1.00 DESCRIPTION

1.01 GENERAL

The Squaw Creek Dam and Reservoir serves as a source of cooling water for the Comanche Peak Steam Electric Station. The operating range of the lake is from Elevation 770 to 775 mean sea level datum. The lake level is maintained within this range by natural runoff from the watershed and by the Makeup Water Return System from Lake Granbury. Pertinent data on the dam and reservoir is given in Appendix B. Area capacity vs. elevation relationships for the reservoir are tabulated in Appendix B.

The dam consists of an earth and rock fill embankment, service outlet, service spillway, and emergency spillway each as described below.

1.02 EMBANKMENT AND INSTRUMENTATION

Squaw Creek Dam is a zoned embankment dam consisting of a central clay core, up and downstream random zones and a downstream rock zone all as shown on the record drawings. Instrumentation in the form of settlement plates, piezometers and benchmarks have been incorporated in the dam's construction to evaluate the performance of the dam as the reservoir fills and during its operational life. Operation personnel are to make routine measurement of the piezometric water surface and record this data.

1.03 SERVICE OUTLET

The service outlet works is a two purpose structure. One purpose is to release water downstream in order to meet permit requirements or, in event of an emergency, to quickly lower the reservoir. The second

purpose is to return water to Lake Granbury. The intake structure is provided with low flow selector gates to control the elevation of the water being released or returned to Lake Granbury.

1.04 SERVICE SPILLWAY

The service spillway is a 100-foot wide ogee crest chute type spillway with a hydraulic jump stilling basin. The spillway is uncontrolled and the crest is at Elevation 775.0. The spillway will flow with any rise of the reservoir above this elevation. The crest section is provided with an inspection gallery to allow access to construction joints or other sources of leakage. The chute and stilling basin are provided with underdrains.

1.05 EMERGENCY SPILLWAY

The emergency spillway is excavated in the left abutment of the dam. It is a 2,200-foot wide excavation with a crest at Elevation 783.0. The crest is uncontrolled and reservoir levels above this elevation will cause the spillway to flow.

1.06 RESERVOIR STAGE RECORDS

The United States Geological Survey (USGS) has installed a reservoir stage recorder on the service outlet tower. This gage automatically records the level of the reservoir at all times. The tower is provided with a Wire Weight Gage for visual observation of reservoir elevation.

2.00 EMBANKMENT AND INSTRUMENTATION

2.01 GENERAL

Squaw Creek Dam is an earth and rock fill zoned embankment. A positive water barrier was obtained by excavating a core trench to unweathered impervious bedrock. The core trench was backfilled with clay. A sand drainage filter was placed between the clay core and the downstream face of excavation to prevent piping of the core into the more pervious foundation material.

The central clay core extends from the core trench bottom to Elevation 791.0. This core is supported on the upstream side by a compacted random fill zone, and on the downstream side by random and rock fill zones. A sand filter lies between the core zone and downstream random zone to intercept any seepage through the core and direct it to the horizontal drainage blanket which lies on the foundation below the downstream random zone.

The upstream face of the embankment is protected from wave action by rock riprap and riprap blanket from Elevation 760.0 to the top of the dam. The downstream face is rock fill and no other erosion protection is provided.

The central portion of the embankment between Stations 53+00 and 71+60 is over built to Elevation 798.4 or 2.4 feet above the remainder of the dam to allow for settlement of the embankment without loss of freeboard. Details of the above construction are shown on the project drawings.

The instrumentation program provided includes two different types of companion piezometers, settlement plates and surface reference markers. The location of these instruments is shown in Appendix C.

2.02 PIEZOMETERS

Piezometers are the simplest types of instrumentation used to check the behavior of dams and are generally considered the most important, since their purposes involve the measurement of water pressure beneath or within a structure. Piezometers vary greatly in types, shapes and materials, and it is generally engineering judgment as to the type to be used. The types selected for this program and installed as companion units on five (5) feet spacing, included the open tube wellpoint type and the pneumatic pore pressure transducer type. A typical open tube piezometer consists of a wellpoint (tip) and riser pipe and is generally installed in a drilled bore hole with the tip set and sealed at the depth where the water movement through the soil or water pressure is to be measured. The principal of the pneumatic piezometer is theoretically comparable to the open tube with the exception that the measurement of water pressure is accomplished by using a diaphram with little or no movement of fluid through the enclosing soil or rock. The location and other data on the piezometers is given in Appendix C.

2.03 SETTLEMENT PLATES

Settlement plates are 30" x 30" steel plates installed in critical zones during construction to be used to determine the amount of settlement. Should it be necessary to check the elevation of these plates this

will have to be done by drilling. The location of these plates is shown in Appendix C.

2.04 SURFACE REFERENCE MONUMENTS

Surface reference monuments vary greatly as to types, but have one common denominater and this is permanence. Monuments are installed to monitor horizontal and vertical surface movement of a structure. Movements are gaged relative to control monuments established independent of the observation monuments. The location and elevation of these monuments is given in Appendix C.

2.05 MEASUREMENTS AND TESTS

Instrumentation is an integral part of a structure and plays a very important role in maintaining structure integrity. Since instrumentation represents the pulse of a structure, care must be exercised in protecting and maintaining instrument installation, in making scheduled observations, reporting erratic behaviors and promptly interpreting current reports. The collection of accurate field measurements is of utmost importance to the entire instrumentation program and as such, every effort should be made to minimize possible errors. Field measurements in the open tube piezometers will be performed with an electric probe and with a portable pneumatic readout instrument for the closed system piezometers. Surface elevations for all instrumentation will be obtained using at least third order surveying techniques. Surface monument elevations will be reported to the nearest one-hundredth (0.01) of a foot. Horizontal movement shall be reported to the nearest one-hundredth (0.01) of a foot.

2.06 OPERATION

Instrumentation will be monitored in the field by TUGCO. Fi measurements will be retained on file for review by interested agencies. Field observation will be performed monthly during impoundment, bi-annually for the next two (2) years and annually from then on.

Piezometers - Thirty (30) open tube and eighteen (18) closed system piezometers were installed as listed in Table 2.1 in Appendix C and shown on Figure 1 in Appendix C. These instruments will be observed by TUGCO personnel.

Settlement Plates - Three (3) settlement plates were installed as listed in Table 2.2 and shown on Figure 2 in Appendix C. Elevation determinations of these plates will be under the direction of TUGCO.

Surface Reference Monuments - Fifty-eight (58) surface reference monuments were installed as listed on Table 2.3 in Appendix C and shown on Figure 3. Elevation determinations of these monuments will be under the direction of TUGCO.

2.07 MAINTENANCE

Extreme care will be taken by project personnel performing embankment maintenance near instrumentation not to damage the instruments. Maintenance and repairs of the instrumentation system will be provided by TUGCO.

2.08 INSPECTION

It will be considered standard operating procedure to visually inspect project structures during the normal schedule of instrument

measurements. The visual inspection will include surveillance of structure movement, seepage, vegetation growth and any other changes in and associated with Squaw Creek Dam.

3.00 SERVICE OUTLET WORKS

3.01 GENERAL

The purpose of the Service Outlet is to release water downstream to meet permit requirements, to quickly lower the reservoir elevation and to provide an intake for the return water pump station. Releases downstream are accomplished by opening one or more of the rotary cone valves in the downstream valve house. The level in the reservoir from which water is drawn is controlled by the low flow selector gates. Releases exceeding 93 cfs should be made by opening the 6' x 6' Service Gate.

3.02 SERVICE GATE SYSTEM

The Service Gate System consists of the 6' x 6' Service and Emergency Gates, their operators and power system, the 10" x 10" pressure relief gate and the vent system.

A. Operation

The Service Gate is operated by the Service Gate Hydraulic Cylinder. The hydraulic system is equipped with a manual bypass. The gate can be raised 75". The upper piston rod projects from the hydraulic cylinder and indicates the height of rise of the gate. See Section 3.03C for description of the hydraulic unit operation. Table 3.1 in Appendix B gives the discharge rating of the Service Gate.

