VIII. APPENDIX

DIRECT AND PRECISE METHODS FOR PHOTO IDENTIFICATION

If size prohibits the direct identification, a small diameter image point readily identifiable on the photography is used for a compass bearing and distance tie to the water source. Small pinholes in the photo emulsion surface are used to identify the image point selected (reference Figure 1).

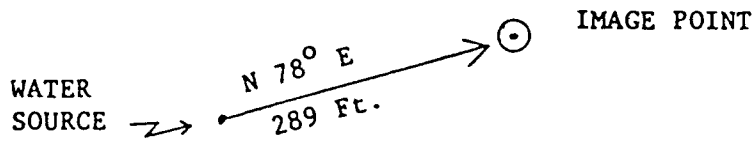


Figure 1 -

Figure 1. Compass bearing and distance. Note that the bearing is from the property corner to the image point. If horizontal distance exceeds 400 feet, the precise identification procedure should be used (reference Figure 2).

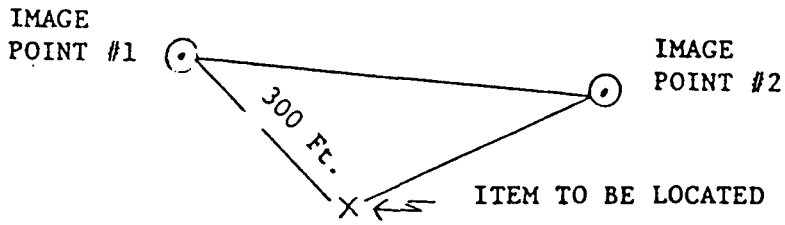


Figure 2 - Precise Identification Tie

In Figure 2, both image points must be pinpricked on the photograph. Horizontal and vertical angles are observed from X to image points 1 and 2. Horizontal and vertical angles are observed from image point #1 to X and image point #2. Horizontal distance is measured between image point 1 and X. Regardless of the method used, a sketch (and description of image points and item being located) on the back of the photograph are essential. Both methods of identification provide for accurate photogrammetric transfer to a base map. If water sources or other items required to be plotted on a base map are tied horizontally to the photo control network their positions may be scaled on the base map from coordinate values. In the event color infrared photography is not required or available, the photo-identification will apply to existing project photography.

B.

PHOTOGRAMMETRIC MAP COMPILATION

DESCRIPTION

1. This work shall consist of compiling a topographic map and/or "reading" a series of points from aerial photographs in accordance with these specifications, including labor, equipment, materials, and incidentals necessary to complete the work. The initial area to be mapped shall be the area to be mined in the next 18 months (plus angle of draw) on the entire lease area as appropriate.

MATERIALS

2. Base sheets for both the original base manuscripts and the overlays shall be polyester base film between 0.004 inch and 0.007 inch in thickness. Paper prints of the final drafted map sheets shall be 16 pounds or heavier stock paper.

REQUIREMENTS

3. MANUSCRIPT MAP REQUIREMENTS. Manuscripts shall be compiled as follows:

   a. Coordinate Grid Ticks. The plotted positions of each plane coordinate grid tick shall not vary by more than 0.01 inch from the true grid position. Grid ticks shall be plotted at 5 inch intervals. A north arrow indicating grid north shall be shown on each sheet.

   b. Scale and Contour Interval. The scale and contour interval shall be 1" = 100' and 2' or as specified by individual project.

   c. Match Lines. Match lines and reference numbers shall be provided ~~to~~ so that each map may be accurately joined to those which are adjacent.

d. Sheet Layout. Each sheet shall be numbered in the border area in each of the four corners. The numbers shall be approximately 0.5 inch high and shall be encircled. A label which includes Forest name, project name, date and scale shall be placed in the margin at the lower right hand corner of each sheet.

e. Control Points. All control points shall be plotted and labeled including: horizontal and vertical control points, pass points, tie points, and construction survey control points when required. The principle point of each photo shall also be plotted and labeled.

f. Planimetric Features. All planimetric features visible and identifiable on the aerial photos shall be shown. Planimetric feature symbols shall conform to Figure ~~195-1~~ 3. Planimetric features not shown on Figure ~~195-1~~ 3 shall be drawn to scale and labeled.

g. Topographic Features. All contours shown shall be compiled using a stereo plotting instrument. Every fifth contour shall be a heavier weight line. The elevation of every fifth contour shall be shown in tiers approximately 10 inches apart.

Where contours spacing is more than 2 inches apart at final scale, spot elevations shall be shown in a 1-inch grid pattern. Spot elevations shall also be shown at peaks, depressions, saddles, on centerline at each end of a bridge, on centerline at road intersections, and at locations where interpolation from contours will not give true elevations.

Where contour spacing is less than 10 per inch, the intermediate contours may be dropped and every fifth contour, with heavier line weights, shall be left.

4. FINAL MAP REQUIREMENTS. Except for sheet layout the final map sheets shall meet the manuscript map requirements. In addition, the final map sheets shall meet the following requirements.

a. Sheet Size and Layout. Sheets shall be the size specified in Special Project Specifications. Each sheet shall have a border and title block in the lower right hand corner.

