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CAPABILITIES OF REMOTE SENSORS TO DETERMINE  
ENVIRONMENTAL INFORMATION FOR COMBAT

ARMY ENGINEER TOPOGRAPHIC LABORATORIES  
FORT BELVOIR, VIRGINIA

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<p>U.S. Army Field and Technical Manuals were used to develop a list of 313 environmental information needs, or factors, required by the Army to accomplish its various tasks. Each factor was evaluated against a list of remote sensing systems to determine the extent to which each system could provide the needed information. Interpretation procedures were restricted to evaluation of imagery by conventional interpretation techniques and equipment. The systems evaluated are LANDSAT (ERTS), radar, thermal</p> <p>(Continued)</p>		

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19. (Continued)

Hydraulic Structures  
Pollution  
Map and Chart Revision  
Construction

Site Selection  
Construction Resources  
Military Aspects

20. (Continued)

infrared, low-level oblique photography, standard photo index sheets, stereo 1:100,000 scale vertical aerial photography, and stereo 1:20,000 scale vertical aerial photography. Each image form is considered for each factor by a means of identification, i.e. by direct observation of the image, by measurements on the image, or by inferential procedures. For each category, one of four levels of capability is assigned. The levels are (1) a practical way of gaining information about a given factor, (2) a possible method, but with limitations, (3) the evidence is not available to make a judgment, but there is no reason that it cannot be done, and (4) the technique is not applicable to the specified factor. The factors were also evaluated in terms of the level of skill required to obtain the information. The evaluation includes comments and discussion about definitions of factors, difficulty in extracting needs from the manuals, limitations with reference to both the factors and procedures, and possible use of other sensor systems. Four examples that demonstrate the application of the evaluations to specific problems are presented following the evaluation: Cover and Concealment, Cross-Country Movement, Lines of Communication, and River Crossing Operations.

## TABLE OF CONTENTS

Title	Page
<b>INTRODUCTION</b>	2
Background	2
Purpose and Scope	2
Application	2
<b>PROCEDURE</b>	2
General	2
Factors	2
Sensors	4
Evaluations	5
<b>ALPHABETIZED LISTING</b>	9
<b>CATEGORIZED LISTING</b>	122
<b>ALPHABETIZED EVALJATIONS</b>	155
<b>CATEGORIZED EVALUATIONS</b>	190
<b>APPLICATION TO SELECTED PROBLEMS</b>	223
Cover and Concealment	224
Cross-Country Movement	226
Lines of Communication	229
River Crossing Operations	235

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34

CAPABILITIES OF REMOTE SENSORS TO DETERMINE  
ENVIRONMENTAL INFORMATION FOR COMBAT

INTRODUCTION

Background. In recent years, advances in systems and analytical procedures have made the overall field of remote sensing more directly applicable to environmental studies. The Army, facing the potential task of conducting operations throughout the world, has a need for timely and accurate environmental information. However, before evaluating the application of new systems and techniques to military needs, two questions must be considered: (1) what are the specific items of information required by the Army to make strategic decisions and to conduct tactical operations, and (2) can these new remote sensing systems or procedures provide the required information in a more efficient manner than conventional techniques, or can they provide an alternate method when conventional techniques cannot be used?

Purpose and Scope. This study determined to what extent remote sensing techniques could be used to obtain environmental information pertinent to Army requirements. The informational needs were limited to those specified in Army manuals, and the remote sensing techniques were restricted to conventional interpretation procedures using available, off-the-shelf equipment.

Application. The data have been cross-indexed, arranged in matrix format, and otherwise ordered so that required information pertaining to some defined problem can be easily extracted and evaluated with reference to such questions as: what techniques are best suited to the task, and what levels of skill are involved? Since the majority of the factors pertain to general environmental information, the evaluations are as applicable to civilian interests as they are to military ones.

PROCEDURE

General. In the basic procedure, a list of information requirements was compared to a list of remote sensors and image types representative of systems available to the Army, and the relative utility of each system for obtaining the needed information was indicated. These information needs were to be defined by reference to current Army doctrine. Accordingly, the Alphabetized Evaluation and the Categorized Evaluation are the primary parts of this report, but their utilization requires an understanding of how they were developed and what their limitations are.

Factors. The authors reviewed the manuals listed in table 1 to identify items of information stated to be required by the Army. This review resulted in multiple lists of items. The authors then provided additional items based on needs expressed by implication in the manuals.\* Those additional items give CRS (Center for Remote Sensing, ETL) as the reference. The lists contain redundancies,

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\* For instance, although camouflage was referred to, the need to detect it and the attendant information required for doing so were not stated. Therefore, items such as this were added by the authors.

Table 1. Army Manuals Used for Factor Identification

Number	Date	Title
FM 5-30	September 1967	Engineer Intelligence
FM 5-36	January 1970	Route Reconnaissance and Classification
FM 21-26	January 1969	Map Reading
FM 30-5	October 1973	Combat Intelligence
FM 30-10	March 1972	Military Geographic Intelligence - (Terrain)
FM 30-20	April 1969	Aerial Surveillance and Reconnaissance - Field Army
FM 31-60	March 1972	River Crossing Operations
FM 55-8	March 1970	Transportation Intelligence
FM 101-5	July 1972	Staff Officer's Field Manual - Staff Organization and Procedure
TM 5-330	September 1968	Planning and Design of Roads, Airbases, and Heliports in the Field of Operations
TM 5-332	December 1967	Pits and Quarries
TM 5-545	August 1967	Geology

ambiguities, and entries inappropriate for consideration under the topic of remote sensing. Through a sequence of multiple reviews by the authors working as a group, the lists were initially reduced by elimination of explicit redundancies and inappropriate items, and they were consolidated into a single list of 1,600 items. These 1,600 items are presented in the Alphabetized Listing. The list was further reduced to 500 items and then to the final 313 factors by eliminating implied redundancies and combining similar terms. An asterisk (\*) is used to indicate deleted items, and the reason for deletion is given. The final list of factors was categorized as shown in table 2, and the factors are so listed in the Categorized Listing.

Table 2. Categories

- |   |  |
|---|--|
| <p><u>I. Natural Terrain Features</u></p> <ol style="list-style-type: none"> <li>1. Climate and Weather</li> <li>2. Surface Configuration</li> <li>3. Vegetation</li> <li>4. Hydrology</li> <li>5. Surface Materials</li> <li>6. Geology</li> </ol> | <p><u>II. Man-made Features</u></p> <ol style="list-style-type: none"> <li>1. Transportation</li> <li>2. Telecommunications and<br/>Electric Power</li> <li>3. Built-up Areas</li> <li>4. Agriculture</li> <li>5. Hydraulic Structures</li> <li>6. Pollution</li> <li>7. Construction</li> </ol> |
| <p><u>III. Applications</u></p> <ol style="list-style-type: none"> <li>1. Construction Resources</li> <li>2. Site Selection</li> <li>3. Map and Chart Revision</li> </ol>   | <p><u>IV. Military Aspects</u></p>   |

In the Alphabetized Listing, the categories are identified by symbol as well as by title. For instance, II.2 is major category II, Man-made Features, and minor category 2, Telecommunications and Electric Power. These symbols are used for reference purposes throughout the report. Except for Site Selection and Map and Chart Revision, the various categories contain numerous factors. It is felt that these two categories are sufficiently descriptive in themselves.

During the work, confusion sometimes resulted because of imprecise definitions in the manuals and because the military terminology sometimes conflicted with scientific usage of the same or similar terms. This led to redundancies and inconsistencies in the various listings. Although many such errors were recognized and eliminated as the work progressed, some undoubtedly remain.

**Sensors.** The remote sensor imagery types evaluated with respect to the factor listings include LANDSAT (ERTS), radar, thermal infrared, low-level oblique aerial photography, standard photo index sheets, and stereo black-and-white vertical aerial photography at scales of 1:100,000 and 1:20,000. The imagery types were selected as being representative of the materials most likely available to field personnel, and they appear as column headings on each page of the Alphabetized and Categorized Evaluations.

The LANDSAT (ERTS) category includes equivalent satellite imagery of scanline generation. LANDSAT (ERTS) has the advantage of recording a number of intensity levels on each of four spectral bands so that, in addition to normal imagery interpretation procedures, one can employ channel mixing, computer display, and statistical analysis methods. In this study, however, evaluation assumes conventional procedures applied to black-and-white prints of each band, plus a color composite.

Reflected return of radio waves, or radar, can be recorded as a range or distance value, displayed as an image, or analyzed statistically for phase and intensity information. In this study, radar means SLAR (Side-Looking Airborne Radar) images. Radar systems commonly provide imagery in the scale range of 1:250,000 to 1:1,000,000, which is excellent for regional coverage.

Infrared thermal sensing techniques primarily record energy that is largely dependent on surface temperature. Thus, the signal can be influenced by subtle heat transfer processes, such as air movement and back radiation. Thermal scanners may operate in a quantitative or nonquantitative mode, depending on whether or not the incoming radiant energy is compared to a known, internal source in the scanner. The grey tones in the image from a nonquantitative scanner cannot be compared on an absolute basis in different parts of the image; whereas, those in a quantitative scanner can be compared to identify areas of similar radiance. Recording of the image may be done either in analog (film or magnetic tape) or digital form. Unless indicated otherwise, infrared thermal refers to nighttime imagery with a detector operating in the 8 to 14 micron band at altitudes in the nominal range of 1,000 to 5,000 feet (305 to 1,524 meters).

Nonstereo, low-level oblique photographs can often provide information about natural and cultural features beyond the capability of conventional stereo vertical photography and can provide assistance in making the transition in visualization from vertical photos to terrestrial observation.

Much existing stereo vertical photography is available in the form of photo index sheets. In the United States the sheets are at a scale of 1:62,500 (1 inch = 1 mile, or 1 cm = 1.6 km).\* Mosaics are excellent for obtaining regional information for analysis of areas of operations, site selection studies, and selections of avenues of approach.

Stereo vertical imagery at a scale of 1:100,000 is representative of small-scale imagery in general. Although the scale is marginal for many specific detection tasks, general regional terrain information can be obtained.

From the standpoint of geology, vegetation, soils, land use, and archaeology, panchromatic stereo vertical imagery at a 1:20,000 scale is most useful. Some studies in archaeology and vegetation benefit from larger scales, but for general use, a 1:20,000 scale is usually more than adequate. Any factor that can be obtained from black-and-white panchromatic imagery can also be obtained from color photography. However, consideration here is limited specifically to black-and-white panchromatic vertical aerial photography.

The column labeled Other in the Alphabetized and Categorized Evaluations indicates where other sensors or techniques are applicable. These sensors include color, false color (including color infrared), multiband, multichannel scanners, microwave thermal, monochrome radar, scatterometry, radiosonde, laser profilometer, magnetometry, atmospheric samplers, short-time-lapse photography, and others.

For any remote sensing technique, there are limitations of a practical, self-evident nature, such as scale, line of sight, and angle of view. Obviously, with larger scale imagery or better edge contrast/resolution, smaller details are more easily detected and identified. Scale restrictions are applicable to all factors evaluated in this study, and therefore were not specifically mentioned as a limitation for each factor within the evaluation.

For some detection problems, stereo imagery may be of little use, but for determining terrain composition and conditions, it is invaluable. Vertical exaggeration is a strong asset when dealing with subtle, small scale changes in relief, which are often crucial in identification of terrain features. Panchromatic, color, color infrared photography, and thermal infrared and radar imagery can be flown to obtain stereo, but often it is not so obtained. This consideration influenced the sensor evaluations.

Evaluations. The main result of this work is the evaluations presented alphabetically and categorically. The first four columns of the Alphabetized Evaluation are a repeat of the Alphabetized Listing minus the eliminated factors. The last column contains comments on the applicability and on the limitations of the sensors for the listed factor. The intervening columns are the actual evaluations. The Categorized Evaluation is similar except that the first three columns are from the Categorized Listing. The last page of the Alphabetized Evaluation is a list of factors added on the basis of the findings presented in the appendix. These added factors do not appear in the Categorized Evaluation.

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\* They are available from Aerial Photography Field Office, Salt Lake City, Utah, and National Archives and Record Service, Washington, DC.

To understand how the evaluation of factors versus sensors was accomplished, it must be reiterated that techniques of evaluating remote sensor imagery were limited to conventional, manual procedures using only such basic tools as magnifiers, pocket stereoscopes (2X magnification), floating dot attachments, or Old Delft stereoscopes (2 to 4X magnification). No effort was made to evaluate such techniques as automatic pattern recognition, density slicing, computer assisted analysis, multiband or multichannel comparisons, or any other form of digital or analog image manipulation. The reason for the exclusions is that such techniques and equipment are not generally available to the field user.

One can derive information from remote sensor imagery by essentially three different means - direct observation or detection, measurement, or inferential procedures. Table 3 briefly defines each of these methods.

Table 3. Methods of Evaluation

Method	Symbol	Procedure	Comments
Direct	d	Direct observation or detection of objects, shapes, patterns, arrangements, color changes, etc.	In general, these two methods require less training. The development of keys and automatic recognition equipment, etc., will be of direct aid here.
Measurement	m	Determination of dimensions (width, length, height), area, slope, gradient, brightness, color, temperature, orientation, etc.	
Inferential	i	Inductive and deductive reasoning from associated clues and convergent lines of evidence to derive information not directly apparent in the imagery. Estimate, predict, etc.	This method requires more ability, training, and knowledge. The development of computer procedures (most probable match for stated parameters, logic trees, etc.) will be of direct aid here.

NOTE: When evaluating direct and measurement methods, you are generally evaluating systems and equipment. When evaluating inferential methods, you are generally evaluating personnel.

Direct observation (symbol d) considers questions of whether or not the factor, or the pattern related to the factor, can be seen by direct viewing of the image. Measurement (symbol m) refers primarily to dimensions (including height) that can be obtained from the image. Inferential procedures (symbol i) refer to the method of getting information about a factor by reasoning or deductive processes. Each factor is therefore evaluated by each of these methods for each sensor image type considered.

Within each of these methods of obtaining information, each factor is evaluated as to the level of success that could be reasonably expected from the given sensor/factor combination. Four levels are used, ranging from lack of applicability to practical success. Table 4 defines the symbolization used in this evaluation.

Table 4. Factor/Sensor Success Levels

Symbol	Definition
+	Denotes that within practical limitations the indicated remote sensing technique is applicable to the indicated factor.
L	Denotes limitations. The task can, and has been done, but there are situations or conditions where negative results can be obtained or where less information can be derived than with another sensor.
?	Denotes uncertainty. There is a basis for possibility, but whether this sensor is applicable in a practical sense or not is unknown.
0	Denotes lack of applicability, or that nothing can be done with the indicated factor/sensor combination.

After making these evaluations, it was determined that even though one factor/sensor evaluation might be as successful as another, the success in evaluating that item of information is highly dependent upon the skill of the individual making the evaluation. For this reason, a column labeled Skill Level was added to the matrix format. Table 5 defines the symbolization used in analysis of the skill level

Table 5. Skill Levels

Symbol	Definition
1	This indicates that the minimum level of training, 2- or 4-week school, for example, plus a few days experience, should be sufficient to meet these needs.
2	In addition to the above, this level requires considerable knowledge about a specialty (bridges, road classification, soil, geology, vegetation, etc.) as well as enough experience to make the analyst feel relatively confident.
3	This level requires an unusual depth of knowledge about a specialty, or a working knowledge of several specialties, plus considerable working experience. In some cases, it would suggest the need for a multidisciplinary team.

required to obtain each item of information. This is a general evaluation of the factor itself, and even though background may influence the ability of the user to get that piece of information from the various imagery forms, this is not taken into consideration. Skill level, therefore, refers to the factor only and not to the factor/sensor combination.

It cannot be overemphasized that the evaluations of factor/sensor combinations represent opinions, not incontestable certainties. These opinions are strongly influenced by the training and experience of those involved in preparing the evaluations, which in this case are dominated by the earth sciences and related engineering and physical sciences. More reliable opinions are in the areas of natural terrain features rather than man-made features or military aspects. Further, these opinions refer to conventional procedures - i.e. direct observation of the imagery with or without a hand lens or stereoscope - and on this basis they could be construed as broadly defining a realistic, practical level of competency for obtaining terrain information via remote imaging systems.

For some of the factor/sensor cells, there is little or no hope of improvement from research efforts. For others, a definite gain can be made through research. Areas for future research can be determined from the alphabetized and categorized evaluations and would include factors evaluated as either questionable or limited.

ALPHABETIZED LISTING

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Aggregate durability	30-10, p 3-14	III.1	soundness & loss, LART abrasion & loss; comments are specified in manual, but they are included in this factor; do not understand factor, so delete
Aggregate, source	5-330, p 7-13	III.1	
Agricultural areas	30-10, p 3-21 5-30, p 39	II.4	location and extent in 30-10
* Agricultural practices	30-10, p 3-22	II.4	see specific practices; harvesting, cultivation, etc.
Agricultural production data	5-30, p 39	II.4	manual requests specific numerical data, but range estimates can be made from imagery
* Agriculture	30-20, p 3-21	II.4	changed to agricultural areas
Agriculture, general type	101-5, p G-2	II.4	vineyards, row crops, orchards, etc.; from cultivated vegetation in the manual
Air temperature	30-5, p 2-18	I.1	this factor is abstracted from a general reference to temperature in the manual; near surface; range estimates only
Aircraft detection	CRS	II.1	
Aircraft, identification	CRS	II.1	
* Airfields	5-30, p 4	II.1	too all-inclusive
* Airfields, adjacent terrain	30-10, p 5-62	II.1	included under natural features
* Airfields, administration buildings	30-10, p 5-62	II.1	included in airfields, support facilities
* Airfields, aircraft maintenance facilities	30-10, p 5-61	II.1	included in airfields, support facilities
* Airfields, anti-detonation fluid	30-10, p 5-62	II.1	water-alcohol; included in airfields, support facilities
* Airfields, auxiliary power units	30-10, p 5-62	II.1	included in airfields, support facilities

121

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Airfields, capacity	5-30, p 39	II.1	ambiguous
* Airfields, covered storage	30-10, p 5-61	II.1	included in airfields, support facilities and storage facilities, II.3
* Airfields, defenses	30-10, p 5-62	II.1	included in defenses, IV
* Airfields, detection	CRS	II.1	
* Airfields, electricity	30-10, p 5-62	II.1	included in airfields, support facilities
Airfields, elevation	30-10, p 5-61	II.1	
Airfields, fueling facilities	30-10, p 5-61	II.1	called petroleum and oil lubricants in the manual
* Airfields, hangars	30-10, p 5-61	II.1	included in airfields, layout
* Airfields, hardstands	30-10, p 5-61	II.1	included in airfields, layout
* Airfields, housing facilities	30-10, p 5-61	II.1	included in airfields, support facilities
* Airfields, jet starting units	30-10, p 5-62	II.1	included in airfields, support facilities
Airfields, layout	30-10, p 5-61	II.1	runways, taxiways, hardstands, parking and warm-up areas, hangars, etc.
* Airfields, lighting facilities	30-10, p 5-61	II.1	included in airfields, support facilities
* Airfields, medical facilities	30-10, p 5-62	II.1	included in airfields, support facilities and in medical facilities, II.3
* Airfields, munition storage	30-10, p 5-61	II.1	included in dispersal and storage facilities, detection, IV
* Airfields, navigation facilities	30-10, p 5-61	II.1	includes weather facilities; included in airfields, support facilities
* Airfields, number of runways	30-10, p 5-61	II.1	included in airfields, layout
* Airfields, oxygen availability	30-10, p 5-61	II.1	included in airfields, support facilities

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Airfields, parking and warm-up areas	30-10, p 5-61	II.1	included in airfields, layout
* Airfields, principal use	30-10, p 5-61	II.1	military, civilian, or joint; passenger, cargo, etc.; meaning unclear in manual
Airfields, runway and taxiway descriptions	30-10, p 5-61	II.1	size, design, surface, etc.; each runway and/or taxiway
* Airfields, sanitation	30-10, p 5-61	II.1	included in airfields, support facilities
* Airfields, site for	5-30, p 39	III.2	category title all-inclusive by itself
* Airfields, special equipment	30-10, p 5-61	II.1	included in airfields, support facilities
* Airfields, status	30-10, p 5-61	II.1	active or abandoned; meaning unclear in manual
Airfields, support facilities	CRS	II.1	lighting, storage, APU's, maintenance of runways, etc., navigation and weather facilities, aircraft maintenance facilities, etc.
* Airfields, taxiway, description of	30-10, p 5-61	II.1	included in airfields, runway and taxiway descriptions
Airfields, type	30-10, p 5-61 5-36, p 4-6 30-10, p 7-28	II.1	civilian, military, or joint; plane type
* Airfields, utilizing airlines and/or military	30-10, p 7-28	II.1	included in airfields, type
* Airfields, weather facilities	30-10, p 5-62	II.1	included in airfields, support facilities
* Airlanding facilities	5-36, p 1-9	II.1	same as airfields
* Airports	30-20, p E-2 21-26, p 10-10	II.1	same as airfields
* Alignment, landforms	30-20, p 3-8	I.2	included in description of a landform - landform, specific type
* Alluvial aprons	30-10, p 3-2	I.2 I.5	included in landforms, specific type

1481

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Alluvial fans	30-10, p 3-2	I.2 I.5	included in landforms, specific type
Anchorage	30-10, p 5-33 55-8, p C-3	II.1	depth, size, clearances, berths, bottom, etc.
* Anchorages, berth locations	30-10, p 5-33 55-8, p C-3	II.1	type and size; included in anchorages
* Anchorages, bottom material	30-10, p 5-33 55-8, p C-3	II.1	included in anchorages
* Anchorages, controlling clearances	30-10, p 5-33 55-8, p C-3	II.1	included in anchorages and clearances, horizontal vertical
* Anchorages, depth	30-10, p 5-33 55-8, p C-3	II.1	included in anchorages and water depth, I.4
* Anchorages, size	30-10, p 5-33	II.1	included in anchorages
* Antennas, bandwidth capability	30-10, p 6-16	II.2	included in antennas, electromagnetic characteristics
Antennas, characteristics and description	CRS	II.2	type, number, pattern, dimensions, direction, single or multiple element, type of feed system, etc.; above items specified in manual, but combined by CRS
Antennas, detection	CRS	II.2	
* Antennas, dimensions	30-10, p 6-16	II.2	length, height, diameter, etc.; included in antennas, characteristics and description
* Antennas, direction	30-10, p 6-16	II.2	orientation; included in antennas, characteristics and description
Antennas, electromagnetic characteristics	30-10, p 6-15 30-10, p 6-16	II.2	bandwidth capability, operating frequency, polariza- tion, radiation pattern
* Antennas, mounting structure	30-10, p 6-16	II.2	building, pole, tower, etc.; included in antennas, characteristics and description

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Antennas, number on structure	30-10, p 6-16	II.2	included in antennas, characteristics and description
* Antennas, operating frequencies	30-10, p 6-16	II.2	included in antennas, electromagnetic characteristics
* Antennas, ownership or control	30-10, p 6-16	II.2	military, government, or private; N/A
* Antennas, polarization	30-10, p 6-16	II.2	horizontal, vertical or circular; included in antennas, electromagnetic characteristics
* Antennas, radiation pattern	30-10, p 6-16	II.2	omnidirectional, unidirectional, bidirectional; included in antennas, electromagnetic characteristics
* Antennas, rotation	30-10, p 6-15	II.2	degree and direction of rotation; included in antennas, characteristics and description
* Antennas, security at site	30-10, p 6-16	II.2	N/A
* Antennas, single or multiple elements	30-10, p 6-16	II.2	included in antennas, characteristics and description
* Antennas, type of feed system	30-10, p 6-16	II.2	single wire, open wire, cable, etc.; included in antennas, characteristics and description
* Antennas, type of installation	30-10, p 6-16	II.2	included in antennas, characteristics and description
* Antennas, type of service	30-10, p 6-16	II.2	FM, AM, TV, satellite, radio astronomy, etc.; changed to telecommunications, service type
* Antennas, use	30-10, p 6-16	II.2	transmitter, receiver, or both; manual states you cannot tell the difference
Aqueducts	55-8, p C-3	II.1	length, width, construction details, etc.
* Aqueducts, construction details	55-8, p C-3	II.1	included in aqueducts
* Aqueducts, height above stream or obstacle overpassed	55-8, p C-3	II.1	included in aqueducts
* Aqueducts, length	55-8, p C-3	II.1	included in aqueducts
* Aqueducts, width	55-8, p C-2	II.1	included in aqueducts

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Aquifers	30-10, p 3-20	I.4	yield of aquifers in manual; aquifers would be indicated primarily by location and identification of wells, springs, and seeps, so consider included
* Arroyos	30-10, p 3-3	I.2	included in landforms, specific type
* Artillery fire, degradation effects	30-10, p 3-22	IV	included in damage assessment
* Artillery fire, fusing effects	30-10, p 3-22	IV	included in damage assessment
Assembly areas, potential	CRS 31-60, p 2-2	IV	
* Assembly areas, potential enemy	30-5, p 3-9	IV	included in assembly areas, potential
Avenues of approach	5-30, p 40 101-5, p G-2 5-36, p 1-3 30-10, p 4-2 31-60, p 2-2	IV	air, ground, water

30175

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Backshore material	30-10, p 4-17	I.2	composition, texture, trafficability; see landforms, specific type
* Backshore, slope	30-10, p 4-17	I.2	included in landforms, specific type and slope
* Banks (financial)	30-10, p 7-29	II.3	included in functional areas (commercial)
* Barrier construction, sites for	5-30, p 15	III.2	category (Site Selection) all-inclusive by itself
* Barriers to enemy movement, artificial	5-30, p 15	IV	included in obstacles to movement, artificial
* Barriers to enemy movement, natural	5-30, p 15	IV	included in obstacles to movement, natural
* Bars, elevation	30-10, p 3-19	I.2	included in landforms, specific type
* Bars, extent	30-10, p 3-19	I.2	included in landforms, specific type
* Bars, location and distance from low water shoreline	30-10, p 4-17	I.2	included in landforms, specific type
* Bars, pattern	30-10, p 3-19	I.2	included in landforms, specific type
* Bars, surface material	30-10, p 3-19	I.5	included in landforms, specific type
* Bars, water depth	30-10, p 4-17	I.4	at low and high water; sandbars; included in landforms, specific type and water depth
* Basins	30-10, p 3-3	I.2	included in landforms, specific type
* Basins, intermontane, border terraces	30-10, p 3-8	I.2	included in landforms, specific type
* Basins, intermontane, bottomland, flat extent	30-10, p 3-8	I.2	included in landforms, specific type
* Basins, intermontane, elevation	30-10, p 3-8	I.2	included in landforms, specific type
* Basins, intermontane, length	30-10, p 3-8	I.2	included in landforms, specific type
* Basins, intermontane, profile	30-10, p 3-8	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Basins, intermontane, shape	30-10, p 3-8	I.2	included in landforms, specific type
* Basins, intermontane, slope	30-10, p 3-8	I.2	included in landforms, specific type and slope
* Basins, intermontane, stream associations	30-10, p 3-8	I.4	included in landforms, specific type, I. 2
* Basins, intermontane, width	30-10, p 3-8	I.2	included in landforms, specific type
* Beach exits	30-10, p 4-18	IV	type, location, number; included in landing beaches
* Beach features, bypass possibilities	30-10, p 4-17	IV	included in landing beaches
* Beach features, influence on operations	30-10, p 4-17	IV	included in landing beaches
* Beach features, number and extent	30-10, p 4-17	I.2	included in landforms, specific type
* Beach features, type	30-10, p 4-17	I.2	cusps, stream mouths, groins, piers, outfall pipes, etc.; included in landforms, specific type and shorelines, description
* Beach ridges	30-10, p 3-2	I.2	included in landforms, specific type
* Beach width	30-10, p 4-17	I.2	at low and high water; included in landforms, specific type
Berths	55-8, p C-3	II.1	called berthages in terms of passing basins and anchorages in manual; length, type, apron, alongside depth, etc.
* Berthage, alongside depth	55-8, p C-3	II.1	included in berths
* Berthage, construction material	55-8, p C-3	II.1	included in berths
* Berthage, total length	55-8, p C-3	II.1	included in berths
* Berthage, type	55-8, p C-3	II.1	included in berths
* Berthage, width of apron	55-8, p C-3	II.1	included in berths
* Billeting and quartering availability	30-10, p 8-3	IV	as defined in manual, not applicable to remote sensing techniques; in structures, II.3

FACTOR	REFERENCE	CATEGORY	COMMENTS
Bivouac areas, detection	5-30, p 15	IV	actual and potential
* Bivouacs, potential	5-36, p 5-6	IV	included in bivouac areas, detection
* Bivouacs, site for	5-36, p 2-6	III.2	included in site selection
* Bog	30-10, p 3-19	I.3 I.4	changed to wetlands, extent and wetlands, type
Borrow pits	5-36, p 4-10	III.1	manual refers to borrow pits in terms of availability of local materials
* Boulder fields	30-10, p 3-3	I.2	included in surface irregularities
Branch characteristics	CRS	I.3	habit, thorns, density, size, geometry, etc.
Bridges, abutment characteristics	30-10, p 5-16	II.1	type, dimensions, material, etc.
* Bridges, abutments	30-10, p 5-16	II.1	changed to bridges, abutment characteristics
* Bridges, approaches	30-10, p 5-16	II.1	see specific transportation type
* Bridges, arches, description	30-10, p 5-17	II.1	included in bridges, structure type
Bridges, bypasses	30-10, p 5-16 5-36, p 2-6 5-36, p 2-65	II.1	to be classified as easy, difficult, and impossible; location
* Bridges, classification	5-30, p 15 5-36, p 2-12 5-36, p 2-52	II.1	manual asks for classification in terms of type and load carrying capacity; see bridges, military load classification and bridges, structure type
* Bridges, clearance	5-36, p 2-5 55-8, p C-3	II.1	underbridge, horizontal and vertical clearances at mean high and mean low water; through truss clearance; included in clearance, horizontal and vertical
Bridges, condition	30-10, p 5-16	II.1	in terms of effort required to repair damage in manual
* Bridges, demolition requirements	30-10, p 5-17	II.1	changed to demolition requirements, IV

FACTOR	REFERENCE	CATEGORY	COMMENTS
Bridges, detection	CRS	II.1	
* Bridges, effects of climate and weather	30-10, p 5-17	II.1	included in I.1
* Bridges, horizontal clearance	30-10, p 5-16	II.1	included in clearance, horizontal and vertical
* Bridges, intermediate support characteristics	30-10, p 5-17	II.1	included in bridges, structure type
Bridges, military load classification	30-10, p 5-16 5-36, p 3-40	II.1	load carrying capacity
* Bridges, number of spans	30-10, p 5-16	II.1	included in bridges, structure type
* Bridges, obstacle spanned	30-10, p 5-16	II.1	included in bridges, detection
* Bridges, safety and security features	30-10, p 5-17	II.1	N/A
* Bridges, sites for	5-36, p 2-68	II.1	category all-inclusive by itself (site selection)
* Bridges, span, description	30-10, p 5-16	II.1	included in bridges, structure type
Bridges; structure type	30-10, p 5-16	II.1	number of spans, description of spans, suspension system, description of arches, intermediate support characteristics, etc.
* Bridges, structure type, movable span	55-8, p C-3 30-10, p 5-17	II.1	swing or double swing, lift, central island turntable, retractile; included in bridges, structure type
* Bridges, suspension system	30-10, p 5-17	II.1	included in bridges, structure type
* Bridges, traffic control markings	30-10, p 5-17	II.1	N/A
* Bridges, traffic control and safety features	30-10, p 5-17	II.1	N/A
Bridges, use type	CRS	II.1	dummy, vehicular, foot; multiple or single use; aqueducts
* Bridges, use type, dummy	5-30, p 40	II.1	included in bridges, use type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Bridges, use type, floating	30-10, p 5-17	II.1	inaccurate terminology
* Bridges, use type, vehicular	5-30, p 40	II.1	included in bridges, use type
* Bridges, walkways	30-10, p 5-16	II.1	included in bridges, use type
* Bridges, width of travelled way	30-10, p 5-16	II.1	assume manual is referring to horizontal clearance, so included in clearances, horizontal and vertical
* Buildings	5-30, p 15	II (all)	too all-inclusive; see structures, II.3
Built-up areas, classification	CRS	II.3	see specific factor in this category
Built-up areas, detection	CRS	II.3	
Built-up areas, extent	21-26, p 2-6 30-10, p 7-28	II.3	
Burned areas	30-10, p 3-22 30-20, p 11-2	I.3	degree and extent of past burn-off
* Buttes	30-10, p 3-3	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Cableways, approaches	30-10, p 5-22	II.1	manual says to refer to appropriate collection file
* Cableways, base stations	30-10, p 5-21	II.1	included in cableways, description
* Cableways, carriage data	30-10, p 5-22	II.1	included in cableways, description
* Cableways, daily capacity	30-10, p 5-21	II.1	N/A
Cableways, description	30-10, p 5-21 31-60, p 2-3	II.1	base stations, capacity, length, maintenance, power, carriage data, etc.; in terms of check list, p 5-21, 5-22
Cableways, detection	CRE	II.1	
* Cableways, effects of climate and weather	30-10, p 5-22	II.1	included in I.1
* Cableways, importance to local economy	30-10, p 5-22	II.1	N/A
* Cableways, intermediate towers	30-10, p 5-21	II.1	included in cableways, description
* Cableways, length	30-10, p 5-21	II.1	included in cableways, description
* Cableways, maintenance	30-10, p 5-22	II.1	included in cableways, description
* Cableways, ownership	30-10, p 5-22	II.1	N/A
* Cableways, power cable	30-10, p 5-22	II.1	included in cableways, description
* Cableways, principal uses	30-10, p 5-22	II.1	changed to cableways, uses
* Cableways, route connection	30-10, p 5-22	II.1	see specific transportation type
* Cableways, security and safety features	30-10, p 5-22	II.1	N/A
* Cableways, single lift capability	30-10, p 5-21	II.1	included in cableways, description
* Cableways, terminals	30-10, p 5-21	II.1	included in cableways, description
* Cableways, track cable	30-10, p 5-21	II.1	included in cableways, description

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Cableways, traverse time	30-10, p 5-21	II.1	included in cableways, description
Cableways, uses	30-10, p 5-21	II.1	
Camouflage	30-5, p 9-10	IV	this reference describes briefly the general use of camouflage, not the need for camouflage information; remote sensing techniques can be used in two ways: 1) to evaluate a given piece of terrain to determine general type required, or 2) to attempt to detect camouflage in place; CRS has arbitrarily defined camouflage in terms of detection.
* Canals	30-10, p 3-18 30-5, p B-3 21-26, p 10-10 5-36, p 4-3	II.1	included in waterways, type
* Canals, design standards	30-10, p 5-34	II.1	included in waterways, description
* Canyons	30-10, p 3-3	I.2	included in landforms, specific type
* Caves	30-5, p B-3 30-10, p 3-14 5-30, p 15	I.6	changed to caves, detection
* Caves, continuity	30-10, p 3-14	I.6	changed to caves, detection
Caves, detection	CRS	I.6	
* Caves, dimensions	30-10, p 3-14	I.6	changed to caves, detection
Central heating plants, characteristics	CRS	II.3	installation, area served, type, etc.
Central heating plants, detection	30-10, p 7-28 30-20, p E-1	II.3	
* Channel, aids to navigation	55-8, p C-3 30-10, p 5-34	II.1	changed to navigation aids
* Channel, alignment	30-10, p 5-33	II.1	included in waterways, layout

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Channel approach, controlling depth	30-10, p 5-33 55-8, p C-2	II.1	changed to waterways, approaches; also, see clearances, horizontal and vertical
* Channel approach, controlling width	30-10, p 5-33 55-8, p C-2	II.1	included in water depth, I.4
* Channel approach, obstacle location	30-10, p 5-33 55-8, p C-3	II.1	included in underwater obstacles, I.4
* Channel, bank characteristics	30-10, p 3-18 31-60, p 2-2	I.4	material, slope, height; information duplicated in waterways, ferries, and fords
* Channel, bank material depth	30-10, p 3-19	I.4	changed to waterways, bank slope and waterways, bank composition
* Channel, bottom character	55-8, p C-3	I.4	changed to waterways, bottom characteristics
* Channel, bottom characteristics	30-10, p 3-19	I.4	changed to waterways, bottom characteristics
* Channel, bottom material depth	30-10, p 3-19 30-10, p 5-33	I.4	changed to waterways, bottom characteristics
* Channel, bottom width	55-8, p C-3	I.4	changed to waterways, bottom characteristics
* Channel, clearance	55-8, p C-3 30-10, p 5-33	II.1	changed to clearances, horizontal and vertical
* Channel, critical bends	55-8, p C-3	II.1	changed to waterways, layout and waterways, description
* Channel, cross section and longitudinal profile	30-10, p 3-19	I.4	changed to waterways, cross section and profile
* Channel, depth	30-10, p 5-33 55-8, p C-3	I.4	included in water depth
* Channel, known obstructions	55-8, p C-3 30-10, p 5-33	II.1	included in underwater obstacles, I.4
* Channel, length	30-10, p 3-19 55-8, p C-2	I.4	changed to waterways, layout and waterways, description

