

HYDRAULIC SURVEY

THREE MILE ISLAND
NUCLEAR STATION

JUNE 1980

—Prepared by—
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HYDRAULIC SURVEY
THREE MILE ISLAND NUCLEAR STATION
JUNE 1980

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INTRODUCTION

On June 11, 1980, a survey was conducted in the vicinity of the Three Mile Island (TMI) Nuclear Station cooling tower discharge structure. The general survey area is shown in Figure 1.

The purpose of the survey was to comply with TMI Unit 2 Environmental Technical Specifications, Section 4.3. The purpose and scope is as follows: "That portion of the Susquehanna River in the vicinity of cooling tower discharge structures out to the Middle Channel shall be monitored to determine the extent of scouring or sedimentation of the river bed that is occurring as a result of operating the Three Mile Island Nuclear Station."

METHODS AND MATERIALS

The equipment utilized in the cooling tower discharge survey performed on June 11, 1980, included:

1. One 16-foot aluminum boat with 20-hp outboard motor.
2. One Raytheon Model DE-719B portable recording fathometer.
3. One 600-foot, 3/16-inch diameter calibrated aircraft cable and supporting winch and boom.
4. Styrofoam buoys with flags.
5. Steel pipes, 1 to 2 inches in diameter, 8 to 10 feet long.
6. Signal flag.

7. Two transits and related survey equipment.
8. Life jackets, first aid kit, fire extinguisher, portable loudspeaker, air horn, and other equipment necessary to satisfy applicable U.S. Coast Guard and State of Pennsylvania Water Safety Regulations.

Prior to the work, in accordance with a directive from the Pennsylvania Fish Commission Bureau of Waterways, dated April 4, 1978, notification was sent to the Bureau of our intentions to begin the survey. One of the provisions of the directive was the placing of notices at all local marinas (Figure 2) and placing an advertisement (Figure 3) with the three major area newspapers describing the work involved and any inherent dangers therein. The notices were placed prior to the work at the Tri-County Marina east shore; the Marina at Goldsboro, west shore; Metropolitan Edison's picnic area, Shelly's Island; and the public picnic area and boat launch ramp on the west shore north of the Marina at Goldsboro. The newspaper advertisements were run in the York Dispatch, Intelligencer Journal-New ERA (Lancaster), and the Patriot (Harrisburg) during the week of May 26, 1980.

To ensure safety of personnel, all U.S. Coast Guard and State of Pennsylvania regulations pertaining to small boat handling were followed. Also, extreme caution was exercised while the 600-foot tag line was extended to ensure that recreational boaters in the vicinity did not collide with the line. Coast Guard approved life jackets were available to all members of the survey crew. All safety requirements of the directive from the Pennsylvania Bureau of Waterways were followed.

The procedure for obtaining horizontal control is described in detail in the 1979 Hydraulic Survey Report (pages 3 and 4). All control points on shore were found to be intact from the previous year's survey (see Figure 4). Naturally, the only control points to be reestablished were the markers over the water.

With the horizontal control completed, the hydraulic survey was started.

The only major difference with the procedure normally followed in previous years was that the arcs were swung upstream instead of downstream. Usually, the wind is blowing upstream and it has more effect on the control of the boat than the current; therefore, the boat is directed into the wind (or downstream). This year, the wind was basically calm and the only effect on the boat was the current; consequently, the arcs were swung upstream with good control of the boat throughout the Hydraulic Survey.

For each arc, the calibrated cable tag line was attached to the radius point and the boat was positioned at the beginning of a circular transect along the downstream side of the range line. With the fathometer operating, a line was transcribed across the strip chart denoting the beginning of the transect. With the boat pulling outward, the line was drawn taut, the boat then angled outward and slightly upstream, and moved slowly at a constant rate of speed toward the first 45° control line. As the fathometer transducer, mounted aft, passed the first 45° control line, the instrumentman signaled the boat crew by flag and another line was transcribed across the strip chart denoting this event. He then walked from the upstream transit to the downstream transit. As the boat approached the parallel offset and as the transducer passed this line; that is, when the parallel offset range poles and the transducer were in line, this event was recorded on the strip chart. The instrumentman again signaled the boat crew when the transducer crossed the upstream 45° line, and the boat crew used the rangeline buoys to locate the upstream range line which terminated the scan. Bottom soundings were taken along the arcs defined by radii of 50, 75, 100, 125, 150, 175, 200, 250, and 300 feet from the radius point.

This procedure gave good horizontal control, with five check points along each transect. Horizontal accuracy is to ± 1 foot along the radii from the radius point and ± 2 feet along the arc. The vertical control is to an accuracy of ± 0.5 feet.

The fathometer was field-calibrated at the beginning and during the day's survey. This was done by using a surveying rod to measure the depth of water at a location where the river bottom is relatively uniform, and adjusting the fathometer to the same depth reading. Such field adjustment eliminates the need for theoretical adjustment of the fathometer based on water temperature, salinity, and other effects.