A title block and bar scale shall be shown on each final map sheet. The title blocks shall include the following statements:

(1) Date of photography, scale of aerial photography and scale at which map was compiled.

(2) Statement of datum basis of map grid and elevation.

A small scale, correctly oriented, map sheet index shall be shown on each map sheet. The index shall show all sheets and their numbers. The sheet upon which the index is located shall be crosshatched.

b. Drafting. Final map sheets shall be either scribed, or drafted with ink, at the final map scale. The drafting method chosen shall be used for all sheets.

Map details shall be clear, sharp, and legible after reproduction. Lettering shall not be done freehand.

5. MAP ACCURACY

a. Topography. At least 90 percent of all elevations determined from contours shall be within 0.5 contour interval of true elevation, and all elevations so determined shall be within 1.0 contour interval of true elevation except as follows:

(1) Where the ground is obscured by brush or tree cover, contours shall be plotted from the stereoscopic model, making use of spot elevations measured photogrammetrically in places where the ground is visible. In these areas, at least 90 percent of the elevations determined from contours shall be within 1.0 contour interval of true elevation. All elevations so determined shall be within 2 contour intervals of true elevation. Contours within these areas shall be shown as dashed lines.

(2) In densely wooded areas where spot elevations cannot be determined, contours shall not be drawn. They shall be outlined and labeled "ground not visible" or "GVN".

b. Spot Elevations. At least 90 percent of all spot elevations shall be within 0.25 contour interval of true elevation. All spot elevations shall be within 0.50 contour interval of true elevation.

c. Planimetric Features. At least 90 percent of all well-defined planimetric features such as structures, paved roads, intersections, etc., shall be within 0.025 inch of their true position. All shall be within 0.050 inch of their true position.

d. Coordinate Grid Ticks. The plotted position of all coordinate grid ticks shall not vary by more than 0.01 inch from their true grid position.

e. Horizontal Control. The plotted position of all horizontal control points shall not vary by more than 0.01 inch from their calculated position.

Acceptance or rejection of the map or portions thereof will be the responsibility of the leasee and based on whatever means they feel necessary to perform (generally field survey methods).

6. MAP ACCURACY TESTS. The Forest Service may elect to evaluate map accuracy and precision based on a sample of test points. The test points will be randomly selected models and representative of the feature being tested.

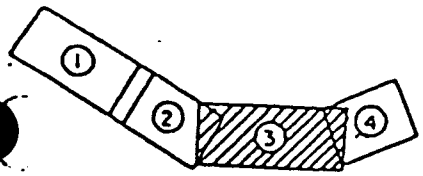
The position and elevation of test points will be determined by the Forest Service using photogrammetric or ground survey methods of equal or better precision than those used for map production. Discrepancies will be calculated between the test values and map values. Statistical methods of hypothesis testing will be used to determine if the mean and standard error of the sample of discrepancies indicate that map accuracy requirements have been met.

The values listed on Table 195-1 will be used to determine if the mean and standard error may be reduced by assuming a horizontal displacement not to exceed 0.025 inch. Tests for accuracy will apply only to the models in which tests were performed.

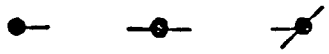
All required materials or suitable duplicate thereof will provided to the Forest Service as requested to insure and assist in the successful implementation and continuation of this program.

H-1A	HORIZONTAL CONTROL POINT (LABEL)
P-1A 1234.56	VERTICAL CONTROL POINT - FIELD (LABEL)
HP-1A 1234.56	HORIZONTAL & VERTICAL CONTROL POINT - FIELD
BM-22 1234.56	BENCH MARK
X 1234.5	SPOT ELEVATION PHOTOGRAMMETRICALLY CONTROLLED POINT
P C 1 23	AERIAL PHOTO CENTER
2 1 11 12	SECTION CORNER
2 1	QUARTER CORNER
	GRID TICK (1 INCH LONG)
Y123,000 X1,234,500	COORDINATE VAULES - LABEL AROUND PERIMIETER OF SHEET
2	SHEET NUMBERS - ON EACH CORNER OF MANUSCRIPT SHEETS. ADJACENT MATCH SHEET NUMBER SAME, NO CIRCLE.

Figure ~~195-1~~ 3 -- Photogrammetric Map Symbols



SHEET LAYOUT DIAGRAM, FINAL SHEETS. ORIENT TO SHEET BEING DRAFTED, CROSS HATCH SHEET ON DIAGRAM.



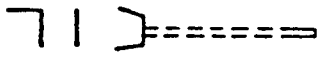
UTILITY POLES.

