INVESTIGATION OF THE

CANDELSTICK PARK WIND PROBLEM

Volume II: Wind-Tunnel Model Study

by

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ABSTRACT

The overall purpose of this investigation is to determine whether or not there are practical methods for controlling the afternoon winds at Candlestick Park in order to alleviate the unsatisfactory wind conditions which now exist.

Field observations have shown that two characteristic and distinctive wind flow patterns exist within the stadium. Each results from the interaction of Bay View Hill on the unidirectional air flow approaching the stadium complex.

These wind conditions have been reproduced in a 1:768 scale model of the Bay View Hill-stadium complex, demonstrating that the wind-flow patterns observed in the model are directly correlated with those in the stadium complex, i.e. the prototype. Accordingly, changes in the wind-flow patterns resulting from modifications in the model can be evaluated in terms of corresponding modifications in the prototype.

Approximately 150 different model-wind flow situations have been examined. From the results obtained it is evident that elimination of the objectionable features of the existing flow patterns, and a general reduction in wind speed within the stadium, can be achieved if both Bay View Hill and the stadium are modified as follows:

Bay View Hill - Cut a slot through the south end of the hill tangent to the Left-Field edge of the stands or, remove the southerly portion of the hill.

Stadium - Partially cover the stadium with a protective dome extending beyond the infield, or erect a vertical screen on top of the rim between 50 and 100 feet high, or install vanes on top of the rim to deflect the wind vertically.

Modifications which are not effective singly or in combination includes:

Complete removal or reduction in elevation of Bay View Hill; partial or complete extension of the upper stands around the outfield; addition of solid, porous or deflecting barriers on Bay View Hill or across left field or completely around the outfield.

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ACKNOWLEDGMENTS

The excellent cooperation experienced in working with Metronics Associates, Inc. and in particular with Dr. W. A. Perkins has made this study both pleasant and stimulating.

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PURPOSE AND OBJECTIVE OF THE INVESTIGATION

The purpose of this investigation is to determine what practical measures can be taken to alleviate the unsatisfactory wind conditions in Candlestick Park short of covering the entire stadium. Engineering concepts rather than design details are investigated with engineering feasibility rather than economic and aesthetic factors being given first consideration.

Because the unfavorable winds in the ballpark are a direct result of the strong westerly diurnal flow of marine air into the Bay Area, the first objective of the investigation was to define by field measurements the unknown circulation patterns within the ballpark originating from the westerly wind. The second objective was to determine through use of a wind-tunnel model of Bay View Hill and Candlestick Park the effectiveness of various terrain and structural modifications in reducing the wind speed or changing the existing circulation patterns within Candlestick Park. An essential part of the latter objective was the delineation of those modifications which are ineffective so that they can be eliminated from further consideration.

Results of the investigation are presented in three volumes and a seven-reel motion picture. Volume I is a detailed report of the prototype wind studies, Volume II is a detailed account of the wind-tunnel model study, Volume III presents the conclusions and recommendations together with a non-technical summary of the investigation. The motion picture shows prototype wind flow patterns and model performance for each of the 150 combinations of configurations and wind directions studied.

I. INTRODUCTION

Ever since Candlestick Baseball Park was built at San Francisco, some four years ago, both fans and baseball players have been annoyed by the peculiar wind patterns generated during the afternoons. The local wind patterns in Candlestick Park are fixed by the following two features: (1) the geometry of Bay View Hill located to the west of the stadium and running approximately in a direction 30° north of west to 30° south of east; and (2) the sharp features of the stadium itself. Even though the strong afternoon flow of marine air from the west into the Bay Area cannot be stopped, there does exist the possibility of making the ballpark more pleasant by diverting the winds locally by modifying Bay View Hill, the stadium or both.

Stimulated by the increase in complaints about the wind during the 1961 major league all-star game, the administration of the City and County of San Francisco made the decision to thoroughly investigate the problem. Consequently, a joint field and model study was initiated. This report pertains to the wind-tunnel modeling phase of the investigation.

The objectives of the model study were fourfold:

(1) to help determine the objectionable features of the wind pattern in the existing stadium,

(2) to determine the reproducibility of prototype wind patterns for neutral atmospheric conditions,

(3) to determine wind patterns and wind stability for the model of Candlestick Park under various combinations of modified topography and stadium structure for neutral atmospheric conditions, and

(4) to determine if any combination of modified topography and stadium structure studied in objective (3) can remove or reduce the objectionable characteristics in the existing wind patterns in Candlestick Park.

II. PREVIOUS STUDIES ON TERRAIN AERODYNAMICS

Generally speaking, wind problems such as are encountered in the Candlestick Park Baseball Stadium may be classified under the broad heading of "Terrain Aerodynamics". Terrain aerodynamics may be described as a study, laboratory and/or field, of the effect of local topography on the wind distribution and the contribution of the terrain to the local turbulence or gustiness.

One of the earliest scale model experiments for this type of study was carried out in Japan by Abe[1] in 1928 with a model of Mount Fujiyama. The contours of Fujiyama being quite smooth, the flow pattern was affected to a large degree by the local Reynolds number. Thus, the model flow patterns obtained were not even qualitatively close to that observed in actual field tests. On the other hand, Reynolds number effects have less influence on flow over rough, craggy terrain; therefore, true mean flow patterns can be obtained from the wind tunnel air flow over a scale model of such terrain.

An example of a successful study of terrain aerodynamics in the laboratory was that performed, in 1929 at the National Physical Laboratory of Great Britain[2], on the 1:5000 - scale model of the Rock of Gibraltar in a low-speed wind tunnel.

In the model investigation two methods were used to determine the wind patterns caused by the Rock. In the first, an extensive grid of some 800 "flags", two-inch silk fibers spaced at regular lateral and vertical intervals, was fixed within the wind tunnel. These flags were observed for range and violence of movement and for prevailing wind direction in pitch and yaw. In the second method, long streamers of fine wool fibers were placed in various critical positions, and a record of streamline patterns was made. The wind speed used was about 25 feet per second, and the wind direction was varied from NE through E to SE. It was found that wind

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[1] Abe, M. Mountain clouds, their forms and connected air currents. Bull. Cent. Meteor. Obs. Tokyo, vol. 7, no. 3, 1929.

[2] Field, J. H. and Warden, R. A survey of the air currents in the Bay of Gibraltar in 1929-1930. Geophysical Memoir No. 59, Meteorological Office, Great Britain, 1932.

directions and the distribution of vortices and vertical currents obtained with the model agreed closely with those occurring in nature at Gibraltar. In the case of features of the wind such as the actual intensity of gustiness and the rapidity of changes in direction and gustiness, the modeled flow was not in good agreement with the prototype flow.

More recently flow over a 1:275 - scale model of a building was studied.[3]

From the brief review of "terrain aerodynamics" given above, it is seen that several scale model studies of the wind pattern over terrain models have been conducted in the past - most of these have been partially successful. In general, modeling of flow over rough topography has yielded satisfactory results. Thus, modeling of the wind pattern at Candlestick Park is a feasible undertaking.

III. EXPERIMENTAL EQUIPMENT

In this section the wind tunnel, the models and the equipment used to make the measurements will be described.

A. Wind Tunnel

The investigation of flow over the model was conducted in a wind tunnel with a 6 ft square, 35 ft long test section. The tunnel was of the recirculating type and was powered by a constant-speed, variable-pitch 75 HP fan (see Fig. 1).

The air entered the test section from a stilling chamber of 12 ft x 12 ft cross section through a set of two stainless steel screens and a contraction section in which the area was reduced from 12 ft x 12 ft to 6 ft x 6 ft. The turbulence present in the air stream due to action of the fan and the turning vanes in the corners was broken down into small eddies by the screens. The screens serve also to reduce non-uniformities in mean velocity across the entrance section. Thus, the air enters the

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[3] Dau, K. Wind tunnel tests of the Toronto City Hall. University of Toronto, Institute of Aerophysics, Tech. Note No. 50, 1961.

test section uniformly distributed and with a low initial level of turbulence.

A zero longitudinal pressure gradient was maintained in the test section, with the pressure being nearly atmospheric. All the tests were conducted at a wind speed of approximately 30 feet per second. Because the local topography, rather than thermal stability, appeared to dominate the flow pattern in the stadium and its vicinity, all tests were conducted under neutral stability conditions.

B. Models

For a neutral atmosphere, inertial characteristics of the air flow dominate the wind pattern when the geometry changes abruptly in height. Thus, a true geometrical model with test wind speeds of the same order-of-magnitude as in the prototype were required for the investigation. With an undistorted scale model, wind directions for the modeled flow should correspond to prototype flow wind direction and dimensionless model wind speeds (local wind speed/characteristic wind speed -- u_m/U_m) should correspond to dimensionless prototype wind speeds u_p/U_p when compared at similar locations. Dimensional arguments immediately yield the result that gust frequency for the model flow f_m is related to gust frequency for the prototype flow f_p by

$$f_m = \frac{U_m}{U_p} \frac{L_p}{L_m} f_p$$

where L_p/L_m is the ratio of characteristic lengths for prototype and model. When U_m/U_p is approximately unity the model gust frequencies will be larger than prototype frequencies by a factor L_p/L_m .

The choice of scale for the model was governed entirely by two factors: (a) size of the wind tunnel and (b) inclusion of the necessary topography that affected the wind patterns in the stadium. A scale of 1:800 was selected for the model -- the largest scale possible that would include the total hill for all desired wind directions.

The model of Bay View Hill was made from a mixture of light weight aggregate and cement which was shaped according to contours given by a contour map supplied by the City and County of San Francisco (see map). The model was made in two sections with each mounted on a six-foot diameter semicircular plywood (see Fig. 2). The base represented the surface of San Francisco Bay. The model of the hill and the base were mounted on a turntable raised about six inches above the wind-tunnel floor. Thus, it was possible to rotate the model through an angle of 360° to obtain any desired wind direction. This model of the hill has been called the "original hill" in all subsequent sections of this report.

Miniature trees, made of Norwegian Lichens, were glued to the north side of the hill to simulate the vegetation on the hill slopes. Photographs of the prototype were used to locate these trees on the model.

Smoke orifices made from 1/4 inch copper tubing were mounted flush with the hill slopes at various critical locations. These orifices were connected through "Tygon" tubing to kerosene smoke generators located outside the tunnel. The raised turntable gave easy access to the orifice connections.

Upstream and downstream ramps, two feet and four feet in length respectively, were used to give a smooth transition between the floor of the wind-tunnel test section and the base of the model (see Fig. 3). The leading edge of the upstream ramp and the trailing edge of the downstream ramp were shaped to give smooth transitions.

The model of the stadium itself was made with a framework of sheet metal and a plaster-of-paris filler from detail drawings furnished by the City and County of San Francisco. Two scales were used for the stadium model -- 1:400 and 1:800*. The 1:800 scale model was used for most of the study. The 1:400 scale model was used to test the effect of model scale on the flow pattern within the stadium by comparison with the pattern observed in the 1:800 scale model (no hill present in both cases). Smoke outlets were provided in the 1:800 scale model at Sections 2-4 in the upper stands and Sections 22-24 in the lower stands. The parking lot was also included in the model.

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* The true scales used were 1:384 and 1:768.

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Several modified forms of Bay View Hill and the stadium were made. These were made with the same materials and in an identical manner as the original models. A description of these modifications will be found in a later section.

C. Techniques of Measurement

In order to judge the degree of turbulence of the wind and to record its range of direction in a horizontal plane, and to determine the streamline pattern, an extensive grid of pivoted streamers was constructed at various critical locations on Bay View Hill, in the stadium and in the parking lot. These streamers were approximately one-inch long "Orlon" yarns glued on glass beads that were free to rotate in a horizontal plane on a pin (see Fig. 4). The pins could be fixed upright at any desired position on the model with the yarn attached at any height. Using these streamers, one could estimate the main or predominant position of each streamer and the total range of angle variation in a horizontal plane. In general, the range extended symmetrically on the two sides of the predominant positions; but there were cases where no predominant direction occurred, but merely continuous oscillations between the recorded range limits, or even complete rotary motion occurred.

In addition to the pivoted streamers, kerosene smoke was released continuously at critical locations in the model as a means of visualizing the streamline pattern. These two methods -- smoke and pivoted streamers, were not used simultaneously, but merely to supplement each other.

Motion pictures with a 16mm Reflex Type Paillard Bolex camera were used to record the complete motion of the streamers*. Diagrams of the flow pattern were then drawn from these motion pictures by taking each streamer in turn and estimating its mean direction and the prevailing direction in yaw.

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* A composite motion picture showing a short sequence of pictures for all configurations of hill and stadium examined has been prepared. Table 2, Details of Modifications (p. 78), describes scenes in the order of appearance in the film. This film should be referred to by those wishing to study the model results in detail.

Mean velocity measurements were also made at five locations in the model. These measurements were made by a manually balanced mean-velocity, constant-temperature, hot-wire anemometer. The circuit diagram of this instrument is shown in Fig. 5. The sensing element consisted of a 0.4 inch length of 0.001 inch diameter platinum wire mounted on the tips of two piano wiré prongs, the other ends of the prongs were embedded in plastic. The hot-wire was calibrated by means of a pitot tube and a Flow Corporation micromanometer. After calibration the hot-wire probe was placed in the wind tunnel with the sensing element normal to the flow and the velocity measured at each of the five locations (see Fig. 6 for these locations).

IV. CORRELATION PHASE

A. Introduction

The objective of this phase of the work was to make measurements of air flow over a model of the existing hill and stadium, using pivoted streamers and anemometry in order to establish model-prototype correlations in terms of the mean circulation pattern in and around the stadium. In addition, based on these measurements and field measurements, the specific elements of the wind pattern which seem objectionable and should be eliminated or modified were to be established.

This part of the investigation was conducted at several wind speeds and over a range of wind directions. The choice of the speeds and directions was based on the observations made by Metronics Associates, Inc. at the field reference station at McLaren water tank. Wind speeds and direction measurements were recorded on a twenty-four hour basis at the reference station from April through September 1962. The half-hourly average directions for the period 1300 - 1800 hours PDST were determined from the records (these are the primary hours of interest for baseball games). The half-hourly averages were plotted in terms of frequency diagrams showing for each month the number of half-hourly periods in 3° direction increments.

The directions corresponding to the 5, 50, 95 percentile points on the frequency diagram together with the maximum direction for each month were then found. Fig. 7 is a summary of these wind direction reductions (details can be found in Vol. I of this investigation). As seen from this Fig. 7, 90 percent of the half-hourly average directions fall between West and 45^{o}S of W. Consequently, measurements in the wind tunnel were made at 5^{o} intervals between 6^{o}S of W and 41^{o}S of W. The records at the McLaren water tank reference station also show that the wind speeds vary between 10 to 30 mph during 1300 - 1800 hours PDST in the months of April to September. Thus, the tests during this phase of the work were conducted with wind speeds at approximately 10, 20 and 30 mph.

An assumption inherent in the above choice was that the year 1962 was typical of past years. Records at the City Hall in San Francisco indicate that the wind was blowing from a more southerly direction in 1962 than in past years. Since no previous records were kept at the McLaren water tank reference station, no conclusions can be made as to the validity of this assumption.

B. Summary of Prototype Flow Pattern

The following summary of the prototype flow patterns was obtained from field studies conducted by Metronics Associates, Inc. The patterns were inferred from movies of smoke releases and streamers in the stadium, the parking lot, and Bay View Hill. The summary is broken down into three subsections: (1) stadium pattern, (2) parking lot pattern, and (3) overall circulation over hill. The readers should refer to Vol. I of this report for more details.

1. Stadium flow patterns: Two distinct types of patterns were observed. One is called for brevity, "Left-Field Control" and the other "Southerly Control". No correlation was found between wind direction at McLaren water tank and these predominant flow patterns. It was observed that the Left-Field Control occurred during the major portion of time measurements were

made. These distinct patterns existed even for the lower velocities, although they were more marked at wind speeds around 30 mph.

a. Left-Field Control: The following distinct features were observed for this type of flow (refer to Figs. 8a and 8b):

(i) A large vortex formed at Section 32 of the upper stands. The smoke released always cleared the upper stand and never obscured the end.

(ii) A predominant mean flow was observed going down third-base line towards home plate, impinging on Sections 7 through 11 of the upper stands and then going over the top of the rim and out of the stadium.

(iii) A clockwise flow formed in back of the lower stands from Section 5 to Section 18, approximately. This flow is at relatively low speed, but is continuous and essentially non-variable.

(iv) A predominant flow came from left field with interrupted flow parallel to the stands which moved away from home plate at Section 23 of the lower stand and Section 23 of the upper stand.

(v) A clockwise flow was produced under the upper-stand rim of Sections 2 - 4 becoming weak after Sections 8 - 10, but persisting to Section 32.

(vi) A 180° shift in direction occurred parallel with the bottom edge of the upper stand at Section 1. The shift in direction took place at intervals of approximately ten seconds to one minute.

(vii) A mean flow extended from the left-field opening across the outfield particularly at the bleachers and the scoreboard position.

This particular type of flow was called "Left-Field Control" because the entire flow pattern in the stadium is governed or controlled by flow across the left-field opening.

b. Southerly Control: This type of flow was quite different from the Left-Field Control pattern. The following distinct features of this type of pattern were observed (refer to Figs. 9a and 9b):

(i) A downward flow from the rim at Sections 4 to 10 of the upper stand extended on to the playing field. The flow reached the ground surface between home plate and the lower stands. After contacting the surface, there was a marked surface flow outward into the left field area at a depth of 75 feet or less. The flow diverges and moves along both the first and third-base lines. Smoke that was released under the rim was never carried above the upper edge of the rim.

(ii) The downward flow created a characteristic eddy in the upper stands and also in the lower stands. The line of contact at the ground surface extended outward towards the pitcher's mound as the wind speed decreased.

(iii) The flow over bleachers and the scoreboard was from home plate moving into the outfield.

(iv) The wind direction in Sections 22 and 23 of the lower stands and Sections 23 and 28 to 30 of the upper stands showed a characteristic flow parallel to the stand moving out away from home plate.

(v) The field flags showed two types of patterns. Those near home plate showed the flow recirculating back into the stands, whereas, those in the out-field show the continuous flow from home plate out towards the scoreboard.

This particular flow pattern was governed or controlled by a south-westerly wind flowing over the rim and, hence, has been called "Southerly Control" for short.

2. Parking-lot flow pattern: The parking-lot flow pattern was very steady irrespective of what was occurring in the stadium. The wind seemed to be steadily blowing from about 12°S of W to 21°S of W, which was also the mean wind direction at the McLaren tank reference station. Although the direction of the mean wind was steady, the magnitude of the wind velocity was quite large. Figs. 10a and 10b show the parking-lot wind pattern, observed in the prototype, for wind directions of 12°S of W and 21°S of W at the McLaren water tank, (details of the patterns may be obtained from Vol. I of this report).

3. Circulation over hill: Fig. 11 shows the circulation pattern over the hill when left-field flow was occurring in the stadium. One observes that flow occurs along the surface on the hill slopes just to the west of the stadium. Smoke released on the highway to the west of the stadium hugs the hillside and moves toward the south. Smoke released on the crest of the hill flows past the roadway at the mean wind direction (at McLaren reference station). Just past the roadway the flow appears to split into two layers. The lower layer turns towards the south-east and heads towards the left-field stands in the stadium, whereas the upper layer continues in the mean-flow direction. Smoke released on the north side of the hill near the KYR television tower moves towards the north-east. Just past the roadway the flow again splits into two layers. The lower layer turns towards the south-east, flows along the roadway, and heads into the left-field opening in the stadium. The upper layer continues in its original direction towards the north-east.

No flow pattern over the hill for the "Southerly Control" was provided by Metronics Associates, Inc.; thus, no model - prototype comparison can be made in this case.

C. Model Flow Pattern

In order to facilitate comparison between the model and prototype flow pattern this section will be subdivided similar to the previous section as follows: (1) stadium pattern (2) parking-lot pattern, and (3) general circulation over hill. All the deductions reported in this section are based on studies of flow over the 1:800 scale model.

1. Stadium flow patterns: Unlike the prototype there was correlation between mean direction of the wind approaching the hill and the type of flow pattern observed; i.e., whether the stadium flow was primarily "Southerly Control" or "Left-Field Control". Mean-flow patterns were photographed at 5° intervals between 6°S of W and 41°S of W at a wind speed of approximately 17 mph. Figs. 12 through 15 show the flow pattern for 16°S of W, 31°S of W, 6°S of W and 41°S of W. In addition, the flow pattern for 16°S of W was photographed at a wind speed of 30 mph and 10 mph. Fig. 16 shows the pattern at 30 mph wind speed.

a. Left-Field Control: This pattern was most prominent at a wind direction of 16°S of W. The following features were observed:

(i) A strong vortex in Section 28-30 of the upper stands;

(ii) A mean flow across the outfield originating at the left-field opening and flowing past the bleachers and scoreboard;

(iii) A mean flow at Sections 23 and 34 of the lower stands and Sections 23 of the upper stands from the left-field towards San Francisco Bay;

(iv) A clockwise flow in the upper stands from Section 5 to Section 24. This pattern was quite persistent throughout the upper stands;

(v) A clockwise flow in back of the lower stands from Section 4 to Section 18. The flow is along third-base line from Section 18 to Section 44 of the lower stands;

(vi) A predominant mean flow going down third base line, impinging on Sections 7 through 11 of the upper stands and then going over the top of the rim and out of the stadium.

By comparing the mean pattern for the Left-Field Flow for the model and prototype it can be seen that there is definitely model-prototype similarity. This may be easily observed by referring to the superimposed flow shown in Fig. 17. Of course, shifts in wind direction at the bottom edge of the upper stand at Section 1, which occurred at a frequency of ten seconds to a minute in the prototype, could not be easily determined because these were of high frequency in the 1:800 scale model.

b. Southerly Control: This pattern was most prominent at a wind direction of 31°S of W. The following features were observed:

(i) A downward flow from the rim at Sections 4 and 10 of the upper stand. The flow reached the ground surface between home plate and the pitcher's mound. After contacting the ground surface the flow diverged out along both the first and third-base lines.

(ii) The field flags nearest to the stands show the flow recirculating back into the stands after approaching the ground surface. These flags in the outfield show the flow diverging out along the first and third baselines and generally continuous flow from home plate out towards the scoreboard.

(iii) The flow in the lower stands starting from Section 24 to Section 23 at the right-field opening was generally counter-clockwise in direction. The upper-stand flow seems to exhibit a similar trend; i.e., generally counterclockwise throughout the stands.

Again, a model-prototype comparison for Southerly Control indicates similarity at least for the mean-flow direction and for relative velocities. The general agreement is shown in Fig. 18. The flow near the scoreboard and at the left end of the lower stands is slightly different for model and prototype. The prototype flow for this case could not be definitely associated with a change of wind direction at the McLaren water tank.

2. Parking-lot flow pattern: Very steady flow and high speeds were observed in the parking lot. The streamers indicated that the wind direction at the parking lot was the same as the direction of the mean reference wind. This pattern was also observed in the prototype. Fig. 19 shows the parking-lot flow pattern for reference wind of 31°S of W.

3. <u>Circulation over hill</u>: Fig. 20 indicates the flow pattern over the hill for the reference wind direction of 16°S of W in the model.

4. <u>Effect of wind direction on flow pattern</u>: As stated earlier, flow patterns were taken at 5° intervals from West to 41°S of W. Figs. 14 and 15 show the wind pattern in the stadium at 6°S of W and 41°S of W. It can be seen that Left-Field Control already predominates at 6°S of W with typical Left-Field Control at 16°S of W. As the wind comes more from the south at about 26°S of W there is transition flow with extreme gustiness in the stadium with alternating Left-Field and Southerly Control. At 31°S of W the fully established Southerly Control exists which continues more or less until the wind comes from 41°S of W.

5. <u>Effect of wind speed on flow pattern</u>: Just as in the prototype, the predominant flow patterns persisted irrespective of the mean free-stream speed. The higher the speeds the more pronounced the pattern. Figs. 12 and 16 show the flow pattern for a wind direction of 16°S of W and wind speeds of 17 mph (26 ft/sec) and 30 mph illustrating the above point.

6. <u>Effect of model scale</u>: At a scale of 1:400 topography could not be included in the model because of limitations on size imposed by the test section width of 6 ft. Therefore, only flow patterns within the stadium for scales of 1:400 and 1:800 can be compared when the hill is completely removed in both cases. Figs. 21 and 22 show comparison of flow patterns for the two scale models at a reference wind speed of 17 mph and 16°S of W. No significant differences were anticipated and none were detected. Similar agreement was observed for a reference wind direction of 31°S of W. Accordingly, one may conclude that the Reynolds number is not a significant parameter in determining the mean flow pattern when the Reynolds number is equal to or larger than the minimum obtained in this study with the 1:800 scale model.

V. MODIFICATION PHASE

A. Introduction

Having established the existence of model-prototype similarity for the mean wind patterns, a serious study of flow patterns resulting from modifications to Bay View Hill and the stadium was justified. Before launching the study, decisions on what the modifications were to accomplish and how to evaluate the effectiveness of the modifications were necessary.

Two primary objectives were set for accomplishment by the modifications. These were as follows:

(i) Elimination of the Left-Field Control flow pattern with its strong wind along the third baseline toward home plate and the cross wind in the cutfield from left to right.

(ii) Reduction in intensity of the Southerly Control flow.

The Left-Field Control pattern being caused primarily by the hill should respond to modification of that feature or to blocking of the left-field opening of the stadium. However, the Southerly Control flow seems to be associated with the stadium geometry and should respond to additions or modifications to this structure. The effect sought in attempting to achieve both of these objectives was to reduce both mean wind speed throughout the stadium and the degree of gustiness. Therefore, if a new type of flow pattern resulting from a modification gave mean wind speeds and a degree of gustiness which were not reduced, it would have to be discarded.

To evaluate the effectiveness of a given modification the following observations were taken:

(i) Mean velocity at five stations in and above the stadium as shown in Fig. 6.

(ii) An estimate of gustiness by visually comparing the activity of the pivoted yarns in each case with the activity for flow over the unmodified model.

The observation for mean velocity made with a hot-wire anemometer were quantitative; however, the estimate of gustiness was essentially qualitative but recorded in the motion pictures taken of all cases. A quantitative measure of gustiness was not chosen for the following reasons:

(i) Many modifications were to be made so that the limited resources of time and funds for the work demanded that the simplest and quickest method be chosen.

(ii) Such a measure could not be used to great advantage because the degree of gustiness necessary for discomfort to spectators and players is unknown. An interesting and valuable study would be to determine the effect of gustiness (turbulence) on the performance of humans engaged in various tasks and sports.

B. Modfications

Most of the modifications studied were part of a systematic effort to eliminate or reduce the characteristic Left-Field and Southerly Control flows. However, some of the modifications studied were motivated by suggestions from various sources having an interest in the problems. A few of the modifications were studied primarily to eliminate them from further consideration as possible solutions.

The following tabulation lists the order in which flow patterns for all modifications are presented in a 7-reel motion picture made during the model study. Basic configurations of hill and stadium appearing in the various reels are as follows:

REEL		BASIC CONFIGURATIONS	
1	Correlation Phase	HILL: STADIUM:	Unmodified Unmodified
2,3	Modification Phase	HILL: STADIUM:	Unmodified Modified
4,5	Modification Phase	HILL: STADIUM:	Removed Unmodified and modified
6,7	Modification Phase	HILL: STADIUM:	Modified Modified

Table 1. Content of Motion Picture Reels.

Details of each sequence in the 7-reels of motion pictures are given in Table 2, Details of Modifications (see page 78.)

C. Wind Pattern Comparisons

In comparing wind speeds for the various cases, one should keep in mind that wind speeds particularly at stations 1 and 4 may show large changes when certain stadium modifications are made whereas wind speeds at station 3 respond strongly to both hill and stadium changes. The best flow patterns resulting from the modifications are those in which both mean wind speed and gustiness in the stadium are reduced to low values. Therefore, a measure of each of these quantities was selected so that each of the configurations could be plotted on a graph for comparison. The wind speed at station 2 was chosen as the ordinate and the gustiness classification of poor, fair, good and excellent (shown in last column of Table of Modifications) were given equal weights on a linear scale to form the abscissa. Fig. 23 shows the location of all flow patterns on such a comparison plot.

Selection of a region on Fig. 23 which insures a zone of flow conditions causing little distress to ball players and spectators alike is not simple. On one hand we have no real knowledge of when distress begins--this is also determined by air temperature, humidity and suspended solids--and on the otherhand there will always be local regions of the stadium where some distress will occur. For these reasons any configuration falling within a zone selected as satisfactory should be given careful consideration before concluding that it offers a solution. Furthermore, the configuration should fall within the satisfactory zone for at least both the 16° and 31°S of W wind directions. The zone selected as representing a satisfactory solution is limited to a maximum wind speed of 1.5 mph for good and excellent gustiness classifications with the wind speed then decreasing linearly to zero as the gustiness classification decreases through fair to poor. This is based upon the supposition that higher mean wind speeds become more tolerable as the degree of gustiness decreases.

The following table lists in decreasing order of effectiveness the modifications found to give a possible solution to the wind problem.

RUN NO.	WIND DIRECTION	HILL	STADIUM
Satisfactory Configurations for Both Wind Directions--16° and 31°S of W			
E20	16	45° cut (Fig. 29)	Partial dome
E8	31	45° cut (Fig. 29)	Partial dome
C46	16	Removed	Partial dome
C44	31	Removed	Partial dome
E25	16	S end removed (Fig. 31)	Partial dome
E12	31	S end removed (Fig. 31)	Partial dome
E14	16	45° cut (Fig. 29)	100' porous screen on rim
E1	31	45° cut (Fig. 29)	100' porous screen on rim
E23	16	S end removed (Fig. 31)	100' porous screen on rim
E10	31	S end removed (Fig. 31)	100' porous screen on rim
E26	16	S end removed (Fig. 31)	Partial dome with slot
E13	31	S end removed (Fig. 31)	Partial dome with slot
E17	16	45° cut (Fig. 29)	Deflector vanes on rim and stands to Sec. 34
E5	31	45° cut (Fig. 29)	Deflector vanes on rim and stands to Sec. 34
C41	16	Removed	Deflection vanes on rim to Sec. 22 and vertical deflection vanes to Sec. 44
B31	31	Removed	Deflection vanes on rim to Sec. 22 and vertical deflection vanes to Sec. 44

Table 3. Modifications Giving Possible Solutions to Wind Problem--in Decreasing Order of Effectiveness.

Table 3 - Continued

RUN NO.	WIND DIRECTION	HILL	STADIUM
Satisfactory Configurations for One Wind Direction--31°S of W			
E9	31	S end removed (Fig. 31)	100' porous screen on rim
E4	31	45° cut (Fig. 29)	Deflection vanes on rim to Sec. 22
B34	31	Unmodified	Partial dome
C19	16	Removed	Solid screens on stands to Sec. 44
E7	31	45° cut (Fig. 29)	Upper stands enclose field
E6	31	45° cut (Fig. 29)	Deflection vanes to Sec. 44 and upper stands enclose field
B3	31	Unmodified	Upper stands enclose field
B28	31	Unmodified	Deflection vanes to Sec. 44 and upper stands enclose field
C49	31	Removed	100' solid screen on rim
D19	16	45° cut (Fig. 29)	Unmodified

VI. CONCLUSIONS

Based upon the prototype studies (see Vol. I) and the model studies of the Candlestick Park complex described in this volume conclusions of positive significance may be made. Conclusions of a general nature as well as of a specific nature related to a solution of the wind problem at Candlestick Park have been reached. These are as follows:

1. A 1:800 scale model of the Candlestick Park complex yielded model flow patterns closely similar to prototype flow patterns.
2. The model flow patterns for a given ambient wind direction remained similar when the ambient wind speed was varied from 17 to 30mph and the model scale was varied from 1:800 to 1:400. Thus, gross Reynolds number effects are not present and the flow pattern is determined by the geometrical features inherent in the scale model.
3. Changes made in the hill or stadium geometry produced modifications in the wind patterns which would occur with a high degree of certainty in the prototype if similar geometrical changes were to be effected.
4. Both the element of wind speed and the element of wind gustiness must be considered when estimating the relative improvement of wind conditions in regard to comfort of spectators and performance of baseball players exposed to the environment. Thus, a solution to the wind problem requires that both wind speed and the degree of gustiness be reduced to an acceptable level for most of the wind directions occurring at the site.
5. Existing disagreeable wind conditions can be alleviated to a large degree by certain modifications in the stadium and Bay View Hill if taken together. Modification of the stadium alone is not sufficient. The most favorable combinations of modifications in decreasing order of effectiveness with respect to stadium additions are the following:

HILL	STADIUM (See Fig. 24)
Cut through south end of hill down to parking lot level with axis parallel to left-field edge of stadium. (See Fig. 29) or Removal of south end of hill down to parking lot level. (See Fig. 31)	a. Partial dome over ballpark b. Vertical porous screen around edge of upper rim. c. Deflector vanes on top of upper rim.

6. Any one of the solution concepts listed under Conclusion 5 should be optimized through further model study to obtain maximum relief from the wind problem while meeting certain physical and economic restrictions.

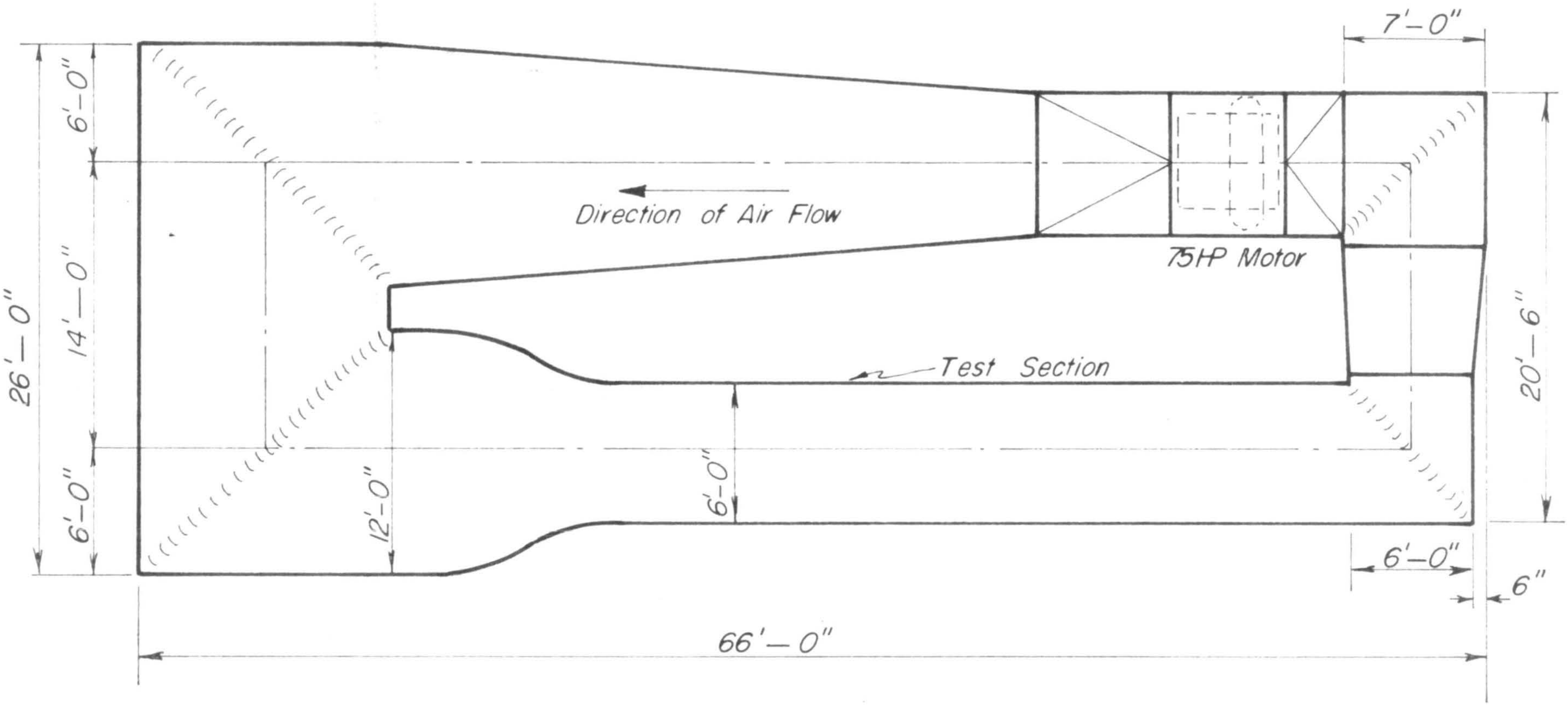


FIG. 1 PLAN VIEW OF WIND TUNNEL

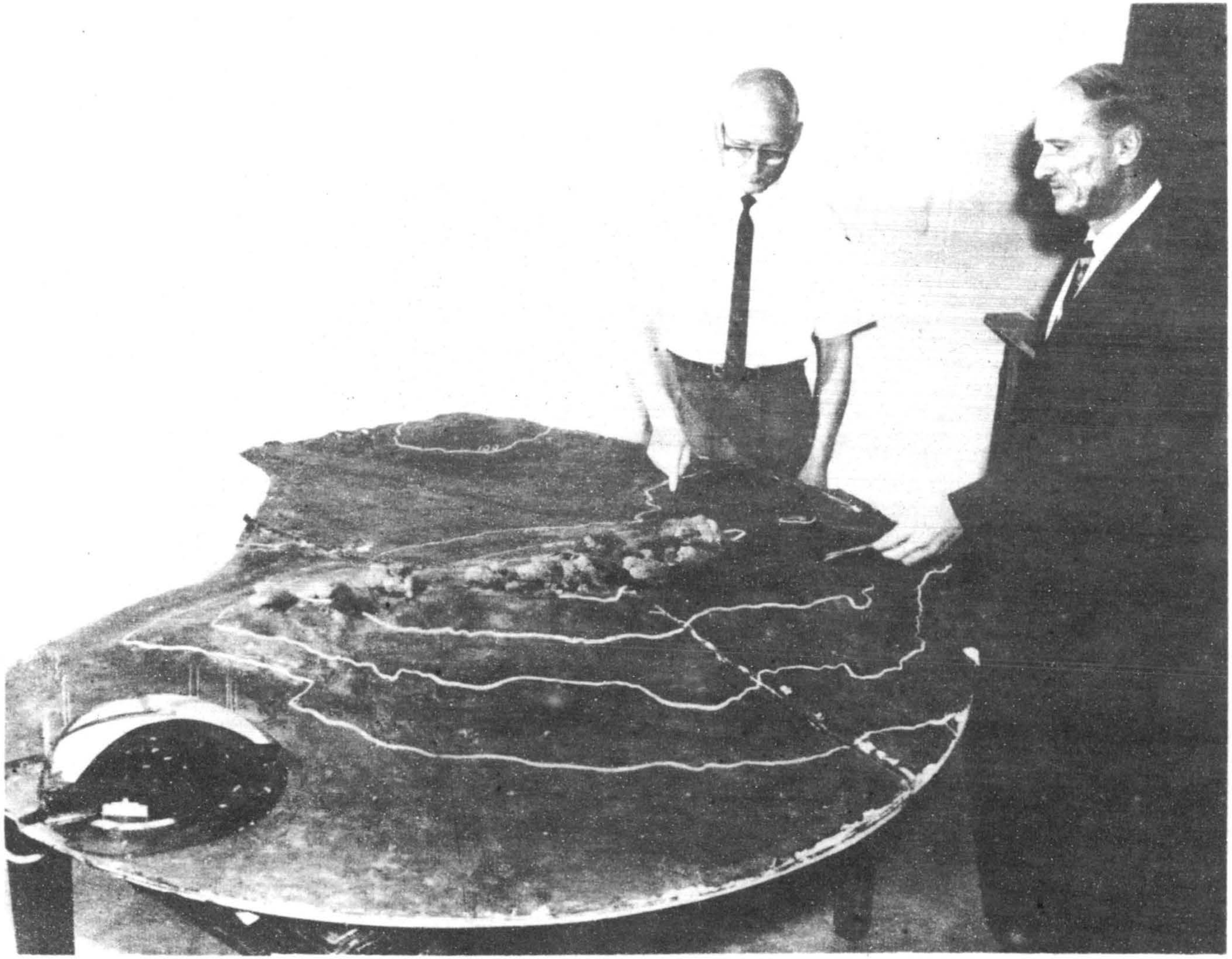


Fig. 2 Photograph of model (hill and stadium - 1:[illegible]) scale.