Because the water surface is the survey datum, the water surface elevation was recorded at the beginning and at the end of the day's survey. Water surface elevations were obtained from the markings of the Unit 1 intake structure. The tape records of the fathometer readings were reduced and plotted at a minimum interval of 25 to 30 feet along each arc.

All field notes and calculations used in developing the following information are on file and available for inspection in the Gilbert Associates, Inc. Reading offices.

RIVER FLOW

On the date of the survey, June 11, 1980, the river flow was approximately 20,000 cfs at Harrisburg, Pennsylvania, and the water surface elevation at the TMI Unit 1 river water intake structure staff gage was 279.0.* A plot of daily flow rates in the Susquehanna River at Harrisburg is shown in Figure 5. The stages and stage-discharge relationship at Harrisburg were furnished by the National Weather Service Federal-State River Forecast Center in Harrisburg.

At rates below about 20,000 cfs, the total river flow passes through the York Haven Head Race Channel, and no water overflows the York Haven or East Channel Dams. Under this condition of flow, the river bed in the vicinity of the intakes and discharge is in its most stable condition.

*All elevations are in feet above mean sea level.

RESULTS

Figure 6 depicts the contours of last year's survey, performed on July 19, 1979. Figure 7 shows this year's results, dated June 11, 1980. The contours were generated by using an accepted electronic data processing surface approximation and contour mapping system. The computer processed plots are preferred over manual contouring because of speed, accuracy, and uniformity of technique. The computer places a grid system over the entire area specified by the data points and evaluates the data using a weighted least squares fit. Using the same mathematical technique on essentially the same data coordinates from one survey to the next is important for comparisons, between past, present, and future survey results. The computer program, SACM, used to generate these contours, was developed by Application Consultants, Inc., and is in the current data processing library of United Computing Systems, Inc. of Kansas City, Missouri. Gilbert Associates, Inc. accessed this program from a remote terminal located at Green Hills, Pennsylvania.

In the immediate vicinity of the discharge structure, soundings could be obtained this year because of the lower discharge flow, lack of turbulence, and also slightly deeper water. The bottom contours in this area are relatively uniform with no scouring evidenced.

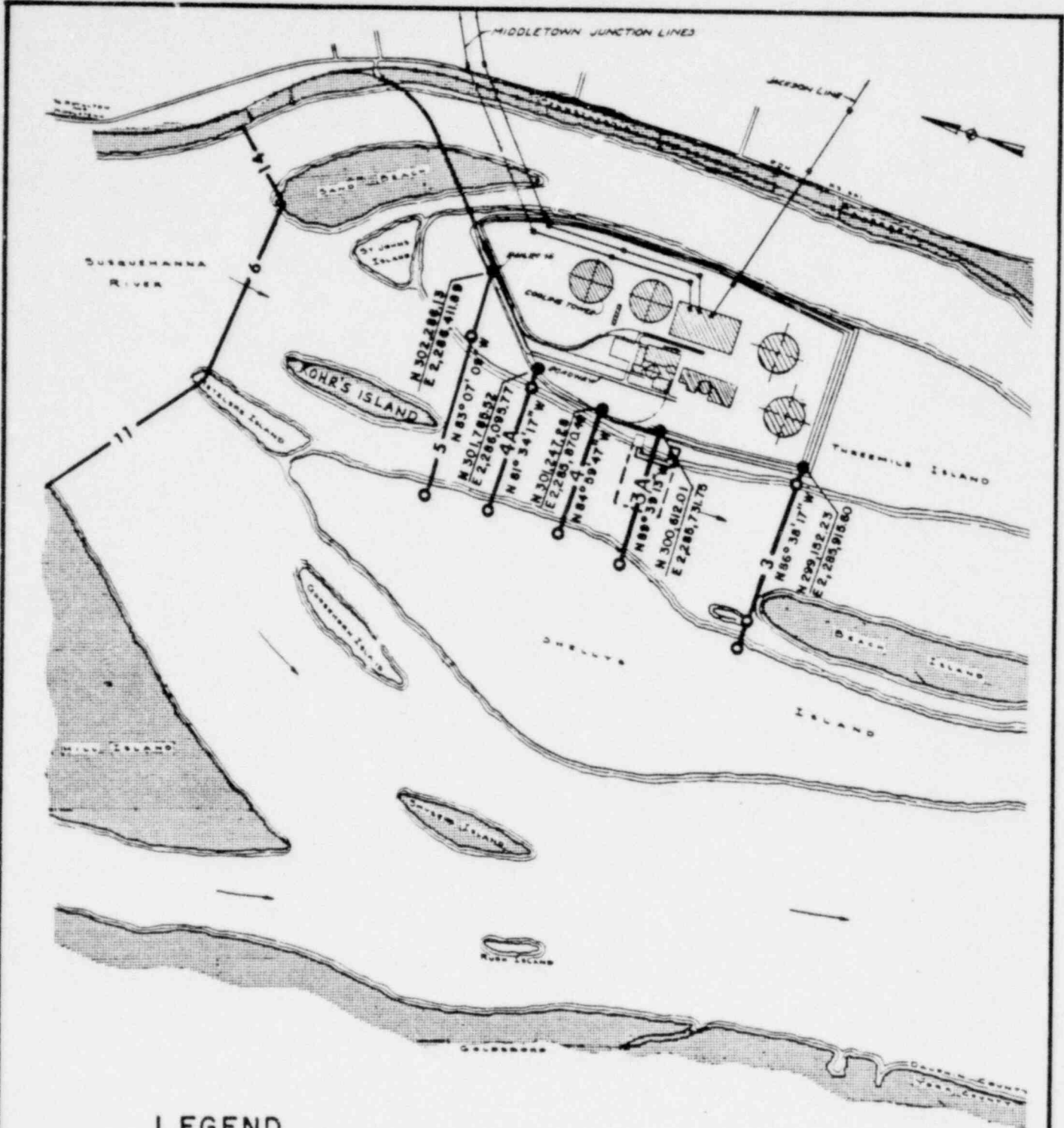
Because the computer generated contour plots from 1978, 1979, and 1980 were all plotted to the same scale, it was relatively easy to overlay them to detect any discontinuities, trends, or distinctive differences among the three.