TRANSMISSION LINES & TOWERS

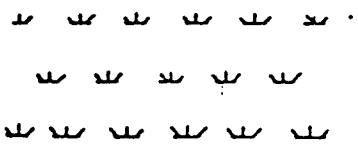
MANHOLE 3/32 INCH CIRCLE w/3 DOTS

DRAINAGE INLET SMALL SQUARE w/3 LINES

FIRE HYDRANT



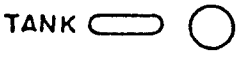
HEADWALL, HDWL w/PIPE, LABEL ONLY TO CLARIFY



MARSH OR SWAMP

INDIVIDUAL AND GROUPED TREES, BRUSH GROUND COVER
P - PINE O - OAK

ROCKS (LABEL)



TANK (LABEL)

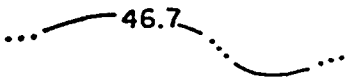
FIRE HYDRANT - FH
FLAGPOLE - LABEL - FP
PULLBOX - PB
WELL - WELL
ETC. LABEL TO CLARIFY
ALL 1/16 INCH CIRCLE

Figure ~~195-1~~ 3 -- Photogrammetric Map Symbols

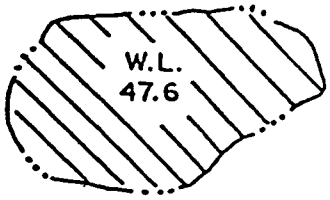
RAILROADS - 50 SCALE OR LARGER
100 SCALE OR SMALLER

FREEWAY SIGNS

SIGNS

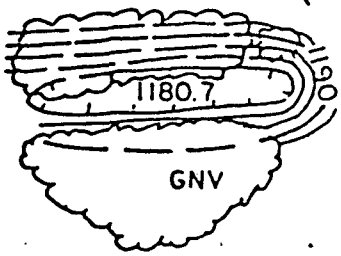


SMALL STREAM

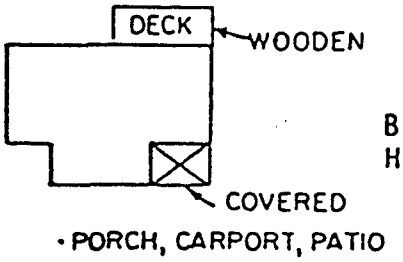


LARGE BODIES OF WATER. WATER LEVEL AS SHOWN. CROSS HATCH APPROX. 0.25 INCH IN AROUND EDGE

SMALL BODIES OF WATER CROSS HATCH AS SHOWN.

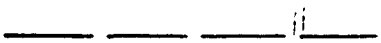


CONTOURS SOLID LINES IN OPEN AREAS. 1.0 INCH DASH LINES UNDER TREES AND BRUSH WHERE GROUND IS OBSCURED, BUT WITH OPEN SPOTS. WHERE GROUND IS NOT VISIBLE AND THERE ARE NO OPEN SPOTS, DO NOT DRAW CONTOURS. LABEL GNV. USE TICK MARKS AND SPOT ELEVATIONS TO INDICATE DEPRESSIONS.



BUILDING. LABEL ONLY TO CLARIFY. SHOW MOBILE HOMES THE SAME. DO NOT SHOW TRAVEL TRAILERS.

EDGE OF CONCRETE OR ASPHALT TRAVELED WAY. 0.5 INCH DASH.



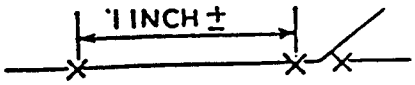
EDGE OF SHOULDERS TURNOUTS, PARKING AREAS 0.5 INCH DASH.

ASPHALT DIKE (LABEL)

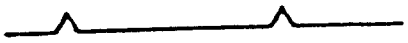
Figure ~~195-1~~ 3 -- Photogrammetric Map Symbols

EDGE OF AGGREGATE OR EARTH TRAVELED WAY. 0.25 INCH DASH LABEL TO CLARIFY.

TRAIL OR WHEEL TRACKS. 0.25 INCH DASH. LABEL TO CLARIFY.

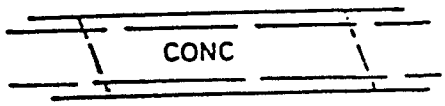


FENCE & GATE.



RETAINING WALL. "V" TOWARD HIGH SIDE

GUARD RAIL POSTS - PLOT AT SCALE



BRIDGE SHOW RAIL AND ENDS OF BRIDGE.

MISCELLANEOUS PLANIMETRY LABEL TO CLARIFY.

NOTES: 1. All maps 1:1200 and larger shall be drafted with two line weights.

SCRIBE	INK
a. Fine=0.010 inch	#00 Rapidograph or equal
b. Heavy=0.016 inch	# 2 Rapidograph or equal

For maps smaller than 1:1200 use:

a. Fine=0.006 inch	#000 Rapidograph or equal
b. Heavey=0.013 inch	#0 Rapidograph or equal

2. Map lettering shall be size 100 Leroy caps or equal. Except for proper names which shall be 120 Leroy caps or equal with fine pen.