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Channel, longitudinal profile	30-10, p 3-19	I.4	changed to waterways, cross section and profile, II.1
* Channel, obstructions, bypass	30-10, p 5-33 55-8, p C-2	II.1	included in obstacles to movement, artificial and obstacles to movement, natural
* Channel, obstruction, effect on navigation	30-10, p 5-33 55-8, p C-2	II.1	included in obstacles to movement, artificial and obstacles to movement, natural
* Channel, obstructions, effort required to remove	30-10, p 5-33	II.1	included in obstacles to movement, artificial, and obstacles to movement, natural
* Channel, obstruction, nature	30-10, p 5-33 55-8, p C-2	II.1	tidal bores, rapids, reefs, sandbars, whirlpools, wrecks, shoals, narrows, snags, scouring, landslides, excessive vegetation; included in obstacles to movement, artificial and obstacles to movement, natural
* Channel, seasonal variation	55-8, p C-3	I.4	information duplicated in waterways, fords and ferries
* Channel, slope	30-10, p 3-19	I.4	included in waterways, cross section and profile and stream, gradient
* Chart, revision and verification	30-10, p 1-12	III.3	category all-inclusive by itself
* Churches	30-10, p 7-29 21-26, p 10-10	II.3	changed to religious structures
* Cities, towns, and villages	30-10, p 9-1 30-10, p 8-1	II.3	and other built-up areas such as hamlets, metropolitan areas, etc.; included in built-up areas, classification
Clearance, vertical and horizontal	30-10, p 5-11 30-10, p 5-16	II.1	limits to 0.1 m on p 5-16
* Cliffs	30-5, p B-2	I.2	included in landforms, specific type
* Cliffs, distinguishing characteristics	21-26, p 10-10	I.2	included in landforms, specific type
* Cliffs, elevation	21-26, p 10-10	I.2	included in landforms, specific type
* Cliffs, height	21-26, p 10-10	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Cliffs, length	21-26, p 10-10	I.2	included in landforms, specific type
* Cliffs, outline	21-26, p 10-10	I.2	included in landforms, specific type
* Cliffs, slope	21-26, p 10-10	I.2	included in slope
* Cliffs, type	21-26, p 10-10	I.2	included in landforms, specific type
Climate	101-5, p G-2	I.1	the reference asks for general climate and weather information as part of a general description of an area; some of these conditions can be deduced from imagery and it is in this sense the item is evaluated.
Clouds	30-5, p 2-18 5-36, p 1-3	I.1	the manual discusses clouds in terms of effect on operations; remote sensing is of limited use for these tactical considerations; can study clouds directly (pattern, development, cycles, etc.) and the associations of patterns with terrain and meteorological conditions; clouds are evaluated in these terms.
* Coastal areas, availability of fresh water	30-10, p 4-18	I.4	included in water supply, source
* Coastal areas, defenses	30-10, p 4-18	IV	included in defenses
* Coastal areas, dispersal and storage areas	30-10, p 4-18	IV	included in dispersal and storage areas, detection
* Coastal terrain, critical features	30-10, p 4-18	I.2	included in landforms, specific type
* Coastal type	30-10, p 4-17	I.2	emergent, submergent, compound, coral reef, delta, volcanic, fault, man-made, etc.; included in shorelines, description
* Coasts	5-30, p 4	I.2	included in shorelines, detection and shorelines, description
* Cols	30-10, p 3-3	I.2	included in landforms, specific type
* Communications facilities, characteristics	30-10, p 6-15	II.2	see specific telecommunications factor
* Communications, military, types	30-10, p 6-15	IV	see specific telecommunications factor, II.2

FACTOR	REFERENCE	CATEGORY	COMMENTS
Concealment, potential for	5-30, p 40 5-36, p 1-3 30-10, p 3-22 31-60, p 2-2	IV	protection from observation
* Conduits, alignment and length	30-10, p 3-19	II.5	included in dams, associated structures
* Conduits, related intake structures	30-10, p 3-19	II.5	included in dams, associated structures
* Conduits, type and purpose	30-10, p 3-19	II.5	canal, tunnel, pipe, within dam; included in dams, associated structures
* Construction, civilian	5-30, p 4	II.7	included in construction sites, description
Construction equipment	30-10, p 5-12	II.7	manual refers specifically to railways, but factor can be applied universally, and is so intended; location and detection
* Construction materials, amounts	5-30, p 40 30-10, p 8-15	III.1	included in developmental aspects, construction resources
* Construction materials, nature	5-30, p 40 30-10, p 8-15	III.1	unclear and ambiguous
* Construction materials, sources	5-30, p 40	III.1	see specific construction resource
* Construction materials, vegetation	30-10, p 3-22	III.1	changed to vegetation for construction, use suitability
* Construction, military	5-30, p 4	II.7	included in construction sites, description
* Construction resources	5-30, p 4 30-10, p 8-15	III.1	too general; see specific resource in category of this name
* Construction resources, bridge timbers	5-30, p 15	III.1	changed to timber
* Construction resources, developmental aspects	30-10, p 8-15	III.1	changed to developmental aspects, construction resources
* Construction resources, stockpiled material	30-10, p 8-15	III.1	changed to stockpiled material

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Construction resources, stone	30-10, p 8-15	III.1	included in rock, use suitability
* Construction sites, access	5-30, p 15	II.7	included in construction sites, description
* Construction sites, acreage	5-30, p 15 30-10, p 8-15	II.7	included in construction sites, description
Construction sites, description	5-30, p 15	II.7	drainage, water supply, facilities, access, power, acreage, soils earthwork, etc.
Construction sites, detection	5-30, p 15 30-10, p 8-15	II.7	in the manual, this is referred to as area identification and location (30-10)
* Construction sites, drainage	5-30, p 15	II.7	included in construction sites, description
* Construction sites, earthwork	5-30, p 15	II.7	included in construction sites, description
* Construction sites, power	5-30, p 15	II.7	included in construction sites, description
* Construction sites, soil	5-30, p 15	II.7	included in construction sites, description; see soil factors, I.5
* Construction sites, water supply	5-30, p 15	II.7	included in construction sites, description; see water supply factors, II.3
Contaminated areas (CBR)	30-5, p 3-17	IV	CBR = chemical, biological, and/or radiological
Cover, potential	5-30, p 40 5-36, p 1-3 31-60, p 2-2	IV	protection from fire
* Craters	30-5, p 3-17	IV	shell, bomb, missile, etc.; included in damage assessment
* Craters, analysis	30-5, p 3-17	IV	size and direction of enemy fire; included in damage assessment
* Craters, shell	30-5, p 3-17	IV	included in damage assessment
Crevasse detection	CRS	I.5	

FACTOR	REFERENCE	CATEGORY	COMMENTS
Critical points	30-10, p 5-12	IV	landslides, avalanches, etc.; railways, highways; note: a critical point can be any item of interest and may be actual or potential
Crop identification	30-10, p 3-21	II.4	specific crop, such as peaches, beans, or bananas, etc.
Cross country movement	30-10, p 4-3 to p 4-16 5-36, p 4-1 to p 4-5	IV	
Cultural centers	30-10, p 7-29	II.3	museums, theaters, libraries, etc.
Cultivation	30-10, p 3-22	II.4	method, period
* Cultivation, method	30-10, p 3-22	II.4	changed to cultivation
* Cultivation, period	30-10, p 3-22	II.4	changed to cultivation
Culverts	30-10, p 5-16 5-330, p 6-41	II.1	manual defines as a short bridge; disagree with usage
Culverts, detection	5-36, p 2-70 5-330, p 6-41	II.1	5-330 defines culvert as a short bridge; but CRS is using culvert as defined in 5-36, as an underground passage for water
Currents	30-10, p 3-18 55-8, p C-3	I.4	tidal, littoral, stream, oceanic, undertows, etc.
* Currents, tidal, direction	30-10, p 3-18	I.4	included in currents
* Currents, tidal, location	30-10, p 3-18	I.4	included in currents
* Currents, tidal, period	30-10, p 3-18	I.4	included in currents
* Currents, tidal, velocity	30-10, p 3-18 55-8, p C-3	I.4	included in currents
* Currents, undertow	30-10, p 3-18	I.4	included in currents

FACTOR	REFERENCE	CATEGORY	COMMENTS
Damage assessment	5-36, p 1-6 30-5, p 3-18	IV	artillery, bombs, missiles, etc.; need indicated in many places, but not specific; CRS defines this item as damage to terrain by artillery, etc.; natural damage can be evaluated by the same techniques.
Dams, associated structures	30-10, p 3-19	II.5	spillways, conduits, gates, intakes, outlets, etc.
* Dams, bypasses	55-8, p C-3	II.5	N/A
* Dams, construction materials	30-10, p 3-19	II.5	earthfill, rockfill, concrete, etc.; included in dams, type
* Dams, design	55-8, p C-3	II.5	N/A
Dams, detection	CRS	II.5	
* Dams, dimensions	30-10, p 3-19	II.5	height, length, width, thickness; included in dams, type
Dams, intake structures	30-10, p 3-19	II.5	location, type; included in dams, associated structures
* Dams, operating characteristics	30-10, p 3-19	II.5	N/A
* Dams, outlets	30-10, p 3-19	II.5	number, type, location, size, shape, length, etc.; included in dams, associated structures
Dams, purpose	30-10, p 3-19 55-8, p C-3	II.5	power, water supply, irrigation, flood control
* Dams, seasonal variation in water supply	55-8, p C-3	II.5	see reservoirs
* Dams, security and safety features	30-10, p 3-19	II.5	N/A
Dams, type	30-10, p 3-19	II.5	fixed, movable, gravity, etc.; earthfill, rockfill, concrete, etc.
* Defense positions	5-30, p 15	IV	potential - may not be defended at present; included in defenses

315

FACTOR	REFERENCE	CATEGORY	COMMENTS
Defenses	5-30, p 4 5-30, p 15 30-10, p 7-22	IV	airfield, coastal, ports, tunnels, fixed installations, etc.; actual and potential; manuals indicate need for this information, CRS has lumped the items together to include these specific items and others like them.
Defilade positions	5-30, p 15	IV	according to AR 310-25, this refers to protection from enfilading fire and enemy observation
Defoliation, susceptibility to	30-10, p 3-21	IV	
* Deltas	30-10, p 3-2	I.2	included in landforms, specific type
Demolition requirements	30-10, p 5-17	IV	bridges, silos, tunnels, towers, etc.; the initial reference is bridges only but the factor can be applied universally
* Depressions	30-10, p 3-3	I.2	included in landforms, general type; cols, arroyos, canyons, gullies, gorges, etc.
Developmental aspects, construction resources	30-10, p 8-15	III.1	processing requirements, accessibility, etc.
Dikes and levees	30-10, p 5-33	II.5	CRS assumes manual refers to man-made levees and has added dikes to represent all types of retaining walls
Dispersal and storage areas, detection	30-10, p 4-18	IV	actual and potential; all types of dumps
Ditches	30-10, p 5-6	II.5	depth, width, lining, condition, structures (weirs, gratings, etc.), etc.
* Drainage basin, area	30-10, p 3-18	I.4	included in drainage basin, characteristics
Drainage basin, characteristics	30-10, p 3-18	I.4	area, slope, shape; same as watershed
* Drainage basin, shape	30-10, p 3-18	I.4	included in drainage basin, characteristics
* Drainage basin, slope	30-10, p 3-18	I.4	included in drainage basin, characteristics and slope
* Drainage, internal	30-10, p 3-14	I.4	included in drainage pattern

325

FACTOR	REFERENCE	CATEGORY	COMMENTS
Drainage pattern	30-10, p 3-16	I.4	annular, dendritic, parallel, radial, rectangular, trellis; internal, interrupted, etc.
* Drainage, surface	30-10, p 3-13 STOPIN, p U-1	I.4	included in drainage pattern
* Drainage system	5-30, p 15 101-5, p G-2 21-26, p 10-10	I.4	included in drainage pattern
* Drainage, type	30-10, p 3-13	I.4	internal or external; included in drainage pattern
Drainage, urban	CRS	II.3	storm water and snow-melt runoff
Drop sites	30-10, p 3-8	IV	potential or suitable
* Drop sites, surface configuration	30-10, p 3-8	IV	changed to drop sites
* Drumlips	30-10, p 3-2	I.2	included in landforms, specific type
* Dry docks, inclined planes, conditions	30-10, p 5-33	II.1	changed to waterways, description
* Dry docks, inclined planes, construction design	30-10, p 5-33 55-8, p C-3	II.1	changed to waterways, description
* Dry docks, inclined planes, hoisting device	30-10, p 5-33 55-8, p C-3	II.1	handpowered or mechanically powered; included in waterways, description
* Dry docks, inclined planes, location	30-10, p 5-33 55-8, p C-3	II.1	included in waterways, description
* Dry docks, inclined planes, transit time (minutes)	30-10, p 5-33	II.1	N/A
* Duds	30-5, p 3-17	IV	manual wants information on type and caliber of enemy weapons, which is not applicable to remote sensing techniques
* Dune fields	30-10, p 3-2	I.2	included in landforms, specific type

334

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Earthquakes	30-10, p 3-8	I.6	N/A
* Earthwork	5-30, p 15	II.7	changed to earthwork requirements
Earthwork requirements	5-330, p 4-22	II.7	mass diagrams; rock and soil excavation
Effluent, chemical	CRS	II.6	
Effluent, thermal	CRS	II.6	
* Electric power	5-30, p 4 30-10, p 7-28 21-26, p 10-10	II.2	see powerplants, power substations, and/or transmission lines
* Electric power, area served	30-10, p 7-28	II.2	N/A
* Electric power, fuel and equipment	30-10, p 7-28	II.2	included in powerplant, characteristics
* Electric power, output	30-10, p 7-28	II.2	average, peak, and seasonal variation; N/A
* Electric power, system capacity	30-10, p 7-28	II.2	normal, peak, and seasonal variation; N/A
* Electric power, ties with outside sources	30-10, p 7-28	II.2	included in power transmission lines, layout
* Electric power, transformer system	30-10, p 7-28	II.2	included in power substations, function
* Electric power, transmission	30-10, p 7-28	II.2	lines, voltages, former stations, included in power transmission lines
* Embankments	5-36, p 4-5	II.1	meaningless in terms or remote sensing in this reference
* Embankments, composition	55-8, p C-2	II.1	included in layout of various transportation types
* Embankments, description	55-8, p C-2	II.1	composition, height; included in layout of various transportation types
* Embankments, height	55-8, p C-2	II.1	included in layout of various transportation types
Enemy command posts	30-5, p 3-7	IV	

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Enemy engineer troops, capabilities	5-30, p 40	IV	not specified as needed in the manual
* Enemy engineer troops, location	5-30, p 40	IV	included in troop concentrations
Enemy fortifications	21-26, p 10-10 30-10, p 7-30 101-5, p G-2 30-5, p B-2	IV	location, extent, type, camouflage, armament, design, purpose, and description
* Enemy fortified areas	30-10, p 7-30	IV	description, extent, and purpose; included in enemy fortifications
* Enemy fortified areas, description	30-10, p 7-30	IV	included in enemy fortifications
* Enemy fortified areas, extent	30-10, p 7-30	IV	included in enemy fortifications
* Enemy fortified areas, purpose	30-10, p 7-30	IV	included in enemy fortifications
* Enemy movement	30-5 p 3-8	IV	not applicable in terms of sensors applied in this study
Enemy outposts	30-5, p 3-7	IV	
* Enemy reserves	30-5, p 3-7	IV	included in troop concentrations
* Enemy supplies	30-5, p 3-8	IV	included in dispersal and storage areas, detection
* Enemy trails	30-5, p 3-8	IV	routes leading to objective in the manual; included in guerrilla activity
* Enemy withdrawal areas (possible)	30-5, p 3-11	IV	changed to withdrawal areas
* Enemy withdrawal routes	30-5, p 3-11	IV	changed to withdrawal routes
* Engineer dumps	5-30, p 40	IV	equipment dump; included in dispersal and storage areas, detection
* Engineer equipment	5-30, p 15	III.1	included in construction resources
* Engineer facilities and equipment	30-10, p 7-28	II.4	manual somewhat unclear, but appears to refer to construction equipment and resources (II.7 and III.1)

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Engineer materiel	5-30, p 4 31-60, p 2-2	IV	quarries, timber, steel, etc.; as defined in this comment, the factor is included in construction resources, III.1
* Engineer resources	5-30, p 4	IV	included in construction resources, III.1
* Escarpments	5-36, p 4-5	I.2	included in landforms, general type
* Escarpments, dimensions	30-10, p 3-8	I.2	included in landforms, general type
* Escarpments, elevation	30-10, p 3-8	I.2	included in landforms, general type
* Escarpments, local relief	30-10, p 3-8	I.2	included in relief, topographic
* Escarpments, slope	30-10, p 3-8	I.2	included in slope
* Escarpments, unique characteristics	30-10, p 3-8	I.2	included in landforms, general type
* Eskers	30-10, p 3-2	I.2	included in landforms, specific type
* Excavation material, % shrinkage of rock	30-10, p 3-14	III.1	N/A
* Excavation material, relative shrinkage and expansion of soil	30-10, p 3-13	III.1	N/A
* Excavation material, relative shrinkage and expansion of soil percent	30-10, p 3-13	III.1	N/A
* Excavation material, relative shrinkage of rock	30-10, p 3-14	III.1	N/A
* Excavation material, shrinkage and expansion	30-10, p 3-13	III.1	relative and %; N/A to remote sensing techniques
Expansion potential	CRS	II.1	airfields, ports, harbors, railroads, etc.; manual refers to ports and harbors, but this factor is applicable to all transportation development and is therefore used in the latter sense here
* Explosives	5-30, p 15	IV	included in dispersal and storage areas, detection

FACTOR	REFERENCE	CATEGORY	COMMENTS
Extractive industry, capacity	CRS	II.3	range estimates only
Extractive industry, detection	CRS	II.3	
Extractive industry, facilities	CRS	II.3	buildings, and equipment
Extractive industry, method of operation	30-10, p 8-15	II.3	surface (single or multiple trench) or underground
Extractive industry, product	CRS	II.3	ore, gravel, crushed or cut stone, coal, oil, gas, etc.
Extractive industry, status	CRS	II.3	active or abandoned

375

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Faults	30-10, p 3-14	I.6	Included in fractures, characteristics
* Faults, activity	30-10, p 3-14	I.6	included in fractures, characteristics
* Faults, dip of fault plane	30-10, p 3-14	I.6	called slope rather than dip in the manual, which is incorrect terminology; included in fractures, characteristics
* Faults, displacement	30-10, p 3-14	I.6	included in fractures, characteristics
* Faults, type	30-10, p 3-14	I.6	included in fractures, type
* Ferries	5-30, p 15 5-36, p 2-1 55-8, p C-3	II.1	manual refers to ferries in terms of general information only; see specific ferry item
Ferries, description	31-60, p 2-2 30-10, p 5-20	II.1	crossing time, traffic, propulsion method, type, hazards, routes, etc.
Ferries, detection	CRS	II.1	this includes ferry terminals
* Ferries, propulsion method	30-10, p 5-19	II.1	included in ferries, description
* Ferry anchors, trail and flying ferries only	30-10, p 5-20	II.1	included in ferries, description
* Ferry cables, trail and flying ferries only	30-10, p 5-20	II.1	included in ferries, description
* Ferry, course followed when crossing	30-10, p 5-20	II.1	included in ferries, description
* Ferry, crossing time	30-10, p 5-20	II.1	included in ferries, description
* Ferry, effects of climate and weather	30-10, p 5-20	II.1	included in climate and weather, I.1
* Ferry, importance to local economy	30-10, p 5-20	II.1	N/A
* Ferry, navigation aids	30-10, p 5-20	II.1	included in navigation aids
* Ferry, ownership	30-10, p 5-20	II.1	N/A

38  
- 01

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ferry, possible hazards to	30-10, p 5-20	II.1	included in ferries, description
* Ferry, principal traffic	30-10, p 5-20	II.1	included in ferries, description
* Ferry, stream crossed	30-10, p 5-19	II.1	included in ferries, description
* Ferry, terminals	30-10, p 5-19	II.1	included in ferries, description and ferries, detection
* Ferry, type	30-10, p 5-19	II.1	included in ferries, description
* Ferry, vessel features	30-10, p 5-19	II.1	general description; included in ferries, description
Fields of fire, flat trajectory	31-60, p 2-2 30-10, p 3-22	IV	reference refers to flat trajectory weapons from the standpoint of vegetation
Fire fighting facilities and equipment	30-10, p 5-51 21-26, p 10-10	II.3	number of stations, equipment, water source
* Flood control	30-10, p 3-18	I.4	included in dams, purpose, II.5
* Flooding	30-10, p 3-18 55-8, p C-3	I.4	too general; see specific flooding item
* Flooding, affects	30-10, p 3-18 30-10, p 5-34 31-60, p 2-2	I.4	included in flooding, characteristics
* Flooding, artificial	5-30, p 40	I.4	combined into flooding, characteristics
* Flooding, cause	31-60, p 2-2 31-60, p 2-2	I.4	artificial or natural (tidal, snow-melt, direct runoff, etc.); included in flooding, characteristics
Flooding, characteristics	30-10, p 3-18 30-10, p 5-34	I.4	affects, cause, duration, frequency, and type (tidal, snow-melt, direct runoff, etc.)
* Flooding, dates	30-10, p 3-18	I.4	N/A
* Flooding, duration	30-10, p 3-18 30-10, p 5-34 31-60, p 2-2	I.4	included in flooding, characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
Flooding, extent	30-10, p 5-34 30-10, p 3-18 31-60, p 2-2	I.4	
* Flooding, frequency	30-10, p 5-34	I.4	included in flooding, characteristics
Flooding, potential for	CRS	I.4	
* Flooding, type	30-10, p 3-18	I.4	included in flooding, characteristics
* Floodplains	30-10, p 3-2	I.2	included in landforms, specific type
Folding	30-10, p 3-14 5-332, p 4	I.6	anticlines, synclines, etc.
* Footbridges	5-30, p 40	II.1	included in bridges, use type
* Forbs	30-10, p 3-20	I.3	included in vegetation, general type (grass)
* Fordability	5-30, p 15	II.1	included in fords, description
Fords, approaches	30-10, p 5-21	II.1	width, condition, and length
* Fords, azimuth of crossing	30-10, p 5-21	II.1	included in fords, description
* Fords, banks	30-10, p 5-21	II.1	included in waterways, bank slope and waterways, bank composition and fords, description
* Fords, bottom slope at exits	30-10, p 5-21	II.1	included in fords, description
* Fords, bypasses and alternate crossings	30-10, p 5-21	II.1	included in fords, description
* Fords, cross section	30-10, p 5-21	II.1	included in waterways, cross section and profile
Fords, description	30-10, p 5-21 31-60, p 2-2	II.1	hazards, bypasses, banks, bottoms, load class, etc.
Fords, detection	5-30, p 15 5-36, p 2-1	II.1	

40

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Fords, effort required to improve crossing	30-10, p 5-21	II.1	included in fords, description
* Fords, length of crossing at high, low, and normal water	30-10, p 5-21	II.1	included in fords, description
* Fords, military load classification	30-10, p 5-21	II.1	included in fords, description
* Fords, nearest depth gage location	30-10, p 5-21	II.1	N/A
* Fords, possible hazards	30-10, p 5-21	II.1	included in fords, description
* Fords, site plan	30-10, p 5-21	II.1	included in fords, description
* Foreshore material	30-10, p 4-17	I.5	composition, texture, trafficability; included in landforms, specific types (I.2) and trafficability (IV)
* Foreshore, slope	30-10, p 4-17	I.2	included in slope
* Forest fire, characteristic residue	30-10, p 3-22	I.3	N/A
* Forest fire, degree of past burn-off	30-20, p 11-3 30-10, p 3-22	I.3	changed to burned areas
Forest fire, detection	30-5, p B-5 30-20, p 11-3	I.3	
* Forest fire, seasonal aspects	30-10, p 3-22	I.3	included in forest fire, susceptibility to
Forest fire, susceptibility to	30-10, p 3-22	I.3	
* Forest fire, type	30-10, p 3-22	I.3	caused, accidental, controlled; N/A
Forest, type	30-10, p 3-20	I.3	the manual is not specific on needs, but they do want to know type; conifers, deciduous, mixed, mixed hardwoods, etc.
* Forests, extent	5-30, p 15 5-36, p 1-8 21-26, p 2-5	I.3	see vegetation, general type

FACTOR	REFERENCE	CATEGORY	COMMENTS
Fossil fuel sources	30-10, p 8-8	I.6	coal, oil, gas
* Fossils	5-545, p 72	I.6	N/A
Foundation conditions	30-10, p 5-51	II.7	condition of materials, suitability
Fractures, characteristics	30-10, p 3-14	I.6	dip, pattern, size, spacing, displacement, shape, etc.; many fractures are readily apparent and easily mapped, but others are difficult to trace with certainty and require considerable effort, time, and careful evaluation
Fractures, detection	CRS	I.6	
* Fractures, pattern	30-10, p 3-14	I.6	included in fractures, characteristics
* Fractures, size	30-10, p 3-14	I.6	included in fractures, characteristics
* Fractures, spacing	30-10, p 3-14	I.6	included in fractures, characteristics
Fractures, type	30-10, p 3-14	I.6	fault (reverse, thrust, etc.) or joint
* Freezing conditions	30-10, p 5-34	I.1	extent, duration, probable occurrence, effects; called icing conditions in manual; deleted because manual is unclear and the factor does not request the same kind of information
Functional area	30-10, p 7-28 101-5, p G-2 30-5, p 15	II.3	military, residential, commercial, industrial, governmental; etc.

A25Ct

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Gaps, topographic	30-10, p 3-3	I.2	included in landforms, specific type
* Garages	5-30, p 15	II.3	vehicle repair and/or storage; too specific building type, so included in structures
* Garbage and trash disposal, area served	30-10, p 7-29	II.3	N/A
* Garbage and trash disposal, equipment	30-10, p 7-29	II.3	included in garbage and trash facilities
* Garbage and trash disposal, methods and schedules	30-10, p 7-29	II.3	N/A
* Garbage and trash disposal, treatment and disposal plants	30-10, p 7-29	II.3	included in garbage and trash facilities
Garbage and trash facilities	30-10, p 7-29	II.3	disposal and treatment plants (location, type, and capacity)
Gas distribution facilities (urban areas)	CRS	II.3	pipelines, mains, trunks, tanks, controls, auxiliary installations, etc.
* Gas, illuminating, annual consumption	30-10, p 7-29	II.3	N/A
* Gas, illuminating, area served	30-10, p 7-29	II.3	N/A
* Gas, illuminating, distribution system	30-10, p 7-29	II.3	pipelines, mains, trunks, tanks, controls, auxiliary installations; included in gas distribution facilities
* Gas, illuminating, output	30-10, p 7-29	II.3	average, peak, seasonal variation; N/A
* Gas, illuminating, source	30-10, p 7-29	II.3	included in extractive industries, product
* Gas, illuminating, storage	30-10, p 7-28	II.3	location, type, capacity, characteristics; included in storage facilities, commodity stored and storage facilities, type
* Gas storage, above ground	30-10, p 7-28	II.3	included in storage facilities
* Geology	5-30, p 4	I.6	too all-inclusive; see specific factor

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Glaciers, characteristics	30-10, p 3-8	I.5	not specific on needs; refer to specific factor
* Glaciers, characteristics, unique	30-10, p 3-8	I.5	included in glaciers, characteristics
* Glaciers, dimensions	30-10, p 3-8	I.5	included in glaciers, extent
* Glaciers, elevation	30-10, p 3-8	I.5	N/A
Glaciers, extent	CRS	I.5	
* Glaciers, relief, local	30-10, p 3-8	I.5	included in surface irregularities, I.2
* Glaciers, slope	30-10, p 3-8	I.5	included in slope, I.2
Glaciers, thickness	CRS	I.5	
* Gorges	30-10, p 3-3	I.2	included in landforms, specific type
* Grass, high	30-10, p 3-21	I.3	included in vegetation, general type
* Grass, low	30-10, p 3-21	I.3	included in vegetation, general type
* Grass, type	30-10, p 3-21	I.3	included in vegetation, specific type; from species in the manual
* Grasslands, extent	30-10, p 3-20 5-30, p 39	I.3	included in vegetation, general type
Grasslands, type	CRS	I.3	savannahs, prairies, meadows, etc.
Groins	30-10, p 5-33	II.5	part of inland waterways check list along with jetties; manual wants location, function, design and materials
* Groins, construction design	30-10, p 5-33	II.5	included in groins
* Groins, construction materials	30-10, p 5-33	II.5	included in groins
* Ground cover	30-10, p 3-22	I.3	name, height, season, area covered; included in vegetation, general type

4423

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ground cover, area	30-10, p 3-22	I.3	included in vegetation, general type
* Ground cover, height	30-10, p 3-22	I.3	included in vegetation, general type
* Ground cover, name	30-10, p 3-22 101-5, p G-2	I.3	included in vegetation, general type
* Ground cover, season	30-10, p 3-22	I.3	included in vegetation, general type
Ground water	5-332, p 11 30-10, p 3-20	I.4	amount, flow, depth, temperature; see also water table
* Ground water, amount	5-332, p 11	I.4	included in ground water
* Ground water, flow	5-36, p 4-3	I.4	included in ground water
* Ground water, temperature	30-10, p 3-20	I.4	included in ground water
Guerrilla activity	31-60, p 2-3 CRS	IV	campsites, fires, trails, cleared areas, etc.
* Gullies	30-10, p 3-3 21-26, p 10-10	I.2	included in landforms, specific type

45

FACTOR	REFERENCE	CATEGORY	COMMENTS
Harbors, approaches and entrances	30-10, p 5-50	II.1	location, width, depth
* Harbors, area in hectares	55-8, p C-3 30-10, p 5-50	II.1	included in harbors, description
* Harbors, depth	55-8, p C-3	II.1	included in harbors, description and water depth, I.4
Harbors, description	30-10, p 5-50 55-8, p C-3	II.1	depth, divisions, fairways, maintenance, protective works, turning basins, types, etc.
Harbors, detection	CRS	II.1	
* Harbors, divisions	30-10, p 5-50	II.1	included in harbors, description
* Harbors, fairways	30-10, p 5-50	II.1	included in harbors, description
* Harbors, maintenance	30-10, p 5-51	II.1	included in harbors, description
* Harbors, protective works	30-10, p 5-50	II.1	included in harbors, description
* Harbors, turning basins	30-10, p 5-50	II.1	included in harbors, description
* Harbors, type	55-8, p C-3	II.1	included in harbors, description
Harvesting	30-10, p 3-22	II.4	method, period, product, yield, distribution, and disposition; because they are unclear in the manual, we are not considering disposition and distribution
* Harvesting, disposition	30-10, p 3-22	II.4	changed to harvesting
* Harvesting, method	30-10, p 3-22	II.4	changed to harvesting
* Harvesting, period	30-10, p 3-22	II.4	changed to harvesting
* Harvesting, product	30-10, p 3-22	II.4	changed to harvesting
* Harvesting, yield	30-10, p 3-22	II.4	changed to harvesting
* Hedgerows	30-10, p 4-12	II.4	included in obstacles to movement, artificial, IV

46

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Highways, civilian use of	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, classification	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, curves less than 30 m in radius	30-10, p 5-6 5-36, p 2-6	II.1	included in roads, layout and roads, characteristics
* Highways, description of ditches	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, description of shoulders	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, description of travelled way	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, length of segment in kilometers	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, load classification of lowest class bridge	30-10, p 5-6	II.1	included in roads, military load classification and bridges, military load classification
* Highways, maximum grade	30-10, p 5-6	II.1	included in roads, grades
* Highways, median strip composition	30-10, p 5-6	II.1	included in roads, characteristics
* Highways, obstacles	30-10, p 5-6	II.1	included in roads, characteristics and obstacles to movement, artificial and obstacles to movement, natural, IV
* Highways, off-road parking areas	30-10, p 5-6	II.1	included in roads, layout
* Highways, prominent features along route which can be used for convoy check points	30-10, p 5-6	II.1	description and location of features; included in landforms, specific type, I.2
* Highways, sections subject to blockage	30-10, p 5-6	II.1	included in roads, characteristics and obstacles to movement, artificial and obstacles to movement, natural, IV
* Highways, significant junctions or grade crossings	30-10, p 5-6	II.1	included in roads, layout
* Highways, total number of bridges	30-10, p 5-6	II.1	bridge is defined as any structure spanning gaps greater than 6 m; included in bridges, detection

475

475

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Highways, total number of culverts	30-10, p 5-6	II.1	culvert is defined as any structure spanning gaps 6m or less; see culverts
* Highways, underpasses	30-10, p 5-6	II.1	included in roads, layout
* Hills	30-10, p 3-2 21-26, p 10-10	I.2	included in landforms, general type
* Hills, distinguishing characteristics	21-26, p 10-10	I.2	included in landforms, specific type
* Hills, elevation	21-26, p 10-10	I.2	included in landforms, specific type
* Hills, height	21-26, p 10-10	I.2	included in landforms, specific type
* Hills, high	30-10, p 3-2	I.2	included in landforms, general type
* Hills, length	21-26 p 10-10	I.2	included in landforms, specific type
* Hills, low	30-10, p 3-2	I.2	included in landforms, general type
* Hills, outline	21-26, p 10-10	I.2	included in landforms, specific type
* Hills, slope	21-26, p 10-10	I.2	included in slope
Hospitals	30-10, p 7-29	II.3	adequacy, capacity, condition, specialization
* Hospitals, adequacy	30-10, p 7-29	II.3	included in hospitals
* Hospitals, capacity	30-10, p 7-29	II.3	included in hospitals
* Hospitals, condition	30-10, p 7-29	II.3	included in hospitals
* Hospitals, specialization	30-10, p 7-29	II.3	included in hospitals
* Hummocks	30-10, p 3-3	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
Ice bearing capacity	CRS	I.5	
* Ice surface conditions	5-330, p 13-22	I.2	included in surface irregularities
Ice temperature	5-330, p 13-22	I.5	
Ice thickness, fresh water	CRS	I.5	non-glacial ice only
Ice thickness, salt water	CRS	I.5	non-glacial ice only
Ice type	5-330, p 13-23	I.5	river, fresh, sea, young, pack
* Icing, conditions	55-8, p C-2 30-10, p 5-34	I.5	manual is unclear on needs
* Icing, duration	30-10, p 5-34 55-8, p C-2	I.5	manual is unclear on needs
* Icing, effects	30-10, p 5-34	I.5	manual is unclear on needs
* Icing, extent	30-10, p 5-34	I.5	manual is unclear on needs
* Icing, probable occurrence	30-10, p 5-34	I.5	manual is unclear on needs
Icings, type	5-330, p 6-76 5-330, p 6-77	I.5	coastal, river, spring, ground; coastal and river icing can be evaluated in Ice type above
Industrial areas, detection	30-5, p B-2 101-5, p G-2	II.3	manuals request general information on location, extent, and type of industrial area, i.e., a park with buildings or a group of steel mills
* Industrial buildings, capacity	21-26, p 10-10	II.3	included in industrial buildings, characteristics
* Industrial buildings, category	21-26, p 10-10	II.3	included in industrial buildings, characteristics
Industrial buildings, characteristics	21-26, p 10-10	II.3	location, dimensions, status, capacity, etc.
Industrial buildings, detection	CRS	II.3	
* Industrial buildings, serviceability	21-26, p 10-10	II.3	included in industrial buildings, characteristics

495

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Industrial buildings, size	21-26, p 10-10	II.3	included in industrial buildings, characteristics
Industrial waste disposal, detection	CRS	II.3	
* Industry, aircraft	30-10, p 9-3	II.3	airframe plants, aircraft engine plants, aircraft component plants, repair and modification plants; included in manufacturing plants, characteristics
* Industry, ammunition and armament	30-10, p 9-31	II.3	included in manufacturing plants, characteristics
* Industry, atomic energy processing	30-10, p 9-31	II.3	included in processing plant, characteristics
* Industry, chemical	30-10, p 9-5	II.3	chlorine plants, oxygen plants, sulfuric acid plants, synthetic ammonia plants, synthetic rubber plants; included in processing plant, characteristics
* Industry, electronics	30-10, p 9-14	II.3	tube and lamp plants, communications equipment plants, electronic parts plants, special equipment plants; included in manufacturing plants, characteristics
* Industry, explosives	30-10, p 9-30	II.3	included in manufacturing plants, characteristics
* Industry, guided missiles	30-10, p 9-2	II.3	airframe/assembly plants, rocket engine plants; included in manufacturing plants, characteristics
* Industry, machine and equipment	30-10, p 9-15	II.3	abrasive plants, agricultural machinery plants, anti-friction bearing plants, storage battery plants, chemical equipment plants, electric wire and cable plants, heavy electrical equipment plants, heavy equipment plants, machine tool plants; included in manufacturing plant, characteristics
* Industry, motor vehicle production	30-10, p 9-30	II.3	included in manufacturing plants, characteristics
* Industry, nonferrous metals	30-10, p 9-17	II.3	alumina plants, metallic aluminum plants, magnesia plants, metallic magnesium plants, primary lead plants, primary zinc plants, copper smelters, copper refineries, nickel refineries; included in processing plant, characteristics

50

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Industry, pharmaceutical and drug	30-10, p 9-29	II.3	antibiotic plants, vaccine and serum plants, biological and chemical warfare plants; included in processing plant, characteristics
* Industry, steel	30-10, p 9-9	II.3	includes coke and iron; included in processing plant, characteristics
* Industry, tanks and self-propelled guns	30-10, p 9-32	II.3	included in manufacturing plants, characteristics
* Infiltration rate	30-10, p 3-13	I.4	water through soil; part of soil-rock check list/internal drainage in the manual; included in drainage patterns
* Intelligence, evaluation of reliability	30-5, p 5-12 5-30, p 33	IV	N/A
* Inundation, causes	30-10, p 3-19	I.4	irrigation, rainfall-runoff imbalance, stream overflow, tides; included in flooding, characteristics
Irrigation, detection	30-10, p 3-16	II.4	inadequately defined in manual; CRS assumes detection of systems and practices
* Islands, elevation	30-10, p 3-19	I.2	included in landforms, specific type
* Islands, extent	30-10, p 3-19	I.2	included in landforms, specific type
* Islands, location	30-10, p 3-19	I.2	included in landforms, specific type
* Islands, surface materials	30-10, p 3-19	I.5	see soil and rock factors
* Islands, pattern	30-10, p 3-19	I.2	included in landforms, specific type

51  
703

FACTOR	REFERENCE	CATEGORY	COMMENTS
Jetties	30-10, p 5-33	II.5	location, function, design, and materials
* Jetties, design	30-10, p 5-33	II.5	included in jetties
* Jetties, materials	30-10, p 5-33	II.5	included in jetties
* Jungles	5-30, p 39	I.3	included in forests, type