The Emergency Gate is operated manually from a floor stand on the operation deck. This gate can be closed at full reservoir head (Elev. 775); however, it cannot be opened at heads greater than 51 feet

(Elev. 704). In order to open the emergency gate at normal reservoir operating level, the chamber between the emergency and service gates must be flooded thus equalizing the pressure on either side of the gate leaf. This flooding is accomplished by opening the 10" x 10" Pressure Relief Gate by use of a handwheel on the operating deck.

The emergency gate is designed to be closed when some emergency prevents closing the service gate. The emergency gate is normally kept in the closed position with the 10" x 10" pressure relief gate and at least one low flow selector gate open to allow the chamber between the two gates to have the same pressure as the reservoir head outside.

B. Operation Procedure

When it is desired to open the Service Gate, the following procedure is to be followed:

1. Notify property owners downstream if possible.

2. Open 10" x 10" Pressure Relief Gate if it is not already open by turning the handwheel. Allow time for chamber between the Service Gate and Emergency Gate to fill completely.

3. Open the Emergency Gate fully. This may be done by the hand crank or with a drill motor and adaptor to fit the crank shaft. The stem cover top cap has been so located that the stem bears against it when the gate is fully open - 75.0". Care must be taken to not jam the stem against the cover cap. Slots have been provided in the stem cover to allow the position of the stem to be determined. The drill motor should be disengaged when the gate is 0'-3" of being fully opened and the last 0'-3" opened by use of the hand crank.

If the gate is opened too high it will result in damage to the stem guide beams.

4. When the Emergency Gate is fully open, the Service Gate is opened by actuating the hydraulic cylinder.

Closing the gates is the reverse. First close the Service Gate, then the Emergency Gate. The Pressure Relief Gate is left open.

If the chamber between the two gates is to be dewatered, the Pressure Relief Gate is first closed then the Service Gate is opened slightly to drain the chamber. After the need for access to the chamber is over, the Pressure Relief Gate is opened and the chamber flooded. Never try to flood the chamber by opening the Emergency Gate.

C. Service and Emergency Gates

Both gates consist of a frame and a gate leaf. The service gate is vented to minimize the possibility of cavitation. The emergency gate is not vented.

The gates are opened and closed by sliding the leaf on bronze seals mounted on both the frame and leaf. The bottom of the gate seals against a babbitt seal cast into the frame. Details of construction of the gates are shown on the shop drawings listed in Appendix A.

D. Hydraulic Cylinder

The Service Gate Hydraulic Cylinder is double acting double rod extension, 16" bore, 6" rod, 75" stroke with 1" clearance top and bottom. The fluid requirement for raising or lowering is 8.97 GPM. Care should be exercised in adjusting these valves not to over pressure the system.

This caution is especially needed in closing so as not to damage the cylinder mounting. Details of the hydraulic system are shown on the construction drawings and the manufacturer's operating manuals.

E. Electrical

A pressure switch which opens at pressures above 1000 psi in the closing side of the hydraulic cylinder has been installed to act as a backup system for the pressure relief valve. This switch is an additional safety against over pressuring the closing hydraulic system. Details of the electrical system are shown on the construction drawings and in the manufacturer's operating manuals.

F. Emergency Gate Operator

The Emergency Gate Operator is a CPE-48 Lift with bronze lift nut and cast iron pedestal manufactured by Armco Steel Corporation. Consult the manufacturer's operating manual for details and maintenance. The dial position indicator is not sensitive enough to be used to fully open the gate. Use procedure described in Paragraph B for opening gate.

G. Pressure Relief Gate

The Pressure Relief Gate is a 10" x 10" bronze face seating flanged back flush bottom gate designed for 123.33 feet of seating head and 20 feet of unseating head manufactured by Armco Steel Corporation. The gate is raised and lowered by a 30-inch diameter handwheel located at the operating deck. The invert of the gate is Elevation 666.5. Consult manufacturer's operating manual for details and maintenance.

H. Vents

The Service Gate is provided with two vents to supply the air demand during operation. These vents should be kept clear at all times.

I. Discharge Rating

Appendix B gives the calculated discharge rating of the Service Gate for various openings with the reservoir between Elevation 770.0 and Elevation 775.0 and for various elevations with the gate full open. The opening and time should be logged so that the flow records at the U.S.G.S. flow gage on the S.H. 144 can be used to calibrate these computations.

3.03 LOW FLOW SELECTOR GATE SYSTEM

The Low Flow Selector Gate System consists of the three Low Flow Selector Gates and their hydraulic lifts; the hydraulic unit, the Stop Log Gate, the Traveling Hoist, the Butterfly Valve and the three Rotary Cone Valves. The system is designed so that water may be withdrawn from the reservoir at any of three elevations; 666.5, 715.0 and/or 764.0 (flow lines of the gate openings), and released downstream through the Rotary Cone Valves or returned to Lake Granbury via the Return Pump Station.

A. Low Flow Selector Gates

The Low Flow Selector Gates are 48" x 72" bronze face seating, flange back, flush bottom, heavy duty sluice gates manufactured by Armco Steel Corporation. Design data on these gates are as follows:

Gate No.	Flow Line Elev.	Seating Head	Unseating Head
1	666.5	105.5'	10'
2	715.0	105.5'	10'
3	764.0	105.5'	10'

1. Pressure Relief Valve - Set 1900 psi
2. Counterbalance Valve:

   Service Gate - Set 330 psi

   Gate 1 - Set 90 psi

   Gate 2 - Set 120 psi

   Gate 3 - Set 517 psi
3. Flow Control Valves:

   Gate 1 - Valve 1A - Set 792 cu. in/min

   Valve 1B - Set 792 cu. in/min

   Gate 2 - Valve 2A - Set 487 cu. in/min

   Valve 2B - Set 487 cu. in/min

   Gate 3 - Valve 3A - Set 103 cu. in/min

   Valve 3B - Set 103 cu. in/min
4. Pump: Set 2000 psi
5. Pressure Relief Valve in service gate cylinder lowering line - set 800 psi.

A description of the operation of the unit is as follows:

1. Start both pumps for normal operation and allow fluid to circulate in the system. See initial setting, Item No. 4.
2. The control valves are 4-way directional, solenoid operated with manual override, 3 position spring return to center. One valve is provided for each cylinder. By electrically energizing the "Rise" or "Lower" Solenoid of a selected gate control valve the fluid is directed to the bottom or top of the cylinder respectively, causing that gate to move. When solenoids are de-energized, the fluid flow is stopped and the gate stops.

3. The counterbalance valves permit free flow of fluid during the raising operation. During lowering operation, an adjustable pressure relief causes a back pressure to the lower end of the cylinder. This pressure relief should be set to prevent the gate from closing due to its own weight. See initial setting Item No. 2.

4. For pump protection, the pressure relief valve at the pump discharge is set slightly below the rated pressure of the pump. See initial setting, Item No. 1.

5. The flow control valves in the three small gate piping provide a means of controlling flow to each gate cylinder to the quantity required for a gate speed of approximately one foot per minute. The Service Gate does not have flow control valves since the system is designed for its gate speed of one foot per minute at approximately ten GPM or the discharge capacity of the two pumps. See initial setting, Item No. 3.

6. When one pump is used, the gate speed will be cut in half (for Service Gate only).

7. Manual pump will allow slow movement of the selected cylinder as follows with a requirement of approximately 190 strokes with 60-65 lbs effort per gallon:

Service Gate	-	1.34 inches
Gate No. 1	-	3.50 inches
Gate No. 2	-	5.68 inches
Gate No. 3	-	26.89 inches

D. Adjustment of Low Flow Selector Gates

The seal of the bottom of the Low Flow Selector Gate is adjusted with its operating cylinder "bottomed out" by adjusting the length of the stem by means of the stem couplings. The gate, gate stem and cylinder mount should not be subjected to the full force of the cylinder with gate in full down position. Bottoming out the cylinder will prevent this from happening. Gate wedge adjustment should be made in accordance with the manufacturer's operating manual.