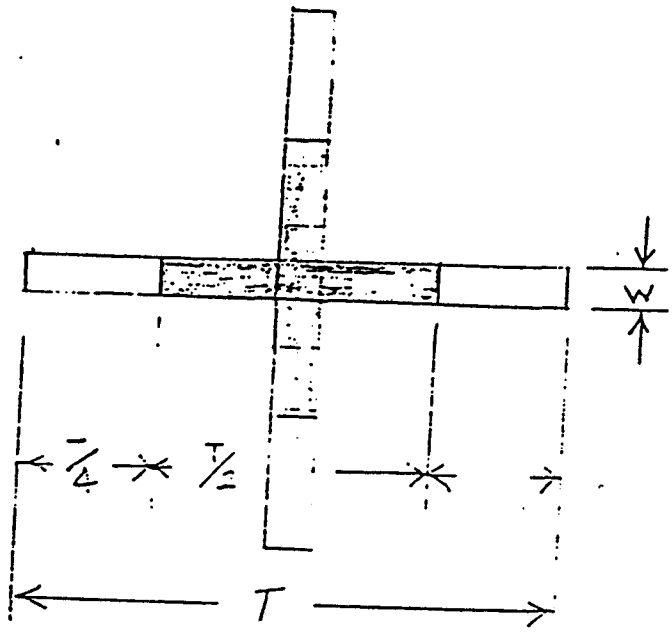
Figure ~~195-1~~ 3 -- Photogrammetric Map Symbols

PHOTOGRAPHIC TARGETS (GROUND PANELS)

The precision required in large scale mapping projects using photogrammetrics methods, requires an exact correlation between the photography coverage and a significant number of selected points or monuments on the ground for which X, Y, and Z coordinates are accurately measured and established by ground survey methods. These points are usually station markers in the ground in solid rock or on a permanent concrete-type structure where the points, once measured, will be well preserved for recovery and use whenever needed. Placement of a target centered on the monument or station marker so it will appear as a well-defined concentric image on the aerial photographs is essential (see Figure 4). These targets should also be placed on all supplemental control points required for orientation of the aerial photographs in photogrammetric instruments for forming stereoscopic models to scale and elevation for accomplishing the required measuring and mapping. Targets should also be placed on pertinent survey monuments on the boundaries of all affected properties including Township and Range, Section and quarter corners. Predetermined points on which photogrammetric measurements will be made to establish surface bareline information may also require targeting, however, these will not require permanent monumentation. In this case, capped rebar in the center of each target will be adequate. Property corners not used as basic control may be targeted with only 3 legs of equal spacing using the same dimensions as shown in Figure 3.

Care should be taken where possible to place control and targets in open areas where they will not be obscured by ground cover and/or shadows. In some cases, this may not be possible and clearing will be required. Figure 5 illustrates the approximate clearing criteria. Experience has shown that the darker center of the target provides better contact for "readability".

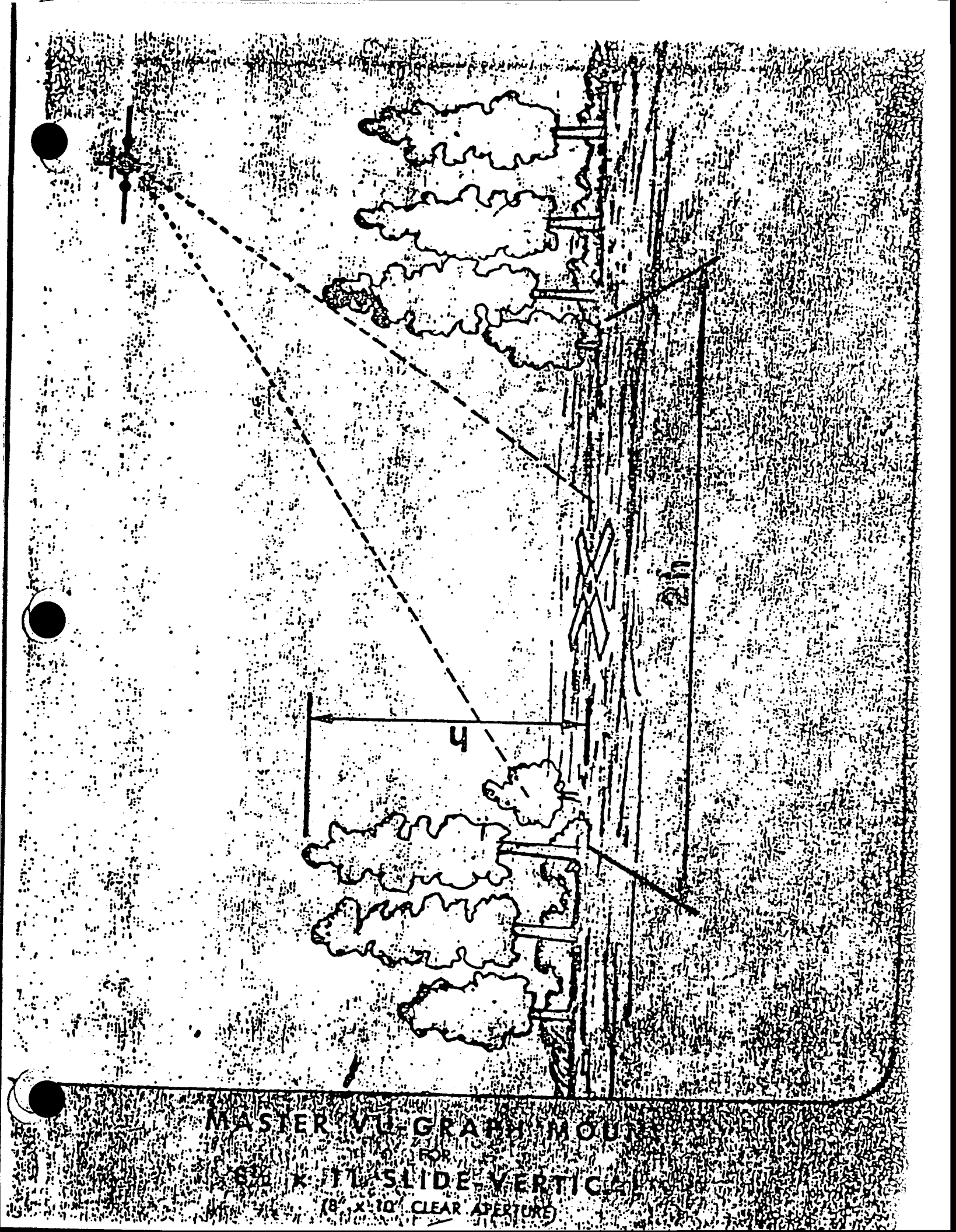
FIGURE 3 - Recommended target configurations and dimensions for placement on station markers. Recommended material is Griffolyn Type 65 black and white matte finish or equivalent.