526

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Kames	30-10, p 3-2	I.2	included in landforms, specific type
* Karst topography, dimensions	30-10, p 3-8	I.6	included in drainage pattern, I.4, and landforms, specific type, I.2
* Karst topography, elevation	30-10, p 3-8	I.6	included in drainage pattern, I.4, and landforms, specific type, I.2
* Karst topography, identification	30-10, p 3-8	I.6	included in drainage pattern, I.4, landforms, specific type, I.2, and rock type, specific
* Karst topography, local relief	30-10, p 3-8	I.6	included in surface irregularities, I.2
* Karst topography, slope	30-10, p 3-8	I.6	included in slope, I.2
Key terrain features	101-5, p G-3	IV	according to the manual, this is defined as a locality which gives advantage to either side
* Knolls	30-10, p 3-3	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Lakes, inlets	30-10, p 3-18	I.4	included in water bodies, characteristics
* Lakes, location	30-10, p 3-18 5-36, p 4-3 30-5, p B-2	I.4	included in water bodies, characteristics
* Lakes, name	30-10, p 3-18	I.4	N/A
* Lakes, outlets	30-10, p 3-18	I.4	included in water bodies, characteristics
* Lakes, size	30-10, p 3-18	I.4	included in water bodies, characteristics
* Landforms, elevation	30-10, p 3-8	I.2	included in landforms, specific type
Landforms, general type	30-10, p 3-2	I.2	plains, mountains, hills, depressions, escarpments
* Landforms, length	30-10, p 3-8	I.2	included in landforms, specific type
* Landforms, profile, longitudinal	30-10, p 3-8	I.2	included in landforms, specific type
* Landforms, profile, transverse	30-10, p 3-8	I.2	included in landforms, specific type
Landforms, specific type	CRS	I.2	bars, kames, moraines, ridges, etc.
Landing beaches	5-30, p 4	IV	the manual is unclear in terms of need; CRS assumes selection and assessment
* Landslides	5-36, p 2-1 30-10, p 3-8 5-332, p 4	I.2	included in mass movement features, detection and mass movement features, potential
* Lava flows, dimensions	30-10, p 3-8	I.2	included in landforms, specific type
* Lava flows, elevation	30-10, p 3-8	I.2	included in landforms, specific type
* Lava flows, identification	30-10, p 3-8	I.6	included in rock type, specific, landforms, specific type, I.2, and surface irregularities, I.2
* Lava flows, local relief	30-10, p 3-8	I.2	included in surface irregularities

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Lava flows, slope	30-10, p 3-8	I.6	included in slope, I.2
* Lava flows, unique characteristics	30-10, p 3-8	I.6	included in landforms, specific type and surface irregularities, I.2
Leaf characteristics	30-10, p 3-21	I.3	color, density, seasonal variation, type, etc.
* Leaf color	30-10, p 3-21	I.3	included in leaf characteristics
* Leaf density	30-10, p 3-21	I.3	included in leaf characteristics
* Leaf seasonal variation	30-10, p 3-21	I.3	included in leaf characteristics
* Leaf type	30-10, p 3-21	I.3	included in leaf characteristics
* Levees, natural	30-10, p 3-8	I.2	included in landforms, specific type
* Lifts, vessel, condition	30-10, p 5-33	II.1	included in waterways, description
* Lifts, vessel, construction design	30-10, p 5-33 55-8, p C-3	II.1	included in waterways, description
* Lifts, vessel, demolition chambers	30-10, p 5-33	II.1	included in waterways, description
* Lifts, vessel, depth over sills of chamber	55-8, p C-3	II.1	included in waterways, description
* Lifts, vessel, difference in water level to overcome	55-8, p C-3	II.1	included in waterways, description
* Lifts, vessel, dimensions of movable chamber	55-8, p C-3	II.1	included in waterways, description
* Lifts, vessel, power source	30-10, p 5-33 55-8, p C-3	II.1	included in waterways, description
* Lifts, vessel, transit time (minutes)	30-10, p 5-33 55-8, p C-3	II.1	N/A
Line of sight	101-5, p G-2	IV	includes critical relief

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Lines of communication	5-30, p 4	II.1 II.2	see specific item in II.1, transportation and II.2, telecommunications and electric power
Litter characteristics	30-10, p 3-22	I.3	type, depth, etc.
* Litter, vegetation, depth	30-10, p 3-22	I.3	included in litter characteristics
* Litter, vegetation, type	30-10, p 3-22	I.3	included in litter characteristics
* Locks, aids to navigation	55-8, p C-3	II.1	changed to navigation aids
* Locks, condition	30-10, p 5-33	II.5	included in locks, description
* Locks, controlling dimensions	30-10, p 5-33 55-8, p C-3	II.5	included in locks, description
* Locks, demolition chambers	30-10, p 5-33	II.5	included in locks, description
* Locks, depth over sill	55-8, p C-3	II.5	included in locks, description
Locks, description	30-10, p 5-33 55-8, p C-3	II.5	type of gates, depth over sill, condition, etc.
Locks, detection	CRS	II.5	
* Locks, filling basins	30-10, p 5-33	II.5	included in locks, description
* Locks, time required to fill and clear	30-10, p 5-33 55-8, p C-3	II.5	included in locks, description
* Locks, type of gates	55-8, p C-3	II.5	included in locks, description
* Locks, type of operating machinery	55-8, p C-3	II.5	included in locks, description
* Lumber	5-30, p 15	II.3	included in processing plant, characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Manufacturing plants, annual production	STOPIN, P K-1	II.3	N/A
Manufacturing plants, characteristics	CRS	II.3	facilities, product, status, etc.
* Manufacturing plants, equipment	STOPIN, P K-1	II.3	included in manufacturing plants, characteristics
* Manufacturing plants, land area	STOPIN, P K-1	II.3	included in industrial areas, detection
* Manufacturing plants, manpower	STOPIN, P K-1	II.3	N/A
* Manufacturing plants, number of buildings	STOPIN, P K-1	II.3	included in manufacturing plants, characteristics
* Manufacturing plants, number of months operational	STOPIN, P K-1	II.3	N/A
* Manufacturing plants, ownership	STOPIN, P K-1	II.3	N/A
* Manufacturing plants, products	STOPIN, P K-1	II.3	included in manufacturing plants, characteristics
* Manufacturing plants, type	STOPIN, P K-1	II.3	included in manufacturing plants, characteristics
* Map revision	5-30, p 4	III.3	category all-inclusive by itself
* Maps	5-30, p 4	III.3	category all-inclusive by itself
* Marsh	30-10, p 3-19 21-26, p 10-10 5-36, p 4-3 30-5, p 39	I.4 I.3	included in wetlands, type and wetlands, extent
Mass movement features, detection	CRS	I.2	landslides, mudslides, talus slopes, rock falls, etc.
Mass movement features, potential	CRS	I.2	
* Mass transit, area served	30-10, p 7-29	II.1	mass transit called public transportation in manual
* Mass transit, capacity	30-10, p 7-29	II.1	included in mass transit system
* Mass transit, equipment	30-10, p 7-29	II.1	type, quantity, storage location, motive power, condition; included in mass transit system

57507

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Mass transit, maintenance facilities	30-10, p 7-29	II.1	included in mass transit system
* Mass transit, routes and schedules	30-10, p 7-29	II.1	included in mass transit system
* Mass transit, terminals	30-10, p 7-29	II.1	included in mass transit system
* Mass transit, types	30-10, p 7-29	II.1	included in mass transit system
Mass transit system	30-10, p 7-29	II.1	terminals, type, equipment, capacity, maintenance, etc.; manual lists as public transportation
* Meadows	30-10, p 3-21	I.3	included in grasslands, type
Mechanized operations, areas suitable for	5-30, p 15	IV	
* Medical facilities	30-10, p 7-29 30-10, p 5-50	II.3	hospitals, clinics, nursing homes, research facilities, etc.; changed to hospitals
* Mesas	30-10, p 3-3	I.2	included in landforms, specific types
Military installations, detection	CRS	IV	posts, airfields, etc.
* Military installations, site for	5-30, p 39	IV	included in site selection, III. 2
Minefields	5-36, p 2-1	IV	
* Mineral grain shape	5-545, p 72	I.6	N/A - doubt necessity
* Mineral grain size	5-545, p 72 30-10, p 3-14	I.6	N/A - doubt necessity
* Mineral grain size, percent size distribution	30-10, p 3-14	I.6	N/A - doubt necessity
* Mineral grain size, range	30-10, p 3-14	I.6	N/A - doubt necessity
* Minerals, identification	5-545, p 72 5-30, p 39	I.6	N/A - doubt necessity

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Missile fragments	30-5, p 3-17	IV	N/A for practical purposes
* Moraines, ground	30-10, p 3-2	I.2	included in landforms, specific type
* Moraines, kettle-kame	30-10, p 3-2	I.2	included in landforms, specific type
* Mounds	30-10, p 3-3	I.2	included in landforms, specific type
* Mountains	5-30, p B-2 30-5, p 39 30-10, p 3-2	I.2	included in landforms, specific type
* Mountains, high	30-10, p 3-2	I.2	included in landforms, general type
* Mountains, low	30-10, p 3-2	I.2	included in landforms, general type
* Movement, operational aspects	30-10, p 3-22	IV	not applicable to remote sensing techniques
* Mudslides	30-10, p 10-4	I.2	changed to mass movement features, detection and mass movement features, potential
* Munition storage	30-10, p 5-51	IV	included in dispersal and storage areas, detection

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Natural gas fields, extent	30-10, p 8-10	II.3	included in extractive industry, detection
* Natural gas fields, number of producing wells	30-10, p 8-10	II.3	N/A
* Natural gas fields, ownership	30-10, p 8-10	II.3	government or private; N/A
* Natural gas fields, % of national production	30-10, p 8-10	II.3	N/A
* Natural gas fields, planned expansion	30-10, p 8-10	II.3	N/A
* Natural gas fields, production	30-10, p 8-10	II.3	included in extractive industry, capacity
* Natural gas fields, proven reserves	30-10, p 8-10	II.3	N/A
* Natural gas fields, status	30-10, p 8-10	II.3	exploited or unexploited; cannot determine an unexploited field from remote sensing; exploited fields included in extractive industry, status
* Natural gas fields, transportation destination	30-10, p 8-10	II.3	N/A
* Natural gas fields, transportation method	30-10, p 8-10	II.3	pipeline, railroad, road, water; see specific transportation type
* Natural gas fields, unproven reserves	30-10, p 8-10	II.3	N/A
* Natural resources	5-30, p 5	I	too broad; see specific item of interest
* Navigability	30-10, p 3-18 5-30, p 15	II.1	manual refers only to inland waterways collection file
* Navigability, navigable length	55-8, p C-3	II.1	included in waterways, description
* Navigable channel, approaches	30-10, p 5-33 55-8, p C-3	II.1	included in waterways, approaches
Navigation aids	55-8, p C-3	II.1	
* Nearshore depth	30-10, p 4-17	I.4	10, 6, 4, 2 m depth curves; included in water depth

609

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Observation aspects, surface configuration	30-10, p 3-8 101-5, p G-3	IV	included in line of sight
Observation points	31-60, p 2-2 31-60, p 3-20	IV	probable
* Obstacles	101-5, p G-3 30-10, p 4-2	IV	changed to obstacles to movement, artificial and obstacles to movement, natural
Obstacles to movement, artificial	5-30, p 15 5-36, p 4-9 101-5, p G-3 31-60, p 2-2 31-60, p 3-20	IV	also obstructions to air landing
Obstacles to movement, natural	5-30, p 15 5-36, p 4-9 101-5, p G-3 31-60, p 2-2 31-60, p 3-20	IV	also includes obstructions to air landing
* Obstacles, sunken	5-30, p 15	I.4	under ports in the manual; changed to underwater obstacles
* Obstacles, underwater	5-36, p 4-12	I.4	under means of inland waterway reconnaissance in manual; changed to underwater obstacles
Oil spills	CRS	II.6	on water; extent
* Oil fields, areal extent	30-10, p 8-10	II.3	included in extractive industry, detection
* Oil fields, number of producing wells	30-10, p 8-10	II.3	N/A
* Oil fields, ownership	30-10, p 8-10	II.3	N/A
* Oil fields, % of national production	30-10, p 8-10	II.3	N/A
* Oil fields, planned development	30-10, p 8-10	II.3	expected increase, date, method; N/A
* Oil fields, product	30-10, p 8-10	II.3	type, characteristics; ambiguous; included in extractive industry, product

614

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Oil fields, production	30-10, p 8-10	II.3	included in extractive industry, capacity
* Oil fields, reserves, proven	30-10, p 8-10	II.3	N/A
* Oil fields, reserves, unproven	30-10, p 8-10	II.3	N/A
* Oil fields, status	30-10, p 8-10	II.3	exploited, unexploited; cannot determine an unexploited field from remote sensing; exploited fields included in extractive industry, status
* Oil fields, transportation method of product	30-10, p 8-10	II.3	pipeline, railroad, road, water; see specific transportation factor
* Orchards	30-10, p 3-21	II.4	included in agriculture, general type
Order of battle	30-5, p 4-3	IV	unit type, sizes, name
* Outcrop, elevation	5-545, p 72	I.6	included in surface irregularities, I.2, and rock type, specific
* Outcrop, location	5-545, p 72	I.6	included in surface irregularities, I.2, and rock type, specific
* Overburden	30-10, p 3-14	I.5	manual asks for seasonal condition and type; included in soil classification, unified, and soil classification, major
* Overburden, condition, seasonal	30-10, p 3-14	I.5	included in soil classification, unified and soil classification, major
* Overburden, depth	30-10, p 3-14 30-10, p 8-15	I.5	included in soil depth
* Overburden, type	30-10, p 3-14	I.5	included in soil classification, unified and soil classification, major

622

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Parking areas	5-30, p 40	II.4	placed incorrectly - military in intent
* Parks	5-30, p 40	IV	included in dispersal and storage areas, detection
Parks and recreational areas	CRS	II.3	
* Passes, approaches	30-10, p 3-8	I.2	alignment, slope, and width; included in landforms, specific type and slope
* Passes, distance between	30-10, p 3-8	I.2	included in landforms, general type
* Passes, elevation	30-10, p 3-8 21-26, p 10-10	I.2	included in landforms, specific type
* Passes, length	21-26, p 10-10 30-10, p 3-8	I.2	included in landforms specific type
* Passes, seasonal variation	30-10, p 3-8	I.2	periods closed; included in landforms, specific type
* Passes, slope	21-26, p 10-10 30-10, p 3-8	I.2	included in slope
* Passes, width	30-10, p 3-8	I.2	included in landforms, specific type
* Passing basins, controlling clearances	30-10, p 5-33 55-8, p C-3	II.1	included in clearances, horizontal and vertical
* Permafrost	21-26, p 10-10	I.5	changed to permanently frozen material, detection
Permanently frozen material, detection	CRS	I.5	includes permafrost, active zone
Permeability	30-10, p 3-13	I.4	part of soil-rock check list/internal drainage in the manual; estimates only
* Petroleum	5-30, p 4	I.6	all aspects; included in fossil fuel sources and extractive industry, product, II.3
* Petroleum storage	5-30, p 15	II.3	included in storage facilities, commodity stored
* Physiography	5-332, p 4	I.2	included in landforms, general type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Pipelines, actual throughput	30-10, p 5-25	II.1	N/A
* Pipelines, branch lines	30-10, p 5-26	II.1	included in pipelines, characteristics
* Pipelines, capability for reverse flow	30-10, p 5-25	II.1	N/A
Pipelines, characteristics	30-10, p 5-25	II.1	type, size, condition, etc.
Pipelines, detection	CRS	II.1	
* Pipelines, general condition	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, horizontal alignment	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, importance to local economy	30-10, p 5-25	II.1	N/A
* Pipelines, input sources	30-10, p 5-26	II.1	included in pipelines, characteristics
Pipelines, leaks	CRS	II.1	
* Pipelines, materials normally carried	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, operation and maintenance	30-10, p 5-26	II.1	included in pipelines, characteristics
* Pipelines, ownership	30-10, p 5-25	II.1	N/A
Pipelines, pumping stations	30-10, p 5-26	II.1	location, function, type
Pipelines, pumping stations, detection	30-10, p 5-26	II.1	
* Pipelines, rated capacity	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, repair requirements	30-10, p 5-26	II.1	included in pipelines, characteristics
* Pipelines, security and safety features	30-10, p 5-26	II.1	N/A
* Pipelines, ship to shore loading and unloading facilities	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, size	30-10, p 5-25	II.1	included in pipelines, characteristics

64

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Pipelines, status	30-10, p 5-25	II.1	operative, inoperative, etc.; included in pipelines, characteristics
* Pipelines, total length	30-10, p 5-25	II.1	included in pipelines, characteristics
* Pipelines, trunk line segments	30-10, p 5-26	II.1	included in pipelines, characteristics
* Pit, access roads and turnarounds	30-10, p 8-15	II.3	included in extractive industry, facilities
* Pit, equipment	30-10, p 8-15	II.3	included in extractive industry, facilities
* Pit, daily production capacity	30-10, p 8-15	II.3	N/A
* Pit, existing gravel	5-36, p 4-5	II.3	included in extractive industry, product and borrow pits, III.1
* Pit, method of cleaning and sorting	30-10, p 8-15	II.3	included in extractive industries, facilities
* Pit, method of extraction	30-10, p 8-15	II.3	hand labor, machinery, dredging; included in extractive industry, facilities
* Pit, quantity and quality of material	30-10, p 8-15	II.3	N/A
* Pit, sand	30-10, p 8-15	II.3	included in extractive industry, product, borrow pits, III.1, and sand and gravel, III.1
* Pit, site for borrow	5-36, p 4-10	II.3	availability of local materials in the manual; changed to borrow pits
* Pit, standing water	30-10, p 8-15	II.3	included in water bodies, cype, I.4
* Plains	30-10, p 3-3	I.2	floodplains, coastal plains, alluvial plains, till plains, outwash plains; included in landforms, general type
* Plains, alluvial	30-10, p 3-2	I.2	included in landforms, specific type
* Plains, coastal	30-10, p 3-2	I.2	included in landforms, specific type
* Plains, outwash	30-10, p 3-2	I.2	included in landforms, specific type

655

FACTOR	REFERENCE	CATEGORY	COMMENTS
Planting practices	30-10, p 3-22	II.4	method, period
* Plateaus	30-10, p 3-2	I.2	included in landforms, specific type
Police protection	30-10, p 7-29	II.3	detention and security areas, stations, equipment
* Ponds, inlets	30-10, p 3-18	I.4	included in water bodies, characteristics
* Ponds, location	30-10, p 3-18	I.4	included in water bodies, characteristics
* Ponds, name	30-10, p 3-18	I.4	N/A
* Ponds, outlets	30-10, p 3-18	I.4	included in water bodies, characteristics
* Ponds, size	30-10, p 3-18	I.4	included in water bodies, characteristics
Population characteristics	30-10, p 8-3	II.3	nomadic, seminomadic, permanent
* Population, nomadic	30-10, p 8-3	II.3	included in population characteristics
* Population, permanent	30-10, p 8-3	II.3	included in population characteristics
Population, present	30-10, p 7-27	II.3	
* Population, seminomadic	30-10, p 8-3	II.3	included in population characteristics
Population, significant segments	30-10, p 7-27	II.3	ethnic, religious, etc.
Population, trend	30-10, p 7-27	II.3	
Porosity	30-10, p 3-14	I.5	part of soil-rock check list/internal drainage in the manual
* Ports	5-30, p 4	II.1	manual refers to ports only for general information; see specific item of interest
* Ports, adjacent terrain	30-10, p 5-51	II.1	included in major category I, Natural Features
* Ports, available electricity	30-10, p 5-51	II.1	included in power plants, power substations and power transmission lines, II.2

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ports, capacity	30-10, p 5-50	II.1	manual wants metric tons/day, which is not applicable to remote sensing techniques; relative capacity is included in ports, description
* Ports, capacity in metric tons/day	30-10, p 5-50	II.1	changed to ports, capacity
Ports, cargo handling facilities	5-30, p 15	II.1	miscellaneous cranes, wharves, etc.
* Ports, communication facilities	30-10, p 5-51	II.1	included in telecommunications II.2
* Ports, defenses	30-10, p 5-51	II.1	included in defenses, IV
Ports, description	30-10, p 5-50	II.1	condition, obstructions, operating data, relative capacity (CRS), etc.
* Ports, economic importance	30-10, p 5-50	II.1	N/A
* Ports, expansion potential	30-10, p 5-51	II.1	included in expansion potential
* Ports, features vulnerable to nuclear or CBR attack	30-10, p 5-51	II.1	N/A
* Ports, fire protection	30-10, p 5-51	II.1	included in fire fighting facilities and equipment, II.3
* Ports, fixed mooring berths	30-10, p 5-50	II.1	included in berths
* Ports, free swinging mooring areas	30-10, p 5-50	II.1	included in berths
* Ports, general condition	30-10, p 5-50	II.1	included in ports, description
* Ports, harbor data	30-10, p 5-50	II.1	included in harbors, description
* Ports, hards and unimproved sites usable for cargo	30-10, p 5-50	II.1	included in ports, cargo handling facilities
* Ports, hydrographic conditions	30-10, p 5-50	II.1	included in ports, description and harbors, description
* Ports, largest vessel accommodated	30-10, p 5-50	II.1	included in ports, description
* Ports, major operating problems	30-10, p 5-50	II.1	N/A

675

680

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ports, medical facilities	30-10, p 5-51	II.1	changed to hospitals, II.3
* Ports, military housing	30-10, p 5-51	IV	included in military installations, detection
* Ports, military transportation facilities	30-10, p 5-51	IV	included in military installations, detection
* Ports, military training facilities	30-10, p 5-51	IV	included in military installations, detection
* Ports, miscellaneous cranes	30-10, p 5-50	II.1	included in ports, cargo handling facilities
* Ports, obstructions	30-10, p 5-51	II.1	included in ports, description
* Ports, offshore berths	30-10, p 5-50	II.1	offshore pipeline berths in manual; included in berths
* Ports, operating data	30-10, p 5-51	II.1	included in ports, description
* Ports, ordnance facilities	30-10, p 5-51	II.1	included in ports description and defenses, IV
* Ports, pilotage data	30-10, p 5-51	II.1	included in ports, description and harbors, description
* Ports, principal activity	30-10, p 5-50	II.1	passenger, cargo, fishing, recreation, military, etc.
Ports, shipbuilding and repair facilities	30-10, p 5-50	II.1	dry docks, cranes, etc.
* Ports, stevedore gear	30-10, p 5-50	II.1	included in ports, cargo handling facilities
* Ports, storage facilities	30-10, p 5-50	II.1	included in storage facilities, II.3
* Ports, strategic importance	30-10, p 5-50	II.1	N/A
* Ports, type	30-10, p 5-50	II.1	natural, improved natural, artificial; included in harbors, description
* Ports, unusual geophysical conditions	30-10, p 5-50	II.1	N/A
* Ports, water supply	30-10, p 5-51	II.1	included in water supply, I.4
* Ports, wharfage summary	30-10, p 5-50	II.1	included in ports, cargo handling facilities

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ports and harbors	30-10, p 5-50	II.1	see specific port and/or harbor item of interest
* Ports and harbors, principal wharves	30-10, p 5-50	II.1	included in ports, cargo handling facilities, and harbors, description
* Post offices	30-10, p 7-29	II.3	included in functional area and structures
* Postal facilities	30-10, p 7-29	II.3	included in functional area and structures
Power substations, detection	CRS	II.2	
Power substations, function	30-10, p 8-7	II.2	switching, converting, and transforming
* Power substations, transformer characteristics	30-10, p 8-7	II.2	manual wants capacity in KVA and voltage ratio, both of which are not obtainable from remote sensing techniques
Power substations, type	30-10, p 8-7	II.2	distribution, industrial, transmission
* Power transmission lines, conductor characteristics	CRS	II.2	type of conductor, insulation, voltage; N/A
* Power transmission lines, damage	30-10, p 8-7	II.2	condition, failure, etc.; manual wants frequency, cause, and effects of failure, so N/A
Power transmission lines, layout	CRS	II.2	placement, location, etc.; these items are specified in the manual, but were combined by CRS; this is a system layout; we are not trying to detect conductors or supporting cables
* Power transmission lines, placement	30-10, p 8-7	II.2	overhead, underground, submarine, etc.; included in power transmission lines, layout
Power transmission lines, towers and poles	30-10, p 8-7	II.2	type (metal, wood, or concrete)
Power transmission lines, wire and cable characteristics	30-10, p 8-7	II.2	
* Power plants, annual production	30-10, p 8-7	II.2	KW hours; N/A

695

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Power plants, area served	30-10, p 8-7	II.2	N/A
Power plants, characteristics	CRS	II.2	cooling facilities, fuel type, handling, and storage, number of hydroturbines, engines, reactors, boilers, and/or generators, capacity (range estimates only); above items are specified in the manual, but combined by CRS here
* Power plants, cooling facilities	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, condition and age	30-10, p 8-7	II.2	N/A
Power plants, detection	CRS	II.2	
* Power plants, fuel type	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, generator rating	30-10, p 8-7	II.2	N/A
* Power plants, general type	30-10, p 8-7	II.2	N/A
* Power plants, generating voltage	30-10, p 8-7	II.2	N/A
* Power plants, hydroturbine heat and flow	30-10, p 8-7	II.2	N/A
* Power plants, number of boilers, reactors, or engines	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, number of generators	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, number of hydroturbines	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, ownership	30-10, p 8-7	II.2	government or private; N/A
* Power plants, phase and hertz	30-10, p 8-7	II.2	N/A
* Power plants, purpose	30-10, p 8-7	II.2	base load, peak load, or standby; N/A
* Power plants, quantity of thermal fuel used per year	30-10, p 8-7	II.2	N/A
* Power plants, rating of hydroturbines	30-10, p 8-7	II.2	N/A

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Power plants, thermal, cooling facilities	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, thermal, efficiency	30-10, p 8-7	II.2	N/A
* Power plants, thermal, fuel type	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, thermal, number of boilers, reactors, or engines	30-10, p 8-7	II.2	included in power plants, characteristics
* Power plants, thermal, operating temperature	30-10, p 8-7	II.2	N/A
* Power plants, thermal, rating of boilers	30-10, p 8-7	II.2	N/A
* Power plants, thermal, shielding and control mechanism	30-10, p 8-7	II.2	N/A
* Power plants, thermal, steam pressure in PSI	30-10, p 8-7	II.2	N/A
* Power plants, thermal, waste disposal	30-10, p 8-7	II.2	included in industrial waste disposal, detection
* Power plants, transmission line connections, number	30-10, p 8-7	II.2	included in power transmission lines, layout
Power plants, type	30-10, p 8-7	II.2	conventional steam thermal, hydroturbine run-of-river, hydroturbine storage, internal combustion, nuclear steam thermal, solar, tidal, thermal
* Power plants, type of hydroturbine	30-10, p 8-7	II.2	N/A
* Power plants, waste disposal	30-10, p 8-7	II.2	included in industrial waste disposal, detection
* Prairies	30-10, p 3-20	I.3	included in grasslands, type
Precipitation	30-5, p 2-17 5-36, p 1-3	I.1	
Processing plants, characteristics	CRS	II.3	such as refineries; facilities, product, status, etc.

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Production data, agricultural	5-30, p 39	II.4	changed to agricultural production data
* Production data, mineral	5-30, p 39	I.6	N/A
* Pumping stations	30-10, p 5-34 55-8, p C-3	II.1	location, function, power source, type of pumps (rated capacity); see specific type - waterways, pipelines, etc.

22

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Quarries	5-30, p 15	II.3	included in extractive industry, detection
* Quarries, access routes and turnarounds	30-10, p 8-15	II.3	included in extractive industry, facilities
* Quarries, crushed stone on hand	30-10, p 8-15	II.3	quantity, quality, size; included in developmental aspects, construction resources
* Quarries, daily production	30-10, p 8-15	II.3	uncrushed stone, crushed stone by sizes; daily capacity in manual; N/A
* Quarries, equipment on hand	30-10, p 8-15	II.3	rock crushers, drilling equipment, etc.; included in extractive industry, facilities
* Quarries, method of operation	30-10, p 8-15	II.3	single, multiple trench; included in extractive industry, method of operations
* Quarries, overburden amount	30-10, p 8-15	II.3	included in soil depth
* Quarries, sites for	30-10, p 3-14	III.2	category all-inclusive by itself
* Quarry, material type	30-10, p 3-14	II.3	included in extractive industry, product

734

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Railways, axle load limit	30-10, p 5-11	II.1	not clear in our minds as to meaning, and manual is not clear, either - check list item
* Railways, bypasses around urban areas	30-10, p 7-28	II.1	included in railways, layout
* Railways, carrying capacity	5-30, p 39	II.1	N/A
* Railways, construction equipment	30-10, p 5-12	II.1	changed to construction equipment, II.7
* Railways, critical points	30-10, p 5-12	II.1	changed to critical points, IV
* Railways, crossovers	30-10, p 5-11	II.1	included in railways, layout
Railways, description and characteristics	CRS	II.1	sections in need of repair, propulsion method, rolling stock, service facilities, signals and control features, tracks, etc.; the above items are specified in the manual, but were combined by CRS to form this factor
Railways, detection	CRS	II.1	
* Railways, electrification	30-10, p 5-11	II.1	included in railways, description and characteristics
* Railways, endpoints of double track segments	30-10, p 5-11	II.1	included in railways, layout
* Railways, freight handling facilities	30-10, p 5-11	II.1	included in railways, description and characteristics
* Railways, fuel facilities	30-10, p 5-12	II.1	included in railways, description and characteristics
Railways, grade	30-10, p 5-11	II.1	manual wants maximum grade in terms of location and direction of travel
Railways, layout	CRS	II.1	crossovers, mainline junctions, curvature, length, underpasses, etc.; above items are specified in the manuals, but were combined to form layout by CRS
* Railways, locomotive terminals	30-10, p 5-11 21-26, p 10-10	II.1	included in railways, description and characteristics
* Railways, mainline junctions	30-10, p 5-11	II.1	included in railways, layout

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Railways, maintenance and repair equipment	30-10, p 5-12	II.1	included in railways, description and characteristics
* Railways, maintenance schedule	30-10, p 5-12	II.1	N/A
* Railways, maximum grade	30-10, p 5-11	II.1	changed to railways, grade
* Railways, minimum horizontal and vertical clearances	30-10, p 5-11	II.1	included in clearances, horizontal and vertical
* Railways, ownership	30-10, p 5-11	II.1	public or private; N/A
* Railways, radius of tightest curve	30-10, p 5-11	II.1	included in railways, layout
* Railways, repair shops	30-10, p 5-11	II.1	included in railways, description and characteristics
* Railways, roadbed	30-10, p 5-11	II.1	not clear; assume bearing strength, composition, etc.; included in railways, description and characteristics
* Railways, rolling stock	30-10, p 5-12	II.1	included in railways, description and characteristics
* Railways, routes through urban areas	30-10, p 7-28	II.1	included in railways, layout
* Railways, safety and security features	30-10, p 5-12	II.1	N/A
* Railways, sections in need of repair	30-10, p 5-12	II.1	included in railways, description and characteristics
* Railways, service facilities	30-10, p 5-11	II.1	freight, fueling, terminals, maintenance, repair, etc.; included in railways, description and characteristics
* Railways, signals and control features	30-10, p 5-12	II.1	N/A
* Railways, signals and train control	30-10, p 5-12	II.1	N/A
* Railways, spacing of tracks	30-10, p 5-11	II.1	center line to center line; included in railways, description and characteristics
* Railways, stations	30-10, p 5-11	II.1	included in railways, description and characteristics
* Railways, subballast	30-10, p 5-11	II.1	included in railways, description and characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Railways, total length	30-10, p 5-11	II.1	included in railways, layout
* Railways, tracks	30-10, p 5-11	II.1	gauge; spacing, rails; included in railways, description and characteristics
* Railways, underpasses	30-10, p 5-11	II.1	included in railways, layout
* Railways, use	30-10, p 5-12	II.1	number of trains per day; not applicable to remote sensing techniques
* Railways, watering facilities	30-10, p 5-12	II.1	included in railways, description and characteristics
* Railways, yards	30-10, p 5-11	II.1	included in railways, description and characteristics
* Rapids	30-10, p 3-19 5-36, p 4-16	I.4	location, extent, materials, etc.; changed to waterfalls and rapids, detection
* Ravines	30-10, p 3-3 21-26, p 10-10	I.2	included in landforms, specific type
* Ravines, depth	21-26, p 10-10	I.2	included in landforms, specific type
* Ravines, elevation	21-26, p 10-10	I.2	included in landforms, specific type
* Ravines, length	21-26, p 10-10	I.2	included in landforms, specific type
* Ravines, slope	21-26, p 10-10	I.2	included in slope
* Reefs, channels through	30-10, p 4-17	I.2	alignment, width, and depth; included in landforms, specific type
* Reefs, distance from low water to shorelines	30-10, p 4-17	I.2	included in landforms, specific type
* Reefs, effects on surf	30-10, p 4-17	I.2	included in wave conditions and characteristics, I.4
* Reefs, effects on tides	30-10, p 4-17	I.2	included in currents and tidal phenomena, I.4
* Reefs, height above water	30-10, p 4-17	I.2	at high and low tides; included in landforms, specific type

76

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Reefs, length and width	30-10, p 4-17	I.2	included in landforms, specific type
* Reefs, slope	30-10, p 4-17	I.2	included in slope
* Reefs, type	30-10, p 4-17	I.2	included in landforms, specific type
* Reefs, water depth	30-10, p 4-17	I.2	at high and low tide; depth to surface in manual; included in water depth, I.4
* Refinery, buildings	30-10, p 8-11	II.3	type, number, and characteristics; called processing plant in manual; included in processing plant, characteristics and industrial buildings, detection
* Refinery, condition	30-10, p 8-10	II.3	included in industrial buildings, characteristics
* Refinery, equipment	30-10, p 8-10	II.3	rated capacity, type, number, and condition; included in processing plant, characteristics
* Refinery, ownership	30-10, p 8-10	II.3	government or private; N/A
* Refinery, percent national capacity	30-10, p 8-10	II.3	N/A
* Refinery, planned expansion	30-10, p 8-10	II.3	N/A
* Refinery, power source	30-10, p 8-11	II.3	included in processing plant, characteristics
* Refinery, product	30-10, p 8-10	II.3	included in processing plant, characteristics
* Refinery, product quality	30-10, p 8-10	II.3	N/A
* Refinery, product quantity	30-10, p 8-10	II.3	included in processing plant, characteristics
* Refinery, rated production capacity	30-10, p 8-10	II.3	N/A
* Refinery, transportation finished product	30-10, p 8-11	II.3	identification, method, and destination; see specific transportation type
* Refinery, transportation of raw materials	30-10, p 8-11	II.3	identification, method, origin; see specific transportation type

522

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Refinery, type	30-10, p 8-11	II.3	complete, cracking, distilling, skimming, synthetic; included in processing plant, characteristics
* Refinery, water source	30-10, p 8-10	II.3	included in water supply, source, I.4
Relief, topographic	21-26, p 2-5 101-5, p G-2 5-36, p 4-3 30-10, p 3-8	I.2	
Religious structures	30-10, p 7-29	II.3	manual specifies churches only, but mosques, synagogues, etc., are to be included
Reservoirs	30-10, p 3-19	II.5	dimensions, depth, capacity, etc.; associated with dams
* Rice paddies	30-10, p 3-21	II.4	included in agriculture, general type
* Ridge crests, height above adjacent valley flats	30-10, p 3-8	I.2	included in relief
* Ridge crests, orientation	30-10, p 3-8	I.2	included in ridge pattern
* Ridge crests, pattern	30-10, p 3-8	I.2	included in ridge pattern
* Ridge crests, skyline, description	30-10, p 3-8	I.2	included in ridge pattern
Ridge pattern	30-10, p 3-8	I.2	orientation, skyline; can also aid in differentiating lithologic units
* Ridge system	5-30, p 15	I.2	included in ridge pattern
* Ridges, elevation	21-26, p 10-10	I.2	included in landforms, specific type
* Ridges, height	21-26, p 10-10	I.2	included in landforms, specific type
* Ridges, length	21-26, p 10-10	I.2	included in landforms, specific type
* Ridges, slope	21-26, p 10-10	I.2	included in slope

78<

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Ridges, type	21-26, p 10-10	I.2	included in landforms, specific type
* River crossings	5-330, p 3-3	II.1	see specific transportation type
* Rivers	30-10, p 3-18 5-36, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3	I.4	changed to waterways, type
* Roadblocks	5-36, p 2-1	II.1	included in roads, characteristics and obstacles to movement, artificial, IV
* Roads, bypasses around urban areas	30-10, p 7-28	II.1	included in roads, layout
* Roads, capacity	31-60, p 2-2 5-36, p 2-2	II.1	vehicles per hour or day and payload; N/A
Roads, characteristics	CRS	II.1	weather classification, curvature, number of lanes, limiting characteristics, construction materials, length, width, obstructions, etc.; above items specified in manual, but combined here by CRS
* Roads, classification	5-36, p 3-45	II.1	limiting characteristics, weather classification, construction materials, length, obstructions, etc.; changed to roads, characteristics
* Roads, cuts	21-26, p 10-10	II.1	included in rock, use suitability and soil, use suitability, III.1
* Roads, detection	CRS	II.1	
* Roads, fills	21-26, p 10-10	II.1	included in rock, use suitability and soil, use suitability, III.1
* Roads, foundation conditions	5-36, p 3-51	II.1	changed to foundation conditions, II.7
Roads, grade	21-26, p 10-10 5-36, p 2-5	II.1	an obstruction to movement if 7% or greater

808

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Roads, junctions	21-26, p 10-10	II.1	included in roads, layout
Roads, layout	CRS	II.1	pattern, junctions, etc.; above items are specified in the manual, but combined by CRS to form layout here
* Roads, limiting characteristics	5-36, p 3-45	II.1	inadequate ditches, radius of curvature less than 30 m, slopes less than or equal to 7%, surface bumpy, rutted, or ptholed to an extent to reduce convoy speed, unstable, loose, or easily displaced material; included in roads, characteristics
Roads, military load classification	5-36, p 2-4	II.1	bearing capacity; a load capacity rating system as defined in the manual
* Roads, number of lanes	21-26, p 10-10	II.1	included in roads, characteristics
* Roads, routes through urban areas	30-10, p 7-28	II.1	included in roads, layout
* Roads, seasonal passability	21-26, p 10-10	II.1	included in roads, characteristics
* Roads, surface condition	5-36, p 3-51	II.1	included in roads, characteristics
* Roads, surface type	5-36, p 3-51 21-26, p 10-10	II.1	included in roads, characteristics
* Roads, width and depth of ditches	21-26, p 10-10	II.1	included in roads, characteristics
* Rock, absorption % (water)	30-10, p 3-14	I.6	coarse, fine; not applicable as this requires a lab test - manual refers reader to 5-330
* Rock, amount cementation	30-10, p 3-14 5-545, p 72	I.6	N/A
* Rock, bed, thickness	5-545, p 72 30-10, p 3-14 5-332, p 4	I.6	included in rock thickness
* Rock, bedded	30-10, p 3-14	I.6	continuity and material variation; included in rock layering