All three low flow selector gates should be operated through full range once a month to check for deficiencies.

E. Stop Gate

The purpose of the Stop Gate is to seal off any one of the three low flow selector gate chambers so that it may be dewatered to service the low flow selector gate. The Stop Gate is positioned by the traveling hoist and lowered to the bottom of the chamber. The procedure is as follows:

1. Close all low flow selector gates.
2. Position Stop Gate in desired chamber (see Section 3.03F. Traveling Hoist).
3. Open the low flow selector gate in the chamber with the stop log gate in position.
4. Open the 12" Rotary Cone Valves in the valve house and drain the intake tower to an elevation below the flow line of the gate.
5. Service the low flow selector gate.

6. Close rotary cone valves.

7. Open one or both of the other low flow selector gates.

8. When the tower has filled to the reservoir elevation, remove and store the stop log gate.

9. Close low flow selector gates not needed for return flow or releases.

The Stop Gate should not be moved while there is a head differential across it or the "J" seals will be damaged.

F. Traveling Hoist

The traveling hoist is a Type "S" twin hook monorail mounted hoist with H.G. trolley manufactured by Duff-Norton Co. of Charlotte, North Carolina. Specifications of the hoist are as follows:

Catalog No.	-	WDGT-345-S
Capacity	-	3000 lbs.
Hoist Speed	-	40/16 F.P.M.
Lift	-	130 ft.
Power	-	460 V, 3 ph, 60 hz.
Hoist Motor	-	612-1/4 hp @ 1200/450 RPM, High Slip, High Torque, Extra Insulated
Cables	-	Two Sets 1 Part Single Reeving - 3/8" Dia. 6 x 371 WRC Stainless Steel Type 302 with Macwhyte Zinc Poured Open Socket #SA - 163-Y2
Wiring	-	Ridged Threaded Conduit

The hoist cables are connected to the Stop Gate with turnbuckles which allow the gate to be leveled. The hoist is positioned on the monorail with an endless chain operated trolley. The gate is raised or lowered and the speed of travel selected by means of a 5 button P.B. Station with key lock. The button controls are OFF/ON, UP SLOW, UP FAST, DOWN SLOW, and DOWN FAST.

The hoist cables and stop gate deck frames are color coded to allow the operator to tell by color the location of a particular gate slot and how close the gate is to the bottom of the slot. The gate position color codes are as follows:

Gate No.	Stop Gate Deck Frame	Cable Segments		
		5'-0"	3'-0"	1'-0"
1	White	White	Yellow	Red
2	Dark Blue	Dark Blue	Yellow	Red
3	Gray	Gray	Yellow	Red

The operating procedure is as follows:

1. Turn on hoist power with key lock.
2. Tension cables using UP SLOW button.
3. Release Stop Gate by sliding out storage pins.
4. Raise gate slowly from storage frame.
5. Position gate over desired low flow selector gate slot noting color of frame.
6. Lower gate using first DOWN SLOW button until gate is well into frame then the DOWN FAST button until cable color code matching color of frame appears at the frame.

7. Shift to DOWN SLOW button to position gate. Cables will slack when gate bottoms.

8. Remove and store gate using this procedure in reverse.

For details on operation and maintenance, see the manufacturer's operating manual.

G. Butterfly Valve

The valve structure contains a 30-inch diameter Triton XR-70 Butterfly Valve, High Pressure with HBC Manual Operator manufactured by the Henry Pratt Company of Aurora, Ill. The valve is normally kept in the open position and is only used to isolate the cone valves.

H. Rotary Cone Valves

The 30-inch service outlet conduit discharges through either of two 12-inch or one 6-inch rotary cone valves located in the valve structure. The valves are 12-inch or 6-inch Rotovalves, Class 150 cast steel electric motor operated manufactured by Allis-Chalmers. The valves are operated either electrically or manually with Limitorque Valve Controls manufactured by the Limitorque Corporation. Consult the manufacturer's operating manual for details of operation and maintenance.

Computed discharge rating of the various valve combinations are given in Table 3.2 in Appendix B.

3.04 CONDUIT ALIGNMENT

The conduit is provided with brass reference mark plugs at each joint of pipe to be used to check vertical and horizontal alignment and joint elongation. These plugs are 1-inch hexagons located 6-inches on either side of the joint in the bottom inside of the conduit. The plugs are

marked with the monolith number starting with M1 at the tower contact and U.S. or D.S. to indicate upstream or downstream end of monolith. A cross is stamped in the plug as the alignment and measurement point. Initial measurements of the elevation of these plugs on July 19, 1976 is given in Table 3.3 in Appendix C. The alignment should be checked if any unusual movement is visually observed in the conduit.

The alignment and elevation of these plugs should be surveyed and recorded once a year for five years then once every two years. This data should be made available to the Texas Department of Water Resources during their bi-annual inspection of the dam.

3.05 ACCESS BRIDGE

A. Loading

The access bridge to the service outlet tower is designed for an A.A.S.H.T.O. H.S.-20-44 loading. This is a tractor truck with semi-trailer, the front axle is 8,000# spaced 14' in front of a 32,000# axle which is followed at 14' to 30' by the 2nd 32,000# axle. The bridge should not be subjected to a greater loading than this.

B. Jack Pads

The girder ends of the embankment abutment are equipped with jack pads. These pads are used to raise the bridge at the embankment end to compensate for settlement of the dam.

If it should become necessary to raise this end of the bridge, all four girders must be raised together to avoid twisting and cracking of the deck. This operation will require eight jacks of 12 ton capacity each.

Once the bridge is raised the grout cap must be replaced between the pad base and the abutment shelf. Details of construction are shown on the construction drawings.

3.06 ELECTRICAL

The purpose of the electrical system is to supply power to the bridge lighting, hydraulic unit pumps and roto-cone valves. For details of the system consult the record drawings.

3.07 MAINTENANCE SCHEDULE

A regular maintenance schedule that includes test operation and visual checks of the components of all systems should be maintained. The purpose of the monthly maintenance check is to insure that the systems will function properly when needed.

A. Service Gate System

1. The Service Gate should be operated by raising it 1/2 inch to 1 inch then closing monthly. This may be done with the Emergency Gate and the Pressure Relief Gate closed to avoid releasing water other than that captured between the gates. After operation of the Service Gate the Pressure Relief Gate must be opened to flood the chamber. When the chamber is completely flooded, the Emergency Gate should be raised and lowered several inches with both the Service Gate and Pressure Relief Gate closed.

A visual check of all piping, cylinders, and equipment during this test operation to find any sources of possible trouble such as leaks, binding or structural damage should be performed.

2. In addition to the monthly schedule, the system should be dewatered annually and a visual check of the service gate, its frame, stem, stem guides, and air vent; the back of the Emergency Gate and frame; and the conduit should be performed.

B. Low Flow Selector Gate System

1. The components of this system should be operated monthly. This may be accomplished with a minimum of spillage by opening and/or closing the low flow selector gates several inches with the downstream valves closed. The butterfly valve and roto cone valves may then be operated through a partial cycle. After completion of this operation at least one low flow selector gate should be left open as required in 3.02A. The Stop Gate should be checked by operating the traveling hoist both transversely and vertically.

   All piping, cylinders, and equipment should be observed during the test operation for sources of possible trouble such as leaks, binding, or structural damage.

2. A visual check of the Low Flow Selector Gates and their stem and stem guides should be performed annually by dewatering. The Stop Gate must be used to dewater, so only one gate at a time can be checked.

C. Miscellaneous

1. Electrical boxes should be checked for moisture periodically.
2. All painted surfaces will need periodic inspection and repair.
3. No maintenance of concrete structures will be required except to repair damage noted in visual inspections. Inspection of concrete structures will be discussed in Section 7.00.

4.00 SERVICE SPILLWAY

4.01 GENERAL

The service spillway has a 100-foot wide uncontrolled ogee crest at Elevation 775.0 connected to a hydraulic jump stilling basin at Elevation 628.0 by a concrete chute. The crest section has an inspection gallery with vent and drain and the chute and stilling basin have underdrains. The spillway is designed to allow flood waters to discharge without any system energization when the reservoir rises above Elevation 775.0. The plans give details of the system.