T = total length (in feet) = 1/40 photo scale expressed in feet to inches. Example: 1:4800 photo scale equals 1" = 400' ÷ 50 = 10'.

W = width of leg in inches = 1/60 photo scale expressed in feet to inches. Example: 1:4800 = 1" = 400' ÷ 60 = 6.7.

Note: Allowances should be made in width and length for "hem" or double thickness if spikes are used to hold down target. Additional width and length should also be used if rocks are necessary to hold down target or if targets are placed on steep sideslopes.



MASTER VUGRAPH MOUNT
FOR
620 K-11 SLIDE VERTICAL
(8" x 10" CLEAR APERTURE)

United States Department of Agriculture | Forest Service | R-4

Reply to: 7140 Geometronics

Date: 7-19-85

Subject: Aerial Photography and Photogrammetry Project, Genwal - Crandall Canyon Mine (yr Ltr 7-3-

To: Forest Supervisor, Manti-LaSal NF

☐ Enclosed is a project request form showing the details of your project for Forest verification, [redacted] a copy of Flight/control plan map, and cost est. worksheet.

☐ Additional information necessary as indicated on enclosed form.

☒ Submit Form 6500-46 identifying each project, management codes, and costs.

☐ Submit prints of resource photograph for navigation and control planning:

Resource Project	Strip No.	Roll No.	Exposure No.

Estimated cost for this project $1450.00 (including C & C IR 2 sets prints ea.)

Return requested information by _____.

If you have questions, please call Lynn Wiese. His telephone number is 586-5213 or commercial (801) 625-5213.

ROBERT H. BYE
Geometronics Engineer

Enclosure

cc: WIESE
C. Reed

RECEIVED
MANTI-LASAL N.F.
JUL 22 1985
Sam

cc: ~~Genwal Coal Co.~~

LW

CRANDALL CANYON

Subsidence and Hydrologic Monitoring
1985 Photography Cost Estimate

Aircraft and Pilot (Color and Color IR)

Ferrying Time	Hrs. @	$
Photo Time	Hrs. @	$
	Subtotal	($ 315.00)

Photo Crew (2 Members for Color and Color IR)

Salary	Hrs. @	$
Overtime	Hr. Lunch @	$ NA
	Subtotal	

Transportation (pilot, crew, and equipment between the airport and official station)

Day @ $ ——

Photography

Color*

Label, shipping & indexing 24 @ 1.50 ea		$ 36.00
24	Exposures @ 5.50 / ea	$ 137.50
24	Prints @ 3.00 / ea	$ 72.00
24	Film Positives @ 10 / ea	$ 240.00
	1 set Color Subtotal	(485.50)

Color Infrared*

24	Exposures @ 7.00 ea	$ 168.00
24	Prints @ 3.00 / ea	$ 72.00
	1 set CIR Subtotal	(240.00)

Per Diem (2 days, 2 people, $50/day/person) Prorated amt. $ (25.00)