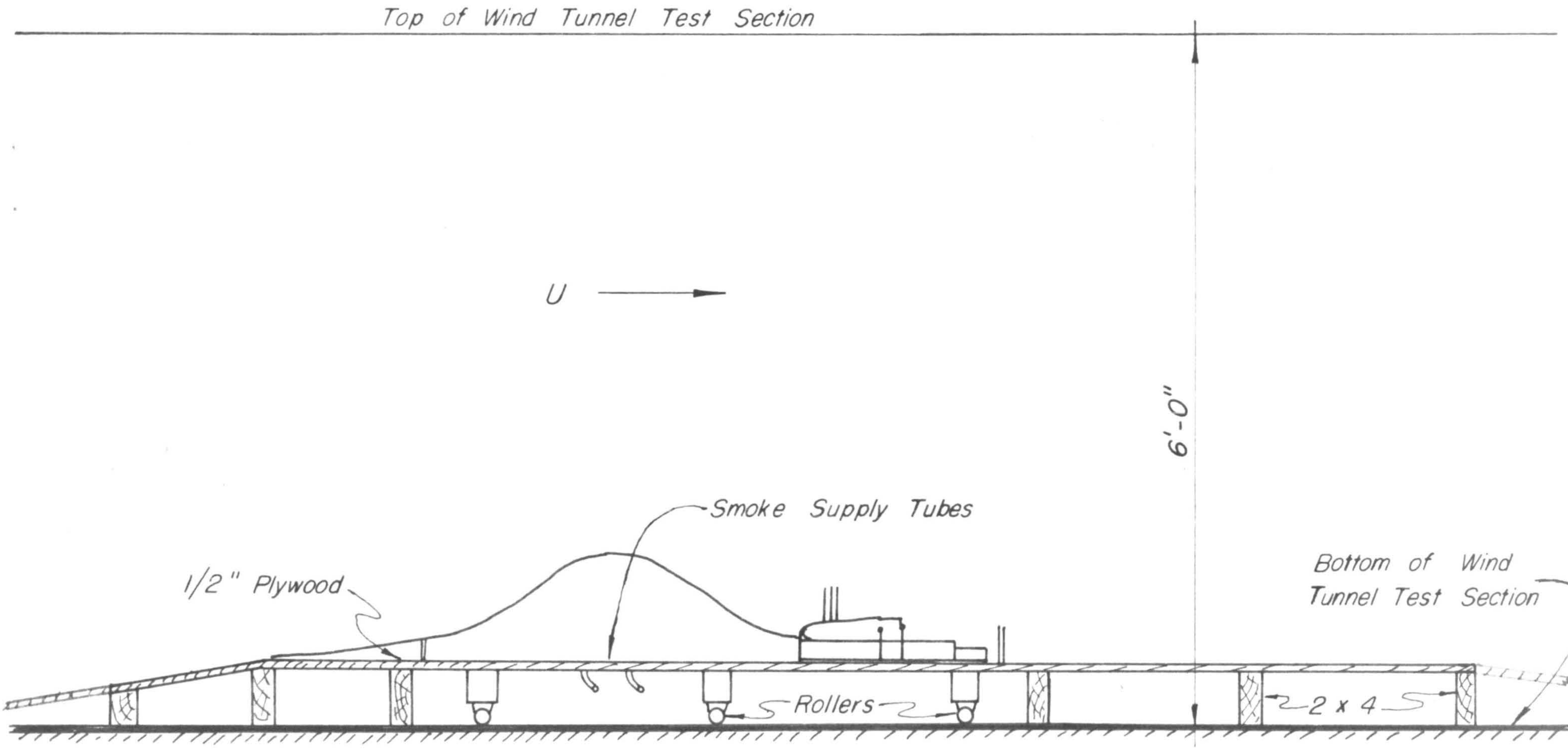
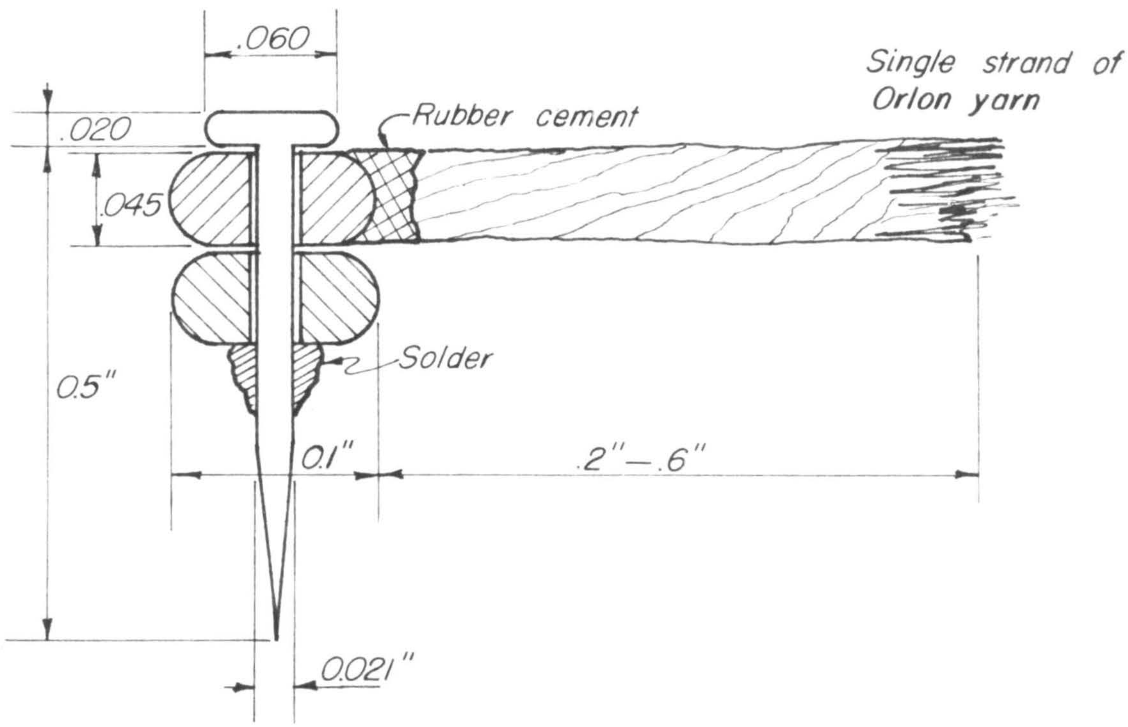


FIG. 3 LONGITUDINAL VIEW OF TEST SECTION SHOWING RAMPS



Details of Typical Pivot Yarn Used

FIG. 4 PIVOTED STREAMER

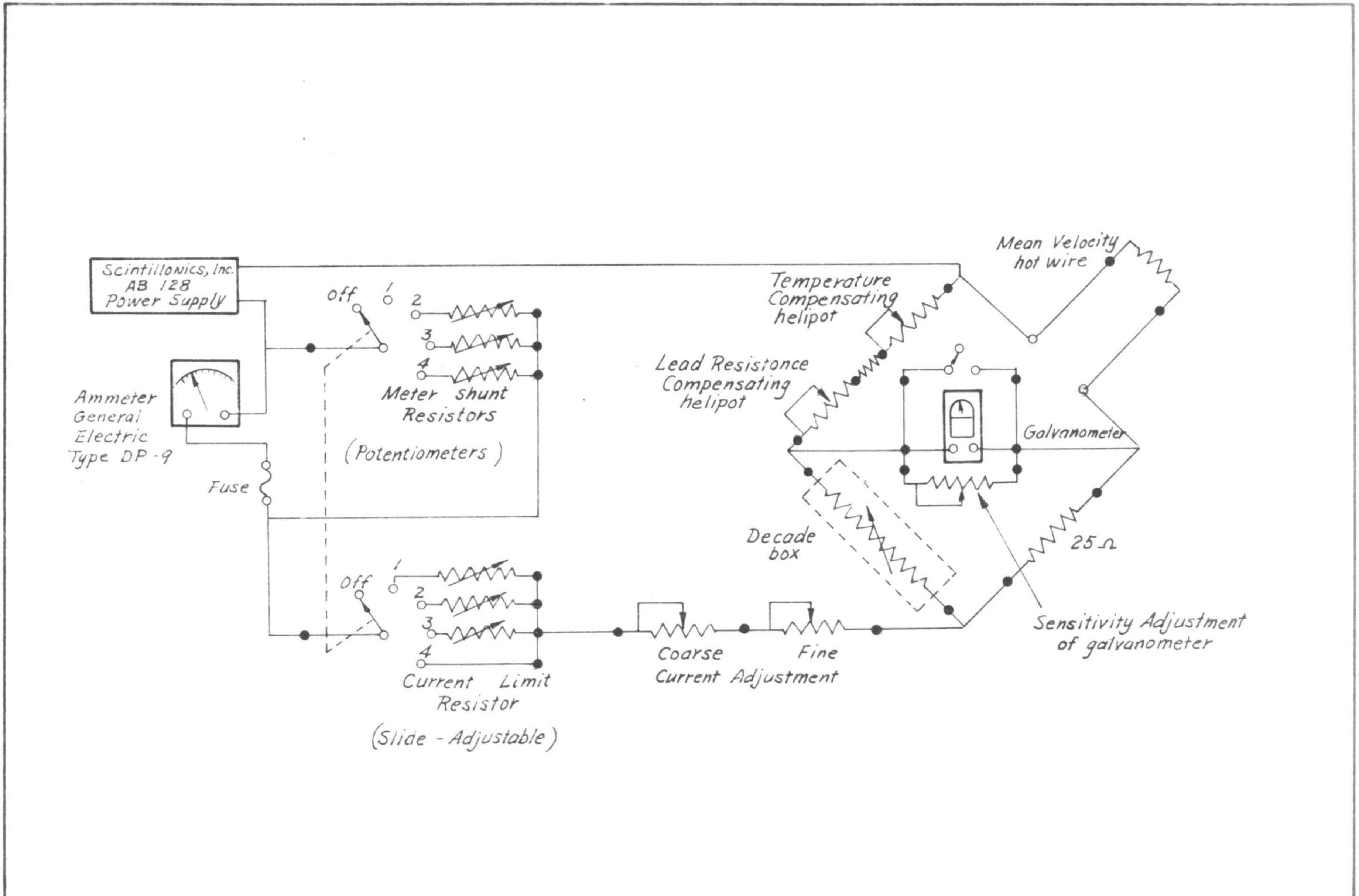


FIG. 5 MEAN VELOCITY HOT-WIRE ANEMOMETER

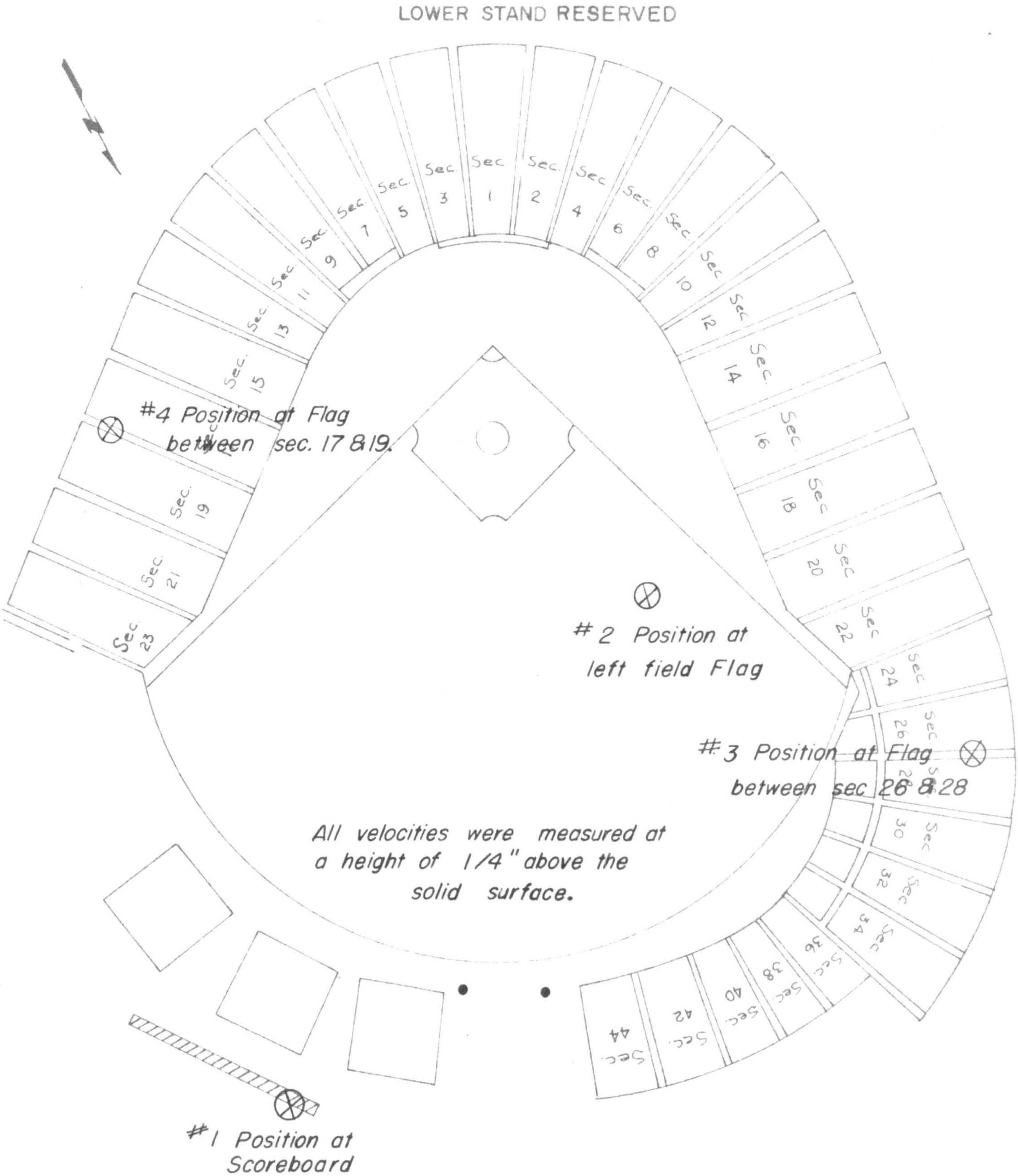


FIG. 6 LOCATION OF POINTS WHERE VELOCITY WAS MEASURED

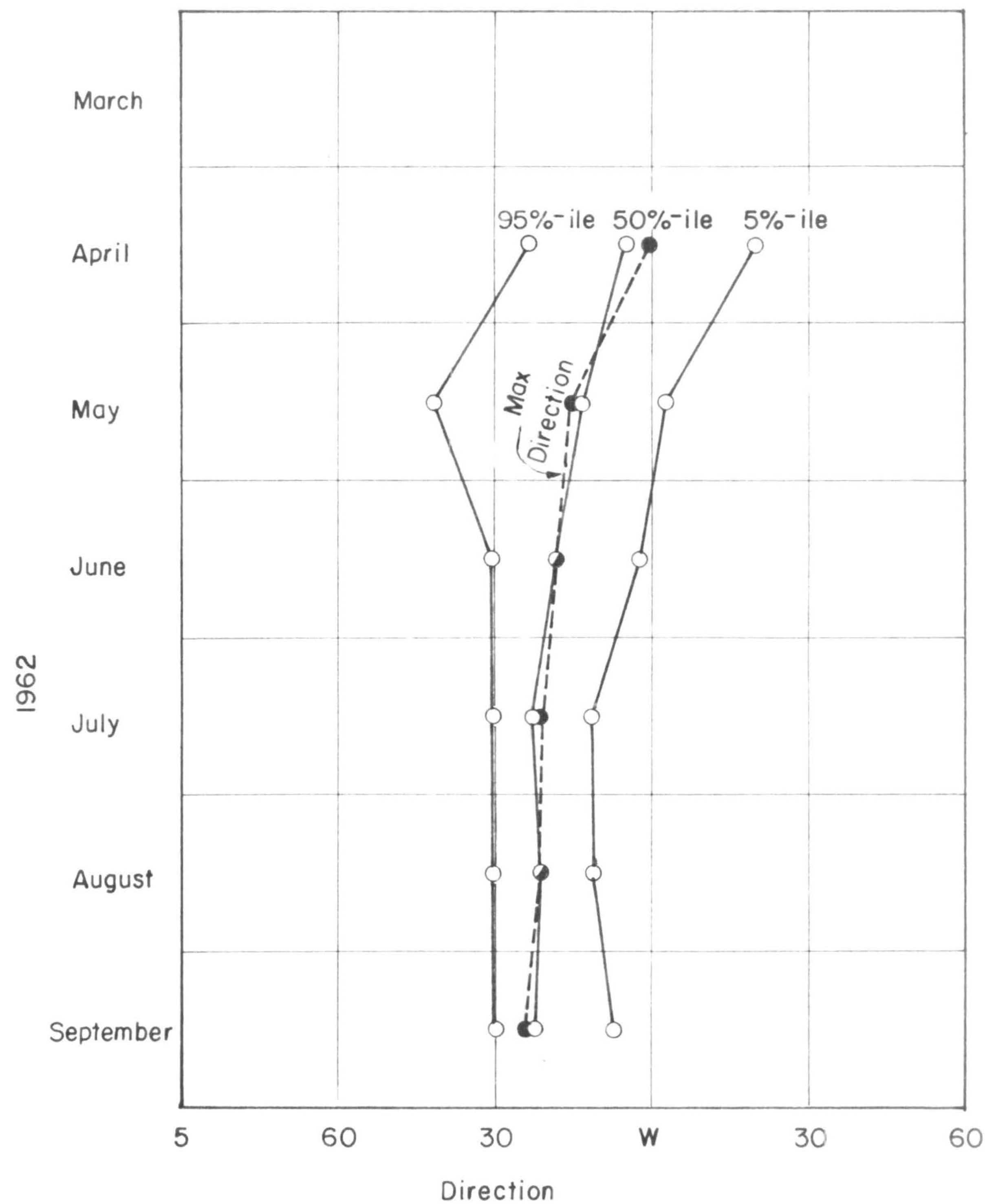


FIG. 7 5, 50, & 95%-iles with Maximum Wind Direction Frequencies From 1300 — 1800 PDST at McLaren Tank Reference Station