4.02 SERVICE GALLERY

The service gallery is located under the crest section of the spillway with a manhole entrance at the east end of the spillway bridge. The gallery allows access to construction joints and other sources of leakage. Underdrains are located on the upstream side of the gallery so that seepage under the crest may be controlled or monitored. The gallery is drained by a cast iron pipe near the entrance access. The pipe discharges through the concrete wall at the downstream end of the earth fill on the east spillway wall. Ventilation is provided. A visual inspection of the gallery should be made monthly during the reservoir filling. Thereafter, an annual inspection should be made.

4.03 UNDERDRAIN

The spillway chute and stilling basin has an extensive underdrain system. The purpose of the system is to relieve hydrostatic pressure

buildup on the bottom of concrete slabs should water become trapped below them. The drains consist of holes drilled into the rock foundation with cast iron pipes allowing the holes to drain through the concrete slabs.

4.04 WALL DRAIN

The east wall downstream of the crest, which has earth fill against it, has a drainage system. The wall drain is a perforated PVC pipe with sand and gravel filters around it. It discharges through the concrete wall at the downstream end of the earth fill. The purpose of the drain is to reduce the hydrostatic pressure on the wall.

4.05 SPILLWAY BRIDGE

The spillway bridge is designed for an A.A.S.H.T.O. H.S.-20-44 loading. See paragraph 3.05A for details.

4.06 MAINTENANCE

No maintenance of the structure will be required except to repair damage noted in visual inspections and removal of obstructions either upstream or downstream which may reduce the discharge capabilities of the structure. Inspection of concrete structures will be discussed in Section 7.00. The Barrier System should be kept clear of debris.

4.07 DISCHARGE RATING

Table 4.1 in Appendix B has a tabulation of the calculated discharge rating of the Service Spillway.

4.08 BARRIER SYSTEM

The approach channel has a Barrier System across it to prevent floating debris from entering the spillway and stilling basin.

5.00 EMERGENCY SPILLWAY

5.01 GENERAL

The emergency spillway is an earthen spillway excavated in the left abutment of the dam. It is 2,200 feet wide with an uncontrolled crest at Elevation 783.0. The purpose of this spillway is to prevent the dam from being overtopped by impoundment of flood waters from an extreme storm faster than they can be discharged by the service spillway. The crest is formed by a concrete wall to maintain Elevation 783.0.

5.02 MAINTENANCE

The only maintenance required during normal conditions is removal of any obstruction to flow such as trees, tall weeds, and debris and maintaining the crest and slopes. If the spillway should ever be used during an extreme flood, erosion damage may occur.

5.03 DISCHARGE RATING

The calculated discharge rating is tabulated in Table 5.1, Appendix B.

6.00 RESERVOIR STAGE RECORDER

6.01 GENERAL

The United States Geological Survey (USGS) has installed a Reservoir Stage Recorder and a Wire-Weight Gage on the service outlet tower. The Reservoir Stage Recorder automatically records the level of the reservoir at all times. The Wire-Weight Gage is for visual observation of the reservoir elevation.

6.02 RECORDS

The records from the Reservoir Stage Recorder will be maintained by the USGS. The charts from the recorder must be analyzed by the USGS as they are not direct read. A visual observation to obtain the reservoir elevation may be obtained by either using the Wire-Weight Gage or by reading the elevation off of the cables in the Reservoir Stage Recorder. Arrangements for obtaining records should be made with the USGS.

6.03 MAINTENANCE

The gages will be operated and maintained by the USGS. They will change the recorder charts every six weeks. If the gages are damaged between USGS visits or any information is needed, contact the USGS at the location indicated on the gages.

7.00 INSPECTION FOR EVIDENCE OF DISTRESS

7.01 TEXAS DEPARTMENT OF WATER RESOURCES

An excerpt from the Rules of the Texas Department of Water Resources on the maintenance and operation of dams and reservoirs is given in Appendix E. Of particular importance is the requirement that the owners, or their agents, are to keep available and in good order, records of all construction, of pertinent maintenance, and of engineering including piezometric and geologic investigations and preventive maintenance inspections.

7.02 AREAS OF DISTRESS

All earth and concrete structures should be observed during normal operation activities for unusual changes. In addition, a program should be established to periodically inspect all structures in detail as to their safety and capability to perform their design function.

A. Embankment Structures

Embankment structures should be visually checked monthly for the following possible distress areas:

1. Seepage. Seepage is the percolation of water through or under the embankment. Seepage may appear as a continuously wet area on the downstream face of abutments, embankment slopes, and concrete structure interfaces, and on areas downstream of toe or as a flow of water. Seepage of clear water through the embankment may reduce the stability of the embankment by saturating the soil

and causing slides. Any time seepage is cloudy, muddy, or sandy no matter how far downstream, it indicates the seepage is carrying soil particles and has become a serious threat to the stability of the structure.

Animal burrows or tree growth found on the slopes during the inspection should be removed as they might cause seepage.

2. Subsidence. Subsidence is the settlement of the embankment. Some settlement is expected and is included in the design of the embankment. The rate of settlement or a change in the rate of settlement may be an indication of an abnormal condition. Any change in alignment or grade that could be observed without instruments will be a danger sign.
3. Sloughing. Sloughing is the slipping or flowing out of position of a portion of the slope. Any slide on a dam represents an abnormal condition. Slides with a deep or long vertical drop near the top indicates a very serious problem.
4. Cracks. Some surface cracks will appear as a result of dry weather. Others will appear in conjunction with subsidence and sloughing. Any crack appearing in the crown or surface should be considered as potentially dangerous.

5. Slope Protection. Slope protection should be examined for change in grades and reduction in wave resistant or erosion capabilities. A change in grade of riprap could be an indication of embankment damage. A reduction in wave resistant capabilities.

6. Erosion. The source of any erosion on slopes and abutments should be determined and corrected.

7. Drainage System. The toe drain outlet, which is located on the downstream toe of the dam just upstream of the culvert under the access road at Squaw Creek, should be checked to make sure that the drain is not obstructed. It should also be checked for any muddy seepage or other signs that the filters in the drain are not functioning properly.

In addition to the visual checks, additional observations should be made using the installed instrumentation as described in Section 2.00. A study by a competent geotechnical engineer should be made if there is any unusual distress.

B. Concrete Structures

Concrete structures should be visually checked monthly for the following possible distress areas:

1. Concrete surfaces. The condition of the concrete surfaces should be examined to evaluate the deterioration and continuing serviceability of the concrete. It should be checked for erosion cavitation and obstructions.

If the concrete surfaces in the service spillway stilling basin have to be checked, the basin will have to be drained.

2. Movement. Visual observation of construction joints and monolith joints should reveal any movement either vertical or horizontal.
3. Drains. Drains should be examined to determine that they are capable of performing their design function.
4. Interfaces. All visable interfaces with embankment and foundation should be examined for damage or seepage.
5. Seepage. Any evidence of seepage or abnormal leakage should be examined to determine any possible potential damage.

No instrumentation has been installed in the concrete structures except conduit alignment monuments in the service outlet conduit. If necessary, they may be checked by a survey. Some movements may also be checked by survey instrumentation. A study by a competent engineer familiar with dams and appurtenances should be made of any unusual conditions.

C. General

Surrounding conditions should be continuously observed for developments which might effect the capability and serviceability of the dam and its appurtenances including upstream and downstream obstructions and changes.