Actual Total $ 1065.50

Rounded Total $ 1450.00

with 2 sets C & CIR

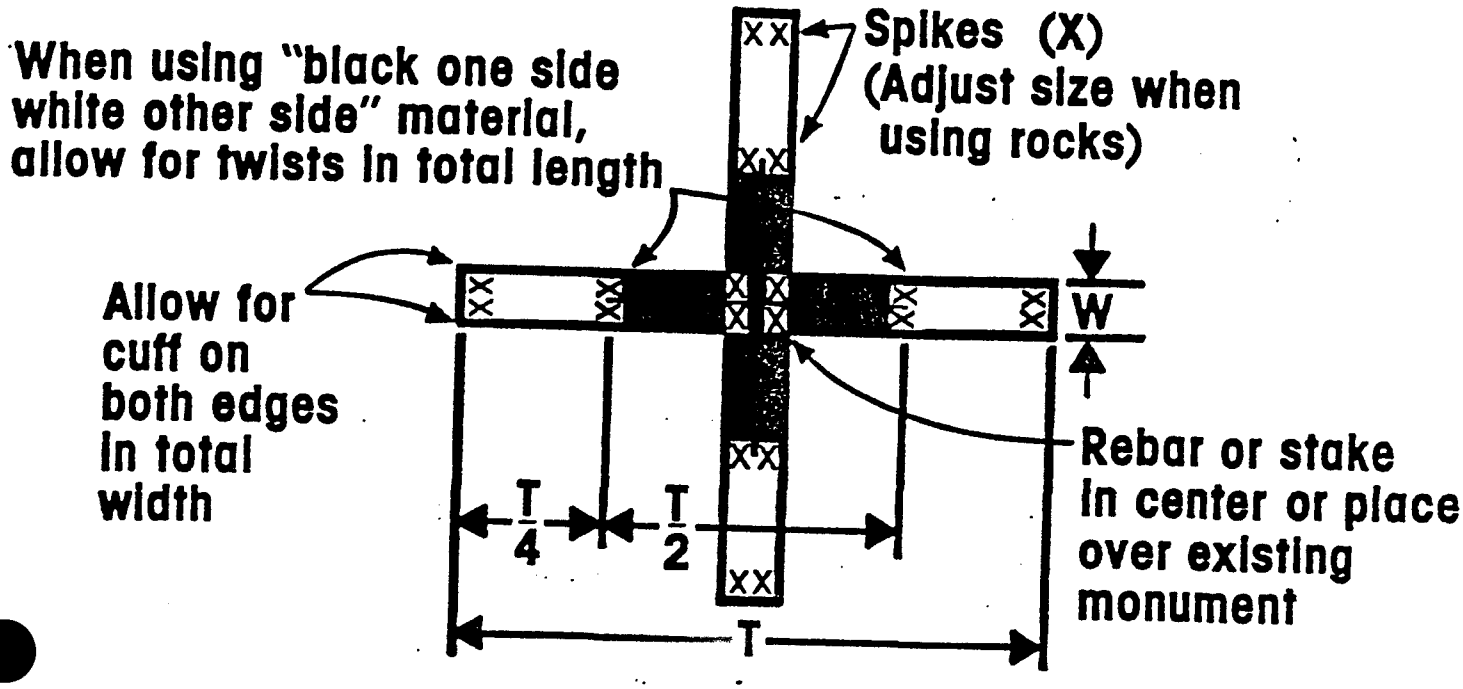
*Includes film processing, B/W inspection prints, and one set of color prints (additional prints $3.00 each).

