loss through the riser assembly

The riser assembly is normally of the 2-elbow or 3-elbow configuration. Figures 3 and 4 show the components of these two assemblies. The purpose of these recommended assemblies is to provide convenience for installation, protect the buried pipe lateral from damage if the riser is disturbed with machinery or livestock and to be sure the valve is plumbed vertical.

The 2-elbow assembly is less flexible and not as convenient in installing the valve at a set height. This option may be the best for standard application where the valve is above ground.

The 3-elbow assembly is for installation flexibility when the valve is in a box. It is easier to vertically plumb the riser with this option. There is more friction loss and turbulence in this assembly than in the 2-elbow option because of the addition of one more elbow. See Table 2 for the friction loss pressure that must be added to the system to flow the adequate water necessary for proper gun performance.

Table2
SWING JOINT FRICTION LOSS
(2" Pipe)

Flow (gpm)	2-Elbow (psi	3-Elbow (psi)
80	0.6	1.0
100	1.2	1.6
120	1.6	2.1
140	2.4	4.1
160	3.6	5.4
180	4.4	5.8

THRUST FROM THE BIG GUN

How much thrust

The thrust generated by Big Guns can be substantial and provisions must be made to prevent tipping or vibration of the risers. Portable aluminum tripod supports can be used for sprinkler mounting to avoid the need to stabilize the riser with a concrete block or post. The amount of thrust generated from operation of a T0.7" nozzle on the Nelson Big Gun sprinkler is shown in Table 3.

Table 3

Pressure (psi)	Thrust in pounds
50	34
70	48
90	62

Importance of stability

Stability of the riser will assure the correct operation of the sprinkler. The QC valve and key connection were designed to form a ridged coupling. With a stable riser the drive arm will give the necessary amount of drive to assure the sprinkler turns uniformly. Also, the vibration created by the drive arm must be dampened out to not reach the lateral pipe where it could cause fatigue and possibly failure to the tee joint. Vibration will reduce the throw of the sprinkler stream. If the sprinkler is not solidly mounted the stream throw radius can be reduced as much as 20%.

INSTALLATION DETAILS AND OPTIONS

Typical riser plumbing components

Typical riser assemblies and methods to mount the QC valve are shown on the follow pages. These options are shown as suggestions. It is possible a loose soil will require more stabilizing than shown. The methods have been successfully used in normal clay and clay loam soils.

Valve box with concrete stabilizing

This option is shown in Figure 5. The primary advantage of the valve in the box is the reduced exposure to damage and interference with cultural practices.

Valve box with tripod gun support

This option is shown in Figure 6. The primary advantage of the valve in the box is the reduced exposure of the valve to damage and interfering with equipment operation. The tripod is portable and is used to stabilize the sprinkler without the need of concrete or a post on the riser.

Valve on riser with stabilizing post

This option is shown in Figure 7. The primary advantage of the valve on the riser is the ease of mounting and removing the sprinkler. Because no concrete is required there is no need to allow for forming or curing time during the installation process.

Valve on riser with concrete stabilizing

This option is shown in Figure 8. The primary advantage of the valve on riser with concrete to stabilize is longer life expected with concrete as compared to the wood post. With this option the forming, placing and curing time of concrete must be allowed for during installation.

TRAJECTORY ANGLE OF THE BIG GUN

Selection of the correct trajectory angle of the Nelson Big Gun sprinkler will result in optimization of pattern uniformity, minimized wind drift and evaporation, maximized radius of throw and best droplet conditions possible. Generally the 24 degree trajectory angle provides the best choice. At 80 psi with the T0.7" nozzle the stream height of the 24 degree trajectory is 24 feet above the nozzle at the maximum point. Under the same conditions the 21 degree trajectory throws 19 feet above the nozzle.

INSTALLATION HINTS

The following hints may be useful in efficient installation and use of the QC valve system.

Select the proper valve box. Adequate clearance for the valve allows for easy mounting of the sprinkler and key and connecting of the pilot connector. Also, the gun drive mechanism will clear obstruction best if the valve is located as high as possible within the valve box.

When placing the QC valve near a fence line or other obstruction, be sure to allow for and check clearance of the gun and stream through the entire arc of rotation.

When installing several valves which will

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be used as part circles, orient the valve pilot connector in a consistent direction. This will avoid unnecessary changing of the arc setting stops on the gun when the gun and key is moved from valve to valve.