APPENDIX A

LIST OF SUPPLEMENTARY EXHIBITS

APPENDIX A
LIST OF SUPPLEMENTARY EXHIBITS

Item	Vendor	Exhibits
Hydraulic Cylinders 16"	Hydraulic Resources, Inc.	Maintenance Procedure, Parts List, Drwg.,
4"-8"-10"	Armco Steel Co.	Drwg. (Folder SCR-30, 30A 71, 76, 76A, 80)
Hydraulic Unit	Armco Steel Co.	Drwg. (Folder SCR-30), Parts (Folder SCR-30), Parts Information*
Emergency Gate Operator	Armco Steel Co.	Maintenance Procedure
Service and Emergency Gate	Southwest Ornamental Iron Co.	Drwg. (Folder SCR-28)
Low Flow Selector Gate	Armco Steel Co.	Installation, Operation & Maintenance Manual (Folder SCR-27), Drwg. (Folder SCR-27)
Pressure Relief Gate	Armco Steel Co.	Installation, Operation & Maintenance Manual (Folder SCR-27), Drwg. (Folder SCR-27)
Traveling Hoist for Stop Gate	Duff-Norton Co.	Drwg. (Folder SCR-29), Operation and Maintenance Instructions
Stop Gate	Southwest Ornamental Iron Co.	Drwg. (Folder SCR-28 & 92)
Butterfly Valve	Henry Pratt Co.	Installation & Service Manual
Roto Cone Valves	Allis Chalmers Co.	Operation & Maintenance Manuals, Drwgs. (Folder SCR-39)
Bridge Lighting	Wide-Lite Co.	Drwgs. (Folder SCR-79)

The exhibits listed with a folder no. following them were original shop drawings. A copy of the drawing is in the F&N field office shop drawing file which has been forwarded to the owner for his use. Multiple copies of all exhibits listed without folder no. have been compiled and forwarded to the owner as Operation and Maintenance Manuals.

*Additional copies of information previously submitted as shop drawings (Folder SCR-30). Sent to F&N by BRV-5376 on 6-23-77.

APPENDIX B

ENGINEERING DATA

APPENDIX B
TABLE 1.1

PERTINENT DATA
SQUAW CREEK DAM

Pertinent Data

Drainage Area - 64 sq. mi.
Design Storm Rainfall - 39.1 inches
Design Storm Runoff - 34.1 inches
Max. Design Storm Inflow - 175,000 cfs
Max. Spillway Discharge - 127,000 cfs
Max Reservoir Water Surface Elevation - 790.1 ft. above msl

Embankment

Type	Earth and rock fill
Length	4,200 ft.
Height	148 ft.
Top of dam elevation	796 ft. above msl

Service Spillway

Type	Uncontrolled concrete ogee crest with concrete chute
Location	Right abutment
Crest Elevation	775 ft. above msl
Length	100 ft.

Emergency Spillway

Type	Cut in natural bank
Location	Left abutment
Crest Elevation	783 ft. above msl
Length	2,200 ft.

Service Outlet

The Service Outlet's purpose is to release water downstream and to return water to Lake Granbury. The system is capable of releasing water downstream to meet permit requirements or in event of an emergency, to quickly lower the reservoir.

APPENDIX B
TABLE 1.2
SQUAW CREEK RESERVOIR
AREA & CAPACITY CHARACTERISTICS

Elev.	0	1	2	3	4	5	6	7	8	9	
650						0	5	11	17	22	Acres
						0	3	11	25	45	Ac-Ft.
660	28	34	38	43	51	59	69	79	91	104	Acres
	70	101	137	177	224	279	343	417	502	599	Ac-Ft.
670	118	132	146	158	172	188	204	216	232	250	Acres
	710	835	974	1,126	1,291	1,471	1,667	1,877	2,101	2,342	Ac-Ft.
680	268	292	316	344	368	396	420	448	472	500	Acres
	2,601	2,881	3,185	3,515	3,871	4,253	4,661	5,095	5,555	6,041	Ac-Ft.
690	524	536	548	562	573	586	598	611	624	637	Acres
	6,553	7,083	7,625	8,180	8,748	9,328	9,920	10,525	11,143	11,773	Ac-Ft.
700	652	670	691	712	733	755	776	797	820	842	Acres
	12,417	13,078	13,758	14,460	15,182	15,926	16,692	17,478	18,286	19,117	Ac-Ft.
710	866	892	924	956	988	1,018	1,050	1,081	1,114	1,147	Acres
	19,971	20,850	21,758	22,698	23,670	24,673	25,707	26,773	27,871	29,002	Ac-Ft.
720	1,180	1,210	1,244	1,276	1,310	1,344	1,378	1,414	1,447	1,482	Acres
	30,165	31,360	32,587	33,847	35,140	36,467	37,828	39,224	40,655	42,120	Ac-Ft.
730	1,516	1,554	1,592	1,630	1,967	1,705	1,743	1,781	1,819	1,857	Acres
	43,619	45,154	46,727	48,338	49,985	51,672	53,396	55,158	56,958	58,796	Ac-Ft.

(Continued on next page)

TABLE 1.2, Continued

Elev.	0	1	2	3	4	5	6	7	8	9	
740	1,895	1,933	1,969	2,007	2,044	2,080	2,117	2,154	2,192	2,230	Acres
	60,672	62,586	64,537	66,525	68,551	70,613	72,712	74,848	77,021	79,232	Ac-Ft.
750	2,268	2,308	2,348	2,390	2,431	2,473	2,516	2,558	2,600	2,642	Acres
	81,481	83,769	86,097	88,466	90,876	93,328	95,822	98,359	100,938	103,559	Ac-Ft.
760	2,684	2,724	2,764	2,803	2,843	2,884	2,924	2,964	3,004	3,045	Acres
	106,222	108,926	111,670	114,454	117,277	120,141	123,045	125,989	128,973	131,998	Ac-Ft.
770	3,084	3,122	3,162	3,195	3,234	3,272	3,308	3,329	3,354	3,380	Acres
	135,062	138,165	141,307	144,485	147,700	150,953	154,243	157,562	160,903	164,270	Ac-Ft.
780	3,411	3,445	3,489	3,534	3,578	3,624	3,672	3,722	3,772	3,823	Acres
	167,665	171,093	174,560	178,072	181,628	185,229	188,877	192,574	196,321	200,119	Ac-Ft.
790	3,874	3,925	3,976	4,030	4,079	4,130	4,082	4,235	4,286	4,339	Acres
	203,967	207,867	211,818	215,821	219,875	223,980	228,136	232,345	236,606	240,919	Ac-Ft.
800	4,391										Acres
	245,284										Ac-Ft.

Note: Based on sedimentation survey ranges established pursuant to the requirements of the Texas Water Rights Commission, May 1977

APPENDIX B
TABLE 3.1

DISCHARGE RATING FOR 6' X 6' SERVICE GATE
SQUAW CREEK DAM

Reservoir Elevation	Discharge in Cubic Feet Per Second For Full Open Gate
670	470
680	600
690	710
700	800
710	880
720	960
730	1,030
740	1,100
750	1,160
760	1,220
770	1,280
775	1,310

Gate Opening in feet	Discharge in cubic feet per second Reservoir Elevation					
	770	771	772	773	774	775
1	380	390	390	390	390	390
2	700	700	700	710	710	710
3	920	930	930	940	940	940
4	1,080	1,080	1,090	1,090	1,090	1,100
5	1,180	1,180	1,190	1,190	1,190	1,200
6	1,280	1,290	1,290	1,300	1,300	1,310

APPENDIX B
TABLE 3.2

DISCHARGE RATING FOR ROTOCONE VALVES
SQUAW CREEK DAM

Condition	Discharge In Cubic Feet Per Second
One-6" Valve	10
One-12" Valve	46
One-6" Valve & One-12" Valve	56
Two-12" Valves	86
One-6" Valve & Two-12" Valves	93

This is based on the valves wide open and a reservoir elevation between 770.0 and 775.0.