The general pattern of the 1980 contours closely resembles that of last year; and in the area of the discharge plume, the differences in bottom elevation randomly vary by ± 0.5 feet. This indicates that the normal scouring and depositional effects of river flows and icing conditions, which occur each year, are more significant and widespread than any scouring effects from the discharge structure.

CONCLUSIONS AND RECOMMENDATIONS

At the time of this survey, on June 11, 1980, there was no evidence of scouring of the river bed in the vicinity of the TMI cooling tower discharge structure. It was mentioned in last year's hydraulic report that if, "the survey shows no drastic changes in river bed configurations, it is recommended that this discharge survey be terminated." It is our conclusion that no significant changes in the bed have taken place at this time; however, the discharge survey is a TMI Unit 2 Environmental Technical Specification and cannot be eliminated.

FIGURES



LEGEND

- PERMANENT MARKERS (MARBLE)
- SEMI-PERMANENT MARKERS (STEEL PIPES)
- COMPLETED SEMI ANNUALLY
- - - JUNE SURVEY ONLY

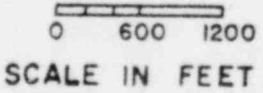


FIGURE 1
HYDROGRAPHIC AND SEDIMENT MONITORING PROGRAM
THREE MILE ISLAND NUCLEAR STATION

ATTENTION BOATERS

This notice is to inform you that on or about _____
GILBERT ASSOCIATES, INC., an engineering firm, will be conduct-
ing a hydrographic survey in the vicinity of _____.

This work may entail the stringing of a 3/16" wire cable from
shore to a blue 16' Duranautic aluminum utility boat during the
survey. The cable will be marked with orange flags every 50'
and orange buoys placed in the vicinity of the work detail. For
your own safety please use extreme caution when within the
working area. This cable will not be left unattended and will
be reeled in at the completion of each days work. Thank you
for your cooperation.

CAUTION

PUBLIC NOTICE

BOATERS - This notice is to inform all persons boating within the vicinity of Three Mile Island Nuclear Generating Station, Middletown, Pa., of a two-week hydrographic survey to be performed beginning in the week of June 9, 1980. The work area will be in the Susquehanna River between Shelly's island and Three Mile Island, directly in front of the power plant's concrete intake structures. This work will entail the stringing of a 3/16" wire cable from the Three Mile Island shore to a blue 16 foot duranautic aluminum utility boat during the survey. The cable will be marked with orange flags every 50 feet and orange bouys placed in the vicinity of the work detail. For your safety, please use extreme caution within the working area. This cable will not be left unattended and will be reeled in at the completion of each day's work. Thank you for your cooperation.

FIGURE 3

NEWSPAPER ADVERTISEMENT
THREE MILE ISLAND NUCLEAR STATION
SURVEY CONDUCTED JUNE 1980

BACK FACE OF
DISCHARGE

SOUTH-EAST
CORNER

29.51'

