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The Basic Map Interpretation and Terrain Analysis Course (MITAC) Narrative

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The map interpretation and terrain analysis course (MITAC) was upgraded to a computer-based training format to correct deficiencies in low altitude navigation training for helicopter pilots. This report describes the narrative used to produce a set of videodiscs to store the course content for individual study. The narrative is divided into six sections that describe the interpretation of different kinds of topographic features (e.g., terrain relief, hydrography, vegetation, cultural features) that can be used for navigation.

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PREFACE

This report contains the narrative used to prepare the two videodiscs (four sides) that are the primary components of a computer-based course designed to teach U.S. Army aviators the basic methods for interpreting and analyzing 1:50,000-scale topographic maps. The narrative is divided into six general sections. The title and the topics addressed in each section are presented below.

Interpretation of Terrain Relief (Side 1)

This section is divided into five parts. Part 1 presents information about contour lines, contour intervals, spot elevations, and benchmarks. Part 2 presents methods used to portray various types of slopes. Part 3 discusses the portrayal of basic landforms. Part 4 describes strategies for conceptualizing the lay of the land. Part 5 discusses concepts and strategies related to terrain masking.

Interpretation of Inland Hydrography (Side 2)

This section is divided into four parts. Part 1 presents some of the cartographic principles for portraying hydrographic features. Part 2 discusses the portrayal of streams, waterfalls, and rapids. Part 3 discusses the portrayal of lakes, ponds, and dams. Part 4 discusses the portrayal of miscellaneous hydrographic features such as springs, marshes, and swamps.

Interpretation of Vegetation (Side 3)

This section contains a discussion of the cartographic principles for portraying natural and cultural vegetation.

Interpretation of Transportation Lines (Side 3, continued)

This section contains a discussion of the cartographic principles for portraying roads, railroads, and bridges.

Interpretation of Cultural Features (Side 4)

This section contains a discussion of miscellaneous man-made aerial obstructions and navigation cues, excluding transportation lines and buildings.

Interpretation of Buildings and Populated Places (Side 4, continued)

This section contains a discussion of the cartographic principles for portraying permanent and temporary structures, such as churches, schools, ruins, and abandoned buildings.

THE BASIC MAP INTERPRETATION AND TRAIN ANALYSIS COURSE (MITAC) NARRATIVE

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THE BASIC MAP INTERPRETATION AND TERRAIN ANALYSIS COURSE (MITAC) NARRATIVE

INTERPRETATION OF TERRAIN RELIEF

PART ONE: INTRODUCTION

THIS LESSON CONTAINS AN INTRODUCTION TO THE TOPIC OF TERRAIN RELIEF INTERPRETATION AND DISCUSSES THE WAYS IN WHICH TERRAIN RELIEF IS PORTRAYED ON 1:50,000-SCALE TOPOGRAPHIC MAPS PREPARED BY THE DEFENSE MAPPING AGENCY. YOU WILL BE TAUGHT PRINCIPLES THAT WILL HELP YOU WHEN INTERPRETING THE PORTRAYAL OF TERRAIN RELIEF ON TOPOGRAPHIC MAPS.

THE TERM TERRAIN RELIEF REFERS TO "THE SHAPE AND HEIGHT OF LANDFORMS." THE MAP PORTRAYAL OF TERRAIN RELIEF IS A REPRESENTATION OF THE SHAPE AND HEIGHT OF LANDFORMS. TERRAIN RELIEF USUALLY PROVIDES THE MOST RELIABLE CHECKPOINTS AVAILABLE; ALSO, IT WILL HAVE AN IMPORTANT INFLUENCE ON YOUR ABILITY TO INTERPRET OTHER CLASSES OF TOPOGRAPHIC FEATURES IN AN AREA OF OPERATION.

THE METHODS USED TO PORTRAY TERRAIN RELIEF INFORMATION ON DMA 1:50,000-SCALE TOPOGRAPHIC MAPS INCLUDE: CONTOUR LINES, FORM LINES, SPOT ELEVATIONS AND BENCHMARKS. A CONTOUR LINE IS AN IMAGINARY LINE ON THE SURFACE OF THE EARTH TAKING WHATEVER FORM IS NECESSARY TO REMAIN AT AN EQUAL ELEVATION ABOVE MEAN SEA LEVEL. CONTOUR LINES ALLOW THE CARTOGRAPHER TO PORTRAY THREE-DIMENSIONAL ASPECTS OF LANDFORMS, SUCH AS ELEVATION, SLOPE, FORM, AND SIZE ON A TWO-DIMENSIONAL PLANE, THE MAP SHEET.

CONTOUR INTERVAL IS THE DIFFERENCE IN THE ELEVATION BETWEEN ADJACENT CONTOUR LINES. THE VALUE OF THE CONTOUR INTERVAL IS ALWAYS PRINTED IN THE LOWER MARGIN OF THE MAP SHEET.

THERE ARE FOUR TYPES OF CONTOUR LINES ON DMA 1:50,000-SCALE MAPS: INDEX CONTOUR LINES, INTERMEDIATE CONTOUR LINES, SUPPLEMENTARY CONTOUR LINES, AND DEPRESSION CONTOUR LINES. INDEX CONTOUR LINES ARE SLIGHTLY WIDER THAN THE OTHER CONTOUR LINES AND THEREFORE APPEAR TO BE DARKER. INDEX CONTOUR LINES ARE BROKEN AT INTERVALS AND THE ELEVATION OF THE CONTOUR LINE IS PRINTED IN THE SPACE.

INTERMEDIATE CONTOUR LINES ARE THE THINNER CONTOUR LINES LOCATED BETWEEN THE INDEX CONTOURS. ON 1:50,000-SCALE MAPS, THERE ARE USUALLY FOUR INTERMEDIATE CONTOUR LINES BETWEEN INDEX CONTOUR LINES. IF THE CONTOUR INTERVAL RESULTS IN TOO MUCH CONGESTION OF CONTOUR LINES IN STEEP AREAS, INTERMEDIATE CONTOURS MAY BE DROPPED FOR SHORT DISTANCES WHERE THEY WOULD OTHERWISE OVERLAP.

SUPPLEMENTARY CONTOUR LINES ARE DEPICTED WITH A DASHED LINE. AS THIS NAME IMPLIES, SUPPLEMENTARY CONTOUR LINES ARE USED TO SUPPLEMENT INDEX AND INTERMEDIATE CONTOUR LINES. SUPPLEMENTARY CONTOUR LINES ARE USED WHEN THE CARTOGRAPHER JUDGES THAT A LANDFORM IS NOT ADEQUATELY PORTRAYED WITH INDEX AND INTERMEDIATE CONTOUR LINES. SUPPLEMENTARY CONTOUR LINES ARE OFTEN NOT CONTINUOUS AND MAY BEGIN AND END ANY PLACE ON THE MAP. THE CONTOUR INTERVAL FOR SUPPLEMENTARY CONTOUR LINES IS USUALLY ONE-HALF OR ONE-FOURTH OF THE CONTOUR INTERVAL FOR INTERMEDIATE CONTOUR LINES. THE VALUE OF THE SUPPLEMENTARY CONTOUR INTERVAL IS PRINTED IN THE LOWER MARGIN OF THE MAP.

DEPRESSION CONTOUR LINES INCLUDE ISOLATED BASINS OR DEPRESSIONS AND ARE DISTINGUISHED BY TICK MARKS. THE TICK MARKS POINT INWARD OR DOWN SLOPE, AND INDICATE THAT THE AREA WITHIN THE DEPRESSION CONTOUR DIPS BELOW THE ELEVATION OF THAT CONTOUR LINE. DEPRESSIONS SERVE AS NATURAL TRAPS FOR RAINWATER, SO A LAKE OR POND IS OFTEN PORTRAYED AT THE BOTTOM OF A DEPRESSION.

PRAIRIES AND ROLLING PLAINS WILL OFTEN BE PORTRAYED WITH A CONTOUR INTERVAL OF 10 METERS. HILLS WILL GENERALLY BE DEPICTED WITH AN INTERVAL OF 20 METERS. AND STEEP MOUNTAINS WILL OFTEN BE SHOWN WITH AN INTERVAL OF 40 METERS OR MORE.

THERE IS NO CONTOUR INTERVAL THAT WOULD BE SUITABLE FOR PORTRAYING BOTH THIS MOUNTAIN RANGE AND THE FLAT AREA THAT SURROUNDS IT. IN SITUATIONS SUCH AS THIS, THE CARTOGRAPHER USUALLY SELECTS A CONTOUR INTERVAL THAT IS SUITABLE FOR PORTRAYING THE MOUNTAINOUS TERRAIN AND USES SUPPLEMENTARY CONTOUR LINES TO ENHANCE THE PORTRAYAL OF THE FLATTER AREAS.

SPOT ELEVATIONS ARE USED TO SUPPLEMENT THE CONTOUR-LINE PORTRAYAL OF TERRAIN RELIEF BY PROVIDING PRECISE ELEVATION VALUES FOR SELECTED HIGH AND LOW POINTS ON THE MAP. TWO TYPES OF SPOT ELEVATIONS ARE PORTRAYED ON DMA TOPOGRAPHIC MAPS. ONE TYPE IS A "CHECKED" SPOT ELEVATION; THE OTHER IS AN "UNCHECKED" SPOT ELEVATION. CHECKED SPOT ELEVATIONS ARE SHOWN WITH A DOT OR AN "X," AND THE ELEVATION VALUE IS SHOWN IN BLACK. CHECKED SPOT ELEVATIONS HAVE BEEN CHECKED BY FIELD SURVEY TECHNIQUES, SO THE CITED ELEVATION VALUES ARE ACCURATE TO WITHIN ONE-TENTH OF A CONTOUR INTERVAL. UNCHECKED SPOT ELEVATIONS ARE SHOWN WITH A DOT OR AN "X," AND THE ELEVATION VALUE IS SHOWN IN BROWN. THE VALUE OF AN UNCHECKED SPOT ELEVATION IS ESTABLISHED WITH PHOTOGRAPHIC TECHNIQUES THAT YIELD VALUES CONSIDERED ACCURATE TO WITHIN THREE-TENTHS OF A CONTOUR INTERVAL. HOWEVER, THE DOT OR "X" MAY BE OMITTED AND ONLY THE ELEVATION VALUE SHOWN WHEN THE SPOT ELEVATION

MEASUREMENT IS MADE AT AN EASILY RECOGNIZABLE POINT SUCH AS A SHARP PEAK, OR A ROAD JUNCTION.

BENCHMARKS ARE LOCATIONS WHERE THE ELEVATION HAS BEEN MEASURED WITH GREAT PRECISION BY A SURVEY TEAM. THE LOCATION OF A BENCHMARK IS MARKED WITH A LARGE "X" OR THE LETTERS "BM." BENCHMARK ELEVATIONS ARE GIVEN TO THE NEAREST TENTH OF A METER. WHEN ELEVATION VALUES ARE GIVEN IN FEET, BOTH BENCHMARK VALUES AND SPOT ELEVATIONS ARE GIVEN TO THE NEAREST FOOT.

THIS CONCLUDES PART ONE OF THE LESSON ON TERRAIN RELIEF.

PART TWO: TERRAIN SLOPE

THIS LESSON DISCUSSES TERRAIN SLOPE. IN THIS LESSON, YOU WILL BE TAUGHT TO ESTIMATE THE SHAPE AND MAGNITUDE OF SLOPES FROM VARIATIONS IN THE SPACING OF CONTOUR LINES.

TERRAIN SLOPE IS DEFINED AS "THE RATE OF ELEVATION CHANGE IN THE LAND SURFACE OVER A GIVEN DISTANCE." THERE ARE FIVE DIFFERENT TYPES OF SLOPES YOU MUST BE ABLE TO RECOGNIZE. THESE INCLUDE: UNIFORM STEEP, UNIFORM GENTLE, CONVEX, CONCAVE, AND CLIFFS OR VERTICAL SLOPES.

CONTOUR LINES SPACED EVENLY AND CLOSE TOGETHER INDICATE A UNIFORM STEEP SLOPE, SUCH AS WHEN THERE IS A LARGE ELEVATION CHANGE OVER A SHORT HORIZONTAL DISTANCE. CONTOUR LINES SPACED EVENLY AND FAR APART INDICATE A GENTLE SLOPE. CONTOUR LINES WIDELY SPACED AT THE TOP AND CLOSELY SPACED AT THE BOTTOM INDICATE A CONVEX SLOPE. CONTOURS CLOSELY SPACED AT THE TOP AND WIDELY SPACED AT THE BOTTOM INDICATE A CONCAVE SLOPE. A BREAK IN THE SLOPE IS THE POINT AT WHICH THE STEEPNESS OF THE SLOPE CHANGES ABRUPTLY. CLIFFS FALL UNDER THE VERTICAL SLOPE CATEGORY.

ON OLDER MAPS, CLIFFS ARE SHOWN WITH CONVERGING CONTOUR LINES. SOMETIMES, HOWEVER, INSTEAD OF CONVERGING CONTOUR LINES, CLIFFS ARE SHOWN BY MERGING SEVERAL CONTOUR LINES INTO A SINGLE CARRYING CONTOUR LINE. ON NEWER MAPS, CLIFFS WITH A HEIGHT EQUAL TO OR GREATER THAN THE CONTOUR INTERVAL ARE SHOWN BY CONVERGING LINES WITH SHORT TICK MARKS POINTING DOWN SLOPE. CLIFFS WITH A HEIGHT LESS THAN THE CONTOUR INTERVAL ARE DEPICTED BY A SINGLE DASHED LINE WITH SHORT TICK MARKS POINTING DOWN SLOPE.

RECOGNIZING THE RELATIVE MAGNITUDE OF SLOPES CAN ALSO HELP YOU ASSOCIATE REAL-WORLD LANDFORMS WITH THEIR MAP PORTRAYAL. RECOGNIZING RELATIVE MAGNITUDE OF SLOPES MEANS

THAT YOU CAN JUDGE WHICH ONE OF TWO OR MORE SLOPES IS STEEPER. FOR EXAMPLE, EXAMINE THE SLOPE ON EITHER SIDE OF THIS LANDFORM. YOU CAN SEE THAT THE LEFT SLOPE IS MUCH STEEPER THAN THE RIGHT SLOPE.