APPENDIX B
TABLE 4.1

DISCHARGE RATING SERVICE SPILLWAY
SQUAW CREEK DAM

Reservoir Elevation	Discharge in cubic feet per second
775	0
776	300
777	900
778	1,700
779	2,700
780	3,800
781	5,100
782	6,400
783	8,000
784	9,600
785	11,400
786	13,300
787	15,300
788	17,400
789	19,600
790	21,900

APPENDIX B
TABLE 5.1

DISCHARGE RATING EMERGENCY SPILLWAY
SQUAW CREEK DAM

Reservoir Elevation	Discharge In Cubic Feet per Second
783	0
784	3,500
785	13,000
786	26,000
787	41,500
788	59,500
789	81,000
790	104,500

APPENDIX C

INSTRUMENTATION

APPENDIX C
TABLE 2.1

PIEZOMETER LOCATION
SQUAW CREEK DAM

No.	Type	Piezometer Tip			Piezometer Riser		
		Station	Offset from ℄	Elevation	Station	Offset from ℄	Elevation
P-I-1	Wellpoint	46+00	6.7' U.S.	715	45+99.44	6.77' U.S.	797.46
P-I-2	Wellpoint	46+05	7.0' U.S.	735	46+04.60	6.99' U.S.	797.45
P-I-3	Wellpoint	46+11	7.0' U.S.	755	46+09.35	7.00' U.S.	797.42
P-I-4	Wellpoint	46+15	7.0' U.S.	770	46+14.41	6.94' U.S.	797.44
P-I-5	Pneumatic	46+01	30.0' D.S.	715	45+99.94	1.55' U.S.	797.47
P-I-6	Pneumatic	46+06	30.0' D.S.	735	46+04.53	3.36' U.S.	797.45
P-I-7	Pneumatic	46+11	30.0' D.S.	755	46+09.80	1.60' U.S.	797.45
P-I-8	Pneumatic	46+14	30.0' D.S.	770	46+13.75	0.83' D.S.	797.82
P-I-9	Wellpoint	46+02	140.3' D.S.	710	46+02.20	140.30' D.S.	755.00
P-I-9a	Pneumatic	46+08	139.9' D.S.	710	46+07.70	139.85' D.S.	756.74
P-I-10	Wellpoint	46+12	139.7' D.S.	725	46+12.35	136.65' D.S.	755.53
P-I-10a	Pneumatic	46+17	140.4' D.S.	725	46+17.80	140.40' D.S.	756.26
P-II-0aCB	Pneumatic	55+95	20.3' U.S.	650	55+94.90	20.33' U.S.	797.76
P-II-1a	Pneumatic	56+05	18.4' U.S.	650	56+04.55	18.39' U.S.	796.88
P-II-2	Wellpoint	56+10	20.5' U.S.	690	56+15.80	20.46' U.S.	797.51
P-II-2a	Pneumatic	56+16	20.4' U.S.	690	56+20.00	19.80' U.S.	798.00
P-II-3	Wellpoint	56+20	19.8' U.S.	730	56+26.20	21.42' U.S.	796.20
P-II-4	Wellpoint	56+25	21.4' U.S.	770	56+30.50	20.70' U.S.	795.44

TABLE 2.1, Continued

No.	Type	Piezometer Tip			Piezometer Riser		
		Station	Offset from ℄	Elevation	Station	Offset from ℄	Elevation
P-II-5	Wellpoint	56+02	35.9' D.S.	650	56+01.87	35.90' D.S.	793.20
P-II-5a	Pneumatic	56+07	35.6' D.S.	650	56+06.65	35.55' D.S.	793.34
P-II-6	Wellpoint	56+12	35.8' D.S.	690	56+11.65	35.80' D.S.	793.23
P-II-6a	Pneumatic	56+17	35.8' D.S.	690	56+16.70	35.75' D.S.	793.35
P-II-7	Wellpoint	56+22	35.6' D.S.	730	56+21.70	35.55' D.S.	793.32
P-II-8	Wellpoint	56+27	35.4' D.S.	770	56+27.05	35.35' D.S.	792.56
P-II-9	Wellpoint	55+92	183.5' D.S.	680	55+91.78	183.50' D.S.	740.36
P-II-9a	Pneumatic	55+96	183.6' D.S.	680	55+96.33	183.60' D.S.	742.06
P-II-10	Wellpoint	56+02	184.4' D.S.	695	56+01.63	184.10' D.S.	739.04
P-II-10a	Pneumatic	56+06	185.4' D.S.	695	56+06.35	185.40' D.S.	741.34
P-III-1	Wellpoint	69+00	6.2' U.S.	650	69+00.39	6.18' U.S.	798.94
P-III-2	Wellpoint	69+05	5.9' U.S.	690	69+04.89	5.94' U.S.	798.90
P-III-3	Wellpoint	69+10	5.9' U.S.	730	69+09.89	5.85' U.S.	798.79
P-III-4	Wellpoint	69+15	5.7' U.S.	770	69+14.59	5.65' U.S.	798.77
P-III-5	Pneumatic	69+00	45.0' D.S.	650	69+03.34	284.55' D.S.	707.85
P-III-6	Pneumatic	69+05	45.0' D.S.	690	69+08.98	284.35' D.S.	708.14
P-III-7	Pneumatic	69+10	45.0' D.S.	730	69+14.09	283.80' D.S.	708.26
P-III-8	Pneumatic	69+15	45.0' D.S.	770	69+19.54	285.46' D.S.	708.20
P-III-9	Wellpoint	69+03	284.6' D.S.	652	68+99.90	0.18' D.S.	798.60
P-III-9a	Pneumatic	69+09	284.4' D.S.	652	69+04.75	0.13' D.S.	798.61
P-III-10	Wellpoint	69+10	283.8' D.S.	667	69+09.85	0.70' D.S.	798.49
P-III-10a	Pneumatic	69+20	285.5' D.S.	667	69+14.72	10.58' D.S.	798.09

early generation

APPENDIX C
TABLE 2.2

SETTLEMENT PLATE LOCATION
SQUAW CREEK DAM

Number	Location	Elevation
S.C.D. S.P.-1	Sta. 50+49.2 0.6' left of centerline	724.43
S.C.D. S.P.-2	Sta. 60+50 centerline	710.05
S.C.D. S.P.-3	Sta. 70+50 centerline	674.53

Note: Dimensions of settlement plate is 30" x 30" x 1/2" thick. Material is plate steel conforming to ASTM A-36.