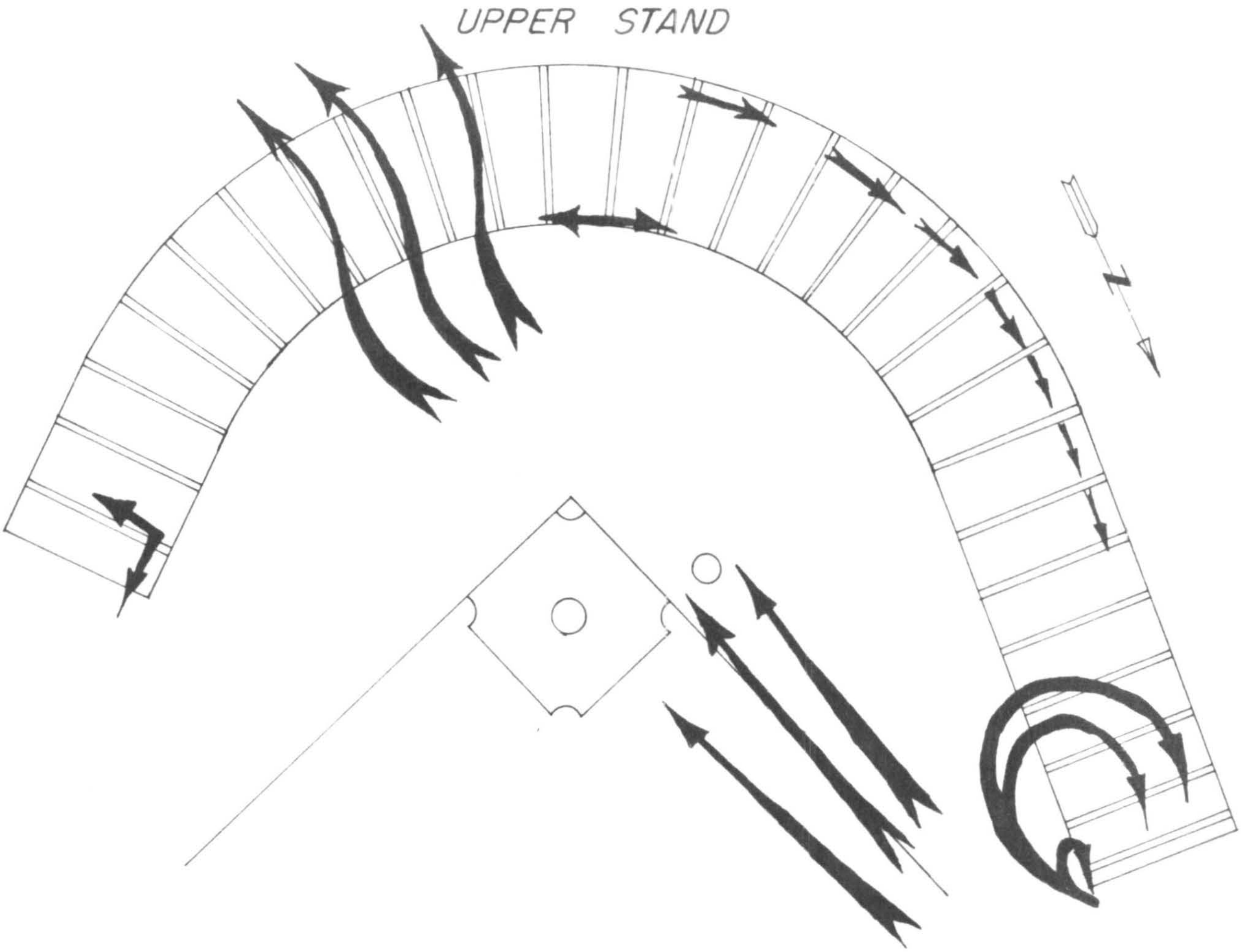


FIG. 8 a WIND CIRCULATION PATTERN — LEFT-FIELD CONTROL

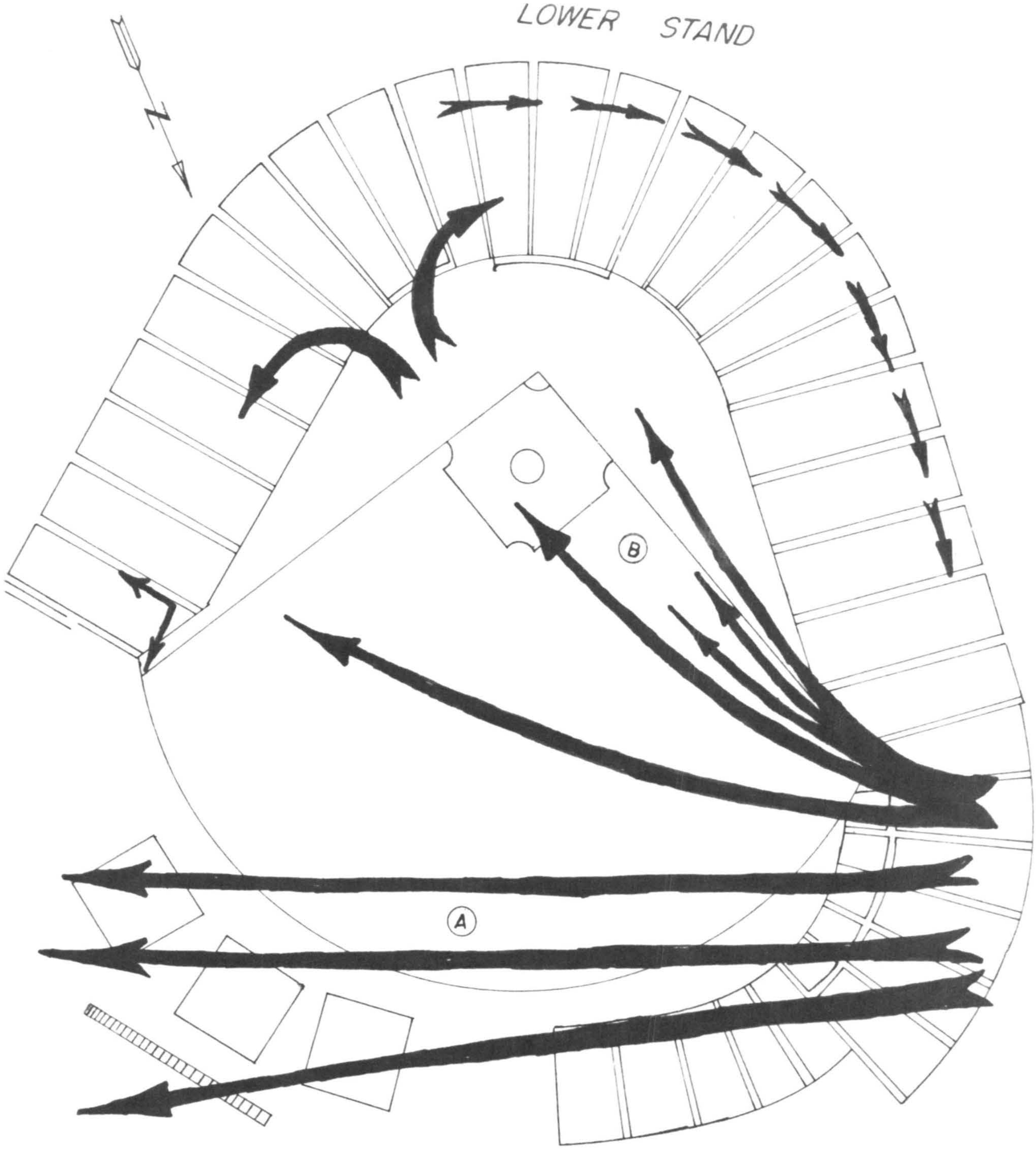


FIG. 8b. WIND CIRCULATION PATTERN — LEFT-FIELD CONTROL

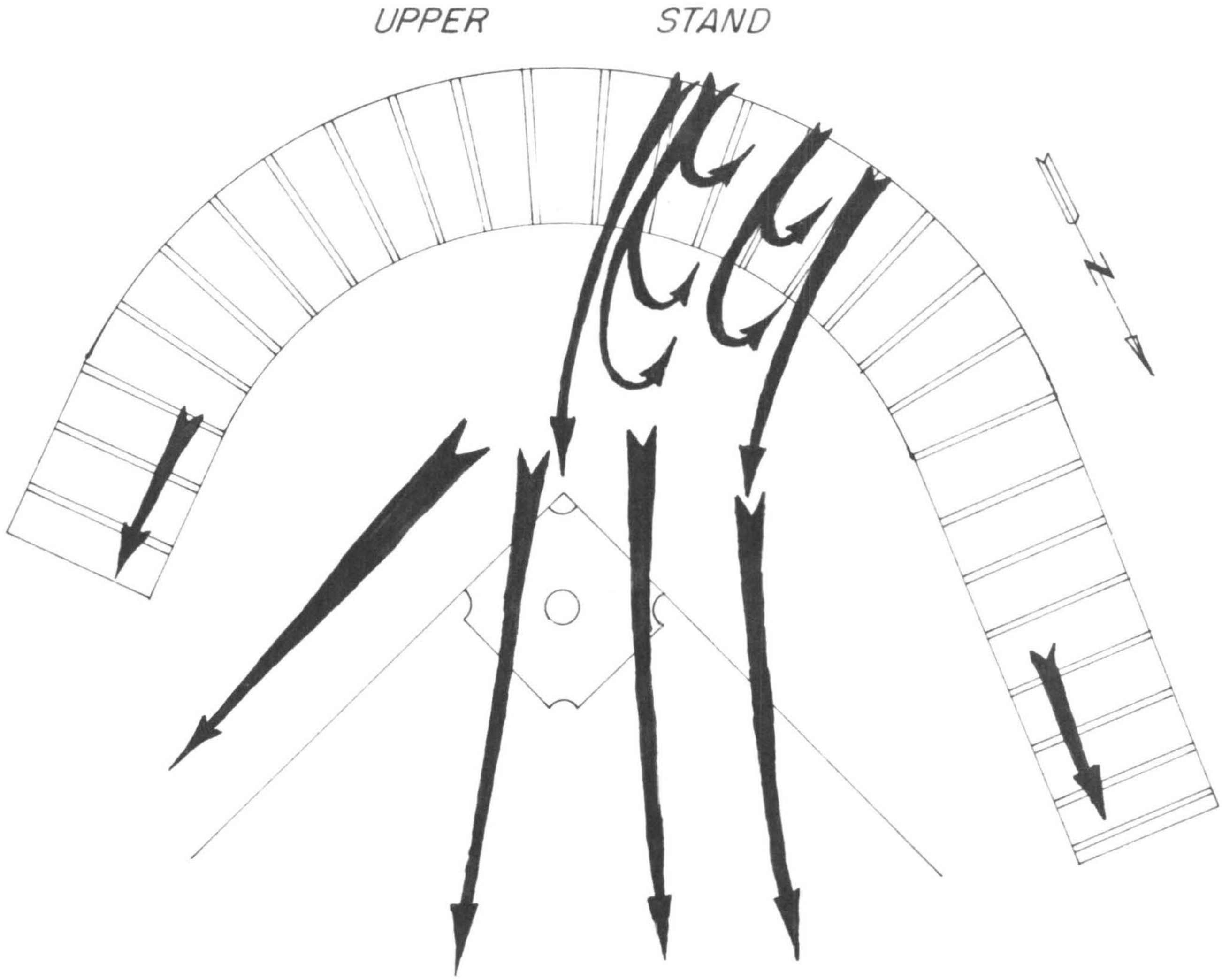


FIG. 9a. WIND CIRCULATION PATTERN — SOUTHERLY CONTROL

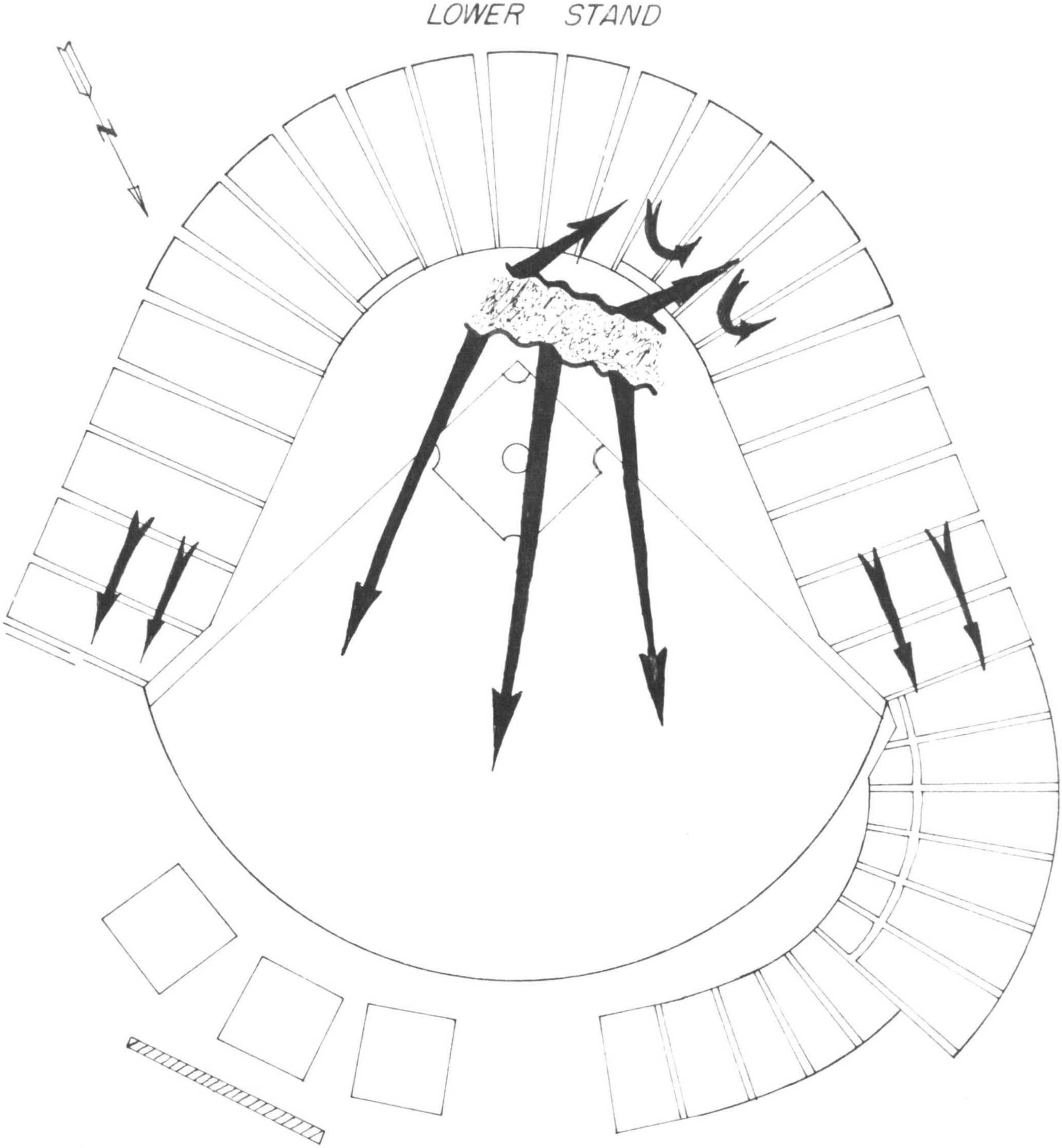


FIG. 9b WIND CIRCULATION PATTERN — SOUTHERLY CONTROL

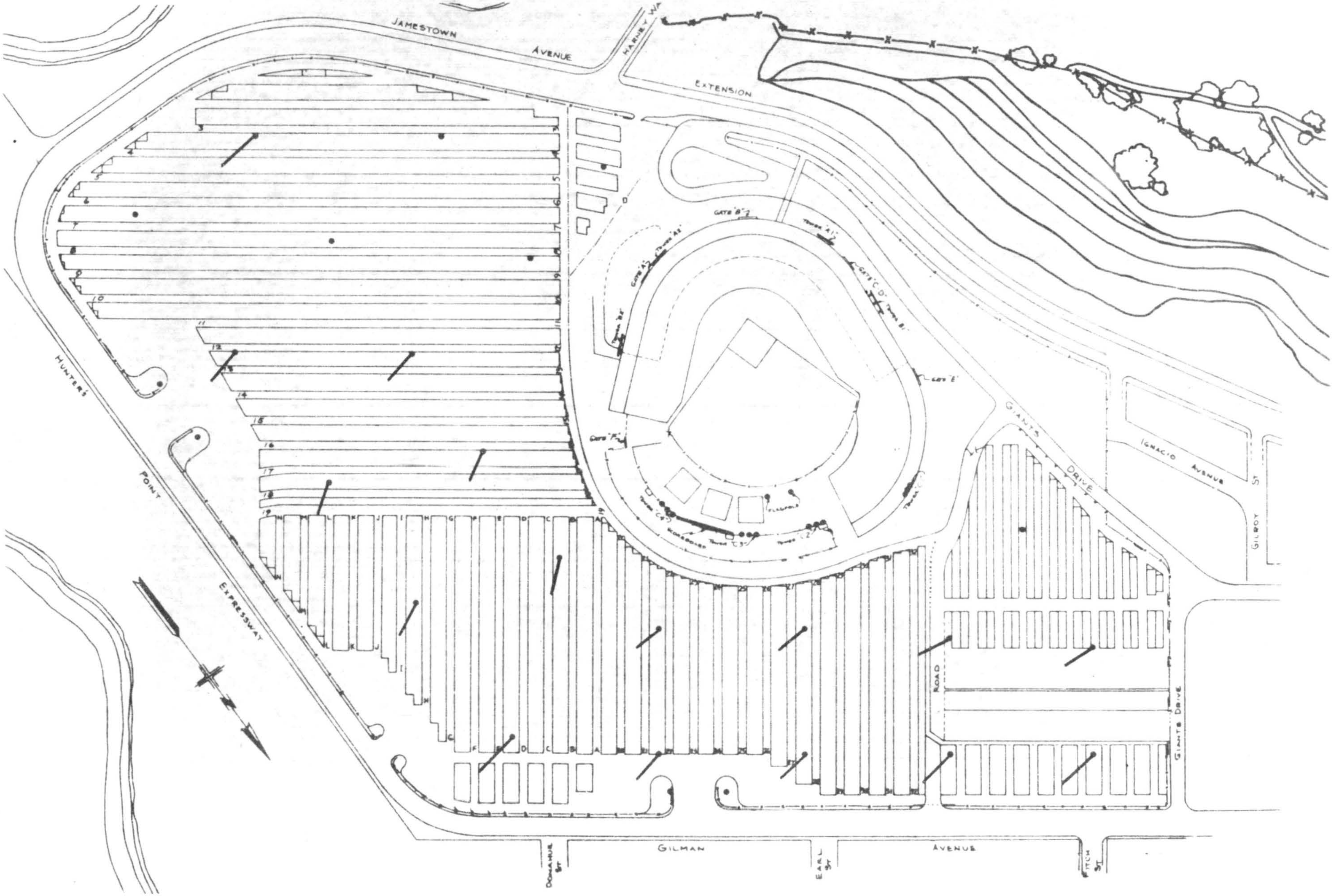


FIG. 10 A PROTOTYPE FLOW PATTERN IN PARKING LOT - WIND DIRECTION 12° S OF W

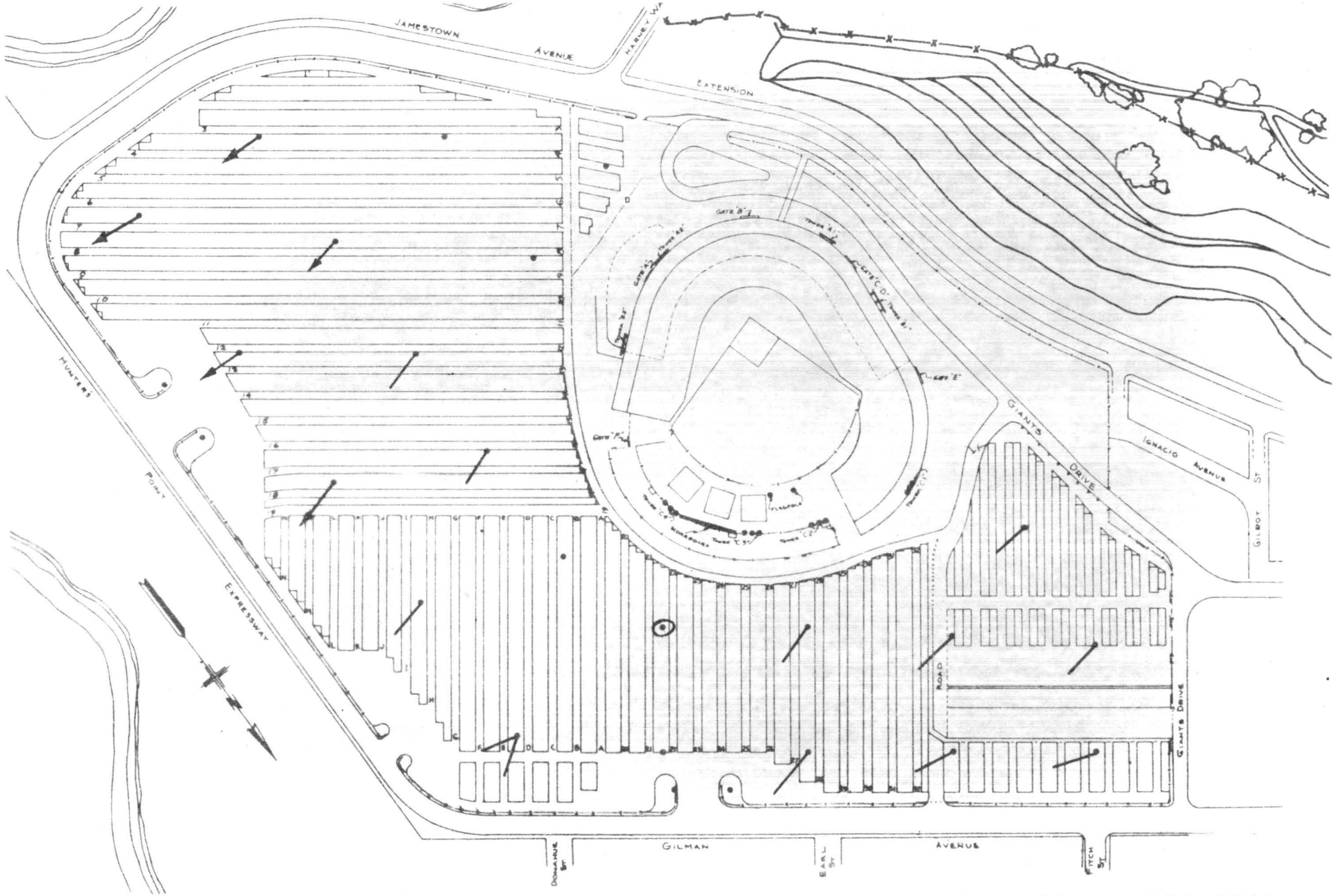


FIG. 10B PROTOTYPE FLOW PATTERN IN PARKING LOT - WIND DIRECTION 21° S OF W

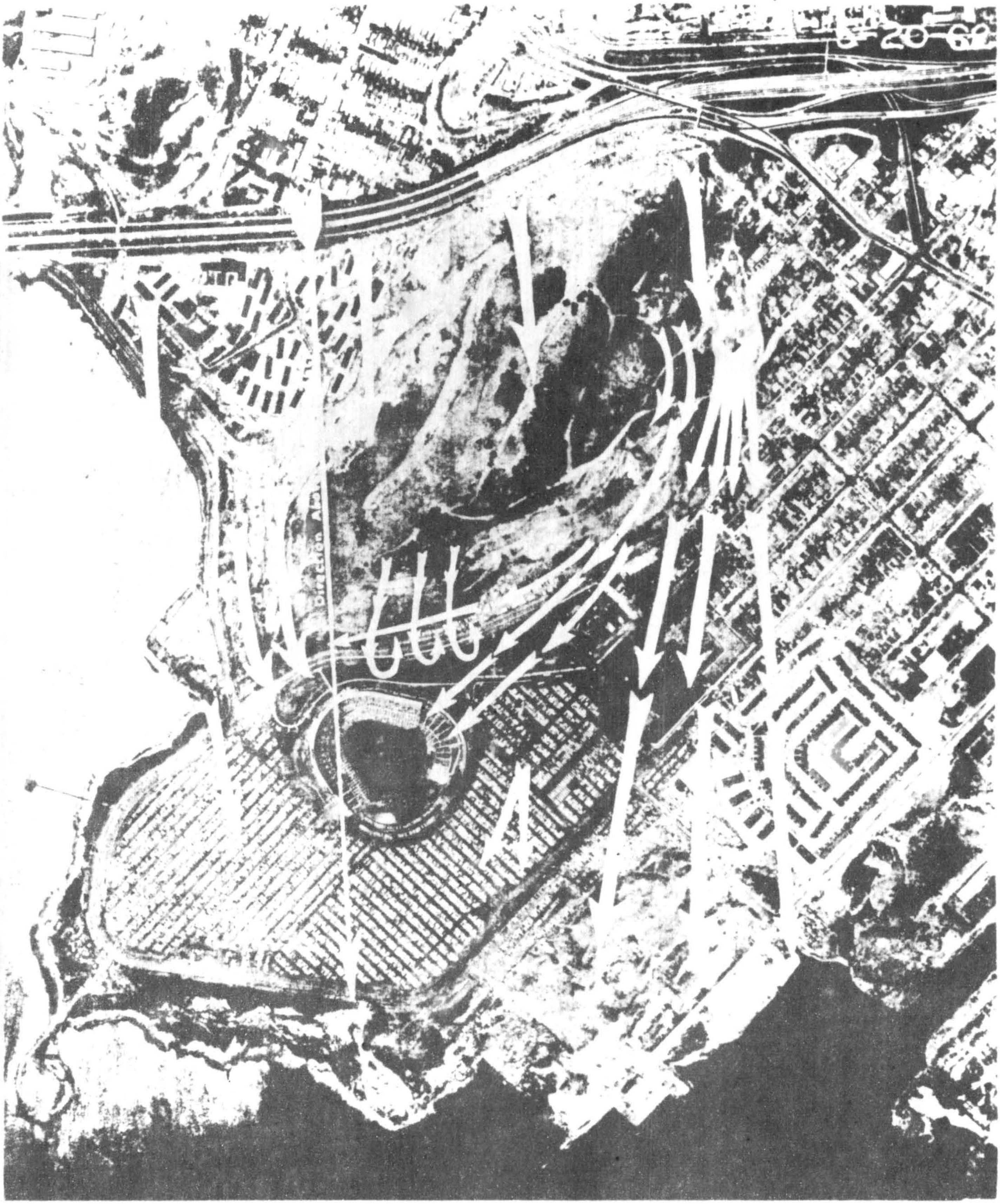


FIG. II CIRCULATION PATTERN OVER BAY VIEW HILL FOR LEFT-FIELD CONTROL

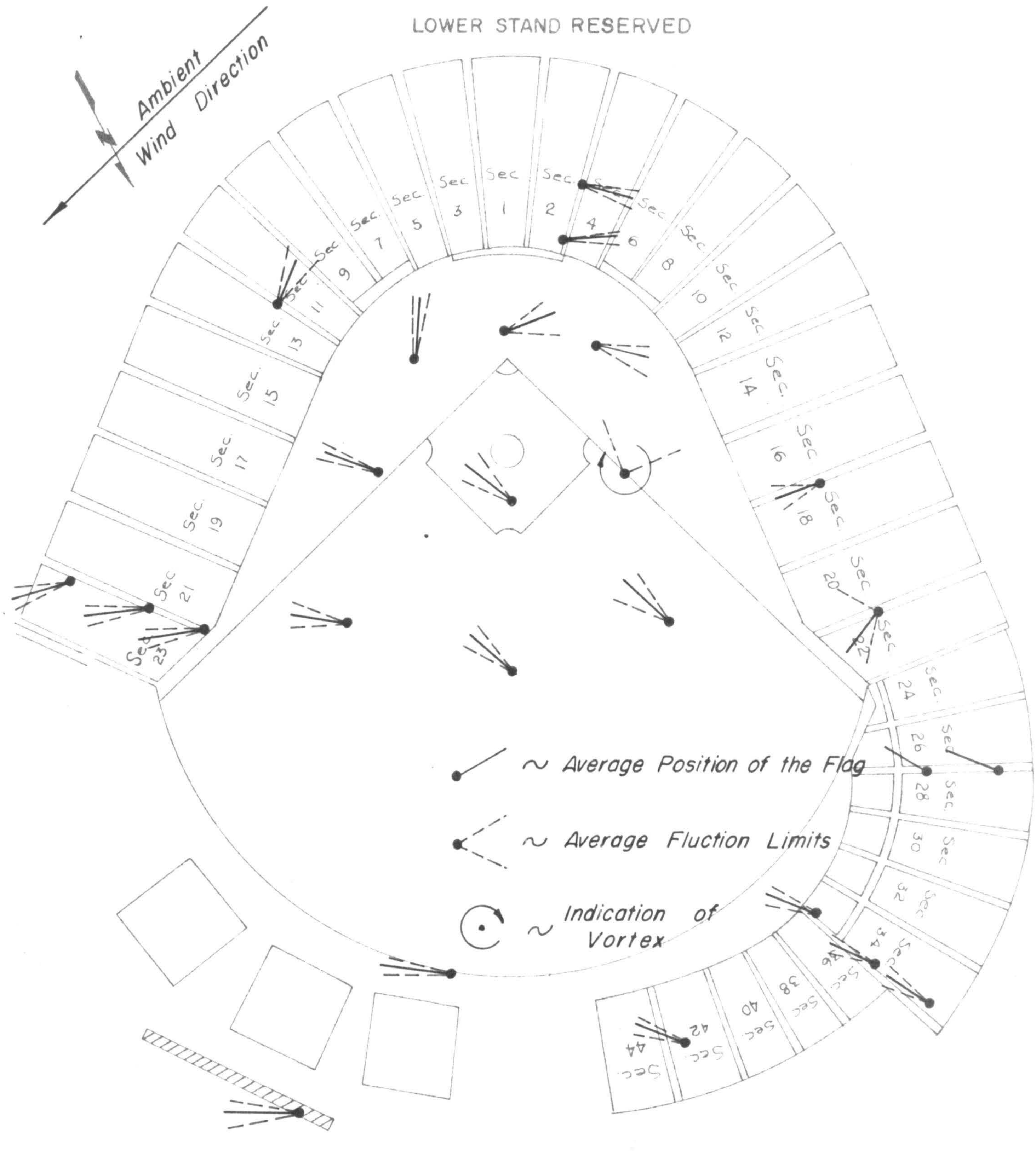


FIG. 12a MODEL–PROTOTYPE CORRELATION, ORIGINAL HILL & STADIUM
16° S of W

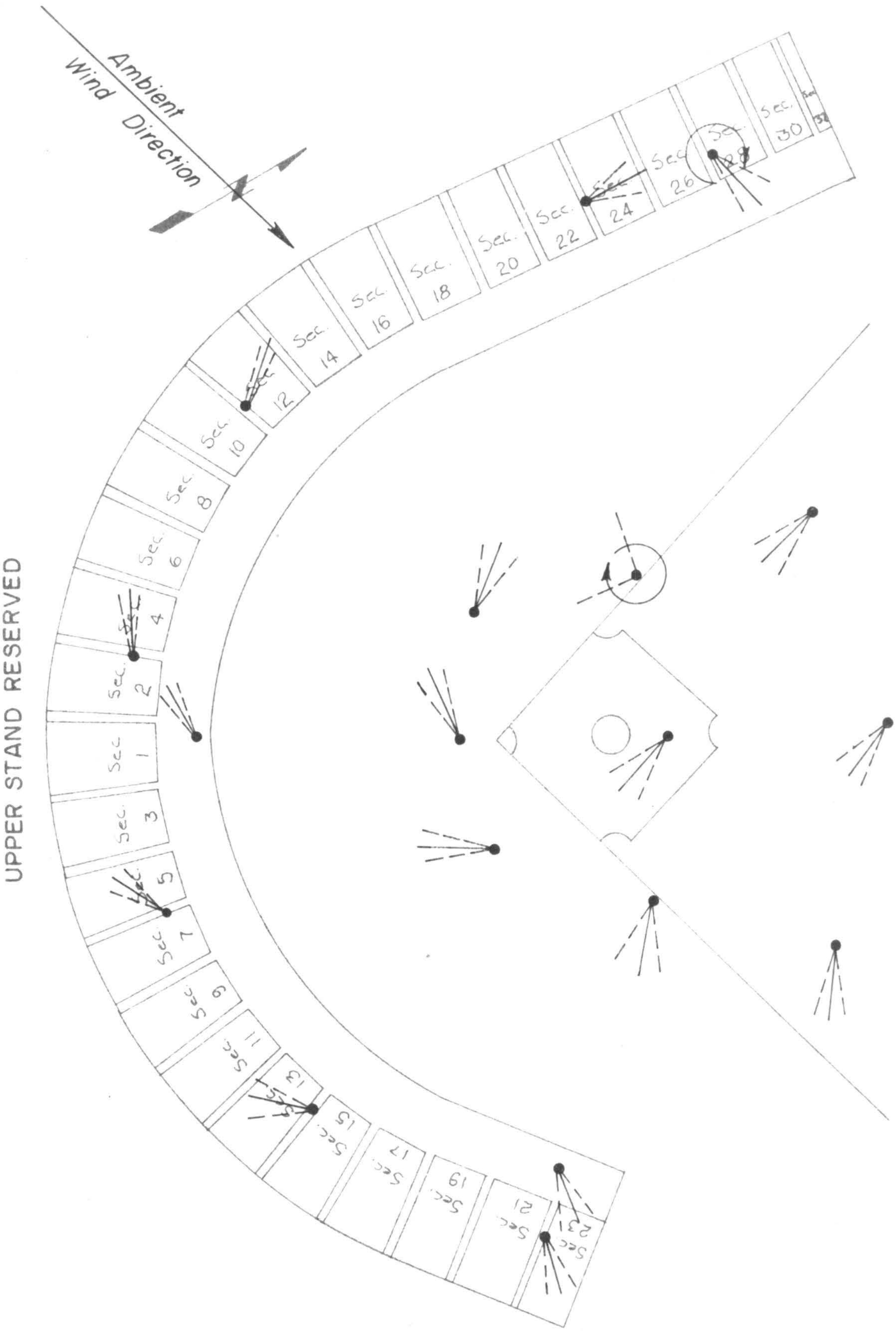


FIG. 12 b ORIGINAL HILL AND STADIUM, 16° S of W

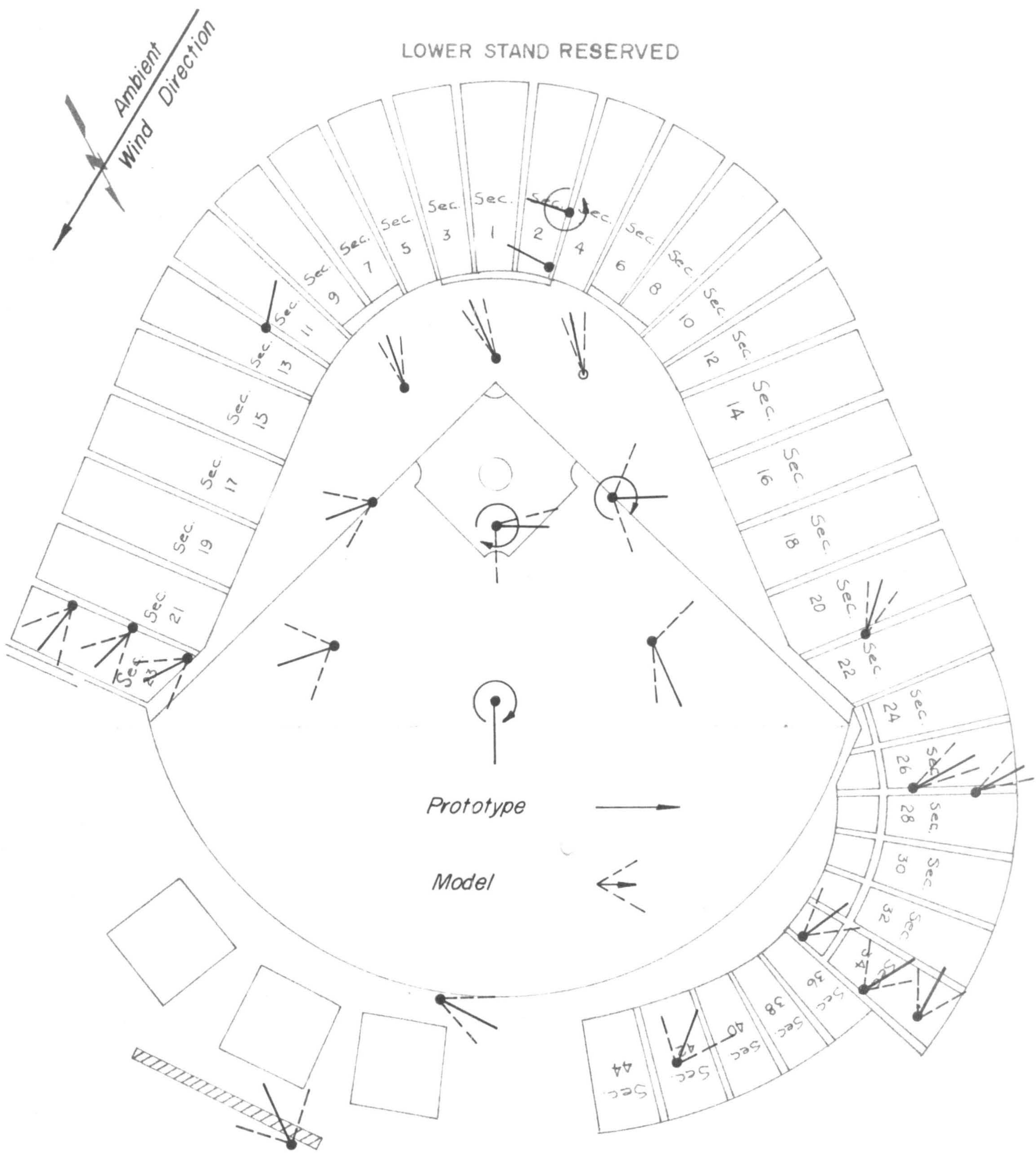


FIG. 13a MODEL – PROTOTYPE CORRELATION, ORIGINAL HILL & STADIUM

31° S of W

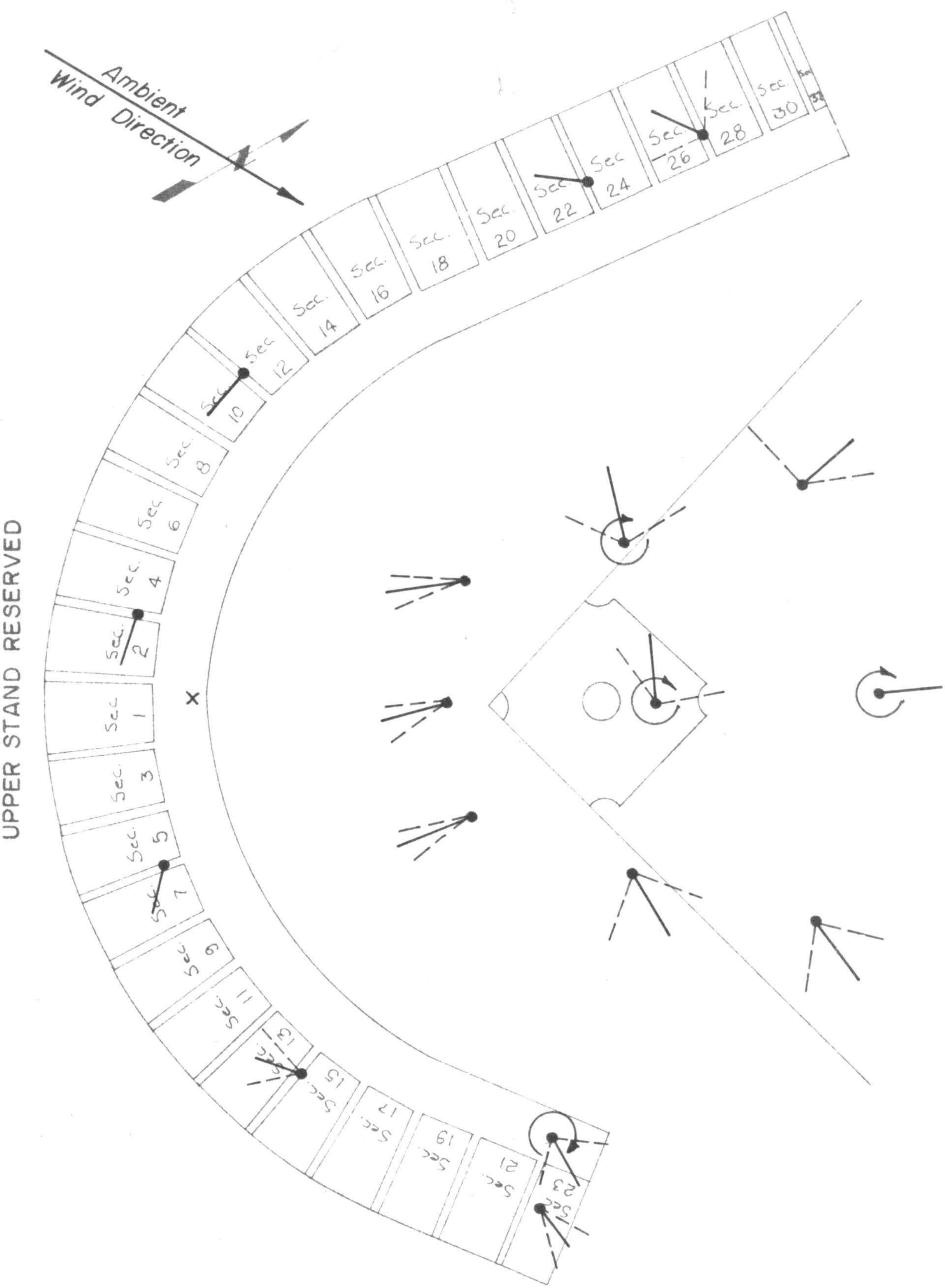


FIG. 13 b ORIGINAL HILL AND STADIUM, 31° S of W

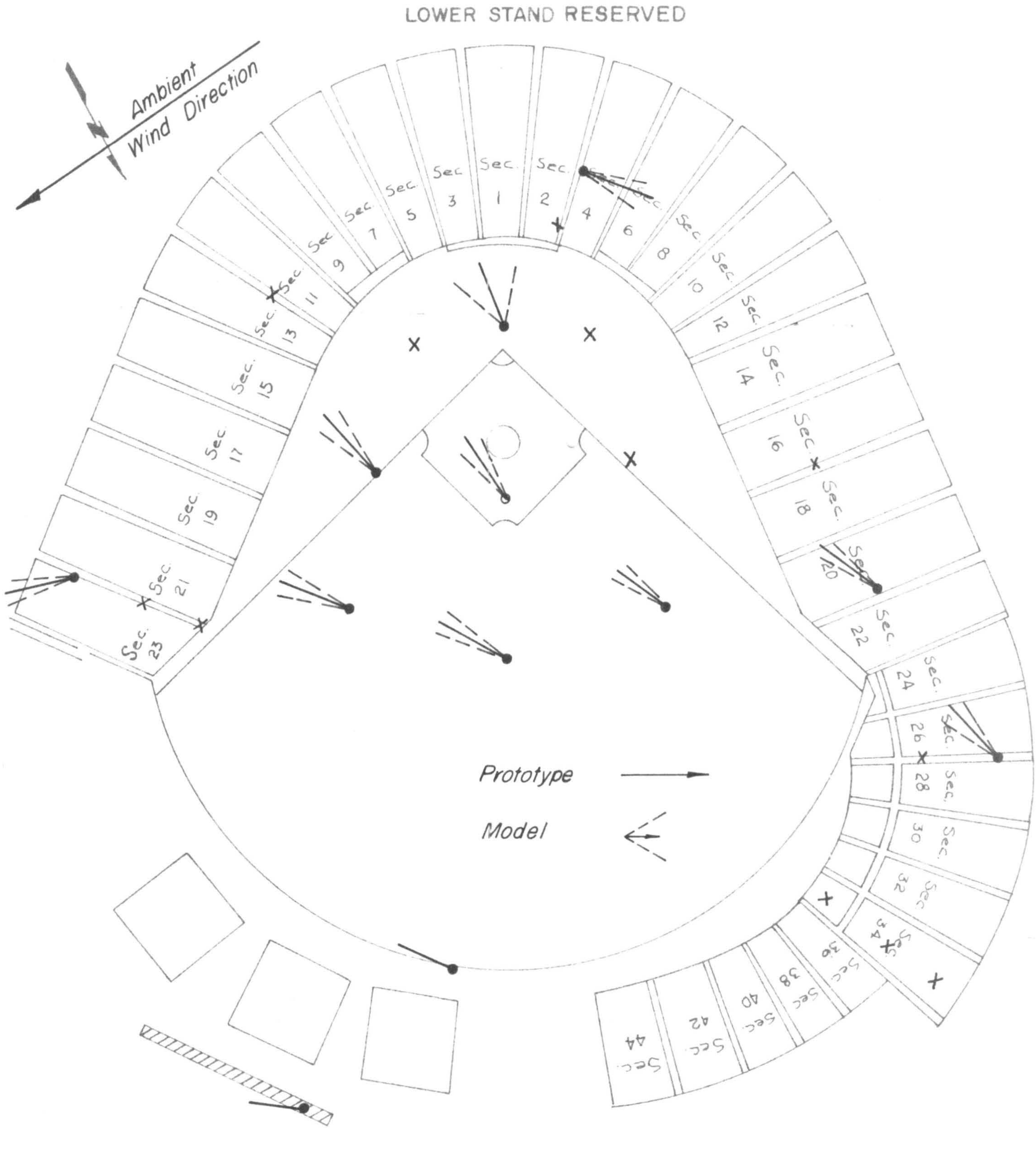


FIG. 14 MODEL-PROTOTYPE CORRELATION, ORIGINAL HILL & STADIUM
6° S of W

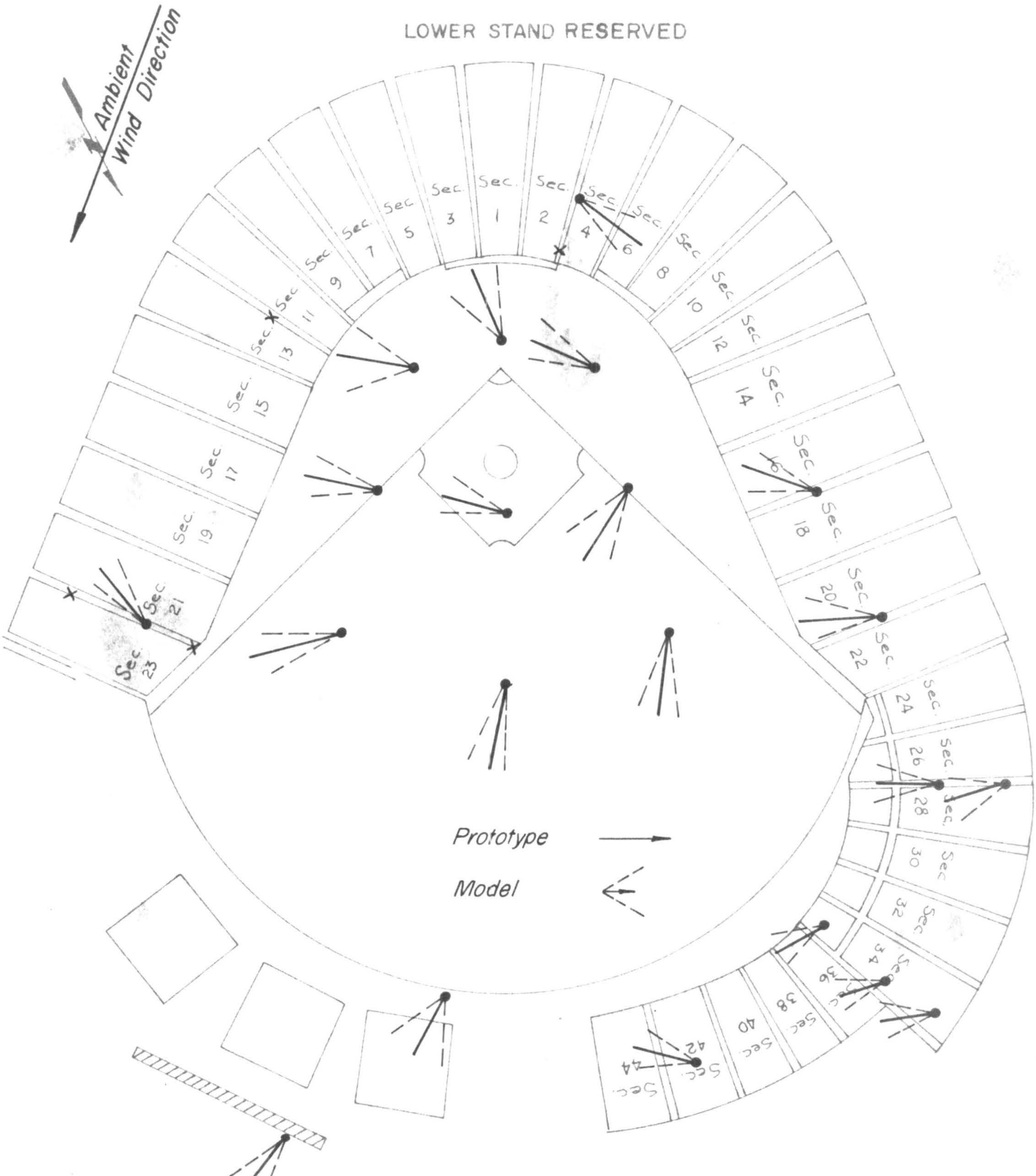


FIG. 15 MODEL–PROTOTYPE CORRELATION, ORIGINAL HILL & STADIUM
41° S of W

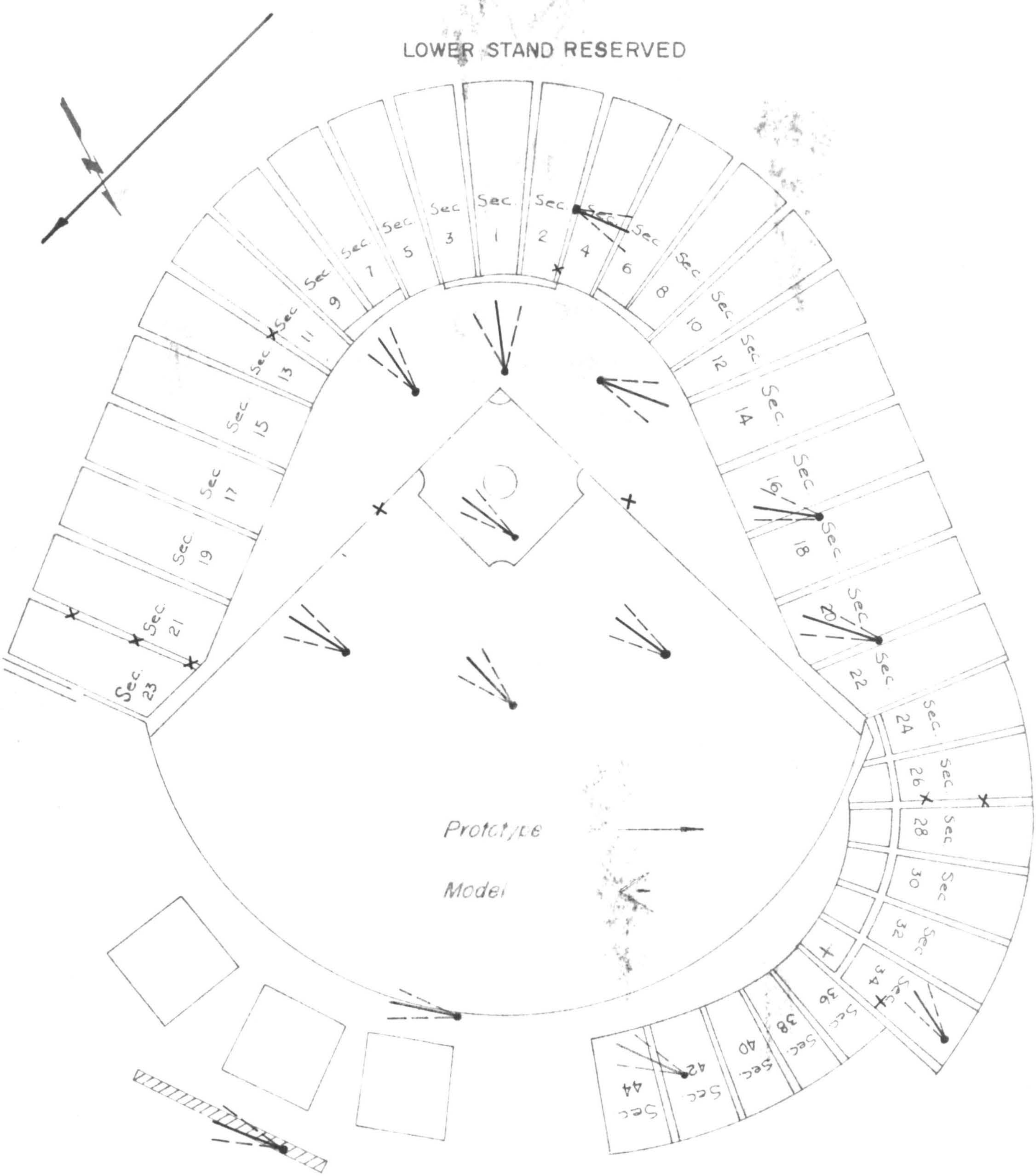


FIG. 16 MODEL- PROTOTYPE CORRELATION , ORIGINAL HILL & STADIUM
30 MPH , 16° S of W

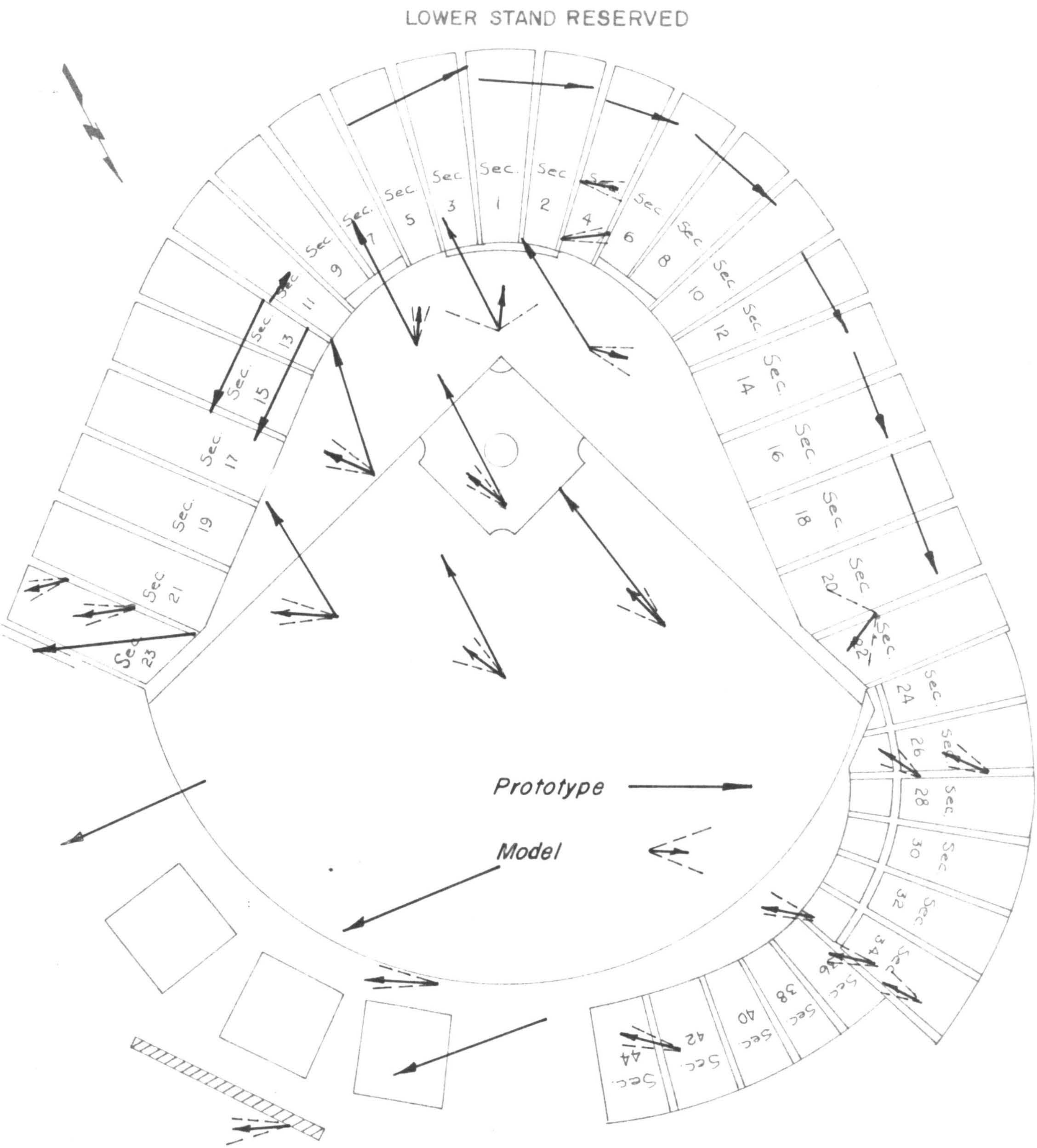


FIG. 17 MODEL—PROTOTYPE CORRELATION, LEFT-FIELD CONTROL

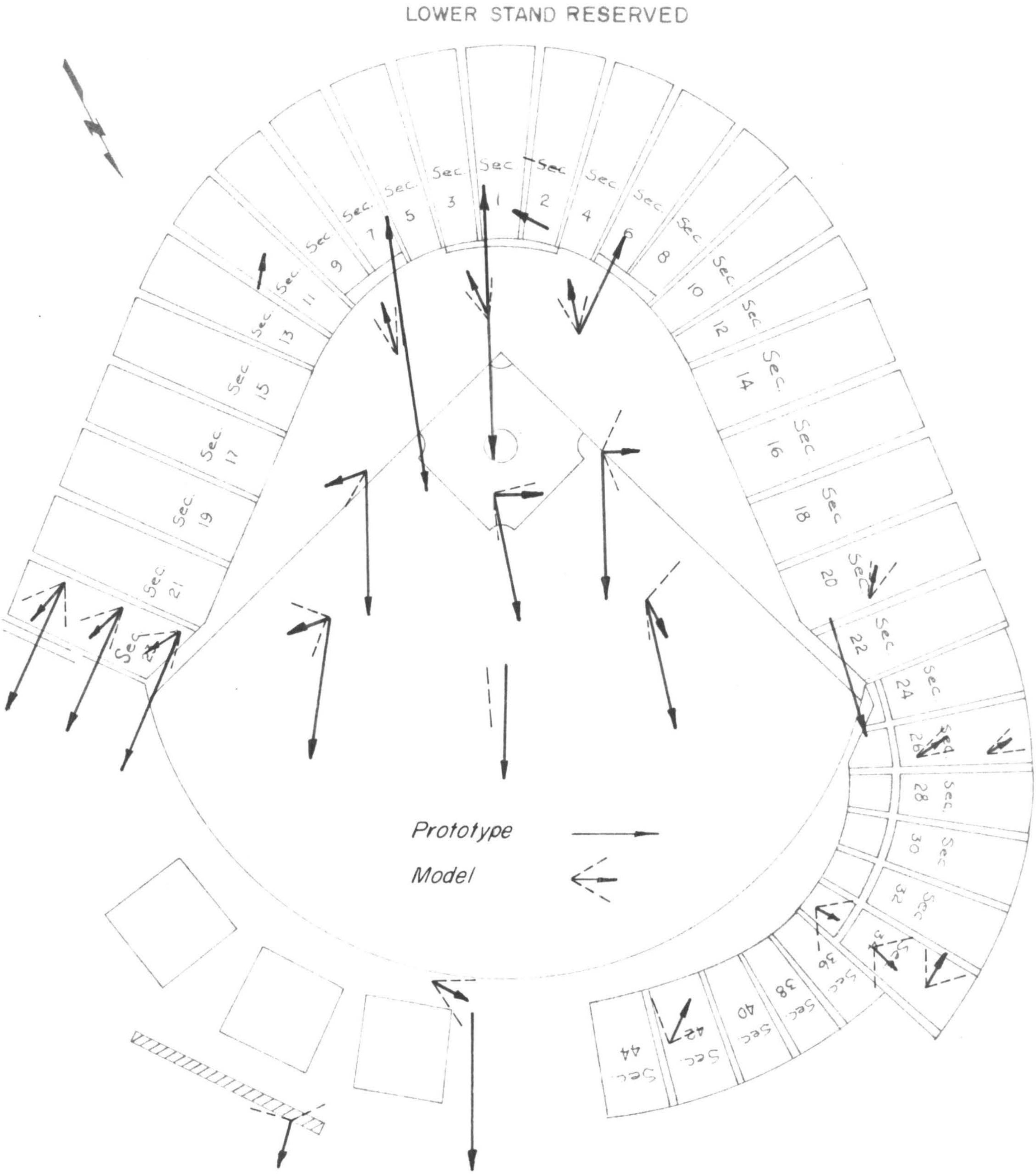


FIG. 18 MODEL-PROTOTYPE CORRELATION, SOUTHERLY CONTROL

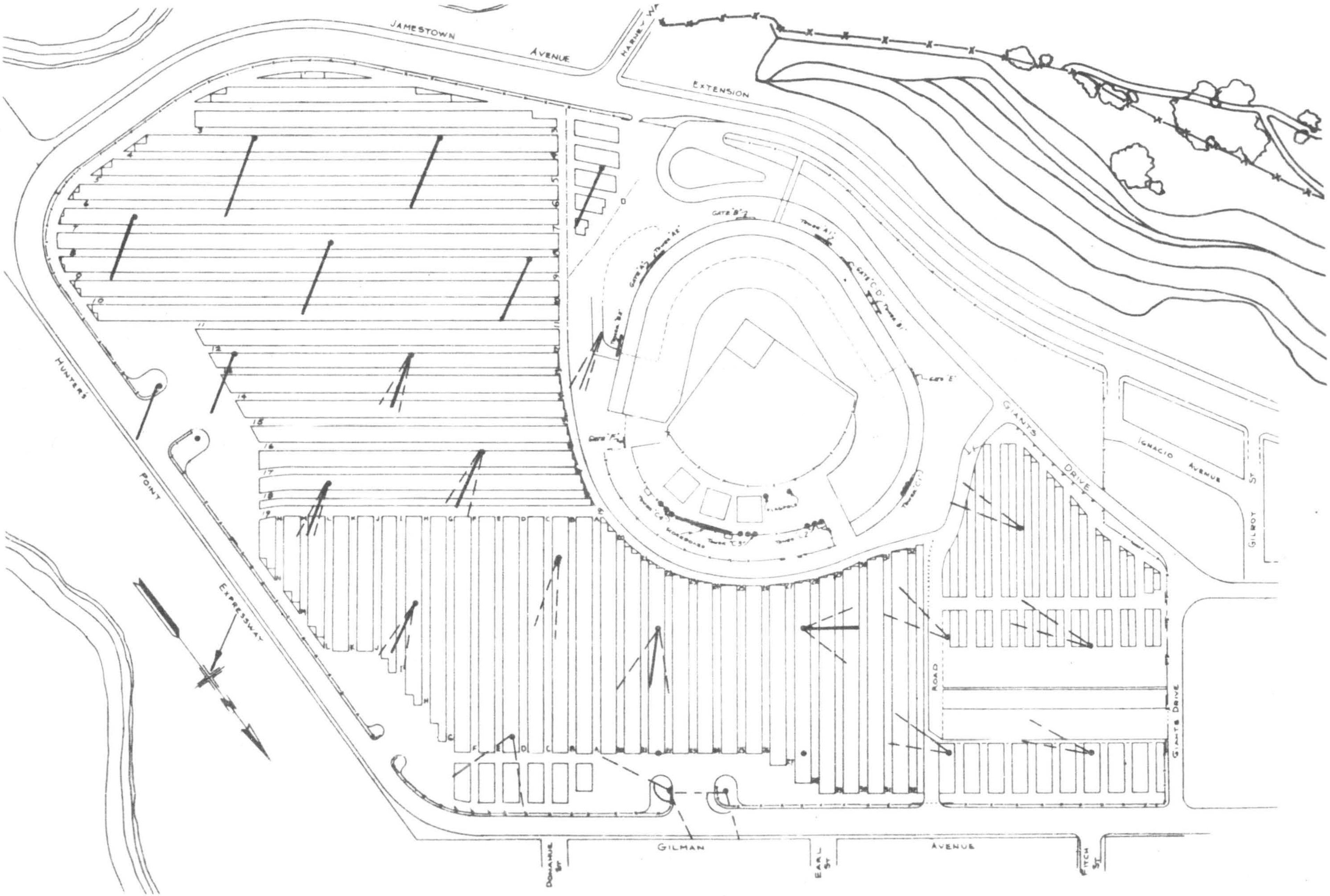


FIG. 19 PROTOTYPE FLOW PATTERN IN PARKING LOT - WIND DIRECTION 31° S OF W

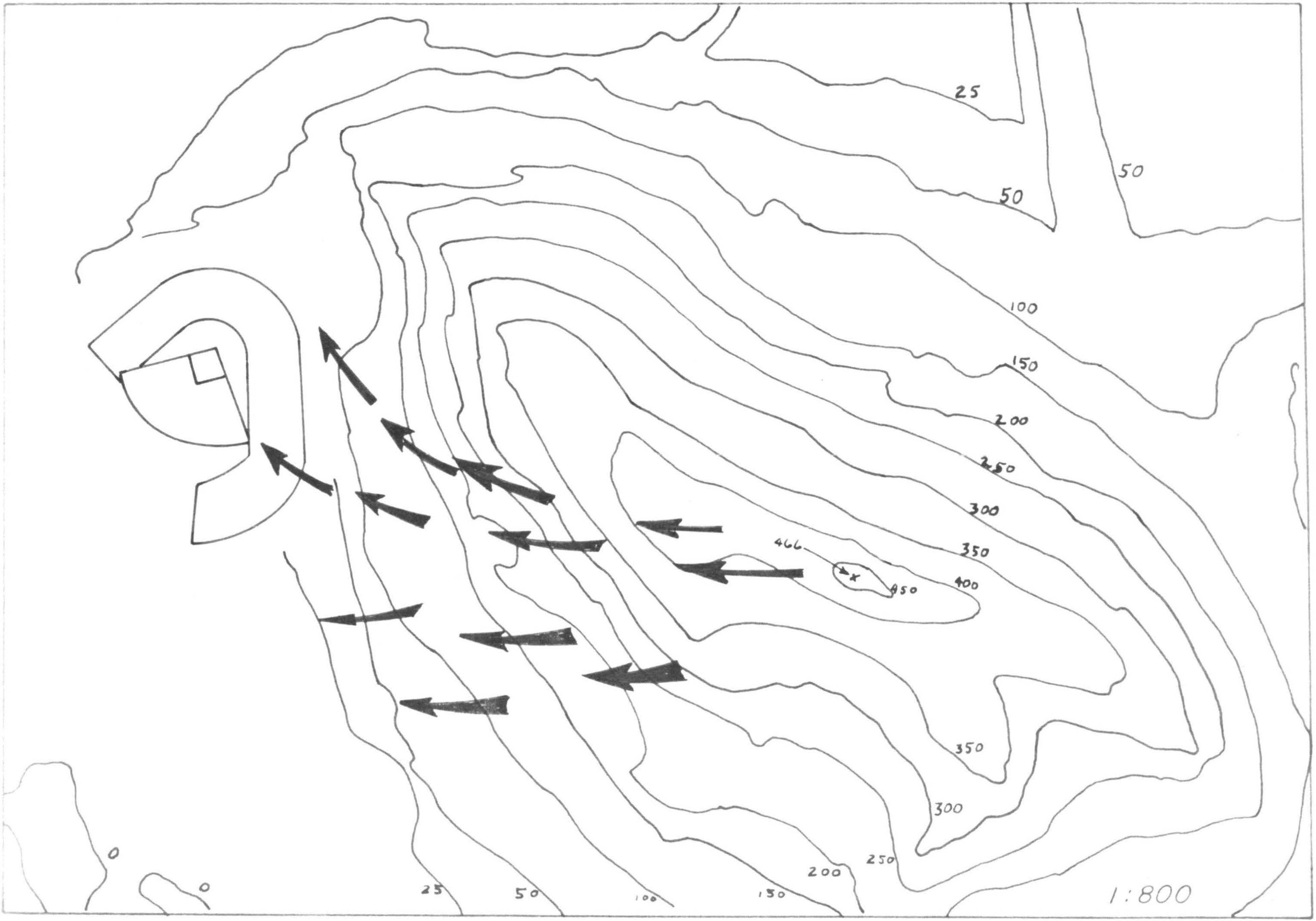


FIG. 20 CIRCULATION OVER MODEL HILL FOR WIND OF 16°S OF W & 17 mph

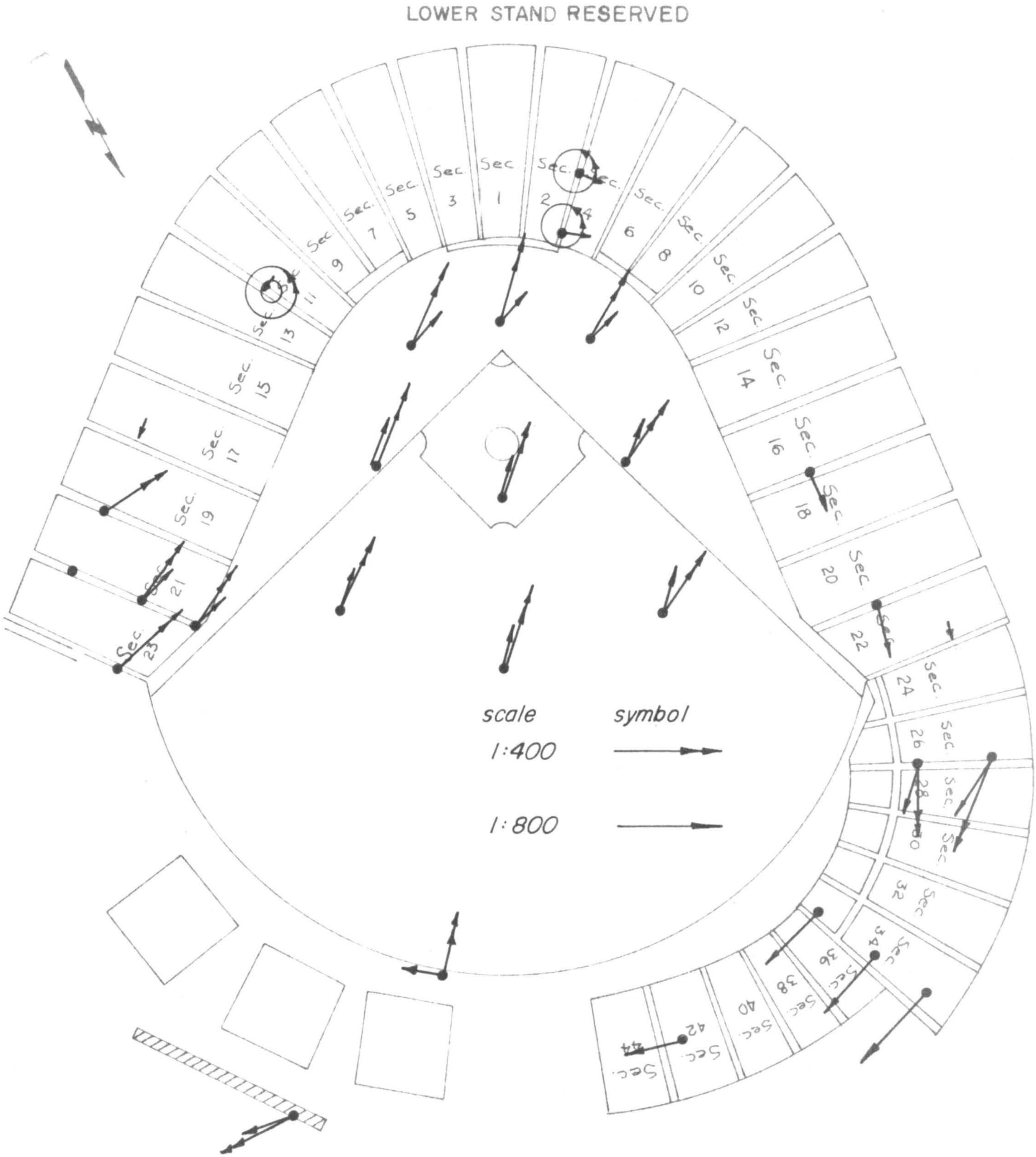


FIG. 21 COMPARISON OF LOWER STAND FLOW PATTERN FOR 1:400 AND 1:800 SCALE MODELS WITH HILL REMOVED (REF. WIND 17 MPH AT 16° S OF W)