NOW, EXAMINE THE MAP PORTRAYAL OF THE LANDFORM. BY COMPARING THE SPACING OF THE CONTOUR LINES, YOU CAN SEE THAT THE CONTOUR LINES ON THIS SIDE ARE MORE CLOSELY SPACED THAN THOSE ON THE OTHER SIDE.

THIS CONCLUDES PART TWO OF THE INTERPRETATION OF TERRAIN RELIEF.

PART THREE: BASIC LANDFORMS

IN THIS UNIT, A SET OF BASIC LANDFORMS WILL BE DEFINED AND THE CONTOUR LINE PORTRAYAL OF THE LANDFORMS WILL BE ILLUSTRATED. THE BASIC LANDFORMS TO BE DISCUSSED ARE: HILLS, RIDGES, SADDLES, SPURS, DRAWS, VALLEYS, FLAT-TOPPED LANDFORMS, AND ALLUVIAL FANS.

HILLS ARE ELEVATED LANDFORMS THAT ARE MORE OR LESS ROUND IN SHAPE. THEY ARE REPRESENTED ON THE MAP WITH A SERIES OF CONCENTRIC CONTOUR LINES, WHICH FORM A ROUGHLY CIRCULAR OR OVAL SHAPE. HILLS THAT HAVE ROUNDED TOPS AND GENTLE SLOPES ARE INDICATED ON THE MAP BY LARGE, CONCENTRIC CONTOURS THAT ARE WIDELY SPACED. OTHER HILLS HAVE SHARP PEAKS AND STEEP SLOPES. HILLS OF THIS TYPE ARE DEPICTED WITH SMALL CONCENTRIC CONTOURS SPACED CLOSE TOGETHER. OTHER HILLS HAVE COMBINATION SLOPES. THESE HILLS MAY HAVE A STEEP SLOPE ON ONE SIDE AND A GENTLE SLOPE ON ANOTHER SIDE, OR THEY MAY HAVE A COMBINATION OF DIFFERENT TYPES OF SLOPE ON ONE SIDE.

RIDGES ARE ELEVATED LANDFORMS THAT CAN BE THOUGHT OF AS ELONGATED HILLS. LIKE HILLS, RIDGES ARE PORTRAYED BY A SERIES OF CONCENTRIC CONTOUR LINES, BUT THE CONTOUR LINES PORTRAYING RIDGES ARE MORE ELONGATED IN SHAPE. SOME RIDGES HAVE BROAD, SMOOTH CRESTS WITH LITTLE RELIEF. THE BROAD, SMOOTH RIDGECREST IS DEPICTED BY WIDELY SPACED CONTOUR LINES. THE CONTOUR LINES DEPICTING THE RIDGECREST ARE EASILY DISTINGUISHED FROM THE CLOSELY SPACED CONTOURS DEPICTING THE STEEPER FRONT AND BACK SLOPES OF THE RIDGE. OTHER RIDGES HAVE NUMEROUS SHARP PEAKS ALONG THE RIDGECREST. THESE PEAKS ARE PORTRAYED BY SMALL, ENCLOSED CONTOUR LINES LOCATED IN THE RIDGECREST.

A SADDLE IS A LOW AREA BETWEEN A PAIR OF PEAKS LOCATED ON A RIDGECREST. SADDLES CAN BE RECOGNIZED ON TOPOGRAPHIC

MAPS BECAUSE THE CONTOUR LINES THAT DEPICT THE SADDLE FORM AN HOURGLASS SHAPE.

DRAWS AND SPURS ARE FOUND ON THE SLOPES OF RIDGES AND HILLS. A DRAW IS AN INDENTATION IN THE SIDE OF A RIDGE OR HILL THAT WAS FORMED BY WATER EROSION. A SPUR IS A LANDFORM THAT JUTS OUT FROM THE SIDE OF A RIDGE OR HILL THAT WAS FORMED AS THE RESULT OF WATER EROSION CUTTING DRAWS INTO THE SIDE OF THE RIDGE OR HILL.

A VALLEY IS A STREAM COURSE THAT HAS AT LEAST A LIMITED AMOUNT OF LEVEL GROUND ON ONE OR BOTH SIDES OF THE STREAM BED THAT RUNS ALONG THE VALLEY FLOOR. THE MORE GRADUAL THE FALL OF A STREAM, THE FARTHER EACH CONTOUR LINE PARALLELS THE VALLEY BEFORE CROSSING THE VALLEY FLOOR. THE CURVE OF THE CONTOUR LINES THAT CROSS A STREAM ALWAYS POINTS UPSTREAM.

CANYONS ARE DEEP, RELATIVELY NARROW VALLEYS WITH STEEP, ALMOST CLIFF-LIKE SIDES. THE CONTOUR LINE CROSSINGS OF CANYONS ARE CLOSER THAN THOSE OF REGULAR VALLEYS. A STREAM GENERALLY OCCUPIES MOST OF A CANYON FLOOR.

IN ARID REGIONS, LARGE, FLAT-TOPPED RIDGES AND MOUNTAINS ARE SOMETIMES CALLED MESAS OR BUTTES. FLAT-TOPPED HILLS AND RIDGES CAN BE DISTINGUISHED ON THE MAP BY CLOSELY SPACED CONTOURS ON THE SIDES, INDICATING STEEP SLOPES, AND WIDELY SPACED CONTOURS ON TOP, INDICATING FLAT OR GENTLE SLOPES.

ALLUVIAL FANS ARE LANDFORMS FOUND AT THE BASE OF MOUNTAIN RANGES IN ARID REGIONS. THEY CONSIST OF ROCKS AND SOIL DEPOSITED BY STREAMS FLOWING OUT OF NARROW MOUNTAIN CANYONS DURING INFREQUENT DESERT RAINSTORMS. ALLUVIAL FANS ARE SHOWN BY CONTOUR LINES THAT FORM A SEMI-CIRCULAR PATTERN AT THE BASE OF THE MOUNTAIN.

THIS CONCLUDES PART THREE OF THE LESSON ON TERRAIN RELIEF.

PART FOUR: CONCEPTUALIZING THE LAY OF THE LAND

WHEN PLANNING A MISSION, IT IS IMPORTANT TO STUDY MAPS OF THE AREA TO BE FLOWN. THIS IS NECESSARY TO DEVELOP AN INTEGRATED CONCEPT OF THE LAY OF THE LAND. THIS PROVIDES FOR A CLEAR UNDERSTANDING OF THE GENERAL TYPES OF LANDFORMS, THE SPECIFIC SIZES AND SHAPES OF LANDFORMS, AND THE RELATIVE LOCATION OF LANDFORMS IN THE GEOGRAPHICAL AREA OF INTEREST.

THE MAP SHOWN HERE IS AN EXAMPLE OF TERRAIN RELIEF THAT IS SO EASY TO CONCEPTUALIZE THAT DETAILED MAP STUDY IS NOT

REQUIRED. AS CAN BE SEEN AT A LANCE, THE MAP PORTRAYS SEVERAL LARGE HILLS LOCATED ON A FLAT DESERT FLOOR. THE RELATIVE SHAPE AND ELEVATION OF THE HILLS CAN BE SEEN WITH LITTLE EFFORT.

ON OTHER MAPS, SUCH AS THIS ONE, THE CONTOUR LINES ARE SO NUMEROUS AND SO CLOSELY SPACED THAT EVEN EXPERIENCED MAP USERS FIND IT DIFFICULT TO SEE A MEANINGFUL PATTERN OF LANDFORMS.

IT IS SOMETIMES DIFFICULT TO GET A CLEAR UNDERSTANDING OF THE RELATIVE ELEVATION OF LANDFORMS IN COMPLEX TERRAIN. A METHOD FOR SIMPLIFYING THIS TASK IS TO HIGHLIGHT SELECTED CONTOUR LINES ON THE MAP. HIGHLIGHTING INDEX CONTOUR LINES ON AN ACETATE OVERLAY WITH COLORED PENS MAKES THE RELATIVE ELEVATION OF OF LANDFORMS MORE APPARENT AT A GLANCE. ALL OF THE INDEX CONTOUR LINES APPEARING ON THIS MAP HAVE BEEN HIGHLIGHTED. THE COLOR REFLECTS THE ELEVATION OF THE INDEX CONTOUR. THE LOWEST INDEX CONTOUR, HIGHLIGHTED IN RED, HAS AN ELEVATION OF 3,000 METERS. THE INDEX CONTOUR WITH AN ELEVATION OF 3,500 METERS IS HIGHLIGHTED IN BLUE. THE HIGHEST INDEX CONTOUR, HIGHLIGHTED IN ORANGE, HAS AN ELEVATION OF 4,000 METERS. OTHER TERRAIN FEATURES THAT ARE USEFUL TO IDENTIFY ARE PROMINENT SADDLES AND PEAKS THAT COULD SERVE AS ORIENTATION FEATURES.

TERRAIN ASSOCIATION REFERS TO THE TASK OF ASSOCIATING ACTUAL LANDFORMS YOU CAN SEE WITH THE MAP PORTRAYAL OF THE LANDFORMS. THIS TASK MUST BE PERFORMED ANY TIME YOU WISH TO USE A LANDFORM AS A NAVIGATION CHECKPOINT. WHEN YOU ARE REQUIRED TO PERFORM THE TERRAIN-ASSOCIATION TASK AT A LOCATION SUCH AS THIS, THE FIRST THING YOU SHOULD DO IS ORIENT THE MAP USING YOUR COMPASS.

THE NEXT TASK IS TO EXAMINE THE REAL-WORLD SCENE AND TO IDENTIFY LANDFORMS THAT YOU BELIEVE WILL BE EASY TO RECOGNIZE ON THE MAP. IN MOST INSTANCES, IT IS BEST TO SELECT LANDFORMS THAT ARE UNIQUE IN SOME RESPECTS. FOR EXAMPLE, THE FLAT-TOPPED LANDFORM ON THE RIGHT HAS THE MOST OBVIOUS UNIQUE SHAPE THAT IS EASY TO IDENTIFY ON THE MAP. NOTE THAT THE CONTOUR LINES PORTRAYING THE TOP OF THE HILL ARE WIDELY SPACED, WHILE THE CONTOUR LINES DEPICTING THE SIDE OF THE LANDFORM ARE SPACED MORE CLOSELY TOGETHER, INDICATING A STEEPER SLOPE.

ANOTHER LANDFORM THAT IS EASY TO IDENTIFY IN THE SCENE IS THE SPUR SHOWN ON THE LEFT. IT'S A SIMPLE TASK TO ASSOCIATE THIS LANDFORM WITH ITS MAP COUNTERPART. THE CONTOUR LINES DEPICTING THE SPUR INDICATE THAT IT HAS A UNIFORM, GENTLE SLOPE. THE FLAT AREA IN THE FOREGROUND IS ALSO USEFUL IN THE TERRAIN ASSOCIATION TASK. THE VEGETATION

GROWING IN THIS AREA INDICATES THAT THERE IS A STREAM THAT FLOWS THROUGH THE SITE. THE STREAM IS CLEARLY PORTRAYED ON THE MAP.

THE SLOPING MOUNTAIN RANGE IN THE UPPER PORTION IS ALSO EASY TO IDENTIFY ON THE MAP. NOTE THAT THE LINES DEPICTING THE SLOPE INDICATE A UNIFORM SLOPE. OTHER FEATURES THAT AID IN IDENTIFICATION INCLUDE THE STREAM THAT FLOWS THROUGH THE AREAS AS WELL AS THE UNIMPROVED DIRT ROAD RUNNING PARALLEL TO THE STREAM. WHEN PERFORMING THE TERRAIN ASSOCIATION TASK, IT IS IMPORTANT TO USE A COMBINATION OF FEATURES FOR CONFIRMATION AND NOT TO RELY ON ONLY ONE OR TWO.

THIS CONCLUDES PART FOUR OF THE INTERPRETATION OF TERRAIN RELIEF.

PART FIVE: TERRAIN MASKING

THIS IS THE FINAL SECTION OF THE LESSON ON TERRAIN RELIEF. IN THIS LESSON, YOU WILL BE TAUGHT METHODS FOR USING A TOPOGRAPHIC MAP TO ASSESS TERRAIN MASKING. ASSESSMENT OF TERRAIN MASKING IS THE TASK OF DETERMINING WHETHER OR NOT INTERVENING TERRAIN MASKS AN OBSERVER'S VIEW FROM A GIVEN POINT.

THERE ARE SEVERAL TERMS RELEVANT TO TERRAIN MASKING WITH WHICH YOU SHOULD BE FAMILIAR. THESE TERMS ARE: INTERVISIBILITY, MASK, DEFILADE, TOPOGRAPHIC CREST, AND MILITARY CREST.

WHEN AN OBSERVER CAN SEE FROM ONE POINT TO ANOTHER, THE TWO POINTS ARE SAID TO BE INTERVISIBLE. ALL THREE PEAKS HIGHLIGHTED IN THIS PICTURE ARE INTERVISIBLE BECAUSE EACH PEAK IS VISIBLE FROM THE OTHERS.

A MASK IS A TERRAIN FEATURE THAT BLOCKS THE LINE OF SIGHT BETWEEN TWO POINTS. HILL B BLOCKS THE LINE OF SIGHT BETWEEN HILL A AND HILL C, SO HILL B IS A MASK. AN AREA THAT IS MASKED FROM VIEW IS SAID TO BE IN A DEFILADE. HERE, THE ENTIRE SHADED AREA IS IN A DEFILADE FROM AN OBSERVER AT POINT A.

THE TOPOGRAPHIC CREST OF A HILL IS THE SINGLE SPOT ON THE HILLTOP THAT HAS THE HIGHEST ELEVATION. THE MILITARY CREST OF A HILL IS THE HIGHEST POINT ON THE HILL FROM WHICH IT IS POSSIBLE TO SEE ALL THE WAY TO THE BASE OF THE HILL.