RADIUS POINT

45° CONTROL LINE

45° CONTROL LINE
PARALLEL OFFSET

RIVER FLOW
→

ENLARGED DETAIL

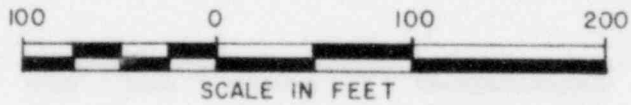
UNIT NO. 1
WATER
INTAKE

UNIT NO. 2
WATER
INTAKE

N-S CHANNEL
RADIUS PIN

RAN

SUSQUEHANNA RIVER
→



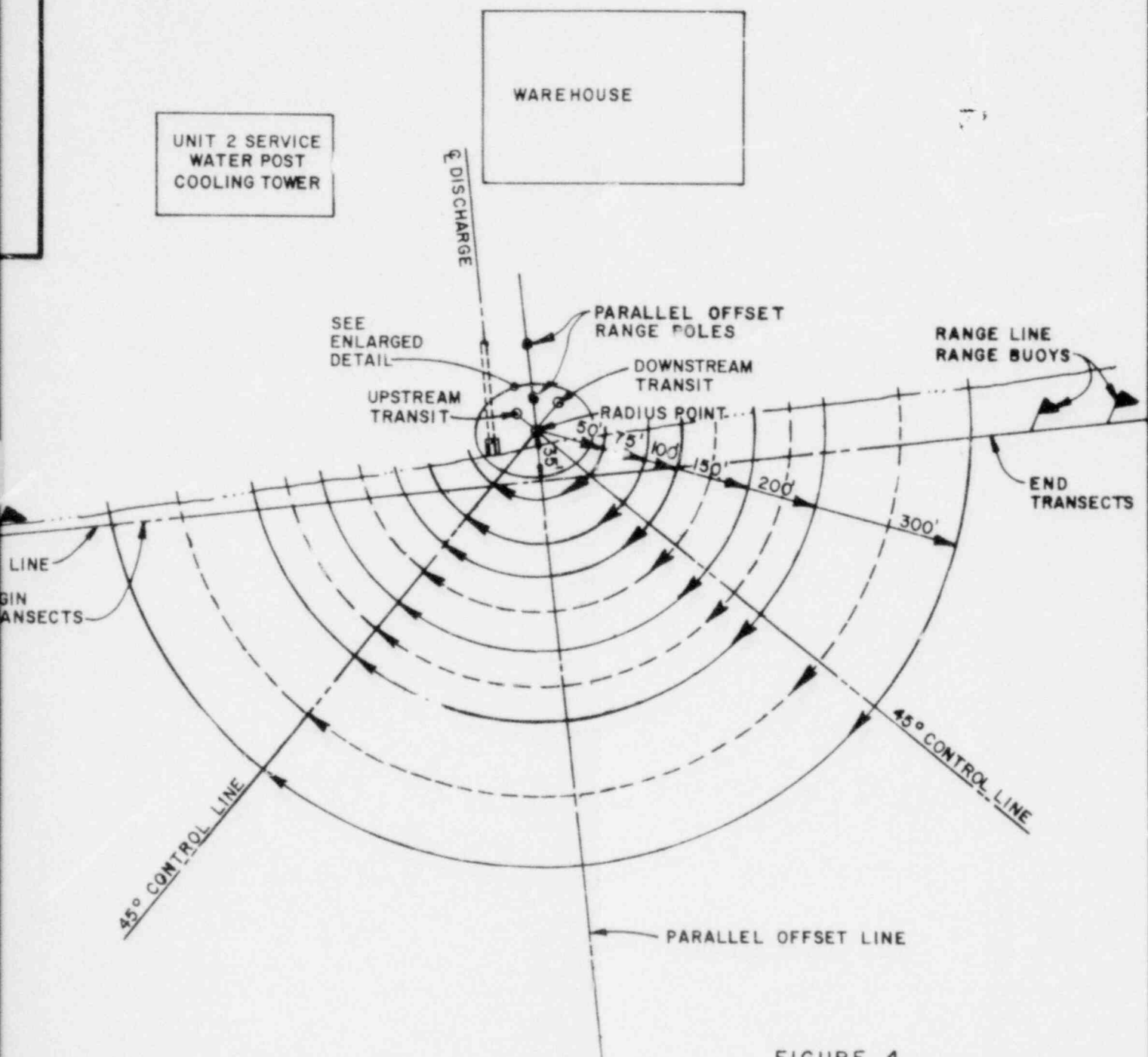


FIGURE 4
 LOCATION HORIZONTAL CONTROL PLAN
 COOLING TOWER DISCHARGE SURVEY
 THREE MILE ISLAND NUCLEAR STATION

SURVEY CONDUCTED JUNE 1980

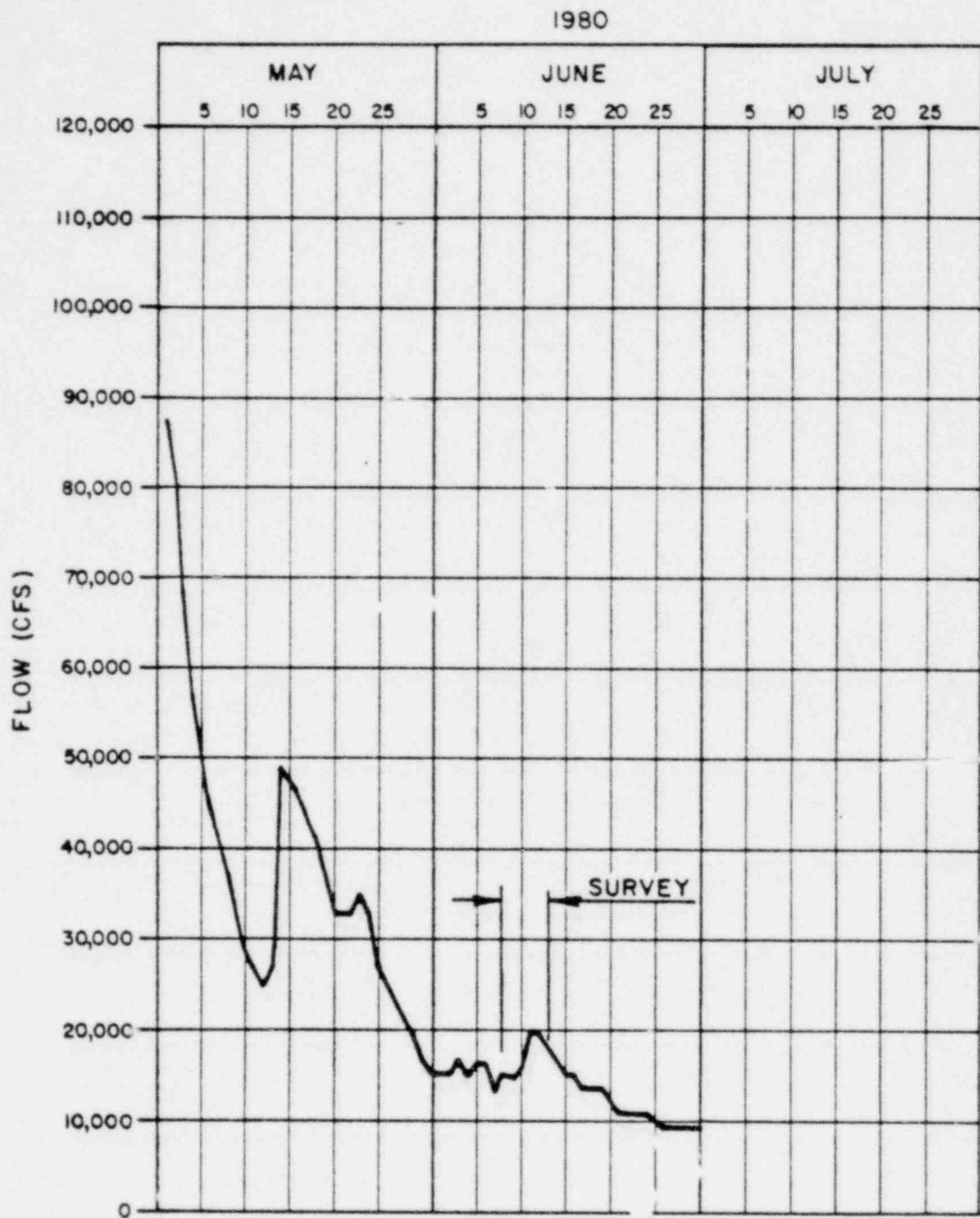
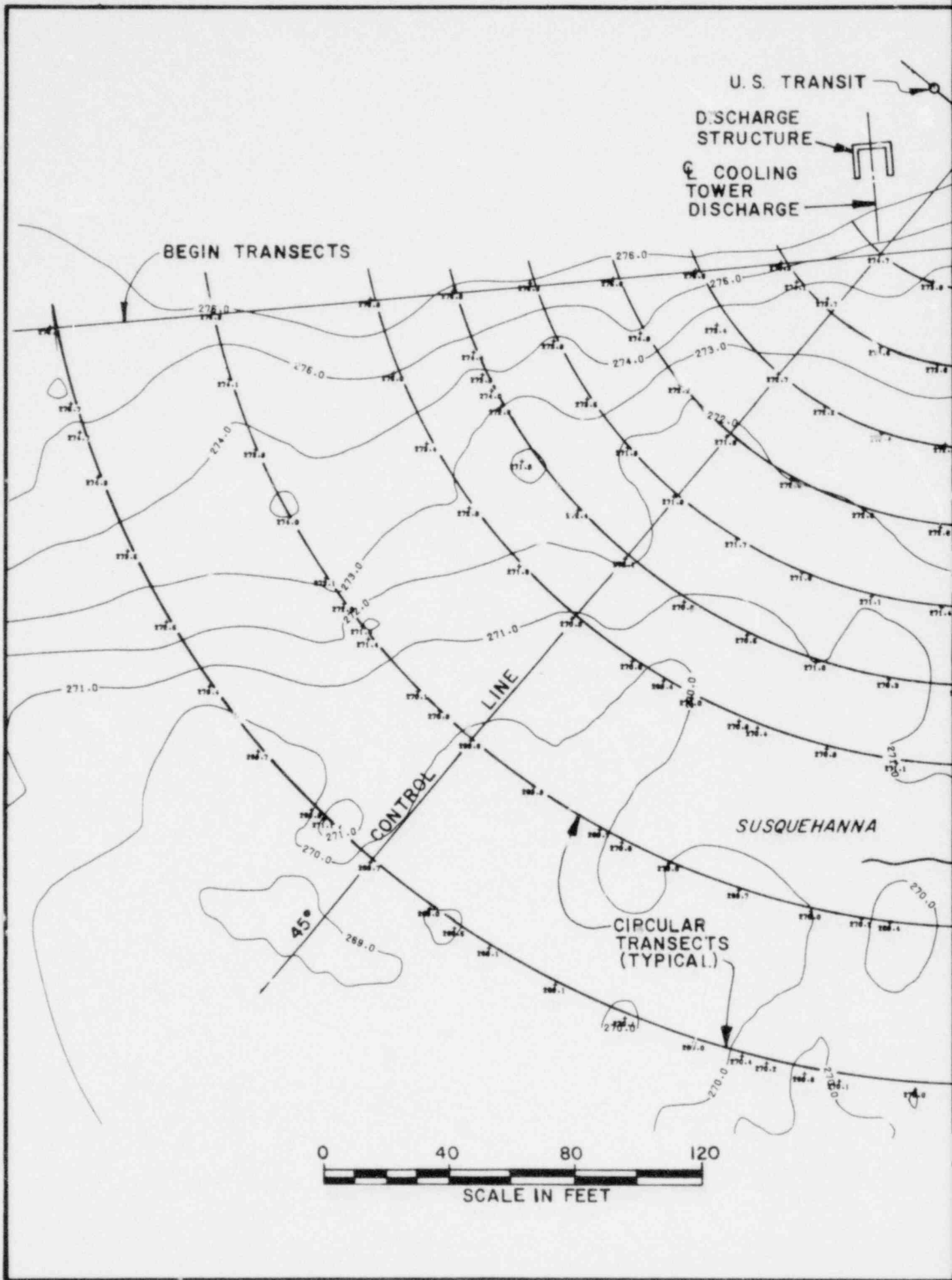