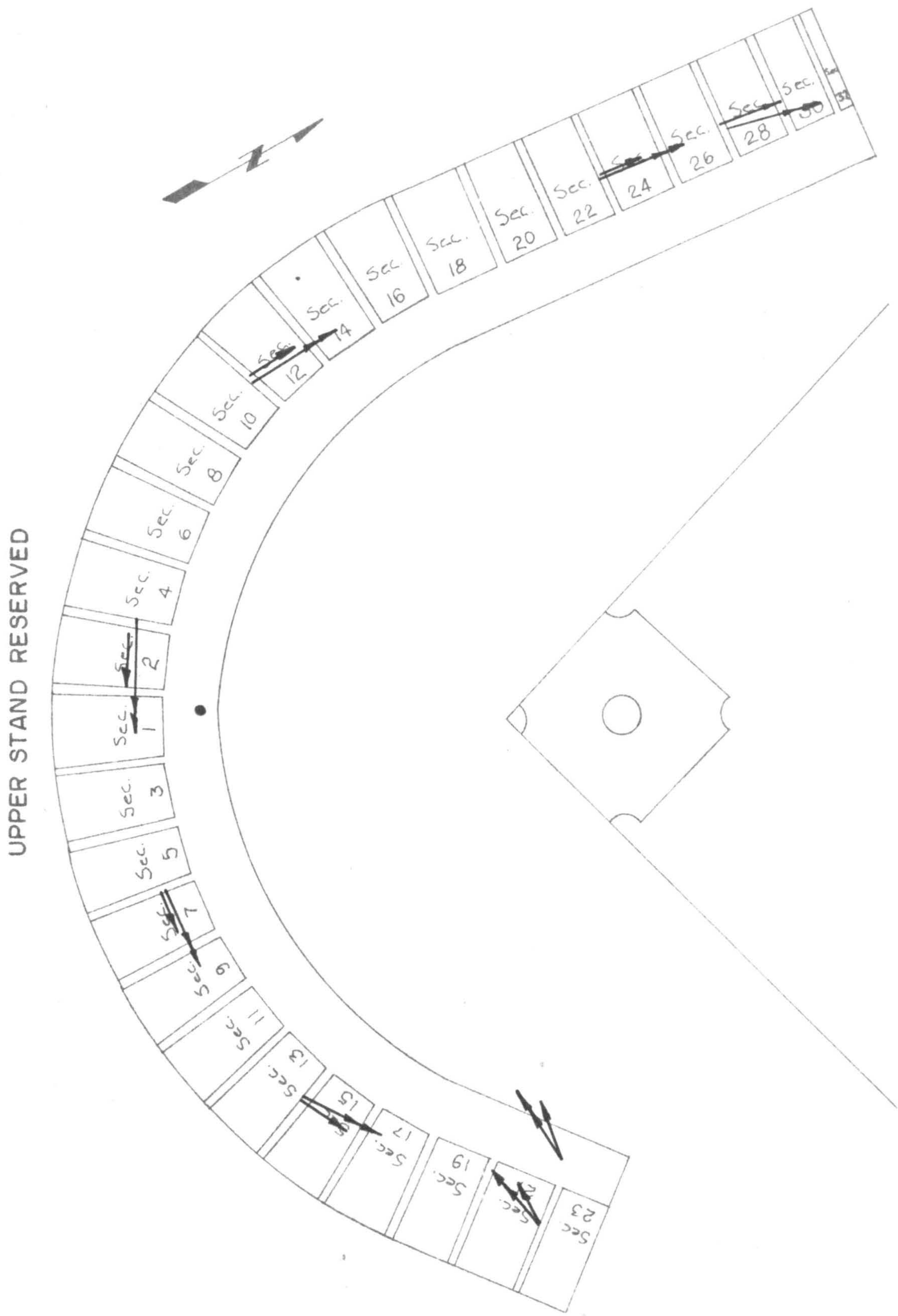


FIG. 22 COMPARISON OF UPPER STAND FLOW PATTERN FOR 1:400 AND 1:800 SCALE MODELS WITH HILL REMOVED (REF. WIND 17 MPH AT 16° S OF W)

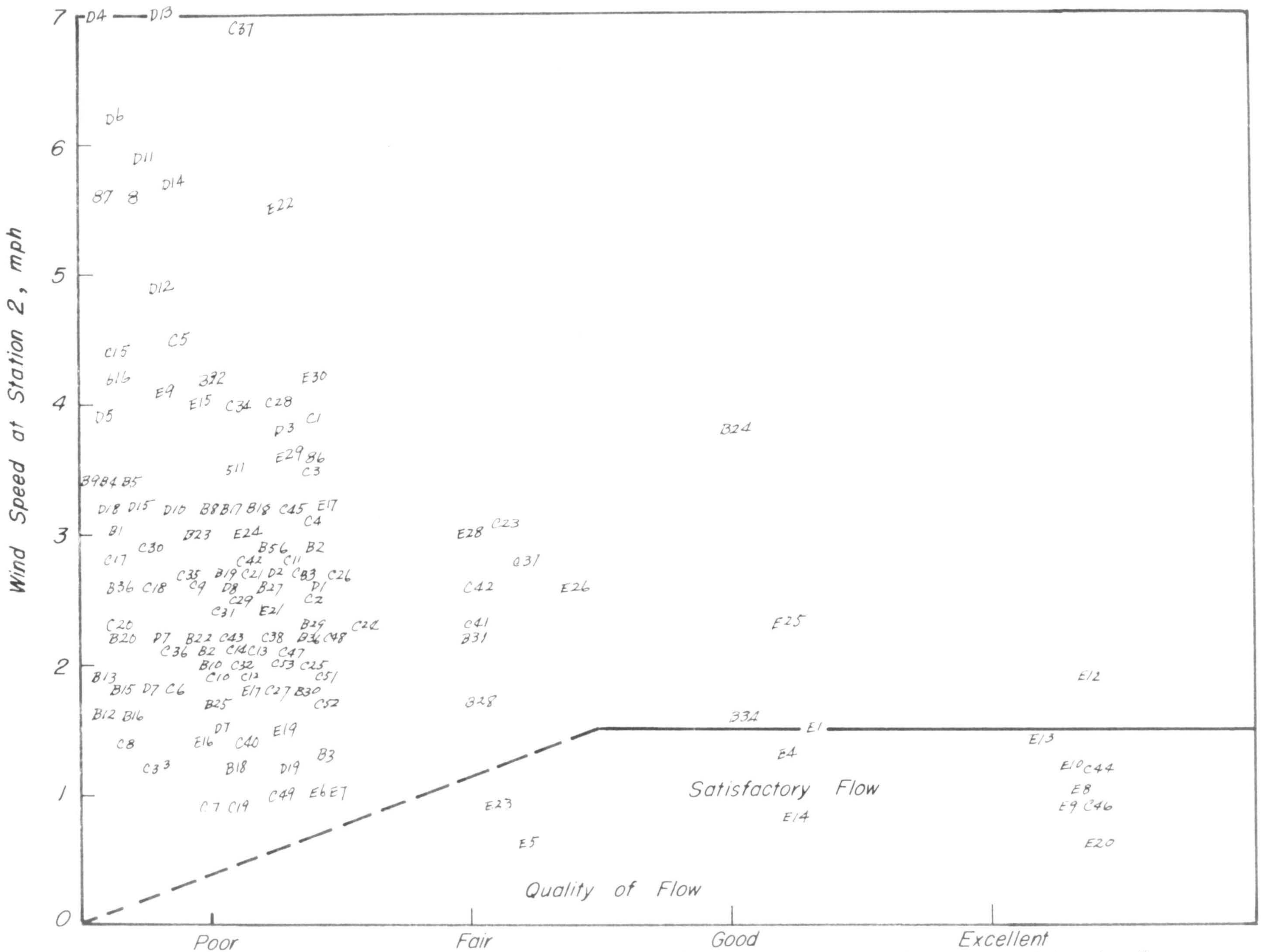
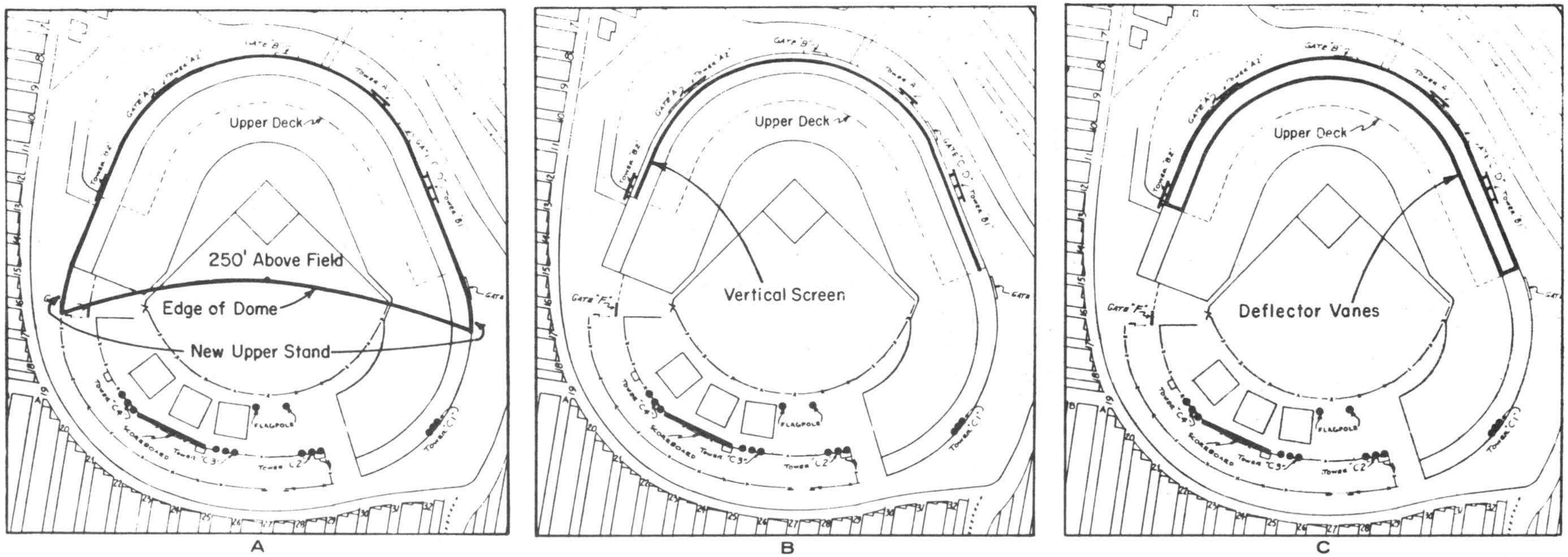


FIG. 23 ESTIMATE OF FLOW CONDITION IN STADIUM (increasing quality of flow condition implies a lesser degree of gustiness)



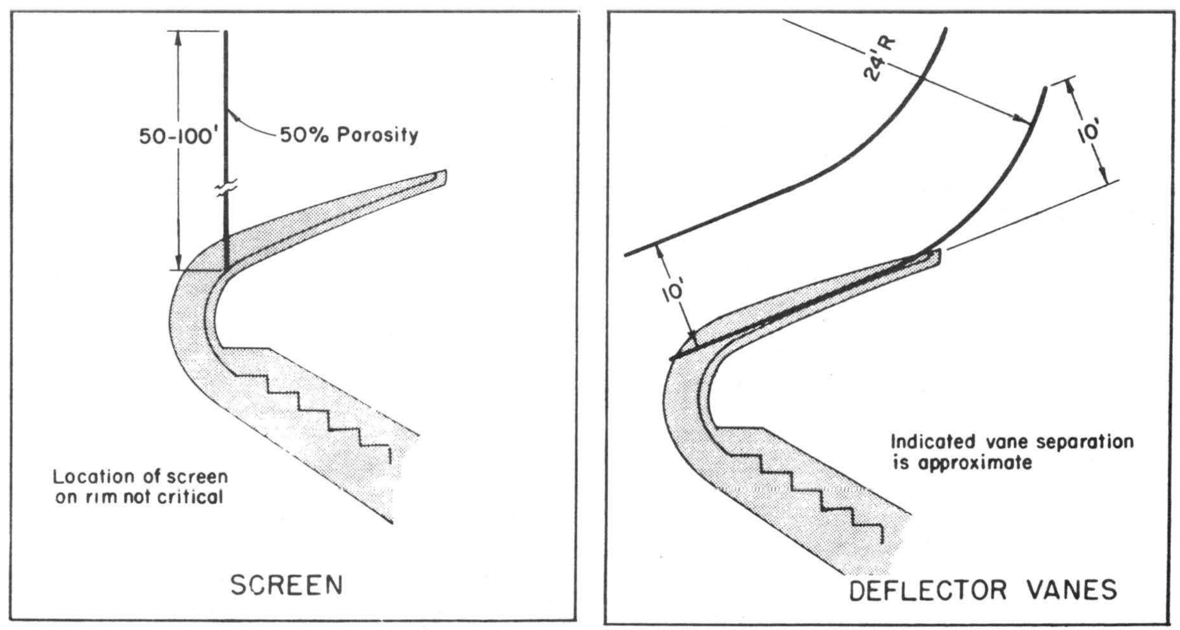


Fig. 24 -Stadium modifications for the elimination of Southerly Control conditions. a) Partial dome across stadium. b) Vertical porous screen around existing rim. c) Vanes on rim to provide vertical deflection of the air across the stadium.