3 strips
Color Yes Color IR Yes

8 targets required prior to 85 Flights

GROUND TARGETS FOR CONTROL SURVEYS

RECOMMENDED DIMENSIONS

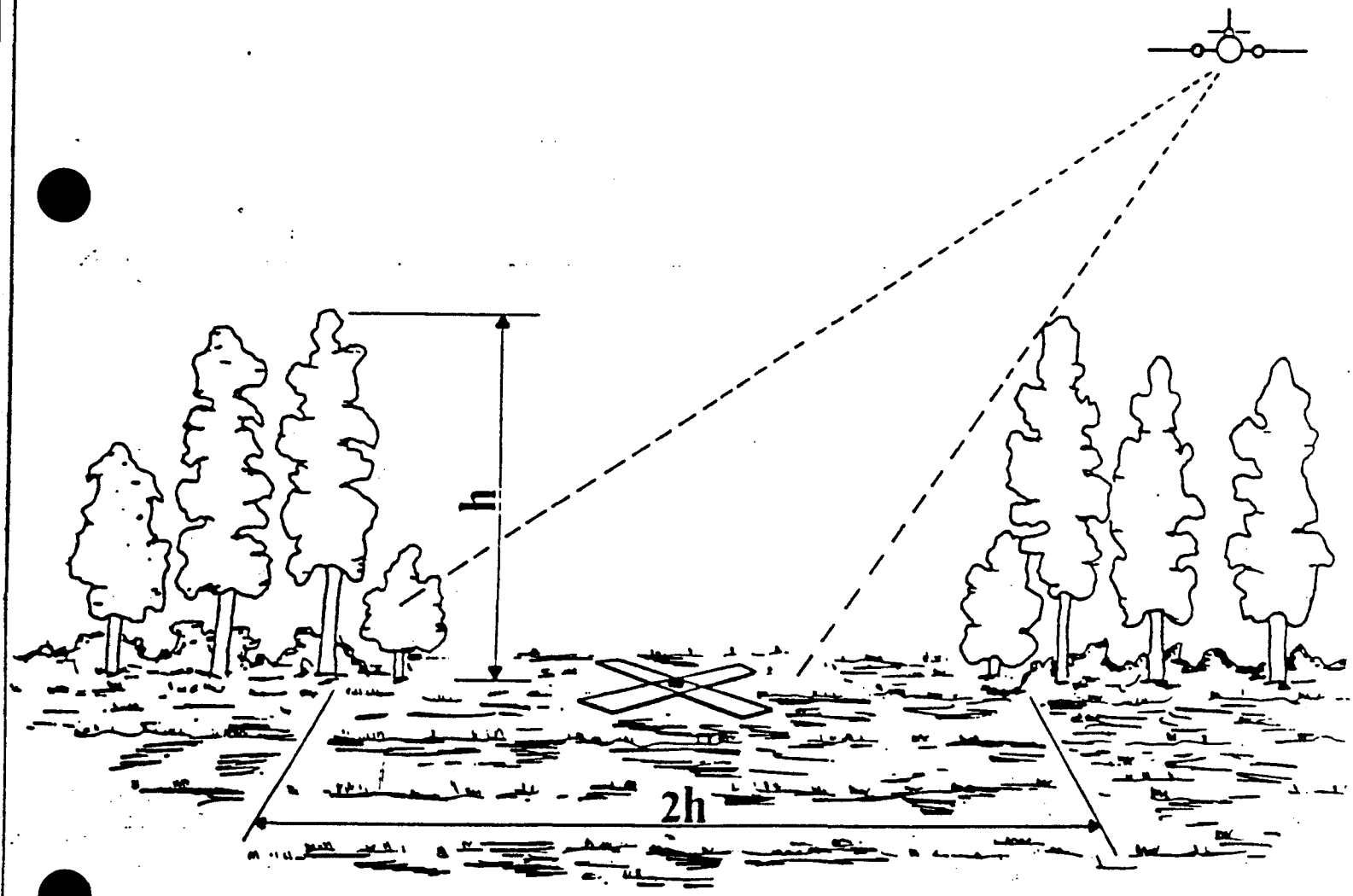


T = Total Length (in feet)
= 1/50 Photo Scale (ft to 1 in)
ie. 1:6000 PSR = 1" = 500' ÷ 50 = 10'-12'

W = Width of Leg (in inches)
= 1/60 Photo Scale (ft to 1 in)
ie. 1:6000 = 1" = 500' ÷ 60 = 8.3"-12"

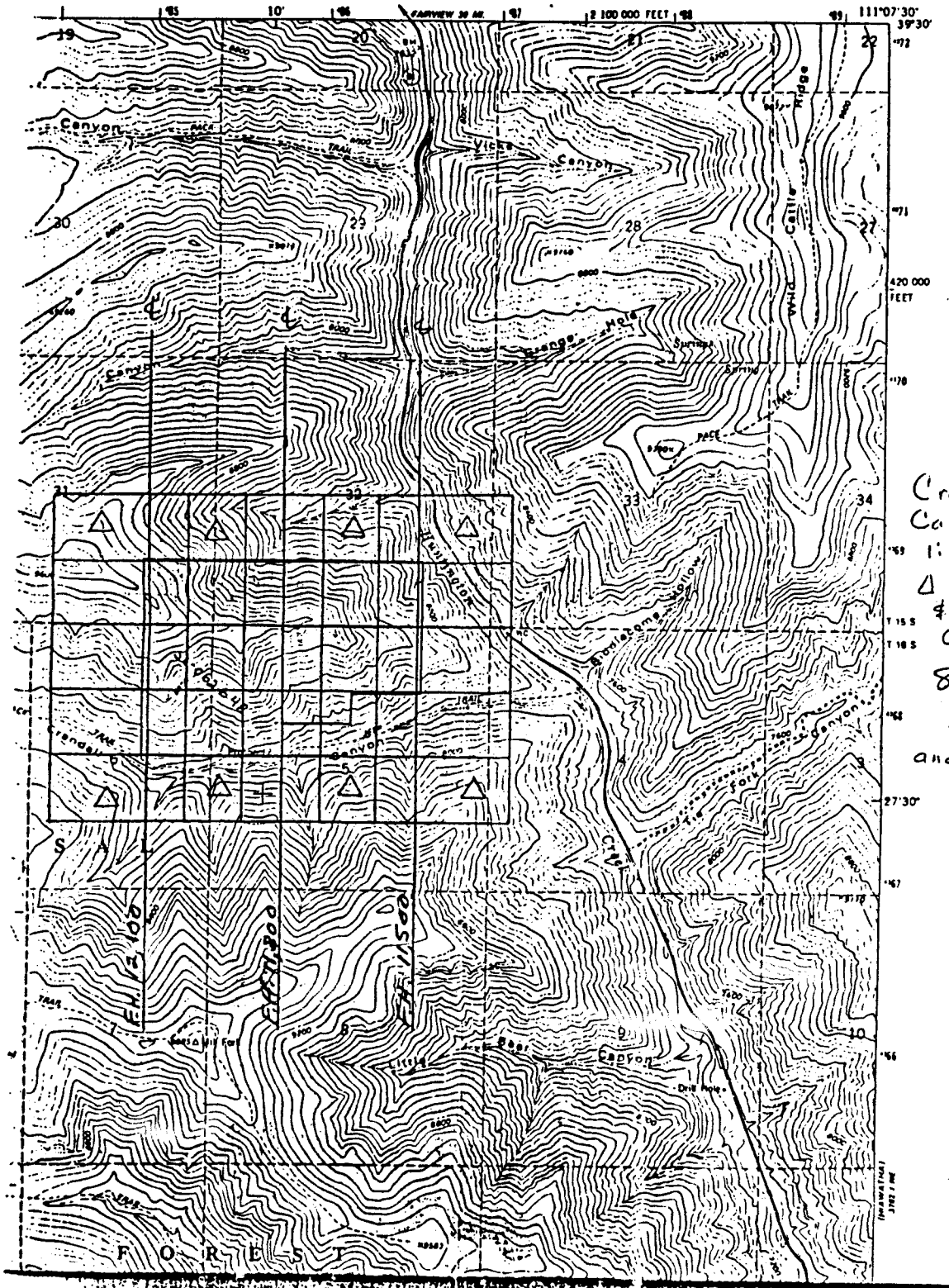
- Terrain, cover and reflectance characteristics of surface material affect pt. reading accuracy of targeted control station
- Record of location (photo I.D./image pt. tie)
- Maintenance
- Roll stock, pre-cut and/or prefabricated material and targets available from commercial sources