In areas where freezing could damage the piping be sure to provide drain valves at all low points. The "ball valve" type has the highest durability against leakage.

A magnetized plumbing level is very useful during installation to get the riser vertical.

An air control valve will release air trapped in the riser. It should be located right under the QC valve.

Safety first!

Always exercise good safety procedures. Persons operating the system, or persons who will be in areas where the Big Gun Quick Coupler system operates, should be warned that personal injury may result from the high pressure water stream emitted from the gun nozzle. A special danger existes when the Quick Coupler gun is automatically controlled because the high pressure stream may be emitted without warningwhen the valve automatically opens. Post warning signs or take other steps to prevent passersby from being injured.

* Read all warning labels and cautions!
* Use the Quick Coupling Valve and Key only with the Nelson SR100 or F100 sprinklers!
* Never remove or modify the safety guards!
* Be sure water flow through the valve has stopped before turning the key to disengage from valve!

WARRANTY AND DISCLAIMER

Nelson BIG GUN sprinklers and Quick Coupling valves are warranted for one year from date of original sale to be free of defective materials and workmanship when used within the working specifications for which the product was designed and under normal use and service. The manufacturer assumes no responsibility for installation, is limited solely to replacement or repair of defective parts, and the manufactures will not be liable for any crops or other consequential damages resulting from any defects or breach of warranty.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES AND OF ALL OTHER OBLIGATIONS OR LIABILITIES OF MANUFACTURER.

No agent, employee or representative of the manufacturer has authority to waive, alter or add to the provision of this warranty, nor to make any representations or warranty not contained herein.

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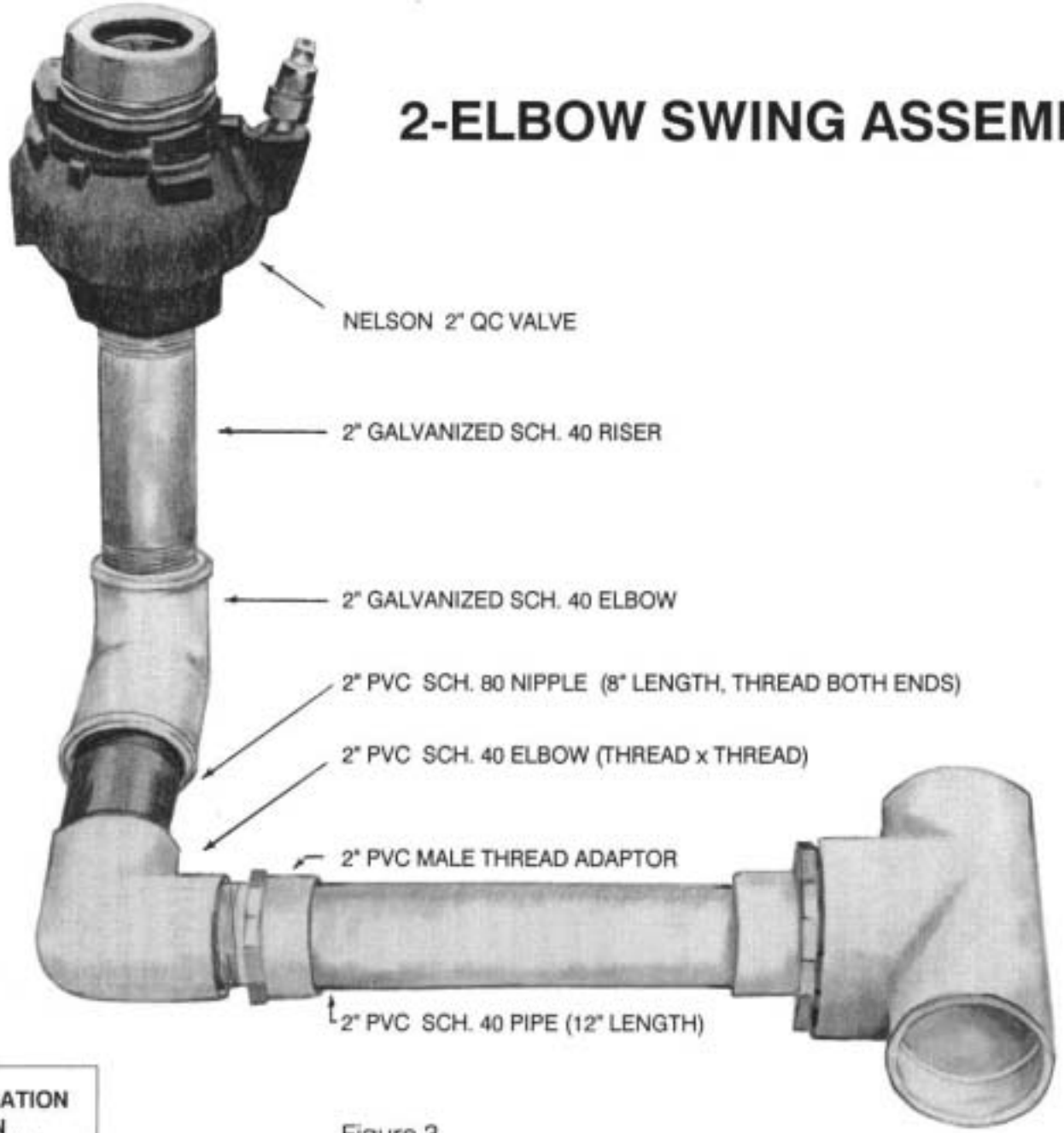
2-ELBOW SWING ASSEMBLY