812

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Rock, cementation	30-10, p 3-14	I.6	type (silica, calcite), amount; N/A
Rock color	5-545, p 72 30-10, p 3-14	I.6	
* Rock, contacts	5-545, p 72	I.6	sharp or gradational; included in rock type, specific
* Rock, crushers	5-30, p 15	II.3	included in extractive industry, facilities
* Rock, crystalline	5-332, p 4	I.6	included in rock type, major
* Rock density	30-10, p 3-14	I.6	incorrect reference and not practical
Rock dip and strike	5-545, p 72 30-10, p 3-14 5-332, p 4	I.6	alignment; dip called slope of bed in 30-10, which is incorrect terminology
* Rock, excavation	30-10, p 3-14	III.1	ease, method, and rate; included in earthwork requirements, II.7
* Rock, excavation, break size	30-10, p 3-14	III.1	average and range; included in earthwork requirements, II.7
* Rock, expansion	30-10, p 3-14	III.1	and relative amount; N/A
* Rockfalls	5-36, p 2-1	I.2	included in mass movement features, detection
* Rock foliation	30-10, p 3-14	I.6	degree, density, direction; included in rock layering
* Rock, foundation conditions for construction	30-10, p 3-14	III.1	light or heavy; included in foundation conditions, II.7
* Rock, hardness	5-332, p 9	III.1	requires laboratory testing, so N/A
* Rock, igneous, basalt	30-10, p 3-3 30-10, p 3-9	I.6	included in rock type, specific
* Rock, igneous, gabbro	30-10, p 3-9	I.6	included in rock type, specific

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Rock, igneous, granite	30-10, p 3-9	I.6	included in rock type, specific
* Rock, igneous, lava	30-10, p 3-8	I.6	included in rock type, specific
* Rock, igneous, pyroclastics	30-10, p 3-9	I.6	included in rock type, specific
* Rock, igneous, rhyolite	30-10, p 3-9	I.6	included in rock type, specific
* Rock, interbedded	5-332, p 4	I.6	hard or soft; included in rock layering
* Rock, kind of cementation	30-10, p 3-14	I.6	N/A
Rock, layering	CRS 5-332, p 4	I.6	stratification, schistosity, foliation, etc.
* Rock, massive	30-10, p 3-14	I.6	size, shape, geologic name; non-bedded bodies in manual; included in rock layering
* Rock, materials, origin	30-10, p 3-2	I.6	aeolian, lacustrine, alluvial, glacial, marine; landform classification in manual; included in rock type
* Rock, metamorphic, gneiss	30-10, p 3-9	I.6	included in rock type, specific
* Rock, metamorphic, marble	30-10, p 3-9	I.6	included in rock type, specific
* Rock, metamorphic, quartzite	30-10, p 3-9	I.6	included in rock type, specific
* Rock, metamorphic, schist	30-10, p 3-9	I.6	included in rock type, specific
* Rock, metamorphic, serpentine	30-10, p 10-5	I.6	included in rock type, specific
* Rock, metamorphic, slate	30-10, p 3-9	I.6	included in rock type, specific
* Rock, noncrystalline	5-332, p 4	I.6	included in rock type
* Rock, permeability	30-10, p 3-14	I.6	included in permeability, I.5
* Rock, plasticity	5-545, p 72	I.6	N/A
* Rock, porosity	30-10, p 3-14	I.6	included in porosity, I.5

834

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Rock, relative age	5-545, p 72	I.6	in terms of the law of superposition, as intended here, included in rock layering
Rock, resistance to erosion	5-332, p 7 5-545, p 72	I.6	resistance to erosion called "durability" in 5-332
* Rock, resistance to fracture	5-332, p 8	I.6	both for construction and susceptibility to fragmentation under bombardment; N/A to remote sensing techniques; see fractures
* Rock, schistosity	30-10, p 3-14	I.6	density and direction; included in rock layering
* Rock, sedimentary, conglomerate	30-10, p 10-5	I.6	Included in rock type, specific
* Rock, sedimentary, dolomite	30-10, p 3-9	I.6	included in rock type, specific
* Rock, sedimentary, evaporite	30-10, p 3-9	I.6	included in rock type, specific
* Rock, sedimentary, gypsum	30-10, p 10-5	I.6	included in rock type, specific
* Rock, sedimentary, limestone	30-10, p 3-9	I.6	included in rock type, specific
* Rock, sedimentary, sandstone	30-10, p 3-9	I.6	included in rock type, specific
* Rock, sedimentary, shale	30-10, p 3-9	I.6	included in rock type, specific
* Rockslide	5-36, p 2-1	I.2	included in mass movement features, detection
* Rock, specific gravity	30-10, p 3-14	I.6	lab test only, so not applicable
* Rock, stratification	5-332, p 4	I.6	massive, thick, thin; included in rock layering
* Rock, strike of	5-545, p 72 5-332, p 4	I.6	included in rock, dip and strike
* Rock, structure	5-545, p 72	I.6	see specific item, fractures or folding
* Rock, structure, folding	5-332, p 4	I.6	changed to folding
* Rock, structure, major, anticline	30-10, p 3-14	I.6	included in folding

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Rock, structure, major, syncline	30-10, p 3-14	I.6	included in folding
* Rock, subsurface	5-545, p 72	I.6	shape, size, structure; included in rock type
* Rock, suitability for aggregate	30-10, p 3-14	III.1	bituminous and concrete; included in rock, use suitability
* Rock, suitability for base course	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for binder	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for bituminous aggregate	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability, bituminous strippability	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for concrete aggregate	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability, concrete aggregate reactivity	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for embankments	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for fill	30-10, p 3-14	III.1	embankments; included in rock, use suitability
* Rock, suitability for masonry	30-10, p 3-14	III.1	rubble and cut stone; included in rock, use suitability
* Rock, suitability for riprap	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for roofing material	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for subbase	30-10, p 3-14	III.1	included in rock, use suitability
* Rock, suitability for untreated surfacing	30-10, p 3-14	III.1	included in rock, use suitability
* Rock texture	30-10, p 3-14 5-545, p 2-7	I.6	loose terminology; manual reduces to crystal structure, size, orientation
Rock thickness	30-10, p 3-14 5-545, p 72 5-332, p 4	I.6	average and range

85

FACTOR	REFERENCE	CATEGORY	COMMENTS
Rock type, major	30-10, p 3-9	I.5	igneous, metamorphic, and sedimentary
* Rock type, major, igneous	30-10, p 3-12	I.6	included in rock type, major
* Rock type, major, metamorphic	30-10, p 3-12	I.6	included in rock type, major
* Rock type, major, sedimentary	30-10, p 3-12	I.6	included in rock type, major
Rock type, specific	30-10, p 3-9 30-10, p 10-5	I.6	basalt, sandstone, serpentine, etc.
Rock, use suitability	CRS 30-10, p 3-14	I.6	degree and limiting factors for binder, base course, aggregate, fill, embankments, masonry (rubble and cut stone), riprap, roofing material, subbase, untreated surfacing, etc.
Roots, characteristics	30-10, p 3-21	I.3	habit, diameter above ground, height of emergence, spread above ground, spread below ground
* Roots, diameter above ground	30-10, p 3-21	I.3	included in roots, characteristics
* Roots, habit	30-10, p 3-21	I.3	included in roots, characteristics
* Roots, height of emergence	30-10, p 3-21	I.3	included in roots, characteristics
* Roots, spread above ground	30-10, p 3-21	I.3	included in roots, characteristics
* Roots, spread below ground	30-10, p 3-21	I.3	included in roots, characteristics
* Route classification	5-36, p 3-5	II.1	military load classification, width, obstructions, etc.; included in roads, military load classification, and roads, characteristics
* Route constrictions	5-36, p 2-6	II.1	included in roads, characteristics
* Route type	30-10, p 5-6 5-36, p 2-4	II.1	weather classification; included in roads, characteristics
Runoff factor	30-10, p 3-22	I.4	factor = coefficient; seasonality, condition

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Runoff factor, condition	30-10, p 3-22	I.4	included in runoff factor
* Runoff factor, seasonal variation	30-10, p 3-22	I.4	included in runoff factor
* Rural area, billeting and quartering availability	30-10, p 8-3	II.3	N/A
* Rural area, importance	30-10, p 8-3	II.3	N/A
* Rural area, significance	30-10, p 8-3	II.3	N/A
* Rural area, type	30-10, p 8-3	II.3	farmstead, village, or small settlement; included in built-up area, classification, and built-up area, extent

875

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Saddles, topographic	30-10, p 3-3	I.2	included in landforms, specific type
* Sand dunes	30-10, p 3-2	I.2	included in landforms specific type
Sand and gravel	30-10, p 8-15 31-60, p 2-2	III.1	location and extent of sources; unexploited sources
* Savannahs	30-10, p 3-20	I.3	included in grasslands, type
* Sawmills	5-30, p 15	II.3	included in processing plant, characteristics
* Sawmills, access	30-10, p 8-15	II.3	included in processing plant, characteristics
* Sawmills, availability of indigenous labor	30-10, p 8-15	II.3	N/A
* Sawmills, daily production capacity	30-10, p 8-15	II.3	N/A
* Sawmills, equipment used	30-10, p 8-15	II.3	included in processing plant, characteristics
* Sawmills, finished lumber on hand	30-10, p 8-15	II.3	quantity and sizes; included in storage facilities, commodity stored
* Sawmills, hauling requirements	30-10, p 8-15	II.3	N/A
* Sawmills, nature of timber used	30-10, p 8-15	II.3	hard, soft, and size limitations; see vegetation, specific type
* Sawmills, timber on hand	30-10, p 8-15	II.3	included in stockpiled material
Schools	30-10, p 7-29 21-76, p 10-10	II.3	universities, colleges, etc.
* Scrub, cactus	30-10, p 3-20	I.3	included in vegetation, specific type
* Scrub, mesquite	30-10, p 3-20	I.3	included in vegetation, specific type
* Scrub, sagebrush	30-10, p 3-20	I.3	included in vegetation, specific type
* Sea conditions	30-5, p 6-6	I.4	included in water bodies, characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Sea, inland	30-10, p 3-18	I.4	included in water bodies, characteristics
* Sewage disposal, area served	30-10, p 7-29	II.3	in isolated areas, such information could be determined from imagery, but not in fairly highly developed areas
* Sewage disposal, type	30-10, p 7-29	II.3	storm or sanitary; included in urban drainage
* Sewage disposal type, industrial	30-10, p 7-29	II.3	included in industrial waste disposal, detection
Sewage treatment plants, characteristics	30-10, p 7-29	II.3	type, equipment, capacity, and type of collection; actually a type of processing plant, but CRS has defined processing plant as consumer oriented
Sewage treatment plants, detection	CRS	II.3	
* Shoals, elevation	30-10, p 3-19	I.2	N/A
* Shoals, extent	30-10, p 3-19	I.2	included in underwater obstacles, I.4
* Shoals, location	30-10, p 3-19	I.2	included in underwater obstacles, I.4
* Shoals, pattern	30-10, p 3-19	I.2	included in underwater obstacles, I.4
Shorelines, description	CRS	I.2	includes coastal type - emergent, submergent, volcanic, man-made, etc.
Shorelines, detection	CRS	I.2	any land/water interface
* Shrubs, coniferous	30-10, p 3-19	I.3	included in vegetation, general type
* Shrubs, deciduous	30-10, p 3-20	I.3	included in vegetation, general type
* Shrubs, extent	30-10, p 3-20	I.3	included in vegetation, general type
* Shrubs, tundra	30-10, p 3-20	I.3	incorrect terminology
* Shrubs, type	30-10, p 3-20	I.3	included in vegetation, specific type
* Sinkholes	30-10, p 3-8	I.2	included in landforms, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Site selection	5-36, p 3-54	III.2	redundant with category title
* Site selection, accessibility	5-36, p 4-9	III.2	category all-inclusive by itself
* Site selection, construction materials available	30-10, p 8-15	III.2	aggregate, cement, timber, structural steel, etc.; included in stockpiled material
* Site selection, electric power	30-10, p 8-15	III.2	included in power factors, II.2
* Site selection, extent of site	30-10, p 8-15	III.2	included in construction sites, detection
* Site selection, labor potential	30-10, p 8-15	III.2	number, skills, housing; N/A
* Site selection, meteorological conditions	5-36, p 4-9	III.2	see climate and weather, I.1
* Site selection, transportation	30-10, p 8-15	III.2	see specific transportation factor
* Site selection, water sources	30-10, p 8-15	III.2	see water supply factors, II.3
Slope	30-10, p 3-13 21-26, p 10-10 101-5, p G-2 30-5, p 8-2 5-36, p 2-5	I.2	
Slope, maximum stable	30-10, p 3-13	II.7	cut or natural
* Slope, maximum stable cut	30-10, p 3-13	II.7	changed to slope, maximum stable
* Slope, maximum stable natural	30-10, p 3-13	II.7	changed to slope, maximum stable
Smog, detection	CRS	II.6	
Smoke, detection	CRS	II,6	
Snow accumulation areas	CRS	I.5	including terrain evaluation for snow fence location; potential
Snow depth	5-36, p 4-3	I.5	less or greater than 0.3m and 1.0m; wheeled and tracked vehicles

89  
A

FACTOR	REFERENCE	CATEGORY	COMMENTS
Snow extent	CRS	I.5	snow/land interface
* Snow fence, location for	5-330, p 8-12 5-36, p 2-6	I.5	included in snow accumulation areas
Snow temperature	CR:	I.5	
* Soil	101-5, p G-2	I.5	too general; see specific soil factor
Soil, Atterberg limits	CRS	I.5	plasticity index, liquid limit, plastic limit, specific gravity, shrinkage limit, etc.; inferences (range estimates) are possible
Soil, bearing strength	30-10, p 3-13	I.5	compacted state, natural state, modulus of subgrade reaction, wet or dry, etc.
* Soil bearing strength, compacted state	30-10, p 3-13	I.5	included in soil, bearing strength
* Soil bearing strength, natural state	30-10, p 3-13	I.5	included in soil, bearing strength
* Soil bearing strength, soil structure destroyed state	30-10, p 3-13	I.5	included in soil, bearing strength
* Soil, California bearing ratio	30-10, p 3-13 STOPIN, p U-3	I.5	included in soil, bearing strength
* Soil, cementing material	30-10, p 3-13 STOPIN, p U-2	I.5	included in soil classification, unified and soil classification, major
* Soil, concentration of corrosive chemicals	STOPIN, p U-3	I.5	N/A
* Soil, corrosive chemicals	STOPIN, p U-3	I.5	type, number, concentration; N/A
Soil classification, major	30-10, p 3-13	I.5	grading (sand, gravel, silt, clay), composition (organic, mineral), and consistency (friable, plastic)
Soil classification, unified	30-10, p 3-13 STOPIN, p U-1	I.5	30-10 refers the reader to TM 5-330
* Soil color	30-10, p 3-13 STOPIN, p U-1	I.5	included in soil classification, major and soil classification, unified

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Soil, compaction characteristics	30-10, p 3-13	I.5	included in trafficability, terrain group and class of soil
* Soil compaction, ease of	30-10, p 3-13	I.5	included in earthwork requirements, II.7
* Soil compaction, optimum method of	30-10, p 3-13	I.5	included in trafficability, terrain group and class of soil
* Soil composition	30-10, p 3-13 31-60, p 2-2	I.5	% boulders, gravel, fines, rock, sand; see soil classification, major
* Soil composition, % boulders	30-10, p 3-13	I.5	included in soil classification, major
* Soil composition, % fines	STOPIN, p U-2	I.5	included in soil classification, major
* Soil composition, % gravel	30-10, p 3-13 STOPIN, p U-2	I.5	included in soil classification, major
* Soil composition, % rock	30-10, p 3-13	I.5	included in soil classification, major
* Soil composition, % sand	STOPIN, p U-2	I.5	included in soil classification, major
* Soil, condition	STOPIN, p U-1	I.5	described in other itemized characteristics
* Soil, cone index	30-10, p 3-13 STOPIN, p U-1	I.5	included in trafficability, terrain group and class of soil
* Soil, cone index, airfield	30-10, p 3-13	I.5	included in trafficability, terrain group and class of soil
* Soil, cone index, rating	STOPIN, p U-2	I.5	included in trafficability, terrain group and class of soil
* Soil consistency	30-10, p 3-13	I.5	included in soil classification, major
* Soil, content effecting induced radiation	101-5, p G-2	I.5	N/A
Soil density	30-10, p 3-13 STOPIN, p U-2	I.5	dry compacted, in place, maximum; only range estimates are possible

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Soil density, dry compacted	30-10, p 3-13	I.5	included in soil density
* Soil density, in place	STOPIN, p U-3	I.5	included in soil density
* Soil density, maximum	STOPIN, p U-3	I.5	included in soil density
Soil depth	30-10, p 3-13	I.5	
* Soil depth, major subsurface layer	30-10, p 3-13	I.5	included in soil depth
* Soil depth, major surface layer	30-10, p 3-13	I.5	included in soil depth
* Soil depth, to base or bedrock material	STOPIN, p U-1	I.5	included in soil depth
* Soil, drainage, internal	30-10, p 3-13	I.5	included in drainage pattern, I.4
* Soil, drainage rate	30-10, p 3-13	I.5	included in drainage pattern, I.4
* Soil, ease of excavation	30-10, p 3-13	I.5	included in earthwork requirements, II.7
* Soil, excavation conditions	30-10, p 3-13	I.5	included in earthwork requirements, II.7
* Soil, foundation conditions, suitability for construction	30-10, p 3-13	I.5	light or heavy; included in foundation conditions, II.7
* Soil, grading	30-10, p 3-13	I.5	included in soil classification, major
* Soil, ice content	5-330, p 2-42	I.5	included in soil classification, major
* Soil, infiltration rate	30-10, p 3-13	I.5	included in drainage pattern, I.4
* Soil layers, depth below surface	STOPIN, p U-1	I.5	included in soil depth
* Soil layers, designation of	STOPIN, p U-1	I.5	N/A
* Soil layers, number	STOPIN, p U-1	I.5	N/A
* Soil, liquid limit	30-10, p 3-13 STOPIN, p U-2	I.5	included in Atterberg limits

28

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Soil, method of excavation	30-10, p 3-13	I.5	included in earthwork requirements, II.7
* Soil, modulus of subgrade reaction	30-10, p 3-13 STOPIN, p U-3	I.5	included in soil, bearing strength
Soil moisture content	30-10, p 3-13 STOPIN, p U-2	I.5	30-10 requests soil moisture content as % dry weight, which cannot be obtained, but as good estimates can be made from imagery, the factor is included
* Soil moisture content, maximum	STOPIN, p U-3	I.5	included in soil moisture content
* Soil moisture, optimum for compaction	30-10, p 3-13	I.5	included in soil moisture content
* Soil, particle shape	30-10, p 3-13 STOPIN, p U-2	I.5	included in soil classification, major
* Soil particles, size distribution	30-10, p 3-13	I.5	included in soil classification, major
* Soil particle size, maximum	30-10, p 3-13	I.5	included in soil classification, major
* Soil, permeability	30-10, p 3-13 STOPIN, p U-1	I.5	changed to permeability, I.4
* Soil, pH value	30-10, p 3-13	I.5	manual requesting laboratory test data, so N/A
* Soil, plastic limit	STOPIN, p U-2	I.5	included in soil, Atterberg limits
* Soil, plasticity	STOPIN, p U-2	I.5	included in soil, Atterberg limits
* Soil, plasticity index	30-10, p 3-13	I.5	included in soil, Atterberg limits
* Soil, porosity	30-10, p 3-13	I.5	changed to porosity
Soil profile	30-10, p 3-13	I.5	
* Soil properties, undisturbed	STOPIN, p U-2	I.5	unclear
* Soil, remolding index	30-10, p 3-13 5-330, p 9-1	I.5	included in trafficability, terrain group and class of soil

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Soil, shrinkage ratio	STOPIN, p U-3	I.5	included in soil, Atterberg limits
* Soil, slipperiness	30-10, p 5-13 5-330, p 9-17	I.5	included in trafficability, terrain group and class of soil
* Soil, specific gravity	30-10, p 3-13 STOPIN, p U-2	I.5	N/A - lab test
* Soil, suitability for airfields and helipads, surfaced	30-10, p 3-13	III.1	included in soil, use suitability
* Soil suitability for airfields and helipads, unsurfaced	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for binder	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for bituminous aggregate	30-10, p 3-13	III.1	soil is not used for aggregate as defined
* Soil, suitability for borrow for fill	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for concrete aggregate	30-10, p 3-13	III.1	soil is not used for aggregate as defined
* Soil, suitability for construction	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for fill	30-10, p 3-13	III.1	embankments; included in soil, use suitability
* Soil, suitability for fill and embankments	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for roads, unsurfaced	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for subgrade	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, suitability for topsoil	30-10, p 3-13	III.1	included in soil, use suitability
* Soil, trafficability	CRS	I.5	cone index, remolding index, rating cone index, airfield cone index, compaction characteristics, slipperiness, dustiness, etc.; included in trafficability, terrain group and class of soil
* Soil type	5-330, p 3-2	I.5	included in soil classification, major

96

953

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Soil, type of corrosive chemicals	STOPIN, p U-3	I.5	N/A
Soil, use suitability	CRS 30-10, p 3-13	III.1	binder, fills, embankments, unsurfaced roads, sub-grade, topsoils, etc.
* Soil, void ratio	30-10, p 3-13 STOPIN, p U-3	I.5	included in porosity
* Solid fuels	5-30, p 4	II.3	included in extractive industry, product, and processing plant, characteristics
* Spillways, gates	30-10, p 3-19	II.5	type, number, width, height; included in dams, associated structures
* Spillways, piers	30-10, p 3-19	II.5	length, width, spacing; included in dams, associated structure.
* Spillways, type	30-10, p 3-19	II.5	overflow, chute, side-channel, siphon, etc.; included in dams, associated structures
* Springs, characteristics	30-10, p 3-20	I.4	relative yield, variability; characteristics specified in the manual are not applicable to remote sensing techniques
Springs, detection	30-10, p 3-20 21-26, p 10-10 5-36, p 4-3	I.4	
* Springs, natural	30-10, p 3-20 21-26, p 10-10 5-36, p 4-3	I.4	changed to springs, detection
* Springs, natural, spacing	30-10, p 3-20	I.4	N/A
* Springs, natural, yield	30-10, p 3-20	I.4	N/A
* Springs, seasonal variation of yield	30-10, p 3-20	I.4	N/A
* Springs, yield possible after development	30-10, p 3-20	I.4	N/A

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Stalk diameter	30-10, p 3-21	I.3	included in stem characteristics
* Stalk habit	30-10, p 3-21	I.3	included in stem characteristics
* State of ground	5-30, p 4	I.2	see specific factor; soil, snow, etc.
* Steel	5-30, p 15	II.3	included in processing plant, characteristics
Stem characteristics	30-10, p 3-21	I.3	diameter and habit
* Stem, diameter	30-10, p 3-21	I.3	included in stem characteristics
* Stem habit	30-10, p 3-21	I.3	included in stem characteristics
* Steppes	30-10, p 3-20	I.2	included in landforms, specific type
Stockpiled material	30-10, p 8-15	III.1	location, type, characteristics, quantity, and loading equipment
* Storage facilities	30-10, p 8-11	II.3	defined more specifically in itemized factors
Storage facilities, capacity	30-10, p 7-29	II.3	range estimates only
Storage facilities, commodity stored	30-10, p 7-29	II.3	
* Storage facilities, condition	30-10, p 8-11	II.3	included in storage facilities, type
* Storage facilities, construction	30-10, p 7-29	II.3	type, material, dimensions, layout, physical condition, cargo facilities; these items were specified in the manual and were combined incorrectly into this factor by CFS
* Storage facilities, natural gas	30-10, p 8-11	II.3	included in storage facilities, commodity stored
* Storage facilities, petroleum	30-10, p 8-11	II.3	included in storage facilities, commodity stored
* Storage facilities, product stored	30-10, p 7-29	II.3	type, normal stock level, capacity; changed to storage facilities, commodity stored
* Storage facilities, refrigeration and ice making	30-10, p 7-29	II.3	included in processing plant, characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Storage facilities, security	30-10, p 7-29	II.3	N/A
* Storage facilities, tank displacement	30-10, p 8-11	II.3	above or below ground; included in storage facilities, capacity
* Storage facilities, tank tops	30-10, p 8-11	II.3	included in storage facilities, type
* Storage facilities, tanks, shape	30-10, p 8-11	II.3	cylindrical, spherical, spheroid, etc.; included in storage facilities, type
* Storage facilities, transportation connections	30-10, p 7-29 30-10, p 8-11	II.3	see specific transportation type, layout
Storage facilities, type	30-10, p 7-29	II.3	vessels, warehouses, open storage, grain elevators, etc.
* Storage facilities, utilities	30-10, p 7-29	II.3	water supply, fire protection, electric power, gas; see specific utility
* Stream banks, description	30-10, p 3-18 21-26, p 10-10 101-5, p G-2 30-5, p 15 5-30, p B-2	I.4	included in waterways, bank slope and waterways, bank composition
* Stream banks, artificial control	30-10, p 3-18	I.4	included in waterways, description, II.1
* Stream banks, composition	30-10, p 3-18	I.4	included in waterways, bank composition
* Stream banks, erosion	30-10, p 3-18	I.4	included in waterways, description, II.1
* Stream banks, height	30-10, p 3-18	I.4	included in waterways, description, II.1
* Stream banks, improved	30-10, p 3-18	I.4	included in waterways, description, II.1
* Stream banks, slope	30-10, p 3-18	I.4	included in waterways, bank slope
* Stream banks, stability	30-10, p 3-18	I.4	included in slope, maximum stable, II.7
* Stream banks, turfed	30-10, p 3-18	I.4	included in waterways, description, II.1

975

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Stream bottoms, composition	30-10, p 3-18	I.4	included in waterways, bottom characteristics
* Stream bottoms, description	30-10, p 3-18 21-26, p 10-10 101-5, p G-2 30-5, p 15 5-30, p B-2	I.4	included in waterways, bottom characteristics
* Stream bottoms, stability	30-10, p 3-18	I.4	included in waterways, bottom characteristics
* Stream bottoms, unusual conditions, type	30-10, p 3-18	I.4	included in waterways, bottom characteristics
* Stream discharge	21-26, p 10-10 30-10, p 3-18	I.4	maximum or minimum; manual wants by season or month, so requesting figures such as obtainable from gaging stations, and, therefore, not applicable to remote sensing techniques
Stream gradient	CRS	I.4	
* Stream type, intermittent	30-10, p 3-18	I.4	N/A
* Stream type, perennial	30-10, p 3-18	I.4	N/A
* Stream velocity	21-26, p 10-10 30-10, p 3-18 5-36, p 2-45 31-60, p 2-1	I.4	wanted at various locations for mean high and low water; in this sense not amenable to remote sensing techniques
Stream width	30-5, p B-2 5-30, p 15 5-36, p 2-37 21-26, p 10-10 31-60, p 2-1	I.4	
* Streams	5-30, p 15	I.4	included in waterways, type
* Streams, eddies	30-10, p 3-18	I.4	included in currents
Streets, classification and prevailing width	30-10, p 7-29	II.3	primary, secondary, tertiary; paved, unpaved, etc.; manual does not define factor, so CRS has provided comments

FACTOR	REFERENCE	CATEGORY	COMMENTS
Streets, condition	30-10, p 7-29	II.3	repair and improvement needed
* Streets, naming and numbering system	30-10, p 7-29	II.3	N/A
Streets, pattern	30-10, p 7-29	II.3	
* Streets, repair and improvement needed	30-10, p 7-29	II.3	included in streets, condition
* Streets, traffic control system	30-10, p 7-29	II.3	N/A
Structures	30-10, p 7-28	II.3	material type, type of construction, etc.; manual asks for predominant type of building
* Subsoils	101-5, p G-2	I.5	included in soil profile
* Substation, area served	30-10, p 8-7	II.2	N/A
* Substation, converters or inverters, capacity	30-10, p 8-7	II.2	N/A - misuse of terms: two types of converters, rectifiers and inverters, one changes DC to AC, the other AC to DC; converter only a general term
* Substation, converters or inverters, number	30-10, p 8-7	II.2	N/A
* Substation, function	30-10, p 8-7	II.2	changed to power substation, function
* Substation, ownership	30-10, p 8-7	II.2	N/A
* Substation, transformers, capacity	30-10, p 8-7	II.2	N/A
* Substation, transformers, number	30-10, p 8-7	II.2	N/A
* Substation, transformers, voltage	30-10, p 8-7	II.2	N/A
* Substation type, distribution	30-10, p 8-7	II.2	changed to power substation, type
* Substation type, industrial	30-10, p 8-7	II.2	changed to power substation, type
* Substation type, transmission	30-10, p 8-7	II.2	changed to power substation, type

100 >

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Suburban areas, boundary and aerial extent	30-10, p 7-28	II.3	included in functional area
* Suburban areas, population	30-10, p 7-28	II.3	included in functional area and population, present
* Surf, breakers	30-10, p 4-17	I.4	type, average height, distance from shore; changed to wave conditions and characteristics
* Surf, direction from which swells approach coast	30-10, p 4-17	I.4	changed to wave conditions and characteristics
* Surf, period	30-10, p 4-17	I.4	changed to wave conditions and characteristics
* Surf, width of zone	30-10, p 4-17	I.4	changed to wave conditions and characteristics
* Surface conditions	30-5, p 6-6	I.1	wet, dry, snow, ice; see specific factor - soil moisture content, ice factors and snow factors
Surface irregularities	CRS	I.2	boulder fields, lava flow surfaces, etc.; refers to what might be called micro-relief features - irregular areas where the irregularities are not specific landforms
* Surface materials	101-5, p G-2	I.5	redundant with category title
* Surface temperature	101-5, p G-2	I.1	see air temperature
* Surface wetness	30-6, p 6-6	I.1	wet or dry; called state of ground in manual, but certain aspects are covered in more specific factors, such as snow; also, manual asks for this information in terms of weather forecasting
* Swamp	21-26, p 2-5 30-10, p 3-19 5-36, p 4-3 30-5, p B-2 5-30, p 15	I.3 I.4	included in wetlands, extent, and wetlands, type

101

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Talus slopes	30-10, p 3-8	I.2	included in mass movement features, detection
* Telecommunications	21-26, p 10-10 5-36, p 1-9 30-20, p 11-1	II.2	see specific item
* Telecommunications, economic importance	30-10, p 6-15	II.2	N/A
* Telecommunications, fixed installations, acreage of antenna fields	30-10, p 6-15	II.2	changed to telecommunications, support facilities
* Telecommunications, fixed installations, administration	30-10, p 6-15	II.2	changed to telecommunications, support facilities
* Telecommunications, fixed installations, defenses	30-10, p 6-15	II.2	included in defenses, IV
* Telecommunications, fixed installations, housing facilities	30-10, p 6-15	II.2	included in telecommunications, support facilities
* Telecommunications, fixed installations, manpower	30-10, p 6-15	II.2	strengthen in manual; N/A
* Telecommunications, fixed installations, security and safety features	30-10, p 6-16	II.2	N/A
* Telecommunications, frequency range	30-10, p 6-16	II.2	when applicable; included in antennas, electromagnetic characteristics (bandwidth capability)
* Telecommunications, government administration	30-10, p 6-15	II.2	agencies involved, functions, location of offices; N/A
* Telecommunications, intercept and direction finding stations	30-10, p 6-16	II.2	see antenna factors
* Telecommunications, line construction	30-10, p 6-15	II.2	included in specific item as in manual
* Telecommunications, maximum reliable range	30-10, p 6-16	II.2	dependent on power and frequency; N/A

1024

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Telecommunications, operating features	30-10, p 7-29	II.2	N/A
* Telecommunications, operational status	30-10, p 6-16	II.2	manned or unmanned; N/A
Telecommunications, poles	30-10, p 6-15	II.2	material, treatment, spacing, number of crossarms, type
* Telecommunications, power requirements and source	30-10, p 6-16	II.2	manual refers to this as a technical detail; N/A
* Telecommunications, power source requirements	30-10, p 6-16	II.2	technical detail; N/A
* Telecommunications, service type	30-10, p 6-16	II.2	AM, FM, TV, satellite, radio astronomy, intercept and direction finding stations; factor title incorrect for comments; see antennas
* Telecommunications, strategic importance	30-10, p 6-15	IV	N/A
* Telecommunications, structures and apparatus	30-10, p 7-29	II.2	too broad - see specific item
* Telecommunications, submarine cable facilities	30-10, p 6-15	II.2	type, length, location, description; included in telecommunications, support facilities
* Telecommunications, submarine cables	30-10, p 6-15	II.2	type, length, location, description; N/A
Telecommunications, support facilities	30-10, p 6-16 31-60, p 2-2	II.2	administration, housing, security, repair shops, exchanges and offices, etc.
* Telecommunications, transmitter specifications	30-10, p 6-16	II.2	N/A - technical detail
* Telecommunications, underground cables	30-10, p 6-15	II.2	method, type, location; N/A
* Telecommunications, underwater cables	30-10, p 6-15	II.2	method, type, location; N/A
* Telegraph line routes	30-10, p 6-15	II.2	included in telecommunications, poles as one usually uses the poles to determine the route
* Telegraph offices	30-10, p 6-15	II.2	included in telecommunications, support facilities

FACTOR	REFERENC <sup>e</sup>	CATEGORY	COMMENTS
* Telegraph open wire lines	30-10, p 6-15	II.2	material, spacing, conductors; included in telecommunications, poles, as one usually uses the poles to determine the route; wires are very difficult to see
* Telegraph repair facilities	30-10, p 6-15	II.2	included in telecommunications, support facilities
* Telephone exchanges and offices	30-10, p 6-15	II.2	included in telecommunications, support facilities
* Telephone line routes	30-10, p 6-15	II.2	included in telecommunications, poles
* Telephone repair facilities	30-10, p 6-15	II.2	included in telecommunications, support facilities
* Terraces	30-10, p 3-8	I.2	included in landforms, specific type
* Terrain analysis	5-30, p 4	I.	too general; see specific item of interest
* Terrain, general nature	5-30, p 15 5-36, p 4-5	I.2	included in landforms, general type
* Terrain group	5-36, p 4-5	IV	groups A, B, and C; included in trafficability, terrain group and class of soil
* Thorns, length	30-10, p 3-21	I.3	included in branch characteristics
* Thorns, location	30-10, p 3-21	I.3	included in branch characteristics
* Tidal effects	30-20, p 3-18 21-26, p 10-10 5-36, p 2-49 30-10, p 5-33 30-5, p B-2	I.4	included in currents in terms of the manual definition
* Tidal flats	30-10, p 3-2	I.2	included in landforms, specific type
Tidal range	55-8, p C-3 30-10, p 4-17	I.4	
Tidal rise, upper limit	55-8, p C-3	I.4	
* Tide datum	30-10, p 3-18	I.4	included in currents in terms of manual definition

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Tide phenomena, current variations	30-10, p 3-18 55-8, p C-3 31-60, p 2-2	I.4	terms confusing in manual; included in currents
* Tide phenomena, range/limits	55-8, p C-3 30-10, p 4-17 31-60, p 2-2	I.4	see tidal range and tidal rise, upper limits
* Tidewater extent	30-10, p 3-18	I.4	at a defined water level; included in currents in terms of the manual definition
* Timber	31-60, p 2-3 30-10, p 8-15	III.1	detection and location of timber on hand; included in stockpiled material
* Timber, development aspects	30-10, p 8-15	III.1	nearby sawmills, etc.; included in developmental aspects, construction resources
Timber, use suitability	CRS	III.1	this is an evaluation of timber resources at any given site with reference to need at hand
* Towns	21-26, p 10-10 101-5, p G-2 5-36, p 1-8	II.3	included in built-up areas, classification
* Toxicity	30-10, p 3-21	I.3	inferential from species identification, so included in vegetation, specific type
* Trafficability	5-36, p 4-2 5-36, p 4-3	IV	foot, wheeled, tracked vehicles; included in trafficability, terrain group and class of soil
* Trafficability, class of soil	6-36, p 4-2	IV	included in trafficability, terrain group and class of soil
* Trafficability, rock, foot	30-10, p 3-14	IV	included in trafficability, terrain group and class of soil
* Trafficability, rock, vehicle	30-10, p 3-14	IV	included in trafficability, terrain group and class of soil

109

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Trafficability, rock, vehicle, wheeled	30-10, p 3-14	IV	included in trafficability, terrain group and class of soil
* Trafficability, soil	30-10, p 3-13	IV	included in trafficability, terrain group and class of soil
* Trafficability, soil, foot	30-10, p 3-13	IV	included in trafficability, terrain group and class of soil
* Trafficability, soil, tracked vehicle	30-10, p 3-13	IV	included in trafficability, terrain group and class of soil
* Trafficability, soil, wheeled vehicle	30-10, p 3-13	IV	included in trafficability, terrain group and class of soil
Trafficability, terrain group and class of soil	5-36, p 4-2 5-36, p 4-5	IV	groups A, B, and C and classes I, II, III, and IV
* Transmission lines, alignment	30-10, p 8-7	II.2	included in power transmission lines, layout
* Transmission lines, failures	30-10, p 8-7	II.2	N/A
* Transmission lines, length	30-10, p 8-7	II.2	included in power transmission lines, layout
* Transmission lines, number	30-10, p 8-7	II.2	N/A
* Transmission lines, ownership	30-10, p 8-7	II.2	N/A
* Transmission lines, phase	30-10, p 8-7	II.2	N/A
* Transmission lines, placement and location	30-10, p 8-7	II.2	overhead, underground, submarine; included in power transmission lines, layout
* Transmission lines, right of way width	30-10, p 8-7	II.2	included in power transmission lines, layout
* Transmission lines, tower type	30-10, p 8-7	II.2	included in power transmission lines, towers and poles
* Transmission lines, voltage	30-10, p 8-7	II.2	N/A
* Transmission lines, wire characteristics	30-10, p 8-7	II.2	included in power transmission lines, wire and cable characteristics