THE PRESENCE OR ABSENCE OF TERRAIN MASKING CAN BE DETERMINED VERY PRECISELY BY DRAWING A PROFILE OF THE TERRAIN OF INTEREST.

ANOTHER WAY TO ASSESS TERRAIN MASKING OVER A LARGE AREA ON THE MAP IS TO DEVELOP OVERLAYS SIMILAR TO THOSE RECOMMENDED FOR CONCEPTUALIZATION OF THE LAY OF THE LAND, PARTICULARLY THE OVERLAYS THAT HIGHLIGHT RIDGECRESTS AND DRAINAGE PATTERNS. THE DASHED RED RINDERPEST LINES INDICATE THE HIGH POINTS OF THE RIDGES, AND THE BLUE LINES INDICATE STREAMS IN THE LOW POINTS OF THE VALLEYS.

ANY SLOPE FACING AWAY FROM AN AVIATOR WILL MOST LIKELY BE MASKED FROM VIEW BY THE INTERVENING RIDGECRESTS. THE REVERSE SLOPES ARE SHADED IN GRAY. THE REVERSE SLOPES ARE NOT THE ONLY DEFILADED AREAS, HOWEVER, SOME AREAS ON THE FRONT-FACING SLOPES WILL ALSO BE MASKED FROM VIEW. AS AN AIRCRAFT APPROACHES THESE AREAS OR CHANGES ALTITUDES, THE DEFILADED AREAS GRADUALLY COME INTO VIEW.

THIS CONCLUDES THE LESSON ON TERRAIN RELIEF.

INTERPRETATION OF INLAND HYDROGRAPHY

PART ONE: INTRODUCTION

IN THIS LESSON, THE METHODS FOR PORTRAYING HYDROGRAPHIC FEATURES WILL BE DISCUSSED AND ILLUSTRATED. THIS CHART LISTS THE TECHNIQUES USED BY CARTOGRAPHERS TO PORTRAY HYDROGRAPHY: COLOR CODING, SHAPE CODING, LINE CONTINUITY, TEXTURED FILL, LAND AREA SYMBOLS, AND ALPHANUMERIC LABELING.

HYDROGRAPHIC FEATURES AND THE NAMES OF HYDROGRAPHIC FEATURES ARE ALMOST ALWAYS PRINTED IN BLUE. ON SOME OLDER MAPS, HOWEVER, THE NAMES OF HYDROGRAPHIC FEATURES ARE PRINTED IN BLACK.

LARGE HYDROGRAPHIC FEATURES ARE PORTRAYED TO SCALE. THE SHAPE OF THE FEATURE PORTRAYED ON THE MAP RESEMBLES THE SHAPE OF THE REAL-WORLD FEATURE. THE SHAPE OF SMALL HYDROGRAPHIC FEATURES IS GENERALIZED OR THE FEATURE IS DEPICTED WITH A STANDARD SHAPE-CODED SYMBOL. SHOWN HERE IS A POND THAT IS SO SMALL THAT ITS TRUE SHAPE COULD NOT BE PORTRAYED ACCURATELY AT 1:50,000-SCALE, SO THE SHAPE OF THE POND WAS GENERALIZED.

ANOTHER WAY IN WHICH HYDROGRAPHIC FEATURES ARE CODED IS BY THE CONTINUITY OF A LINE SHOWING THE LOCATION OR BOUNDARY OF A HYDROGRAPHIC FEATURE. A SOLID BLUE LINE IS USED TO PORTRAY A SINGLE-LINE PERENNIAL STREAM; THE SHORELINE OF A PERENNIAL LAKE AND THE BANKS OF DOUBLE-LINE PERENNIAL STREAMS. A BROKEN BLUE LINE, COMPOSED OF DOTS AND DASHES, IS USED TO DEPICT SINGLE-LINE INTERMITTENT STREAMS. A BROKEN BLUE LINE, COMPOSED OF A SERIES OF DASHES, IS USED FOR A VARIETY OF PURPOSES.

THIS EXAMPLE SHOWS THE USE OF A DASHED BLUE LINE TO PORTRAY THE BANKS OF AN INTERMITTENT DOUBLE-LINE STREAM. A SINGLE DASHED BLUE LINE IS ALSO USED TO PORTRAY SUCH FEATURES AS UNDERGROUND AQUEDUCTS, AND ABANDONED DITCHES.

ANOTHER CODING PARAMETER USED TO PORTRAY HYDROGRAPHIC FEATURES IS TEXTURED FILL. THE THREE MOST COMMON TYPES OF TEXTURED FILL FOUND ON MAPS ARE: BLUE TINT, BLUE DIAGONAL HATCHING, AND BLUE AND SOMETIMES BROWN STIPPLING.

BLUE TINT IS USED TO DEPICT PERENNIAL DOUBLE-LINE STREAMS AND ALL PERENNIAL LAKES AND PONDS. THE SAME BLUE TINT IS USED TO PORTRAY SWIMMING POOLS, RESERVOIRS, AND SEVERAL OTHER MAN-MADE HYDROGRAPHIC FEATURES.

BLUE DIAGONAL HATCHING IS TYPICALLY USED TO PORTRAY INTERMITTENT PONDS. HERE, BLUE DIAGONAL HATCHING IS USED TO PORTRAY A SEWAGE BED.

STIPPLING CONSISTS OF SMALL BLUE OR BROWN DOTS ON A WHITE BACKGROUND. BLUE STIPPLING IS USED HERE TO PORTRAY A DRY LAKE. BROWN STIPPLING IS THE SYMBOL USED FOR DRY SAND; IT IS FREQUENTLY USED TO PORTRAY THE BEDS AND BANKS OF STREAMS, AND DRY LAKES.

THE LAND AREA CODE ILLUSTRATED ON THIS MAP SEGMENT CONSISTS OF ROWS OF DASHED BLUE LINES. THIS CODE IS USED TO DEPICT LAND AREAS THAT ARE SUBJECT TO PERIODIC BUT SHORT-TERM FLOODING. THE SYMBOL IS USED TO DEPICT AREAS IN MAN-MADE FLOOD CONTROL RESERVOIRS AND AREAS ALONG STREAMS AND NATURAL LAKES THAT ARE FLOODED REGULARLY AS A RESULT OF HEAVY RAINFALL.

MANY HYDROGRAPHIC FEATURES FOUND ON TOPOGRAPHIC MAPS ARE CODED BY LABELING. TWO TYPES OF LABELS ARE USED: PROPER NAMES AND THE NAMES OF FEATURE CLASSES. PROPER NAMES WILL APPEAR ON THE MAP PORTRAYAL OF ALL MAJOR LAKES, DOUBLE-LINE STREAMS, AND MOST PERENNIAL SINGLE-LINE STREAMS.

FEATURE CLASS LABELS ARE OFTEN NECESSARY TO UNIQUELY DEFINE THE TYPE OF HYDROGRAPHIC *FEATURE THAT IS PORTRAYED*. FOR EXAMPLE, THERE IS NO UNIQUE SYMBOL FOR AN AQUEDUCT, SO THE SAME BLUE LINE THAT IS USED TO DEPICT A SINGLE LINE STREAM IS USED AND IS LABELED WITH THE WORD "AQUEDUCT."

THIS CONCLUDES PART ONE OF THE INTERPRETATION OF INLAND HYDROGRAPHY.

PART TWO: STREAMS

PART TWO OF THE LESSON ON INLAND HYDROGRAPHY ADDRESSES STREAMS. THE TERM "STREAMS" IS USED HERE TO ENCOMPASS ALL OF THE FEATURES THAT ARE REFERRED TO AS RIVERS, CREEKS, BROOKS, RUNS, BRANCHES, OR ANY NATURAL BED THROUGH WHICH WATER DRAINS FROM THE LAND.

STREAMS ARE DIVIDED INTO TWO MAJOR CATEGORIES: PERENNIAL AND INTERMITTENT. A PERENNIAL STREAM IS ONE THAT CONTAINS WATER FOR 6 MONTHS OR MORE PER YEAR. INTERMITTENT STREAMS ARE THOSE THAT CONTAIN WATER LESS THAN 6 MONTHS PER YEAR.

STREAMS ARE FURTHER DIVIDED INTO FOUR CLASSES. THIS CHART ILLUSTRATES THE FOUR MAJOR CLASSES OF STREAMS THAT WILL BE DISCUSSED IN THIS LESSON. THE FIRST EXAMPLE IS A PERENNIAL DOUBLE-LINE STREAM THAT IS AT LEAST 25 METERS WIDE. THE SECOND AND THIRD EXAMPLES ILLUSTRATE THE SYMBOL FOR A PERENNIAL STREAM LESS THAN 25 METERS WIDE. THE FOUR EXAMPLE SHOWS THE SYMBOL USED TO PORTRAY INTERMITTENT DOUBLE-LINE STREAMS 25 METERS OR MORE WIDE. THE FIFTH AND SIXTH EXAMPLES ILLUSTRATE INTERMITTENT STREAMS MEASURING LESS THAN 25 METERS IN WIDTH. ON OLDER MAPS, INTERMITTENT STREAMS ARE PORTRAYED WITH DASHED LINES CONNECTED WITH DOTS.

DOUBLE-LINE STREAMS ARE ALWAYS SELECTED FOR PORTRAYAL ON 1:50,000-SCALE MAPS. THE AMOUNT OF WATER IN THE STREAM HAS NO BEARING WHATSOEVER ON WHETHER OR NOT A DOUBLE-LINE STREAM WILL BE PORTRAYED ON THE MAP. ANY STREAM BED WITH A BANK-TO-BANK WIDTH OF 25 METERS OR MORE WILL BE PORTRAYED ON THE MAP.

DOUBLE-LINE INTERMITTENT STREAMS ARE OFTEN FOUND IN ARID AREAS WHERE RAIN IS INFREQUENT. THEY ALWAYS DRAIN A LARGER AREA AND ARE FORMED ONLY BECAUSE THE RUN OFF FROM A LARGE AREA COLLECTS AT ONE LOCATION. DOUBLE-LINE INTERMITTENT STREAMS ARE USUALLY VISIBLY PROMINENT BECAUSE THE SANDY SOIL IN THE STREAM BED USUALLY CONTRASTS WITH THE SOIL OUTSIDE THE BOUNDARY OF THE STREAM. ALSO, THE VEGETATION ALONG THE STREAM BED IS OFTEN TALLER, GREENER, OR OF A DIFFERENT TYPE THAN THE VEGETATION GROWING IN THE SURROUNDING AREA.

SINGLE-LINE STREAMS PROVIDE A FRAMEWORK FOR TERRAIN RELIEF. THE PORTRAYAL OF NUMEROUS SMALL STREAMS MAKES IT EASIER TO INTERPRET THE CONTOUR-LINE PORTRAYAL OF TERRAIN RELIEF.

A SINGLE SYMBOL IS USED TO PORTRAY PERENNIAL SINGLE-LINE STREAMS WITH DIFFERING CHARACTERISTICS. FOR EXAMPLE, BOTH OF THESE STREAMS ARE SINGLE-LINE PERENNIAL STREAMS AND WOULD BE DEPICTED ON THE MAP WITH A SINGLE BLUE LINE. BUT NOTE THE DIFFERENCE IN THE WIDTH OF THE TWO STREAMS. THE STREAM IN THE UPPER HALF OF THE SCREEN IS JUST BELOW THE CRITERION WIDTH FOR A DOUBLE-LINE STREAM, BUT WOULD BE PORTRAYED WITH THE SAME SYMBOL AS THE STREAM IN THE LOWER HALF OF THE SCREEN.

IN ARID REGIONS, ALL SINGLE-LINE PERENNIAL STREAMS ARE PORTRAYED. BECAUSE OF THE GREAT IMPORTANCE OF WATER, ALL PERENNIAL WATER SOURCES WILL BE PORTRAYED ON THE MAP, NO MATTER HOW SMALL OR VISUALLY INSIGNIFICANT THEY MAY BE.

THE SAME DIVERSITY OF APPEARANCE THAT EXISTS AMONG SINGLE-LINE PERENNIAL STREAMS EXISTS AMONG SINGLE-LINE INTERMITTENT STREAMS. THE STREAMS SHOWN HERE ARE HIGHLY

VISIBLE BECAUSE OF SURROUNDING VEGETATION AND SANDY STREAM BEDS.

THESE INTERMITTENT STREAMS, HOWEVER, CAN BE DISTINGUISHED FROM THE SURROUNDING TERRAIN ONLY BY THE SLIGHT DISCOLORATION OF THE SOIL IN THE STREAM BEDS. DESPITE THE GREAT DIFFERENCES IN APPEARANCE, THESE STREAMS ARE DEPICTED ON THE MAP WITH THE SAME SYMBOL.

SELECTION PRACTICES FOR SMALL STREAMS VARY FROM ONE GEOGRAPHICAL AREA TO ANOTHER. THIS MAP SEGMENT PORTRAYS HILLY TERRAIN. THERE IS A GREAT ABUNDANCE OF WATER IN THIS AREA, AND THE RELIEF IS DISTINCTIVE. AS A CONSEQUENCE, THE MAP COMPILER HAS CHOSEN TO PORTRAY ONLY A FRACTION OF THE SINGLE-LINE INTERMITTENT STREAMS IN THIS AREA. FOR EXAMPLE, NOTICE THAT THE COMPILER CHOSE TO PORTRAY SINGLE-LINE INTERMITTENT STREAMS IN THE DRAWS INDICATED BY THE THREE ARROWS THAT ARE POINTED DOWNWARD. YET, NO SINGLE-LINE INTERMITTENT STREAMS ARE DEPICTED IN THE THREE SIMILAR DRAWS IDENTIFIED BY THE UPWARD POINTING ARROWS. THE MAP COMPILER DEPICTED ONLY ENOUGH SINGLE-LINE INTERMITTENT STREAMS TO INFORM THE MAP USER THAT THE DRAWS IN THIS GENERAL AREA HAVE SINGLE-LINE INTERMITTENT STREAM BEDS IN THEM.