GROUND TARGET PLACEMENT GUIDE



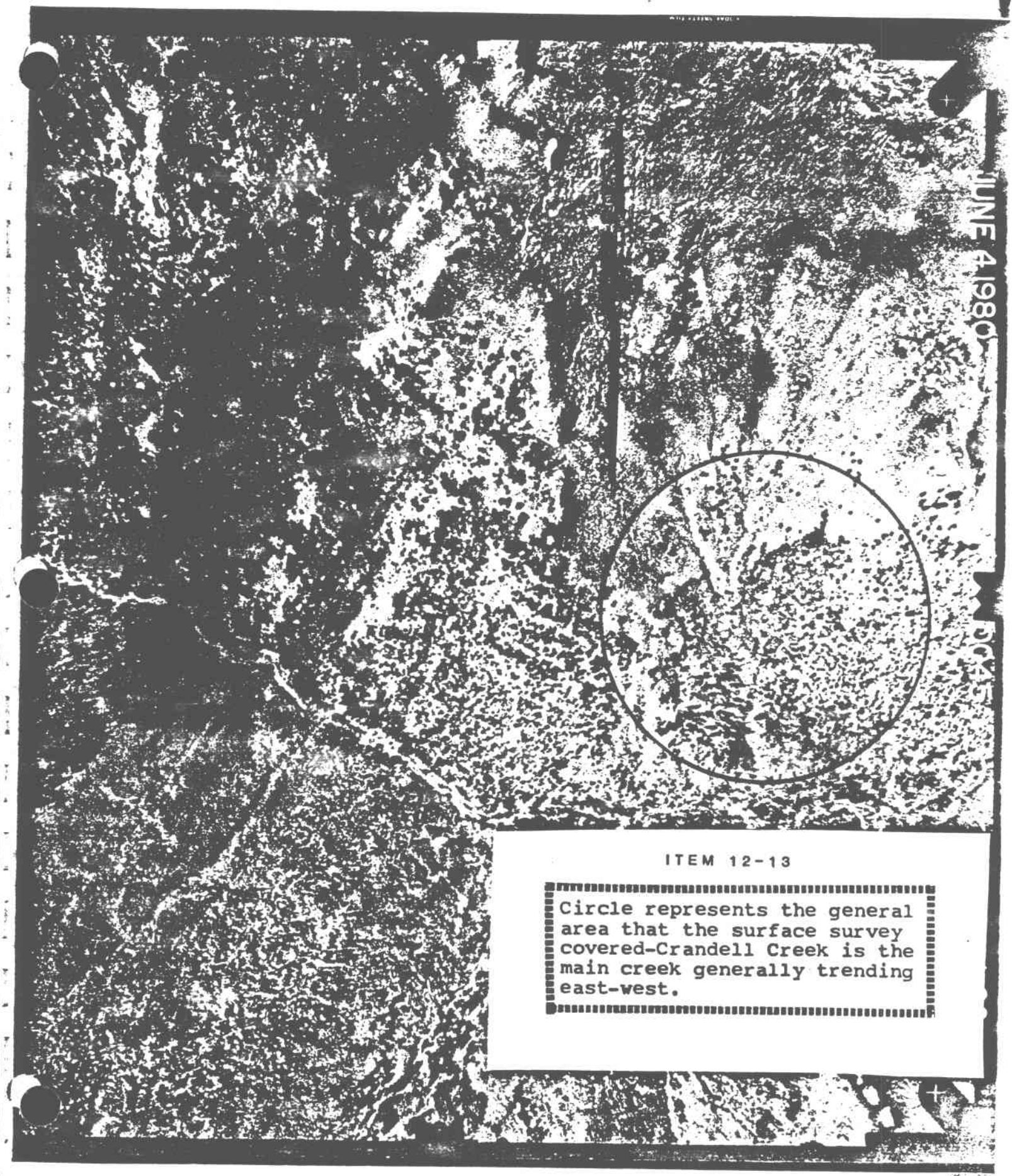
ıH
ERAL SURVEY

RILDA CANYON QUADRANGLE
UTAH
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 HIAWATHA 15' QUADRANGLE



Crandall Canyon Min. 1:4800
Δ Horizontal & Vertical Control Nec.
8¼" F.L.
COLOR and COLOR

ITEM XII-13
AERIAL PHOTOGRAPH



ITEM 12-13

Circle represents the general area that the surface survey covered-Crandell Creek is the main creek generally trending east-west.