NOTE:
1. PERMATEX NO. 51 JOINT COMPOUND IS RECOMMENDED FOR ALL THREADS.
2. ALL CONNECTIONS WITH PVC THREADS SHOULD BE TURNED NO MORE THAN ONE TURN PAST HAND TIGHT.

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Figure 3

3-ELBOW SWING ASSEMBLY

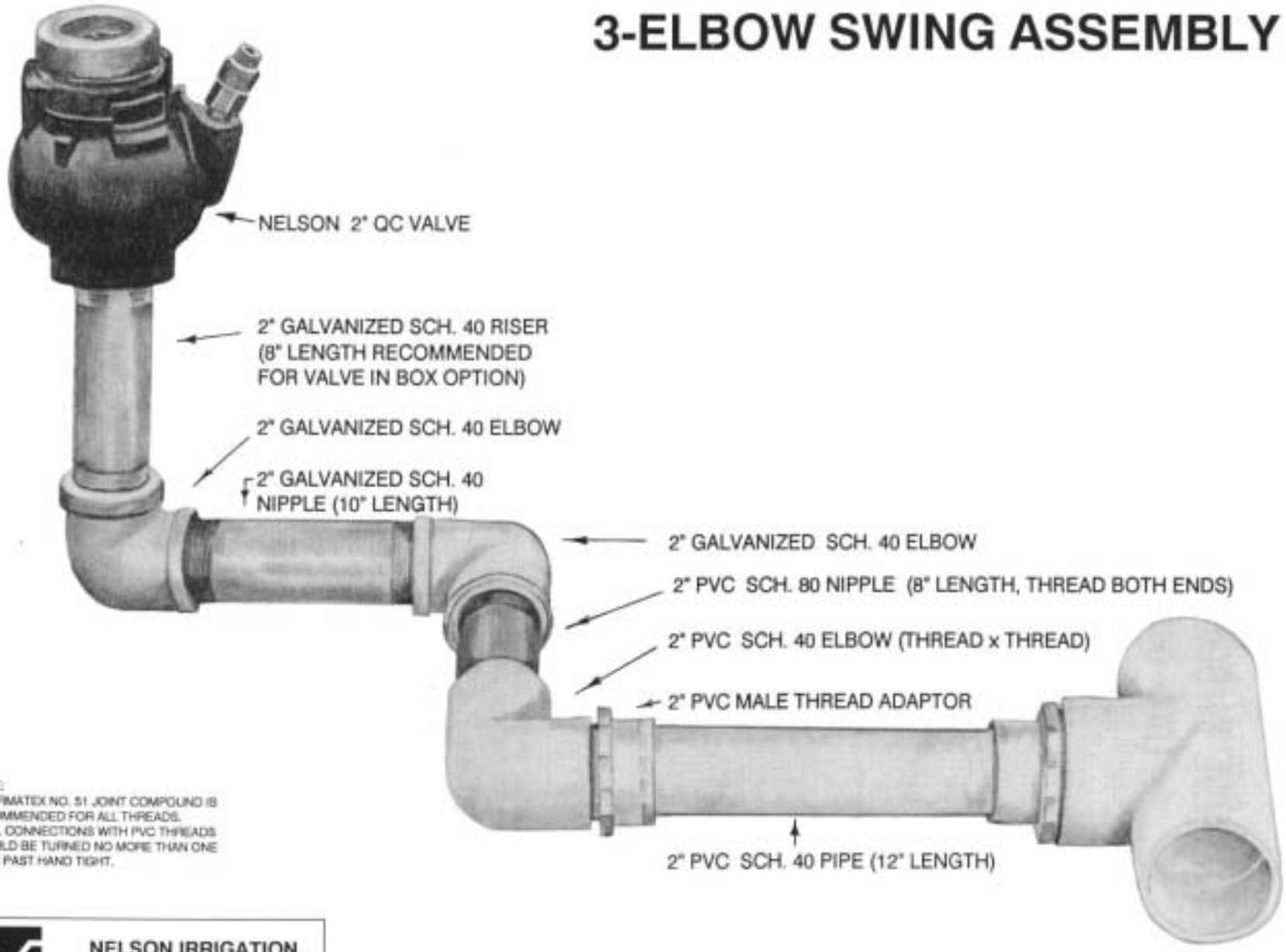

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Figure 4

VALVE IN BOX WITH CONCRETE STABILIZING BLOCK

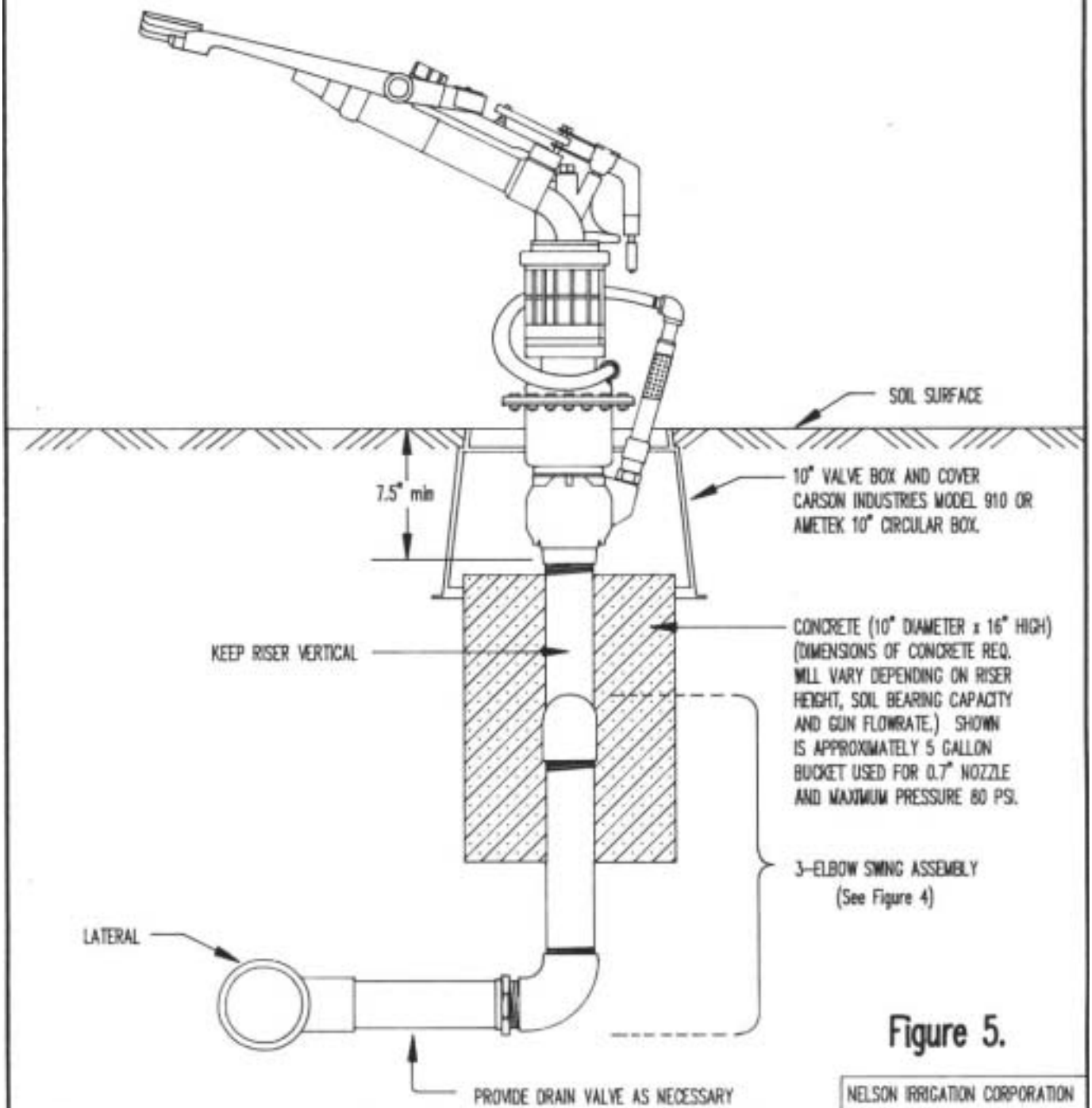

Figure 5.