THIS MAP SEGMENT PORTRAYS RELATIVELY FLAT DESERT TERRAIN. BECAUSE OF THE SCARCITY OF WATER RESOURCES IN THIS AREA, AND BECAUSE THE TERRAIN IS INDEFINITE, THE MAP COMPILER HAS CHOSEN TO PORTRAY NEARLY EVERY MINOR INTERMITTENT STREAM BED THAT EXISTS.

THIS CHART ILLUSTRATES THE MANNER IN WHICH FALLS AND RAPIDS ARE PORTRAYED ON THE MAP. THE PORTRAYAL OF SMALL FALLS IS THE SAME ON SINGLE-LINE AND DOUBLE-LINE STREAMS. THE LOCATION OF THE FALLS IS INDICATED BY A SHORT LINE DRAWN PERPENDICULAR TO THE STREAM.

THE STANDARD SYMBOL USED TO PORTRAY LARGE FALLS ON A STREAM IS AN INVERTED U-SHAPED LINE DRAWN ACROSS THE STREAM WITH TICK MARKS DRAWN FROM THE LINE POINTING DOWNSTREAM, PARALLEL TO THE WATER FLOW.

SMALL RAPIDS ARE PORTRAYED ON A SINGLE-LINE STREAM AND DOUBLE-LINE STREAM WITH TWO LINES DRAWN PERPENDICULAR TO THE STREAM. ONE LINE DEPICTS THE UPSTREAM LIMITS AND THE OTHER LINE DEPICTS THE DOWNSTREAM LIMITS OF THE RAPIDS.

LARGE RAPIDS ARE PORTRAYED WITH SHORT BLUE LINES DRAWN PARALLEL TO THE WATER FLOW. THE TICK MARKS ARE POSITIONED TO PORTRAY BOTH THE SHAPE AND EXTENT OF THE RAPIDS AS ACCURATELY AS IS POSSIBLE WITHIN THE LIMITS IMPOSED BY SCALE.

THIS CONCLUDES PART TWO OF THE DISCUSSION OF STREAMS.

PART THREE: LAKES AND PONDS

THIS PART OF THE LESSON ON INLAND HYDROGRAPHY ADDRESSES THE FACTS AND PRINCIPLES THAT WILL BE BENEFICIAL WHEN INTERPRETING THE PORTRAYAL OF LAKES AND PONDS ON DMA 1:50,000-SCALE TOPOGRAPHIC MAPS. TWO BROAD TOPICS ARE DISCUSSED IN THIS UNIT. THE FIRST TOPIC IS THE CLASSIFICATION AND PORTRAYAL OF LAKES AND PONDS; THE SECOND TOPIC IS THE CLASSIFICATION AND PORTRAYAL OF DAMS.

SIMILAR TO THE CLASSIFICATION OF STREAMS, LAKES AND PONDS ARE CLASSIFIED AS PERENNIAL, INTERMITTENT, OR DRY. PERENNIAL LAKES AND PONDS ARE THOSE THAT CONTAIN WATER 6 MONTHS OR MORE PER YEAR. PERENNIAL LAKES AND PONDS ARE PORTRAYED ON THE MAP WITH A SOLID BLUE OUTLINE AND A BLUE TINT COVERING THE WATER AREA. NAMES AND WATER SURFACE ELEVATIONS ARE SHOWN ON SELECTED LAKES.

FOR NATURAL LAKES AND PONDS CLASSIFIED AS PERENNIAL, THE WATER SURFACE ELEVATIONS SHOWN ON THE MAP ARE INTENDED TO CORRESPOND TO THE NORMAL WATER STAGE. FOR LARGE RESERVOIRS, A NORMAL OPERATING LEVEL IS ESTABLISHED BY THE AGENCY RESPONSIBLE FOR OPERATING THE RESERVOIR. IN SOME INSTANCES, THE MAP DEFINES THE SPILLWAY ELEVATION. THE SPILLWAY ELEVATION IS THE HIGHEST WATER ELEVATION THAT IS POSSIBLE IN A RESERVOIR, SO THE WATER ELEVATION OF A LAKE CANNOT EXCEED THE NUMBER SHOWN.

THE FACTORS THAT AFFECT THE LIKELIHOOD OF A POND OR LAKE CONTAINING WATER INCLUDE: CLIMATE OF THE AREA, SEASON OF THE YEAR, AND RECENCY OF PRECIPITATION IN THE AREA. THE LIKELIHOOD OF FINDING WATER IS GREATEST IN LARGE PERENNIAL LAKES LOCATED IN HUMID AREAS, SUCH AS THIS...AND THIS.

IN HUMID AREAS, EVEN SMALL PERENNIAL PONDS HAVE WATER IN THEM THROUGHOUT THE YEAR EXCEPT DURING PERIODS OF EXTREME DROUGHT. HOWEVER, WHEN ASSESSING THE LIKELIHOOD OF WATER IN A PERENNIAL POND, KEEP IN MIND THAT THERE IS A SMALL, BUT SIGNIFICANT POSSIBILITY THAT THE POND HAS BEEN PERMANENTLY DRAINED FOR ONE REASON OR ANOTHER, AS SHOWN HERE. THIS POND IS SHOWN ON THE MAP EVEN THOUGH IT HAS OBVIOUSLY BEEN DRAINED FOR QUITE A LONG TIME, AS INDICATED BY THE VEGETATION GROWING IN IT.

IN ARID AREAS, SMALL PONDS ARE OFTEN REFERRED TO AS TANKS. THIS MAP SEGMENT SHOWS A SMALL PERENNIAL POND LABELED "BOEDECKER TANK." THIS SMALL POND IS LOCATED ON A FLAT PLAIN IN ARIZONA. THIS SHOWS THAT THE POND IS NEARLY FILLED WITH

WATER. THE REASON IS THAT THIS POND IS FILLED FROM A WELL RATHER THAN BY NATURAL DRAINAGE.

INTERMITTENT LAKES AND PONDS CONTAIN WATER FOR LESS THAN 6 MONTHS DURING THE YEAR. INTERMITTENT LAKES AND PONDS ARE DEPICTED WITH BLUE DIAGONAL HATCHING OUTLINED BY A DASHED BLUE LINE. THE SHORELINES OF INTERMITTENT LAKES AND PONDS ARE MAPPED TO CORRESPOND WITH THE LAKE'S APPARENT HIGH-WATER LINE. WATER SURFACE ELEVATIONS ARE NOT SHOWN FOR INTERMITTENT LAKES AND PONDS.

THE VEGETATION GROWING IN THE BED OF THIS POND INDICATES THAT THERE HAS BEEN NO WATER STANDING IN THE POND FOR MANY MONTHS. THE RECOMMENDED PRACTICE IS TO ASSUME THAT INTERMITTENT LAKES AND PONDS ARE NOT LIKELY TO CONTAIN WATER UNLESS THERE HAS BEEN A RECENT LOCAL RAINSTORM.

A DRY LAKE OR POND IS ONE THAT SELDOM CONTAINS WATER OR CONTAINS WATER FOR ONLY SHORT PERIODS. DRY LAKES ARE SYMBOLIZED WITH A DASHED BLUE OUTLINE AND EITHER A BROWN OR BLUE STIPPLE FILL. THE MOST UP-TO-DATE MAP SPECIFICATIONS PUBLISHED BY DMA CALL FOR THE USE OF A BLUE RATHER THAN A BROWN STIPPLE FILL.

THIS CHART ILLUSTRATES THE MANNER IN WHICH DAMS ARE SYMBOLIZED. DIFFERENT KINDS OF SYMBOLS ARE USED FOR EARTHEN AND MASONRY DAMS AND FOR DAMS WITH VERTICAL SIDES AND SLOPED SIDES. BASIC MASONRY DAMS WITH STRAIGHT SIDES ARE REPRESENTED WITH A BLACK LINE. DAMS WITH SLOPED SIDES ARE PORTRAYED WITH A HEAVY LINE, WITH TICK MARKS DRAWN PERPENDICULAR TO THE HEAVY LINE.

THE PORTRAYAL OF EARTHEN DAMS IS FAR MORE VARIABLE THAN THE PORTRAYAL OF THE MASONRY DAMS. THIS IS AN EXAMPLE OF AN EARTHEN DAM PORTRAYED WITH A BROWN LINE THAT HAS TICK MARKS INDICATING THE SLOPED SIDES OF THE DAM.

NOW, EXAMINE THE EARTHEN DAM SHOWN HERE. NOTICE THAT THE SYMBOL CONSISTS OF A BROWN LINE WITH NO TICK MARKS ON IT. CURRENT DMA MAP DESIGN SPECIFIES THAT ALL EARTHEN DAMS ARE TO BE PORTRAYED BY EITHER OF THESE SYMBOLS.

HERE IS AN EARTHEN DAM PORTRAYED WITH A BLACK LINE. ON OLDER MAPS, EARTHEN DAMS ARE PORTRAYED WITH A BLACK LINE.

THERE ARE ALSO MAP SHEETS ON WHICH NO DAMS WHATSOEVER ARE PORTRAYED. SHOWN HERE ARE PONDS THAT HAVE DAMS THAT ARE NOT PORTRAYED ON THE MAP. THE DAMS ARE INFERRED FROM THE

CONTOUR LINES, OR SOMETIMES, BY THE STRAIGHTNESS OF THE SIDE OF A LAKE OR POND ON WHICH THE DAM IS LOCATED.

THIS CONCLUDES PART THREE OF THE LESSON ON INLAND HYDROGRAPHY.

PART FOUR: MISCELLANEOUS HYDROGRAPHIC FEATURES

THE CLASSES OF HYDROGRAPHIC FEATURES TO BE DISCUSSED IN THIS PART OF THE LESSON INCLUDE: SPRINGS, MARSHES, SWAMPS, WATER CONDUITS, AND CANALS.

A SPRING IS DEFINED AS "A NATURAL OUTFLOW OF WATER FROM A SUB-SURFACE LEVEL." A DISTINCTION IS MADE BETWEEN PERENNIAL AND INTERMITTENT SPRINGS. PERENNIAL AND INTERMITTENT SPRINGS ARE DISTINGUISHED IN THE SAME MANNER AS STREAMS, LAKES, AND PONDS. A SPRING IS CONSIDERED PERENNIAL IF THE OUTFLOW OF WATER OCCURS FOR 6 MONTHS OR MORE PER YEAR. A SPRING IS CONSIDERED INTERMITTENT IF THE OUTFLOW OF WATER OCCURS FOR LESS THAN 6 MONTHS ANNUALLY.

THE SYMBOLS FOR BOTH TYPES OF SPRINGS CONSIST OF A BLUE CIRCLE WITH A SHORT BLUE TAIL ATTACHED. THE SYMBOL FOR PERENNIAL SPRINGS HAS A SOLID BLUE CIRCLE, AND THE SYMBOL FOR INTERMITTENT SPRINGS HAS AN OPEN BLUE CIRCLE. FOR BOTH PERENNIAL AND INTERMITTENT SPRING SYMBOLS, THE BLUE CIRCLE INDICATES THE LOCATION OF THE OUTFLOW OF WATER FROM THE GROUND; THE BLUE TAIL INDICATES THE DIRECTION THE WATER FLOWS FROM THE SPRING. SPRING SYMBOLS ARE OFTEN LABELED.

MARSHES AND SWAMPS ARE PORTRAYED ON THE MAP WITH THE SAME SYMBOL. HOWEVER, THE MARSH SYMBOL TYPICALLY APPEARS OVER A HYDROGRAPHIC OR BLUE BACKGROUND, WHEREAS THE SWAMP SYMBOL APPEARS ON LAND.

THERE ARE TWO TYPES OF MARSHES: TIDAL AND NON-TIDAL. A TIDAL MARSH IS DEFINED AS SATURATED LAND THAT COVERS AND UNCOVERS WITH THE TIDE AND SUPPORTS REED ORGAN-LIKE AQUATIC GROWTHS. A MARSH IN NON-TIDAL OR INLAND WATERS IS DEFINED AS SATURATED LAND, USUALLY COVERED WITH STANDING WATER, THAT SUPPORTS REED ORGAN-LIKE AQUATIC GROWTHS.

TIDAL MARSHES CAN BE RECOGNIZED ON THE MAP BECAUSE OF THEIR CLOSE PROXIMITY TO THE OCEAN. THEY ARE SYMBOLIZED WITH THE ORDINARY MARSH OR SWAMP SYMBOL, EXCEPT THAT THE SHORELINE IS SHOWN AS THE LIMITS OF THE OPEN WATER. TIDAL MARSHES ARE SHOWN ON THE MAP AS THEY WOULD APPEAR WHEN UNCOVERED AT LOW TIDE.

NON-TIDAL MARSHES ARE PORTRAYED ON THE MAP WITH THE MARSH SYMBOL PRINTED OVER THE BLUE TINT REPRESENTING WATER.

SWAMPS ARE AREAS OF LAND THAT ARE SATURATED, BUT ARE NOT ALWAYS COVERED WITH WATER. THE MAP PORTRAYAL OF SWAMPS CAN BE RECOGNIZED WHEN THE SWAMP SYMBOL IS LOCATED ON LAND. VEGETATION IN A SWAMP IS SHOWN WITH ITS PRESCRIBED SYMBOL . OVERPRINTING THE SWAMP SYMBOL. THE SWAMP PORTRAYED ON THIS MAP SEGMENT CONTAINS TREES. IT IS OVERPRINTED WITH A SOLID GREEN TINT REPRESENTING WOODLAND. IF LITTLE OR NO VEGETATION EXISTS IN A SWAMPY AREA, THE SWAMP SYMBOL IS USED WITHOUT ANY VEGETATION OVERPRINT.

THE VISUAL APPEARANCE OF SWAMPS CAN BE QUITE VARIABLE, AS ILLUSTRATED BY THE FOLLOWING EXAMPLES.

A WATER CONDUIT IS "AN ARTIFICIAL OR MAN-MADE CHANNEL THAT CARRIES WATER FOR EITHER SUPPLY OR INDUSTRIAL PURPOSES." THE CATEGORY OF WATER CONDUITS INCLUDES FEATURES COMMONLY REFERRED TO AS AQUEDUCTS, PENSTOCKS, FLUMES, AND SIPHONS. THE SYMBOLS USED FOR WATER CONDUITS DEPEND ON WHETHER THE CONDUIT IS LOCATED ABOVE GROUND OR BELOW GROUND.