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Transmission lines, wire and cable characteristics	30-10, p 8-7	II.2	included in power transmission lines, wire and cable characteristics
* Tree growth rate, crown diameter	30-10, p 3-21	I.3	included in leaf, stem, and branch characteristics
* Tree growth rate, height	30-10, p 3-21	I.3	included in leaf, stem, and branch characteristics
* Tree growth rate, trunk diameter	30-10, p 3-21	I.3	included in leaf, stem, and branch characteristics
Tree height	30-10, p 8-15	I.3	
Tree spacing	5-36, p 4-2	I.3	if trees cannot be toppled, a minimum spacing of 4.5 - 6 m is required
* Tree trunk, diameter	30-10, p 3-21	I.3	greater or less than 2" and 6-8"; also see tree spacing; included in stem characteristics
* Tree trunk, DBH	30-10, p 3-21	I.3	included in stem characteristics
* Tree trunk, habit	30-10, p 3-21	I.3	included in stem characteristics
* Tree trunk, toughness	30-10, p 3-21	I.3	included in stem characteristics
* Trees, deciduous	30-10, p 3-20,	I.3	included in forest, type
* Trees, deciduous, broadleaf	30-10, p 3-20 30-10, p 8-15	I.3	included in forest, type
* Trees, density	101-5, p G-2	I.3	included in tree spacing
* Trees, evergreen, broadleaf	30-10, p 3-20	I.3	included in forest, type
* Trees, evergreen, needleleaf	30-10, p 3-20 30-10, p 8-15	I.3	included in forest, type
* Trees, location	101-5, p G-2	I.3	location is requested for every item; do not need to specify
* Trees, type	30-10, p 3-20	I.3	included in vegetation, specific type
Troop concentrations	CRS	IV	primarily enemy; includes reserves

1062

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Tunneling	30-10, p 3-14	II.7	included in construction sites, description
* Tunnels	5-36, p 2-1	II.1	only referred to as item of general interest
* Tunnels, age	30-10, p 5-18	II.1	manual wants year built; N/A
* Tunnels, alignment	30-10, p 5-18	II.1	included in tunnels, characteristics
* Tunnels, approaches	30-10, p 5-18	II.1	see specific transportation type - railroads, roads, etc.
Tunnels, bypasses	30-10, p 5-18 5-36, p 2-6	II.1	manual asks for efforts to establish bypasses only; we assume actual and potential
* Tunnels, camouflage	30-10, p 5-19	II.1	included in camouflage, IV
Tunnels, characteristics	CRS 55-8, p C-3 30-10, p 3-18	II.1	alignment, length, portal characteristics, lining, type, etc.; above items specified in manual, but combined by CRS
* Tunnels, cross section	30-10, p 5-18	II.1	N/A
* Tunnels, defenses	30-10, p 5-19	II.1	included in defenses, IV
Tunnels, detection	CRS	II.1	
* Tunnels, effects of climate and weather	30-10, p 5-18	II.1	N/A
* Tunnels, highway	30-10, p 5-18	II.1	included in tunnels, characteristics
* Tunnels, horizontal and vertical constrictions	30-10, p 5-18 55-8, p C-3 5-36, p 2-5	II.1	included in clearances, horizontal and vertical
* Tunnels, length	55-8, p C-3	II.1	included in tunnels, characteristics
* Tunnels, length, total	55-8, p C-3 30-10, p 5-18	II.1	included in tunnels, characteristics
* Tunnels, lining material	30-10, p 5-18	II.1	N/A

1078

108

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Tunnels, obstacle tunneled	30-10, p 5-18	II.1	included in tunnels, detection
* Tunnels, portal	30-10, p 5-18	II.1	changed to tunnels, portal characteristics
* Tunnels, portal characteristics	30-10, p 5-18	II.1	material, drainage, possibly cross section, lining, etc.; included in tunnels, characteristics
* Tunnels, portal to portal length	30-10, p 5-18	II.1	included in tunnels, characteristics
* Tunnels, present use	30-10, p 5-19	II.1	in opposition to actual use; e.g., may be abandoned railroad tunnel used for storage; included in tunnels, characteristics
* Tunnels, railroad tracks	30-10, p 5-18	II.1	included in railways, description and characteristics
* Tunnels, shoring and bracing	30-10, p 5-18	II.1	N/A
* Tunnels, surface features over	30-10, p 5-18	II.1	included in tunnels, detection
* Tunnels, susceptibility to above ground demolition	30-10, p 5-18	II.1	included in demolition requirements, IV
* Tunnels, traffic control markings	30-10, p 5-18	II.1	N/A
* Tunnels, traffic control features	30-10, p 5-18	II.1	N/A
* Tunnels, type	5-36, p 2-26	II.1	included in tunnels, characteristics
* Tunnels, water (channel)	30-10, p 5-18	II.1	misnomer; a conduit; included in dams, associated structures
* Turbidity	30-10, p 3-20	I.4	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here; changed to water turbidity

1095

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Underbrush clearing	30-20, p 11-2	IV	enemy related activity; included in guerrilla activity
* Underground features	5-30, p 15	IV	included in underground installations if man-made and in caves, detection and tunnels, detection if natural
Underground installations	30-10, p 7-29 30-10, p 7-30	IV	type, use, construction data, cover, vulnerability, etc.
* Underground installations, construction data	30-10, p 7-29	IV	included in underground installations
* Underground installations, operating equipment	30-10, p 7-30	IV	included in underground installations
* Underground installations, original use	30-10, p 7-29	IV	included in underground installations
* Underground installations, protective cover	30-10, p 7-29	IV	included in underground installations
* Underground installations, transportation accessibility	30-10, p 7-30	IV	see specific transportation type
* Underground installations, type	30-10, p 7-29	IV	plants, hospitals, shelters, storage, etc.; included in underground installations
* Underground installations, utilities	30-10, p 7-30	IV	see specific utility - water supply, sewage, etc.
* Underground openings, accessibility to transportation	30-10, p 7-30	IV	see specific transportation type
* Underground openings, adaptability for use	30-10, p 7-30	IV	N/A
* Underground openings, dimensions	30-10, p 7-30	IV	included in underground installations
* Underground openings, operational status	30-10, p 7-30	IV	N/A
* Underground openings, type	30-10, p 7-30	IV	included in underground installations
* Underground openings, utilities	30-10, p 7-30	IV	see specific utility

FACTOR	REFERENCE	CATEGORY	COMMENTS
Underground openings, vulnerable features	30-10, p 7-30	IV	included in underground installations
Underwater obstacles	31-60, p 3-20 5-36, p 4-12 31-60, p 2-2	I.4	manual is asking for location in terms of reconnaissance
* Urban areas	30-10, p 7-2/	II.3	see built-up areas, classification
* Urban areas, billeting and quartering	30-10, p 7-28	II.3	N/A
* Urban areas, cultural centers	30-10, p 7-29	II.3	changed to cultural centers
* Urban areas, engineering facilities and equipment	30-10, p 7-29	II.3	included in construction sites, description, II.7
* Urban areas, extent	30-10, p 7-28	II.3	changed to built-up areas, extent
* Urban areas, fire protection, alarm communications and dispatching system	30-10, p 7-29	II.3	N/A
* Urban areas, fire protection, area served	30-10, p 7-29	II.3	changed to fire fighting facilities and equipment
* Urban areas, fire protection, hydrants and key valves	30-10, p 7-29	II.3	changed to fire fighting facilities and equipment
* Urban areas, fire protection, manpower and equipment	30-10, p 7-29	II.3	changed to fire fighting facilities and equipment
* Urban areas, fire protection, number of stations	30-10, p 7-29	II.3	included in fire fighting facilities and equipment
* Urban area, fire protection system	30-10, p 7-29	II.3	included in fire fighting facilities and equipment
* Urban areas, fire protection, water source	30-10, p 7-29	II.3	see water supply factors
* Urban areas, importance	30-10, p 7-28	II.3	N/A
* Urban areas, military installations	30-10, p 7-28	II.3	included in military installations, detection, IV
* Urban areas, nearest port	30-10, p 7-28	II.3	see ports and ports and harbors

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Urban areas, police protection, area served	30-10, p 7-29	II.3	N/A
* Urban areas, police protection, detention and security areas	30-10, p 7-29	II.3	included in police protection
* Urban areas, police protection, equipment	30-10, p 7-29	II.3	included in police protection
* Urban areas, police protection, manpower	30-10, p 7-29	II.3	N/A
* Urban areas, police protection, stations	30-10, p 7-29	II.3	included in police protection
* Urban areas, possible and probable invasion routes	30-10, p 7-30	IV	included in avenues of approach
* Urban areas, sites suitable for military purposes	30-10, p 7-28	IV	included in military installations, detection
* Urban areas, structures	30-10, p 7-28	II.3	changed to structures
* Urban areas, type	30-10, p 7-28	II.3	military, residential, commercial, industrial, governmental; changed to functional areas
* Urban areas, vulnerability	30-10, p 7-28	II.3	nuclear, artillery, and/or air attack; N/A
* Utilities, central heating plants	30-10, p 7-28 30-20, p E-2	II.3	changed to central heating plants, detection and central heating plants, characteristics

1  
 20  
 11  
 11

112

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Valley, depth	21-26, p 10-10	I.2	included in landforms, specific type
* Valley, elevation	21-26, p 10-10	I.2	included in landforms, specific type
* Valley, length	21-26, p 10-10	I.2	included in landforms, specific type
* Valley, slope	21-26, p 10-10	I.2	included in slope
* Valley, type	21-26, p 10-10	I.2	included in landforms, specific type
* Valley flats, border terraces	30-10, p 3-8	I.2	included in landforms, specific type
* Valley flats, dimensions	30-10, p 3-8	I.2	included in landforms, specific type
* Valley flats, pattern	30-10, p 3-8	I.2	included in landforms, specific type
* Valley flats, profile	30-10, p 3-8	I.2	included in landforms, specific type
* Valley flats, slope	30-10, p 3-8	I.2	included in slope
* Valley flats, stream associations	30-10, p 3-8	I.2	included in drainage pattern, I.4 and landforms, specific type
* Valley flats, tributary valleys	30-10, p 3-8	I.2	included in drainage pattern I.4 and landforms, specific type
* Vegetation for construction, use suitability	30-10, p 3-22	III.1	palm fronds, thatching material; location and detection; manual specifies suitability of plants for material only
* Vegetation, alpine	30-10, p 3-20	I.3	included in vegetation, specific type
* Vegetation, area in hectares	30-10, p 3-21	I.3	N/A
* Vegetation, blowdown, susceptibility to	30-10, p 3-21 30-5, p B-5	I.3	by wind or other natural causes; manual probably only interested in military aspects and factor included in IV
* Vegetation boundary alignment	30-10, p 3-21	I.3	if the vegetation can be identified it can be bounded; see vegetation, specific type, and vegetation, general type

113

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Vegetation canopy, average height	30-10, p 3-21	I.3	included in vegetation canopy, characteristics
Vegetation canopy, characteristics	30-10, p 3-21 101-5, p G-2	I.3	clearance beneath, cover, depth, average height, structure
* Vegetation canopy, clearance beneath	30-10, p 3-21	I.3	included in vegetation canopy, characteristics
* Vegetation canopy cover	30-10, p 3-21	I.3	included in vegetation canopy characteristics
* Vegetation canopy, depth	30-10, p 3-21	I.3	included in vegetation canopy characteristics
* Vegetation canopy, structure	30-10, p 3-21	I.3	included in vegetation canopy characteristics
* Vegetation, cultivated	101-5, p G-2	I.3	see agriculture, II.4
* Vegetation, distribution pattern	30-10, p 3-21	I.3	included in vegetation, general type, and vegetation, specific type
Vegetation, general type	30-10, p 3-20	I.3	trees, shrubs, or grass
Vegetation, induced blowdown, susceptibility to	30-10, p 3-21	IV	manual does not specify whether it means induced or natural; induced is assumed
* Vegetation, natural	101-5, p G-2	I.3	see specific factor in Vegetation, I.3
* Vegetation, number of fallen plants per hectare	30-10, p 3-21	I.3	N/A
* Vegetation, plantations	30-10, p 3-21	I.3	included in agriculture, general type
* Vegetation, principal species, botanical name	30-10, p 3-21	I.3	included in vegetation, specific type
* Vegetation, principal species, common name	30-10, p 3-21	I.3	included in vegetation, specific type
* Vegetation, principal species, family	30-10, p 3-21	I.3	included in vegetation, specific type
* Vegetation, secondary species, botanical name	30-10, p 3-21	I.3	included in vegetation, specific type

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Vegetation, secondary species, common name	30-10, p 3-21	I.3	included in vegetation, specific type
* Vegetation, secondary species, family name	30-10, p 3-21	I.3	included in vegetation, specific type
Vegetation, specific type	30-10, p 3-21	I.3	species and species characteristics
* Vegetation, timber stands	5-36, p 3-53	III.1	included in forests, type I.3
* Vegetation, toxicity, location	30-10, p 3-21	I.3	dependent on species identification, so included in vegetation, specific type
* Vegetation, toxicity, reactions	30-10, p 3-21	I.3	N/A
* Vegetative irritants, location	30-10, p 3-21	I.3	dependent on species identification, so included in vegetation, specific type
* Vegetative irritants, reaction	30-10, p 3-21	I.3	N/A
Vehicles, detection	CRS	IV	
Vehicles, identification	CRS	IV	
* Vessel repair facilities	55-8, p C-3 30-10, p 5-34	II.1	included in ports, ship building and repair facilities
* Vineyards	30-10, p 3-21 21-26, p 2-5	II.4	included in agriculture, general type
Visibility	30-5, p 2-18 31-60, p 2-2	I.1	
* Volcanic activity, recent	30-10, p 10-4	I.6	included in rock type, specific
* Volcanic cone, pyroclastic	30-10, p 3-2	I.6	included in landforms, specific type
* Volcanos	30-10, p 3-8	I.6	included in landforms, specific type

114

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Wadis	30-10, p 3-3	I.2	included in landforms, specific type
* Water, chemical content	30-10, p 3-20	I.4	included in water quality
Water color	30-10, p 3-20	I.4	used in manual in terms of defining water quality, but as water color is applicable to other interpretations, it is included here
* Water, contamination	30-10, p 3-20 5-36, p 4-16	I.4	included in water quality
* Water, currents, cross	30-10, p 3-18	I.4	included in currents
Water, depth	30-10, p 4-17 31-60, p 2-1	I.4	
* Water, dissolved solids	30-10, p 3-20	I.4	included in water quality
* Waterfalls and rapids, detection	30-10, p 3-19	I.4	
* Waterfalls, elevation	30-10, p 3-19	I.4	included in waterfalls and rapids, detection
* waterfalls, pattern	30-10, p 3-19	I.4	included in waterfalls and rapids, detection
* Water odor	30-10, p 3-19 30-10, p 3-20	I.4	included in water quality
* Water points	5-30, p 15	IV	recommended locations; included in ground water, waterways, water supply, storage facilities, etc.
* Water, potability	5-36, p 4-16	I.4	included in water quality
Water quality	30-10, p 3-20 5-36, p 4-16	I.4	contamination, dissolved solids, odor, potability, organic matter, taste, variation, chemical content
* Water quality, organic matter	30-10, p 3-20	I.4	included in water quality
* Water quality, turbidity	30-10, p 3-20	I.4	changed to water turbidity
* Water quality, variation	30-10, p 3-20	I.4	included in water quality

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Water source	30-10, p 3-19 5-36, p 4-11 5-30, p 15	I.4	included in reservoirs and water supply, storage facilities
* Water supply	30-10, p 3-19 5-30, p 15	I.4	see specific factor
* Water supply, area served	30-10, p 7-28	II.3	N/A
* Water supply, capacity	30-10, p 7-28	II.3	capacity is defined by the size of the storage facility, so see reservoirs and water supply, storage facilities
* Water supply, delivery methods	30-10, p 7-28	II.3	N/A
* Water supply, distribution methods	30-10, p 7-28	II.3	N/A
Water supply, pumping stations	CRS	II.3	
* Water supply, seasonal variations	30-10, p 7-28	II.3	N/A
Water supply, storage facilities	30-10, p 7-28	II.3	type, location, capacity, condition; this factor refers to both water tanks and small, local storage reservoirs, not to large reservoirs associated with dams
Water supply, treatment plants, characteristics	30-10, p 7-28	II.3	type, capacity, condition
Water supply, treatment plants, detection	CRS	II.3	
* Water table	30-10, p 3-13	I.4	general reference only
Water table, depth	30-10, p 3-16 5-332, p 11	I.4	refers to depth of water table beneath the surface
* Water table, elevation	5-332, p 11	I.4	N/A
* Water table, pool, depth of, estimated	STOPIN, p U-1	I.4	N/A
* Water table, seasonal variation	30-10, p 3-16	I.4	N/A

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Water table, stability	30-10, p 3-16	I.4	N/A
* water, taste	30-10, p 3-20	I.4	included in water quality
* Water treatment	30-20, p E-1	II.3	water purification in the manual; included in water supply, treatment plants, characteristics and water supply, treatment plants, detection
Water turbidity	30-10, p 3-20	I.4 II.6	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here
Water turbidity, sources	CRS	II.6	man-induced erosion, acid mine drainage, etc.
Water bodies, characteristics	CRS	I.4	inlets, outlets, size, type, etc.
Water bodies, detection	CRS	I.4	
* Water bodies, seasonal variation	55-8, p C-3	I.4	N/A
* Water bodies, type	30-10, p 3-18	I.4	lakes, ponds, inland seas, oceans, etc.; included in water bodies, characteristics
* Watercourse, depth	30-10, p 3-18 21-26, p 10-10 5-36, p 2-37 101-5, p G-2 30-5, p B-2 5-30, p 15	I.4	depth by sectors at mean high and mean low water; included in water depth
* Watercourse, direction of flow	30-10, p 3-18	I.4	changed to waterways, direction of flow
* Watercourse, type	30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	I.4	river, stream, etc., included in waterways, type
* Waterways, aids to navigation	55-8, p C-3 5-36, p 4-17	II.1	included in navigation aids

FACTOR	REFERENCE	CATEGORY	COMMENTS
Waterways, approaches	30-10, p 5-33	II.1	nature, location, and identification; conspicuous objects or landmarks and approach channel
* Waterways, aqueduct bridges	30-10, p 5-33 55-8, C-1	II.1	included in aqueducts and bridges, use type
* Waterways, bank alignment	30-10, p 5-33	II.1	included in waterways, layout
* Waterways, bank characteristics	30-10, p 5-34 55-8, p C-2	II.1	alignment, composition, etc.; see specific factor
Waterways, bank composition	55-8, p C-2	II.1 I.4	
Waterways, bank slope	31-60, p 2-2	II.1 I.4	
* Waterways, banks	30-10, p 5-34 55-8, p C-2	II.1	see specific factor
Waterways, bottom characteristics	30-10, p 5-34 55-8, p C-2 31-60, p 2-2	II.1 I.4	composition, stream bed roughness, etc.
* Waterways, bottom composition	30-10, p 5-34	II.1	included in bottom characteristics
* Waterways, cargo handling facilities	30-10, p 5-34	II.1	loading and unloading facilities in manual; included in waterways, description
* Waterways, construction and maintenance equipment	30-10, p 5-33 55-8, p C-3	II.1	dredges, derricks, cranes, pile drivers, etc.; included in waterways, description
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2	II.1 I.4	
* Waterways, crossings	30-10, p 5-33	II.1	see specific transportation type
* Waterways, crossings, boat	5-30, p 40	II.1	included in ferries, detection
* Waterways, current velocity	30-10, p 5-33 55-8, p C-3	II.1	at various locations, at mean high and mean low water; N/A

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Waterways, depth	30-10, p 5-33	II.1	included in water depth, I.4
* Waterways, description	CRS	II.1	maintenance and repair requirements and equipment, inclined planes, towage systems, traffic, cargo handling facilities, characteristic vessel type, etc.; above items are specified in the manual, but combined by CRS here
Waterways, direction of flow	CRS	II.1	
* Waterways, distance between important points	55-8, p C-4	II.1	N/A
* Waterways, effects of weather and climate	30-10, p 5-34 55-8, p C-3	II.1	see climate and weather, I.1
* Waterways, heavy floating machinery	30-10, p 5-34 55-8, p C-3	II.1	dredges, yards, construction materials available for improvements; included in waterways, description
* Waterways, horizontal and vertical restrictions	55-8, p C-3	II.1	included in clearances, horizontal and vertical
* Waterways, importance to local economy	30-10, p 5-34	II.1	N/A
* Waterways, inclined planes	30-10, p 5-33	II.1	condition, design, location, etc.; included in waterways, description
* Waterways, junctions	30-10, p 5-33	II.1	included in waterways, layout
Waterways, layout	CRS	II.1	alignment, junctions, etc.; above items specified in manual, but combined by CRS here
* Waterways, loading and unloading facilities	30-10, p 5-34 55-8, p C-4	II.1	changed to waterways, cargo handling facilities and then included in waterways, description
* Waterways, location and nature of critical points	30-10, p 5-34	II.1	included in critical points, IV
* Waterways, maintenance and repair requirements	30-10, p 5-34	II.1	included in waterways, description

120

FACTOR	REFERENCE	CATEGORY	COMMENTS
* Waterways, maintenance and repair requirements, dredging	30-10, p 5-34	II.1	included in waterways, description
* Waterways, major traffic interruptions, type	30-10, p 5-34 55-8, p C-4	II.1	see specific transportation item
* Waterways, major transport organizations	30-10, p 5-34 55-8, p C-4	II.1	N/A
* Waterways, planned development	30-10, p 5-34	II.1	N/A
* Waterways, profile	30-10, p 5-33 55-8, p C-2	II.1	width and depth at mean high and low water; included in waterways, cross section and profile
* Waterways, retaining walls	30-10, p 5-33	II.1	included in waterways, bank composition
* Waterways, safe draft	30-10, p 5-33	II.1	included in water depth, I.4
* Waterways, safety gates	55-8, p C-3	II.5	manual does not define and CRS is unclear as to meaning
* Waterways, security and safety features	30-10, p 5-34	II.1	N/A
Waterways, silting characteristics	55-8, p C-2	II.1 I.4	
* Waterways, tonnage moved by commodity	30-10, p 5-34 55-8, p C-4	II.1	N/A
* Waterways, total length	30-10, p 5-33	II.1	included in waterways, layout
* Waterways, towage system	30-10, p 5-33 55-8, p C-4	II.1	included in waterways, description
* Waterways, traffic	30-10, p 5-34	II.1	presence of vessels, type, volume; vessels using waterway in manual; included in waterways, description
* Waterways, tunnels, vessel movement method	55-8, p C-3	II.1	towed, poled, pushed, self-propelled; N/A

FACTOR	REFERENCE	CATEGORY	COMMENTS
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	II.1 I.4	lake, river, canal, stream; same as channel, water-course, etc.
* Waterways, vessel average net load	55-8, p C-4	II.1	N/A
* Waterways, vessel capacity	30-10, p 5-34 55-8, p C-4	II.1	N/A
* Waterways, vessel propulsion	30-10, p 5-34	II.1	N/A
* Waterways, vessel tonnage classification	30-10, p 5-33	II.1	"of segment" in manual; N/A
* Waterways, vessel turnaround time, by type	55-8, p C-2	II.1	N/A
* Waterways, vessel type	30-10, p 5-34 55-8, p C-4	II.1	characteristic vessel type is included in waterways, description
Wave conditions and characteristics	30-5, p 3-13	I.4	length, frequency, refraction, etc.
Weapons, location of	30-5, p 5-6 31-60, p 2-2	IV	automatic weapons, mortars, artillery, armored vehicles, antiaircraft, etc.
* Weather forecasting	30-5, p 3-19	I.1	see specific factors in I.1, used in weather forecasting
* Weather, influence on operations	101-5, p G-2	IV	too broad in scope; N/A
* Weathering, chemical	30-10, p 3-14	I.6 I.5	included in weathering process
* Weathering, extent	STOPIN, p U-2	I.6 I.5	N/A
* Weathering, mechanical	30-10, p 3-14	I.6 I.5	included in weathering process

FACTOR	REFERENCE	CATEGORY	COMMENTS
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	I.6 I.5	chemical or mechanical
* Weathering process, dominant	30-10, p 3-13	I.6 I.5	included in weathering process
* Wells, aquifers penetrated	30-10, p 3-20	I.4	N/A
* Wells, casing or lining used	30-10, p 3-20	I.4	N/A
* Wells, characteristics	30-10, p 3-20	I.4	yield, water level, recovery rate, etc.; characteristics specified in manual are not amenable to remote sensing techniques
* Wells, diameter	30-10, p 3-20	I.4	N/A
Wells, detection	CRS	I.4	
* Wells, distribution	30-10, p 3-20 5-36, p 4-3	I.4	included in wells, detection
* Wells, drawdown rates at specified yields	30-10, p 3-20	I.4	N/A
* Wells, level, static water	30-10, p 3-20	I.4	N/A
* Wells, material penetrated	30-10, p 3-20	I.4	N/A
* Wells, recovery rate after pumping	30-10, p 3-20	I.4	N/A
* Wells, yields of aquifers	30-10, p 3-20	I.4	N/A
* Wells, yields, effect on nearby wells	30-10, p 3-20	I.4	N/A
* Wells, yields, sustained after prolonged pumping	30-10, p 3-20	I.4	N/A
* Wet areas, seasonal variation	30-10, p 3-19	I.4	included in wetlands, extent, I. 3 and I.4
* Wet areas, watercourses associated	30-10, p 3-19	I.4	included in drainage pattern

FACTOR	REFERENCE	CATEGORY	COMMENTS
Wetlands, extent	CRS	I.3 I.4	
Wetlands, type	30-10, p 3-19 21-26, p 10-10 5-36, p 4-3 5-30, p 39	I.3 I.4	marshes, swamps, bogs, muskeg, etc. (not good terminology - the dictionary defines swamps, bogs, and marshes as the same thing, so more proper terms would be fresh water marsh, salt water marsh, etc.)
* Wharves	5-30, p 15 30-10, p 5-36 30-10, p 5-50	II.1	type, fueling facilities, alongside depth, construction, use, etc.; included in ports, cargo handling facilities
Wind	30-5, p 2-18 5-36, p 1-3	I.1	
Withdrawal areas	30-5, p 3-11	IV	allies and enemy
Withdrawal routes	30-5, p 3-11	IV	allies and enemy
* Woods	30-10, p 3-20 21-26, p 2-5	I.3	included in forests, type

123

CATEGORIZED LISTING

**124 <**

122

CATEGORY: Climate and Weather

CATEGORY SYMBOL: I.1

FACTOR	REFERENCE	COMMENTS
Air temperature	30-5, p 2-18	this factor is abstracted from a general reference to temperature in the manual; near surface; range estimates only
Climate	101-5, p G-2	the reference asks for general climate and weather information as part of a general description of an area; some of these conditions can be deduced from imagery and it is in this sense the items are evaluated
Clouds	30-5, p 2-18	the manual discusses clouds in terms of effect on operations; remote sensing is of limited use for these tactical considerations; can study clouds directly (pattern, development, cycles, etc.) and the associations of patterns with terrain and meteorological conditions; clouds are evaluated in these terms
Precipitation	30-5, p 2-17 5-36, p 1-3	
Visibility	31-60, p 2-2 30-5, p 2-18	
Wind	30-5, p 2-18 5-36, p 1-3	

135

CATEGORY: Surface configuration

CATEGORY SYMBOL: I.2

FACTOR	REFERENCE	COMMENTS
Landforms, general type	30-10, p 3-2	plains, hills, mountains, depressions, escarpments
Landforms, specific type	CRS	bars, kames, ridges, moraines, etc.
Mass movement features, detection	CRS	landslides, mudslides, talus slopes, rockfalls, etc.
Mass movement features, potential	CRS	
Relief, topographic	21-26, p 2-5 101-5, p G-2 30-10, p 3-8 5-36, p 4-3	
Ridge pattern	30-10, p 3-8	orientation, skyline; can also aid in differentiating lithologic units
Shorelines, description	CRS	includes coastal type - emergent, submergent, volcanic, man-made, etc.
Shorelines, detection	CRS	any land/water interface
Slope	5-36, p 2-5 30-10, p 3-13 21-26, p 10-10 101-5, p G-2 30-5, p B-2	
Surface irregularities	CRS	boulder fields, lava flow surfaces, etc.; refers to what might be called micro-relief features - irregular areas where the irregularities are not specific landforms

CATEGORY: Vegetation

CATEGORY SYMBOL: I.3

FACTOR	REFERENCE	COMMENTS
Branch characteristics	CRS	habit, thorns, density, size, geometry, etc.
Burned areas	30-20, p 11-2 30-10, p 3-22	degree and extent of past burn-off
Forest fire, detection	30-5, p B-5 30-20, p 11-3	
Forest fire, susceptibility to	30-10, p 3-22	
Forest, type	30-10, p 3-20	the manual is not specific on needs, but they do want to know type; conifers, deciduous, mixed, mixed hardwoods, etc.
Grasslands, type	CRS	savannahs, prairies, meadows, etc.
Leaf characteristics	30-10, p 3-21	color, density, seasonal variation, type, etc.
Litter characteristics	30-10, p 3-22	type, depth, etc.
Roots, characteristics	30-10, p 3-21	habit, diameter above ground, height of emergence, spread above ground, spread below ground
Stem characteristics	30-10, p 3-21	diameter and habit
Tree height	30-10, p 8-15	
Tree spacing	5-36, p 4-2	if trees cannot be toppled, a minimum spacing of 4.5-6 m is required
Vegetation canopy, characteristics	101-5, p G-2 30-10, p 3-21	clearance beneath, cover, depth, average height, structure
Vegetation, general type	30-10, p 3-20	trees, shrubs, or grass
Vegetation, specific type	30-10, p 3-21	species and species characteristics

1375

CATEGORY: Vegetation

CATEGORY SYMBOL: I.3

FACTOR	REFERENCE	COMMENTS
Wetlands, extent	CRS	
Wetlands, type	30-10, p 3-19 21-26, p 10-10 5-36, p 4-3 30-5, p 39	marshes, swamps, bogs, muskeg, etc. (not good terminology - the dictionary defines swamps, bogs, and marshes as the same thing, so more proper terms would be fresh water marsh, salt water marsh, etc.)

128 <

CATEGORY: Hydrology

CATEGORY SYMBOL: I.4

FACTOR	REFERENCE	COMMENTS
Currents	30-10, p 3-18 55-8, p C-3	tidal, littoral, stream, oceanic, undertows, etc.
Drainage basin, characteristics	30-10, p 3-18	area, slope, shape; same as watershed
Drainage pattern	30-10, p 3-16	annular, dendritic, parallel, radial, rectangular, trellis; internal, interrupted, etc.
Flooding, characteristics	30-10, p 3-18 30-10, p 5-34	affects, cause, duration, frequency, and type (tidal, snow- melt, direct runoff, etc.)
Flooding, extent	30-10, p 3-18 30-10, p 5-34 31-60, p 2-2	
Flooding, potential for	CRS	
Ground water	5-332, p 11 30-10, p 3-20	amount, flow, temperature; also see water table
Permeability	30-10, p 3-13	part of soil-rock check list/internal drainage in manual; estimates only
Run off factor	30-10, p 3-22	factor = coefficient; seasonality, condition
Springs, detection	30-10, p 3-20 21-26, p 10-10 5-36, p 4-3	
Stream gradient	CRS	
Stream width	31-60, p 2-1 30-5, p B-2 5-30, p 15 5-36, p 2-37 21-26, p 10-10	

1295

CATEGORY: Hydrology

CATEGORY SYMBOL: I.4

FACTOR	REFERENCE	COMMENTS
Tidal range	55-8, p C-3 30-10, p 4-17	
Tidal rise, upper limit	55-8, p C-3	
Underwater obstacles	31-60, p 2-2 31-60, p 3-20 5-36, p 4-12	manual is asking for location in terms of reconnaissance
Water color	30-10, p 3-20	used in manual in terms of defining water quality, but as water color is applicable to other interpretations, it is included here
Water depth	31-60, p 2-1 30-10, p 4-17	
Waterfalls and rapids, detection	30-10, p 3-19	
Water quality	30-10, p 3-20 5-36, p 4-16	contamination, dissolved solids, chemical content, odor, taste, potability, variation, organic matter
Water table, depth	30-10, p 3-16 5-332, p 11	refers to depth of water table beneath the surface
Water turbidity	30-10, p 3-20	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here
Water bodies, characteristics	CRS	inlets, outlets, size, type, etc.
Water bodies, detection	CRS	
Waterways, bank composition	55-8, p C-2	
Waterways, bank slope	31-60, p 2-2	

130

CATEGORY: Hydrology

CATEGORY SYMBOL: I.4

FACTOR	REFERENCE	COMMENTS
Waterways, bottom characteristics	31-60, p 2-2 30-10, p 5-34 55-8, p C-2	composition, stream bed roughness, etc.
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2	
Waterways, silting characteristics	55-8, p C-2	
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	river, canal, lake, stream; same as watercourse, channel, etc.
Wave conditions and characteristics	30-5, p 3-13	length, frequency, refraction, etc.
Wells, detection	CRS	
Wetlands, extent	CRS	
Wetlands, type	30-10, p 3-19 21-26, p 10-10 5-36, p 4-3 5-30, p 39	marshes, swamps, bogs, muskeg, etc. (not good terminology - the dictionary defines swamps, bogs and marshes as the same thing, so more proper terms would be fresh water marsh, salt water marsh, etc.)

131

CATEGORY: Surface materials

CATEGORY SYMBOL: 1.5

FACTOR	REFERENCE	COMMENTS
Crevasse detection	CRS	
Glaciers, extent	CRS	
Glaciers, thickness	CRS	
Ice bearing capacity	CRS	
Ice temperature	5-330, p 13-22	
Ice thickness, fresh water	CRS	non-glacial ice only
Ice thickness, salt water	CRS	non-glacial ice only
Ice type	5-330, p 13-23	river, fresh, sea, young, pack, etc.
Icings, type	5-330, p 6-76 5-330, p 6-77	coastal, ground, river, spring; coastal and river icings can be evaluated in Ice, type above
Permanently frozen materials, detection	CRS	including permafrost, active zone
Porosity	30-10, p 3-14	part of soil-rock check list/internal drainage in manual
Snow accumulation areas	CRS	including terrain evaluation for snow fence location; potential
Snow depth	5-36, p 4-3	less or greater than 0.3 and 1.0 m; tracked and wheeled vehicles
Snow extent	CRS	snow/land interface
Snow temperature	CRS	
Soil, Atterberg limits	CRS	plasticity index, liquid limit, plastic limit, specific gravity, shrinkage limit, etc.; inferences (range estimates) are possible
Soil, bearing strength	30-10, p 3-13	compacted state, natural state, modulus of subgrade reaction, wet or dry, etc.; inferences (range estimates) are possible

1324

CATEGORY: Surface materials

CATEGORY SYMBOL: I.5

FACTOR	REFERENCE	COMMENTS
Soil classification, major	30-10, p 3-13	grading(sand, gravel, silt. clay), composition (organic, mineral), and consistency (plastic, friable)
Soil classification, unified	30-10, p 3-13 STOPIN, p U-1	30-10 refers the reader to TM 5-330
Soil density	30-10, p 3-13 STOPIN, p U-2	dry compacted, in place, maximum; only range estimates are possible
Soil depth	30-10, p 3-13	
Soil moisture content	30-10, p 3-13 STOPIN, p U-2	30-10 requests soil moisture content as % dry weight, which cannot be obtained, but as good estimates can be made from imagery, the factor is included
Soil profile	30-10, p 3-13	
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	chemical or mechanical

133

CATEGORY: Geology

CATEGORY SYMBOL: I.6

FACTOR	REFERENCE	COMMENTS
Caves, detection	CRS	
Folding	30-10, p 3-14 5-332, p 4	anticlines, synclines, etc.
Fossil fuel sources	30-10, p 8-8	oil, coal, and gas
Fractures, characteristics	30-10, p 3-14	dip, displacement, pattern, size, shape, spacing, etc.; many fractures are readily apparent and easily mapped, but others difficult to trace with certainty, and require considerable time, and careful evaluation.
Fractures, detection	CRS	
Fractures, type	30-10, p 3-14	joint, fault (reverse, thrust, etc.)
Rock color	5-332, p 4 5-545, p 72 30-10, p 3-14	
Rock dip and strike	5-545, p 72 30-10, p 3-14 5-332, p 4	alignment; dip is called "slope of bed" in 30-10, which is incorrect terminology
Rock layering	CRS 5-332, p 4	stratification, foliation, schistosity, etc.
Rock, resistance to erosion	5-545, p 72 5-332, p 7	resistance to erosion called "durability" in 5-332
Rock thickness	30-10, p 3-14 5-545, p 72 5-332, p 4	average and range
Rock type, major	30-10, p 3-9	igneous, sedimentary and metamorphic

134

CATEGORY: Geology

CATEGORY SYMBOL: I.6

FACTOR	REFERENCE	COMMENTS
Rock type, specific	30-10, p 3-9 30-10, p 10-5	basalt, sandstone, serpentine, etc.
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	chemical or mechanical

1354

CATEGORY: Transportation

CATEGORY SYMBOL: II.1

FACTOR	REFERENCE	COMMENTS
Aircraft, detection	CRS	
Aircraft, identification	CRS	
Airfields, elevation	30-10, p 5-61	
Airfields, fueling facilities	30-10, p 5-61	called petroleum and oil lubricants in the manual
Airfields, layout	30-10, p 5-61	runways, taxiways, hardstands, parking and warm-up areas, hangars, etc.
Airfields, runway and taxiway description	30-10, p 5-61	size, design, surface, etc.; for each runway and/or taxiway
Airfields, support facilities	CRS	lighting, storage, APU's, maintenance of runways, etc., navigation and weather facilities, aircraft maintenance facilities, etc.
Airfields, type	30-10, p 5-61 30-10, p 7-28 5-36, p 4-6	civilian, military or joint; plane type
Anchorage	30-10, p 5-33 55-8, p C-3	depth, size, clearances, berths, bottoms, etc.
Aqueducts	55-8, p C-3	length, width, construction details, etc.
Berths	55-8, p C-3	length, type, apron, alongside depth, etc.; called berthages in terms of anchorages and passing basins in the manual
Bridges, abutment characteristics	30-10, p 5-16	type, dimensions, material, etc.
Bridges, bypasses	30-10, p 5-16 5-36, p 2-6 5-36, p 2-65	to be classified as easy, difficult, and impossible; location
Bridges, condition	30-10, p 5-16	in terms of effort required to repair

1365

CATEGORY: Transportation

CATEGORY SYMBOL: II.1

FACTOR	REFERENCE	COMMENTS
Bridges, detection	CRS	
Bridges, military load classification	30-10, p 5-16 5-36, p 3-40	load carrying capacity
Bridges, structure type	30-10, p 5-16	number of spans, description of spans, suspension system, description of arches, intermediate support characteristics, etc..
Bridges, use type	CRS	dummy, vehicular, foot; multiple or single use; aqueducts
Cableways, description	30-10, p 5-21 31-60, p 2-3	capacity, length, carriage data, base stations, maintenance, power, etc.; in terms of check list p 5-21, 5-22
Cableways, detection	CRS	
Cableways, uses	30-10, p 5-21	
Clearance, horizontal and vertical	30-10, p 5-11 30-10, p 5-16	limits to 0.1 m on p 5-16
Culverts, detection	5-36, p 2-70 5-330, p 6-41	5-330 defines culvert as a short bridge, but CRS is using culvert as defined in 5-36, as an underground passage for water
Expansion potential	CRS	airfields, ports, railroads, harbors, etc.; manual refers to ports and harbors (30-10, p 5-51), but this factor is applicable to all transportation development and is therefore used in the latter sense here
Ferries, description	31-60, p 2-2 30-10, p 5-20	crossing time, type, traffic, hazards, routes, propulsion method, etc.
Ferries, detection	CRS	this includes ferry terminals
Fords, approaches	30-10, p 5-51	width, condition, and length
Fords, description	31-60, p 2-2	banks, load class, hazards, bypasses, bottoms, etc.