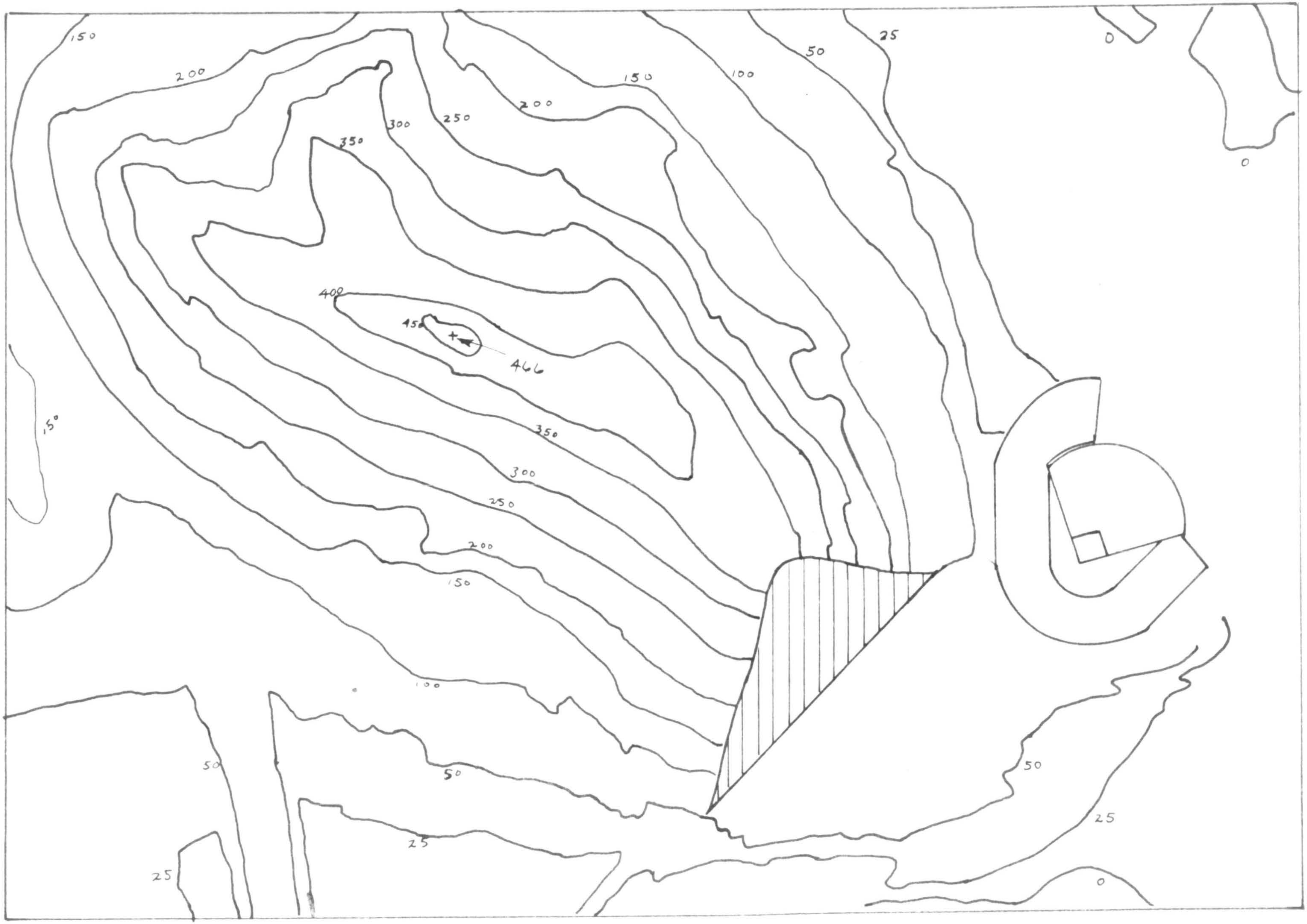


FIG. 25 SMALL CUT OFF SOUTH END OF HILL

FIG. 26 DEEP CUT OFF END OF HILL

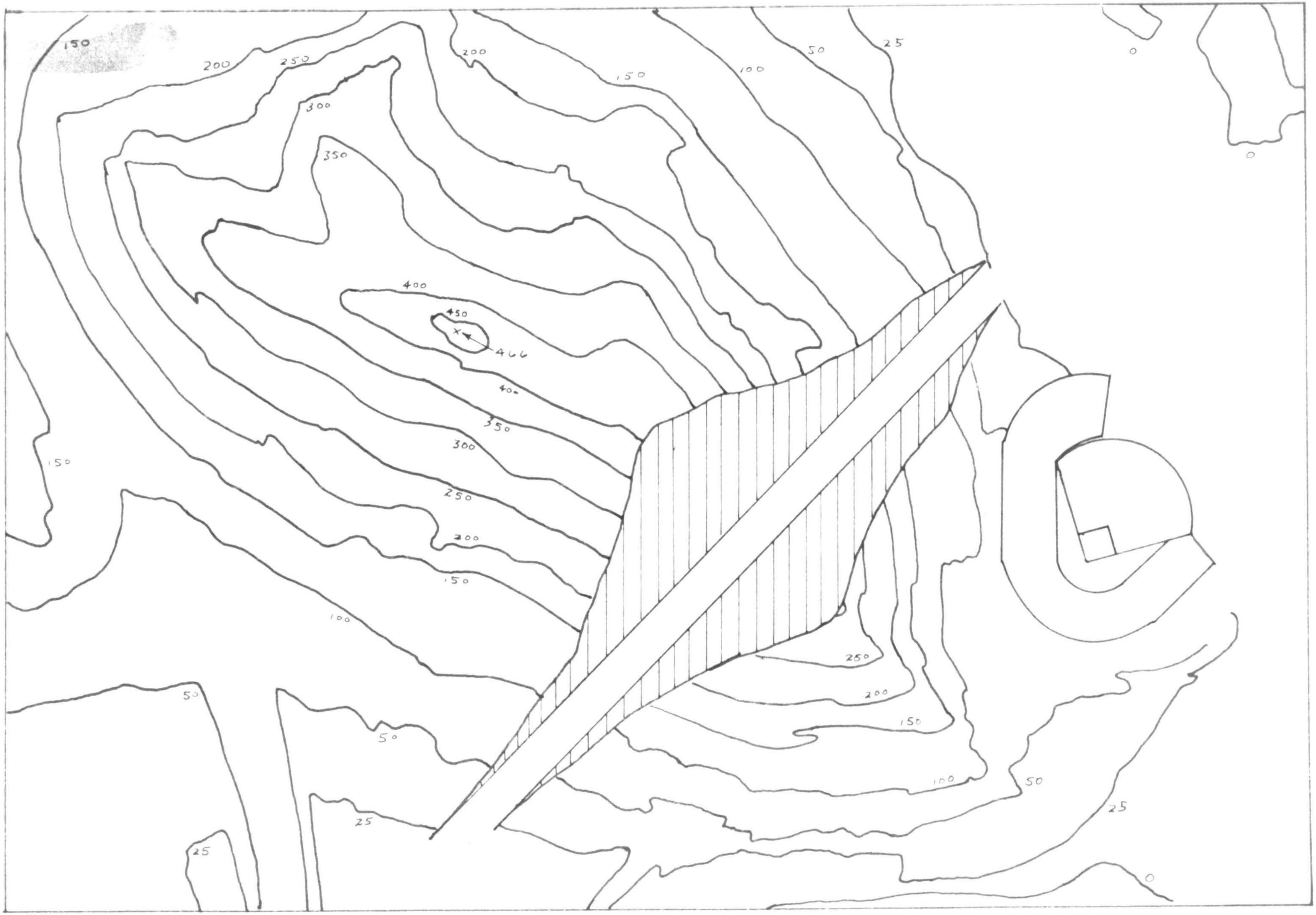


FIG. 27 BROAD CUT THROUGH CENTER OF HILL -- AXIS 45° S OF W

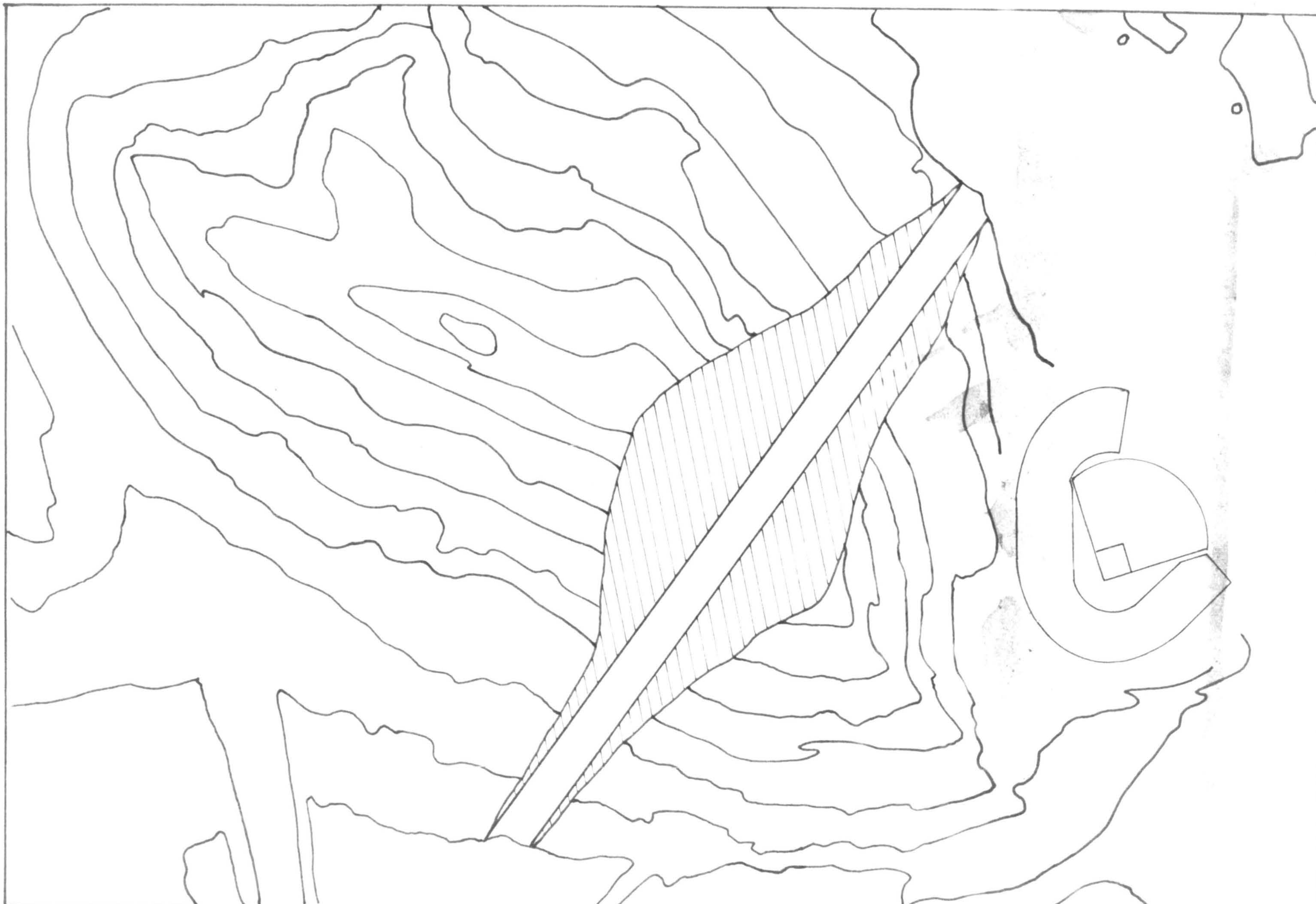


FIG. 28 BROAD CUT THROUGH CENTER OF HILL -- AXIS 55° S OF W

FIG. 29 BROAD CUT TANGENT TO STADIUM -- AXIS 45° S OF W

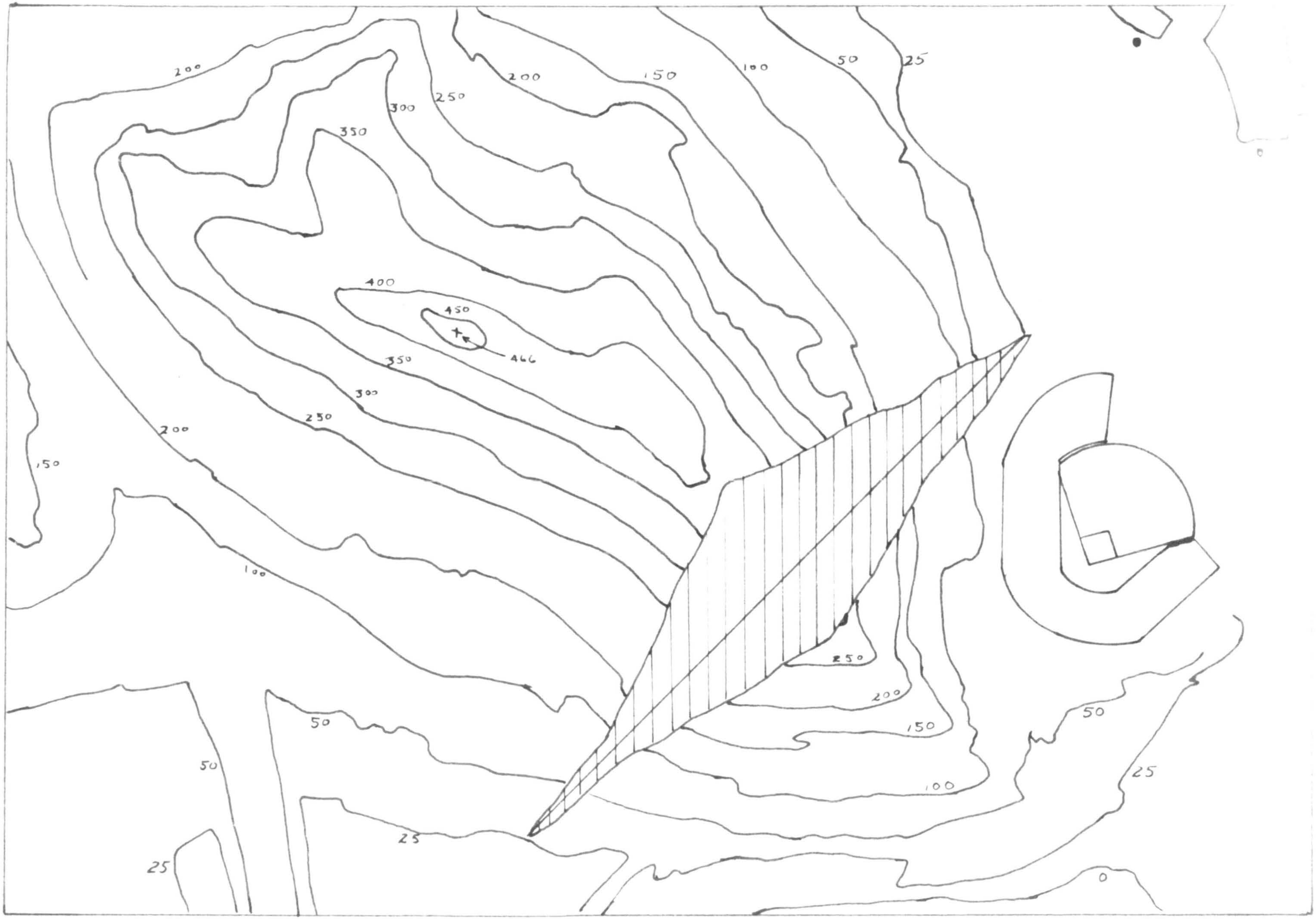


FIG. 30 VEE CUT TANGENT TO STADIUM -- AXIS 45° S OF W

FIG. 31 SOUTH END OF HILL REMOVED--BASE OF CUT TANGENT TO STADIUM

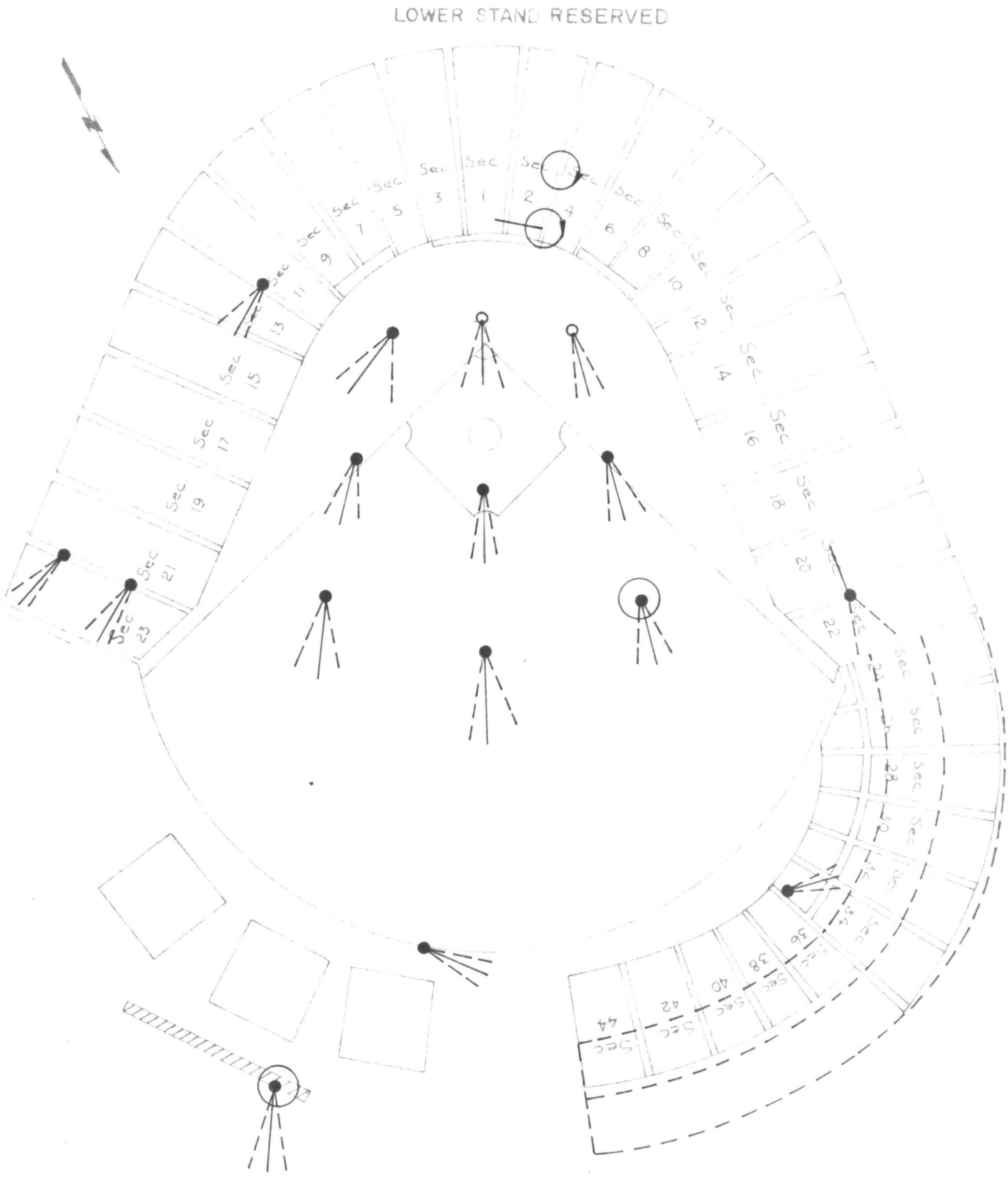


FIG. 32a FLOW PATTERN RUN NO. B2

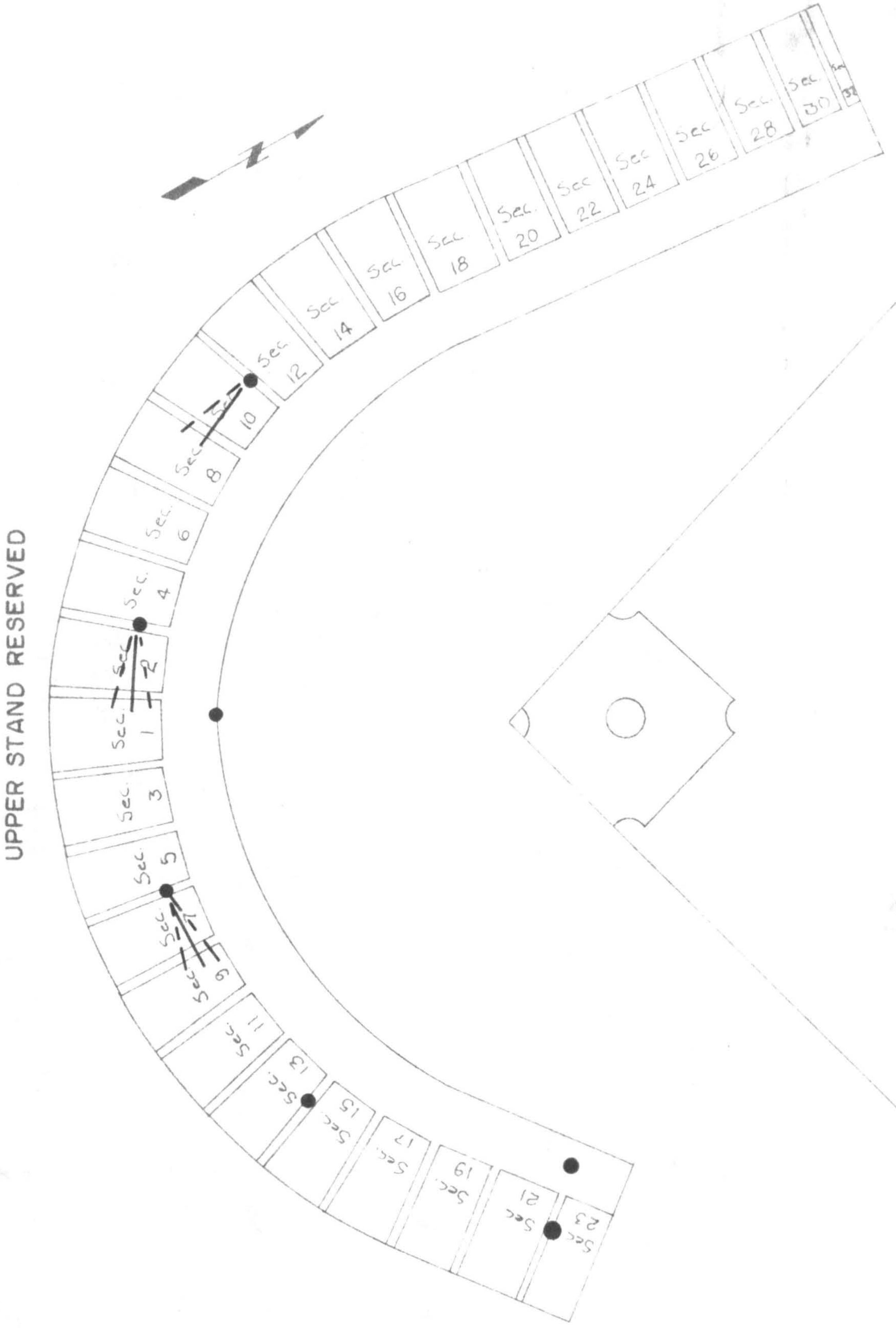


FIG. 32b FLOW PATTERN RUN NO. B2

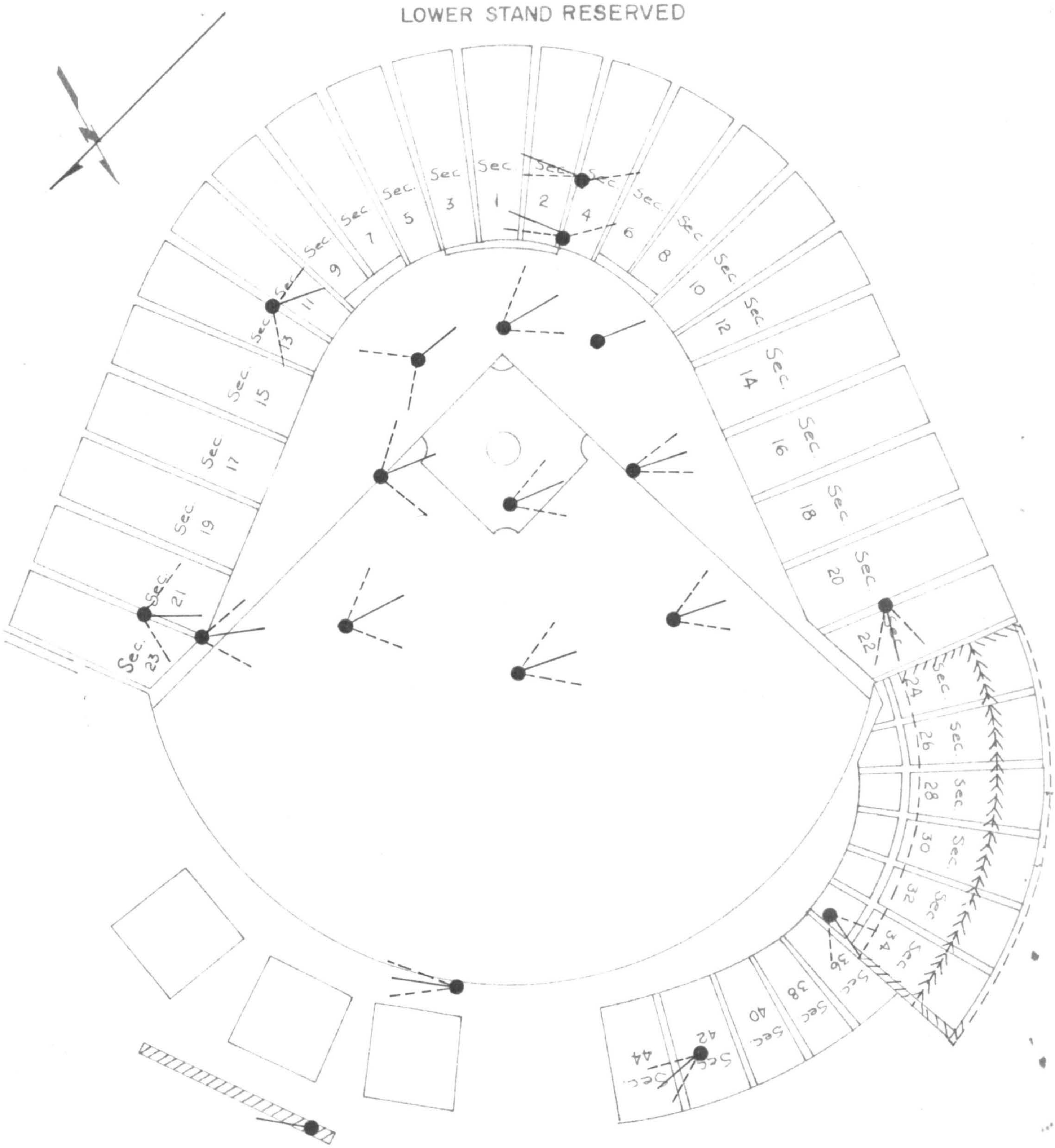


FIG. 33a FLOW PATTERN RUN NO. B4

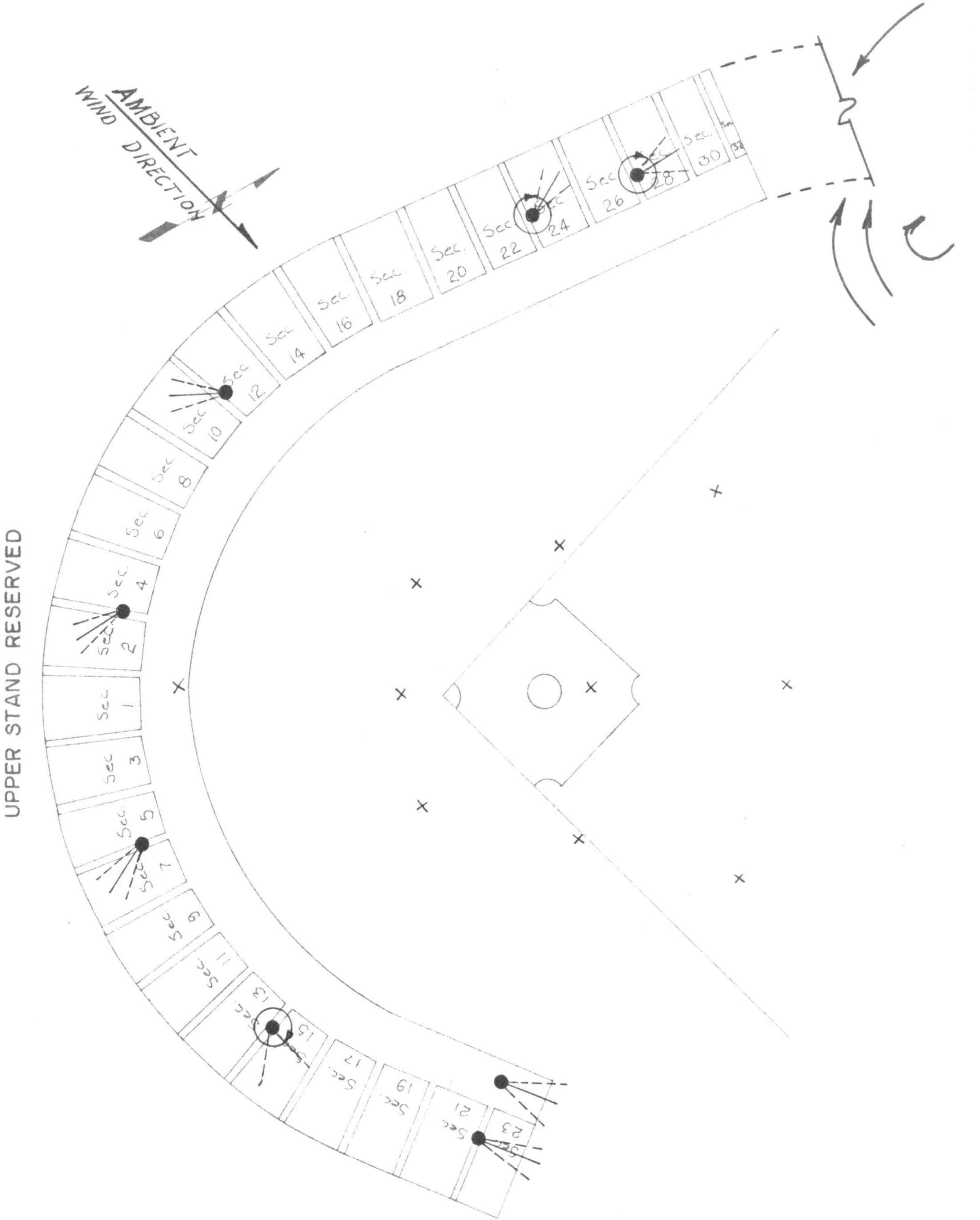


FIG. 33b FLOW PATTERN RUN NO. B4

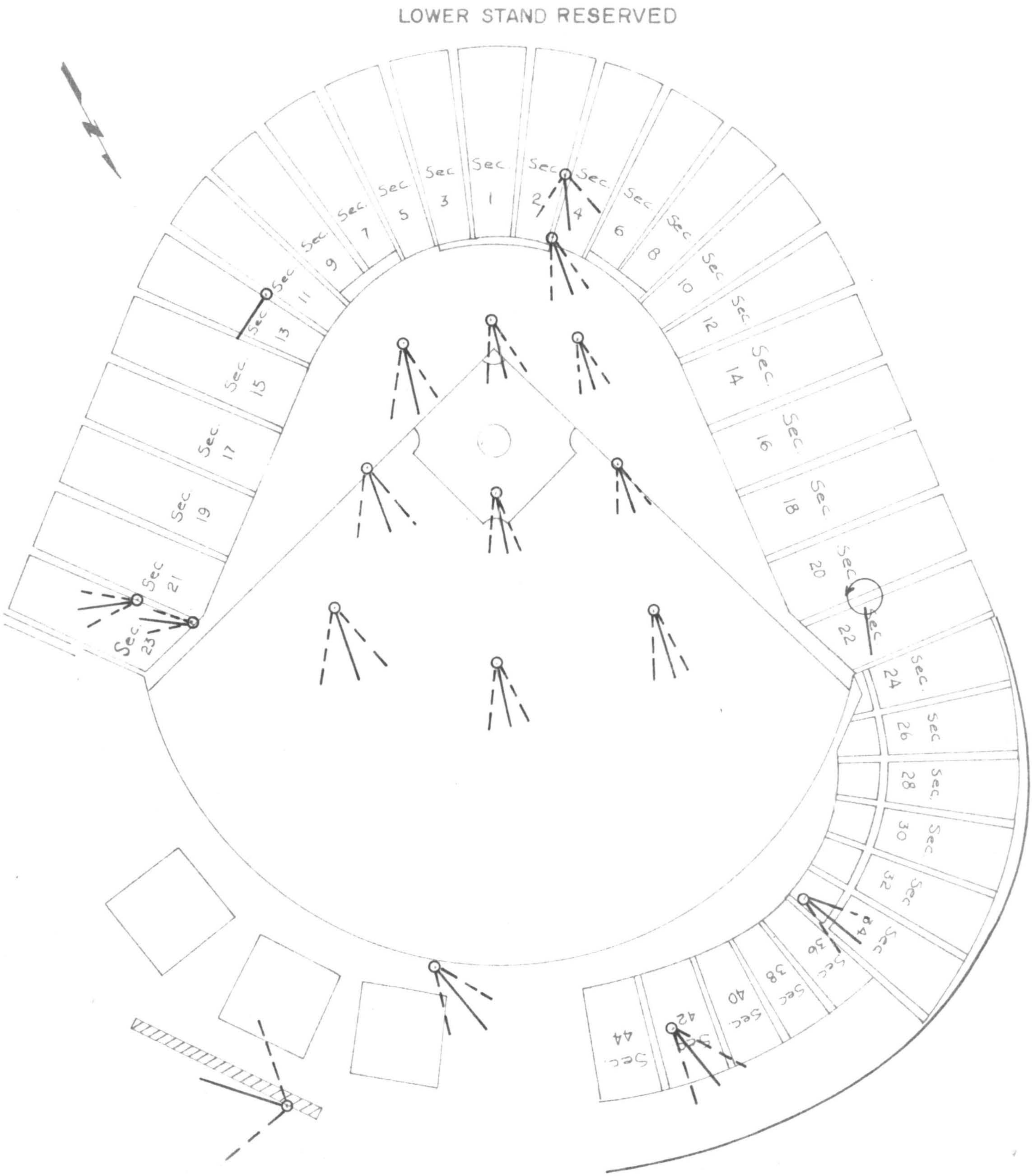


FIG. 34o FLOW PATTERN RUN NO. B9

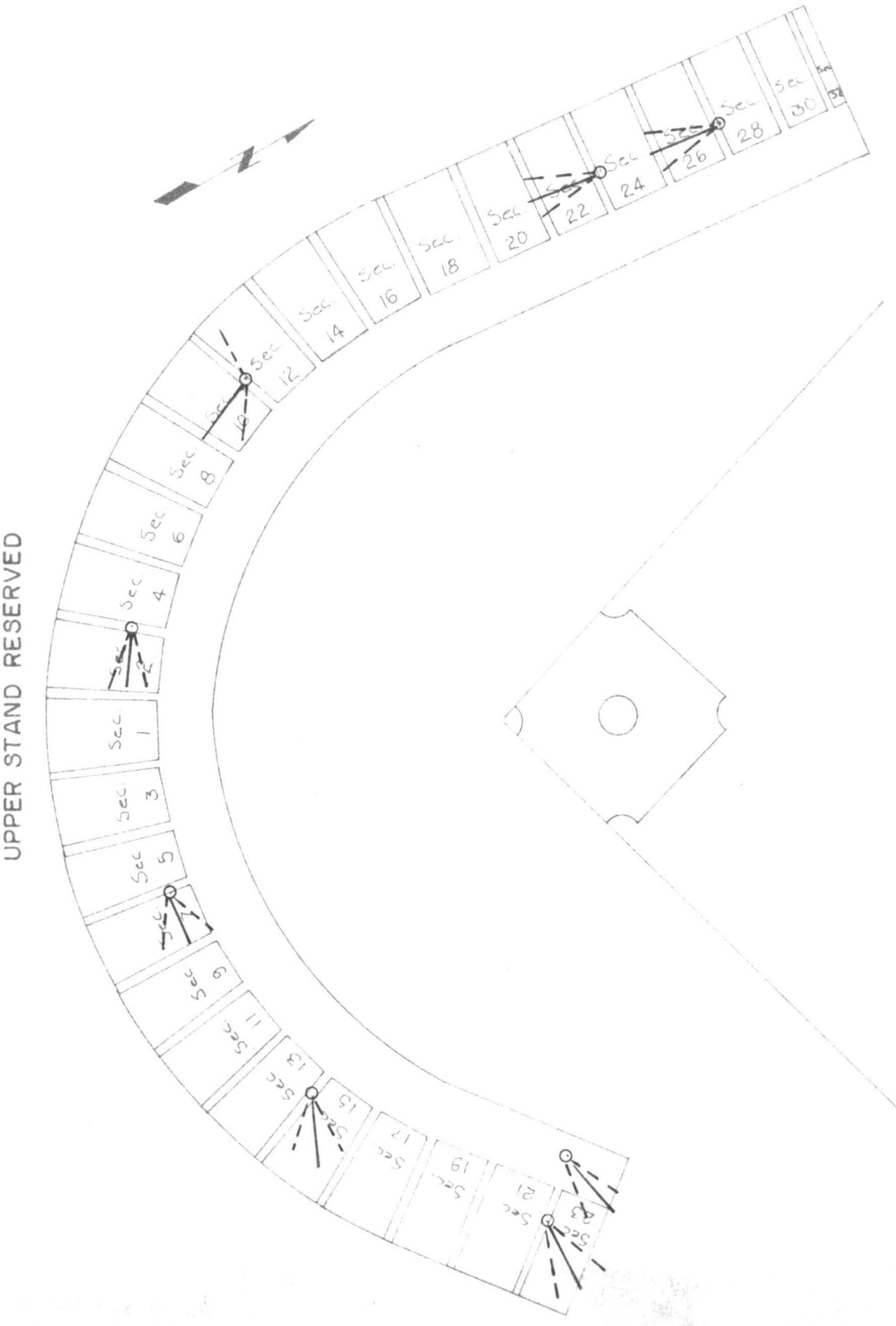


FIG. 34b FLOW PATTERN RUN NO. B9

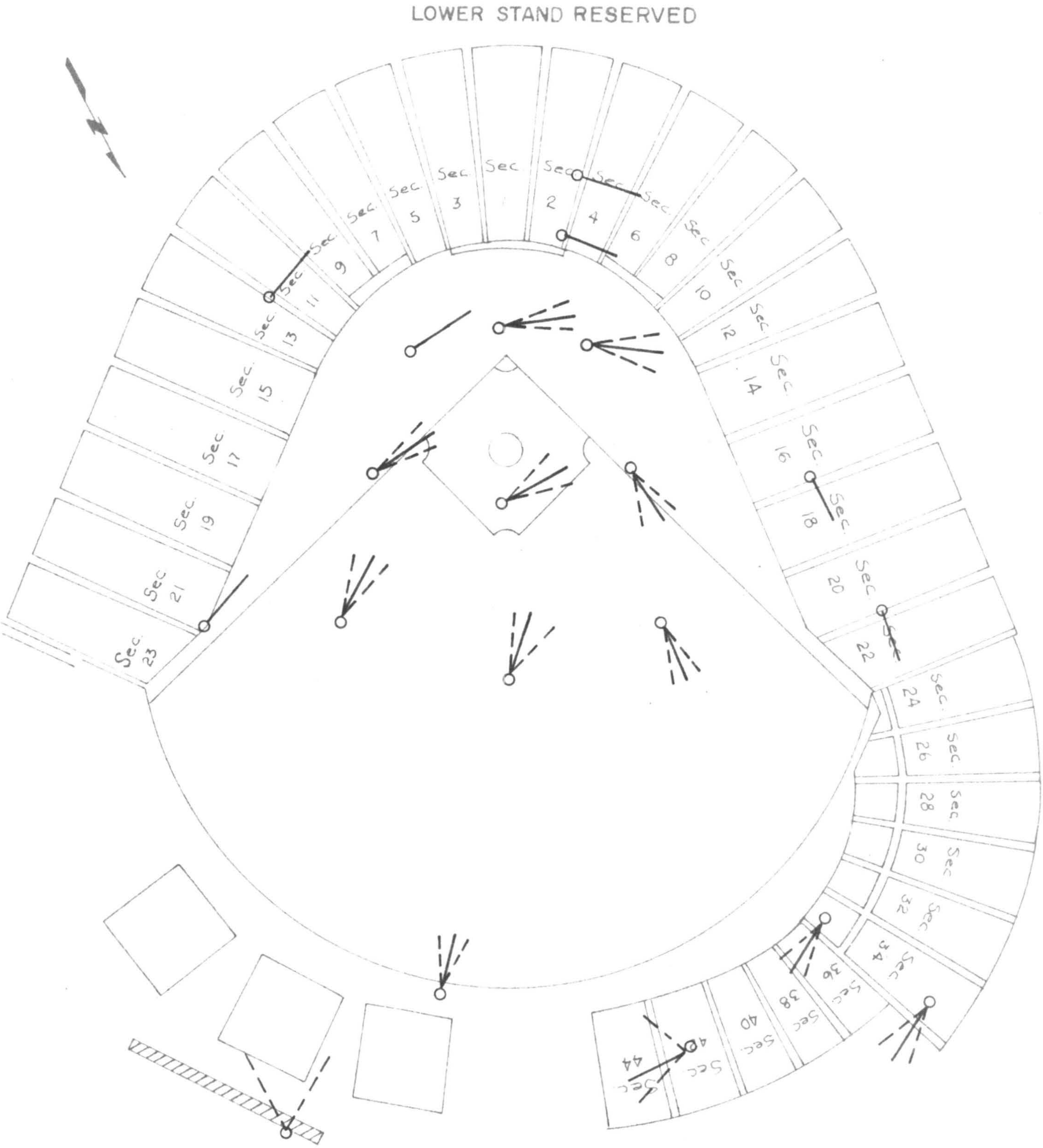


FIG. 35a FLOW PATTERN RUN NO. B34

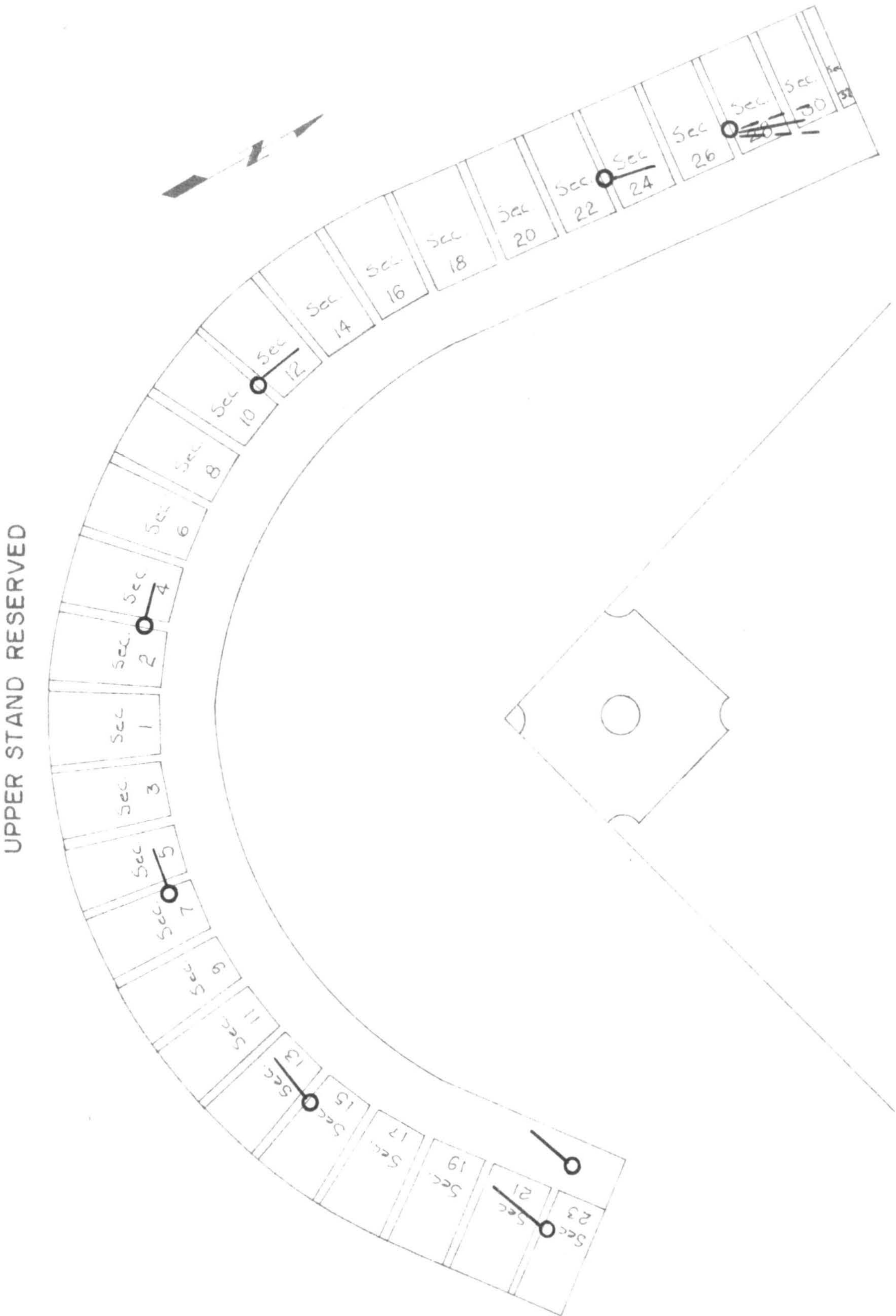


FIG. 35b FLOW PATTERN RUN NO. B 34

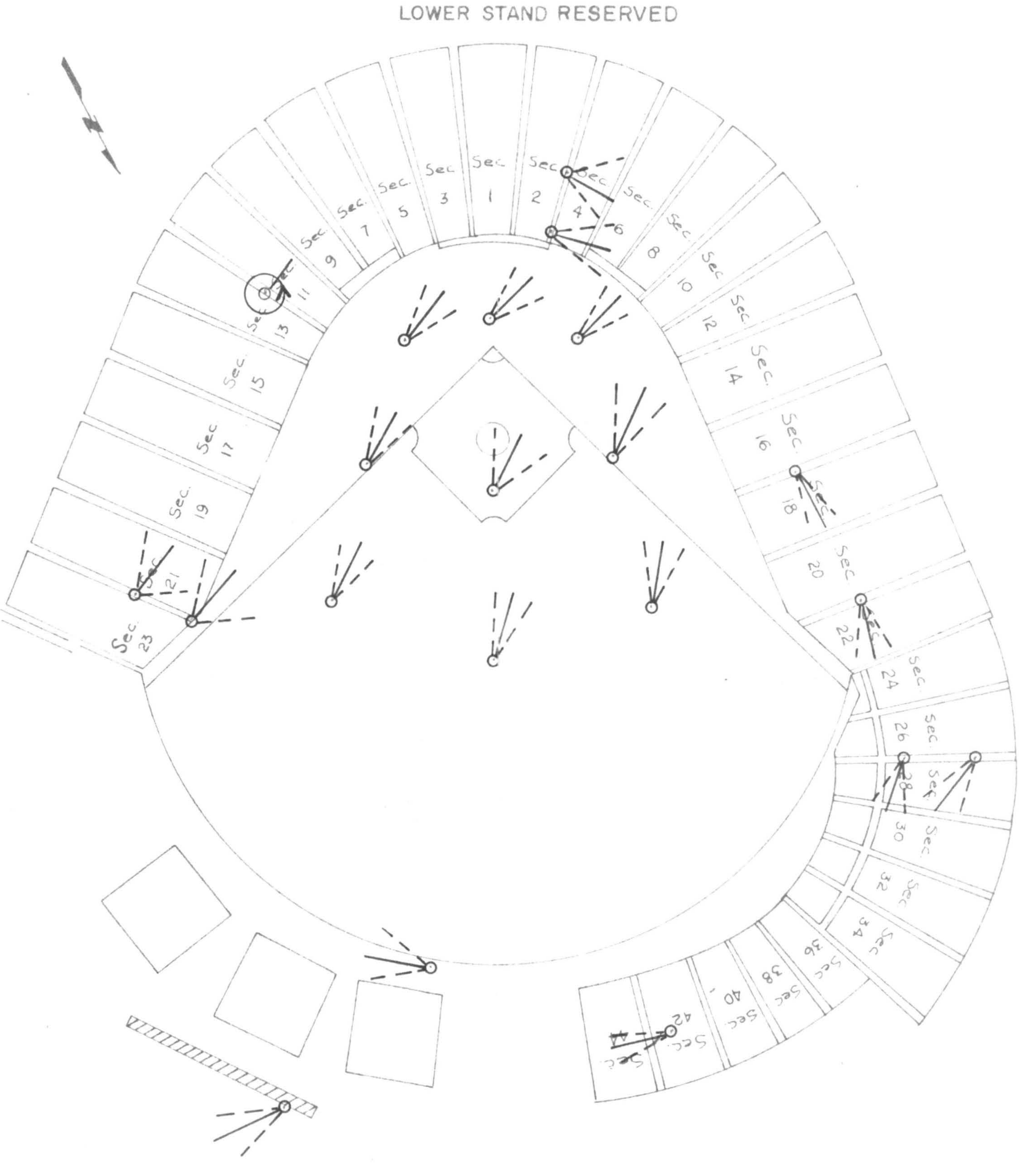


FIG. 36a FLOW PATTERN RUN NO. C7

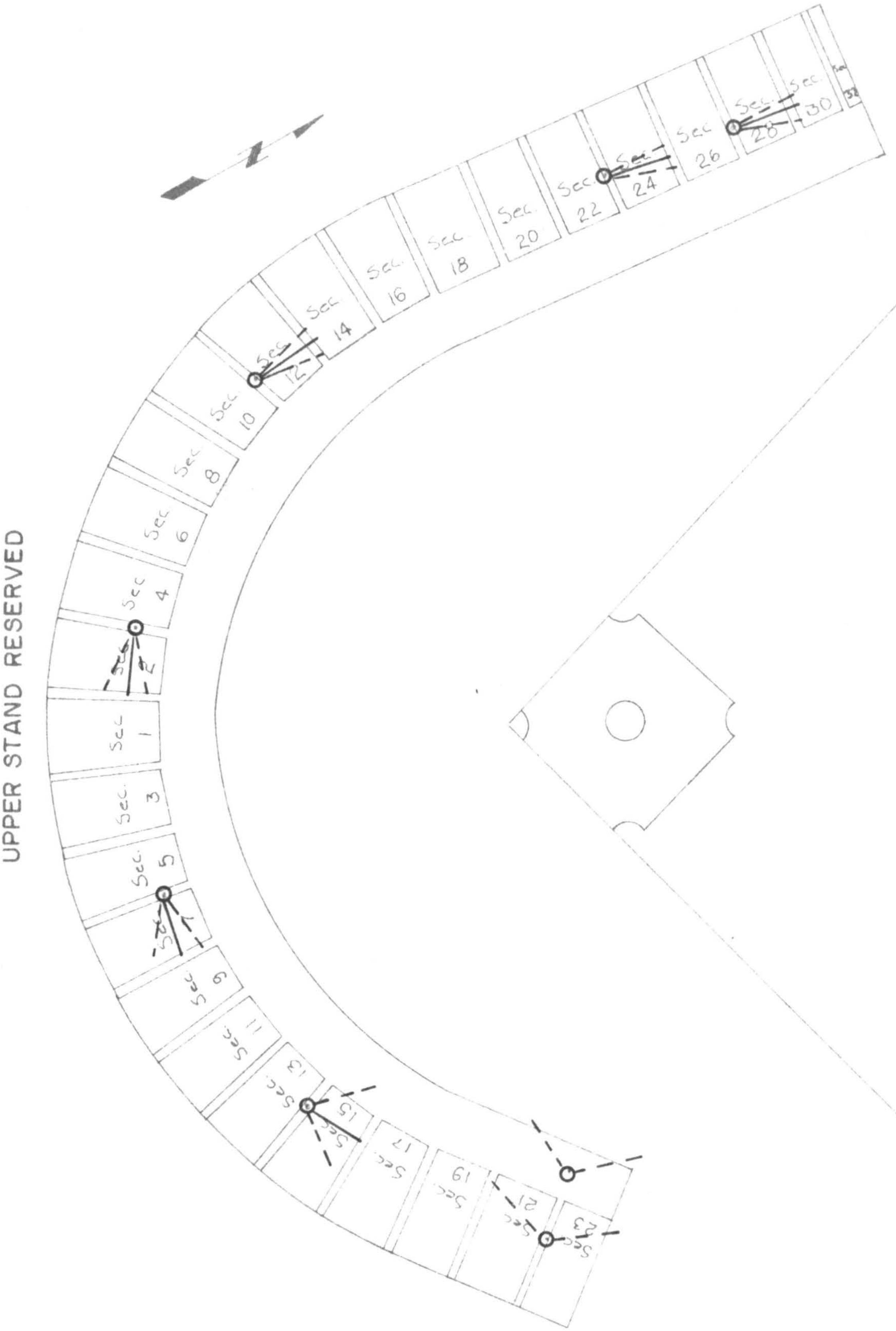


FIG. 36b FLOW PATTERN RUN NO. C7

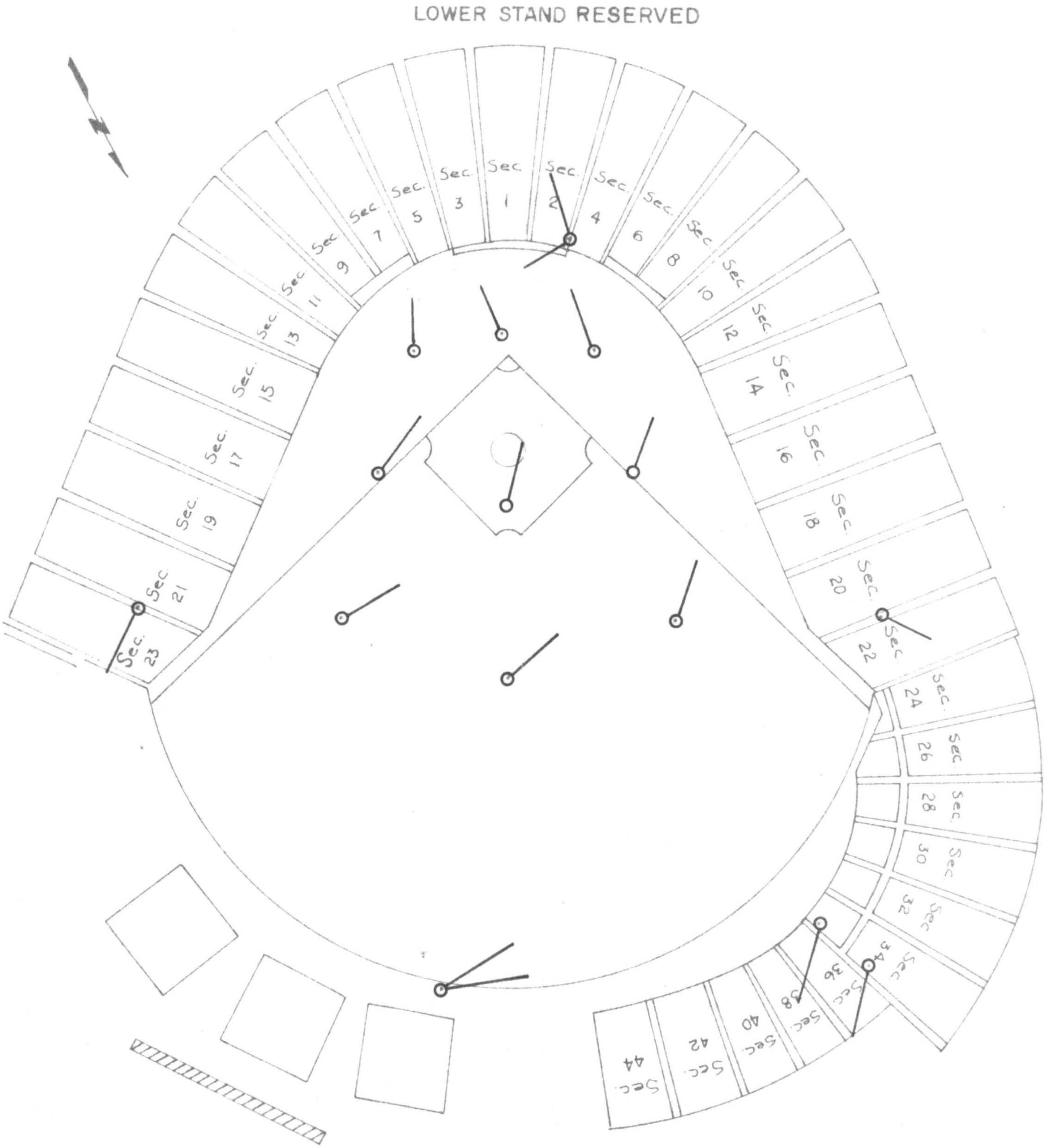


FIG. 37a FLOW PATTERN RUN NO. C 35

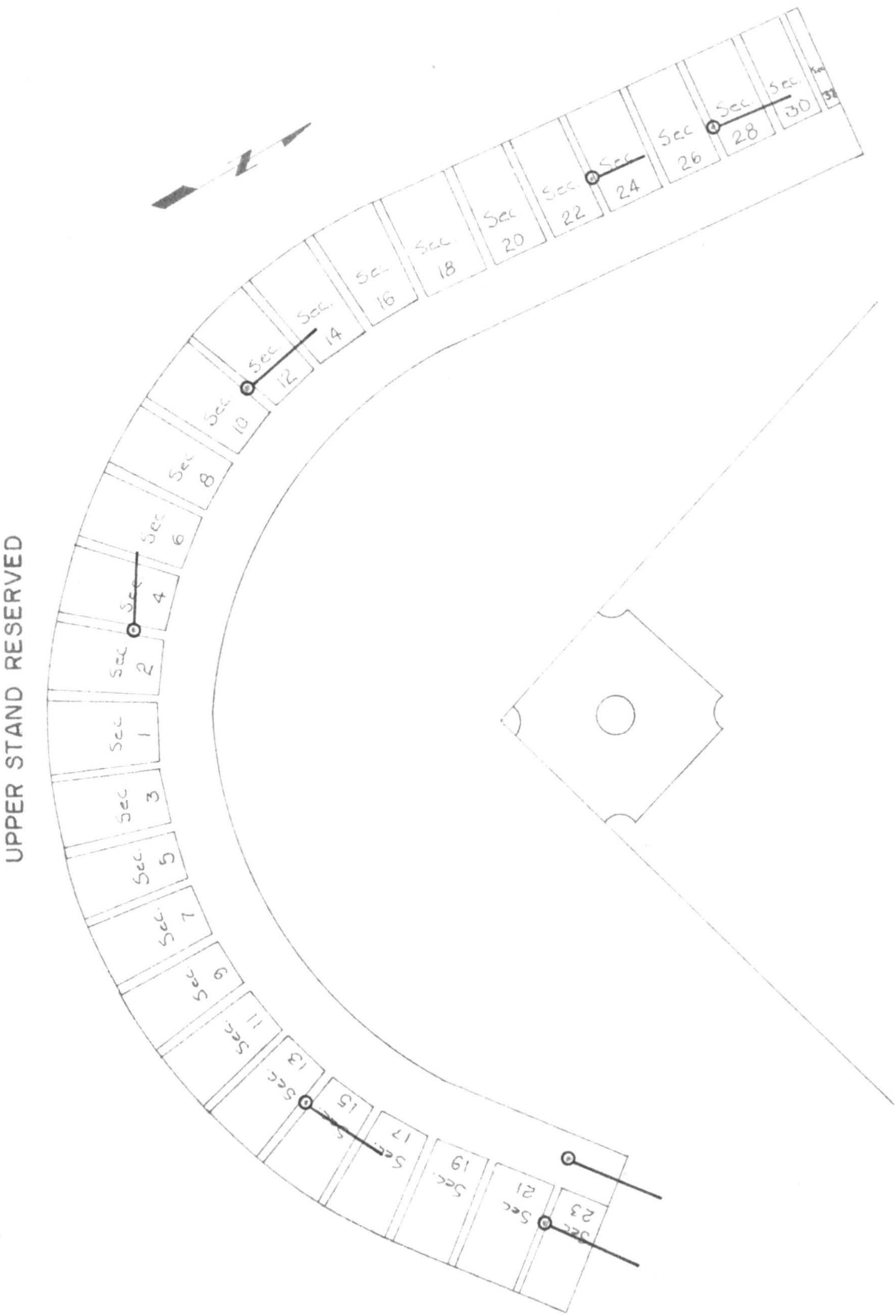


FIG. 37b FLOW PATTERN RUN NO. C 35

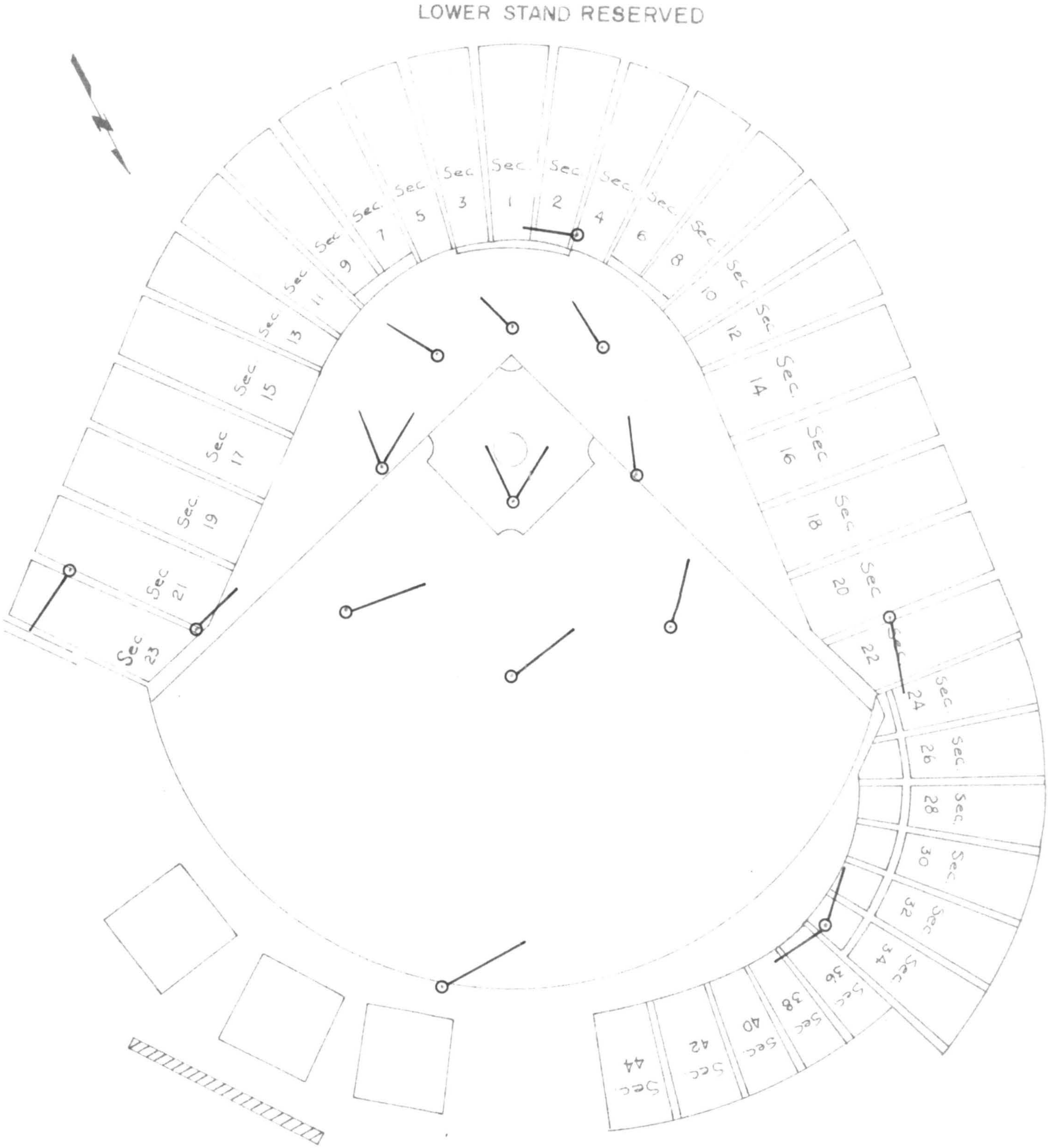


FIG. 38a FLOW PATTERN RUN NO. C 37

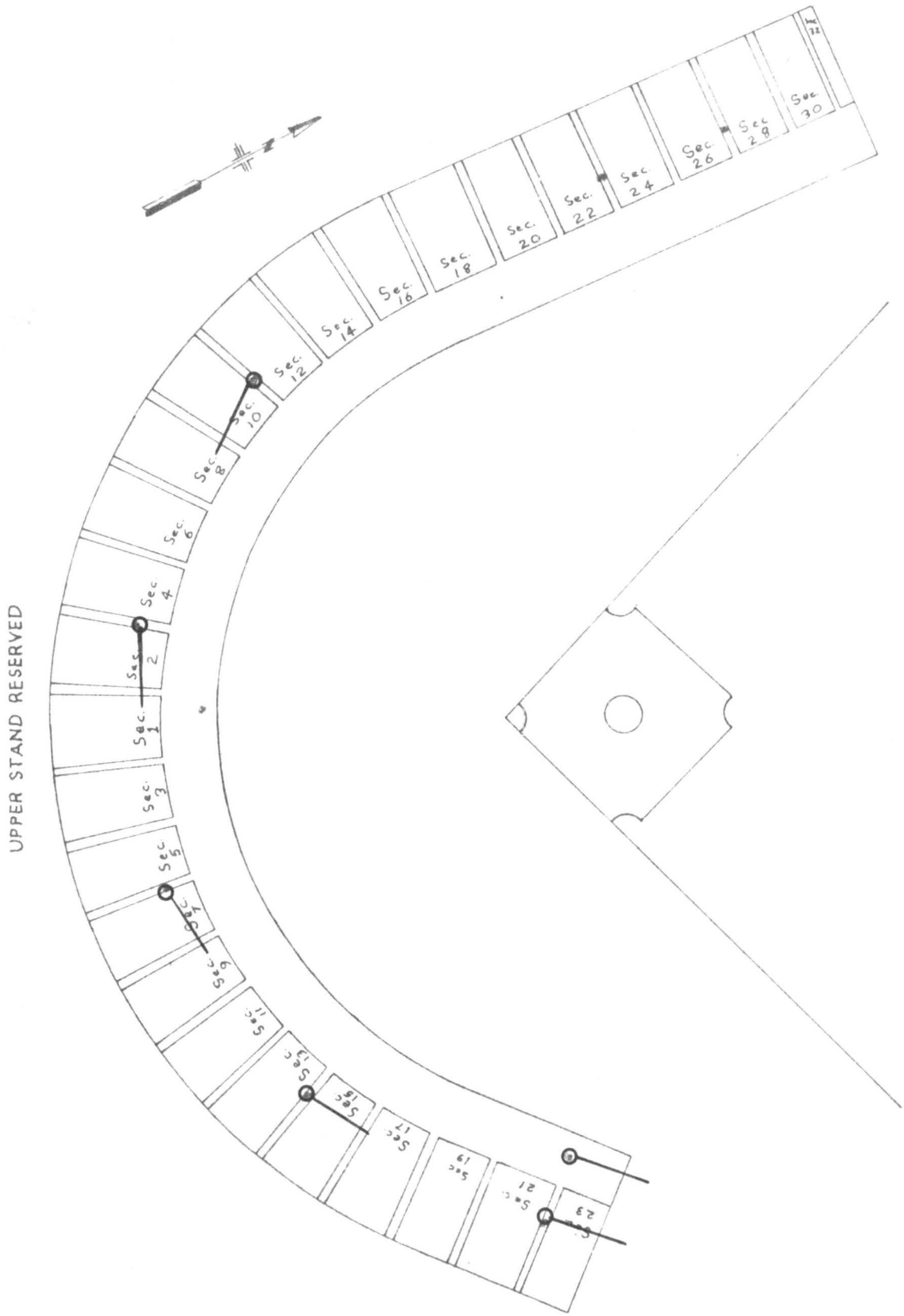


FIG. 38b FLOW PATTERN RUN NO. C37

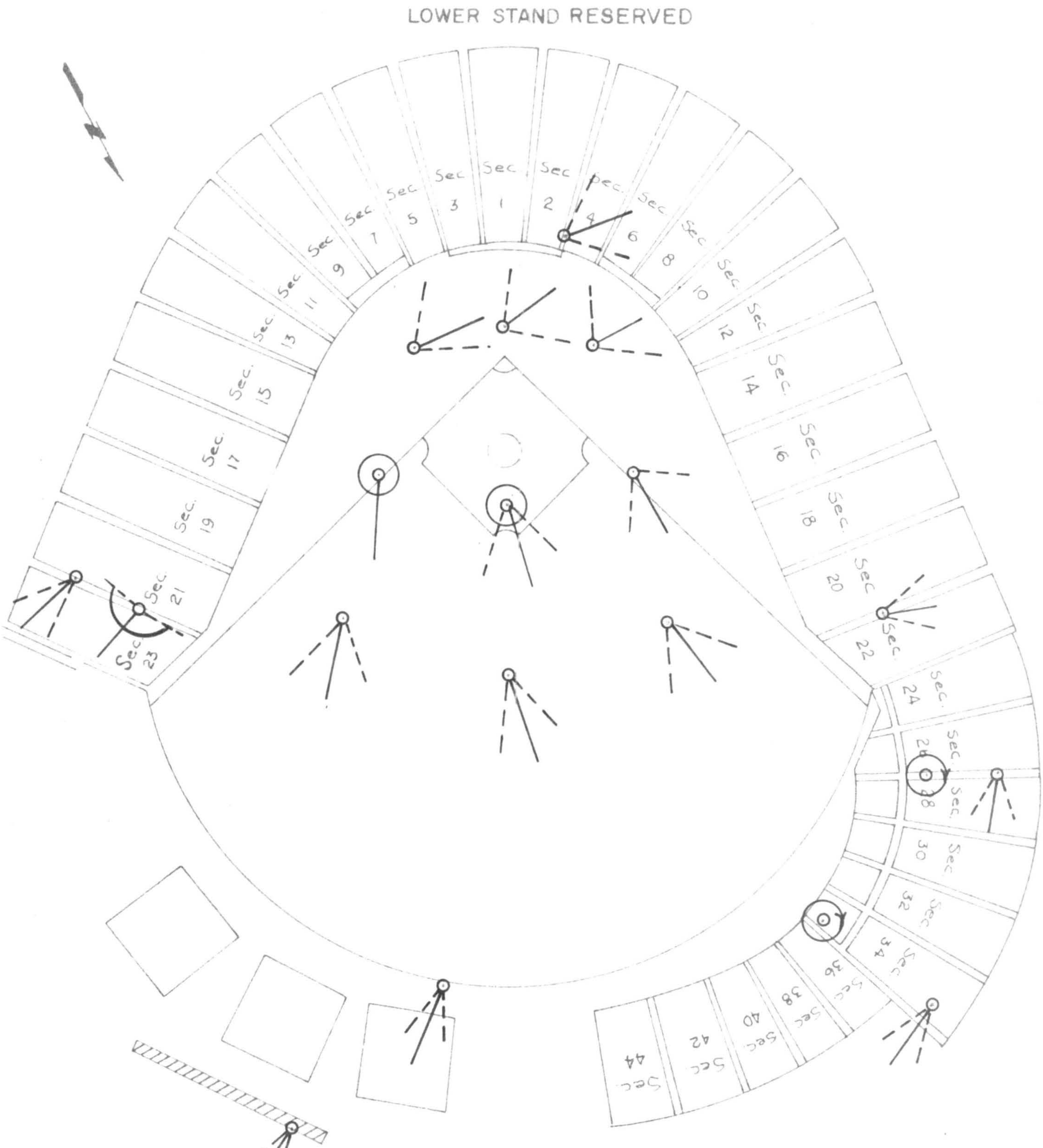


FIG. 39a FLOW PATTERN RUN NO. D9

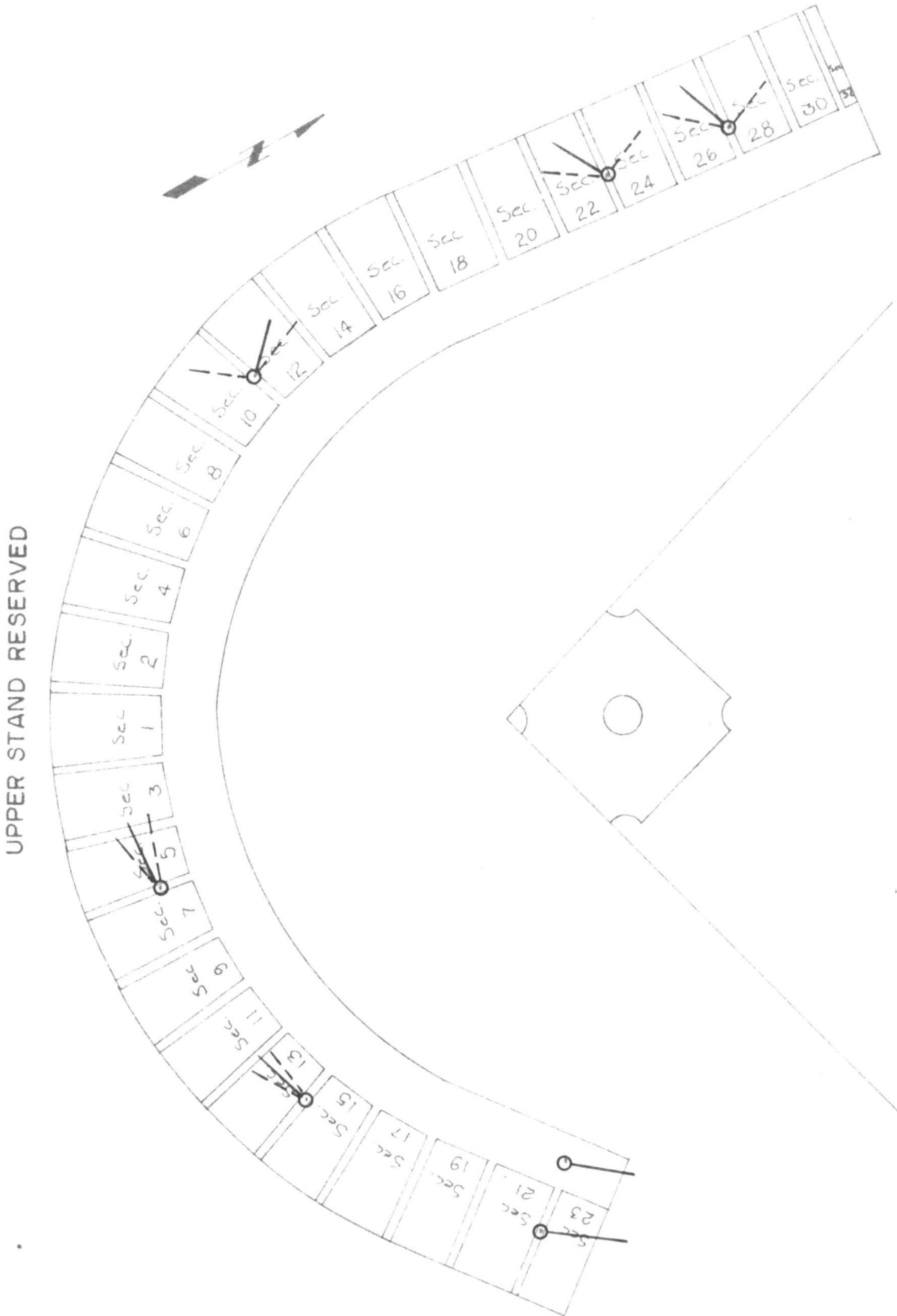


FIG. 39b FLOW PATTERN RUN NO. D9

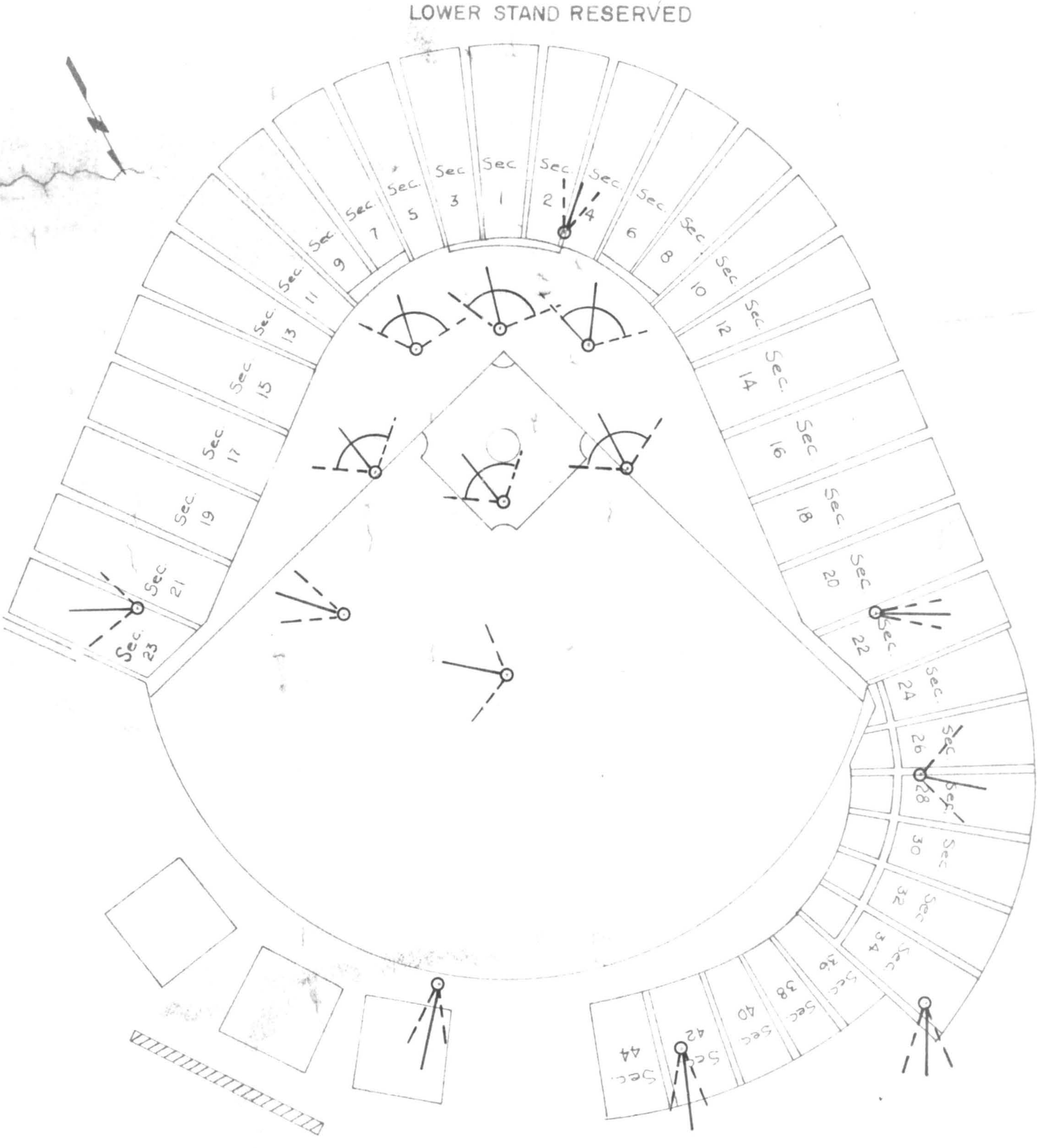


FIG. 40a FLOW PATTERN RUN NO. E3

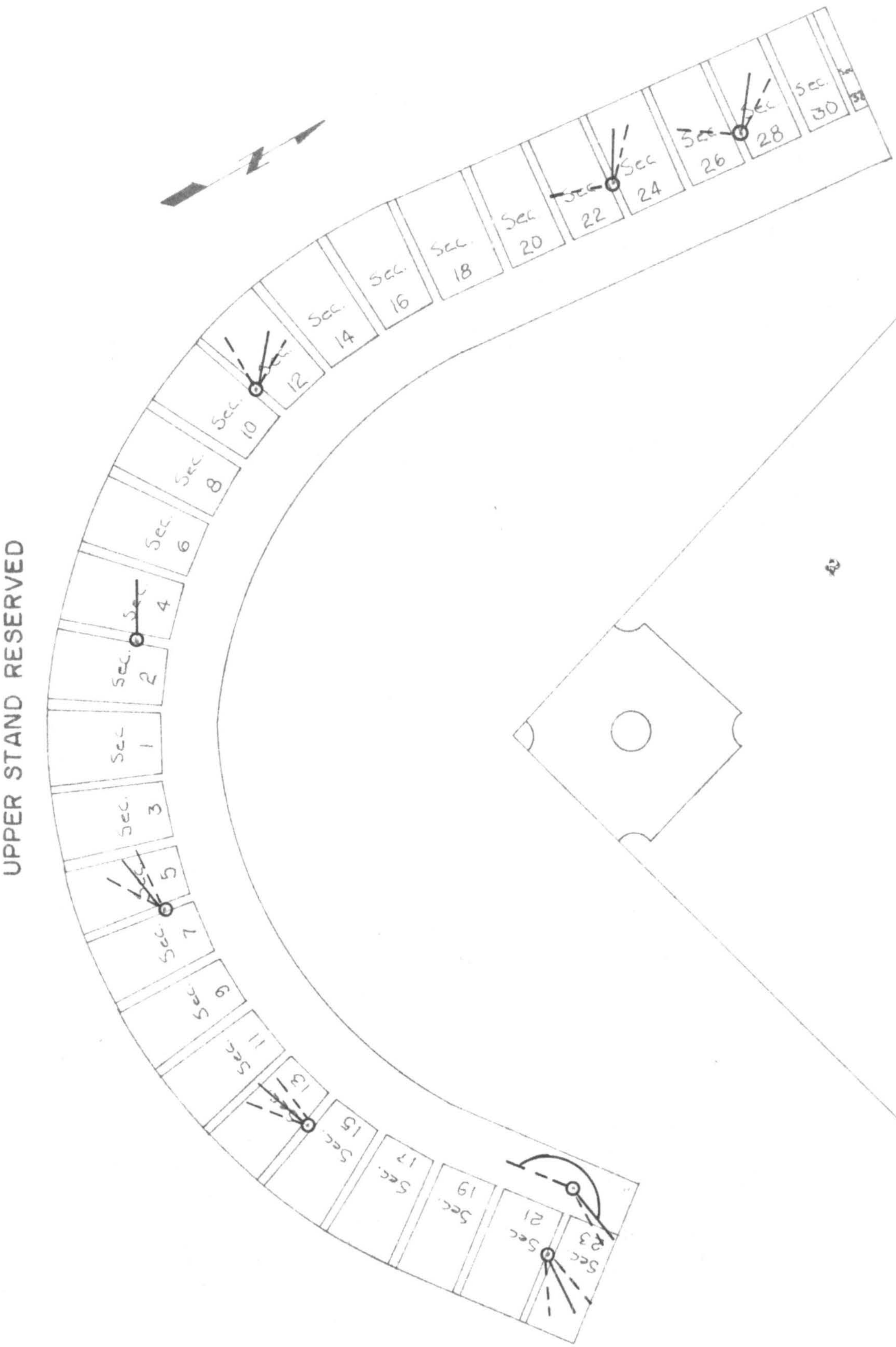


FIG. 40b FLOW PATTERN RUN NO. E3

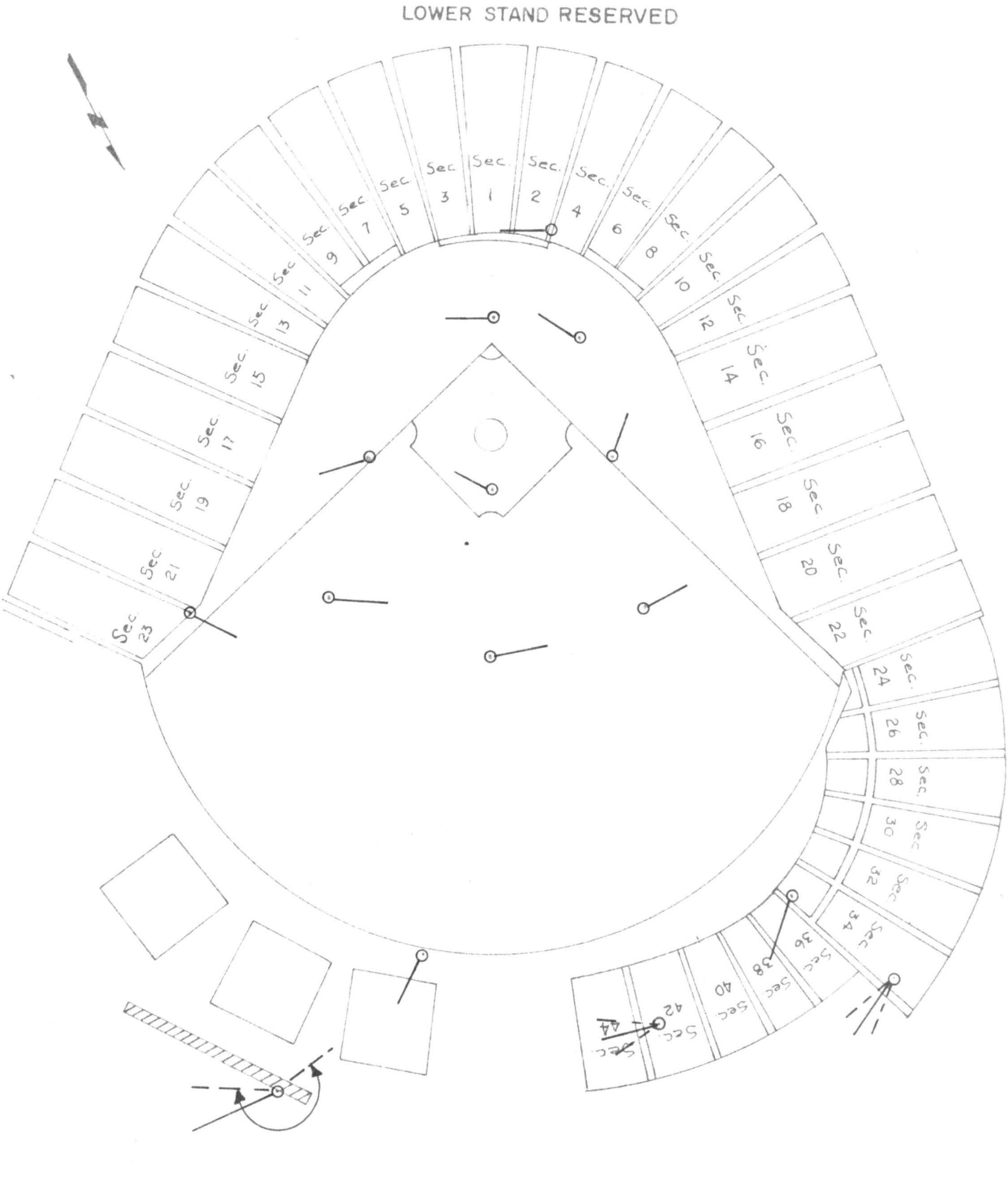


FIG. 4-1a FLOW PATTERN RUN NO. E20

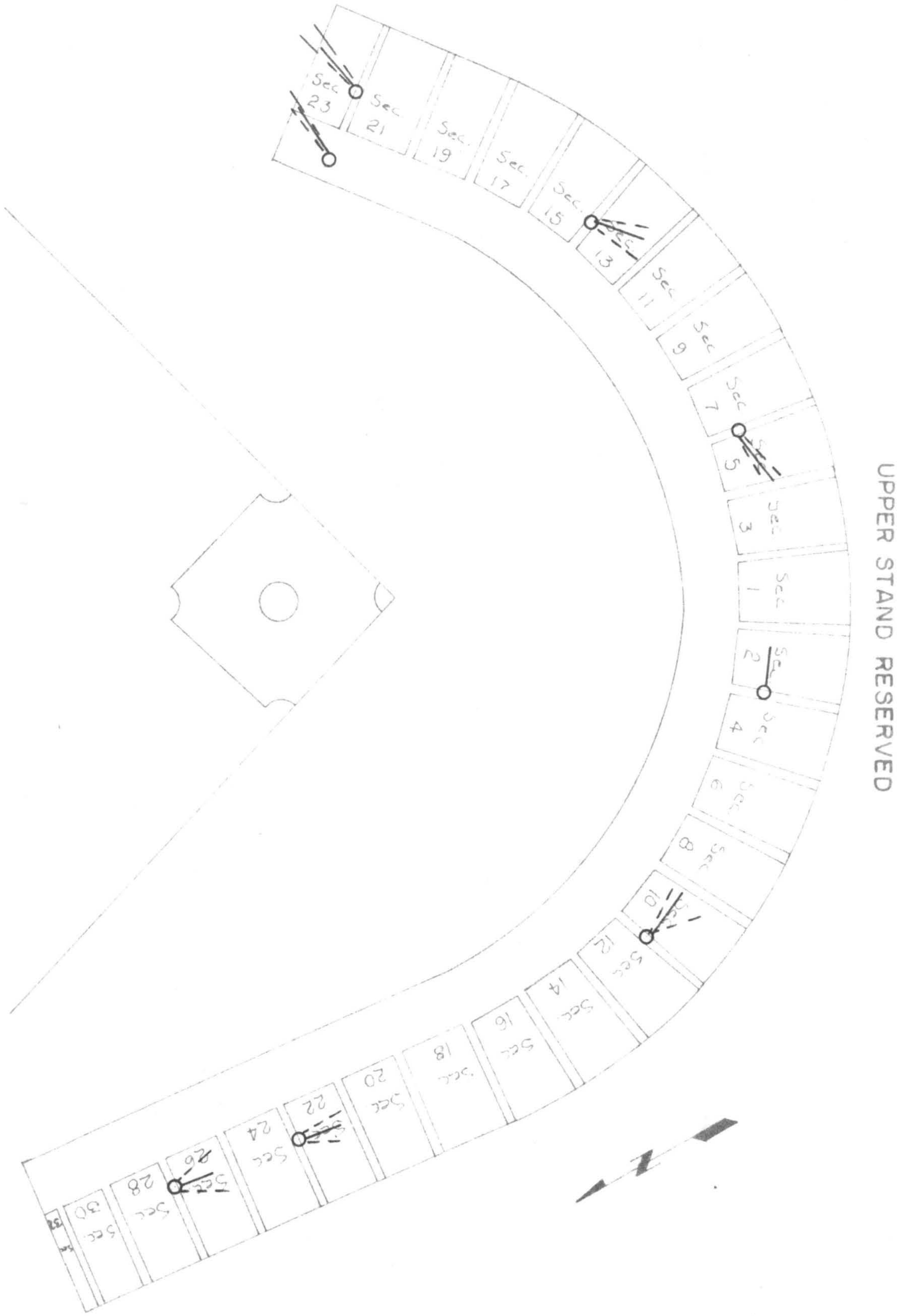
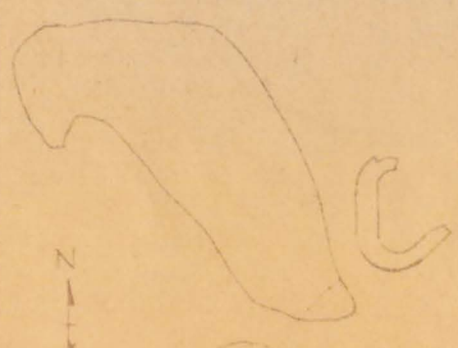
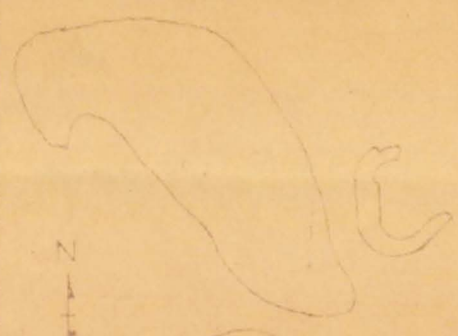
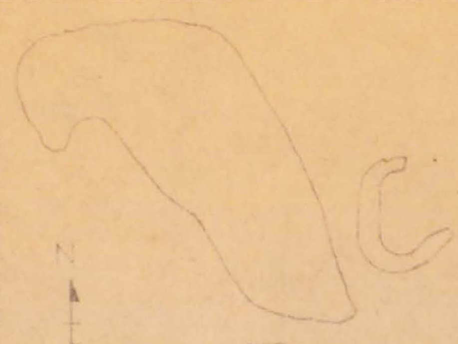
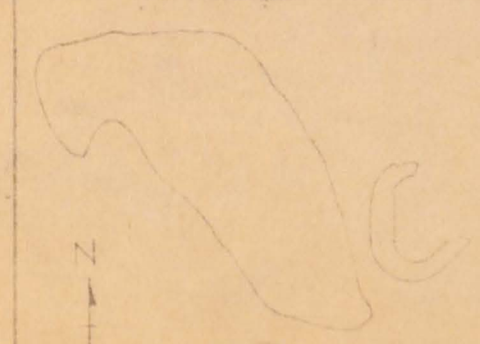


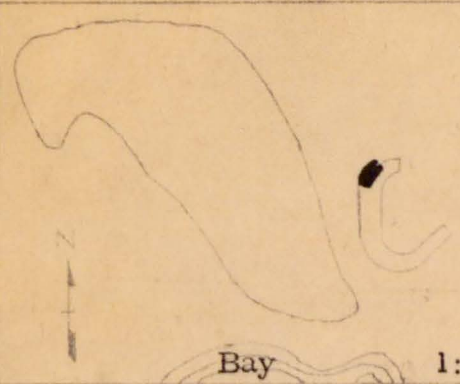
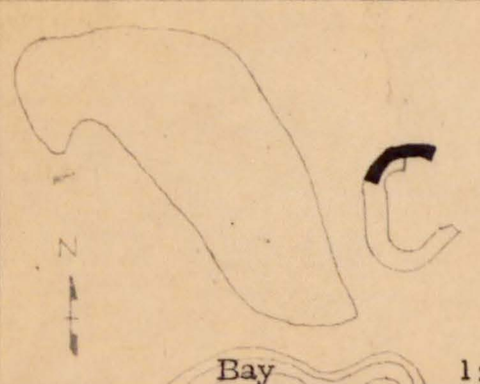
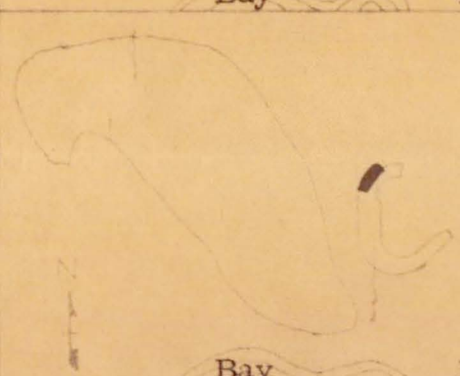
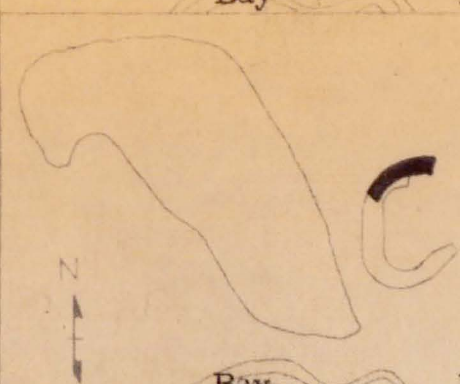
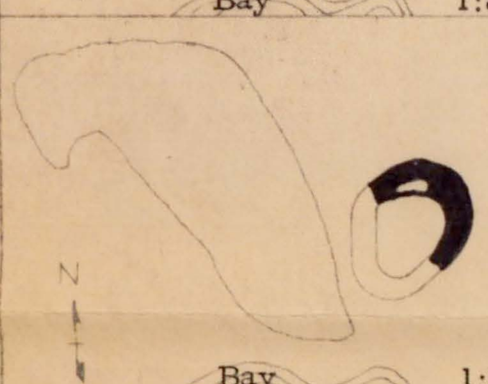
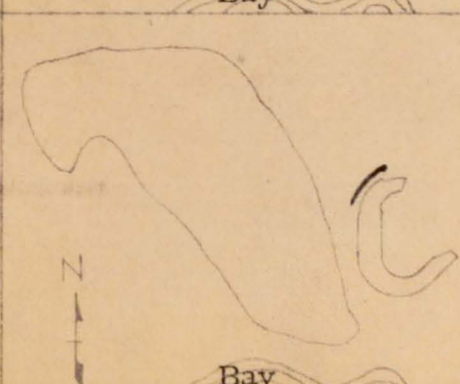
FIG. 41b FLOW PATTERN RUN NO. E 20

Table 2. Details of Modifications

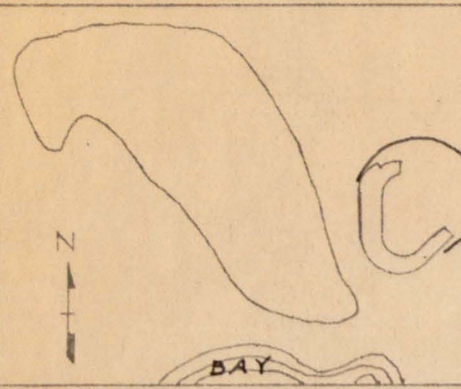
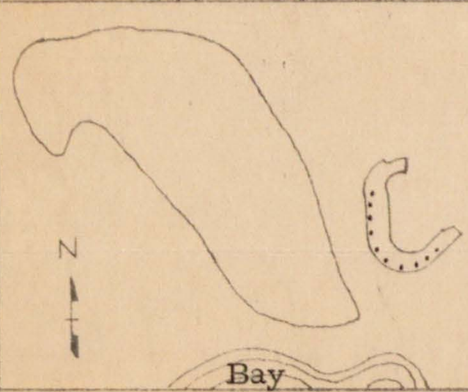
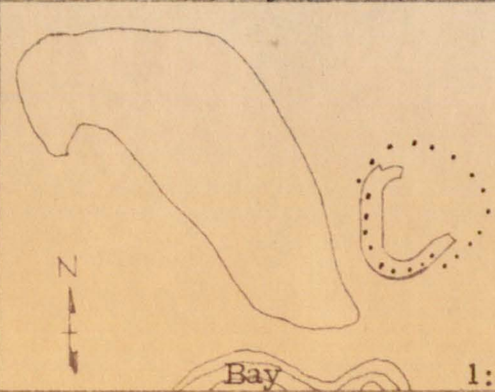
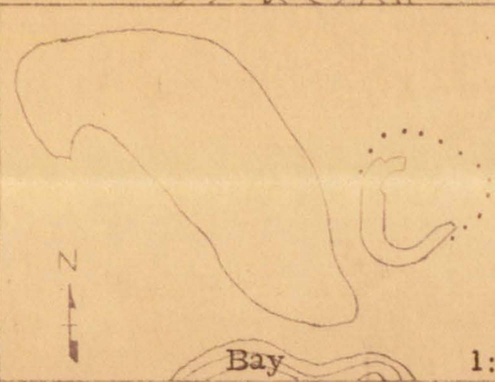
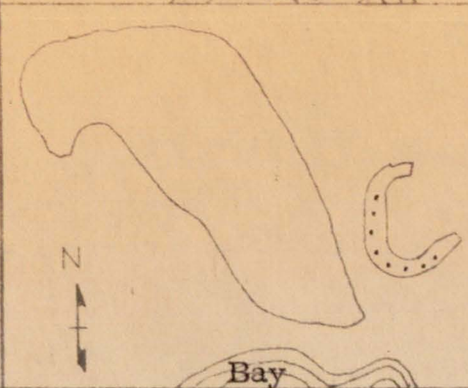
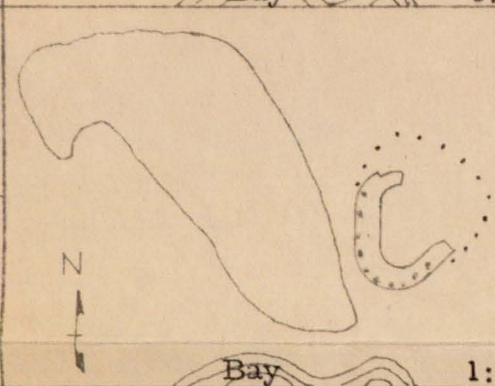
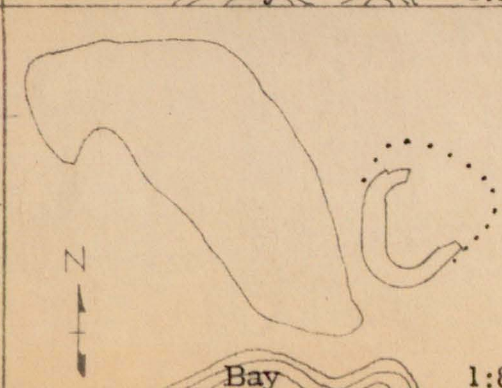
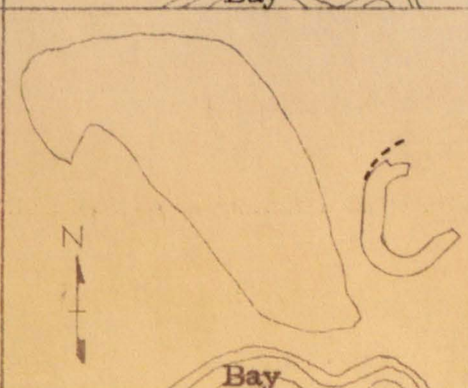
Note: Reel 1 is Correlation Phase ('A' series)

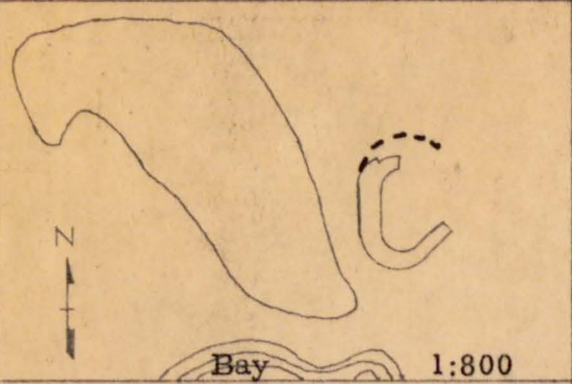
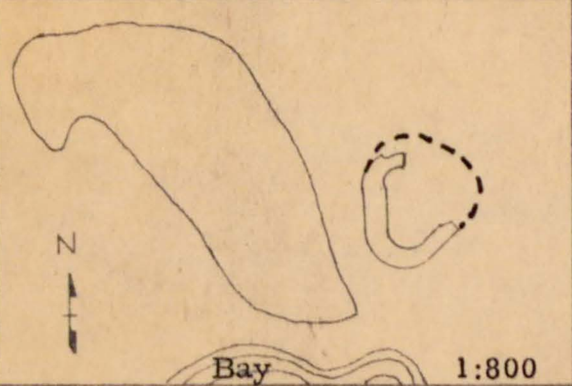
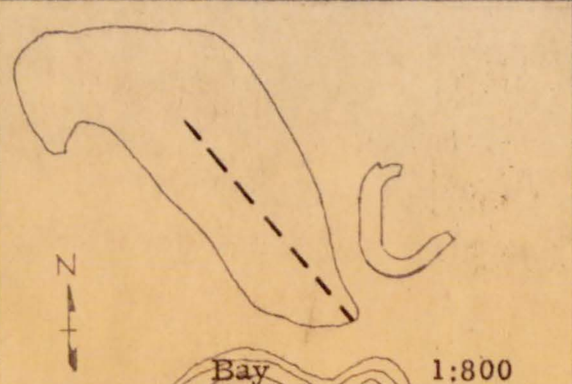
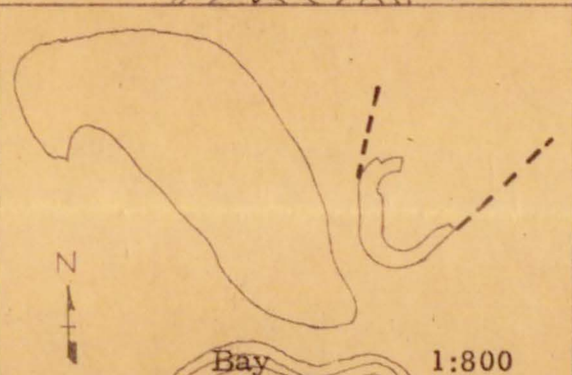