ABOVE-GROUND WATER CONDUITS ARE SYMBOLIZED BY A SOLID BLUE LINE. ABOVE GROUND WATER CONDUITS CAN BE EITHER AT GROUND LEVEL OR ELEVATED. IF ELEVATED, THIS FACT IS NOTED. BELOW-GROUND WATER CONDUITS ARE PORTRAYED WITH A BROKEN BLUE LINE.

A CANAL IS DEFINED AS "A MAINTAINED WATERWAY THAT IS USED BY COMMERCIAL CRAFT IN AN AREA." THIS CHART ILLUSTRATES THE MANNER IN WHICH VARIOUS CANALS ARE PORTRAYED ON A MAP.

LIKE STREAMS, CANALS ARE DIVIDED INTO DOUBLE-LINE AND SINGLE-LINE CANALS. ALL CANALS UNDER 25 METERS IN WIDTH ARE PORTRAYED WITH A SINGLE SOLID LINE. ALL CANALS OVER 25 METERS ARE PORTRAYED TO SCALE ON THE MAP WITH THE DOUBLE-LINE SYMBOL. DRY CANALS ARE SYMBOLIZED ON THE MAP WITH DASHED BLUE LINES.

THIS CONCLUDES THE LESSON ON HYDROGRAPHY.

INTERPRETATION OF VEGETATION

THIS LESSON FOCUSES ON THE INTERPRETATION OF VEGETATION ON DMA 1:50,000-SCALE TOPOGRAPHIC MAPS. THIS LESSON WILL ILLUSTRATE THE CARTOGRAPHIC SELECTION CRITERIA NORMALLY USED IN PORTRAYING VEGETATION AND WILL DISCUSS VEGETATION DENSITY CODES AND SYMBOLS USED ON TOPOGRAPHIC MAPS.

THERE ARE TWO GUIDELINES, OR SELECTION CRITERIA, USED BY CARTOGRAPHERS FOR PORTRAYING VEGETATION ON A MAP. THESE ARE: PERMANENCE OF VEGETATION AND A MINIMUM AREA SIZE REQUIREMENT.

PERMANENT VEGETATION IS CLASSIFIED INTO EIGHT DIFFERENT TYPES ON DMA 1:50,000-SCALE TOPOGRAPHIC MAPS. SIX OF THESE ARE NATURAL VEGETATION TYPES AND TWO ARE CULTURAL OR MAN-MADE. THE FIRST THREE NATURAL TYPES (WOODLAND, SCATTERED TREES, SCRUB), AS WELL AS THE TWO CULTURAL TYPES (ORCHARDS AND VINEYARDS), ARE FOUND ON MAPS ALL OVER THE WORLD. MANGROVE, NIPA, AND TROPICAL GRASS, HOWEVER, ARE ENCOUNTERED MAINLY IN AREAS WITH A TROPICAL OR SEMI-TROPICAL CLIMATE.

TO BE PORTRAYED ON A MAP, EACH VEGETATION TYPE USUALLY MUST MEET A MINIMUM AREA SIZE REQUIREMENT OF OF AROUND 125 METERS SQUARE. THIS IS JUST ABOUT THE SIZE OF 4 ACRES. AREAS OF VEGETATION MEASURING LESS THAN THIS ARE EITHER COMBINED WITH LARGER AREAS OF VEGETATION OR ARE NOT SHOWN AT ALL. HOWEVER, EXCEPTIONS TO THIS SIZE REQUIREMENT ARE SOMETIMES MADE IN AREAS CONTAINING SPARSE VEGETATION.

INSOFAR AS THE MAP SCALE PERMITS, THE CARTOGRAPHER ATTEMPTS TO PORTRAY AREAS OF VEGETATION IN THEIR TRUE SHAPES. HOWEVER, YOU WILL FIND THAT THE SHAPES ARE MORE GENERALIZED ON SOME MAP SHEETS THAN THEY ARE ON OTHERS.

THE SAME SIZE CRITERION USED FOR SELECTING VEGETATION FOR PORTRAYAL IS APPLIED TO THE PORTRAYAL OF CLEARINGS WITHIN A VEGETATED AREA. THESE CLEARINGS MEET THE MINIMUM AREA SIZE REQUIREMENT AND ARE PORTRAYED ON THE MAP. ANY CLEARING SMALLER THAN 4 ACRES WOULD NOT BE PORTRAYED, BUT WOULD, INSTEAD, BE INCLUDED IN THE SOLID WOODLAND TINT. LINEAR CLEARINGS, INCLUDING THOSE ASSOCIATED WITH MAN-MADE FEATURES, SUCH AS TRANSMISSION LINES, ROADS, AND RAILROADS, ARE SHOWN IF THEY ARE APPROXIMATELY 30 METERS OR MORE IN WIDTH.

NATURAL VEGETATION INCLUDES WOODLAND, SCATTERED TREES,SCRUB, AND TROPICAL VEGETATION, SUCH AS MANGROVE, NIPA, AND TROPICAL GRASS. WOODLAND IS PORTRAYED ON THE MAP WITH A SOLID GREEN TINT; SCATTERED TREES ARE DEPICTED WITH THE SCATTERED TREES SYMBOL; AND SCRUB IS REPRESENTED ON THE MAP

WITH STIPPLED GREEN TINT. TROPICAL VEGETATION WILL BE DISCUSSED LATER.

AREAS OF WOODLAND, SCATTERED TREES, AND SCRUB ARE CLASSIFIED ACCORDING TO HEIGHT AND DENSITY. HEIGHT IS USED TO DISTINGUISH SCRUB FROM SCATTERED TREES AND WOODLAND. NATURAL VEGETATION LOWER THAN 10 FEET IS CLASSIFIED AS SCRUB. NATURAL VEGETATION TALLER THAN 10 FEET IS CLASSIFIED AS EITHER WOODLAND OR SCATTERED TREES.

DENSITY OF CROWN COVER IS ALSO USED TO DISTINGUISH BETWEEN WOODLAND, SCATTERED TREES, AND SCRUB. THE CROWN COVER REFERS TO THE PERCENTAGE OF THE GROUND OBSCURED BY VEGETATION WHEN VIEWED FROM DIRECTLY ABOVE. THE SOLID WOODLAND TINT REPRESENTS AREAS OF TREES WITH 50% - 100% CROWN COVER, WHILE THE SCATTERED TREES SYMBOL REPRESENTS AREAS BETWEEN 25% AND 50% CROWN COVER. SCRUB MUST USUALLY HAVE GREATER THAN 25% CROWN COVER TO BE PORTRAYED. THE ABSENCE OF A VEGETATION TINT USUALLY MEANS LESS THAN 25% CROWN COVER, BUT EVEN THIS SMALL AMOUNT OF CROWN COVER CAN BE SIGNIFICANT.

SO, WHEN THE MAP PORTRAYAL SHOWS NO VEGETATION, IT DOES NOT NECESSARILY MEAN THAT THE TERRAIN IS TOTALLY DEVOID OF VEGETATION AS ILLUSTRATED HERE. THE AREA SHOWN HERE IS PORTRAYED AS CLEAR, BUT AS YOU CAN SEE, THERE IS A SIGNIFICANT AMOUNT OF VEGETATION IN THE AREA. ON THE OTHER HAND, WHEN A SOLID VEGETATION TINT IS PORTRAYED, IT DOES NOT NECESSARILY MEAN THAT THE TERRAIN IS TOTALLY FORESTED SUCH AS THE AREA SHOWN HERE.

THE VEGETATION PORTRAYED ON THE MAP IS RELATIVE TO THE AREA. THIS MEANS THAT THE ACTUAL HEIGHT AND DENSITY OF THESE THREE VEGETATION TYPES CAN DIFFER FROM REGION TO REGION. MOST OF THESE REGIONAL DIFFERENCES ARE DUE TO VARYING AMOUNTS OF RAINFALL IN DIFFERENT AREAS OF THE WORLD.

THE KINDS OF TREES THAT COMPRISE A WOODLAND OR SCATTERED TREE AREA ARE CONIFEROUS AND DECIDUOUS. CONIFEROUS TREES OR EVERGREENS NEVER LOSE THEIR LEAVES. DECIDUOUS TREES LOSE THEIR LEAVES DURING WINTER. MANY WOODLAND AREAS CONTAIN BOTH CONIFEROUS AND DECIDUOUS TREES.

IN THE PAST, THERE WAS NO DISTINCTION MADE ON THE MAP BETWEEN WOODLAND AREAS CONTAINING THE TWO KINDS OF TREES; ALL WERE SYMBOLIZED WITH THE SAME GREEN WOODLAND TINT. STARTING WITH SOME RECENT MAPS MADE AROUND 1980, A DISTINCTION WAS MADE BETWEEN THESE TYPES. AREA PATTERN SCREENS ARE SOMETIMES USED, AND THE KINDS OF TREES THAT COMPRISE THE WOODLAND AREAS ARE IDENTIFIED BY SYMBOLS OVERPRINTING THE WOODLAND TINT. EACH SEPARATE AREA OF WOODLAND CONTAINS SYMBOLS OF THE KINDS OF TREES THAT COMPRISE IT. THE FIRST EXAMPLE IS THE SYMBOL

USED TO PORTRAY CONIFEROUS TREES; THE SECOND, DECIDUOUS TREES; AND THE THIRD, A MIXTURE OF CONIFEROUS AND DECIDUOUS TREES.

THE WOODLAND AND SCATTERED TREE VEGETATION TYPES IN SEMI-ARID REGIONS ARE USUALLY CONFINED TO NARROW STRIPS ALONG STREAMS, THE MOIST AND SHADED NORTH-FACING SLOPES OF HILLS AND MOUNTAINS, AND SHELTERED VALLEYS AT HIGHER ELEVATIONS. THE NATURAL CROWN COVER OF WOODED AREAS IN SEMI-ARID REGIONS IS USUALLY MUCH MORE SPARSE THAN IN HUMID REGIONS.

IN CLEAR, SEMI-ARID REGIONS, SCRUB IS THE DOMINANT NATURAL VEGETATION TYPE. SCRUB OCCURRING IN SMALL PATCHES SURROUNDED BY CLEAR AREAS WOULD NOT ORDINARILY BE SHOWN ON A MAP. HOWEVER, WHEN THESE PATCHES OF SCRUB CAN BE USED FOR NAVIGATION PURPOSES, THEY ARE OFTEN PORTRAYED.

THE HEIGHT AND DENSITY OF SCRUB VARIES FROM ONE AREA TO ANOTHER. ON SOUTH-FACING SLOPES, SUCH AS THIS HILLSIDE, YOU MAY FIND SCRUB THAT IS LOW AND DISPERSED. THE MORE DIRECT SUNLIGHT AND HIGHER AVERAGE TEMPERATURE ON THESE SOUTH-FACING SLOPES OFTEN RESULT IN STUNTED SCRUB GROWTH. ON NORTH-FACING SLOPES, HOWEVER, LESS DIRECT SUNLIGHT AND LOWER AVERAGE TEMPERATURES OFTEN RESULT IN MUCH TALLER AND DENSER SCRUB GROWTH.

THESE TYPES OF TROPICAL AND SEMI-TROPICAL AND SEMI-TROPICAL VEGETATION MAY BE PORTRAYED ON SOME MAPS--MANGROVE, NIPA, AND TROPICAL GRASS. MANGROVE IS A THICK GROWTH OF TREES WITH TANGLED AERIAL ROOTS FOUND IN TROPICAL AND SEMI-TROPICAL REGIONS ALONG SEACOASTS AND ALONG THE BANKS OF TIDEWATER STREAMS.

NIPA IS A DENSE GROWTH OF STEMLESS PALMS FOUND IN TROPICAL AND SEMI-TROPICAL TIDAL OR BRACKISH WATERS. THIS USUALLY OCCURS FARTHER INLAND THAN MANGROVE AND GENERALLY FORMS STRIPS IN CHANNELS, THROUGH WHICH TIDES EBB AND FLOW.

TROPICAL GRASS IS FOUND IN TROPICAL OR SEMI-TROPICAL CLIMATES. TROPICAL GRASSLANDS ARE CHARACTERIZED BY DENSE, VERY COARSE GRASSES THAT GROW IN TUFTS OCCASIONALLY SEPARATED BY AREAS OF BARE SOIL. DURING THE RAINY SEASON, TROPICAL GROWTH MAY RANGE IN HEIGHT FROM APPROXIMATELY 4 TO 12 FEET.

THE TWO CULTURAL OR MAN-MADE VEGETATION TYPES PORTRAYED ON THE MAP ARE ORCHARDS AND VINEYARDS. ORCHARDS ARE PORTRAYED ON THE MAP BY OPEN GREEN TREE SYMBOLS ARRANGED IN SYMMETRICAL ROWS AND COLUMNS. AS THIS SYMBOL INDICATES, ORCHARDS ARE SYSTEMATIC PLANTINGS OF PERMANENT TREES OR SHRUBS. ORCHARDS ARE USEFUL FOR ORIENTATION BECAUSE THEIR

SYSTEMATIC PATTERN AND GEOMETRIC SHAPES USUALLY MAKE THEM EASILY RECOGNIZABLE.

SEASONAL VARIATIONS, HOWEVER, WILL AFFECT ORCHARDS IN MUCH THE SAME MANNER AS THEY AFFECT NATURAL WOODLAND. THE SAME SYMBOL IS USED TO PORTRAY BOTH DECIDUOUS AND EVERGREEN ORCHARDS.

THE ONLY REQUIREMENT FOR PORTRAYAL AS AN ORCHARD IS THAT THE VEGETATION MUST BE A SYSTEMATIC PLANTING OF PERMANENT TREES OR SHRUBS. NO HEIGHT OR DENSITY REQUIREMENTS APPLY.