FIGURE 5
 FLOW IN THE SUSQUEHANNA RIVER
 AT HARRISBURG
 THREE MILE ISLAND NUCLEAR STATION



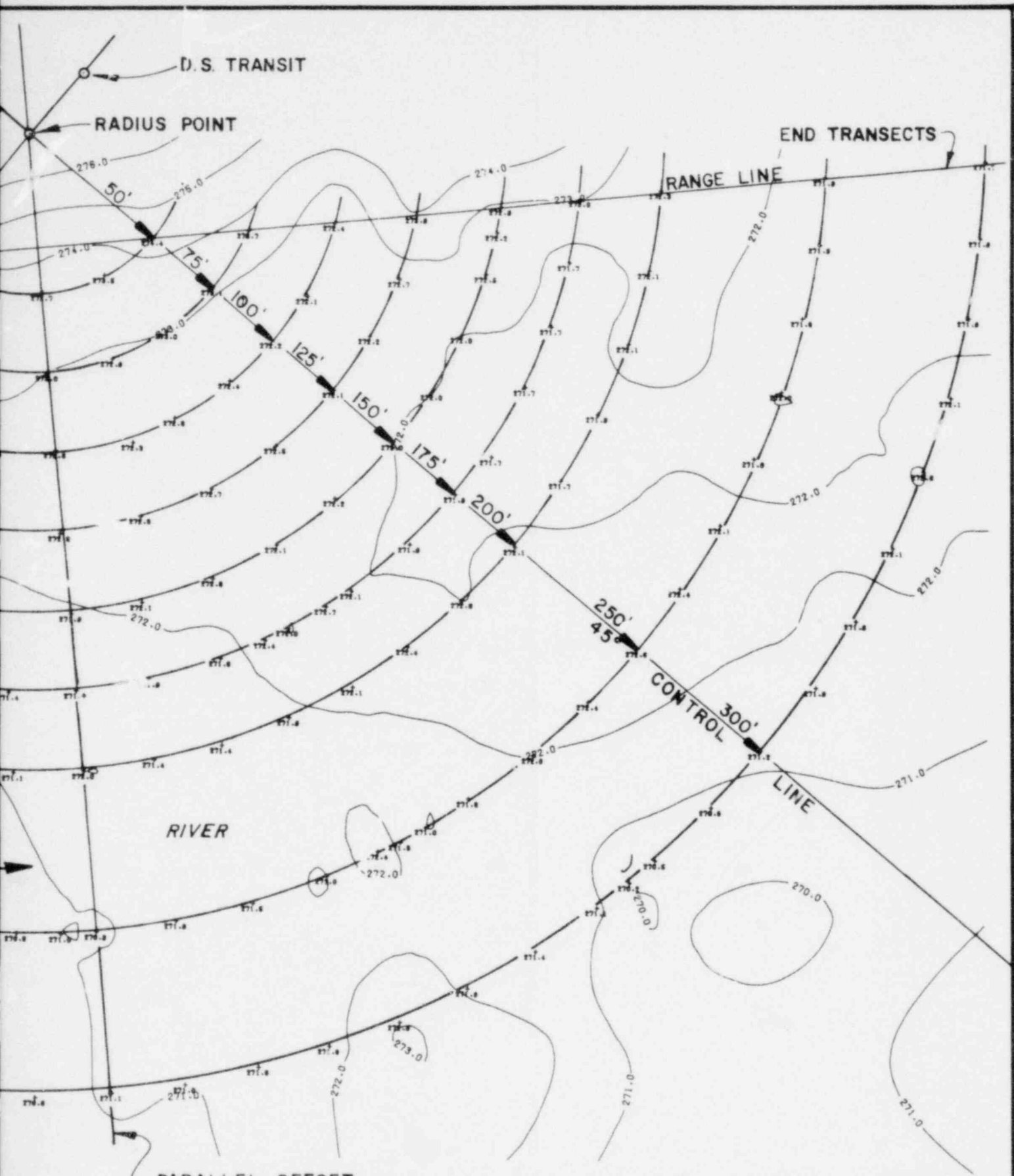
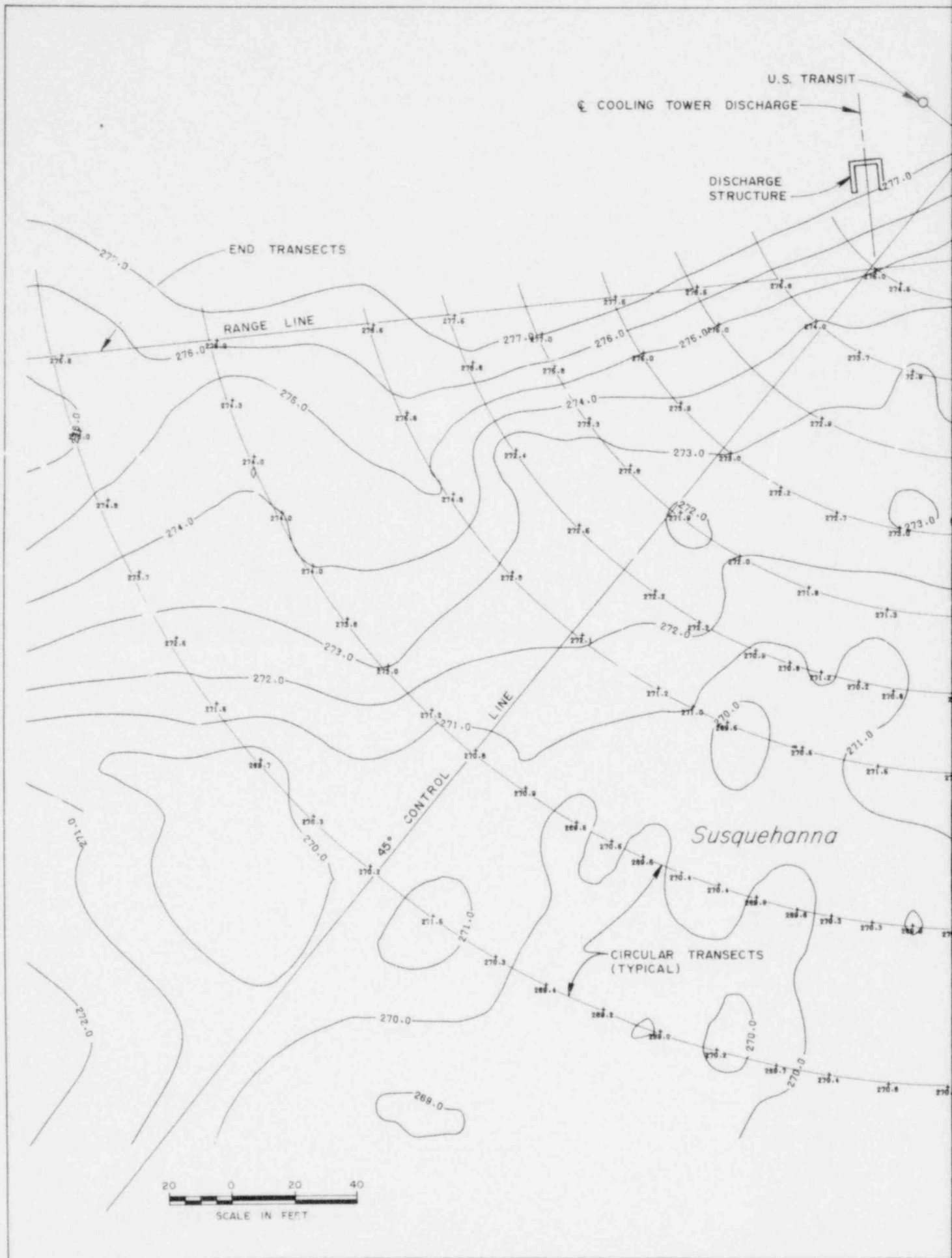