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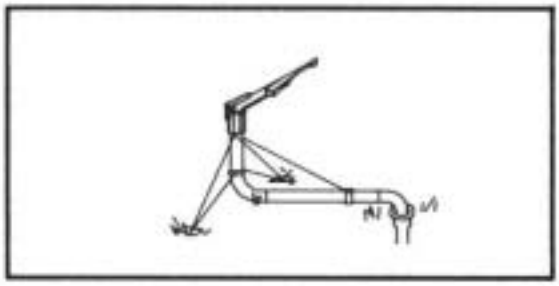
VALVE IN BOX WITH ELBOW KEY ADAPTER
(for use with tripod mounted gun)



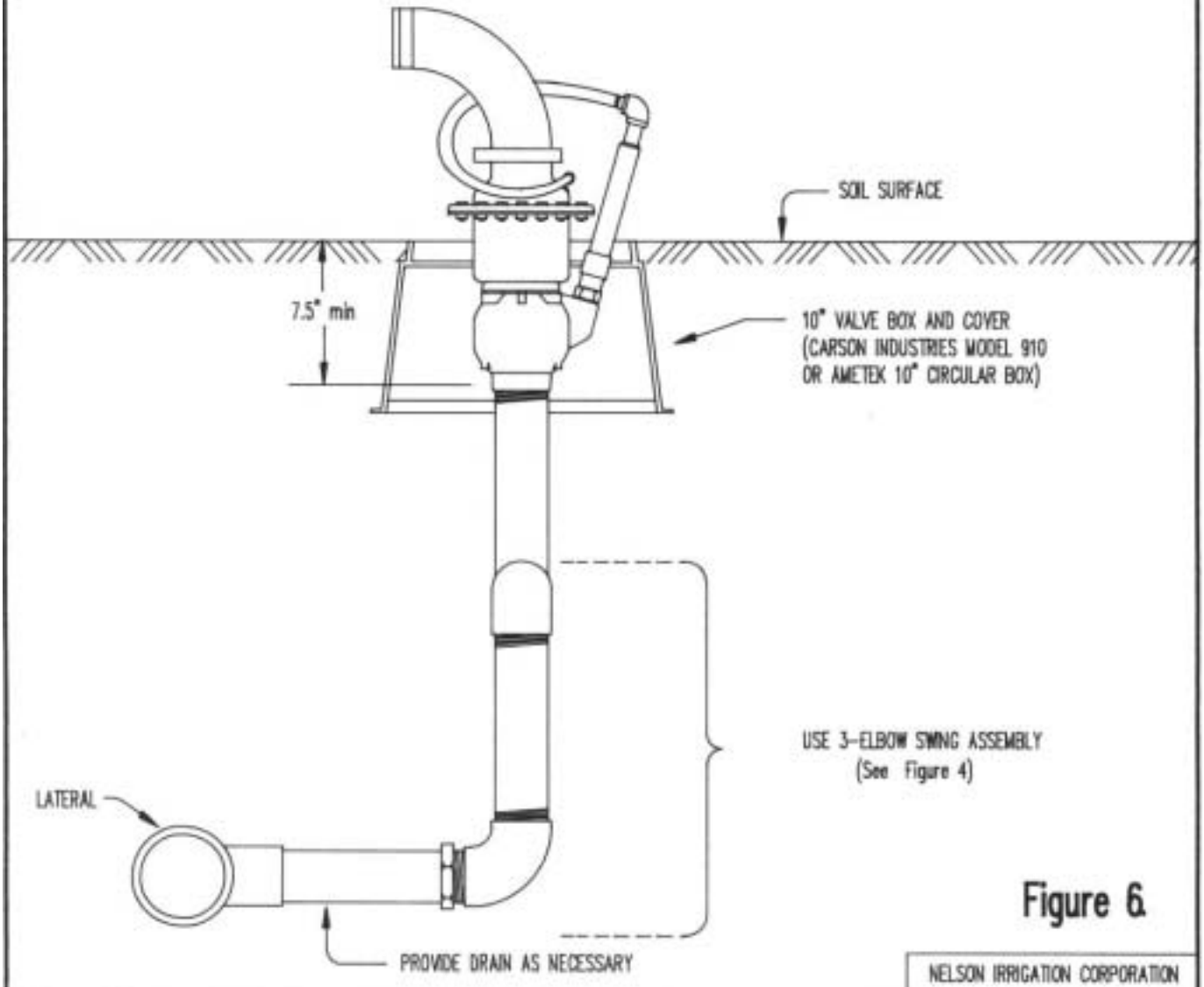


Figure 6.

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VALVE ON RISER WITH STABILIZING WOOD POST

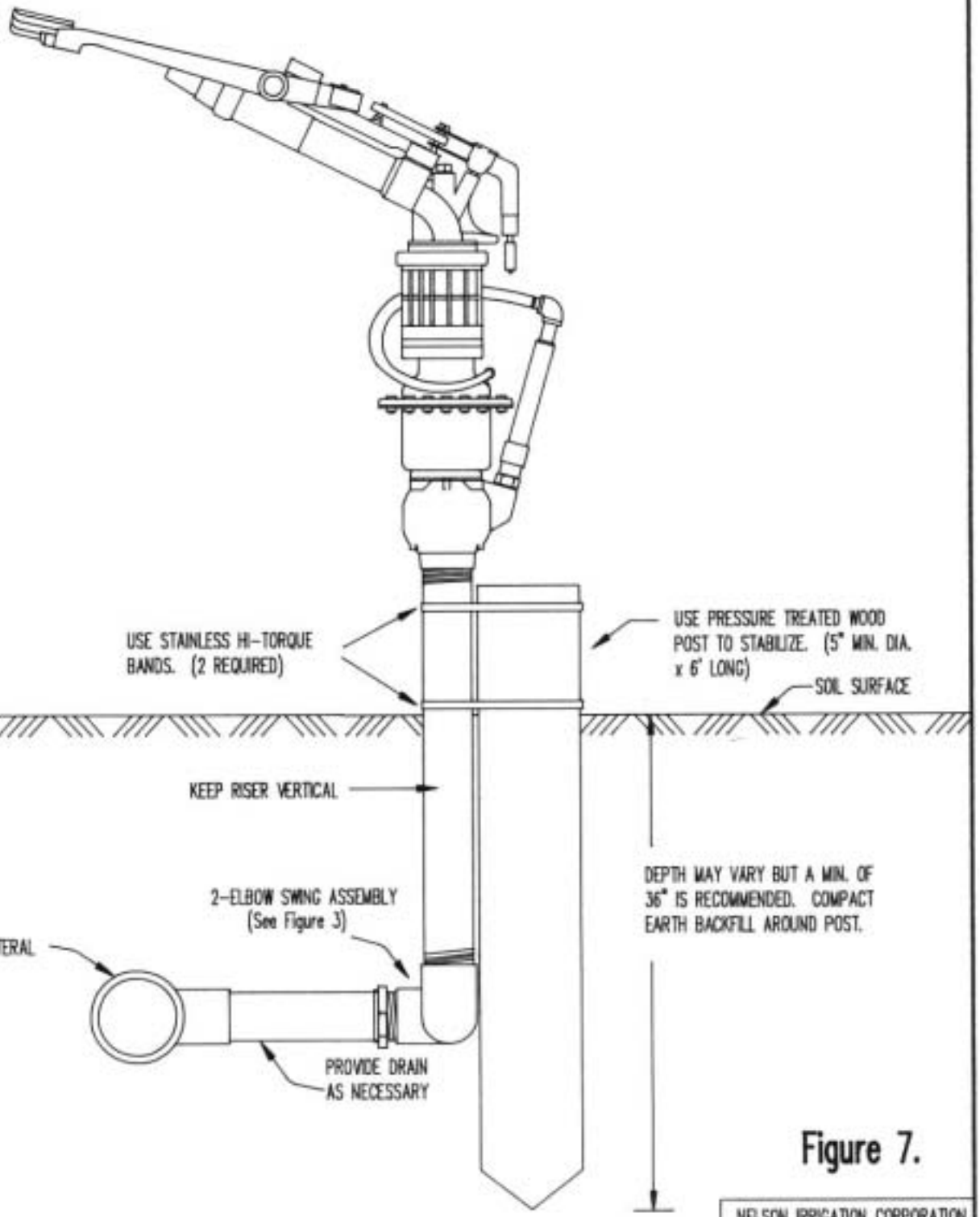

Figure 7.