VINEYARDS ARE PORTRAYED ON THE MAP BY SYMMETRICALLY ARRANGED GREEN DOTS. VINEYARDS ARE SYSTEMATIC PLANTINGS OF VINES, USUALLY PLANTED IN CLOSE ROWS AND SUPPORTED BY STAKES. LIKE ORCHARDS, VINEYARDS ARE USEFUL NAVIGATION FEATURES BECAUSE OF THEIR SYSTEMATIC PLANTING PATTERNS AND UNIQUE, GEOMETRIC SHAPES.

THIS CONCLUDES THE LESSON ON INTERPRETATION OF VEGETATION.

INTERPRETATION OF TRANSPORTATION LINES

THIS LESSON COVERS THE CLASSIFICATION OF MAP SYMBOLS FOR THREE TYPES OF TRANSPORTATION LINES: ROADS, RAILROADS, AND BRIDGES.

THIS CHART ILLUSTRATES THE VARIOUS CLASSES OF ROADS AND THEIR CORRESPONDING MAP SYMBOLS. ROADS ARE CLASSIFIED AS: DIVIDED HIGHWAYS WITH MEDIAN STRIPS, PRIMARY HIGHWAYS, SECONDARY HIGHWAYS, LIGHT DUTY ROADS, AND UNIMPROVED ROADS OR TRAILS. TYPE OF ROAD SURFACE AND WEATHERABILITY ARE ALSO USED TO CLASSIFY ROADS. THESE INCLUDE: HARD SURFACE, ALL WEATHER; IMPROVED SURFACE, ALL-WEATHER; AND UNIMPROVED SURFACE, FAIR OR DRY WEATHER.

A DIVIDED HIGHWAY IS A HIGHWAY WITH A MEDIAN STRIP THAT SEPARATES OPPOSING TRAFFIC LANES. THE MANNER IN WHICH A DIVIDED HIGHWAY IS PORTRAYED ON THE MAP DEPENDS ON THE WIDTH OF THE MEDIAN STRIP. THE SYMBOL USED TO PORTRAY A DIVIDED HIGHWAY A MEDIAN STRIP LESS THAN 10 METERS WIDE IS A TRIPLE-LINE WITH A SOLID RED FILL. MEDIANS 10 METERS OR WIDER ARE PORTRAYED TO SCALE, AND THE HIGHWAY IS PORTRAYED ON THE MAP BY A PAIR OF DOUBLE LINES WITH SOLID RED FILL. A DIVIDED HIGHWAY UNDER CONSTRUCTION WHEN THE MAP WAS BEING COMPILED IS INDICATED WITH LABELING.

PRIMARY AND SECONDARY ROADS SERVE DIFFERENT FUNCTIONS IN THE TRANSPORTATION NETWORK, BUT THE PHYSICAL CHARACTERISTICS OF THESE TWO ROAD CLASSES ARE ESSENTIALLY THE SAME. A DOUBLE-LINE SYMBOL WITH SOLID RED FILL IS USED TO PORTRAY PRIMARY ROADS; A DOUBLE-LINE SYMBOL WITH BROKEN RED FILL IS USED TO PORTRAY SECONDARY ROADS.

ALTHOUGH IT IS EASY TO DISTINGUISH BETWEEN THE SYMBOLS USED TO PORTRAY PRIMARY AND SECONDARY ROADS, IT IS SOMETIMES DIFFICULT TO DISTINGUISH BETWEEN THESE TWO ROAD TYPES IN THE REAL WORLD. FOR EXAMPLE, EXAMINE THE PHYSICAL CHARACTERISTICS OF THIS ROAD. IT IS DEPICTED AS A PRIMARY ROAD.

NOW, EXAMINE THE PHYSICAL CHARACTERISTICS OF THIS ROAD, WHICH IS DEPICTED AS A SECONDARY ROAD.

THE PHYSICAL CHARACTERISTICS OF PRIMARY AND SECONDARY ROADS CAN ALSO BE QUITE DIFFERENT. THE DARK COLORED ROAD SHOWN HERE IS A PRIMARY ROAD. THIS LIGHTER COLORED ROAD IS A SECONDARY ROAD.

IMPROVED LIGHT-DUTY ROADS ARE PORTRAYED WITH THE UNFILLED DOUBLE-LINE SYMBOL. THE TERM "LIGHT-DUTY" REFERS TO THE AMOUNT OF TRAFFIC THE ROAD WAS DESIGNED TO CARRY, NOT ITS LOAD-BEARING CAPACITY.

ROADS SYMBOLIZED AS IMPROVED LIGHT-DUTY ROADS HAVE THE WIDEST RANGE OF PHYSICAL CHARACTERISTICS OF ANY ROAD CLASS. AT ONE EXTREME, YOU MAY FIND PAVED LIGHT-DUTY ROADS THAT HAVE ESSENTIALLY THE SAME PHYSICAL CHARACTERISTICS AS SOME PRIMARY AND SECONDARY ROADS. AT THE OTHER EXTREME, YOU MAY FIND ROADS SUCH AS THIS PORTRAYED ON THE MAP AS LIGHT-DUTY ROADS. THESE ROADS SHOW LITTLE, IF ANY, IMPROVEMENT AND MIGHT BE BETTER CLASSIFIED AS UNIMPROVED DIRT ROADS.

IN HEAVILY POPULATED AREAS, MANY PAVED ROADS ARE PORTRAYED BY THE IMPROVED LIGHT-DUTY ROAD SYMBOL.

ALL-WEATHER LOOSE-SURFACE ROADS SUCH AS THIS ONE ARE ALSO CLASSIFIED AS LIGHT-DUTY ROADS. THIS ROAD IS CLEARLY AN IMPROVED ROAD.

UNIMPROVED ROADS ARE SYMBOLIZED WITH THE DASHED DOUBLE-LINE SYMBOL SHOWN HERE. BY DEFINITION, ROADS OF THIS CLASS ARE UNIMPROVED ROADS THAT ARE UNPAVED AND TRAFFICABLE ONLY IN FAIR OR DRY WEATHER. THIS ROAD CONFORMS CLOSELY WITH MOST MAP USER'S CONCEPT OF ROADS THAT ARE UNIMPROVED AND TRAFFICABLE ONLY IN DRY WEATHER. IN SPARSELY POPULATED AREAS, THE ONLY ROADS PORTRAYED ON THE MAP MAY BE UNIMPROVED ROADS.

TRAILS ARE SYMBOLIZED ON THE MAP WITH A SINGLE DASHED LINE SUCH AS THE ONE SHOWN HERE. LIKE OTHER ROAD CLASSES, THE PHYSICAL CHARACTERISTICS OF TRAILS CAN VARY CONSIDERABLY. BARELY DISCERNIBLE FOOTPATHS SUCH AS THIS ONE ARE SYMBOLIZED AS TRAILS. DIRT ROADS PASSABLE ONLY TO FOUR-WHEEL DRIVEN VEHICLES ARE ALSO SYMBOLIZED AS TRAILS. UNIMPROVED DIRT ROADS, TRACKS, AND TRAILS ARE SELECTED FOR PORTRAYAL ONLY WHEN THE CARTOGRAPHER CONSIDERS THEM TO BE AN IMPORTANT PART OF THE TRANSPORTATION SYSTEM IN THE AREA. MANY MORE UNIMPROVED DIRT ROADS, TRACKS, AND TRAILS WILL APPEAR IN THE REAL WORLD THAN ARE PORTRAYED ON THE MAP.

ROAD IDENTIFICATION IS AN ESSENTIAL SKILL IF YOU INTEND TO USE ROADS AS NAVIGATION CHECKPOINTS. THE TERM "ROAD IDENTIFICATION" REFERS TO THE TASK OF ACCURATELY ASSOCIATING A ROAD YOU SEE IN THE REAL WORLD WITH ITS PORTRAYAL ON THE MAP. THREE TYPES OF ROAD FEATURES THAT ARE POTENTIALLY USEFUL FOR ROAD IDENTIFICATION AND ORIENTATION ARE: DISTINCTIVE BENDS, DISTINCTIVE ROAD JUNCTIONS, AND ROAD ALIGNMENT.

TO BE DISTINCTIVE, IT IS ONLY NECESSARY THAT A BEND BE LARGE ENOUGH TO BE PERCEPTIBLE AND ONLY UNIQUE IN SHAPE ENOUGH TO BE EASILY RECOGNIZABLE. BENDS GREATER THAN 50 METERS IN LFNGTH WILL BE PORTRAYED TO SCALE. SOMETIMES THE SHAPES OF BENDS ARE GENERALIZED BECAUSE IT IS NOT POSSIBLE TO PORTRAY THE SHAPE OF THE BEND EXACTLY, GIVEN THE EXAGGERATED WIDTH OF THE ROAD SYMBOL.

IN FORESTED REGIONS, ROAD BENDS MAY BE DIFFICULT TO SEE AT LOW ALTITUDES. THEIR PRESENCE, HOWEVER, CAN OFTEN BE DETECTED. IF THIS ROAD CONTINUED IN A STRAIGHT LINE, YOU WOULD SEE A CUT IN THE TREES STRAIGHT AHEAD. SINCE THERE IS NO CUT, YOU CAN ASSUME THAT THE ROAD BENDS AHEAD.

IN MOST UNVEGETATED FLAT OR GENTLY ROLLING TERRAIN, EVEN SLIGHT CHANGES IN ROAD DIRECTION CAN AID IN IDENTIFICATION. CARTOGRAPHERS ARE VERY CAREFUL TO PORTRAY ANY SUBTLE BENDS IN ROADS AS ACCURATELY AS POSSIBLE WITHIN SCALE LIMITATIONS.

ANY DISTINCTIVE PATTERN OR SHAPE CREATED BY THE INTERSECTION OF TWO OR MORE ROADS IS PORTRAYED BY CARTOGRAPHERS. A UNIQUELY SHAPED OFF-RAMP INTERSECTING WITH A DIVIDED HIGHWAY IS EASILY RECOGNIZABLE ON THE MAP AND CAN BE USED TO ACCURATELY LOCATE YOUR POSITION ALONG THE HIGHWAY. DISTINCTIVE JUNCTION PATTERNS FORMED BY UNIMPROVED DIRT ROADS CAN BE ONE OF THE MOST USEFUL ORIENTATION CUES AVAILABLE IN FLAT, SPARSELY POPULATED AREAS.

INTERSECTIONS EXHIBITING ISLANDS IN THE SHAPE OF A TRIANGLE ARE PORTRAYED IF THEY EXCEED 80 FEET IN THEIR LONGEST DIMENSION. THIS TRIANGULAR INTERSECTION HAS BEEN ACCURATELY DEPICTED AND PROVIDES AN EXCELLENT ORIENTATION CUE.

ROAD ALIGNMENT IS ANOTHER ATTRIBUTE THAT MAY BE USEFUL FOR ROAD IDENTIFICATION AND ORIENTATION. THE TERM "ROAD ALIGNMENT" IS USED HERE TO REFER TO ALIGNMENT OF A ROAD WITH RESPECT TO GRID NORTH. BY COMPARING THE ALIGNMENT OF A ROAD IN THE REAL WORLD TO THE ALIGNMENT OF VARIOUS ROADS ON THE MAP, YOU CAN OFTEN ISOLATE THE ROAD OVER WHICH YOU ARE POSITIONED.

NOTE ON THE MAP SEGMENT THAT THE ROADS IN THE AREA FORM AN IRREGULAR PATTERN. IN AREAS SUCH AS THIS, ROAD ALIGNMENT CAN BE A RELIABLE AID FOR ROAD IDENTIFICATION AND ORIENTATION BECAUSE THERE ARE NO TWO ROADS THAT HAVE THE SAME ALIGNMENT.

BY CONTRAST, THE ROADS DEPICTED ON THIS MAP SEGMENT RUN PARALLEL TO ONE ANOTHER AND THEREFORE HAVE THE SAME

ALIGNMENT. ROAD ALIGNMENT WOULD HAVE LITTLE VALUE FOR ROAD IDENTIFICATION IN AREAS LIKE THIS ONE. THEREFORE, IT WOULD BE NECESSARY TO FOCUS ON OTHER ROAD CHARACTERISTICS FOR IDENTIFICATION.

RAILROADS ARE AMONG THE MOST RELIABLE FEATURES FOR ORIENTATION ON ANY MAP. THESE CHARTS ILLUSTRATE THE MANNER IN WHICH RAILROADS ARE PORTRAYED ON A MAP. ALL RAILROADS ARE CLASSIFIED INTO TWO GROUPS: OPERATING RAILROADS AND NON-OPERATING RAILROADS. AN OPERATING RAILROAD IS ONE THAT IS IN AT LEAST LIMITED USE OVER A MAINTAINED, PERMANENT RIGHT-OF-WAY. NON-OPERATING RAILROADS ARE THOSE THAT ARE NOT IN USE AND ARE NOT MAINTAINED. ALL OPERATING RAILROADS ARE DEPICTED WITH A SOLID LINE, AND ALL NON-OPERATING RAILROADS ARE SYMBOLIZED WITH A BROKEN LINE. IN ADDITION, NON-OPERATING RAILROADS ARE LABELED WITH A WORD THAT DESCRIBES THE TYPE OF NON-OPERATING RAILROAD THAT IS PORTRAYED.

RAILROADS ARE ALSO CLASSIFIED BASED UPON THE NUMBER OF TRACKS PRESENT ON THE SAME ROADBED. MOST RAILROADS ARE SINGLE-TRACK RAILROADS LIKE THE ONE SHOWN HERE. THE SYMBOL CONSISTS OF A SINGLE LINE AND CROSS-TIES.

RAILROADS ARE CLASSIFIED AS MULTIPLE TRACK IF THERE ARE TWO OR MORE SETS OF TRACKS ON THE SAME ROADBED. ON OLDER MAPS, THE SYMBOL CONSISTS OF TWO CLOSELY SPACED PARALLEL LINES WITH A SINGLE CROSS-TIE. ON NEWER MAPS, THE SYMBOL CONSISTS OF A SINGLE LINE WITH DOUBLE CROSS-TIES.

THIS SYMBOL IS USED TO PORTRAY SETS OF TRACKS THAT ARE PARALLEL, LOCATED CLOSE TO ONE ANOTHER, BUT SITUATED ON SEPARATE ROADBEDS.