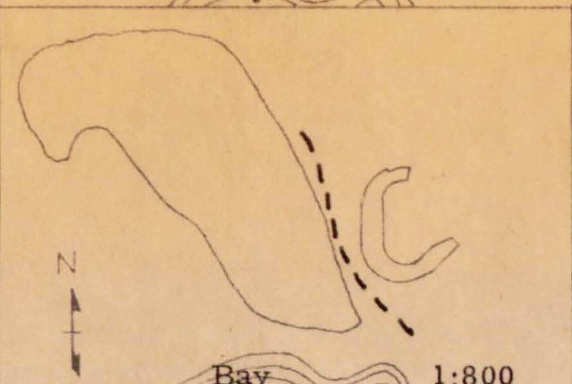
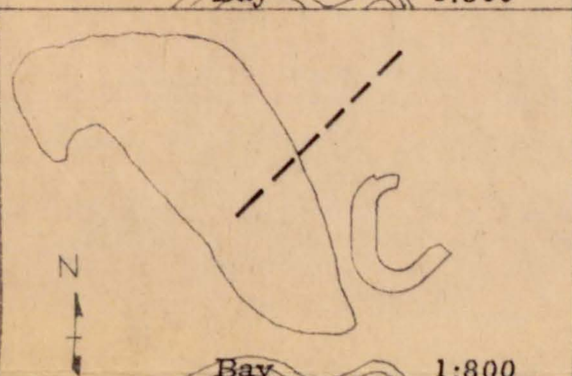
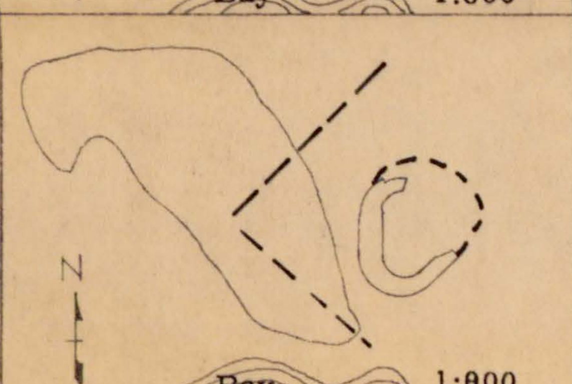
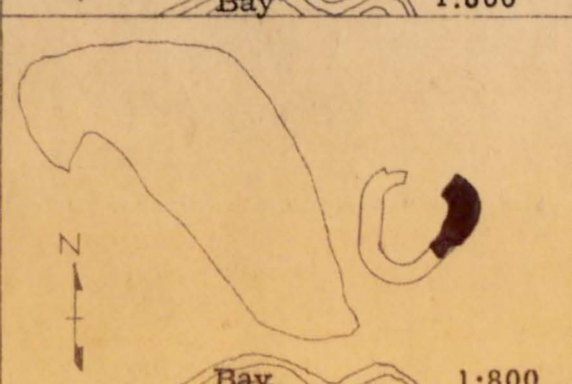
Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in ^{0}S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
A 1	1	 Bay 1:800	30.0 31	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Flow pattern on hill and in stadium Southerly Control	
A 2	1	 Bay 1:800	30.0 31	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Smoke pattern in stadium Southerly Control	
A 3	1	 Bay 1:800	17.7 31	1 8.6 2 3.0 3 2.9 4 2.3	Model-Prototype Correlation Phase Flag pattern in stadium Southerly Control	
A 4	1	 Bay 1:800	30.0 16	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Flow pattern on hill and in stadium Left-Field Control	
A 5	1	 Bay 1:800	30.0 16	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Smoke pattern in stadium Left-Field Control	
A 6	1	 Bay 1:800	17.7 16	1 5.4 2 1.4 3 2.3 4 1.9	Model-Prototype Correlation Phase Flag pattern in stadium Left-Field Control	
A 7	1	 Bay 1:800	30.0 16	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Flag pattern in stadium Left-Field Control	
A 8	1	 Bay 1:800	10.0 21	1 ----- 2 ----- 3 ----- 4 -----	Model-Prototype Correlation Phase Flag pattern in stadium Left-Field Control	

Stadium Modifed (B' series)

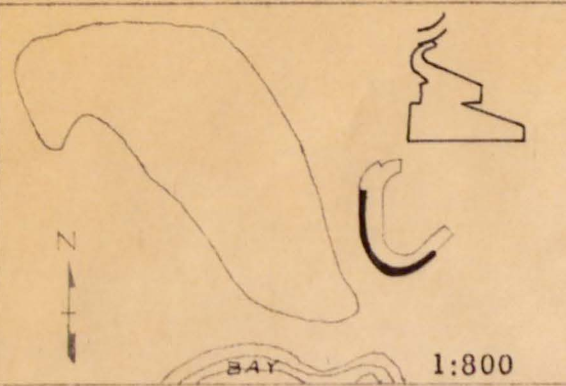
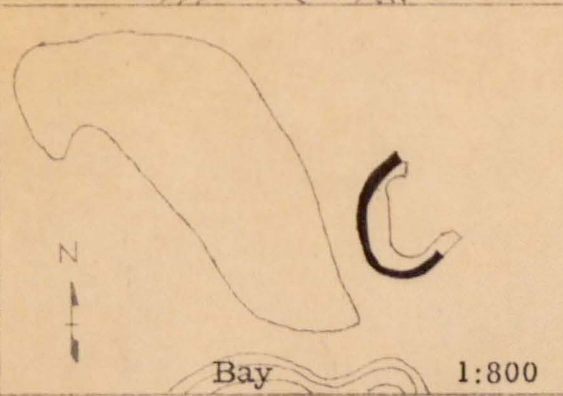
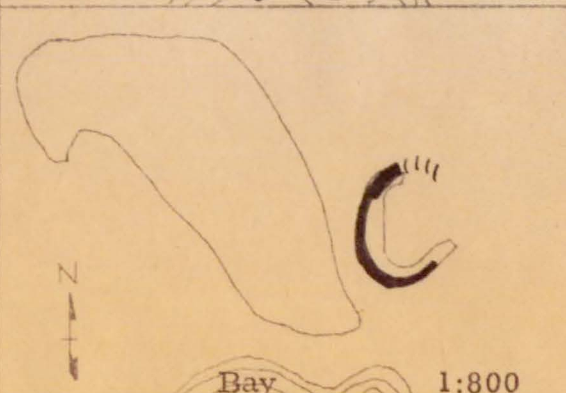
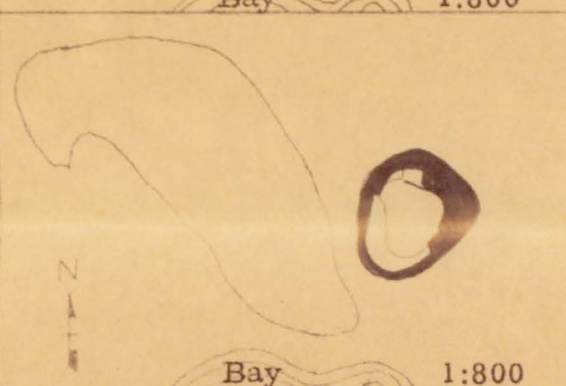
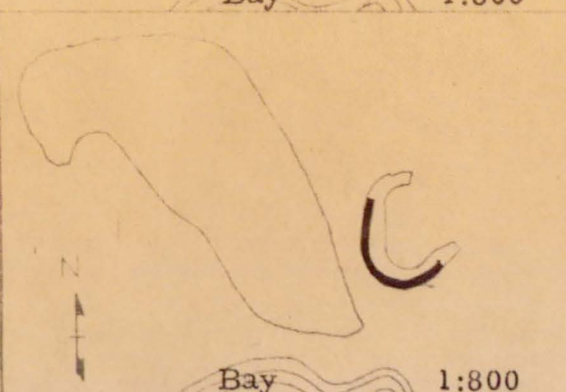
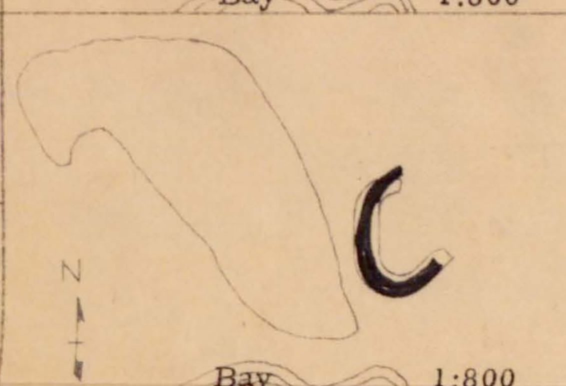
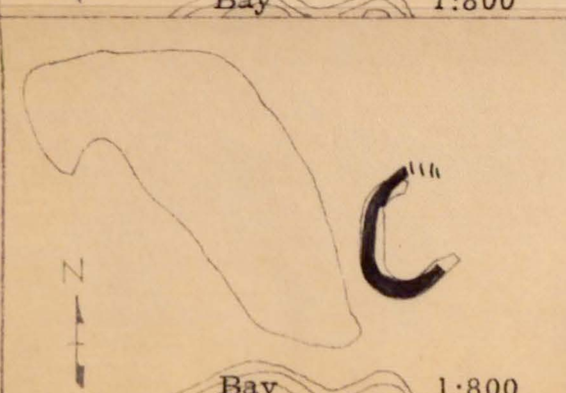
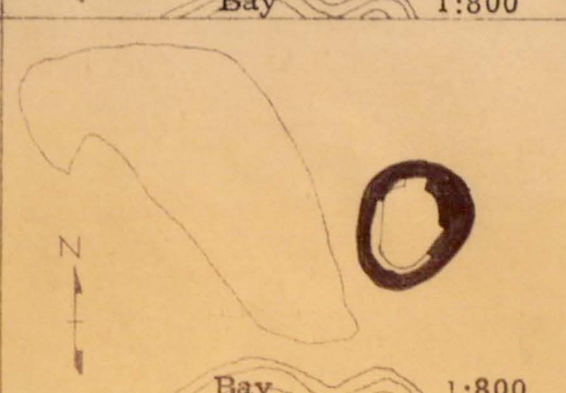
Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in ° S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
B 1	13 a,b 2	 1:800	17.7 31	1: 8.6 2: 3.0 3: 1.6 4: 2.6	HILL: Unmodified STADIUM: Upper stand extended to sec. 34 Southerly Control (Approximately) Very gusty	Poor
B 2	32 a,b 2	 1:800	17.7 31	1: 8.4 2: 2.1 3: 1.7 4: 2.6	HILL: Unmodified STADIUM: Upper stands extended to sec. 44 Southerly Control Gusty	Poor
B 3	13 a,b 2	 1:800	17.7 31	1: 6.5 2: 1.3 3: 3.3 4: 3.4	HILL: Unmodified STADIUM: Upper stands enclose field Southerly Control (Approximately) Reduced gustiness	Poor
B 4	33 a,b 2	 1:800	17.7 16	1: 6.0 2: 3.4 3: 0.7 4: 1.7	HILL: Unmodified STADIUM: Upper stands extended to sec. 34 Field flags point SW perp. to 3rd baseline Very gusty	Poor
B 5	33 a,b 2	 1:800	17.7 16	1: 3.2 2: 3.4 3: 0.8 4: 1.4	HILL: Unmodified STADIUM: Upper stands extended to sec. 44 Similar to B 4	Poor
B 6	33 a,b 2	 1:800	17.7 16	1: 3.0 2: 3.6 3: 1.1 4: 3.6	HILL: Unmodified STADIUM: Upper stands enclose field Similar to B 4 Reduced gustiness	Poor
B7 follows for B 24 B 8	32 a,b 2	 1:800	17.7 16	1: 4.8 2: 3.2 3: 1.2 4: 1.4	HILL: Unmodified STADIUM: Solid screen to sec. 34, height same as upper rim Field flags point generally N Gusty	Poor
B 9	32 a, b 2	 1:800	17.7 16	1: 2.7 2: 3.4 3: 1.3 4: 1.4	HILL: Unmodified STADIUM: Solid screen to sec. 44, height same as upper rim Similar to B 7 Very gusty	Poor