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VALVE ON RISER WITH CONCRETE STABILIZING

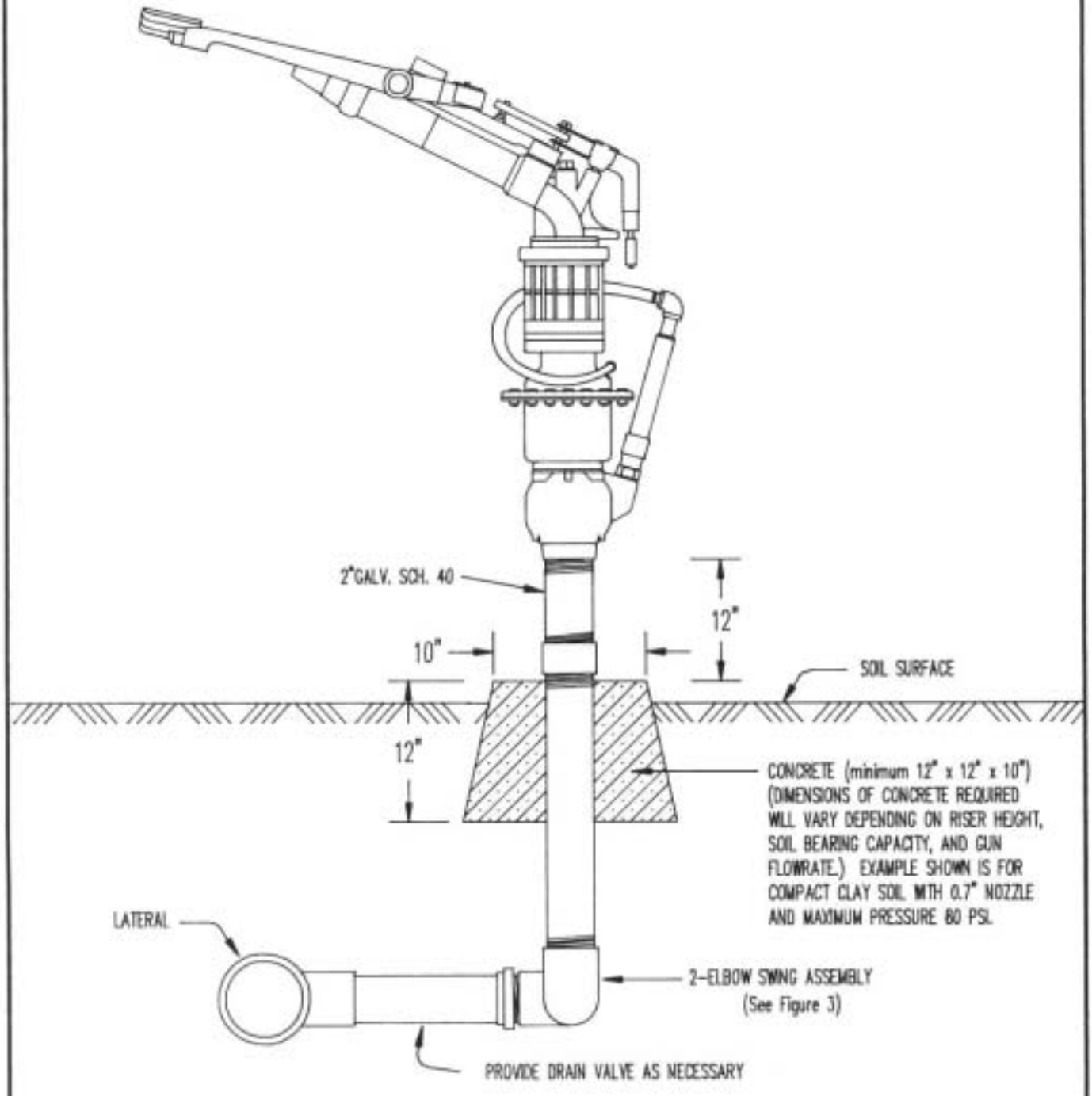

Figure 8.

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