CATEGORY: Transportation

CATEGORY SYMBOL: II.1

FACTOR	REFERENCE	COMMENTS
Fords, detection	5-30, p 15 5-36, p 2-1	
Harbors, approaches and entrances	30-10, p 5-50	location, width, and depth
Harbors, description	30-10, p 5-50 55-8, p C-3	depth, divisions, fairways, maintenance, protective works, turning basins, type, etc.
Harbors, detection	CRS	
Mass transit systems	30-10, p 7-29	maintenance, equipment, capacity, terminals, types, etc.; manual lists as public transportation
Navigation aids	55-8, p C-3	
Pipelines, characteristics	30-10, p 5-25	type, size, condition, etc.
Pipelines, detection	CRS	
Pipelines, leaks	CRS	
Pipelines, pumping stations	30-10, p 5-26	location, function, type
Pipelines, pumping stations, detection	30-10, p 5-26	
Ports, cargo handling facilities	5-30, p 15	miscellaneous cranes, wharves, etc.
Ports, description	30-10, p 5-50	conditions, obstructions, operating data, relative capacity (CRS) etc.
Ports, principal activity	30-10, p 5-50	passenger, cargo, recreation, fishing, military, etc.
Ports, shipbuilding and repair facilities	30-10, p 5-50	dry docks, cranes, etc.

CATEGORY: Transportation

CATEGORY SYMBOL: II.1

FACTOR	REFERENCE	COMMENTS
Railways, description and characteristics	CRS	sections in need of repair, propulsion method, rolling stock, service facilities, tracks, signals and control features, etc.; above items are specified in the manual, but were combined by CRS to form this factor
Railways, detection	CRS	
Railways, grade	30-10, p 5-11	manual wants maximum grade in terms of location and direction of travel
Railways, layout	CRS	crossovers, mainline junctions, curvature, underpasses, length, etc.; above items are specified in the manual, but were combined to form layout by CRS
Roads, characteristics	CRS	limiting characteristics, curvature, width, construction materials, length, obstructions, number of lanes, weather classification, etc.
Roads, grade	21-26, p 10-10 5-36, p 2-5	
Roads, layout	CRS	junctions, pattern, etc.; above items specified in manual, but combined to form layout here
Roads, military load classification	5-36, p 2-4	bearing capacity; a load capacity rating system as defined in the manual
Tunnels, bypasses	5-36, p 2-6 30-10, p 5-18	manual asks for efforts to establish bypasses only; we assume actual and potential bypasses
Tunnels, characteristics	30-10, p 5-18 55-8, p C-3 CRS	alignment, length, portal characteristics, lining, type, etc.; above items specified in manual, but combined by CRS
Tunnels, detection	CRS	

CATEGORY: Transportation

CATEGORY SYMBOL: II.1

FACTOR	REFERENCE	COMMENTS
Waterways, approaches	30-10, p 5-33	nature, location and identification; conspicuous objects or landmarks, and approach channel
Waterways, bank composition	55-8, p C-2	
Waterways, bank slope	31-60, p 2-2	
Waterways, bottom characteristics	30-10, p 5-34 55-8, p C-2 31-60, p 2-2	composition, stream bed roughness, etc.
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2	
Waterways, description	CRS	maintenance and repair requirements and equipment, inclined planes, towage systems, traffic, cargo handling facilities, characteristic vessel types, etc.; above items specified in the manuals, but combined by CRS here
Waterways, direction of flow	CRS	
Waterways, layout	CRS	alignment, junctions, etc.; above items specified in the manual, but combined by CRS here
Waterways, silting characteristics	55-8, p C-2	
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	river, canal, lake, stream, etc.; same as channel, watercourse

190

CATEGORY: Telecommunications and electric power

CATEGORY SYMBOL: II.2

FACTOR	REFERENCE	COMMENTS
Antennas, characteristics and description	CRS	type, number, pattern, dimensions, direction, single or multiple element, type of feed system, etc.; above items specified in the manual, but combined by CRS
Antennas, detection	CRS	
Antennas, electromagnetic characteristics	30-10, p 6-15 30-10, p 6-16	bandwidth capability, operating frequency, polarization, radiation pattern
Power substations, detection	CRS	
Power substations, function	30-10, p 8-7	switching, converting, and transforming
Power substations, type	30-10, p 8-7	distribution, industrial, transmission
Power transmission lines, layout	CRS	placement, location, etc.; above items specified in manual, but combined by CRS; this is a system layout; we are not trying to detect the conductors or supporting cables
Power transmission lines, towers and poles	30-10, p 8-7	type (metal, wood, or concrete)
Power transmission lines, wire and cable characteristics	30-10, p 8-7	
Powerplant, characteristics	CRS	cooling facilities, fuel type, handling and storage, capacity (range estimates only), number of hydroturbines, reactors, boilers, and/or generators; above items specified in manual, but combined by CRS here
Powerplant, detection	CRS	
Powerplant, type	30-10, p 8-7	conventional steam thermal, hydroturbine run-of-river, hydroturbine storage, internal combustion, solar, tidal, nuclear steam thermal
Telecommunications, poles	30-10, p 6-15	material, treatment, spacing, type, number of crossarms

CATEGORY: Telecommunications and electric power

CATEGORY SYMBOL: 11.2

FACTOR	REFERENCE	COMMENTS
Telecommunications, support facilities	30-10, p 6-16 31-60, p 2-2	administration, housing, security, repair shops, exchanges and offices, etc.

192<

CATEGORY: Built-up areas

CATEGORY SYMBOL: II.3

FACTOR	REFERENCE	COMMENTS
Built-up areas, classification	CRS	see specific factor in this category
Built-up areas, detection	CRS	
Built-up areas, extent	21-26, p 2-6 30-10, p 7-28	
Central heating plants, characteristics	CRS	installations, area served, type, etc.
Central heating plants, detection	30-10, p 7-28 30-20, p E-1	
Cultural centers	30-10, p 7-29	museums, libraries, theaters, etc.
Drainage, urban	CRS	storm water and snow-melt runoff
Extractive industry, capacity	CRS	range estimates only
Extractive industry, detection	CRS	
Extractive industry, facilities	CRS	buildings and equipment
Extractive industry, method of operation	30-10, p 8-15	surface (single or multiple trench), underground
Extractive industry, product	CRS	ore, gravel, crushed or cut stone, coal, oil, gas, etc.
Extractive industry, status	CRS	active or abandoned
Fire fighting facilities and equipment	30-10, p 5-51 21-26, p 10-10	number of stations, equipment, water source
Functional area	30-10, p 7-28 101-5, p G-2 30-5, p 15	military, residential, commercial, industrial, governmental
Garbage and trash facilities	30-10, p 7-29	disposal and treatment plants (location, type, capacity)

143

CATEGORY: Built-up areas

CATEGORY SYMBOL: II.3

FACTOR	REFERENCE	COMMENTS
Gas distribution facilities (urban areas)	CRS	pipelines, mains, trunks, tanks, controls, auxiliary installations, etc.
Hospitals	30-10, p 7-29	adequacy, capacity, condition, specialization
Industrial areas, detection	30-5, p B-2 101-5, p G-2	manuals request general information on location, extent, and type of industrial area; i.e., a park with buildings or a group of steel mills
Industrial buildings, characteristics	21-26, p 10-10	location, dimensions, status, capacity, etc.
Industrial buildings, detection	CRS	
Industrial waste disposal, detection	CRS	
Manufacturing plants, characteristics	CRS	facilities, product, status, etc.
Parks and recreational areas	CRS	
Police protection	30-10, p 7-29	detention and security areas, stations, equipment
Population characteristics	30-10, p 8-3	nomadic, seminomadic, permanent
Population, present	30-10, p 7-27	
Population, significant segments	30-10, p 7-27	ethnic, religious, etc.
Population trend	30-10, p 7-27	
Processing plant, characteristics	CRS	such as refineries; facilities, product, status, etc.
Religious structures	30-10, p 7-29	manual specifies churches only, but mosques, synagogues, etc., are to be included
Schools	30-10, p 7-29 21-26, p 10-10	universities, colleges, etc.

199

CATEGORY: Built-up areas

CATEGORY SYMBOL: II.3

FACTOR	REFERENCE	COMMENTS
Sewage treatment plants, characteristics	30-10, p 7-29	type, equipment, capacity, and type of collection; actually a type of processing plant, but CRS has defined processing plant as consumer oriented
Sewage treatment plants, detection	CRS	
Storage facilities, capacity	30-10, p 7-29	range estimates only
Storage facilities, commodity stored	30-10, p 7-29	
Storage facilities, type	30-10, p 7-29	vessels, warehouses, open storage, grain elevators, etc.
Streets, classification and prevailing width	30-10, p 7-29	primary, secondary, tertiary; paved, unpaved, etc., manual does not define factor; CRS has provided comments
Streets, condition	30-10, p 7-29	repairs and improvements needed
Streets, pattern	30-10, p 7-29	
Structures	30-10, p 7-28	material type, type of construction, etc.; manual predominant type of building
Water supply, pumping stations	CRS	
Water supply, storage facilities	30-10, p 7-28	type, location, capacity, condition; this factor refers to both water tanks and small, storage reservoirs, not to large reservoirs associated with dams
Water supply, treatment plants, characteristics	30-10, p 7-28	type, capacity, condition
Water supply, treatment plants, detection	CRS	

CATEGORY: Agriculture

CATEGORY SYMBOL: II.4

FACTOR	REFERENCE	COMMENTS
Agricultural areas	30-10, p 3-21 5-30, p 39	location and extent in 30-10
Agricultural production data	CRS 5-30, p 39	manual requests specific numerical data, but range estimates can be made from imagery
Agriculture, general type	101-5, p G-2	vineyards, row crops, orchards, etc.; from cultivated vegetation in the manual
Crop identification	CRS 30-10, p 3-21	specific crop, such as peaches, beans, or bananas, etc.
Cultivation	30-10, p 3-22	method, period
Harvesting	30-10, p 3-22	method, period, product, yield, distribution, and disposition; because they are unclear in the manual, we are not considering disposition and distribution
Irrigation, detection	30-10, p 3-18	inadequately defined in the manual; CRS assumes detection of systems and practices
Planting practices	30-10, p 3-22	method, period

CATEGORY: Hydraulic structures

CATEGORY SYMBOL: II.5

FACTOR	REFERENCE	COMMENTS
Dams, associated structures	30-10, p 3-19	conduits, spillways, intakes, outlets, gates, etc.
Dams, detection	CRS	
Dams, purpose	30-10, p 3-19 55-8, p C-3	power, water supply, irrigation, flood control
Dams, type	30-10, p 3-19	fixed, movable, gravity; earthfill, rockfill, concrete
Dikes and levees	30-10, p 5-33	CRS assumes manual refers to man-made levees and has added dikes to represent all types of retaining walls
Ditches	30-10, p 5-c	depth, width, lining, condition, structures (weirs, gratings, etc.) etc.
Groins	30-10, p 5-33	part of inland waterways check list along with jetties; manual wants location, function, design, and materials
Jetties	30-10, p 5-33	location, function, design, and materials
Locks, description	30-10, p 5-33 55-8, p C-3	type of gates, depth over sill, condition, etc.
Locks, detection	CRS	
Reservoirs	30-10, p 3-19	dimensions, depth, capacity, etc.; associated with dams

64  
1975

CATEGORY: Pollution

CATEGORY SYMBOL: 11.6

FACTOR	REFERENCE	COMMENTS
Effluent, chemical	CRS	
Effluent, thermal	CRS	
Oil spills	CRS	
Smog, detection	CRS	
Smoke, detection	CRS	
Water turbidity	30-10, p 3-20	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here
Water turbidity, source	CRS	man-induced erosion, acid mine drainage, etc.

148<

CATEGORY: Construction

CATEGORY SYMBOL: II.7

FACTOR	REFERENCE	COMMENTS
Construction equipment	30-10, p 5-12	location and detection; manual refers specifically to railways, but can be applied universally, and is so intended here
Construction sites, description	5-30, p 15	drainage, water supply, facilities, power, access, acreage, soil, earthwork, etc.
Construction sites, detection	30-10, p 8-15 5-30, p 15	in the manual, this is referred to as area identification and location (30-10)
Earthwork requirements	5-330, p 4-22	mass diagrams; rock and soil excavations
Foundation conditions	30-10, p 5-51	condition of material, suitability
Slope, maximum stable	30-10, p 3-13	natural or cut

CATEGORY: Construction resources

CATEGORY SYMBOL: III.1

FACTOR	REFERENCE	COMMENTS
Aggregate, source	5-330, p 7-13	
Borrow pits	5-36, p 4-10	manual refers to borrow pits in terms of availability of local materials
Developmental aspects, construction resources	30-10, p 8-15	accessibility, processing requirements, etc.
Rock, use suitability	CRS 30-10, p 3-14	degree and limiting factors of rock for binder, base course, aggregate, fill, embankments, masonry (rubble and cut stone), riprap, roofing material, subbase, untreated surfacing, etc.
Sand and gravel	30-10, p 8-15 31-60, p 2-2	location and extent of sources; unexploited sources
Soil, use suitability	CRS 30-10, p 3-13	binder, fill, embankments, unsurfaced roads, subgrade, topsoil, etc.
Stockpiled material	30-10, p 8-15	location, type, characteristics, quantity, and loading equipment
Timber, use suitability	CRS	this is an evaluation of timber resources at any given site with reference to the need at hand

CATEGORY: Site Selection

CATEGORY SYMBOL: III.2

FACTOR

REFERENCE

COMMENTS

02/11/11

151 <

CATEGORY: Map and chart revision

CATEGORY SYMBOL: III.3

FACTOR	REFERENCE	COMMENTS

152

CATEGORY: Military Aspects

CATEGORY SYMBOL: IV

FACTOR	REFERENCE	COMMENTS
Aircraft, detection	CRS	
Aircraft, identification	CRS	
Assembly areas, potential	CRS 31-60, p 2-2	
Avenues of approach	5-30, p 40 101-5, p G-2 5-36, p 1-3 30-10, p 4-2 31-60, p 2-2	
Bivouac areas, detection	5-30, p 15	air, ground, and water
Camouflage	30-5, p 9-10	this reference describes the general use of camouflage, not the need for camouflage information
Concealment, potential for	5-30, p 40 5-36, p 1-3 30-10, p 3-22 31-60, p 2-2	protection from observation
Contaminated areas (CBR)	30-5, p 3-17	CBR = chemical, biological, and/or radiological
Cover, potential	5-30, p 40 5-36, p 1-3 31-60, p 2-2	protection from fire
Critical points	30-10, p 5-12	landslides, avalanches, etc.; railways, highways, etc.; a critical point can be any item of interest and may be actual or potential
Cross country movement	5-36, p 4-1 to p 4-5 30-10, p 4-3 to p 4-16	

153

CATEGORY: Military Aspects

CATEGORY SYMBOL: IV

FACTOR	REFERENCE	COMMENTS
Damage assessment	30-5, p 3-18 5-36, p 1-6	artillery, bombs, missiles, etc.; need indicated in many places, but not specific; CRS defines this item as damage to terrain by artillery, etc.; natural damage can be evaluated by the same techniques
Defenses	5-30, p 4 5-30, p 15 30-10, p 7-22	airfields, coastal, tunnels, ports, fixed installations, etc.; actual and potential; manuals indicate need for this information; CRS has lumped the items together to include these specific items and others like them
Defilade positions	5-30, p 15	according to AR 310-25, this refers to protection from enemy observation and enfilading fire
Defoliation, susceptibility to	30-10, p 3-21	
Demolition requirements	30-10, p 5-17	bridges, towers, tunnels, silos, etc.; the initial reference is bridges only, but factor can be applied universally
Drop sites	30-10, p 3-8	potential or suitable
Enemy command posts	30-5, p 3-7	
Enemy fortifications	21-26, p 10-10 30-10, p 7-30 101-5, p G-2 30-5, p B-2	location, extent, type, camouflage, armament, design, purpose, and description
Enemy outposts	30-5, p 3-7	
Fields of fire, flat trajectory	31-60, p 2-2 30-10, p 3-22	reference refers to flat trajectory weapons from the standpoint of vegetation
Guerrilla activity	CRS 31-60, p 2-3	
Key terrain features	101-5, p G-3	according to the manual, this is defined as a locality which gives advantage to either side

154

CATEGORY: Military Aspects

CATEGORY SYMBOL: IV

FACTOR	REFERENCE	COMMENTS
Landing beaches	5-30, p 4	manual is unclear in terms of need; CRS assumes selection and assessment
Line of sight	101-5, p G-2	includes critical relief
Mechanized operations, areas suitable for	5-30, p 15	
Military installations, detection	CRS	posts, airfields, etc.
Minefields	5-36, p 2-1	
Observation points	CRS 31-60, p 2-2 31-60, p 3-20	probable
Obstacles to movement, artificial	5-30, p 15 5-36, p 4-9 101-5, p G-3 31-60, p 2-2 31-60, p 3-20	also obstructions to airlanding
Obstacles to movement, natural	5-30, p 15 5-36, p 4-9 101-5, p G-3 31-60, p 2-2 31-60, p 3-20	also includes obstructions to airlanding
Order of battle	30-5, p 4-3	units, types, sizes, name
Trafficability, terrain group and class of soil	5-36, p 4-2 5-36, p 4-5	groups A, B, and C and classes I, II, III, and IV
Troop concentrations	CRS	primarily enemy; includes reserves
Tunnels, detection	CRS	

155

CATEGORY: Military Aspects

CATEGORY SYMBOL: IV

FACTOR	REFERENCE	COMMENTS
Underground installations	30-10, p 7-29 30-10, p 7-30	type, use, construction data, cover, vulnerability, etc.
Vegetation, induced blowdown, susceptibility to	30-10, p 3-21	manual does not specify whether it means induced or natural; induced is assumed
Vehicles, detection	CRS	
Vehicles, identification	CRS	
Weapons, location of	30-5, p 5-6 31-60, p 2-2	automatic weapons, mortars, artillery, armored vehicles, antiaircraft, etc.
Withdrawal areas	30-5, p 3-11	allies and enemy
Withdrawal routes	30-5, p 3-11	allies and enemy

156 <

ALPHABETIZED EVALUATIONS

**157<**

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS * IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Aggregate, source	5-330, p 7-13	III.1		0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	+	0	+	+	+		2	
Agricultural areas	5-30, p 39 30-10, p 3-21	II.4	location and extent in 30-10	L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		2	
Agricultural production data	5-30, p 39	II.4	manual requests specific numerical data, but range estimates can be made from imagery	0	L	L	0	0	0	L	0	0	0	0	0	+	L	0	?	L	0	?	+	0	+	+	+		3	this is frequently a prediction based on inferences and linked to the ability to identify crops; computer handling of digital tapes of spectral data can be of assistance (ERTS, Purdue University, LARS, etc.)
Agriculture, general type	101-5, p G-2	II.4	vineyards, row crops, orchards, etc.; from cultivated vegetation in the manual	?	0	L	0	0	0	L	0	0	L	+	0	+	L	0	+	+	0	+	+	0	+	+	+		2	different crops can have different textural patterns and different spectral characteristics; obviously, large scale imagery can provide more pattern details than can small scale imagery; if a crop has known spectral characteristics that differ from its surrounds and other crops, then detection is possible by taking imagery in the spectral bands where these differences exist; thus the needs for multi-band, color, and color infrared photography and for density slicing and computer handling of digital tapes
Air temperature	30-5, p 2-18	I.1	this factor is abstracted from a general reference to temperature in the manual; near surface range estimates only	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	3	radiosonde or telemetry for a direct measurement; IR and microwave thermal quantitative scanners can provide inferential information about probable air temperature at the surface
Aircraft, detection	CRS	II.1 IV		0	0	0	L	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		2	
Aircraft, identification	CRS	II.1 IV		0	0	0	?	?	?	L	L	L	+	+	+	0	0	L	?	?	L	L	L	L	L	L	L		2	
Airfields, elevation	30-10, p 5-61	II.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	L	0	2	relative elevations can be obtained from stereo imagery; if the imagery contains a known elevation datum, then a good estimate can be made for the actual elevation; the laser profilometer can be used within the limits of its reference, an atmospheric pressure level
Airfields, fueling facilities	30-10, p 5-61	II.1	called petroleum and oil lubricants in the manual	0	0	0	0	0	0	?	0	L	?	0	+	0	0	0	0	0	0	0	0	?	0	+		2		
Airfields, layout	30-10, p 5-61	II.1	runways, taxiways, hardstands, parking and warm-up areas, hangars, etc.	0	0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		1		
Airfields, runway and taxiway description	30-10, p 5-61	II.1	size, design, surface, etc.; each runway and/or taxiway	0	0	0	0	0	?	0	0	?	+	0	+	C	L	+	+	?	+	0	+	+	+	+		2		
Airfields, support facilities	CRS	II.1	lighting, storage, APU's, maintenance of runways, etc., navigation and weather facilities, aircraft maintenance facilities, etc.	0	0	0	0	0	0	?	0	?	?	0	?	?	0	L	0	0	0	?	0	?	L	0	L		2	low level obliques and large scale stereo can detect certain navigation facilities

\* LANDSAT

158

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SIGNAL LEVEL	SENSOR COMMENTS	
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Airfields, type	30-10, p 5-61 30-10, p 7-28 5-36, p 4-6	II.1	civilian, military or joint; plane type	0	0	0	0	0	0	0	0	?	L	0	+	0	0	L	L	0	+	L	0	+			2	
Anchorage	30-10, p 5-33 55-8, p C-3	II.1	depth, size, clearances, berths, bottoms, etc.	0	0	0	+	+	+	L	L	L	+	L	+	+	+	+	+	+	+	+	+	+			2	depending on size, areal extent can be measured on most imagery; see comments on water depth for depth of anchorages
Antennas, characteristics and description	CBS	II.2	type, number, pattern, dimensions, direction, single or multiple element, type of feed system, etc.; above items specified in manual, but combined by CBS	0	0	0	0	0	?	?	L	?	?	L	0	0	0	?	0	?	?	?	?	L			2	limits of scale and distance/resolution
Antennas, detection	CBS	II.2		0	0	0	?	0	?	?	0	L	L	0	+	?	0	?	?	0	?	L	L	L			2	
Antennas, electromagnetic characteristics	30-10, p 6-15 30-10, p 6-16	II.2	bandwidth capability, operating frequency, polarization, radiation pattern	0	0	0	0	0	0	0	0	?	0	?	0	0	0	?	0	?	?	?	0	?			3	if the antenna pattern can be determined, then some inferences should be possible about its operating characteristics; for many antennas, this would require larger scale imagery; airborne ECM type gear can also determine some propagation characteristics
Aqueducts	55-8, p C-3	II.1	length, width, construction details, etc.	0	0	0	L	L	L	L	L	L	+	+	+	+	L	L	+	L	L	+	+	+			2	
Assembly areas, potential	CBS 31-60, p 2-2	IV		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+			2	
Avenues of approach	5-30, p 40 101-5, p G-2 5-36, p 1-3 30-10, p 4-2 31-60, p 2-2	IV	air, ground, water	0	0	?	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+			3	this generally requires the preparation of an environmental data base by image analysis and an evaluation of slope, soils, vegetation, etc.

1595

160

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m				i
Berths	55-8, p C-3	II.1	length, type, apron, alongside depth, etc.; called berthages in terms of passing basins and anchorages in manual	O	O	O	L	L	L	L	L	L	+	+	+	L	L	L	L	L	L	+	+	+		2	depth information by inference only; refer to comments on water depth
Bivouac areas, detection	5-30, p 15	IV	actual and potential	O	O	O	?	O	?	L	O	+	?	O	+	O	C	O	?	O	?	+	O	+	+	2	color, color infrared, multiband and multi-channel scanners also have application to this element
Borrow pits	5-36, p 4-10	III.1	manual refers to borrow pits in terms of availability of local materials	O	O	O	L	L	L	+	?	+	+	?	+	+	L	+	L	+	+	+	+	+		2	
Branch characteristics	CRS	I.3	habit, thorns, density, size, geometry, etc.	O	O	O	O	O	O	O	O	O	L	O	L	O	O	O	O	O	?	O	O	+		2	although not directly measurable by any practical remote sensing means, average characteristics for a known vegetation type can be inferred by knowledgeable people
Bridges, abutment characteristics	30-10, p 5-16	II.1	type, dimensions, material, etc.	O	O	O	O	O	O	O	O	O	L	L	L	O	O	O	O	O	?	?	O	L		2	
Bridges, bypasses	30-10, p 5-16 5-36, p 2-6 5-36, p 2-65	II.1	to be classified as easy, difficult and impossible; location	O	O	O	O	O	L	O	O	L	+	L	+	L	L	L	L	L	L	+	+	+		2	
Bridges, condition	30-10, p 5-16	II.1	in terms of effort required to repair damage in manual	O	O	O	L	L	L	L	L	L	+	+	+	O	O	O	L	L	L	+	+	+		2	although detection of some types of damage might be relatively easy to do, conclusions about effort and materials needed would be mostly inferential and would be based on experience and specialized knowledge
Bridges, detection	CRS	II.1		O	O	?	+	+	+	+	+	+	+	+	+	L	L	L	+	+	+	+	+	+		1	
Bridges, military load classification	30-10, p 5-16 5-36, p 3-40	II.1	load carrying capacity	O	O	O	O	O	L	O	O	L	O	O	+	O	O	L	O	O	L	O	O	+		2	inferential only; image keys will aid the novice; measurements cannot be made on a classification, but measurements must be made on the bridge itself to develop the classification
Bridges, structure type	30-10, p 5-16	II.1	number of spans, description of spans, suspension system, description of arches, intermediate support characteristics, etc.	O	O	O	L	L	L	L	L	L	+	+	+	O	O	O	L	L	L	L	L	+		2	
Bridges, use type	CRS	II.1	dummy, vehicular, foot; multiple or single use; aqueducts	O	O	O	L	L	L	L	L	+	+	+	+	L	L	L	L	L	L	L	L	+		2	
Built-up areas, classification	CRS	II.3	see specific factor in this category	O	O	O	L	L	L	L	L	L	+	+	+	L	L	L	L	L	L	+	+	+		3	
Built-up areas, detection	CRS	II.3		L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		1	
Built-up areas, extent	21-26, p 2-6 30-10, p 7-28	II.3		L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		1	
Burned areas	30-20, 11-2 30-10, p 3-22	I.3	degree and extent of past burn-off	O	O	O	?	?	?	?	?	?	L	L	+	L	L	+	L	L	+	+	+	+		2	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				d	m	i
Cableways, description	30-10, p 5-21 31-60, p 2-3	II.1	capacity, length, carriage data base stations, maintenance, power, etc., in terms of check list, p 5-21,22	0	0	0	?	?	L	?	?	L	+	+	+	?	?	?	L	L	L	L	L	L	L	L	L		2	
Cableways, detection	CRS	II.1		0	0	0	L	O	L	+	+	+	+	+	+	L	O	L	L	L	L	L	L	L	+	O	+		2	limited by scale, acutance/resolution, and brightness contrast
Cableways, uses	30-10, p 5-21	II.1		0	0	0	O	O	L	O	O	L	O	O	L	O	O	L	O	O	L	O	O	L	O	O	+		2	
Camouflage	30-5, p 9-10	IV	this reference describes briefly the general use of camouflage, not the need for camouflage information	0	0	0	L	O	L	L	O	L	L	O	L	L	O	L	O	O	O	O	O	O	L	O	L	+	3	remote sensing techniques can be used in two ways 1) to evaluate a given piece of terrain to determine general type required and 2) to attempt to detect camouflage in place; CRS has arbitrarily defined camouflage in terms of detection; no one system or combination of systems is adequate; the camouflage must have a different electrical property in some part of the spectrum, or induce such a change at the site; color, false color, multichannel, etc. all have application
Caves, detection	CRS	I.6		0	0	0	O	O	O	L	O	L	L	O	L	?	O	L	?	O	L	L	O	L	L	L	L	3	direct photo detection is limited to line of sight for a cave opening; inferential procedures depend on an analysis of soils, rocks, rock fracture patterns, and drainage patterns; thermal detection is possible once the breathing cycle is worked out; the results are influenced by atmospheric pressure changes and wind; ground based acoustical methods have been tried, but with indifferent results	
Central heating plants, characteristics	CRS	II.3	installation, area served, type, etc.	0	0	0	O	O	L	O	L	O	L	O	+	O	O	?	O	L	L	O	+			2				
Central heating plants, detection	30-10, p 7-28 30-20, p E-1	II.3		0	0	0	+	O	+	+	+	+	+	+	+	L	O	L	L	O	L	+	O	+		2				
Clearances, horizontal and vertical	30-10, p 5-11 30-10, p 5-16	II.1	limits to 0.1 m on p 5-16	0	0	0	O	O	L	L	L	+	+	+	+	L	L	L	L	L	L	+	+	+		2	without stereo imagery vertical measurements are severely limited, although some inferences can be made from shadows, etc.			

161

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Climate	101-5, p G-2	I.1	the reference asks for general climate and weather information as part of a general description of an area; some of these considerations can be deduced from imagery and it is in this sense the item is evaluated	0	0		L	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+	0	0	+	0	0		3	can deduce general characteristics of the climate, i.e., amount and time distribution of precipitation; arctic, temperate, humid, arid, etc.
Clouds	5-36, p 1-3 30-5, p 2-18	I.1	the manual discusses clouds in terms of the effect on operations	+	L	0	+	L	L	0	0	0	+	L	L	0	0	0	+	+	L	L	0	0		2	remote sensing is of limited use for tactical considerations; can study clouds directly (pattern, development, cycle, etc.) and the associations of patterns with terrain and meteorological conditions; clouds are evaluated in these terms			
Concealment, potential for	5-30, p 40 5-36, p 1-3 30-10, p 3-24 31-67, p 2-2	IV	protection from observation	0	0	?	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+		2				
Construction equipment	30-10, p 5-12	II.7	detection and location; manual refers specifically to railways, but factor can be applied universally, and is so intended	0	0	0	0	0	0	L	0	L	+	0	+	0	0	0	0	0	0	L	0	L		2				
Construction sites, description	5-30, p 15	II.7	drainage, water supply, acreage, earthwork, power, access, soil, facilities, etc.	0	0	0	L	L	L	L	L	L	L	L	L	?	L	L	L	L	L	+	+	+		2				
Construction sites, detection	30-10, p 8-15 5-30, p 15	II.7	in the manual this is referred to as area identification and location (30-10)	0	0	0	L	0	L	+	0	+	+	0	+	L	0	L	+	0	+	+	0	+		2				
Contaminated areas (CBR)	30-5, p 3-17	IV	CBR = chemical, biological and/or radiological	0	0	0	0	0	0	?	0	?	?	0	?	0	0	0	?	0	?	?	0	?	L	2	same conditions apply here as under camouflage; in addition, atmospheric samplers, scintillation counters, etc., can provide information			
Cover, potential	5-30, p 40 5-36, p 1-3 31-60, p 2-2	IV	protection from fire	0	0	0	0	0	L	0	0	?	?	0	L	0	0	?	?	0	L	L	0	+		2				
Crevasse detection	CRS	I.5		0	0	0	L	0	L	+	0	+	L	0	L	L	0	L	L	0	L	L	0	L	+	3	photo imagery is limited to proper snow conditions; thermal restricted to atmospheric pressure and wind conditions; monochrome radar of use when snow is dry			

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS							
				d	m	i	d	m	i	d	m	i	d	m	i	d	m				i	d	m	i			
Critical points	30-10, p 3-12	IV	landslides, avalanches, etc.; railways, highways, etc.; a critical point can be any item of interest and may be actual or potential	0	0	L	L	L	L	L	L	L	L	L	L	L	L	L	3	some artificial points are so obvious that detection is simple and direct; other critical points could be designated only by inferential procedures and a high degree of skill							
Crop identification	30-10, p 3-21	II.4	specific crop, such as peaches, beans, or bananas, etc.	0	0	0	0	0	0	0	?	L	0	L	?	0	L	L	0	L	3	ERTS and equivalent imagery have the disadvantage of very small scale; for each band there are a number of brightness levels and this provides the basis for some level of spectral identification; color, multiband, multichannel scanners, etc., can also provide, or help provide, this information; inference based on texture and pattern are limited. Of most use to the analyst are knowledge of local agricultural practices and crop calendars					
Cross country movement	5-36, p 4-1 to p 4-5 30-10, p 4-3 to p 4-16	IV		0	0	L	0	0	L	L	L	L	L	L	L	L	L	L	+	+	+	+	3	regional information such as mountain masses, valleys, etc., can be inferred from ERTS-type imagery, and thus may have application to COM if compatible with the specific problem			
Cultivation	30-10, p 3-22	II.4	method, period	0	0	0	0	0	L	0	0	L	L	0	+	0	0	L	?	0	?	L	0	+	2	any time dependent factor such as period requires sequential imagery and knowledge of local cultural practices	
Cultural centers	30-10, p 7-29	II.3	museums, theaters, libraries, etc.	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	0	0	L	0	L	2	
Culverts, detection	5-36, p 2-70 5-330, p 6-41	II.1	5-330 defines culvert as a short bridge, but CBS is using culvert as defined in 5-36, an underground passage for water	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	0	0	0	L	0	0	L	2	
Currents	30-10, p 3-18 55-8, p C-3	I.4	tidal, littoral, stream, oceanic, undertows, etc.	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	?	0	0	L	?	2	directly observed if flow marks are visible; also possible with stereo time-lapse imagery where apparent relief is proportional to displacement	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Damage assessment	5-36, p 1-6 30-5, p 3-18	IV	artillery, bombs, missiles, etc.; need indicated in many places but not specific; CRS defines this item as damage to terrain by artillery, etc.; natural damage can be evaluated by the same techniques	0	0	0	L	0	L	L	L	L	L	+	+	+	L	L	L	+	L	+	+	+	+		2	
Dams, associated structures	30-10, p 3-19	II.5	conduits, spillways, outlets, intakes, gates, etc.	0	0	0	L	L	L	+	+	+	+	+	+	+	L	L	L	?	?	L	+	+	+	2		
Dams, detection	CRS	II.5		L	0	L	+	0	+	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0		2	can detect directly within scale limits, or infer its presence because of the shape of an impounded water body and its relation to the terrain; satellite imagery, such as ERTS, is quite limited in terms of manual procedures; however, if digital data and computer techniques can be used, then a credible job can be done	
Dams, purpose	30-10, p 3-19 55-8, p C-3	II.5	power, water supply, irrigation, flood control	0	0	L	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+		3		
Dams, type	30-10, p 3-19	II.5	fixed, movable, gravity, etc.; earthfill, rockfill, concrete, etc.	0	0	0	?	0	L	?	0	L	+	0	+	L	0	L	L	0	L	+	0	+		2		
Defenses	5-30, p 4 5-30, p 15 30-10, p 7-22	IV	airfields, coastal, tunnels, ports, fixed installations, etc.; manuals indicate need for this information; CRS has lumped the items together to include these specific items and others like them	0	0	0	?	0	L	L	0	L	+	0	+	?	0	L	?	0	?	L	0	L		2		
Defilade positions	5-30, p 15	IV	according to AR 310-25, this refers to protection from enfilading fire and enemy observation	0	0	0	0	0	L	0	0	0	L	0	L	L	0	L	+	0	+	+	0	+		3	inferential only, and very limited without stereo; many such positions can be readily determined from imagery; other conditions would require a careful evaluation of materials, landform, slope, vegetation, etc.; this latter procedure is more inferential and demands higher levels of skill as well as diverse skills	
Defoliation, susceptibility to	30-10, p 3-21	IV		0	0	0	0	0	0	0	0	0	?	0	L	?	0	L	?	0	?	?	?	0	+	3	species susceptibility can be modified by water balance, presence or absence of certain elements, etc.; thus soil type, mineral content, soil/water relations, slopes, locations, etc. must be evaluated, making this an inferential type task and requiring diverse knowledge and skills	
Demolition requirements	30-10, p 5-17	IV	bridges, tunnels, towers, silos, etc.; the initial reference is bridges only, but factor can be applied universally	0	0	0	0	0	0	0	0	?	0	0	+	0	0	0	0	0	?	0	0	+		2	inferential only	