APPENDIX C
TABLE 2.3

SURFACE REFERENCE MONUMENTS
SQUAW CREEK DAM

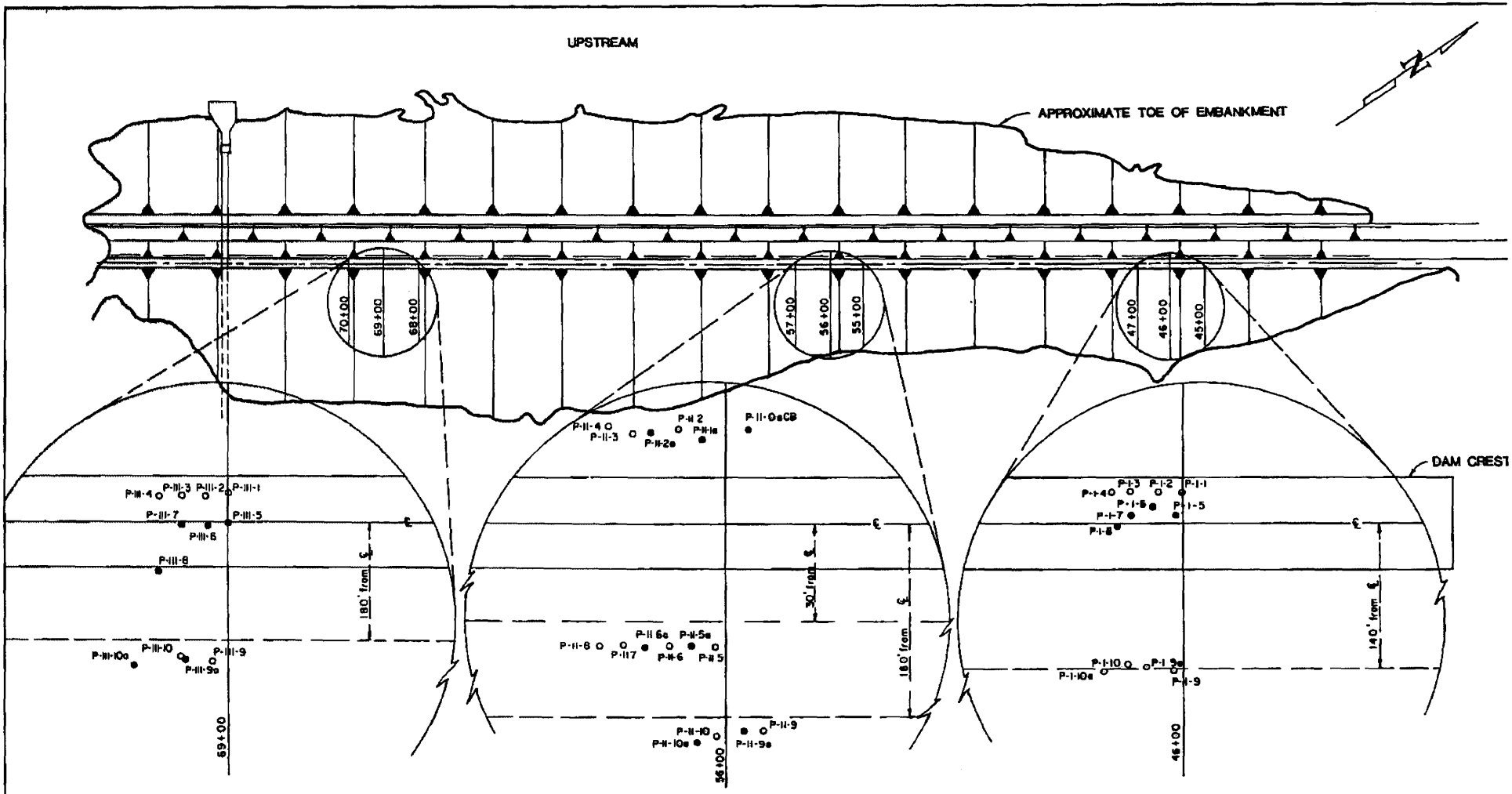
Number	Station	Offset From ℄	Elevation
S.C.D. S.M. 1*	38+99.06	12.00 D.S.	796.69
S.C.D. S.M. 2	38+99.93	12.01 U.S.	796.79
S.C.D. S.M. 3	40+99.44	12.30 D.S.	796.63
S.C.D. S.M. 4	40+99.03	11.80 U.S.	797.05
S.C.D. S.M. 5	42+99.20	12.01 D.S.	796.91
S.C.D. S.M. 6	42+99.31	12.19 U.S.	797.12
S.C.D. S.M. 7	44+99.09	12.18 D.S.	797.02
S.C.D. S.M. 8	44+99.14	11.91 U.S.	797.77
S.C.D. S.M. 9	46+99.70	12.18 D.S.	797.34
S.C.D. S.M. 10	46+98.92	11.87 U.S.	797.80
S.C.D. S.M. 11	48+99.66	11.80 D.S.	798.27
S.C.D. S.M. 12	48+99.47	11.47 U.S.	798.50
S.C.D. S.M. 13	50+99.42	12.00 D.S.	798.48
S.C.D. S.M. 14	50+99.30	11.59 U.S.	799.02
S.C.D. S.M. 15	52+99.81	11.97 D.S.	798.61
S.C.D. S.M. 16	52+99.81	12.16 U.S.	799.28
S.C.D. S.M. 17	54+99.67	12.16 D.S.	798.53
S.C.D. S.M. 18	54+99.56	11.91 U.S.	799.33
S.C.D. S.M. 19	56+99.69	12.08 D.S.	798.72
S.C.D. S.M. 20	56+99.41	12.03 U.S.	798.20
S.C.D. S.M. 21	58+99.93	12.44 D.S.	798.30
S.C.D. S.M. 22	58+99.66	11.88 U.S.	799.01
S.C.D. S.M. 23	60+99.83	12.17 D.S.	798.32
S.C.D. S.M. 24	60+99.89	11.92 U.S.	799.04
S.C.D. S.M. 25	62+99.79	12.08 D.S.	798.74
S.C.D. S.M. 26	62+99.90	12.19 U.S.	799.25
S.C.D. S.M. 27	64+99.89	11.70 D.S.	798.92
S.C.D. S.M. 28	64+99.78	11.69 U.S.	798.80
S.C.D. S.M. 29	67+00.00	12.28 D.S.	798.77
S.C.D. S.M. 30	66+99.90	11.90 U.S.	799.05
S.C.D. S.M. 31	68+99.64	12.22 D.S.	798.66
S.C.D. S.M. 32	69+00.04	12.16 U.S.	798.96
S.C.D. S.M. 33	71+00.05	12.41 D.S.	798.68
S.C.D. S.M. 34	70+99.82	11.55 U.S.	798.87
S.C.D. S.M. 35	72+99.82	12.27 D.S.	797.65
S.C.D. S.M. 36	72+99.98	12.14 U.S.	797.79
S.C.D. S.M. 37	75+00.10	12.08 D.S.	796.67
S.C.D. S.M. 38	75+00.03	11.93 U.S.	796.51

*Survey November 12, 1977

APPENDIX C
TABLE 3.3

CONDUIT ALIGNMENT MARKERS
SQUAW CREEK DAM

Monolith	U.S. Elev.	D.S. Elev.
1	653.010	653.020
2	653.015	652.920
3	652.870	652.750
4	652.745	652.635
5	652.620	652.485
6	652.485	652.350
7	652.360	652.230
8	652.220	652.130
9	652.125	651.975
10	651.970	651.840
11	651.850	651.730
12	651.715	651.565
13	651.575	651.470
14	651.460	651.360
15	651.355	651.200
16	651.190	651.090
17	651.090	650.970
18	650.970	650.880
19	650.880	650.780
20	650.770	650.655
21	650.670	650.510
22	650.510	650.400
23	650.380	650.260
24	650.255	650.075