FIGURE 6
 COMPUTER GENERATED CONTOURS
 COOLING TOWER DISCHARGE AREA
 THREE MILE ISLAND NUCLEAR STATION
 SURVEY CONDUCTED JULY, 1979



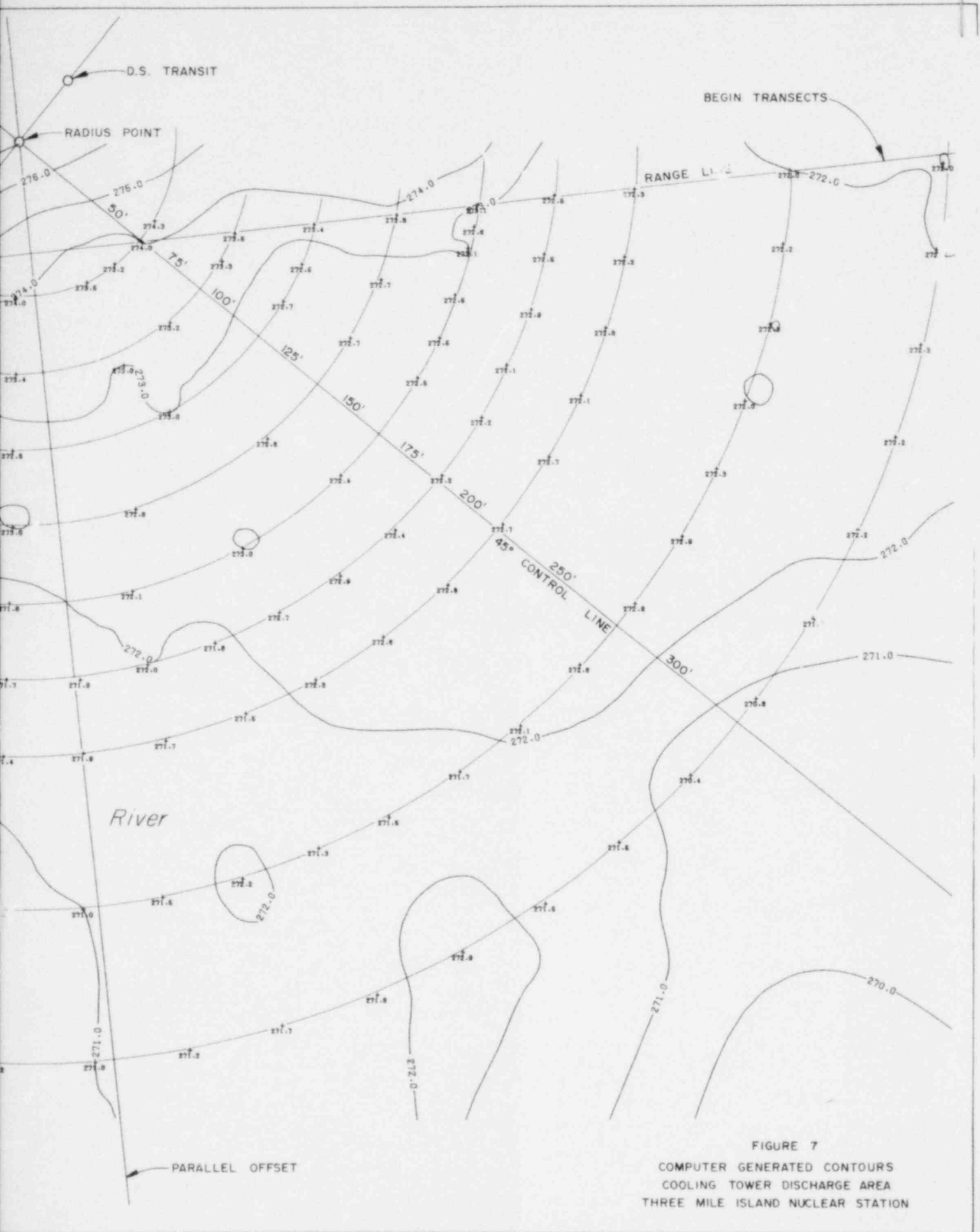


FIGURE 7
 COMPUTER GENERATED CONTOURS
 COOLING TOWER DISCHARGE AREA
 THREE MILE ISLAND NUCLEAR STATION

SURVEY CONDUCTED JUNE, 1980