164

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER	SMALL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				d	m	i
Developmental aspects, construction resources	30-10, p 8-15	III.1	accessibility, processing requirements, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	
Dikes and levees	30-10, p 5-33	II.5	CRS assumes manual refers to man-made levees and has added dikes to represent all types of retaining walls	0	0	0	L	L	L	L	L	L	+	L	+	L	L	L	+	+	+	+	+	+	+	+	+		2	
Dispersal and storage areas, detection	30-10, p 4-18	IV	actual and potential; all types of dumps	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+		2	
Ditches	30-10, p 5-6	II.5	depth, width, lining, condition structures (weirs, gratings, etc.), etc.	0	0	0	0	0	0	L	L	L	+	L	+	L	L	L	?	?	?	+	L	+		2				
Drainage basin, characteristics	30-10, p 3-18	I.4	area, slope, shape; same as watershed	L	L	L	L	L	L	L	L	L	?	?	?	L	L	L	+	+	+	+	+	+	+	+	+	2	any one of these systems can give some information about the various items, but a drainage basin is a regional feature and so regional coverage is required	
Drainage pattern	30-10, p 3-16	I.4	annular, dendritic, rectangular trellis, parallel, radial; internal, interrupted, etc.	L	0	L	L	0	L	L	0	L	0	0	0	L	0	L	+	0	+	+	0	+	+	0	+		2	
Drainage, urban	CRS	II.3	storm water and snow-melt run-off	0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	?	0	?	+	0	+		2				
Drop sites	30-10, p 3-8	IV	potential or suitable	0	0	0	0	0	L	L	0	L	L	0	L	L	0	L	L	0	L	+	+	+	+	+	+		2	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Earthwork requirements	5-330, p 4-22	II.7	mass diagrams; soil and rock excavation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	L	+	+	+	L	2	the laser terrain profiler is applicable here
Effluent, chemical	CBS	II.6		0	0	0	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	2	color, color infrared, multiband and multi-channel scanners have definite application; the user must have knowledge of spectral differences between effluent and background in order to select the proper tool
Effluent, chemical	CBS	II.6		0	0	0	0	0	0	+	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	2	
Enemy command posts	30-5, p 3-7	IV		0	0	0	0	0	0	?	0	L	?	0	L	0	0	0	?	0	?	?	0	L				L	2	
Enemy fortifications	21-26, p 10-10 30-10, p 7-30 101-5, p G-2 30-5, p B-2	IV	location, extent, type, purpose, camouflage, armament, design, and description	0	0	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	?	?	?	L	L	L		3	depending on other factors (camouflage, type, location, etc., spectral differences, magnetic differences, etc.), other sources must also be considered, e.g., color, false color, magnetometry, multiband, etc.
Enemy outposts	30-5, p 3-7	IV		0	0	0	0	0	0	?	0	?	?	0	?	0	0	0	0	0	0	G	?	0	?	?	?	L	2	
Expansion potential	CBS	II.1	airfields, ports, harbors, railroads, etc.; manual refers to ports and harbors, but this factor is applicable to all transportation development and is therefore used in the latter sense here	0	0	?	L	L	L	0	0	0	L	L	L	L	L	L	L	L	L	+	+	+	+	+	+	L	3	most of the information needed for this item is inferential in nature and rests on the proper evaluations of soils, mantle depth, rocks, drainage, subsurface conditions, landform, etc.
Extractive industry, capacity	CBS	II.3	range estimates only	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	?	0	0	+	+	+	L	3	
Extractive industry, detection	CBS	II.3		?	0	?	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	L	2	
Extractive industry, facilities	CBS	II.3	buildings and equipment	0	0	0	L	0	L	L	L	L	+	+	+	L	L	L	L	L	L	+	+	+	+	+	+	L	2	
Extractive industry, method of operation	CBS	II.3	surface (single or multiple trench), underground	0	0	0	?	0	?	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	L	2	
Extractive industry, product	CBS	II.3	ore, gravel, crushed or cut stone, oil, coal, gas, etc.	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	L	0	L	+	0	+	+	0	+	L	2	
Extractive industry, status	CBS	II.3	active or abandoned	0	0	0	0	0	0	L	0	L	L	0	+	0	0	L	?	0	L	L	0	L	L	0	L	L	2	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Ferries, description	31-60, p 2-2 30-10, p 5-20	II.1	crossing time, type, hazards, routes, traffic, propulsion method	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	0	?	0	?	L	0	L		2	
Ferries, detection	CRS	II.1	this includes ferry terminals	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L		2	
Fields, of fire, flat trajectory	30-10, p 3-22 31-60, p 2-2	IV	reference refers to flat trajectory weapons from the standpoint of vegetation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	?	L	0	L	L	0	L		2	
Fire fighting facilities and equipment	30-10, p 5-51 21-26, p 10-10	II.3	number of stations, equipment, water source	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	0	?	L	0	L	L	0	L		2	
Flooding, characteristics	30-10, p 3-18 30-10, p 5-34	I.4	affects, cause, duration, frequency, and type (tidal, snow melt, direct runoff, etc.)	0	0	0	L	L	L	L	L	L	+	+	+	0	0	0	+	+	+	+	+	+	+	+	+		3	much of this rests on inferences; information about duration would require sequential imagery; the affects of flooding can be evaluated only with reference to a given problem
Flooding, extent	31-60, p 2-2 30-10, p 3-18 30-10, p 5-34	I.4		L	L	0	+	+	+	+	+	+	+	+	+	0	0	0	+	+	+	+	+	+	+	+	+		2	must either catch the high water boundary or high line mark or damage after water recedes; color and color IR are useful here
Flooding, potential	CRS	I.4		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+		3	
Folding	30-10, p 3-14 5-32, p 4	I.6	anticlines, synclines, etc.	L	0	L	+	0	+	L	0	L	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+		3	detecting the presence of folds is not as difficult as determining their type (anticline, syncline); if the fold is weathered down, the bedding planes may be visible, but even so, dip and strike can be difficult to work out
Fords, approaches	30-10, p 5-21	II.1	width, condition, and length	0	0	0	0	0	L	0	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+		2	
Fords, description	30-10, p 5-21 31-60, p 2-2	II.1	banks, load class, bottoms, by-passes, hazards, etc.	0	0	0	0	0	0	?	0	L	L	0	L	L	0	L	L	0	L	+	0	+	+	0	+		2	
Fords, detection	5-30, p 15 5-36, p 2-1	II.1		0	0	0	0	0	L	L	0	L	+	0	+	L	0	L	L	0	L	+	0	+	+	0	+		2	
Forest, type	30-10, p 3-20	I.3	the manual is not specific on needs, but they do want to know type; conifers, deciduous, mixed, mixed hardwoods, etc.	?	?	?	0	0	L	L	0	L	+	0	+	L	0	L	?	0	L	+	0	+	+	0	+		2	inferential; photo or image keys will help the novice
Forest fire, detection	30-5, p B-5 30-20, p 11-3	I.2		0	0	L	0	0	0	+	+	+	L	0	L	0	0	L	L	0	?	L	0	+	+	0	+		2	thermal imagery or radiometry detects heat output directly; the 4.5-5.5 band is preferable; other images rely on recording smoke, brightness of the flames, or damaging action; atmospheric samplers might pick up combustion products; thermal images do better at detecting fire boundaries through smoke.
Forest fires, susceptibility to	30-10, p 3-22	I.3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	?	?	0	?	?	0	?		3	inferential only; will need auxiliary information such as dryness, ground conditions, etc.
Fossil fuel sources	30-10, p 8-8	I.6	oil, coal and gas	0	0	?	L	0	L	0	0	0	0	0	0	0	0	0	L	0	L	L	0	L	L	0	L		3	although shales and coal beds can sometimes be determined rather directly from the image, this factor relies more on inference than direct observation

167

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1 100 000			STEREO VERTICAL 1 20 000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Foundation conditions	20-10, p 5-51	II.7	condition of material, suitability	0	0	0	0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	3	
Fractures, characteristics	30-10, p 3-14	I.6	dip, displacement, pattern, size, shape, spacing, etc.	0	0	L	0	0	L	0	0	0	0	0	0	L	0	0	0	+	+	+	+	+	+	+	+		3	fractures are so numerous and are present in so many sizes and degree of exposure that imagery of scales ranging from satellites to microscopes provide the basis for mapping at least some level of the fracture pattern; many fractures are readily apparent and easily mapped, but others are difficult to trace with certainty and require considerable effort, time, and careful evaluation
Fractures, detection	CBS	I.6		+	0	+	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		2	
Fractures, type	30-10, p 3-14	I.6	fault (reverse, thrust, etc.), joint	0	0	L	0	0	L	0	0	?	0	0	L	0	0	L	0	0	L	0	0	L	L	0	+		3	
Functional area	30-10, p 7-28 101-5, p G-2 30-5, p 15	II.3	military, residential, commercial, industrial, governmental	0	0	0	L	0	L	L	0	L	+	0	+	L	0	+	L	0	+	L	0	+	L	0	+		2	frequently inferential

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i			
Garbage and trash facilities	30-10, p 7-29	II.3	treatment and disposal plants (location, type, and capacity)	0	0	0	0	0	0	?	0	?	L	0	L	0	0	0	?	0	?	L	0	L		2	Detection and location are possible; the determination of type and capacity, if possible, can only be done by inference
Gas distribution facilities (urban area)	CRS	II.3	pipelines, mains, trunks, controls, auxiliary installations	0	0	0	0	0	0	?	0	?	?	0	?	0	0	0	0	0	0	?	0	?		3	Buried pipelines can sometimes be detected on photography and thermal infrared imagery.
Glaciers, extent	CRS	I.5		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		1	
Glaciers, thickness	CRS	I.5		0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	2	Radio ice sounding "techniques" usually operate in the 35-100 MHz range (35 MHz preferred for greater depth); are airborne and can profile the ice/rock interface through some 3000 m of ice; for temperate or warm glaciers, the useful distance is greatly decreased.
Grasslands, type	CRS	I.3	savannahs, prairies, meadows, etc.	0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	?	0	+	?	0	+		2	Inferential; image keys can help the novice.
Groins	30-10, p 5-33	II.5	part of inland waterway check list along with jetties; manual wants location, function, design, and materials	0	0	0	L	0	L	+	0	L	+	0	+	L	0	L	+	0	+	+	0	+		2	Information about location is feasible with any imagery; information about design, materials and function is mostly inferential.
Ground water	5-332, p 11 30-10, p 3-20	I.4	amount, flow, temperature, etc.; also see water table	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	?	0	0	?		3	
Guerrilla activity	CRS 31-40, p 2-3	IV	campsites, fires, trails, cleared areas	0	0	0	0	0	0	L	0	L	L	0	L	0	0	L	0	0	L	L	0	L		3	Detection is possible under limited conditions; in most instances, inference only can be made; sequential (time separation) imagery is essential.

169

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SIGNAL LEVEL	SENSOR COMMENTS		
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Harbors, approaches and entrances	30-10, p 5-50	II.1	location, width, depth	0	0	0	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	2	location and dimensional information can be acquired from any imagery with scale limit; depth, at best, is an inference; see water depth
Harbors, description	30-10, p 5-50 55-8, p C-3	II.1	divisions, depth, fairways, maintenance, protective works, turning basins, types, etc.	0	0	0	L	L	L	L	L	L	+	L	+	L	0	L	L	L	L	L	L	L	+		2	depth information by inference only; see water depth	
Harbors, detection	CNS	II.1		L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+		2		
Harvesting	30-10, p 3-22	II.4	method, period, product, yield, disposition and distribution; because they are unclear in the manual, we are not considering disposition and distribution	0	0	0	?	0	L	L	0	L	+	0	+	L	0	L	L	0	L	+	0	+	+		2		
Hospitals	30-10, p 7-29	II.3	adequacy, capacity, condition, specialization	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L	0	0	L	2		

120<

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS		
				d	m	i	d	m	i	d	m	i	d	m	i	d	m				i	d
Ice, bearing capacity	CRS	I.5		0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	2	inferred estimate based on pattern analysis; supplemental information such as ice thickness and temperature is of great help in making this estimate	
Ice temperature	5-330, p 13-22	I.5		0	0	0	0	0	0	+	+	0	0	0	0	0	0	0	0	+	1	quantitative scanner should be used; wind, overcast, etc. influence these results; microwave thermal also has some application
Ice thickness, fresh water	CRS	I.5	non-glacial ice only	0	0	0	+	+	+	L	0	L	0	0	L	0	0	L	+	2	inferential information can be derived from pattern analysis as long as the ice pattern itself is visible; thus snow cover is a handicap to visual and photo analysis, as is wind for thermal imagery; the monocycle radar system, operating with a 2.5 nanosec. pulse (500 MHz bandpass), provides a direct measurement	
Ice thickness, salt water	CRS	I.5	non-glacial ice only	0	0	0	L	L	+	0	0	L	0	0	L	0	0	L	+	3	primarily inferential based on pattern analysis; the monocycle radar and other pulsed systems have potential to measure the thickness, but there are too many influencing factors to make it practically reliable as yet	
Ice type	5-330, p 13-23	I.5	river, fresh, sea, young, pack	0	0	L	+	0	+	L	0	L	L	0	L	L	0	L	3	inferential; image keys of help to novice; ERTS or equivalent imagery has the advantage of extensive regional coverage, but is restricted to fewer ice types; large scale imagery has the advantage of pinpointing boundaries and identifying more types; however, it suffers from restricted areal coverage; thermal imagery is limited in that it is influenced by wind and other meteorological factors		
Icings, type	5-330, p 6-76 5-330, p 6-77	I.5	coastal, ground, river, spring; coastal and river icing can be evaluated in ice type, above	0	0	0	L	0	L	+	0	+	L	0	L	0	0	L	2	inferential; based on pattern analysis and terrain conditions		
Industrial areas, detection	30-5, p B-2 101-5, p G-2	II.3	manuals request general information on location, extent, and type of industrial area; i.e., a park with buildings or a group of steel mills	0	0	?	L	0	L	+	0	+	+	0	+	+	0	+	2			
Industrial buildings, characteristics	21-26, p 10-10	II.3	location, dimensions, capacity, status	0	0	0	?	0	L	L	0	L	+	0	+	0	0	?	2			
Industrial buildings, detection	CRS	II.3		0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	+	2		
Industrial waste disposal, detection	CRS	II.3		0	0	0	0	0	0	L	L	L	L	0	0	0	0	?	1	2	color, EIR, multiband of help as a function of known spectral differences	
Irrigation, detection	30-10, p 3-18	II.4	inadequately defined in manual. CRS assumes detection of systems and practices	0	L	?	0	L	L	0	+	L	0	+	L	0	L	0	+	2		

171c

1724

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVE OBL.			STD PHOTO INDEX			STEREO 1 100.000			STEREO VERTICAL 1 20.000			OTHER	SKILL LEVEL	SENSOR COMMENTS		
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Jetties	30-10, p 5-33	II.5	location, function, design, and materials	0	0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	2	information about location is feasible with any imagery; information about design, function and materials is mostly inferential

173<

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Key terrain features	101-5, p G-3	IV	According to the manual, this is defined as a locality which gives advantage to either side	0	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	+	0	+	+	0	+		3	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Landforms, general type	30-10, p 3-2	I.2	plains, mountains, hills, escarpments, and depressions	L	0	L	L	0	+	?	0	L	L	0	+	L	0	+	+	+	+	+	+	+	+	+	+		2	although the various types can be directly observed in stereo photography, their classification requires background knowledge; without stereo imagery, the types can only be inferred
Landforms, specific type	CBS	I.2	bars, kames, ridges, moraines, etc.	0	0	0	L	0	+	?	0	L	L	0	L	L	0	L	+	+	+	+	+	+	+	+	+		3	same comments apply as above
Landing beaches	5-30, p 4	IV	the manual is unclear in terms of need; CBS assumes selection and assessment	0	0	0	0	0	L	0	0	0	0	0	+	0	0	L	0	L	L	0	+	+	+	+	+		3	
Leaf characteristics	30-10, p 3-21	I.3	color, density, seasonal variation, type, etc.	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	?	?	?	?		3	inferential only for given vegetation type or a type characteristic
Line of sight	101-5, p G-2	IV	includes critical relief	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	?	?	+	L	+	+	+	+		3	
Litter characteristics	30-10, p 3-22	I.3	type, depth, etc.	0	0	0	0	0	0	0	0	?	0	0	L	0	0	?	0	0	L	0	0	L	0	0	L		3	inferential only
Locks, description	30-10, p 5-33 55-8, p C-3	II.5	type of gates, depth over sill, condition, etc.	0	0	0	0	0	0	L	0	L	L	0	+	0	0	L	?	0	?	L	0	L	0	0	L		2	
Locks, detection	CBS	II.5		0	0	0	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		2	

17A

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER SENS. LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Manufacturing plants, characteristics	CRS	II.3	facilities, product, status, etc.	0	C	0	?	0	?	?	0	?	L	0	+	?	0	?	?	0	?	?	0	?	L	0	+	2	
Mass movement features, detection	CRS	I.2	landslides, mudslides, rock falls, talus slopes, etc.	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	L	0	+	+	0	+	+	0	+	2	if the event has occurred, telltale clues or marks can be detected if compatible with the imagery scale
Mass movement features, potential	CRS	I.2		0	0	0	0	0	?	0	0	L	0	0	?	L	0	0	?	0	0	L	0	0	+	0	+	3	
Mass transit system	30-10, p 7-29	II.1	maintenance, equipment, capacity, type, terminals, etc.; manual lists as public transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	detection, identification, and mapping of layout is straight forward within scale limitations; information about specific characteristics is mostly inferential; this is detection of a system, but determining whether it is part of a public transportation system is beyond the scope of remote sensing
Mechanized operations, areas suitable for	3-30, p 15	IV		0	0	0	0	0	?	0	0	?	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	2	
Military installations, detection	CRS	IV	posts, airfields, etc.	0	0	?	L	0	L	L	0	L	+	0	+	L	0	L	L	0	+	+	0	+	+	0	+	2	
Minefields	5-36, p 2-1	IV		0	0	0	0	0	?	0	L	?	0	?	?	0	0	0	0	0	0	0	0	?	0	?	L	2	other applicable sensors include color, false color, multichannel scanners, magnetometers, etc.

1756

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	r	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				d	m	i
Navigation aids	55-8, p C-3	II.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	

176<

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i			d	m	i
Observation points	31-60, p 2-2 31-60, p 3-20	IV	probable	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Obstacles to movement, artificial	31-60, p 2-2 31-60, p 3-20 5-30, p 15 5-36, p 4-9 101-5, p G-3	IV	also obstructions to air landing	0	0	0	?	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Obstacles to movement, natural	31-60, p 2-2 31-60, p 3-20 5-30, p 15 5-36, p 4-9 101-5, p G-3	IV	also includes obstructions to air landing	0	0	?	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	+	2	
Oil spills	CRS	II.6	on water; extent	0	0	0	0	?	?	L	L	L	L	L	L	L	0	0	0	L	+	L	L	+	L		2	color, multiband, and multichannel scanners have application to this factor as well as comparative photography (UV or blue and non-filtered); sun angle is important	
Order of battle	30-5, p 4-3	IV	unit type, sizes, names	0	0	0	C	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	2	names of units are not obtainable by remote sensing techniques	

1775

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS		
				d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m
Parks and recreational areas	CBS	II.3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	3	scale dependent; e.g., Yellowstone Park vs. a small riverside park; primarily inferential and difficult to separate from natural areas		
Permanently frozen material, detection	CBS	I.5	including permafrost, active zone	0	0	0	0	0	0	0	0	+	+	+	+	+	+	+	3	a system such as E-Phase is also applicable		
Permeability	30-10, p 3-13	I.4	part of soil-rock check list/internal drainage; estimates only	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	3			
Pipelines, characteristics	30-10, p 3-23	II.1	type, size, condition, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	some surficial disturbance such as clearing, moisture, and vegetation change, etc., of a thermal surface pattern must be present for detection and description		
Pipelines, detection	CBS	II.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Pipelines, leaks	CBS	II.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	if leaks are of non-gaseous materials, then color, color infrared, multiband, thermal, etc. have at least some basis for detection; if the leak is gaseous, these techniques are not applicable, unless the gas has caused vegetation damage, etc.			
Pipelines, pumping stations	30-10, p 5-26	II.1	location, function, type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Pipelines, pumping stations, detection	30-10, p 5-26	II.1		0	0	0	0	0	0	0	0	+	+	0	0	0	0	2				
Planting practices	30-10, p 3-22	II.4	method, period	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	need sequential imagery for period			
Police protection	30-10, p 7-29	II.3	detection and security areas, stations, equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Population characteristics	30-10, p 8-3	II.3	nomadic, seminomadic, permanent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Population present	30-10, p 7-27	II.3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	inferential only (estimate)			
Population, significant segments	30-10, p 7-27	II.3	ethnic, religious, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Population trend	30-10, p 7-27	II.3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	requires sequential imagery with some reasonable time span			
Porosity	30-10, p 3-14	I.5	part of soil-rock check list/internal drainage in manual	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3				
Ports, cargo handling facilities	5-30, p 15	II.1	miscellaneous cranes, wharves, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Ports, description	30-10, p 5-50	II.1	condition, obstructions, operating data, relative capacity (CBS), etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3				
Ports, principal activity	30-10, p 5-50	II.1	passenger, cargo, fishing, recreation, military, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				
Ports, shipbuilding and repair facilities	30-10, p 5-50	II.1	dry docks, cranes, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				

179 > 621

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS						
				d	m	d	m	d	m	d	m	d	m	d	m	d	m			d	m				
Power substations, detection	CRS	II.2		0	0	0	0	L	L	0	L	+	0	+	L	0	L	L	0	+	+	2			
Power substations, function	30-10, p 8-7	II.2	switching, converting, and transforming	0	0	0	0	0	0	0	?	0	0	?	0	0	?	0	0	?	0	?	2		
Power substations, type	30-10, p 8-7	II.2	distribution, transmission, industrial	0	0	0	0	?	0	0	?	0	0	?	0	0	?	0	0	?	0	?	2		
Power transmission lines, layout	CRS	II.2	placement, location, etc.; these items are specified in the manual, but were combined by CRS; this is a system layout, we are not trying to detect the conductors or supporting cables	0	0	0	L	L	L	L	L	+	L	+	L	L	L	L	L	L	L	+	2		
Power transmission lines, towers and poles	30-10, p 8-7	II.2	type (metal, wood, concrete)	0	0	0	?	0	L	?	0	L	+	0	+	?	0	?	?	0	?	L	0	L	2
Power transmission lines, wire and cable characteristics	30-10, p 8-7	II.2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power plants, characteristics	CRS	II.2	cooling facilities, fuel type, handling, and storage, number of hydroturbines, engines, reactors boilers, and/or generators, capacity (range estimates only); above items specified in manual, but were combined by CRS to form this factor	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	2
Power plants, detection	CRS	II.2		0	0	0	+	0	+	+	0	+	+	0	+	L	0	L	L	0	+	+	0	+	2
Power plants, type	30-10, p 8-7	II.2	conventional steam thermal, hydroturbine storage, hydroturbine run-of-river, internal combustion thermal, nuclear steam thermal, solar, tidal	0	0	0	L	0	L	L	0	L	L	0	+	?	0	L	L	0	L	L	0	+	2
Precipitation	30-5, p 2-17 5-36, p 1-3	I.1		0	0	0	?	0	L	0	0	0	?	0	L	0	0	0	0	0	0	0	0	+	2
Processing plant, characteristics	CRS	II.3	such as refineries; facilities, product, status, etc.	0	0	0	?	0	L	?	0	L	L	0	L	?	0	L	?	0	L	?	0	L	2

airborne and ground based weather radars

radar restricted to metal towers

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1 100 000			STEREO VERTICAL 1 20 000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	.	d	m	.	d	m	.	d	m	.	d	m	.	d	m	.	d	m	.				d	m	.
Railways, description and characteristics	CRS	II.1	sections in need of repair, propulsion method, rolling stock, service facilities, tracks, signals and control features, etc.; the above items are specified in the manual, but were combined by CRS to form this factor	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		2	
Railways, detection	CRS	II.1		0	0	0	L	0	+	L	0	+	+	0	+	L	0	+	L	0	+	+	0	+	+	0	+		1	
Railways, grade	30-10, p 5-11	II.1	manual wants maximum grade in terms of location and direction of travel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	
Railways, layout	CRS	II.1	crossovers, mainline junctions, curvature, underpasses, length, etc.; above items are specified in manual but were combined to form layout by CRS	0	0	0	L	L	+	L	L	+	L	?	L	L	L	+	+	+	+	+	+	+	+	+	+		1	
Relief, topographic	21-26, p 2-5 101-5, p G-2 5-36, p 4-3 30-10, p 3-8	I.2		0	0	0	L	L	L	0	0	L	L	L	L	0	0	L	+	+	+	+	+	+	+	+	+		2	stereo radar and photography provide direct relief information within scale limitations; without stereo, relief can only be inferred; the laser profilometer also provides a means, but the results can be influenced by surface properties
Religious structures	30-10, p 7-29	II.3	manual specifies churches only, but mosques, synagogues, etc. are to be included	0	0	0	0	0	0	0	0	0	0	0	L	0	+	0	0	0	0	L	0	L	L	0	+		2	
Reservoirs	30-10, p 3-19	II.5	dimensions, width, capacity, etc. associated with dams	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		1	
Ridge pattern	30-10, p 3-8	I.2	orientation, skyline; can also aid in differentiating lithologic units	L	0	L	L	0	L	0	0	L	L	0	L	0	0	L	+	+	+	+	+	+	+	+	+		2	can be obtained only from stereo imagery; skyline information is possible from non-stereo low-level obliques
Roads, characteristics	CRS	II.1	curvature, number of lanes, limiting characteristics, construction materials, length, width, obstructions, etc.; above items specified in manual, but combined here by CRS	0	0	0	0	L	L	0	L	L	L	L	+	0	L	L	L	L	L	L	L	L	L	L	L		2	
Roads, grade	21-26, p 10-10 5-36, p 2-5	II.1	an obstruction to movement if 7% or greater	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	L	L	+	L	+	+	+	+	+		2	
Roads, layout	CRS	II.1	junctions, pattern, etc.	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+		1	
Roads, military load classification	5-36, p 2-4	II.1	bearing capacity; a load capacity rating system as defined in the manual	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	?	0	0	?	0	0	L		3		

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1 100,000		STEREO VERTICAL 1 20 000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
				d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
Rock color	5-545, p 72 30-10, p 3-14	I.6		0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	2	color films, multiband black and white, multichannel scanners, spectrophotometers, etc., are of use; since rock types have characteristic color ranges, some limited inferences are possible						
Rock dip and strike	5-545, p 72 30-10, p 3-14 5-332, p 4	I.6	alignment; dip called "slope of bed" in 30-10, which is incorrect terminology	L	L	L	L	L	L	L	L	L	L	L	L	L	L		2							
Rock layering	CMS 5-332, p 4	I.6	stratification, schistosity, foliation, etc.	0	0	L	L	0	L	?	0	L	+	0	+	L	0	L	+	0	L	2	although bedding planes can frequently be seen on rock exposures (within scale limitations of the image), schistosity and foliation are less obvious and can only be inferred, if that			
Rock, resistance to erosion	5-545, p 72 5-332, p 7	I.6	resistance to erosion is called "durability" in 5-332	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L	0	0	+	0	0	+	2	
Rock thickness	30-10, p 3-14 5-545, p 72 5-332, p 4	I.6	average and range	0	0	0	0	0	?	0	0	?	L	L	L	0	0	0	L	L	L	L	L	L	2	
Rock type, major	30-10, p 3-9	I.6	igneous, metamorphic, and sedimentary	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	3	although one can frequently classify the patterns into sedimentary, metamorphic, or igneous, there is also a frequent difficulty in separating some patterns of igneous and metamorphic rock
Rock type, specific	30-10, p 3-9 30-10, p 10-5	I.6	basalt, sandstone, serpentine, etc.	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L	0	0	+	0	0	+	3	the sedimentary series (limestone, shale, and sandstone) can more easily be identified than can the various members of the igneous group; metamorphics are the greatest problem, insofar as the classification from imagery goes
Rock, use suitability	CMS 30-10, p 3-14	III.1	degree and limiting factors of rock for binder, base course, aggregate, fill, embankments, masonry (rubble or cut stone), riprap, roofing material, sub-base, untreated surfacing, etc.	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L	0	0	L	0	0	L	3	
Root characteristics	30-10, p 3-21	I.3	height, diameter above ground, height of emergence, spread above ground, spread below ground	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0	0	?	3	inferential only; the factor requires detailed and extensive knowledge about plant characteristics and their modification by climate, soil, mantle depth, etc.
Runoff factor	30-10, p 3-22	I.4	factor = coefficient; condition and seasonality	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	0	L	0	0	L	3	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	.	d	m	.	d	m	.	d	m	.	d	m	.	d	m	.	d	m	.				d	m	.
Sand and gravel	31-60, p 2-2 30-10, p 8-15	III.1	location and extent of sources; unexploited sources	0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	3	
Schools	30-10, p 7-29 21-26, p 10-16	II.3	universities, colleges, etc.	0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	2	
Sewage treatment plants, characteristics	30-10, p 7-29	II.3	type, equipment, capacity, and type of collection, actually a type of processing plant, but CRS has defined processing plant as consumer oriented	0	0	0	0	0	?	?	0	?	L	0	L	?	0	?	?	0	?	L	0	L				2		
Sewage treatment plants, detection	CRS	II.3		0	0	0	?	0	L	L	0	L	+	0	+	L	0	L	L	0	+	L	0	+				2		
Shorelines, description	CRS	I.2	includes coastal type - emergent submergent, volcanic, man-made, etc.	0	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		2	
Shorelines, detection	CRS	I.2	any land/water interface	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	1	mapping of water/land interface is on a firmer basis with stereo imagery - within scale limits; color infrared is usually the best choice for this task, followed by normal color and black and white infrared; in polar regions where snow covers both the land and the sea ice surfaces (and it is essentially flat-lying) thermal imagery is the best choice
Slope	30-10, p 3-13 21-26, p 10-10 101-5, p G-2 30-5, p 8-2 5-36, p 2-5	I.2		0	0	0	0	0	?	0	0	0	L	0	L	0	0	L	+	+	+	+	+	+	+	+	+		2	with the exception of low level obliques (approaching profile conditions), this factor requires stereo imagery; slope can be measured directly, or, with experience, estimated as a slope class; without stereo, only very general conditions can be inferred; the laser profilometer is also applicable within limits mentioned under "relief, topographic"
Slope, maximum stable	30-10, p 3-13	II.7	natural or cut	0	0	0	0	0	0	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L				3	this is a complex factor and in order to make inferences requires much auxiliary information	
Smog, detection	CRS	II.6		0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	0	L	?	0	L	+	0	L	+	2	airborne air sampler
Smoke, detection	CRS	II.6		0	0	L	0	0	0	0	0	0	L	0	L	0	0	L	L	0	+	L	0	+	+	0	+		2	airborne air sampler
Snow accumulation areas	CRS	I.5	including terrain evaluation for snow fence location; potential	0	0	0	0	0	0	0	0	0	0	0	L	0	0	?	0	0	+	0	0	+				3	need prevailing wind information	
Snow depth	5-36, p 4-3	I.5	less or greater than 0.3 and 1.0 m; wheeled and tracked vehicles	0	0	0	0	0	0	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L				2	monocycle radar usable under dry snow conditions	
Snow extent	CRS	I.5	snow/land interface	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0		1	
Snow temperature	CRS	I.5		0	0	0	0	0	0	0	L	L	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	2	IR thermal results influenced by wind, overcast, etc.; a quantitative scanner should be used; microwave techniques also applicable

152

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS					
				d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m			
Soil, Atterberg limits	CRS	I.1	plasticity index, liquid limit, plastic limit, specific gravity, shrinkage limit, etc.; inferences (range estimates) are possible	0	0	0	0	0	0	?	0	0	0	0	0	0	?	0	0	?	3				
Soil, bearing strength	30-10, p 3-13	I.5	compacted state, natural state, modulus of subgrade reaction, wet or dry, etc.	0	0	0	0	0	0	?	0	0	?	0	0	?	0	0	?	3	estimates of a general range only				
Soil classification, major	30-10, p 3-13	I.5	grading (sand, gravel, silt, clay), composition (organic, mineral), and consistency (friable, plastic)	0	0	0	0	?	0	0	?	0	0	L	0	L	0	0	+	0	0	+	3		
Soil classification, unified	30-10, p 3-13 STOPIN, p U-1	I.5	30-10 refers the reader to TM 5-330	0	0	0	0	?	0	0	?	0	0	L	0	L	0	0	L	0	0	L	3		
Soil density	30-10, p 3-13 STOPIN, p U-2	I.5	dry-compacted, in place, maximum; only range estimates are possible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Soil depth	30-10, p 3-13	I.5		0	0	0	0	0	0	?	0	0	?	0	0	?	0	0	L	0	0	L	+	3	systems analogous to Barringers E-Phase and INPUT may have application to this factor
Soil moisture content	30-10, p 3-13 STOPIN, p U-2	I.5	30-10 requests soil moisture content as % dry weight which cannot be obtained, but as good estimates can be made from imagery, the factor is included	0	0	0	0	?	0	0	L	0	0	0	0	0	0	?	0	0	L	+	3	E-Phase and INPUT have some application potential as does microwave thermal; since this is inferential information, it is dependent on the estimate range required	
Soil profile	30-10, p 3-13	I.5		0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	L			3		
Soil, use suitability	CRS 30-10, p 3-13	III.1	binder, fills, embankments, unsurfaced roads, subgrades, topsoil, etc.	0	0	0	0	?	0	0	?	0	0	L	0	L	0	0	+	0	0	+	3		
Springs, detection	30-10, p 3-20 21-26, p 10-19	I.4		0	0	0	0	0	0	L	0	L	0	L	0	0	L	0	L	0	L	L	2	color and color IR (stereo) also useful; no single sensor can detect all springs; a combination of thermal, photo, and ground reconnaissance has proved best	
Stem characteristics	30-10, p 3-21	I.3	diameter and habit	0	0	0	0	0	0	0	?	?	L	0	0	L	0	0	L	0	0	L	3	Inferential only as a probable type or species characteristic; this factor requires detailed and extensive knowledge about plant characteristics and their modification by climate, soil mantle depth, etc.	
Stockpiled material	30-10, p 8-15	III.1	location, type, characteristics, quantity, and loading equipment	0	0	0	L	?	L	L	L	L	L	+	L	L	L	L	L	+	+	L	+	2	
Storage facilities, capacity	30-10, p 7-29	II.3	range estimates only	0	0	0	0	L	L	0	L	L	0	L	0	L	0	L	0	L	0	L	2	primarily inferential	
Storage facilities, commodity	30-10, p 7-29	II.3		0	0	0	?	0	L	?	0	L	0	+	?	0	L	?	0	L	0	L	2	primarily inferential	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER	SKILL LEVEL	SENSOR COMMENTS					
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				d	m	i		
Storage facilities, type	30-10, p 7-29	II.3	vessels, warehouses, open storage, grain elevators, etc.	0	0	0	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	1	
Stream gradient	CRS	I.4		0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	L	L	L	L	L	L	+	+		2				
Stream width	30-5, p 8-2 5-30, p 15 5-36, p 2-37 31-60, p 2-1 21-26, p 10-10	I.4		0	L	?	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L			1	a dimension cannot be directly observed in an image; for this reason, zeros are used for direct observation; width is often obscured by vegetation, overhanging banks, etc.	
Streets, classification and prevailing width	30-10, p 7-29	II.3	primary, secondary, tertiary; paved, unpaved, etc.; manual does not define factor, so CRS has provided comments	0	0	?	0	0	L	0	L	L	0	L	+	0	L	L	0	L	+	0	+	+			2					
Streets, condition	30-10, p 7-29	II.3	repair and improvement needed	0	0	0	0	0	0	0	0	?	L	0	L	0	0	0	0	0	?	?	0	L	+		2	scale dependenc; scale of 1:10,000 preferable				
Streets, pattern	30-10, p 7-29	II.3		?	0	?	+	0	+	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+			1					
Structures	30-10, p 7-28	II.3	material type, type of construction, etc.; manual asks for predominant type of building	0	0	0	?	0	?	?	0	?	+	0	+	?	0	L	?	0	?	L	0	L			2					
Surface irregularities	CRS	I.2	boulder fields, lava flow surfaces, etc.; refers to what might be called micro-relief features - irregular areas where the irregularities are not specific landforms	0	0	0	?	0	?	?	0	L	L	0	L	0	0	?	0	0	?	?	0	L			2	surface irregularities can be seen directly, and measured, in stereo imagery within the scale limitations; without stereo only inferences can be made; although the inference can be on firmer ground with low level obliques				