RAILROAD SIDINGS ARE SHORT STRETCHES OF TRACK LOCATED CLOSE TO AND PARALLEL WITH THE MAIN LINE. SIDINGS ARE RELIABLE NAVIGATION CHECKPOINTS BECAUSE THEY ARE VISUALLY PROMINENT AND ARE ALMOST ALWAYS PORTRAYED ON THE MAP. THE ARROWS ON THIS MAP SEGMENT POINT TO SIDINGS PORTRAYED ON BOTH SIDES OF A MAINLINE RAILROAD THAT PASSES THROUGH ALABAMA. ALTHOUGH SIDINGS ARE PORTRAYED ON BOTH SIDES OF THE RAILROAD, ONLY ONE ACTUALLY EXISTS. YOU SHOULD KEEP IN MIND WHEN INTERPRETING FEATURES ON ANY MAP THAT THESE FEATURES MAY OR MAY NOT CORRESPOND EXACTLY WITH FEATURES THAT ARE SEEN IN THE REAL WORLD.

RAILROAD JUNCTIONS CAN BE USEFUL NAVIGATION CHECKPOINTS. HERE IS A JUNCTION OF A RAILROAD AND A ROAD. HERE IS A JUNCTION OF A RAILROAD AND A STREAM. THE UTILITY OF THESE JUNCTIONS AS NAVIGATION CHECKPOINTS DEPENDS ON YOUR ABILITY

TO IDENTIFY CORRECTLY THE ROAD OR STREAM THAT INTERSECTS THE RAILROAD.

BOTH HIGHWAY BRIDGES AND RAILROAD BRIDGES PORTRAYED BY A PAIR OF LINES WITH WINGTICKS AT THE END OF EACH LINE. THE HIGHWAY BRIDGE SYMBOL IS DRAWN WITH A LINEWEIGHT THAT IS SLIGHTLY HEAVIER THAN THAT USED FOR THE RAILROAD BRIDGE SYMBOL; OTHERWISE, THE TWO SYMBOLS ARE THE SAME.

BRIDGE SYMBOLS VARY IN LENGTH. BRIDGES LONGER THAN 75 METERS ARE PORTRAYED TO SCALE AND ALL SHORTER BRIDGES ARE PORTRAYED WITH A STANDARD LENGTH BRIDGE SYMBOL. ESTIMATING THE LENGTH OF A BRIDGE FROM ITS MAP PORTRAYAL IS A SIMPLE MATTER WHEN THE BRIDGE IS LONG ENOUGH TO BE PORTRAYED TO SCALE. YOU SHOULD BE ABLE TO MEASURE THE LENGTH OF THE BRIDGE SYMBOL AND ESTIMATE THE LENGTH OF THE BRIDGE TO AN ACCURACY OF A FEW METERS.

A CAREFUL MEASUREMENT WOULD SHOW THAT THE BRIDGE SHOWN HERE IS ABOUT 300 METERS LONG.

ESTIMATING THE LENGTH OF A BRIDGE BECOMES MORE DIFFICULT AND LESS ACCURATE WHEN THE BRIDGE IS DEPICTED WITH A STANDARD-LENGTH SYMBOL. ALL YOU KNOW IS THE BRIDGE IS NO MORE THAN 75 METERS LONG. HOWEVER, YOU CAN INCREASE THE ACCURACY OF YOUR ESTIMATION BY NOTING WHETHER THE BRIDGE CROSSES A SINGLE-LINE OR A DOUBLE-LINE STREAM.

THE BRIDGE SHOWN HERE IS ABOUT 75 METERS LONG BUT CROSSES A DOUBLE-LINE STREAM.

THIS IS A BRIDGE PORTRAYED WITH A STANDARD SYMBOL THAT SPANS A SINGLE-LINE STREAM. SINCE A SINGLE-LINE STREAM IS LESS THAN 25 METERS WIDE, A BRIDGE ABOUT 35 METERS LONG WOULD SPAN MOST SINGLE-LINE STREAMS. THAT IS THE CASE WITH THE BRIDGE PORTRAYED ON THIS MAP SEGMENT. THE LENGTH OF THE BRIDGE IS ONLY A FEW METERS GREATER THAN THE WIDTH OF THE STREAM.

IN SOME INSTANCES, HOWEVER, THE LENGTH OF A BRIDGE IS CONSIDERABLY GREATER THAN THE WIDTH OF THE STREAM IT SPANS. THIS BRIDGE SPANS 400 METERS ACROSS A STREAM. THIS SITUATION IS COMMON IN MANY AREAS THAT ARE SUBJECTED TO OCCASIONAL HEAVY RAINS OR FLASH FLOODS.

THE SYMBOL FOR A DRAWBRIDGE IS ILLUSTRATED HERE. THE ONLY THING THAT DIFFERENTIATES A DRAWBRIDGE SYMBOL FROM A CONVENTIONAL BRIDGE SYMBOL IS THE SMALL CIRCLE LOCATED BETWEEN THE TWO PARALLEL LINES. THE CIRCLE DEFINES THE POINT

AT WHICH SECTIONS OF THE BRIDGE SEPARATE WHEN THE DRAWBRIDGE IS RAISED.

FORDS ARE NOT BRIDGES IN THE TRUE SENSE OF THE WORD, BUT THEY ARE A TYPE OF RIVER CROSSING THAT IS PORTRAYED ON THE MAP. THERE IS NO SPECIAL SYMBOL FOR A FORD. INSTEAD, THE FORD IS PORTRAYED BY CONTINUING THE ROAD SYMBOL ACROSS THE STREAM AND, IN THIS CASE, LABELING THE CROSSING WITH THE WORD "FORD." YOU CAN EXPECT TO ENCOUNTER MANY INSTANCES IN WHICH THE MAP PORTRAYAL OF A FORD IS NOT LABELED.

THIS CONCLUDES THE LESSON ON THE INTERPRETATION OF TRANSPORTATION LINES.

INTERPRETATION OF CULTURAL FEATURES

THIS LESSON DISCUSSES THE INTERPRETATION OF CULTURAL OR MAN-MADE FEATURES. IT ALSO DEMONSTRATES THAT STANDARDIZED MAP SYMBOLS ARE USED TO PORTRAY CULTURAL FEATURES THAT WIDELY VARY IN THEIR ACTUAL APPEARANCE. FINALLY, IT ILLUSTRATES SOME OF THE FACTORS THAT INFLUENCE THE SELECTION OF FEATURES FOR MAP PORTRAYAL.

CULTURAL FEATURES OF SUFFICIENT SIZE, SHAPE, OR PROMINENCE TO MAKE THEM DISTINGUISHABLE AS LANDMARKS ARE ALWAYS SELECTED FOR MAP PORTRAYAL. SUCH FEATURES ARE CALLED LOCATED OBJECTS. THIS CHART ILLUSTRATES THE SYMBOLS OFTEN USED TO PORTRAY LOCATED OBJECTS. EXAMPLES ARE: TOWERS, CHIMNEYS, MEDIA MASTS, AIR BEACONS, LIGHTHOUSES, WATERMILLS, AND WINDMILLS.

LOCATED OBJECTS LESS THAN 61 METERS ABOVE GROUND ARE REPRESENTED BY THE STANDARD SYMBOL OR BY A CHARACTERISTIC SYMBOL. THE STANDARD SYMBOL IS LABELED FOR IDENTIFICATION AND IS USED FOR ALL FEATURES THAT DO NOT HAVE A CHARACTERISTIC SYMBOL. LOCATED OBJECTS THAT EXTEND 61 METERS OR MORE ABOVE THE SURROUNDING TERRAIN ARE CONSIDERED A HAZARD TO FLIGHT AND ARE SHOWN BY THE OBSTRUCTION SYMBOL AND LABELED, INDICATING THE NATURE OF THE OBSTRUCTION.

IN URBAN AREAS, WHERE THERE ARE NUMEROUS LANDMARK BUILDINGS, FEATURES THAT WOULD BE SELECTED AS LOCATED OBJECTS IN OTHER AREAS ARE NOT SYMBOLIZED UNLESS THEY ARE OF UNUSUAL PROMINENCE. LOCATED OBJECTS THAT ARE OBSTRUCTIONS TO AIRCRAFT ARE SHOWN WHEREVER THEY EXIST.

THE VARIOUS TYPES OF CULTURAL FEATURES PORTRAYED ON MAPS WILL NOW BE DISCUSSED, BEGINNING WITH WINDMILLS. NO DISTINCTION IS USUALLY MADE BETWEEN WINDMILLS AND WINDPUMPS.

LARGE CHIMNEYS ARE GOOD CHECKPOINT FEATURES WHEREVER THEY EXIST. SUCH FEATURES ARE USUALLY PORTRAYED WITH THE STANDARD LOCATED OBJECT SYMBOL AS SHOWN. OCCASIONALLY, HOWEVER, THEY ARE PORTRAYED BY A CHARACTERISTIC SYMBOL.

COMMUNICATION TOWERS OR ANTENNAS AND LOOKOUT TOWERS ARE EXCELLENT CHECKPOINTS WHEN LOCATED ON HIGH GROUND. BECAUSE OF THEIR VERTICAL DEVELOPMENT, THEY ARE USUALLY VISUALLY SIGNIFICANT FROM NAP-OF-THE-EARTH ALTITUDES. NOTE THAT THIS TOWER IS PORTRAYED WITH THE OBSTRUCTION SYMBOL.

PIPELINES ARE SHOWN WHERE THEY ARE EITHER OF LANDMARK OR MILITARY SIGNIFICANCE, BECAUSE OF THEIR IMPORTANCE AS ORIENTATION CUES WHEN NAVIGATING. ABOVE-GROUND PIPELINES ARE PORTRAYED WITH A SOLID LINE. BELOW-GROUND PIPELINES ARE PORTRAYED WITH A DASHED LINE AND LABELED.

THIS CHART ILLUSTRATES THE MANNER IN WHICH WELLS DRILLED FOR OIL, GAS, AND SALT ARE PORTRAYED ON MAPS. THE SYMBOL IS AN OPEN BLACK CIRCLE. A WELL SYMBOL IS USUALLY SUPPLEMENTED BY AN APPROPRIATE IDENTIFYING LABEL.

IN CONCENTRATED GROUPS OF SIMILAR WELLS, A REPRESENTATIVE PATTERN IS SHOWN. APPROPRIATE LABELING IS APPLIED TO THE PATTERN, SUCH AS "OIL WELLS," "GAS WELLS," AND "OIL FIELD."

A TANK IS A MAN-MADE RECEPTACLE USED TO STORE GAS, OIL, WATER, OR OTHER LIQUIDS. IT IS PORTRAYED AS A CLOSED BLACK CIRCLE. HOWEVER, IF THE TANK IS USED FOR STORAGE OF WATER, THE SYMBOL USED TO PORTRAY IT IS A SOLID BLUE CIRCLE.

FEATURES PORTRAYED AS TANKS MAY INDICATE PROMINENT ELEVATED TANKS OF THE TYPE SHOWN HERE OR SMALL RECEPTACLES LIKE THIS STORAGE TANK, WHICH IS PORTRAYED WITH THE SAME SYMBOL AS THAT USED TO PORTRAY LARGE TANKS. QUITE OFTEN, TANKS ARE LOCATED IN CLOSE PROXIMITY TO WINDMILLS, EVEN THOUGH ONLY A WINDMILL MAY BE PORTRAYED.

THIS CHART ILLUSTRATES THE VARIOUS WAYS IN WHICH HIGH-TENSION POWER TRANSMISSION LINES AND TELEPHONE AND TELEGRAPH LINES ARE SYMBOLIZED ON A MAP. THESE FEATURES ARE USUALLY DEPICTED PARALLEL TO ROADS, RAILROADS AND CANALS AND ARE BROKEN ONLY FOR SYMBOLIZED POPULATED PLACES. ON SOME MAPS, HOWEVER, THESE FEATURES ARE NOT SHOWN RUNNING ALONGSIDE ROADS, BUT PICK UP AGAIN WHEN NOT RUNNING PARALLEL TO THEM.

THESE FEATURES CAN BE HIGHLY PROMINENT IN A WOODED TERRAIN WHEN VIEWED ALONG THEIR LENGTHS. THEIR VISUAL SIGNIFICANCE COMES ALMOST ENTIRELY FROM THE CLEARED VEGETATION UNDER THE LINE AND FROM THE FACT THAT TRANSMISSION LINES TYPICALLY RUN IN EXTRAORDINARILY STRAIGHT LINES FROM LONG DISTANCES.

BUT, WHEN SEEN FROM THE SIDE, IN WOODED TERRAIN, THEY MAY BE EASILY MISSED DURING FLIGHT. THIS SHOWS THE POWER LINE VIEWED FROM THE SIDE. IT IS MUCH MORE DIFFICULT TO SEE FROM THIS ANGLE.

IN OPEN COUNTRY, THE POWER POLES OR TOWERS ARE THE MAIN VISUAL ELEMENTS, AND WHEN VIEWED FROM NAP-OF-THE-EARTH ALTITUDE, THE LINE-CARRYING TOWERS ARE OFTEN THE ONLY RELIABLE CHECKPOINT FEATURES AVAILABLE.

THE AREA CONTAINING POWER TRANSFORMER STATIONS, WHEN PLOTTABLE TO SCALE, IS OUTLINED BY A DASHED LINE OR SHOWN BY AN APPROPRIATE SYMBOL.

SILOS ARE OFTEN SELECTED FOR PORTRAYAL ON TOPOGRAPHIC MAPS. WHEN THEY ARE TALL AND STAND IN REASONABLY OPEN FIELDS, THEY ARE EXCELLENT CHECKPOINTS. SILOS ARE PORTRAYED WITH THIS SYMBOL ON NEW MAPS.

CEMETERIES AND CHURCHYARDS ARE PLOTTED TO SCALE IN THEIR CORRECT ALIGNMENTS.