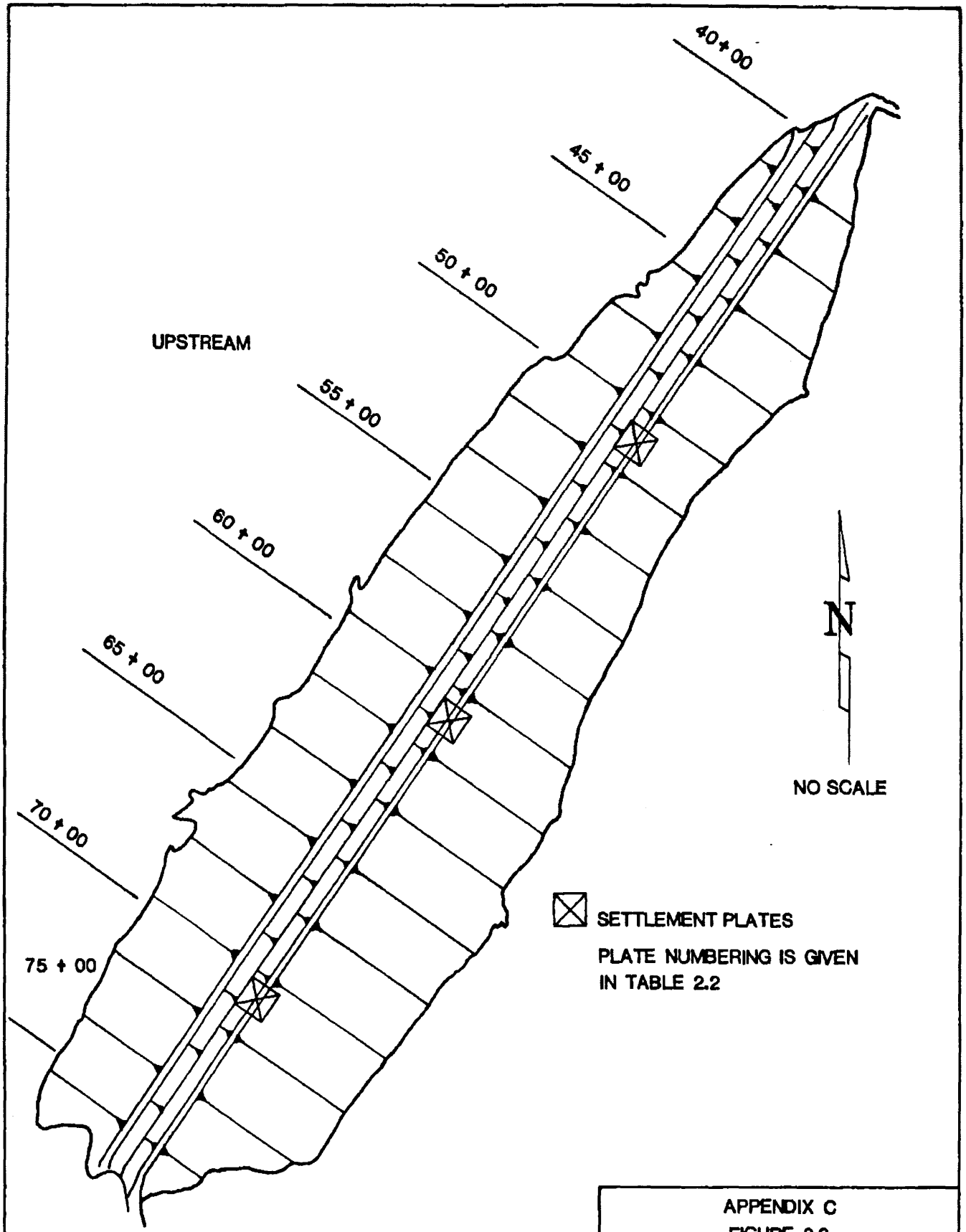


● PNEUMATIC PIEZOMETER RISER
○ WELLPOINT PIEZOMETER RISER

SCALE : PLAN VIEW - NO SCALE
ENLARGED VIEW - NO SCALE

APPENDIX C
FIGURE 2.1

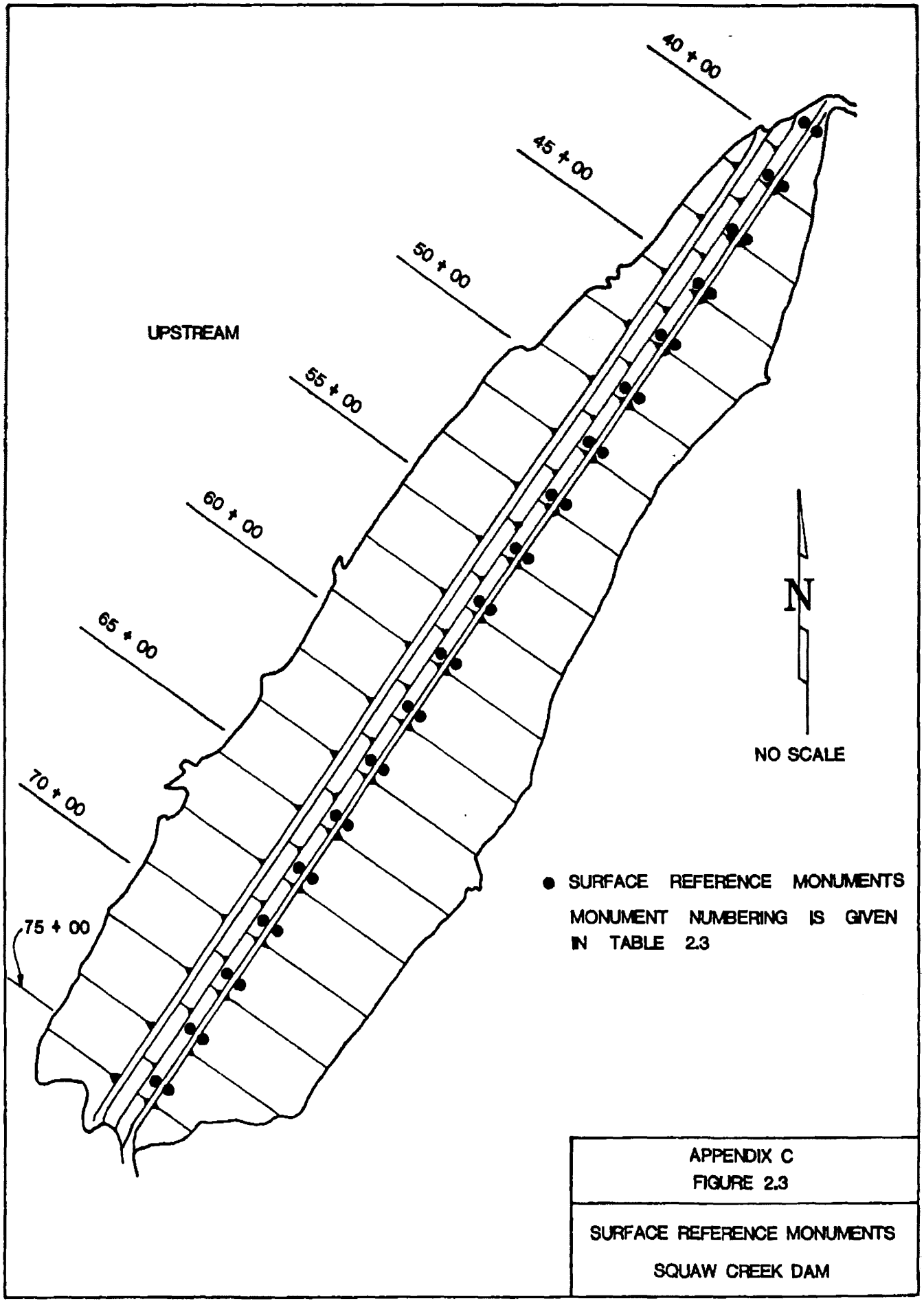
PIEZOMETERS
JAW CREEK DAM



APPENDIX C
FIGURE 2.2

SETTLEMENT PLATES

SQUAW CREEK DAM



APPENDIX C
FIGURE 2.3

SURFACE REFERENCE MONUMENTS
SQUAW CREEK DAM

APPENDIX D

SAMPLE FORMS

FIELD ALIGNMENT MONUMENT LEVELS

Location: SQUAW CREEK DAM Date: ______________________

Reservoir Water Elevation: ________ Party Chief: ____________________

Monument No.	Elevation This Date	Elevation Last Reading	Elevation Initial Reading	Change Last Reading	Total Change

APPENDIX E

TEXAS DEPARTMENT OF WATER RESOURCES

MAINTENANCE, OPERATION, AND REMOVAL
129.08.30.001-.005

These rules are promulgated under the authority of 6.055, Water Code.

.001. GENERAL. Supervision over the maintenance and operation of dams and reservoirs in this State, other than those owned by the Federal Government, insofar as necessary to safeguard life and property from injury by reason of the failure thereof, is vested in the Commission. Owners or their agents shall keep available and in good order records of original construction and any modifications thereto, and maintain pertinent records with respect to maintenance, operation, and engineering including piezometric and geologic investigations and preventive maintenance inspection results conducted to safeguard life and property. In addition, the owner of a dam or reservoir or his agent shall fully and promptly advise the Commission of any sudden or unprecedented flood or alarming circumstance or occurrence existing or anticipated which may affect or has affected the dam or reservoir.

.002. FIELD INSPECTIONS. The Department may make periodic inspections of dams and reservoirs for the purpose of determining their safety and shall require owners to perform work as may be required to disclose information sufficient to enable the Commission to determine conditions of dams and reservoirs in regard to their safety and to perform other work

as may be required, including installation of necessary instruments, to secure maintenance and operation which will safeguard life and property.

.003. RESPONSIBILITY OF THE OWNER. The owner of a dam or reservoir is solely responsible for maintaining the dam or reservoir, including appurtenant works, in a safe condition throughout the life of the structure. If a structure is found in an unsafe or potentially unsafe condition, the Commission shall notify the owner to take action as necessary to render or cause the condition to be rendered safe, including breaching or removal of any dam beyond repair. All expenses involved in restoring the structure or area to a safe condition shall be borne by the owner, including private consulting engineer services rendered.