Note: Reels 2 and 3 are Hill Unmodified, Stadium Modified ('B' series)

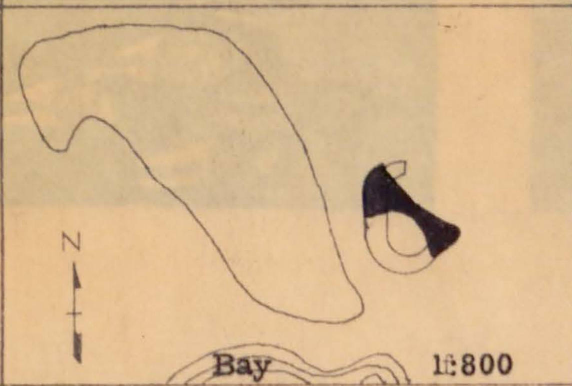
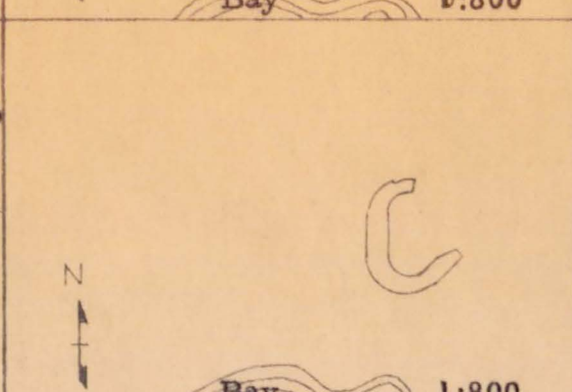
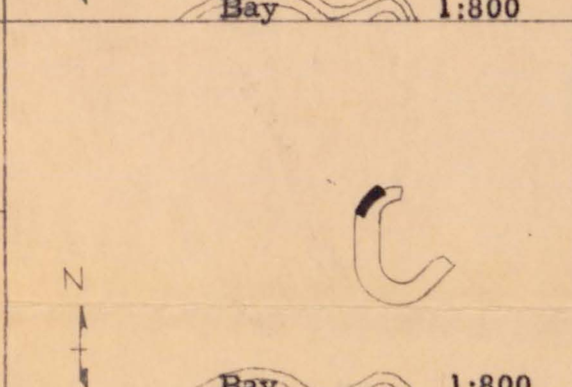
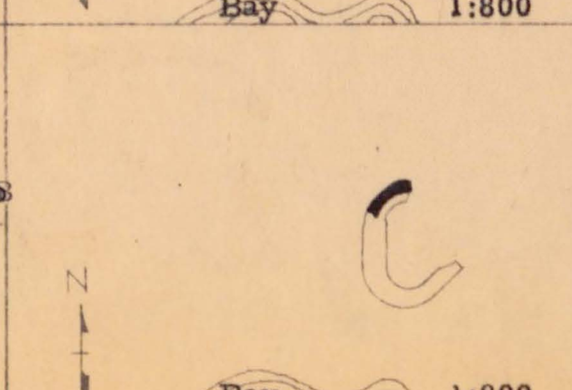
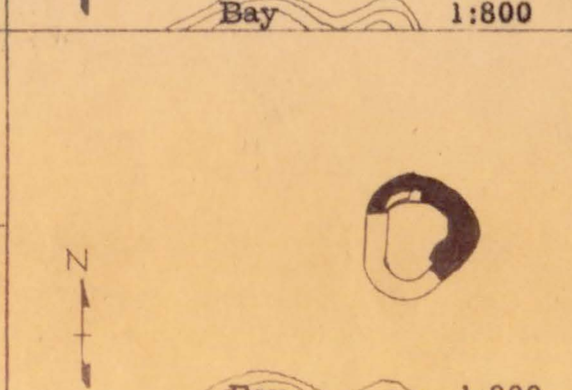
Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
B 10	32 a, b 2	 1:800	17.7 16	1: 3.4 2: 2.0 3: 2.0 4: 2.0	HILL: Unmodified STADIEM: Solid screen encloses field, height same as upper rim Similar to B 7 Gusty	Poor
B 11	13 a, b 2	 1:800	17.7 31	1: ----- 2: ----- 3: ----- 4: -----	HILL: Unmodified STADIUM: 50 ft vertical poles on upper rim Extremely gusty	Poor
B 12	13 a, b 2	 1:800	17.7 31	1: 4.0 2: 1.6 3: 1.3 4: 1.2	HILL: Unmodified STADIUM: 50 ft vertical poles on upper rim and on ground enclosing field Extremely gusty	Poor
B 13	13 a, b 2	 1:800	17.7 31	1: 3.2 2: 1.9 3: 3.5 4: 1.2	HILL: Unmodified STADIUM: 50 ft vertical poles on ground enclosing field Very gusty	Poor
B 14	12 a, b 2	 1:800	17.7 16	1: ----- 2: ----- 3: ----- 4:	HILL: Unmodified STADIUM: 50 ft vertical poles on upper rim Very gusty	Poor
B 15	12 a, b 2	 1:800	17.7 16	1: 4.2 2: 1.8 3: 1.6 4: 1.3	HILL: Unmodified STADIUM: 50 ft vertical poles on upper rim and on ground enclosing field Very gusty	Poor
B 16	12 a, b 2	 1:800	17.7 16	1: 5.7 2: 1.6 3: 1.6 4: 1.6	HILL: Unmodified STADIUM: 50 ft vertical poles on ground enclosing field Very gusty	Poor
B 17	32 a, b 3	 1:800	17.7 16	1: 6.0 2: 3.2 3: 3.4 4: 1.6	HILL: Unmodified STADIUM: Porous screen to sec. 34, height same as upper rim Similar to B 2 Gusty	Poor

Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in ° S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
B 18	32 a, b / 3		17.7 / 16	1: 2.7 2: 3.2 3: 1.8 4: 1.4	HILL: Unmodified STADIUM: Porous screen to sec. 44, height same as upper rim Similar to B 2 Gusty	Poor
B 19	32 a, b / 3		17.7 / 16	1: 2.7 2: 2.7 3: 0.5 4: 1.2	HILL: Unmodified STADIUM: Porous screen on ground enclosing field Similar to B 2	Poor
B 20	33 a, b / 3		17.7 / 16	1: 4.1, 5.8 2: 2.2 3: 2.4 4: 3.2	HILL: Unmodified with porous screen on ridge STADIUM: Unmodified Similar to B 4 Very gusty	Poor
B 21	33 a, b / 3		17.7 / 16	1: ----- 2: ----- 3: ----- 4: -----	HILL: Unmodified STADIUM: Porous screens extending NE along tangent to stadium Extremely gusty	Poor
B 22	12 a, b / 3		17.7 / 16	1: 4.8 2: 2.2 3: 2.3 4: 6.0	HILL: Unmodified with porous screen between stadium and hill STADIUM: Unmodified Left-Field Control Gusty	Poor
B 23	39 a, b / 3		17.7 / 16	1: 5.7 2: 3.1 3: 7.6 4: 17755	HILL: Unmodified with porous screen on Ne-SW line NW of stadium STADIUM: Unmodified Similar to B 4	Poor
B 24	39 a, b / 3		17.7 / 16	1: 5.1 2: 3.8 3: 4.8 4: 5.6	HILL: Unmodified with 100' porous screens STADIUM: 100' porous screen enclosing stadium and field Similar to B 4 Reduced gustiness	Coarse screen Good
B 7	32 a, b / 2		17.7 / 16	1: 11.7 2: 5.6 3: 8.3 4: -----	HILL: Unmodified STADIUM: Upper stand extended to sec. 35 Very gusty	Poor

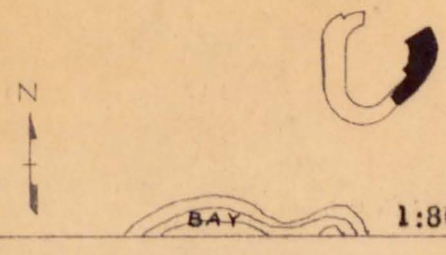
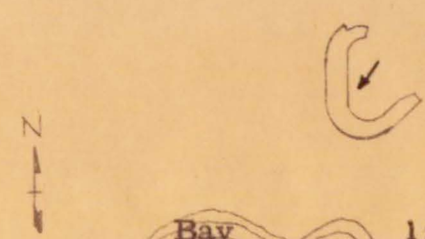
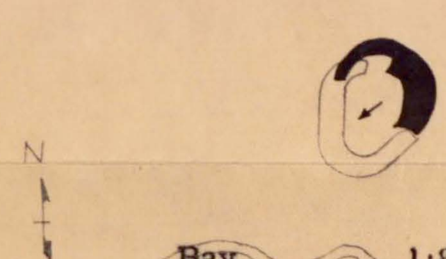
Note: Reel 3 is Hill Unmodified, Stadium Modified ('B' series)

Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in ^{0}S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
B 25	36 a, b 3	 1:800	17.7 31	1: 3.4 2: 1.7 3: 1.3 4: 1.9	HILL: Unmodified STADIUM: Deflector vanes on upper rim Upper stand: Calm field: Gusty	Poor
B 26	36 a, b 3	 1:800	17.7 31	1: 4.7 2: 2.9 3: 1.8 4: 2.2	HILL: Unmodified STADIUM: Upper stand extended to sec. 34 with deflector vanes on entire upper rim Upper stand: Calm Field: Gusty	Poor
B 27	36 a, b 3	 1:800	17.7 31	1: 3.4 2: 2.6 3: 0.9 4: 1.4	HILL: Unmodified STADIUM: Same as B 26 with vertical deflector vanes added beyond sec. 34 Upper stand: Calm Field: Gusty	Poor
B 28	36 a, b 3	 1:800	17.7 31	1: 4.4 2: 1.7 3: 1.6 4: 3.1	HILL: Unmodified STADIUM: Upper stand encloses field with deflector vanes on upper rim to section 44 Upper stands under vanes: calm Field: Gusty	Fair
B 29	33 a, b 3	 1:800	17.7 16	1: 5.6 2: 2.3 3: 2.2 4: 2.1	HILL: Unmodified STADIUM: Same as B 25 Field flags point S Upper stand: Calm Field: Gusty	Poor
B 30	33 a, b 3	 1:800	17.7 16	1: 5.6 2: 1.8 3: 1.1 2.0	HILL: Unmodified STADIUM: Same as B 26 Upper stand: calm Field: Gusty	Poor
B 31	39 a, b 3	 1:800	17.7 16	1: 3.8 2: 2.2 3: 1.2 4: 2.1	HILL: Unmodifed STADIUM: Same as B 27 Field flags point N Upper stand: Calm Field: Gusty	Fair
B 32	33 a, b 3	 1:800	17.7 16	1: 5.0 2: 4.2 3: 0.7 4: 4.4	HILL: Unmodified STADIUM: Same as B 28 Field: Gusty	Poor

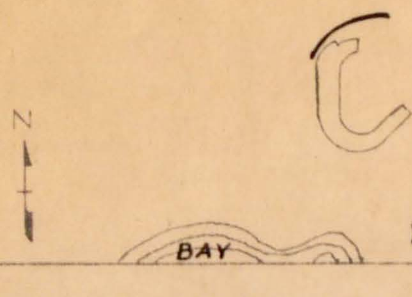
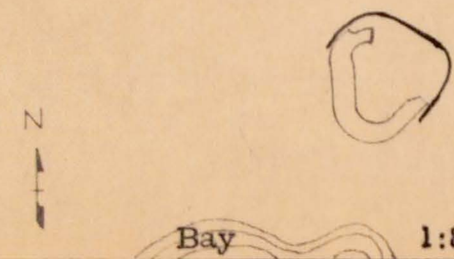
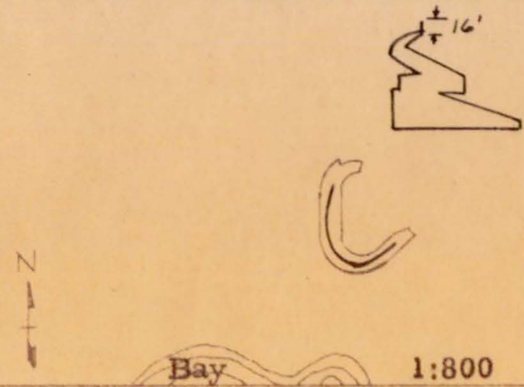
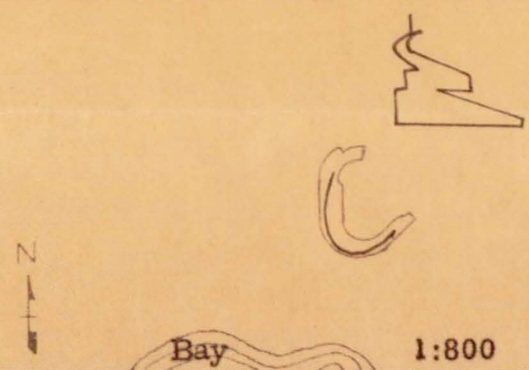
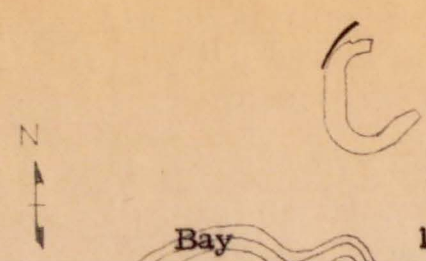
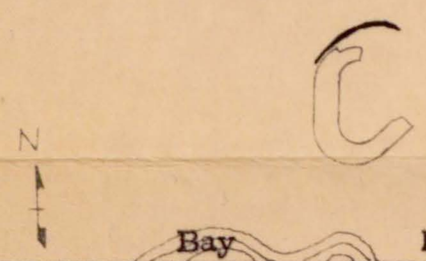
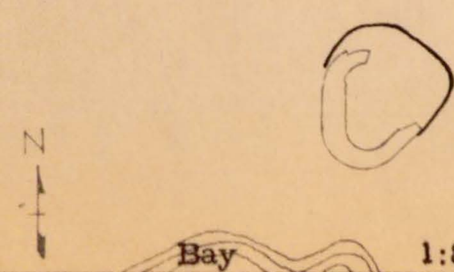
Note: **Reel 3 is Hill Unmodified, Stadium Modified ('B' series); Reel 4 is Hill Removed, Stadium Modified and Unmodified Scale 1:800 ('C' series)**

Run No.	Fig. No. / Reel No.	Sketch	Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
B 33	39 a, b / 3		1:800	17.7 / 31	1: 2.9; 2: 1.2; 3: 0.5; 4: 3.9	HILL: Unmodified STADIUM: Partial dome with large opening over in field. Very gusty	Poor
B 34	35 a, b / 3		1:800	17.7 / 31	1: 3.5; 2: 1.6; 3: 0.6; 4: 3.0	HILL: Unmodified STADIUM: Partial dome. Field flags point to left field. Calm	Good
B 35	35 a, b		1:800	17.7 / 16	1: 12.4; 2: 2.6; 3: 7.8; 4: 4.4	HILL: Unmodified STADIUM: Same as B 33. Very gusty	Poor
B 36	35 a, b / 3		1:800	17.7 / 16	1: 8.5; 2: 2.2; 3: 1.8; 4: 5.8	HILL: Unmodified STADIUM: Same as B 34. Clockwise circulation on field. Reduced gustiness	Poor
C 1	33 a, b / 4		1:800	17.7 / 31	1: 5.9; 2: 3.9; 3: 12.4; 4: 2.6	HILL: Removed STADIUM: Unmodified. Similar to B 4 (Field flags point perp. to 34d baseline). Gusty	Poor
C 2	33 a, b / 4		1:800	17.7 / 31	1: 5.9; 2: 2.5; 3: 1.8; 4: 2.0	HILL: Removed STADIUM: Upper stand extended to sec. 34. Similar to C 1	Poor
C 3	33 a, b / 4		1:800	17.7 / 31	1: 4.4; 2: 3.5; 3: 2.0; 4: 2.4	HILL: Removed STADIUM: Upperstand extended to sec. 44. Similar to C 1	Poor
C 4	33 a, b / 4		1:800	17.7 / 31	1: 8.8; 2: 3.1; 3: 1.5; 4: 3.1	HILL: Removed STADIUM: Upper stand encloses field. Counter-clockwise Circulation in Stadium	Poor

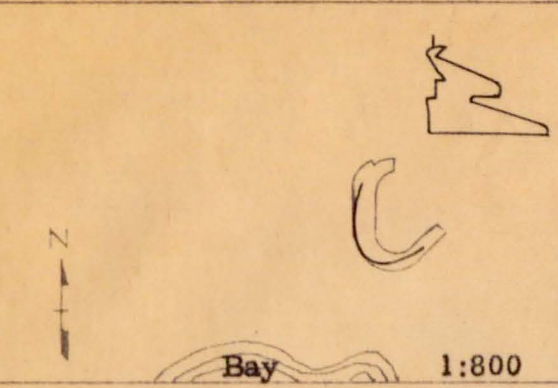
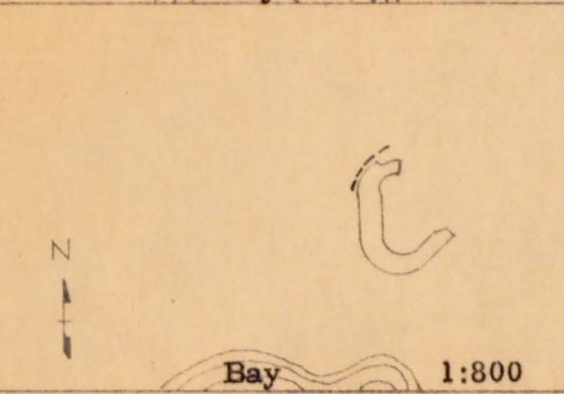
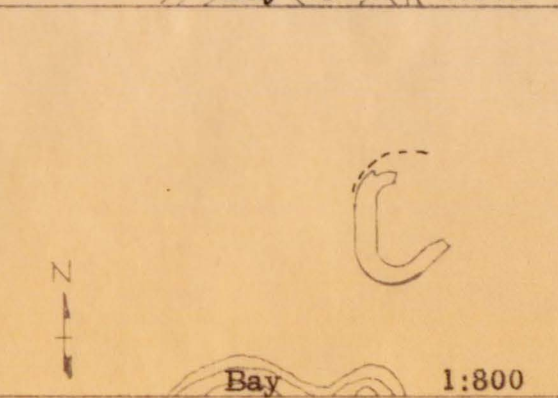
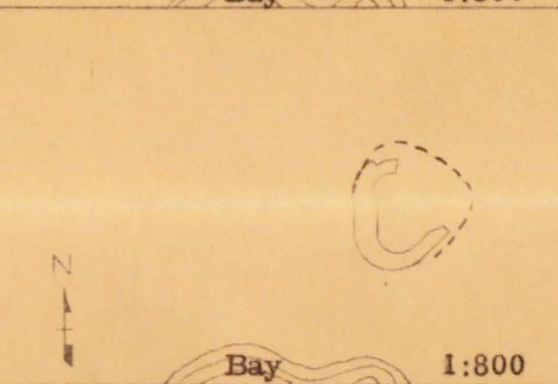
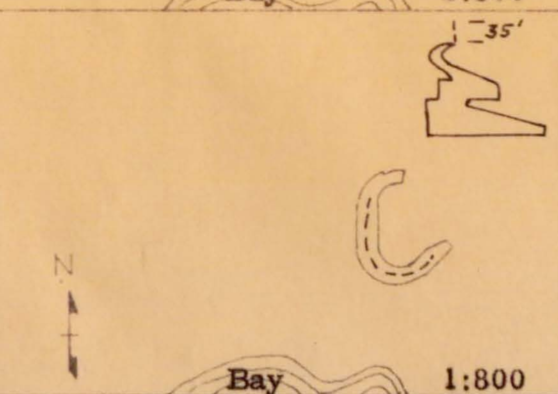
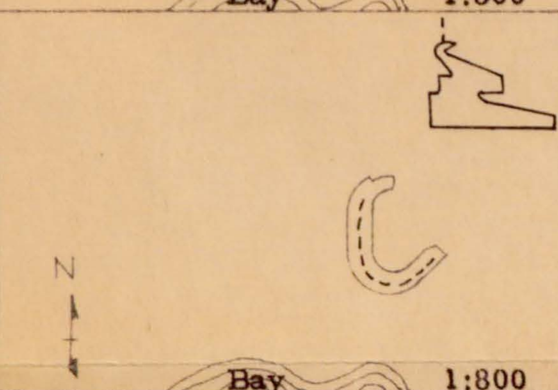
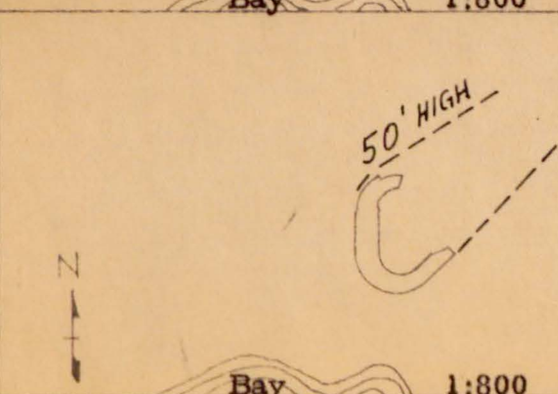
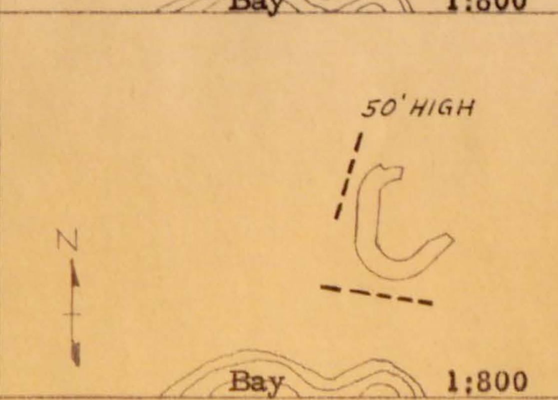
Note: Reel 4 is Hill Removed, Stadium Modified and Unmodified, Scale 1:800 ('C' series)

Run No.	Fig. No. Reel No.	Sketch	Scale	Wind Vel. in MPH Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvem of Flo
C 5	33 a, b 4		1:800	17.7 31	1 8.2 2 4.5 3 4.4 4 3.5	HILL: Removed STADIUM: Upper stand extended to sec. 35 Similar to C 4 Gusty	Poor
C 6	33 a, b 4		1:800	17.7 31	1 5.6 2 1.8 3 1.7 4 3.8	HILL: Removed STADIUM: Upper stand extended to secs. 44 and 35 Similar to C 4	Poor
C 7	35 a, b 4		1:800	17.7 16	1 6.6 2 0.9 3 5.0 4 3.0	H: Removed S: Unmodified Field flags point SW Gusty	Poor
C 8	33 a, b 4		1:800	17.7 16	1 4.3 2 1.4 3 2.1 4 2.8	H: Removed S: Upper stand extended to sec. 34 Similar to B 4 Very Gusty	Poor
C 9	33 a, b 4		1:800	17.7 16	1 4.3 2 2.6 3 1.8 4 2.3	H: Removed S: Upper stands extended to sec. 44 Similar to C 4 Gusty	Poor
C 10	33 a, b 4		1:800	17.7 16	1 5.8 2 1.9 3 2.5 4 2.8	H: Removed S: Upper stand encloses field Similar to B 4 Gusty	Poor
C 11	35 a, b 4		1:800	17.7 16	1 4.9 2 2.8 3 10.4 4 3.6	H: Removed S: Upper stand extended to sec. 35 Clockwise circulation Very gusty	Poor
C 12	33 a, b 4		1:800	17.7 31	1 3.9 2 1.9 3 2.3 4 1.7	H: Removed S: Solid screen to sec. 34, height same as upper rim Similar to B 4 Gusty	Poor

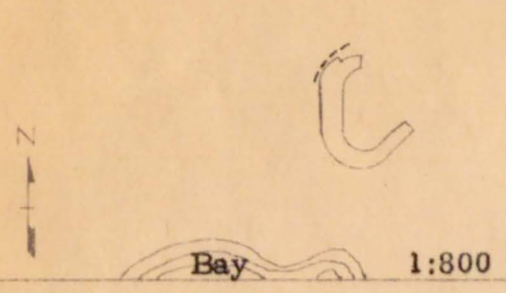
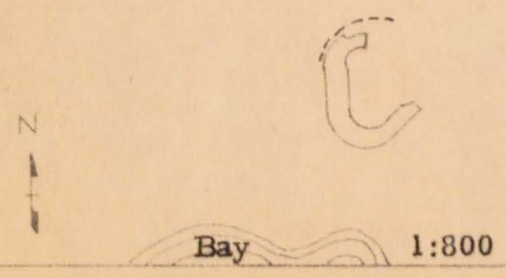
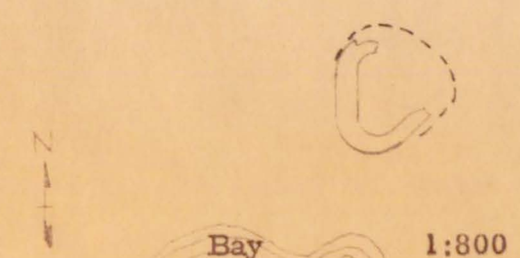
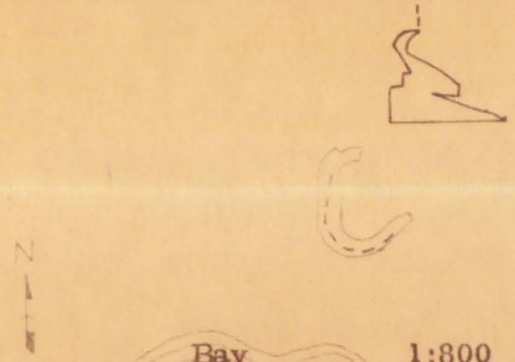
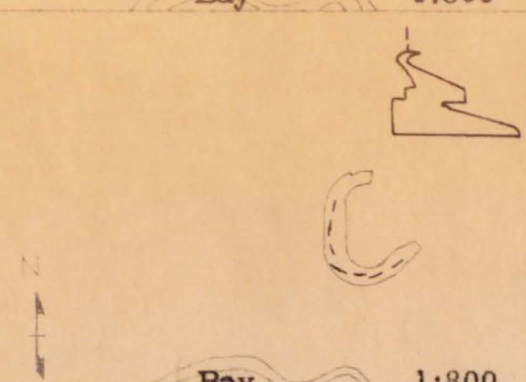
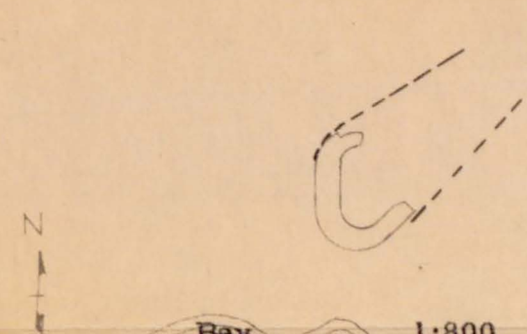
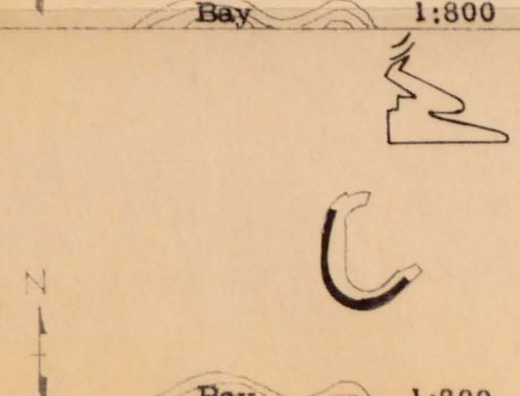
Note: Reel 4 is Hill Removed, Stadium Modified and Unmodified,
Scale 1:800 ('C' series)

Run No.	Fig. No. / Reel No.	Sketch	Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvemen of Flow
C 13	33 a, b / 4		1:800	17.7 / 31	1: 4.9 2: 2.1 3: 3.0 4: 2.2	H: Removed S: Solid screen to sec. 44, height same as upper rim Similar to C 4 Gusty	Poor
C 14	33 a, b / 4		1:800	17.7 / 31	1: 4.9 2: 2.1 3: 3.0 4: 3.4	H: Removed S: Solid screen incloses field; height same as upper rim Similar to C 4	Poor
C 15	33 a, b / 4		1:800	17.7 / 31	1: 4.1 2: 4.4 3: 1.8 4: 1.8	H: Removed S: Solid screen on upper rim (outer edge) Very gusty	Poor
C 16	33 a, b / 4		1:800	17.7 / 31	1: 3.7 2: 4.2 3: 3.4 4: 1.6	H: Removed S: Solid screen on upper rim (10' back of outer edge) Very gusty	Poor
C 17	33 a, b / 4		1:800	17.7 / 16	1: 4.1 2: 2.8 3: 0.6 4: 2.8	H: Removed S: Same as C 12 Very gusty	Poor
C 18	33 a, b / 4		1:800	17.7 / 16	1: 3.2 2: 2.6 3: 0.7 4: 1.7	H: Removed S: Same as C 13 Very gusty	Poor
C 19	33 a, b / 4		1:800	17.7 / 16	1: 3.2 2: 0.9 3: 2.2 4: 2.8	H: Removed S: Same as C 14 Similar to C 4	Poor
C 20	33 a, b / 4		1:800	17.7 / 16	1: 3.7 2: 2.3 3: 3.7 4: 1.4	H: Removed S: Same as C 15 Similar to B 4 Very Gusty	Poor

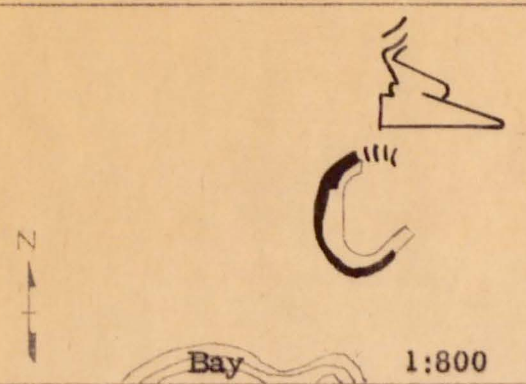
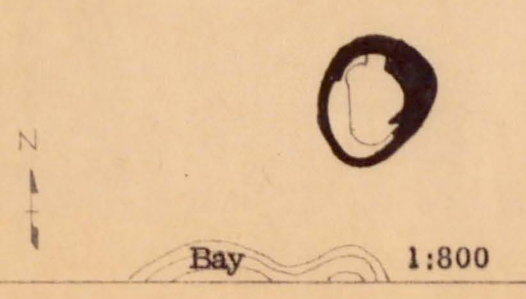
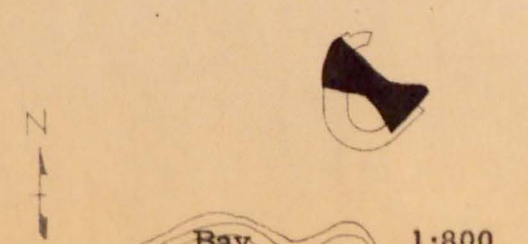
Note: Reel 4 - Stadium Modified and Unmodified
Hill removed, 1:800 ('C' series)

Run No.	Fig. No. Reel No.	Sketch Scale	Wind Vel. in MPH Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
C 21	33 a, b 4	 1:800	17.7 16	1 4.1 2 2.7 3 7.4 4 1.6	H: Removed S: Similar to C 16 Erratic Gusty	Poor
C 22	33 a, b 4	 1:800	17.7 31	1 2.6 2 2.6 3 4.3 4 2.9	H: Removed S: Porous screen to sec. 34, height same as upper rim Upper stand: Calm Field: Gusty	Fair
C 23	33 a, b 4	 1:800	17.7 31	1 3.1 2 3.1 3 4.8 4 2.0	H: Removed S: Porous screen to sec. 44, height same as upper rim Similar to C 22	Fair
C 24	33 a, b 4	 1:800	17.7 31	1 5.0 2 2.3 3 7.1 4 5.7	H: Removed S: Porous screen encloses field, height same as upper rim Counter-clockwise circulation	Poor
C 25	33 a, b 4	 1:800	17.7 31	1 4.4 2 2.0 3 2.7 4 3.9	H: Removed S: Porous screen on rim(outer edge) Erratic	Poor
C 26	33 a, b 4	 1:800	17.7 31	1 3.9 2 2.7 3 4.2 4 1.4	H: Removed S: Porous screen on rim (10' back of outer edge) Counter-clockwise circulation Gusty	Poor
C 27	36 a, b 4	 1:800	17.7 31	1 4.7 2 1.8 3 10.9 4 2.2	H: Removed S: Porous screen extending SW from ends of stand Erratic	Poor
C 28	33 a, b 4	 1:800	17.7 31	1 8.6 2 4.0 3 8.1 4 2.3	H: Removed S: Unmodified - porous screen to S and W of stadium Counter-clockwise circulation Gusty	Poor

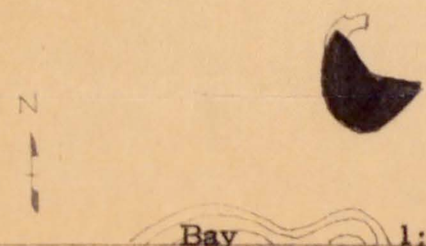
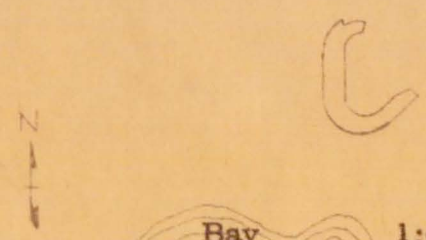
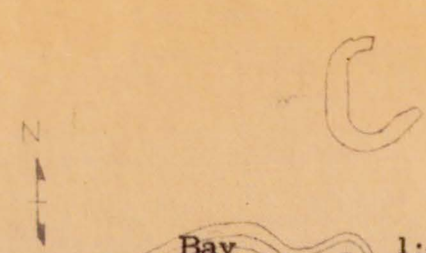
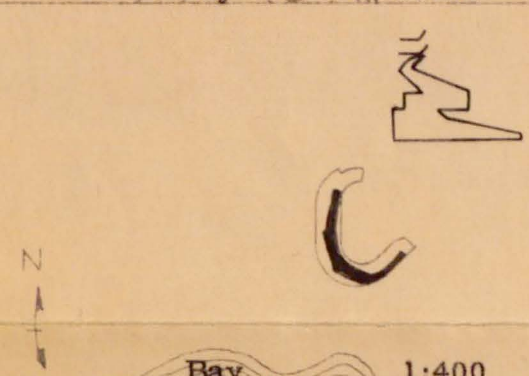
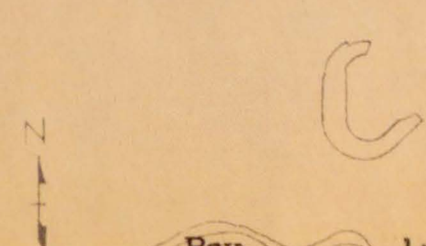
Note: Reel 5 is Hill Removed,
Stadium Modified and Unmodified, 1/800 and 1/400

Run No.	Fig. No. / Reel No.	Sketch	Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
C 29	36 a, b 5		1:800	17.7 16	1 7.2 2 2.5 3 10.4 4 2.0	H: Removed S: Same as C 22 Erratic	Poor
C 30	36 a, b 5		1:800	17.7 16	1 7.0 2 2.9 3 8.7 4 2.4	H: Removed S: Same as C 23 Very gusty	Poor
C 31	36 a, b 5		1:800	17.7 16	1 4.4 2 2.4 3 4.9 4 3.3	H: Removed S: Same as C 24 Erratic	Poor
C 32	36 a, b 5		1:800	17.7 16	1 6.0 2 2.0 3 3.4 4 3.7	H: Removed S: Same as C 25	Poor
C 33	36 a, b 5		1:800	17.7 16	1 4.1 2 2.7 3 7.4 4 1.4	H: Removed S: Same as C 26 Erratic	Poor
C 34	36 a, b 5		1:800	17.7 16	1 9.4 2 4.0 3 15.0 4 4.5	H: Removed S: Same as C 27	Poor
C 35	37 a, b 5		1:800	17.7 31	1 4.8 2 2.7 3 14.2 4 1.0	H: Removed S: Deflector vanes in upper rim Counter-clockwise circulation Upper stands: Calm Field: Gusty	Poor
C 36	37 a, b 5		1:800	17.7 31	1 5.1 2 2.1 3 0.4 4 1.1	H: Removed S: Upper stands extended to sec. 44 with deflector vanes on entire top rim Similar to C 36	Poor

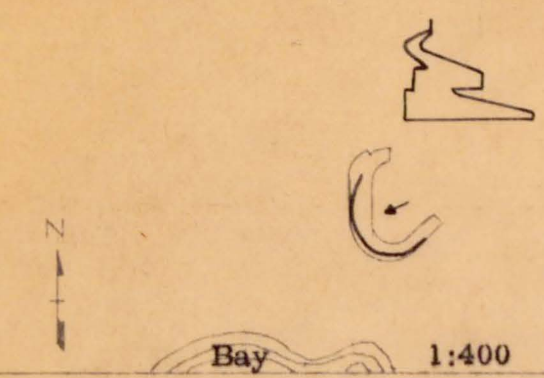
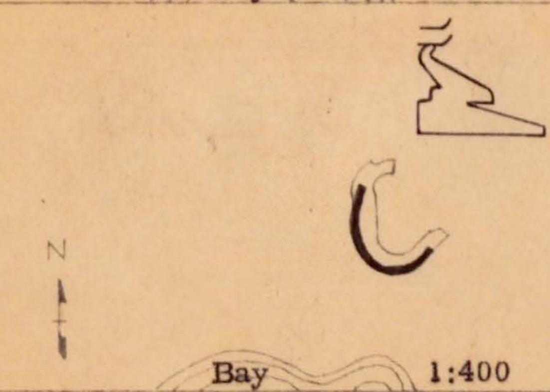
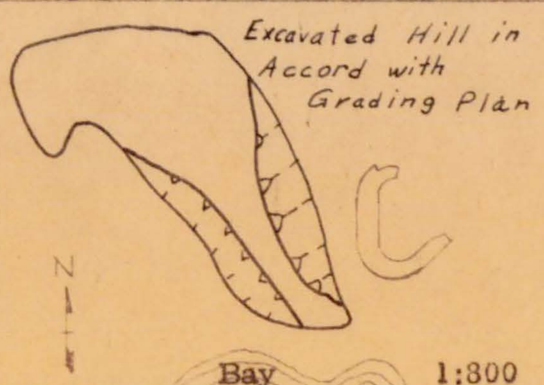
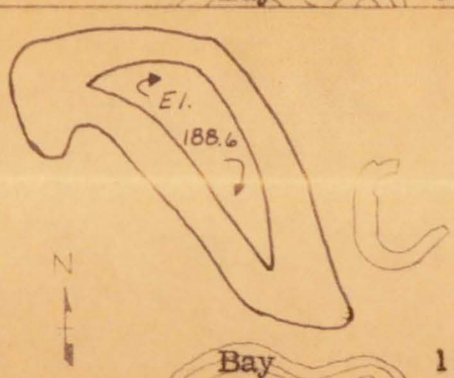
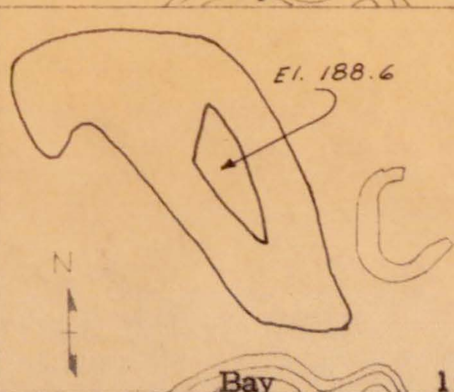
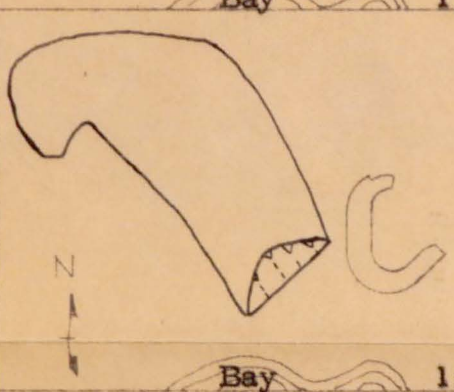
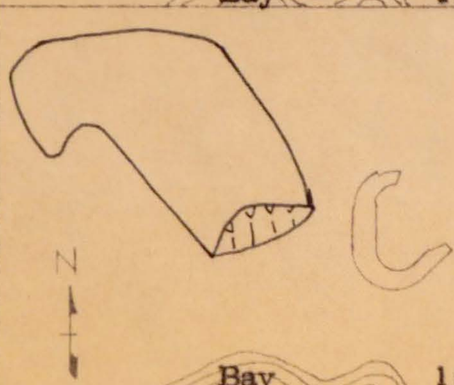
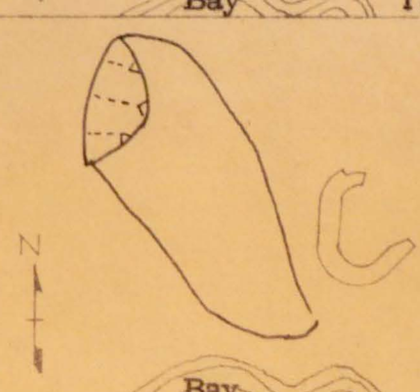
Note: Reel 5 is Hill Removed,
Stadium Modified and Unmodified,
1/800 and 1/400