SOME CEMETERIES PORTRAYED ON TOPOGRAPHIC MAPS ARE EASY TO SEE AND IDENTIFY, SUCH AS THIS ONE. LARGE CEMETERIES ARE ALWAYS PLOTTED TO SCALE AND CAN BE EXCELLENT LANDMARKS. HOWEVER, SMALLER CEMETERIES ARE SOMETIMES MORE DIFFICULT TO DETECT, EVEN THOUGH THEY ARE PORTRAYED ON THE MAP. OTHERS HAVE LITTLE VISUAL SIGNIFICANCE AND MAY NOT BE EASILY RECOGNIZED AS CEMETERIES WHEN SEEN FROM THE AIR.

THE AERONAUTICAL DATA SHOWN ON A MAP INCLUDE: LANDING STRIPS AND LANDING AREAS, AIRPORTS, AIRFIELDS, AND HELIPORTS. THESE FEATURES MAY BE PERMANENT OR TEMPORARY, AND WITH OR WITHOUT SUPPORT FACILITIES. THE NAME AND ELEVATION OF THE FEATURE ARE SHOWN IF THEY ARE KNOWN.

AIRCRAFT LANDING STRIPS AND LANDING AREAS CAN BE USEFUL AS ORIENTATION FEATURES WHEN NAVIGATING IN OR NEAR SPARSELY POPULATED AREAS. THESE FEATURES USUALLY ARE NOT PAVED BUT ARE EASILY RECOGNIZED FROM THE AIR BECAUSE OF THEIR DISTINCT SHAPES. LANDING AREAS ARE USUALLY SHOWN AS CLEAR AREAS AND ARE OUTLINED WITH A DASHED LINE; WHEREAS, LANDING STRIPS ARE USUALLY PORTRAYED IN BLUE AND OUTLINED WITH A DASHED LINE. BOTH LANDING STRIPS AND LANDING AREAS ARE LABELED INDICATING THE TYPES OF SURFACE OF EACH.

RUNWAYS, TAXIWAYS, AND DISPERSAL AREAS OF AIRPORTS AND AIRFIELDS ARE PORTRAYED TO SCALE. THE TYPE OF RUNWAY SURFACE IS SOMETIMES INDICATED BY LABELING. ABANDONED AIRPORTS OR AIRFIELDS ARE PORTRAYED ON A MAP AS ILLUSTRATED HERE. WHERE FIELD LIMITS AND RUNWAY INFORMATION ARE NOT AVAILABLE, THE FEATURE IS REPRESENTED BY THE CHARACTERISTIC SYMBOL, WHICH IS A BROKEN LINE.

HELIPORTS WITH LANDING PADS AND OTHER FACILITIES ARE SHOWN PROVIDED THE SYMBOL DOES NOT OBSCURE OTHER DETAIL. RADIO MASTS, OBSERVATION TOWERS, AND AIR BEACONS ARE SHOWN AS LOCATED OBJECTS AND ARE APPROPRIATELY LABELED.

THIS CHART ILLUSTRATES THE VARIOUS TYPES OF MINES AND THE VARIOUS WAYS IN WHICH MINES ARE PORTRAYED. MINES USUALLY CAN BE RECOGNIZED IN THE REAL WORLD BY THE SLAG PILES LOCATED NEAR THE ENTRANCE OF THE MINE.

ALL MINING FEATURES ARE SHOWN IN AREAS OF SPARSE CULTURE; IN OTHER AREAS, THEY ARE SHOWN IF THEY DO NOT INTERFERE WITH THE LEGIBILITY OF OTHER FEATURES. WHERE A NUMBER OF MINES COVER A GENERAL AREA, THE AREA IS SOMETIMES OUTLINED AND LABELED OR INDICATED BY A REPRESENTATIVE SYMBOL OR SYMBOLS, AS SHOWN HERE.

THIS CHART ILLUSTRATES THE SYMBOLS FOR OPENCAST MINES. OPENCAST MINES ARE THOSE IN WHICH THE EXCAVATIONS ARE PERFORMED FROM THE SURFACE. THESE INCLUDE STRIP MINES, PLACER MINES, OPEN-PIT MINES, QUARRIES, AND GRAVEL AND BORROW PITS. FEATURES PORTRAYED AS OPENCAST MINES CAN HAVE MANY DIFFERENT ACTUAL APPEARANCES, INCLUDING MINOR SURFACE IRREGULARITIES THAT CHARACTERIZE SMALL STRIP MINES AND DEEP-FURROWED PATTERNS, CHARACTERISTIC OF QUARRIES.

SOMETIMES, HOWEVER, SUCH FEATURES MAY BARELY BE RECOGNIZED IN THE REAL WORLD. THESE ARE ABANDONED STRIP MINES THAT HAVE BEEN RECLAIMED BY NATURE. THOUGH BARELY RECOGNIZABLE, THE FEATURES ARE STILL PORTRAYED ON UPDATED MAPS.

THE ONLY MINES THAT CAN BE INTERPRETED WITH CONFIDENCE ARE THOSE THAT ARE PORTRAYED TO SCALE BY MEANS OF DEPRESSION OR ESCARPMENT CONTOURS ON THE MAP. THESE WILL INDICATE LARGE OPEN-PIT MINES.

FOR QUARRIES, THE ESCARPMENT SYMBOL IS SOMETIMES AUGMENTED BY THE MINE SYMBOL AND CENTERED WITHIN THE AREA. HOWEVER, IN SOME INSTANCES, THE AREA IS SIMPLY LABELED "QUARRY."

GRAVEL AND BORROW PITS ARE USUALLY PORTRAYED WITH THE MINE SYMBOL AND LABELING, OR THE AREA IS OUTLINED WITH DASHED LINES. ON SOME MAPS, HOWEVER, THE FEATURES ARE SHOWN BY THE ESCARPMENT SYMBOL.

THIS IS A TAILINGS POND AND ITS CORRESPONDING MAP PORTRAYAL.

THIS IS A TAILINGS DUMP AND ITS CORRESPONDING MAP PORTRAYAL.

THIS CONCLUDES THE LESSON ON INTERPRETATION OF CULTURAL FEATURES.

INTERPRETATION OF BUILDINGS AND POPULATED PLACES

THIS LESSON DISCUSSES BUILDINGS AND POPULATED PLACES. THIS CHART ILLUSTRATES THE VARIOUS TYPES OF BUILDINGS PORTRAYED WITH STANDARD SYMBOLS. BUILDINGS PORTRAYED WITH STANDARD SYMBOLS ON THE MAP CAN HAVE MANY DIFFERENT APPEARANCES IN THE REAL WORLD, AS ILLUSTRATED BY THE FOLLOWING EXAMPLES.

BUILDING SYMBOLS MAY INDICATE CLUSTERS OF BUILDINGS OR INDIVIDUAL BUILDINGS, SUCH AS THIS ORDINARY RESIDENCE. BUT THE SAME BUILDING SYMBOL MAY INDICATE A SMALL SHACK SUCH AS THIS.

THIS OLD BUILDING ONCE SERVED AS A SCHOOL--IT IS PORTRAYED IN A SIMILAR MANNER AS THIS LARGER SCHOOL.

THIS BUILDING OBVIOUSLY IS A CHURCH, JUDGING FROM THE STEEPLE, AND IT IS PORTRAYED ON THE MAP WITH THE CHURCH SYMBOL (A BLACK SQUARE WITH ATTACHED CROSS).

BUT THIS BUILDING IS ALSO A CHURCH. IT IS A COUNTRY MEETING HOUSE THAT FUNCTIONED AS A RELIGIOUS BUILDING AND THEREFORE IS PORTRAYED WITH THE SAME CHURCH SYMBOL AS THAT USED FOR THE PRECEDING BUILDING. NOT ONLY IS IT PORTRAYED THE SAME, BUT IT RECEIVES THE SAME HIGH PRIORITY IN SELECTION FOR PORTRAYAL AS OTHER CHURCHES.

IF A STRUCTURE IS CONSIDERED TO BE TEMPORARY, IT IS PORTRAYED WITH AN OPEN SQUARE. IT IS PORTRAYED WITH A SOLID BLACK SQUARE IF IT IS CONSIDERED A PERMANENT STRUCTURE.

WHEN A BUILDING EXCEEDS 30 OR 40 METERS IN LENGTH, IT IS PLOTTED TO SCALE ON THE MAP. FOR EXAMPLE, THE LONG SHEDS SHOWN HERE ARE PORTRAYED BY BUILDING SYMBOLS IN THE FORM OF RECTANGLES AND ARE PLOTTED TO SCALE ON THE MAP. THUS, A LARGER-THAN-ORDINARY SYMBOL INDICATES THE EXISTENCE OF A LARGE BUILDING THAT MAY SERVE AS A SIGNIFICANT CHECKPOINT.

WHEN A FEATURE IS MADE UP OF SEVERAL BUILDINGS, THE DISTINGUISHING CHARACTERISTIC IS SHOWN ON THE MOST PROMINENT BUILDING IN THE GROUP. THIS APPLIES TO UNIVERSITIES, MONASTERIES, SCHOOLS, HOSPITAL COMPLEXES, AND SIMILAR FEATURES.

IMPORTANT BUILDINGS THAT HAVE NO CHARACTERISTIC SYMBOL ARE IDENTIFIED IN AS CONCISE A FORM AS POSSIBLE BY LABELING.

A DESTROYED BUILDING IS ONE THAT HAS BEEN MADE UNINHABITABLE AS A RESULT OF A NATURAL OR MAN-MADE CATASTROPHE. THE AREA MAY EITHER BE OUTLINED AND LABELED OR SHOWN BY A GRAY TINT.

RUINS ARE ABANDONED BUILDINGS OR OTHER MAN-MADE STRUCTURES THAT ARE IN SUCH A STATE OF DISREPAIR OR DECAY THAT THEY CANNOT BE USED FOR THEIR ORIGINAL PURPOSE. THESE FEATURES ARE SHOWN FOR THEIR LANDMARK, CULTURAL, OR HISTORICAL SIGNIFICANCE. THE LABEL "RUINS" IS SHOWN IN CONJUNCTION WITH THE SYMBOL. LARGE AREAS OF RUINS, WHICH HAVE DETERIORATED TO THE POINT OF BEING MOSTLY RUBBLE, ARE ENCLOSED WITHIN A DASHED OUTLINE AND LABELED "RUINS."

POPULATED PLACES ARE REPRESENTED THREE DIFFERENT WAYS ON A MAP. WHEN THE BUILDINGS ARE DISPERSED, THEY ARE PORTRAYED BY INDIVIDUAL SYMBOLS ON A ONE-TO-ONE BASIS. WHEN THE BUILDINGS APPEAR IN CLUSTERS, ONLY A REPRESENTATIVE PATTERN OF SYMBOLS WILL BE PORTRAYED. TWO OR THREE SYMBOLS MAY BE SHOWN ON THE MAP TO INDICATE THE PRESENCE OF A HALF DOZEN BUILDINGS. WHEN THE BUILDINGS ARE SO CLOSELY SPACED THAT THEY CANNOT BE PORTRAYED INDIVIDUALLY, AND THE BUILT-UP AREA IS LARGER THAN 250 METERS SQUARE, THE AREA IS PORTRAYED WITH A PINK TINT ON THE MAP. MOST OF THE LARGE TOWNS AND CITIES OF THE WORLD HAVE AT LEAST A PORTION OF THEIR DEVELOPED AREAS FALLING INTO BUILT-UP CATEGORIES.

A GRADUAL TRANSITION IN BUILDING DENSITY BETWEEN THE SPARSE AND MORE CONCENTRATED PORTIONS OF THE POPULATED PLACE IS SHOWN WHENEVER SUCH A TRANSITION EXISTS. IN THE CASE OF MOST LARGE CITIES, THE SYMBOLS WILL PROGRESS FROM INDIVIDUAL BUILDING SYMBOLS, MODERATELY TO SPARSELY BUILT-UP AREA TINT, AND DENSELY BUILT-UP TINT AS YOU VIEW INWARD TOWARDS THE CENTER OF THE CITY.

FACTORY COMPLEXES, REFINERIES, RAILROAD YARDS, PORT FACILITIES, AND SIMILAR BUILDING COMPLEXES WITH EXTENSIVE AREAS OF OPEN GROUND ARE NOT INCLUDED WITHIN THE BUILT-UP AREA LIMITS. THESE FEATURES ARE DEPICTED WITH THEIR APPROPRIATE SYMBOLS.

AREAS OF LITTLE OR NO DEVELOPMENT FALLING INSIDE THE OVERALL BUILT-UP AREA ARE NOT TINTED, PROVIDED THEY ARE APPROXIMATELY 125 METERS SQUARE OR LARGER. ALSO, PARKS, CEMETERIES, UNIVERSITIES, AND HOSPITAL COMPLEXES HAVING EXTENSIVE OPEN GROUNDS, ARE TREATED AS OPEN AREAS IF THEY MEET THE MINIMUM SIZE REQUIREMENTS. FACTORY COMPLEXES AND RAILROAD YARDS ARE GIVEN SIMILAR TREATMENT. BUILDINGS OR OTHER FEATURES IN THESE OPEN AREAS ARE SHOWN AS INDIVIDUAL BUILDINGS OR BY AN APPROPRIATE SYMBOL.

SCALE PERMITTING, BUILDINGS ARE SHOWN WHEREVER THEY EXIST BY PROPERLY ORIENTED INDIVIDUAL BUILDING SYMBOLS; THE CENTER OF THE SYMBOL IS POSITIONED OVER THE CENTER OF THE FEATURE. WHEN BUILDINGS OCCUR IN GROUPS AND IN CONJUNCTION WITH MAPPED LINEAR FEATURES, SUCH AS ROADS, RAILROADS, AND DITCHES, THE DENSITY OF THE BUILDINGS MAY MAKE IT IMPOSSIBLE TO PORTRAY ALL THE SYMBOLS IN THEIR TRUE POSITIONS. IN CASES SUCH AS THESE, THE BUILDING SYMBOLS ARE OFTEN DISPLACED SLIGHTLY, BUT THEY STILL PORTRAY THE GENERAL PATTERN OF BUILDINGS.

THIS CONCLUDES THE DISCUSSION OF POPULATED PLACES AND BUILDINGS.