Run No.	Fig. No. / Reel No.	Sketch	Scale	Wind Vel. in MPH / Direct. in ^{0}S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
C 37	38 a, b / 5		1:800	17.7 / 31	1: 3.9; 2: 2.8; 3: 2.3; 4: 2.3	H: Removed S: Upper stands extended to sec. 44 with deflector vanes on upper rim and vert. vanes beyond sec. 44 Calm	Fair
C 38	38 a, b / 5		1:800	17.7 / 31	1: 4.8; 2: 2.2; 3: 1.9; 4: 4.7	H: Removed S: Upper stands encloses field with deflector vanes on upper rim to sec. 44 Erratic	Poor
C 39	33 a, b / 5		1:800	17.7 / 16	1: 7.6; 2: 6.7; 3: 14.2; 4: 2.0	H: Removed S: Same as C 35 Erratic Upper stands: Calm	Poor
C 40	38 a, b / 5		1:800	17.7 / 16	1: 3.2; 2: 1.4; 3: 1.2; 4: 2.8	H: Removed S: Same as C 36 Upper stands: Calm Field: Gusty	Poor
C 41	38 a, b / 5		1:800	17.7 / 16	1: 3.8; 2: 2.3; 3: 3.3; 4: 1.4	H: Removed S: Same as C 37 Upper stands: Calm Field: Gusty	Fair
C 42	33 a, b / 5		1:800	17.7 / 16	1: 5.7; 2: 2.8; 3: 2.2; 4: 6.8	H: Removed S: Same as C 38 Similar to B 4	Poor
C 43	33 a, b / 5		1:800	17.7 / 31	1: 4.4; 2: 2.2; 3: 2.0; 4: 0.7	H: Removed S: Partial dome open over infield Erratic	Poor
C 44	/ 5		1:800	17.7 / 31	1: 3.5; 2: 1.2; 3: 0.5; 4: 0.8	H: Removed S: Partial dome over playing field Very Calm	Excellent

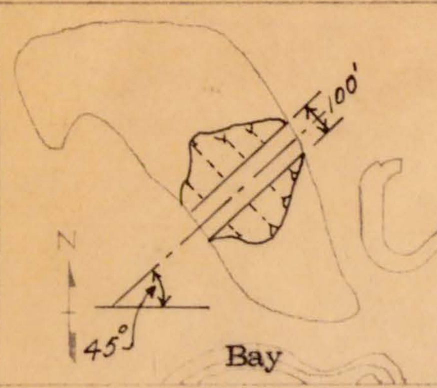
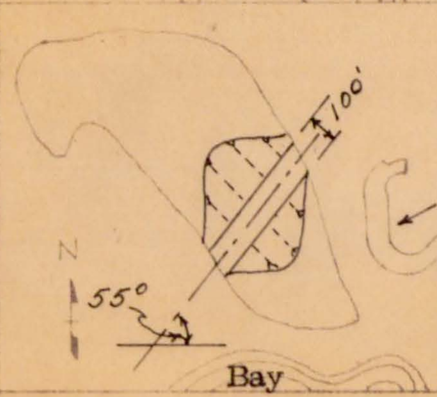
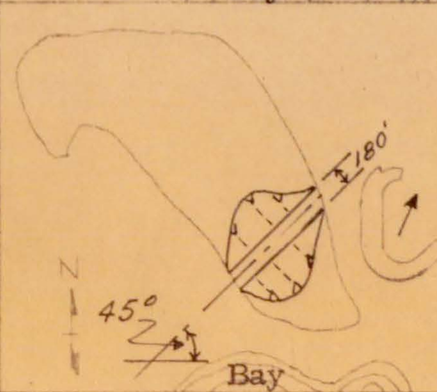
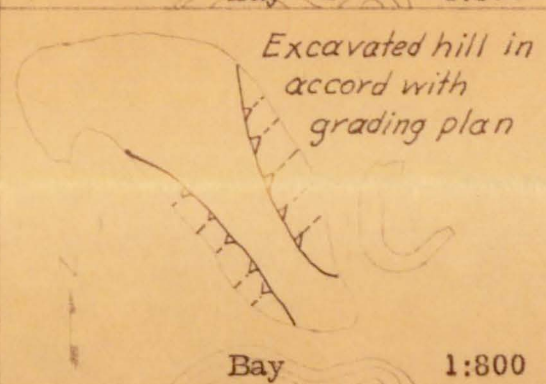
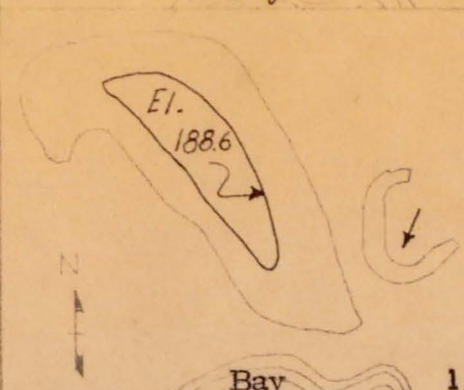
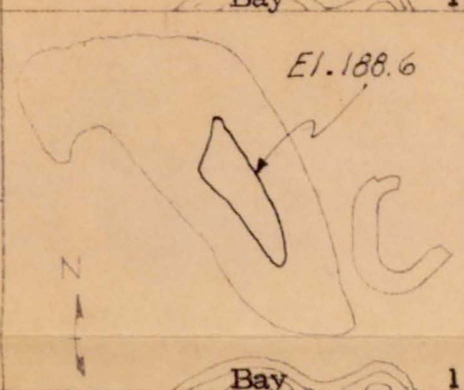
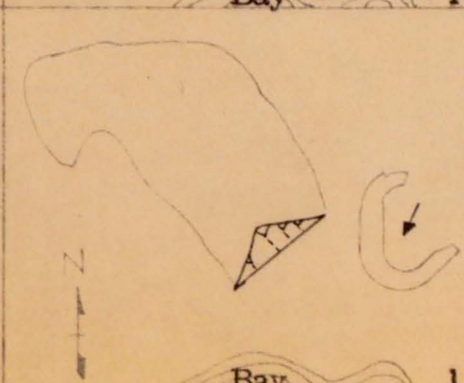
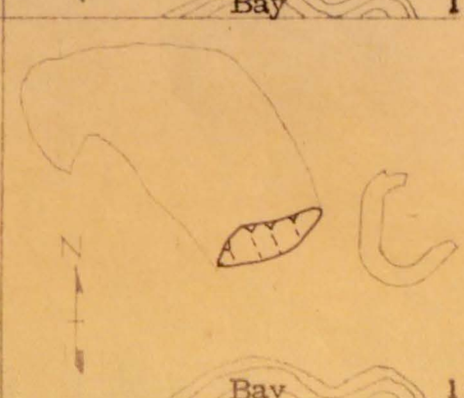
Note: Reel 5 is Hill Removed,
Stadium Modified and Unmodified,
1/800 and 1/400

Run No.	Fig. No. Reel No.	Sketch	Scale	Wind Vel. in MPH Direct. in ^{0}S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
C 45	33 a, b 5	 Bay	1:800	17.7 16	1 2.6 2 3.2 3 1.1 4 7.8	H: Removed S: Same as C 43 Similar to B 4 Gusty	Poor
C 46	5	 Bay	1:800	17.7 16	1 3.3 2 0.9 3 0.6 4 0.6	H: Removed S: Same as C 44 Gusty in center field Calm at all other locations	Excellent
C 47	36 a, b 5	 Bay	1:400	17.7 31	1 10.4 2 2.1 3 10.7 4 1.7	H: Removed S: Unmodified Similar to B 4 Gusty	Poor
C 48	36 a, b 5	 Bay	1:400	17.7 31	1 3.5 2 2.2 3 3.9 4 1.0	H: Removed S: Solid screen incloses field Similar to C 47	Poor
C 49	36 a,b 5	 Bay	1:400	17.7 31	1 2.0 2 1.0 3 8.5 4 1.0	H: Removed S: Solid screen on upper rim 32' high Erratic	Poor
C 50	36 a, b 5	 Bay	1:400	17.7 31	1 -- 2 -- 3 -- 4 --	H: Removed S: Deflector vanes on upper rim Counter-clockwise circulation Upper stand: Calm Field: Gusty	Poor
C 51	36 a, b 5	 Bay	1:400	17.7 16	1 3.3 2 1.9 3 14.6 4 3.5	H: Removed S: Same as C 47 Field flags point toward home base Gusty	Poor
C 52	33 a, b 5	 Bay	1:400	17.7 16	1 2.0 2 1.7 3 3.9 4 4.0	H: Removed S: Same as C 48 Gusty	Poor

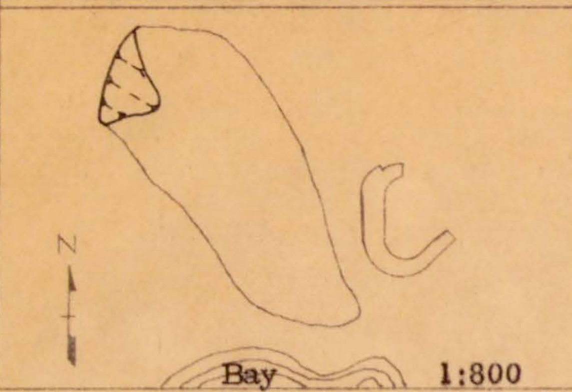
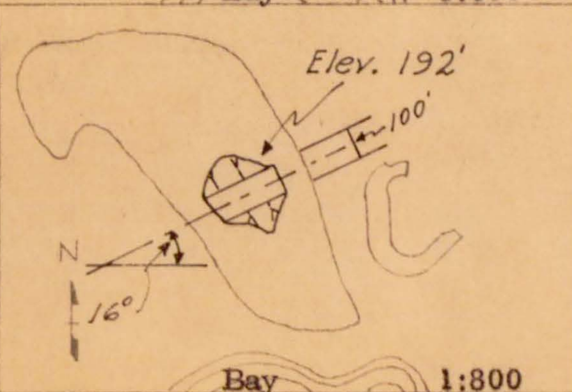
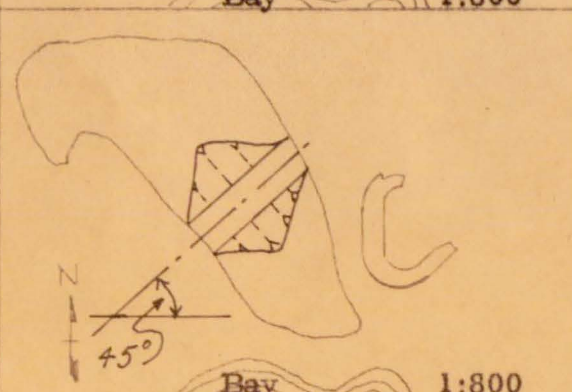
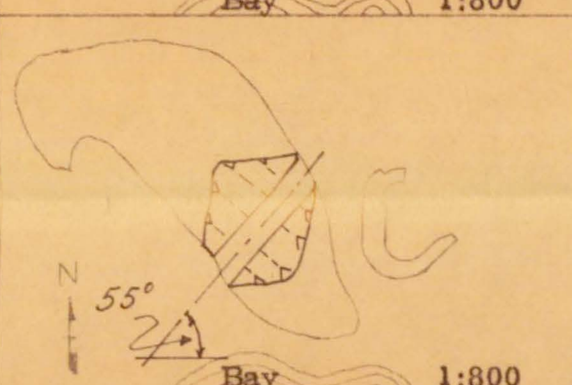
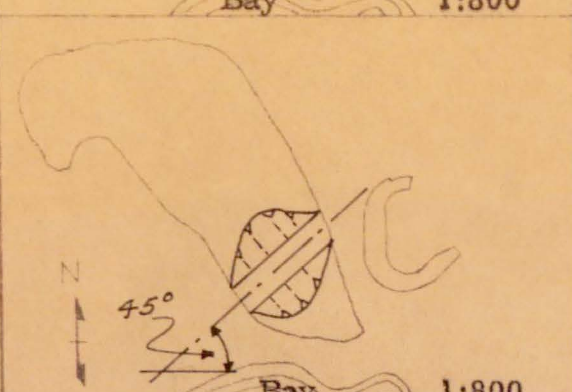
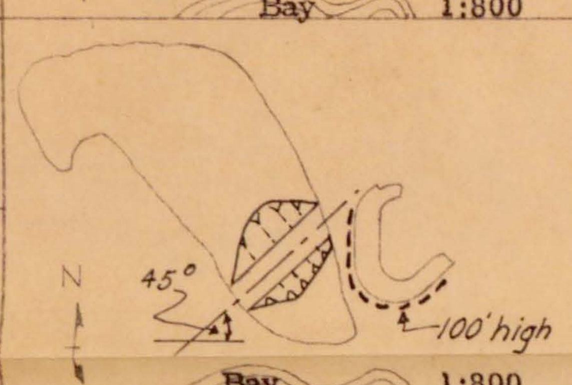
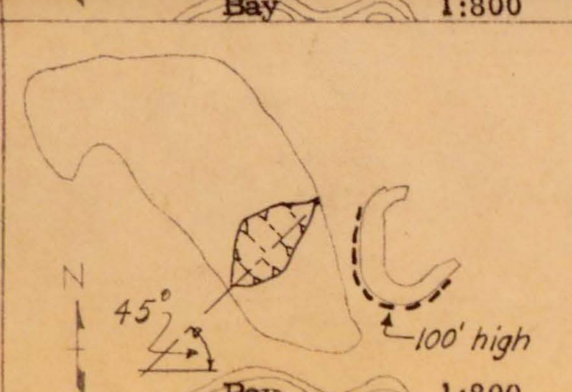
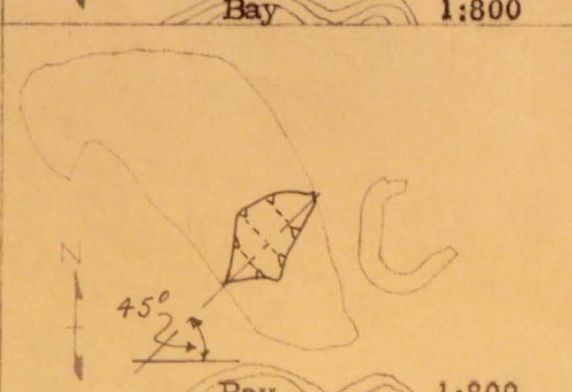
Note: Reel 5 - Hill Removed, Stadium Modified and Unmodified, 1/800 and 1/400.
Reel 6 - Hill Modified, Stadium Unmodified.

Run No.	Fig. No. Reel No.	Sketch Scale	Wind. Vel. in MPH Direct. in ° S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
C 53	33 a, b 5	 1:400	17.7 16	1 1.7 2 2.0 3 13.8 4 2.0	H: Removed S: Solid screen on upper rim 32' high Similar to B 4	Poor
C 54	36 a, b 5	 1:400	17.7 16	1 -- 2 -- 3 -- 4 --	H: Removed S: Deflector vanes on upper rim	Poor
D 1	13 a, b 6	 1:800	17.7 31	1 5.0 2 2.6 3 2.3 4 2.0	H: SW and NE Slopes excavated S: Unmodified Very gusty	Poor
D 2	13 a, b 6	 1:800	17.7 31	1 5.9 2 2.7 3 3.4 4 1.8	H: Upper level removed above 188.6' elevation S: Unmodified Southerly control (approximate)	Poor
D 3	36 a, b 6	 1:800	17.7 31	1 3.1 2 3.8 3 1.7 4 2.6	H: SE portion removed above 188.6' elevation S: Unmodified Erratic	Poor
D 4	36 a, b 6	 1:800	17.7 31	1 5.7 2 9.8 3 4.4 4 3.2	H: SE portion removed above 25' elevation, base of cut intersects stadium at sec. 22 S: Unmodified Erratic	Poor
D 5	33 a, b 6	 1:800	17.7 31	1 5.2 2 3.8 3 3.6 4 3.3	H: SE portion removed above 25' elevation, S: Unmodified Very gusty	Poor
D 6	39 a, b 6	 1:800	17.7 31	1 7.8 2 6.2 3 1.6 4 1.3	H: NW portion removed above 25' elevation S: Unmodified Very gusty	Poor

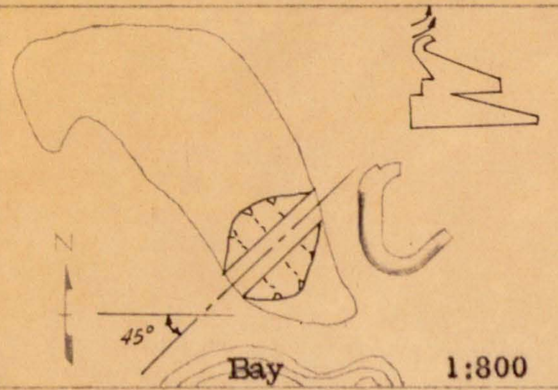
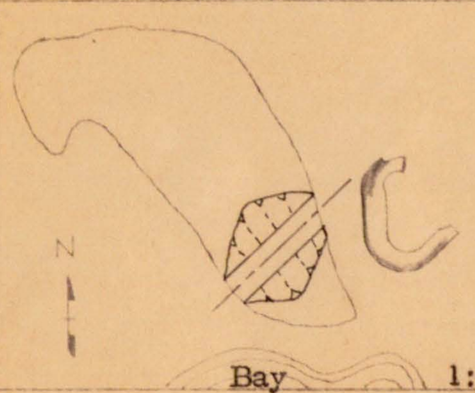
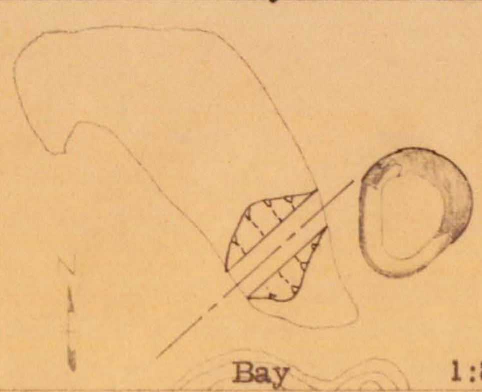
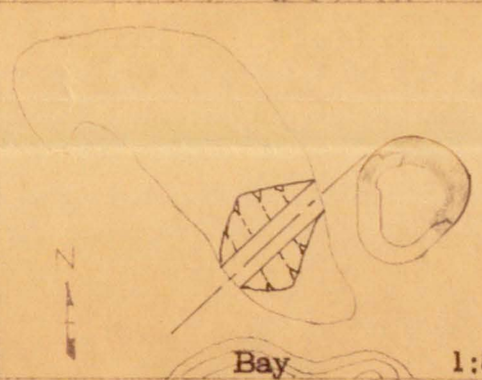
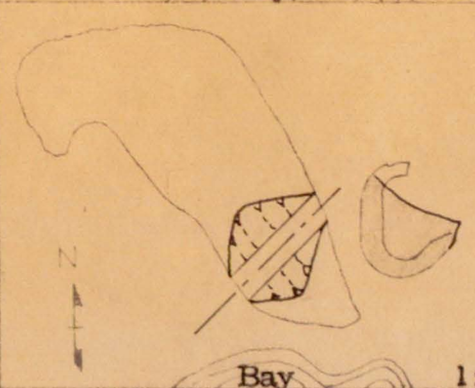
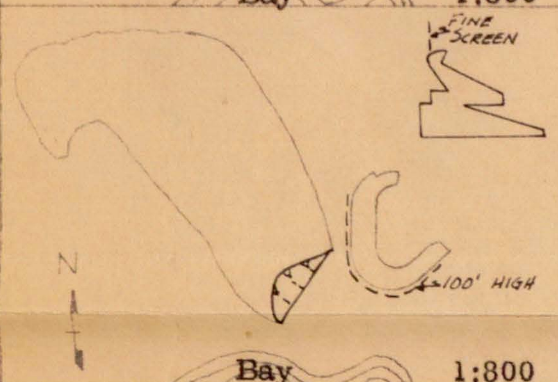
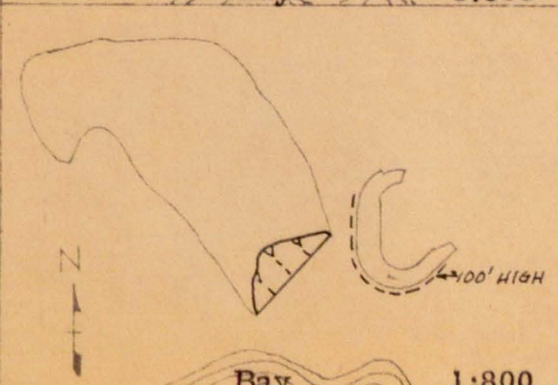
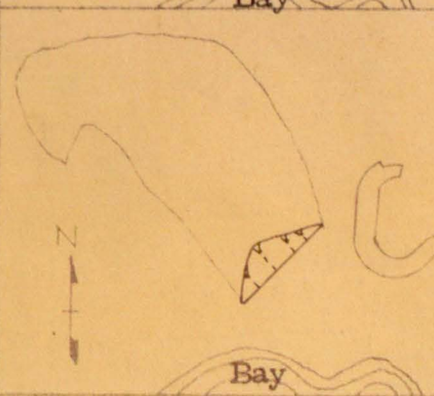
Note: Reel 6 is Hill Modified,
Stadium Unmodified

Run No.	Fig. No. / Reel No.	Sketch	Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
D 7	33 a, b 6		1:800	17.7 31	1: 3.1 2: 1.8 3: 1.8 4: 0.9	H: Broad base cut to 25' elev. on NE axis NW of stadium S: Unmodified Very gusty	Poor
D 8	33 a, b 6		1:800	17.7 31	1: 3.5 2: 2.6 3: 4.7 4: 2.5	H: Broad base cut to 25' elev. on N 35° E axis NW of stadium S: Unmodified Field flags point SW Gusty	Poor
D 9	39 a, b 6		1:800	17.7 31	1: 1.0 2: 2.2 3: 6.4 4: 1.4	H: Broad base cut to 25' elev. on NE axis southerly edge of base tangent to stadium. S: Unmodified Field flags point NE	Poor
D 10	12 a, b 6		1:800	17.7 16	1: 6.8 2: 3.2 3: 7.0 4: 2.6	H: Same as D 1 S: Unmodified Erratic	Poor
D 11	12 a, b 6		1:800a	17.7 16	1: 5.9 2: 5.9 3: 3.4 4: 2.3	H: Same as D 2 S: Unmodified Field flags point toward home plate Gusty	Poor
D 12	12 a, b 6		1:800	17.7 16	1: 11.8 2: 4.9 3: 5.4 4: 2.4	H: Same as D 3 S: Unmodified Erratic	Poor
D 13	12 a, b 6		1:800	17.7 16	1: 12.9 2: 7.0 3: 5.9 4: 3.2	H: Same as D 4 S: Unmodified Field flags point toward home plate Gusty	Poor
D 14	36 a, b 6		1:800	17.7 16	1: 12.8 2: 5.7 3: 13.4 4: 2.6	H: Same as D 5 S: Unmodified Similar to D 13	Poor

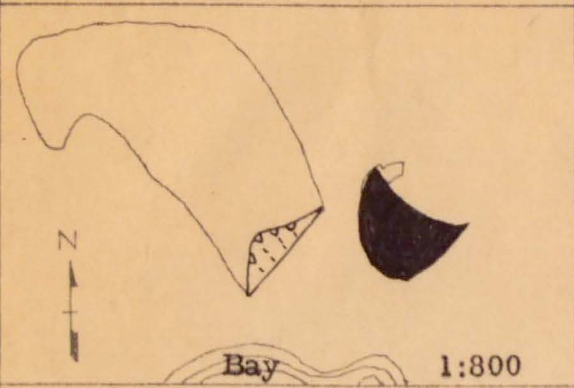
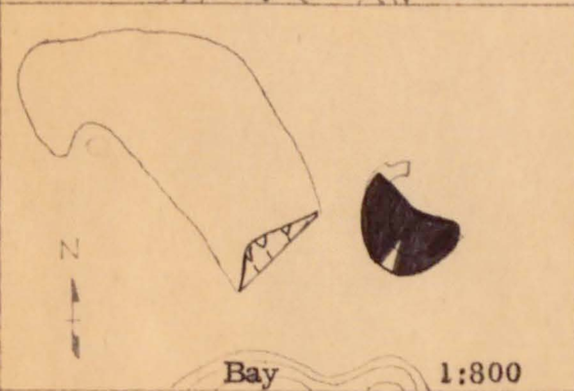
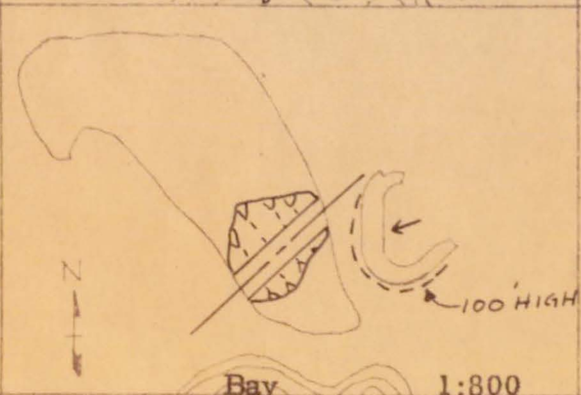
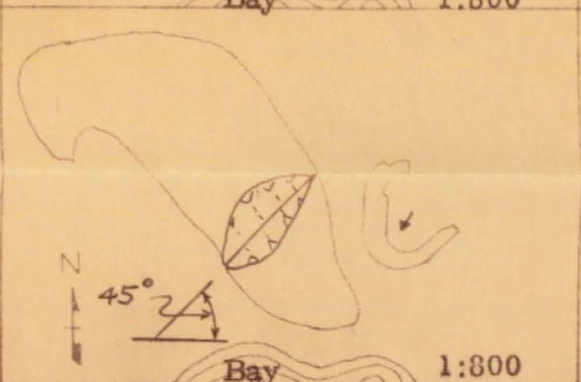
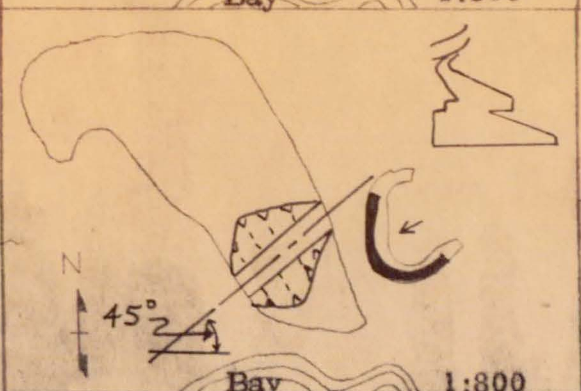
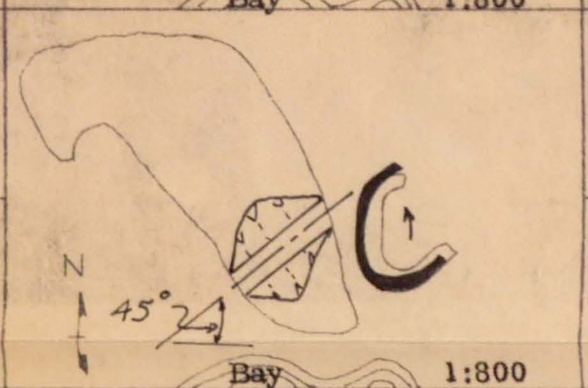
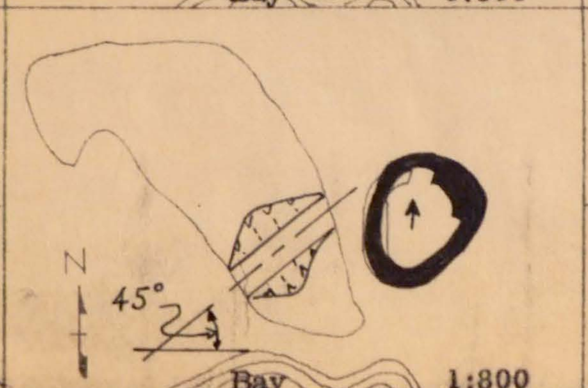
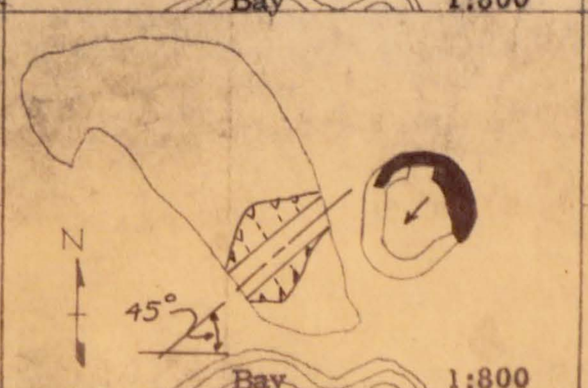
Reel 7 is Hill Modified, Stadium Modified

Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity of Four Points in MPH	Description and Flow Pattern	Improvement of Flow
D 15	36 a, b 6	 1:800	17.7 16	1: 3.8 2: 3.2 3: 2.1 4: 1.9	H: Same as D 6 S: Unmodified Extremely gusty	Poor
D 16	12 a, b 6	 1:800	31 17.7 16	1: -- 2: -- 3: -- 4: --	H: Broad base cut to 192' elev. along axis at N 74° E, NW of stadium S: Unmodified Left-Field control	Poor
D 17	42 a, b 6	 1:800	17.7 16	1: 6.1 2: 1.5 3: 2.4 4: 1.1	H: Same as D 7 S: Unmodified Extremely gusty	Poor
D 18	39 a, b 6	 1:800	17.7 16	1: 4.3 2: 3.2 3: 2.5 4: 2.4	H: Same as D 8 S: Unmodified Very gusty	Poor
D 19	34 a, b 6	 1:800	17.7 16	1: 4.7 2: 1.2 3: 4.8 4: 1.2	H: Same as D 9 S: Unmodified Southerly control (approximately)	Fair
E 1	33 a, b 6	 1:800	17.7 31	1: 6.2 2: 1.5 3: 5.6 4: 2.2	H: Same as D 8 S: 100' porous screen on upper rim Similar to B 4 Calm	Good
E 2	33 a, b 7	 1:800	17.7 31	1: 6.9 2: 2.9 3: 3.1 4: 1.9	H: V-notch at on N 45° E axis NW of stadium cut to 25' elev. S: Same as E 1 Erratic	Poor
E 3	40 a, b 7	 1:800	17.7 31	1: 7.5 2: 4.1 3: 3.5 4: 3.3	H: Same as E 2 S: Unmodified Erratic	Poor

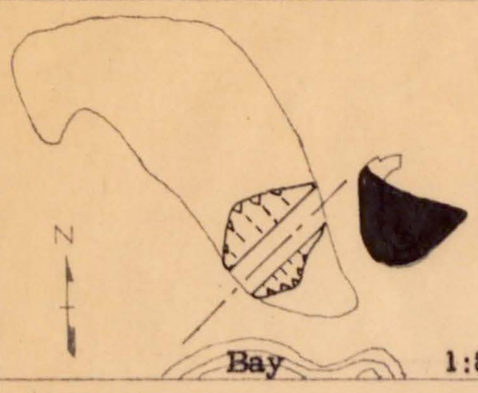
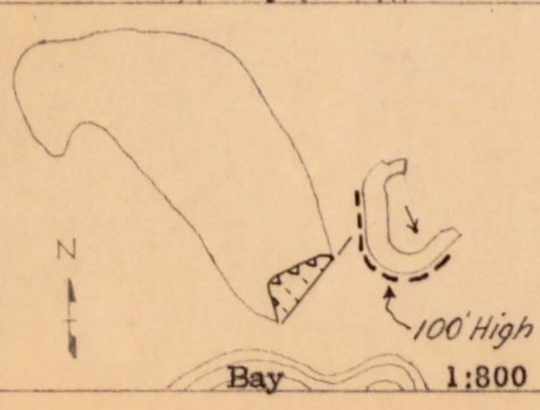
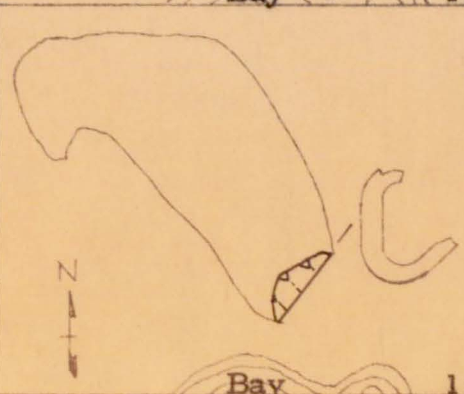
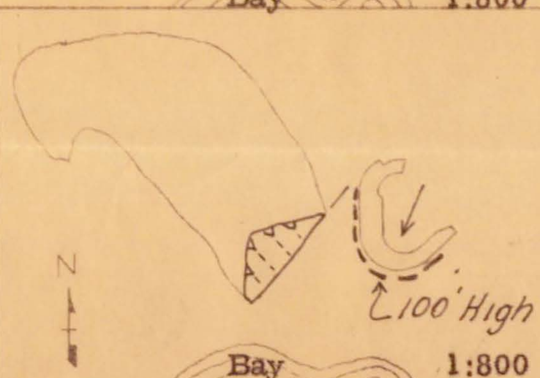
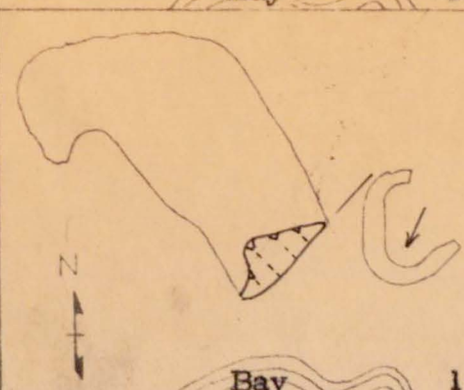
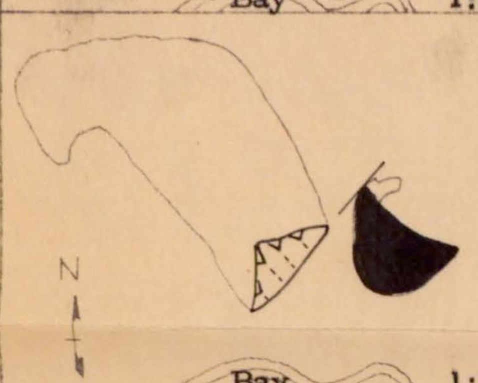
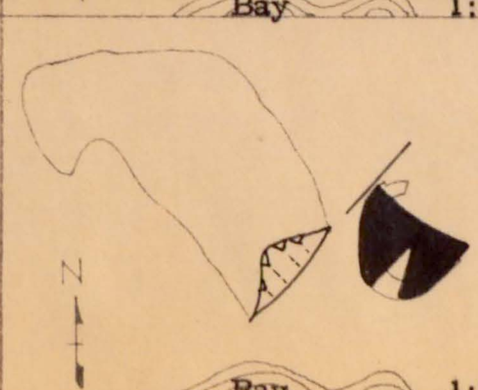
Note: Reel 7 is Hill Modified, Stadium Modified

Run No.	Fig. No. / Reel No.	Sketch / Scale	Wind Vel. in MPH / Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
E 4	33 a, b 7	 1:800	17.7 31	1 4.8 2 1.3 3 8.9 4 0.7	H: Same as D 9 S: Deflector vanes on upper rim Similar to B 4 Upper stands: Calm Field: Mildly gusty	Good
E 5	33 a, b 7	 1:800	17.7 31	1 10.4 2 0.6 3 0.6 4 1.0	H: Same as D 9 S: Upper stands to sec. 34 with deflector vanes on upper rim Similar to B 4 Gusty	Fair
E 6	35 a, b 7	 1:800	17.7 31	1 4.0 2 1.0 3 0.8 4 4.7	H: Same as D 9 S: Upper stands inclose field, deflector vanes on upper rim to sec. 34 Erratic	Poor
E 7	35 a, b 7	 1:800	17.7 31	1 5.7 2 1.0 3 1.5 4 4.4	H: Same as D 9 S: Upper stands inclose field Similar to E 6	Poor
E 8	41 a 7	 1:800	17.7 31	1 3.8 2 1.0 3 0.1 4 0.9	H: Same as D 9 S: Partial dome over playing field Calm	Excellent
E 9	36 a, b 7	 1:800	17.7 31	1 2.6 2 0.9 3 10.3 4 1.4	H: Same as D 4 S: Porous screen on upper rim Calm	Excellent
E 10	36 a, b 7	 1:800	17.7 31	1 5.1 2 1.2 3 3.6 4 1.7	H: SE end removed above 25' elev., base of cut N 45° E tangent to stadium S: Same as E 9 Similar to E 9	Excellent
E 11	36 a, b 7	 1:800	17.7 31	1 4.3 2 3.5 3 8.2 4 1.8	H: Same as E 10 S: Unmodified Erratic	Poor

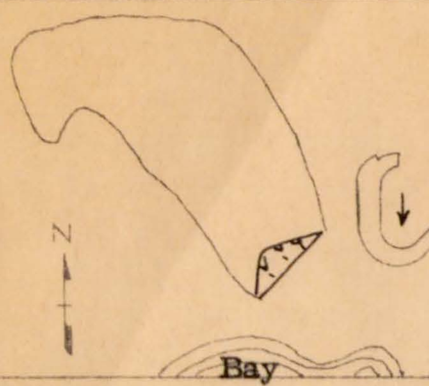
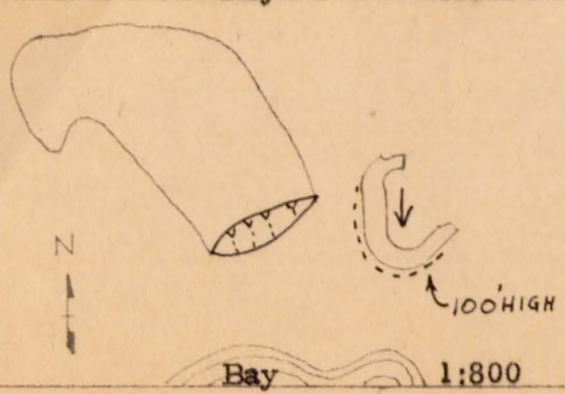
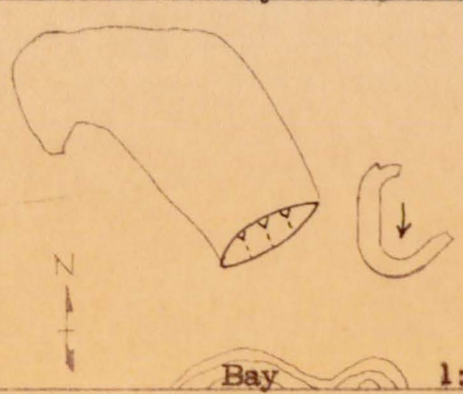
Note: Reel 7 is Hill Modified, Stadium Modified

Run No.	Fig. No. Reel No.	Sketch	Scale	Wind Vel. in MPH Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
E 12	41 a 7		1:800	17.7 31	1 5.7 2 1.9 3 0.5 4 0.9	H: Same as E 10 S: Same as E 8 Very calm	Excellent
E 13	41 a 7		1:800	17.7 31	1 4.4 2 1.4 3 0.6 4 1.4	H: Same as E 10 S: V-opening in SW side of partial dome Similar to E 12 (slight gustiness)	Excellent
E 14	33 a, b 7		1:800	17.7 16	1 2.6 2 0.8 3 1.1 4 1.6	H: Same as D 8 S: Same as E 9 Similar to B 4	Good
E 15	36 a, b 7		1:800	17.7 16	1 7.3 2 4.0 3 3.3 4 2.0	H: Same as E 2 S: Unmodified Field flags point toward home plate	Poor
E 16	33 a,b 7		1:800	17.7 16	1 2.6 2 1.4 3 12.4 4 1.0	H: Same as D 8 S: Same as E 4 Similar to B 4	Poor
E 17	34 a, b 7		1:800	17.7 16	1 2.4 2 1.8 3 0.5 4 1.8	H: Same as D 8 S: Same as E 5 Field flags point mostly to left field	Poor
E 18	34 a, b 7		1:800	17.7 16	1 4.2 2 1.2 3 1.0 4 2.8	H: Same as D 8 S: Same as E 6 Similar to E 17 Very gusty	Poor
E 19	36 a, b 7		1:800	17.7 16	1 4.2 2 1.5 3 0.5 4 4.2	H: Same as D 8 S: Same as E 7 Field flags point SW Gusty	Poor

Note: Reel 7 is Hill Modified, Stadium Modified

Run No.	Fig. No. Reel No.	Sketch / Scale	Wind Vel. in MPH Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
E 20	41 a 7	 1:800	17.7 16	1 3.9 2 0.6 3 0.8 4 1.4	H: Same as D 8 S: Same as E 8 Calm	Excellent
E 21	40 a, b 7	 1:800	17.7 16	1 11.3 2 2.4 3 2.9 4 1.2	H: Same as D 4 Field flags pointing mostly to 1st base line	Poor
E 22	41 a, b 7	 1:800	17.7 16	1 11.7 2 5.5 3 9.5 4 2.4	H: Same as D 4 S: Unmodified Erratic	Poor
E 23	36 a, b 7	 1:800	17.7 16	1 4.7 2 0.9 3 3.9 4 1.3	H: Same as E 10 S: Same as E 10 Field flags point toward home plate	Fair
E 24	36 a, b 7	 1:800	17.7 16	1 5.8 2 3.0 3 1.8 4 1.7	H: Same as E 10 S: Unmodified Field flags point toward home plate Gusty	Poor
E 25	41 a 7	 1:800	17.7 16	1 3.0 2 2.3 3 0.6 4 1.8	H: Same as E 10 S: Same as E 8 Counter-clockwise circulation Mildly gusty	Good
E 26	41 a 7	 1:800	17.7 16	1 5.1 2 2.6 3 0.9 4 2.3	H: Same as E 10 S: Same as E 13 Moderate gustiness	Fair
E 27	40 a, b 7	 1:800	17.7 0	1 11.7 2 3.2 3 3.8 4 4.1	H: Same as D 4 S: Same as E 10 Field flags point S	Poor

Note: Reel 7 is Hill Modified, Stadium Modified

Run No.	Fig. No. Reel No.	Sketch	Scale	Wind Vel. in MPH Direct. in °S of W	Velocity at Four Points in MPH	Description and Flow Pattern	Improvement of Flow
E 28	42 a, b 7		1:800	17.7 0	1 5.8 2 3.0 3 1.8 4 1.7	H: Same as D 4 S: Unmodified Field flags point S Gusty	Fair
E 29	40 a, b 7		1:800	17.7 0	1 6.5 2 3.6 3 4.3 4 2.4	H: Same as D 5 S: Same as E 9 Field flags point S Gusty	Poor
E 30	42 a, b 7		1:800	17.7 0	1 7.3 2 4.2 3 4.1 4 2.8	H: Same as D 5 S: Unmodified Field flags point S Gusty	Poor