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1 100,000			STEREO VERTICAL 1 20 000			OTHER SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Telecommunications, poles	30-10, p 6-15	II.2	material, treatment, type, number of crossarms, spacing	0	0	0	?	0	?	L	L	L	+	L	+	0	0	0	0	0	0	0	0	0	L	L	L	1	detection and mapping of layout is influenced by tower material, tower geometry, and aspect angle
Telecommunications, support facilities	30-10, p 6-16 31-60, p 2-2	II.2	administration, housing, repair shops, security, exchanges and offices, etc.	0	0	0	0	0	?	0	0	?	L	0	L	?	0	L	?	0	?	L	0	L	L	L	L	2	some of the desired information (installation, housing, etc.) can be obtained from imagery; other elements, such as administration, safety, repair facilities, etc., are not obtainable in a practical sense
Tidal range	55-8, p C-3 30-10, p 4-17	I.4		0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L	L	0	L	L	L	2	the manuals show need of this information in many places, most of which must come from tide tables and ground observation; range can be worked out, however, but this requires sequential imagery
Tidal rise, upper limit	55-8, p C-3	I.4		0	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	L	0	0	L	0	0	L	2	
Timber, use suitability	CRS	III.1	this is an evaluation of timber resources at any given site with reference to need at hand	0	0	0	0	0	0	0	0	L	0	0	+	0	0	L	0	0	+	0	0	+	0	0	+	2	
Trafficability, terrain group and class of soil	5-36, p 4-2 5-36, p 4-5	IV	groups A, B, and C and classes I, II, III, and IV	0	0	0	0	0	0	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L	0	0	L	3	these elements require the ability to evaluate soil parameters obtained inferentially from imagery with reference to trafficability standards and criteria
Tree height	30-10, p 8-15	I.3		0	0	0	0	L	?	0	0	?	0	L	+	0	0	L	0	?	L	L	L	L	L	L	L	2	within limitations of scale and obscuration (including closure of trees), these factors can be measured directly in stereo imagery; average estimates for a vegetation type can also be inferred and this is the usual procedure for 1:20,000 scale imagery or smaller
Tree spacing	5-36, p 4-2	I.3	if trees cannot be toppled, a minimum spacing of 4.5-6 m is required	0	0	0	0	0	0	L	L	0	L	L	L	0	0	L	0	0	L	0	L	L	L	L	+	2	
Troop concentrations	CRS	IV	primarily enemy; includes reserves	0	0	0	0	0	L	0	L	L	L	L	L	0	0	?	?	L	L	L	L	L	L	L	L	2	
Tunnels, bypasses	30-10, p 5-18	II.1	manual asks for efforts to establish bypasses only; we assume actual and potential	0	0	0	0	0	?	0	0	L	L	0	L	0	0	L	L	L	+	L	L	+	L	L	+	2	
Tunnels, characteristics	30-10, p 5-18	II.1	alignment, length, portal characteristics, lining, type, etc.; above items specified in manual, but combined by CRS	0	0	0	0	0	L	0	0	L	L	L	L	0	L	L	0	L	L	L	L	L	L	L	L	2	lining characteristics probably cannot be determined from imagery
Tunnels, detection	CRS	II.1 IV		0	0	0	0	0	L	0	0	L	+	0	L	0	0	L	?	0	+	L	0	+	L	0	+	2	the openings of transportation tunnels (railway, roads, etc.) are frequently and directly observed in imagery and the presence of tunnels is easy to infer even if the openings are not visible; mine tunnels must generally be inferred; the opening of a hidden tunnel system can frequently be detected with an IR thermal scanner, but only when an atmospheric low is present, so that the tunnel is exhaling, and only if the internal temperature is different from that of the outside; ground based acoustical systems have had indifferent results

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	:	d	m	:	d	m	:	d	m	:	d	m	:	d	m	:	d	m	:				d	m	:
Underground installations	30-10, p 7-29	IV	type, use, construction data, cover, vulnerability, etc.	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	0	0	0	0	0	L	0	0	L		3	unless there are surficial clues leading to an installation, this item can be derived only inferentially; detection of openings is influenced by other factors (see crevasses, caves, and/or tunnels)
Underwater obstacles	5-36, p 4-12 31-60, p 3-20 31-60, p 2-2	I.4	manual is asking for location in terms of reconnaissance	0	0	0	0	0	0	0	0	0	L	L	L	0	0	0	L	L	L	L	L	L	L	L	L		2	if the water is clear, stereo imagery can show obstacles within scale limitations, water depth limitations (20-30 m), and water surface conditions (waves, wind ripple, sun sparkle, etc.); selected narrow band photography may often be used to observe subsurface objects

186

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		TD PHOTO INDEX		STEREO 1:100,000		STEREO VERTICAL 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS							
				d	m	i	d	m	i	d	m	i	d	m	i	d	m			i	d	m	i			
Vegetation canopy, characteristics	30-10, p 3-21 101-5, p G-2	I.3	clearance beneath, cover, depth, average height, structure	0	0	0	0	0	?	0	C	L	L	L	L	0	0	L	?	?	L	L	L	+	2	within limitations of scale and obscuration, some of these needs can be approximately measured in stereo imagery; other than that, and at scales of 1:20,000 or less, these items can only be estimated as average values for identified vegetation types or species, under the existing soil/moisture conditions
Vegetation, general type	30-10, p 3-20	I.3	trees, shrubs, or grass	0	0	0	0	0	L	0	0	L	+	0	+	L	0	+	L	0	+	+	0	+	2	image keys may help the novice
Vegetation, induced blow-down, susceptibility to	30-10, p 3-21	IV	manual does not specify whether it means induced or natural; induced is assumed	0	0	0	0	0	0	C	0	?	0	0	?	0	0	?	0	0	?	0	0	?	3	
Vegetation, specific type	30-10, p 3-21	I.3	species and species characteristics	0	0	0	0	0	0	0	0	0	L	0	L	0	0	L	0	0	0	?	0	L	3	except for unusual situations, species information requires impractically large scales; pure stands can be identified and most probable members of a mix can be inferred
Vehicles, detect on	CRS	IV		0	0	0	?	0	L	L	0	+	L	0	+	0	0	0	?	0	L	+	0	+	1	
Vehicles, identification	CRS	IV		0	0	0	0	0	0	?	0	L	L	0	+	0	0	0	0	?	L	0	L	2		
Visibility	30-5, p 2-18 31-60, p 2-2	I.1		0	0	0	0	0	0	0	?	L	0	L	0	0	0	0	0	0	L	0	0	?	2	any comparison of a filtered image (e.g., blue band, UV, etc.) to an unfiltered image can provide information about haze, etc.; a laser can also provide information as a function of scatter; however, this need cannot be met, in a practical sense, by remote sensing; radar, of course, can track clouds and cloud cycles

187c

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Water color	30-10, p 3-20	I.4	used in the manual in terms of defining water quality, but as water color is applicable to other interpretations, it is included here	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	true color is a lab measurement (spectrophotometric trace) and is a function of suspended and dissolved material; the apparent color is a function of the light and the spectral sensitivity of the detector (eye, film, etc.); in imagery, the apparent color of water is also influenced by the color of the bottom that reflects some light back up through the water; color photography can give information on apparent color
Water depth	30-10, p 4-17 31-60, p 7-1	I.4		0	0	0	0	0	0	0	0	0	0	0	0	C	0	0	0	0	L	L	0	L	L	L	L		2	clear water can reveal bottom detail to some 15 m with color infrared and 3-40 m with normal color and pan film; pan film is more difficult to evaluate than color film; surface state (ripples, waves, sun glint, etc.) greatly influences the results
Waterfalls and rapids detection	30-10, p 3-19	I.4		0	0	0	?	0	L	?	0	?	+	0	L	L	0	L	+	0	+	+	0	+				1		
Water quality	30-10, p 3-20 5-36, p 4-16	I.4	contamination, dissolved solids, chemical content, odor, organic matter, variability, odor, taste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		
Water supply, pumping stations	CNS	II.3		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L		2	
Water supply, storage facilities	30-10, p 7-??	II.3	type, location, capacity, condition; this factor refers to both water tanks and small, local storage reservoirs, not to large reservoirs associated with dams	0	0	0	0	0	L	0	0	L	+	0	+	?	0	L	?	0	L	+	0	+				2		
Water supply, treatment plants, characteristics	30-10, p 7-28	II.3	type, capacity, condition	0	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	?	0	0	L	0	0	L		2	scale limitations in many instances
Water supply, treatment plants, detection	CNS	II.3		0	0	0	0	0	L	0	0	L	L	0	+	0	0	0	L	0	+	L	0	+				2		
Water table, depth	30-10, p 3-16 5-332, p 11	I.4	refers to depth of water table beneath the surface	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	?	0	0	L	L		3	for the most part, this factor must be inferred; systems analogous to Berringers E-Phase also have applications, but within limits		
Water turbidity	30-10, p 3-20	I.4 II.6	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here	L	0	L	0	0	?	0	?	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L		2	color and color infrared are useful for this factor; pre- and post-turbidity photos might allow for semi-quantitative estimates, otherwise, only a very general qualitative estimate can be made	
Water turbidity, sources	CNS	II.6	man-induced erosion, acid mine drainage, etc.	0	0	L	0	0	0	0	0	?	L	0	L	L	0	L	0	L	L	0	L	0	L		2			

1881

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Water bodies, characteristics	CRS	I.4	inlets, outlets, size, type, etc.	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	+	+	+	+	+	+			1	
Water bodies, detection	CRS	I.4		+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			1	
Waterways, approaches	30-10, p 5-33	II.1	nature, location, and identification, conspicuous objects or landmarks and approach channel	0	0	0	0	0	L	0	0	L	L	0	+	?	0	L	0	0	L	0	0	+			2	
Waterways, bank composition	55-8, p C-3	II.1 I.4		0	0	0	0	0	0	0	0	L	0	0	?	0	0	?	0	0	L	0	0	+			2	mostly inferential unless scale allows one to see riprap
Waterways, bank slope	31-60, p 2-2	II.1 I.4		0	0	0	0	0	0	0	0	0	L	0	L	?	0	0	0	0	0	0	L	?	L	+	2	can measure in stereo if scale is compatible with object size, otherwise it is an estimate; large scale stereo photography has application here
Waterways, bottom characteristics	30-10, p 5-34 55-8, p C-3 31-60, p 2-2	II.1 I.4	composition, stream bed roughness	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	L	0	0	L	3	inferential in all cases except if the stream is low; in this case, the bottom can be partly seen in stereo imagery
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2	II.1 I.4		0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	L	0	?	L	+	2	inferential in all cases; measurements can be made only in dry areas of the waterway; large scale stereo imagery is applicable	
Waterways, description	CRS	II.1	maintenance and repair requirements, equipment, inclined planes, towage systems, traffic, cargo handling facilities, characteristic vessel type, etc.; above items specified in manual, but combined by CRS here	0	0	0	L	0	L	L	0	L	L	0	+	?	0	?	L	0	L	L	0	L			2	
Waterways, direction of flow	CRS	II.1		0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+			2	
Waterways, layout	CRS	II.1	alignment, junctions, etc.; above items specified in manuals, but combined here by CRS	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			1	
Waterways, silting characteristics	55-8, p C-2	II.1 I.4		0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	?	0	0	0	L			3	
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	II.1	river, canal, lake, etc.; same as channel, watercourse	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			1	

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL: 1:20,000			OTHER	SMALL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				d	m	i
Wave conditions and characteristics	30-5, p 3-13	I.4	length, frequency, refraction, etc.	0	0	0	L	L	L	0	0	0	L	L	L	0	0	0	L	L	L	L	L	L	L	L	L	+	3	for photo imagery to be useful, light conditions (aspect, non-diffuse, etc.) must be right; in addition to radar imagery, radar scatterometry has also been used to estimate sea state
Weapons, location of	30-5, p 4-6 31-60, p 2-2	IV	automatic weapons, artillery, mortars, armored vehicles, anti-aircraft, etc.	0	0	0	0	0	L	0	0	L	L	0	+	0	0	0	0	0	0	0	0	L	0	L		2		
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	I.5 I.6	chemical or mechanical	0	0	0	0	L	0	0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	L		3	
Wells, detection	CRS	I.4		0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	L		7	can be detected within scale limits and if not obscured; color infrared very useful for this factor - particularly when the wells are open		
Wetlands, extent	CRS	I.3 I.4		L	L	L	L	L	L	L	L	L	+	0	+	L	L	L	+	+	+	+	+	+	+	+	2	wetlands typing and bounding is more easily done from color infrared photography, if possible, the combination of color and color infrared should be used; image keys needed by novice		
Wetlands, type	30-10, p 3-19 21-26, p 10-10 5-36, r 4-3 5-30, p 39	I.3 I.4	swamps, bogs, marshes, muskeg, etc. (not good terminology - dictionary defines swamps, bogs, marshes as the same thing, so more proper terms would be salt water marsh, fresh water marsh, etc.)	0	0	0	L	0	L	L	0	L	L	0	L	?	0	L	L	0	L	L	0	L	0	L	+	2		
Wind	30-5, p 2-18 5-36, p 1-3	I.1		0	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	L	0	0	L		2	must have indicators in the image such as smoke plumes, thermal shadows, etc.		
Withdrawal areas	30-5, p 3-11	IV	allies and enemy	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+			3			
Withdrawal routes	30-5, p 3-11	IV	allies and enemy	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+			3			

ADDITIONAL FACTORS ADDED AFTER COMPLETION OF MATRIX

FACTOR	REFERENCES	CATEGORY	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO VERTICAL 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
				d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Landing areas, aircraft	31-60, p 2-2	IV	suitable sites for landing helicopters and light aircraft	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+		2	
Supporting weapons, positions suitable for	31-60, p 2-2	IV		0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	0	0	0		2	
Radar sites, positions suitable for	31-60, p 2-2	IV		0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	0	0	+	0	0	+		2				
Combat service support installations, positions suitable for	31-60, p 2-2	IV		0	0	0	0	0	L	0	0	L	0	0	+	0	0	L	0	0	+	0	0	+		2				
Engineering materials	31-60, p 2-2	III.1	structural steel, lumber, etc.	0	0	0	?	0	?	?	0	?	L	0	L	L	0	L	L	0	L	L	0	L		2				
Storm induced instability, potential for	31-60, p 2-2	IV		0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	0	0	+	0	0	+		3				
Bypasses, actual	30-10, p 5-16 5-36, p 2-6 5-36, p 2-65	IV	tunnels, bridges, fords, etc; items specified individually in manual, but combined by CBS	0	0	0	0	0	L	0	0	L	L	0	L	L	L	L	L	L	L	L	L	L	+	L	+		2	
Bypasses, potential	30-10, p 5-21 30-10, p 5-16	IV		0	0	0	0	0	L	0	0	L	+	0	+	L	L	L	L	L	L	+	+	+		2				

CATEGORIZED EVALUATIONS

192<

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS							
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m					
Air temperature	30-5, p 2-18	this factor is abstracted from a general reference to temperature in the manual; near surface; range estimates only	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	+	3	radiosonde or telemetry for a direct measurement; IR and microwave thermal quantitative scanners can provide inferential information about probable air temperature at the surface					
Climate	101-5, p G-2	the reference asks for general climate and weather information as part of a general description of an area; some of these considerations can be deduced from imagery and it is in this sense the item is evaluated	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+	3	can deduce general characteristics of the climate, i.e., amount and time distribution of precipitation; arctic, temperate, humid, arid, etc.				
Clouds	5-36, p 1-3 10-5, p 2-18	the manual discusses clouds in terms of the effect on operations	+	L	0	+	L	L	0	0	0	+	L	L	0	0	0	+	L	L	0	0	2	remote sensing is of limited use for tactical considerations; can study clouds directly (patterns, development, cycle, etc.) and the associations of patterns with terrain and meteorological conditions; clouds are evaluated in these terms		
Precipitation	30-5, p 2-17 5-36, p 1-3		0	0	0	?	0	L	0	0	0	?	0	L	0	0	0	0	0	0	0	0	0	+	2	airborne and ground based weather radars
Visibility	30-5, p 2-18 31-60, p 2-2		0	0	0	0	0	0	0	0	?	L	0	L	0	0	0	0	0	L	0	0	?	2	any comparison of a filtered image (e.g., blue band, UV, etc.) to an unfiltered image can provide information about haze, etc.; a laser can also provide information as a function of scatter, however, this need cannot be met, in a practical sense, by remote sensing; radar, of course, can track clouds and cloud cycles	
Wind	30-5, p 2-18 5-36, p 1-3		0	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	L	0	0	L	2	must have indicators in the image such as smoke plumes, thermal shadows, etc.		



FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS								
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m						
Branch characteristics	CRS	habit, thorns, density, size, geometry, etc.	0	0	0	0	0	0	0	0	L	0	L	0	L	0	0	?	0	0	+	2	although not directly measurable by any practical remote sensing means, average characteristics for a known vegetation type can be inferred by knowledgeable people				
Burned areas	30-20, p 11-2 30-10, p 3-22	degree and extent of past burn-off	0	0	0	?	?	?	?	?	L	L	+	L	L	+	L	L	+	+	+	+	2				
Forest, type	30-10, p 3-20	the manual is not specific on needs but they do want to know type; deciduous, conifers, mixed, mixed hardwoods, etc.	?	?	?	0	0	L	L	0	L	+	0	+	L	0	L	?	0	L	+	0	+	2	inferential; photo or image keys will help the novice		
Forest fire, detection	30-5, p 8-2 30-20, p 11-3		0	0	L	0	0	0	+	+	+	L	0	L	0	0	L	L	0	?	L	0	+	+	2	thermal imagery or radiometry detects heat output directly; the 4.3-5.5 band is preferable; other images rely on recording smoke, brightness of the flames, or damaging action; atmospheric samplers might pick up combustion products; thermal images do better at detecting fire boundaries through smoke	
Forest fire, susceptibility to	30-10, p 3-22		0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	?	?	0	?			3	inferential only; will need auxiliary information such as dryness, ground conditions, etc.	
Grasslands, type	CRS	savannahs, prairies, meadows, etc.	0	0	0	0	0	0	0	0	0	0	L	0	0	L	?	0	+	?	0	+			2	inferential; image keys can help the novice	
Leaf characteristics	30-10, p 3-21	color, density, seasonal variation, type, etc.	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0	0	?		3	inferential only for given vegetation type or a type characteristics
Litter characteristics	30-10, p 3-22	type, depth, etc.	0	0	0	0	0	0	0	?	0	0	L	0	0	?	0	0	L	0	0	L			3	inferential only	
Root characteristics	30-10, p 3-21	habit, diameter above ground, height of emergence, spread above ground, spread below ground	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	?				3	inferential only, the factor requires detailed and extensive knowledge about plant characteristics and their modification by climate, soil mantle depth, etc.	
Stem characteristics	30-10, p 3-21	diameter and height	0	0	0	0	0	0	0	?	?	L	0	0	L	0	0	L	0	0	L				3	inferential only as a probable type or species characteristic, this factor requires detailed and extensive knowledge about plant characteristics and their modification by climate, soil mantle depth, etc.	
Tree height	30-10, p 8-15		0	0	0	0	L	?	0	0	?	0	L	+	0	0	L	0	?	L	L	L	L	L	2	within limitations of scale and obscuration (including closure of trees), these factors can be measured directly in stereo imagery; average estimates for a vegetation type can also be inferred and this is the usual procedure for 1:20,000 scale imagery or smaller	
Tree spacing	5-36, p 4-2	if trees cannot be toppled, a minimum spacing of 4.5-6 m is required	0	0	0	0	0	0	L	L	0	L	L	0	L	0	0	L	0	L	L	L	+		2		
Vegetation canopy, characteristics	30-10, p 3-21 101-5, p G-2	clearance beneath, cover, depth, average height, structure	0	0	0	0	0	?	0	0	L	L	L	L	0	0	L	?	?	L	L	L	+		2	within limitations of scale and obscuration, some of these needs can be approximately measured in stereo imagery; other than that, and at scales of 1:20,000 or less, these items can only be estimated as average values for identified vegetation types or species, under the existing soil/moisture conditions	
Vegetation, general type	30-10, p 3-20	trees, shrubs, or grass	0	0	0	0	0	L	0	0	L	+	0	+	L	0	+	L	0	+	+	0	+		2	image keys may help the novice	

195



1976

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
Currents	30-10, p 3-18 55-8, p C-3	tidal, littoral, stream, oceanic, undertows, etc.	0	0	0	0	0	0	L	0	0	L	0	0	0	0	?	0	0	L	?	2	directly observed if flow marks are visible; also possible with stereo time-lapse imagery where apparent relief is proportional to displacement		
Drainage basin, characteristics	30-10, p 3-18	area, slope, shape; same as watershed	L	L	L	L	L	L	L	L	?	?	?	L	L	L	+	+	+	+	+	+	2	any one of these systems can give information about the various items, but a drainage basin is a regional feature, so regional coverage is required	
Drainage pattern	30-10, p 3-16	annular, dendritic, parallel, trellis, radial, rectangular; internal interrupted, etc.	L	0	L	L	0	L	L	0	L	0	0	0	L	0	L	+	0	+	+	0	+	2	
Flooding, characteristics	30-10, p 3-18 30-10, p 5-34	affects, cause, duration, frequency, and type (tidal, snow-melt, direct runoff, etc.)	0	0	0	L	L	L	L	L	+	+	+	0	0	0	+	+	+	+	+	+	3	much of this rests on inferences; information about duration would require sequential imagery; the affects of flooding can be evaluated only with reference to a given problem	
Flooding, extent	31-60, p 2-2 30-10, p 3-18 30-10, p 5-34		L	L	0	+	+	+	+	+	+	+	+	0	0	0	+	+	+	+	+	+	2	must either catch the high water boundary or high line mark or damage after water recedes; color and color IR are useful here	
Flooding, potential	CBS		0	0	0	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+			3		
Ground water	5-332, p 11 30-10, p 3-20	amount, flow, temperature, etc.; also see water table	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	?	0	0	?			3	
Permeability	30-10, p 3-13	part of soil-rock check list/internal drainage; estimates only	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	0	+	0	0	+	3	
Runoff factor	30-10, p 3-22	factor = coefficient; condition and seasonality	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	0	L			3		
Springs, detection	30-10, p 3-22 21-26, p 10-10		0	0	0	0	0	0	L	0	L	L	0	L	0	0	L	0	L	L	L	L	2	color and color IR (stereo) also useful; no single sensor can detect all springs; a combination of thermal, photo and ground reconnaissance has proved best	
Stream gradient	CBS		0	0	0	0	0	0	0	0	0	0	L	0	0	L	L	L	L	L	+		2		
Stream width	30-5, p 8-2 5-30, p 15 5-36, p 2-37 31-60, p 2-1 21-26, p 10-10		0	L	?	0	L	L	0	L	L	0	L	0	L	L	0	L	L	L			1	a dimension cannot be directly observed in an image; for this reason, zeros are used for direct observation; width is often obscured by vegetation, overhanging banks, etc.	
Tidal range	55-8, p C-3 30-10, p 4-17		0	0	0	0	0	0	0	0	0	0	L	0	0	0	L	L	0	L	L		2	the manuals show need of this information in many places, most of which must come from tide tables and ground observation; range can be worked out, however, but this requires sequential imagery	
Tidal rise, upper limit	55-8, p C-3		0	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	L	0	0	L	2	

198

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i			
Underwater obstacles	5-36, p 4-12 31-60, p 3-20 31-60, p 2-2	manual is asking for location in terms of reconnaissance	0	0	0	0	0	0	0	0	0	L	L	L	0	0	0	L	L	L	L	L	L	2	if the water is clear, stereo imagery can show obstacles within scale limitations, water depth limitations (20-30m), and water surface conditions (waves, wind ripple, sun sparkle, etc.); selected narrow band photography may often be used to observe subsurface objects	
Water color	30-10, p 3-20	used in the manual in terms of defining water quality, but as water color is applicable to other interpretations, it is included here	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	true color is a lab measurement (spectrophotometric trace) and is a function of suspended and dissolved material; the apparent color is a function of the light and the spectral sensitivity of the detector (eye, film, etc.); in imagery, the apparent color of water is also influenced by the color of the bottom that reflects some light back up through the water; color photography can give information on apparent color
Water depth	30-10, p 4-17 31-60, p 2-1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	0	L	L	L	2	clear water can reveal bottom detail to some 15 m with color infrared and 3-40 m with normal color and pan films; pan film is more difficult to evaluate than color film; surface state (ripples, waves, sun glint, etc.) greatly influences the result	
Water falls and rapids, detection	30-10, p 3-19		0	0	0	?	0	L	?	0	?	+	0	L	L	0	L	+	0	+	+	0	+	1		
Water quality	30-10, p 3-20 5-36, p 4-16	contamination, dissolved solids, chemical content, odor, organic matter, variability, taste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Water table, depth	30-10, p 3-16 5-332, p 11	refers to depth of water table beneath the surface	0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	?	0	0	L	L	3	for the most part, this factor must be inferred; systems analogous to Berringers E-Phase also have applications, but within limits	
Water turbidity	30-10, p 3-20	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations, it is included here	L	0	L	0	0	?	0	?	L	0	L	L	0	L	L	0	L	L	0	L	L	2	color and color infrared are useful for this factor; pre- and post-turbidity photos might allow for semi-quantitative estimates, otherwise, only a very general qualitative estimate can be made	
Water bodies, characteristics	CRS	inlets, outlets, size, type, etc.	L	L	L	L	L	L	L	L	L	L	L	L	L	L	+	+	+	+	+	+	+	1		
Water bodies, detection	CRS		+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	1		
Waterways, bank composition	55-8, p C-3		0	0	0	0	0	0	0	0	L	0	0	L	0	0	?	0	0	L	0	0	+	2	mostly inferential unless scale allows one to see riprap, etc.	
Waterways, bank slope	31-60, p 2-2		0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	0	L	?	L	+	2	can measure in stereo if scale is compatible with object size, otherwise, it is an estimate; large scale stereo photography has application here	
Waterways, bottom characteristics	30-10, p 5-34 55-8, p C-3 31-60, p 2-2	composition, stream bed roughness	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	?	1	inferential in all cases except if the stream is low; in this case, the bottom can be partly seen in stereo imagery	
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2		0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	L	0	?	L	+	2	inferential in all cases; measurements can be made only in dry areas of the waterway, large scale stereo imagery is applicable	

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS		
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m
Waterways, silting characteristic	55-8, p C-2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3			
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p 8-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	river, canal, lake, etc.; same as channel, watercourse	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	1			
Wave conditions and characteristics	30-5, p 3-13	length, frequency, refraction, etc.	0	0	0	L	L	L	0	0	0	L	L	L	0	0	L	+	3	for photo imagery to be useful, light conditions (aspect, non-diffuse, etc.) must be right; in addition to radar imagery, radar scatterometry has also been used to estimate sea state	
Wells, detection	CBS		0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	1	can be detected within scale limits and if not obscured; color infrared very useful for this factor - particularly when the wells are open	
Wetlands, extent	CBS		L	L	L	L	L	L	L	L	+	0	+	L	L	L	+	+	2	wetlands typing and bounding is more easily done from color infrared photography; if possible, the combination of color and color infrared should be used; image keys needed by novice	
Wetlands, type	30-10, p 3-19 21-26, p 10-10 5-36, p 4-3 5-30, p 39	swamps, bogs, marshes, muskeg, etc. (not good terminology - dictionary defines swamps, bogs, marshes as the same thing, so more proper terms would be salt water marsh, fresh water marsh, etc.	0	0	0	L	0	L	L	0	L	?	0	L	L	0	L	L	+	2	

CATEGORY: Surface materials

CATEGORY SYMBOL: I.5

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS							
			d	m	d	m	d	m	d	m	d	m	d	m	d	m										
Crevasse detection	CRS		0	0	0	0	L	0	L	+	0	+	L	0	L	L	0	L	L	0	L	+	3	photo imagery is limited to proper snow conditions; thermal restricted to atmospheric pressure and wind conditions; monocyclus radar of use when snow is dry		
Glaciers, extent	CRS		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1			
Glaciers, thickness	CRS		0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	2	radio ice sounding "techniques" usually operate in the 35-100 MHz range (35 MHz preferred for greater depth), are airborne and can profile the ice/rock interface through some 3000 m of ice; for temperate or warm glaciers, the useful distance is greatly decreased	
Ice, bearing capacity	CRS		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	2	inferred estimate based on pattern analysis; supplemental information such as ice thickness and temperature is of great help in making this estimate		
Ice temperature	5-330, p 13-22		0	0	0	0	0	0	+	+	0	0	0	0	0	0	0	0	0	0	0	0	+	1	quantitative scanner should be used; wind, overcast, etc., influence these results; microwave thermal also has some application	
Ice thickness, fresh water	CRS	non-glacial ice only	0	0	0	+	+	+	L	0	L	0	0	L	0	0	0	0	L	0	0	L	+	2	inferential information can be derived from pattern analysis as long as the ice pattern itself is visible; thus snow cover is a handicap to photo and visual analysis, as is wind for thermal imagery the monocyclus radar system, operating with a 2.5 nanosec. pulse (500 MHz bandpass) provides a direct measurement	
Ice thickness, salt water	CRS	non-glacial ice only	0	0	0	L	L	+	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	3	primarily inferential based on pattern analysis; the monocyclus radar and other pulsed systems have the potential to measure the thickness, but there are too many influencing factors to make it practically reliable as yet	
Ice type	5-330, p 13-23	river, fresh, sea, young, pack	0	0	L	+	0	+	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	3	inferential; image keys of help to novice; ERTS or equivalent imagery has the advantage of extensive regional coverage, but is restricted to fewer ice types; large scale imagery has the advantage of pinpointing boundaries and identifying more types, however, it suffers from restricted aerial coverage; thermal imagery is limited in that it is influenced by wind and other meteorological factors	
Icings, type	5-330, p 6-76 5-330, p 6-77	coastal, ground, river, spring; coastal and river icing can be evaluated in ice type, above	0	0	0	L	0	L	+	0	+	L	0	L	0	0	L	0	L	L	0	L	2	inferential; based on pattern analysis and terrain conditions		
Permanently frozen material, detection	CRS	including permafrost, active zone	0	0	0	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	3	a system such as E-Phase is also applicable
Porosity	30-10, p 3-14	part of soil-rock check list/internal drainage in manual	0	0	0	0	0	0	0	0	0	?	0	0	0	0	?	0	0	?	0	?	?	3		

200

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS		
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Snow accumulation areas	CRS	including terrain evaluation for snow fence location; potential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	need prevailing wind information
Snow depth	5-36, p 4-3	less or greater than 0.3 and 1.0 m; wheeled and tracked vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	monocycle radar usable under dry snow conditions
Snow extent	CRS	snow/land interface	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	1	
Snow temperature	CRS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	IR thermal results influenced by wind, overcast, etc.; a quantitative scanner should be used; microwave techniques also applicable
Soil, Atterberg limits	CRS	plasticity index, plastic limit, specific gravity, liquid limit, shrinkage limit, etc.; inferences (range estimates) are possible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
Soil, bearing strength	30-10, p 3-13	compacted state, natural state, modulus of subgrade reaction, wet or dry, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	estimates of a general range only
Soil classification, major	30-10, p 3-13	grading (sand, gravel, silt, clay), composition (organic, mineral), and consistency (friable, plastic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
Soil classification, unified	30-10, p 3-13 STOPIN, p U-1	30-10, refers the reader to TM 5-330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
Soil density	30-10, p 3-13 STOPIN, p U-2	dry compacted, in place, maximum, only range estimates are possible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Soil depth	30-10, p 3-13		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	systems analogous to Berringer's E-Phase and INPUT may have application to this factor
Soil moisture content	30-10, p 3-13 STOPIN, p U-2	30-10 requests soil moisture content as 1 dry weight which cannot be obtained, but as good estimates can be made from imagery, the factor is included	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	E-Phase and INPUT have some application potential as does microwave thermal; since this is inferential information, it is dependent upon the estimate range required
Soil profile	30-10, p 3-13		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	chemical or mechanical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	

201

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m			d	m				
Caves, detection	CRS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	direct photo detection is limited to line of sight for a cave opening; inferential procedures depend on analysis of soils, rock, rock fracture patterns, and drainage patterns; thermal detection is possible once the breathing cycle is worked out; the results are influenced by atmospheric pressure changes and wind ground based acoustical methods have been tried, but with indifferent results					
Folding	30-10, p 3-14 5-332, p 4	anticlines, synclines, etc.	L	0	L	+	0	-	L	0	L	L	0	L	L	0	L	+	3	detecting the presence of folds is not as difficult as determining their type (anticline, syncline); if the fold is weathered down, the bedding planes may be visible, but even so, dip and strike can be difficult to work out				
Fossil fuel sources	30-10, p 8-8	oil, coal, and gas	L	0	L	0	L	0	0	0	0	0	0	L	L	0	L	0	3	although shales and coal beds can sometimes be determined rather directly from the image, this factor relies more on inference than direct observation				
Fractures, characteristics	30-10, p 3-14	dip, displacement, pattern, size, shape, spacing, etc.	0	0	L	0	0	L	0	0	0	0	0	+	+	+	+	+	3	fractures are so numerous and are present in so many sizes and degrees of exposure that imagery of scales ranging from satellites to microscopes provide the basis for mapping at least some level of the fracture pattern; many fractures are readily apparent and easily mapped, but others are difficult to trace with certainty and require considerable effort, time, and careful evaluation				
Fractures, detection	CRS		+	0	+	+	0	+	L	0	L	+	0	+	+	0	+	0	+	2				
Fractures, type	30-10, p 3-14	fault (reverse, thrust, etc.), joint	0	0	L	0	0	L	0	0	0	0	0	L	L	0	0	L	0	3				
Rock color	5-545, p 72 30-10, p 3-14		0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	+	2	color films, multiband black and white, multichannel scanners, spectrophotometers, etc. are of use, since rock types have characteristic color ranges, some limited inferences are possible		
Rock dip and strike	5-545, p 72 30-10, p 3-14 5-332, p 4	alignment, dip called "slope of bed" in 30-10, which is incorrect terminology	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2			
Rock layering	CRS 5-332, p 4	stratification, schistosity, foliation, etc.	0	0	L	0	0	L	0	L	+	0	+	L	0	L	+	0	L	+	0	2	although bedding planes can frequently be seen on rock exposures (within scale limitations of the image), schistosity and foliation are less obvious and can only be inferred if that	
Rock, resistance to erosion	5-545, p 72 5-332, p 7	resistance to erosion is called "durability" in 5-332	0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	0	+	0	0	+	2	
Rock thickness	30-10, p 3-14 5-545, p 72 5-332, p 4	average and range	0	0	0	0	0	0	0	0	0	L	L	L	0	0	L	L	L	L	L	L	2	
Rock type, major	30-10, p 3-9	igneous, metamorphic, and sedimentary	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	+	0	0	+	3	although one can frequently classify the patterns into sedimentary, metamorphic, or igneous, there is also a frequent difficulty in separating some patterns of igneous and metamorphic rock

202

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INPHARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS	
			d	m	d	m	d	m	d	m	d	m	d	m	d	m			d
Rock type, specific	30-10, p 3-9 10, p 10-5	basalt, sandstone, serpentine, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	the sedimentary series (limestone, shale, and sandstone) can more easily be identified than can the various members of the igneous group; metamorphics are the greatest problem, insofar as the classification from imagery goes
Weathering process	30-10, p 3-14 30-10, p 3-13 STOPIN, p U-2	chemical or mechanical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	

203

FACTOR	REFERENCE	FACTOR COMMENTS	EFTS W/AGREY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS							
			d	m	d	m	d	m	d	m	d	m	d	m	d	m									
Aircraft, detection	CRS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2								
Aircraft, identification	CRS		0	0	0	?	?	L	L	L	+	+	0	0	L	?	?	L	L	L	L	2			
Airfields, elevation	30-10, p 5-61		0	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	L	0		2	relative elevations can be obtained from stereo imagery; if the imagery contains a known elevation datum, then a good estimate can be made for the actual elevation; the laser profilometer can be used within the limits of its reference, which is an atmospheric pressure level		
Airfields, fueling facilities	30-10, p 5-61	called petroleum and oil lubricants in the manual	0	0	0	0	0	?	0	L	?	0	+	0	0	0	0	0	?	0	+	2			
Airfields, layout	30-10, p 5-61	runways, taxiways, hardstands, parking and warm-up areas, hangars, etc.	0	0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1			
Airfields, runway and taxiway description	30-10, p 5-61	size, design, surface, etc.; each runway and/or taxiway	0	0	0	0	0	?	0	0	?	+	0	+	0	L	+	+	?	+	0	+	2		
Airfields, support facilities	CRS	lighting, storage, APU's, maintenance of runways, etc., navigation and weather facilities, aircraft maintenance facilities, etc.	0	0	0	0	0	0	?	0	?	?	0	L	0	0	0	?	0	?	L	0	L	2	low level obliques and large scale stereo can detect certain navigation facilities
Airfields, type	30-10, p 5-61 30-10, p 7-28 5-36, p 4-6	civilian, military or joint; plane type	0	0	0	0	0	0	0	0	?	L	0	+	0	0	L	L	0	+	L	0	+	2	
Anchorage	30-10, p 5-33 55-8, p C-3	depth, size, clearances, bottoms, berths, etc.	0	0	0	+	+	L	L	L	+	L	+	+	+	+	+	+	+	+	+	+	2	depending on size, areal extent can be measured on most imagery; see comments on water depth for depth of anchorages	
Aqueducts	55-8, p C-3	length, width, construction details etc.	0	0	0	L	L	L	L	L	L	+	+	+	L	L	+	L	L	+	+	+	2		
Berths	55-8, p C-3	length, type, apron, alongside depth, etc.; called berthages in terms of passing basins and anchorages in manual	0	0	0	L	L	L	L	L	L	+	+	+	L	L	L	L	L	L	+	+	+	2	depth information by inference only; refer to comments on water depth
Bridges, abutment characteristics	30-10, p 5-45	type, dimensions, material, etc.	0	0	0	0	0	0	0	0	0	L	L	0	0	0	0	0	?	?	0	L	2		
Bridges, bypasser	30-10, p 5-10 5-26, p 2-6 5-35, p 2-65	to be classified as easy, difficult and impossible; location	0	0	0	0	0	L	0	0	L	+	L	+	L	L	L	L	L	L	+	+	+	2	
Bridges, condition	30-10, p 5-16	in terms of effort required to repair damage in manual	0	0	0	L	L	L	L	L	L	+	+	+	0	0	0	L	L	L	+	+	+	2	although detection of some types of damage might be relatively easy to do, conclusions about effort and materials needed would be mostly inferential and would be based on experience and specialized knowledge

202

FACTOR	REFERENCE	FACTOR COMMENT	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS				
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m		
Bridges, detection	CNS		0	0	?	+	+	+	+	+	+	+	L	L	L	+	+	+	+	+	+	1	
Bridges, military load classification	30-10, p 5-16 5-36, p 3-40	load carrying capacity	0	0	0	0	0	L	0	0	L	0	0	+	0	0	L	0	0	L	0	0	+
Bridges, structure type	30-10, p 5-16	number of spans, description of spans, suspension system, description of arches, intermediate support characteristics, etc.	0	0	0	L	L	L	L	L	L	+	+	0	0	0	L	L	L	L	L	+	2
Bridges, use type	CNS	dummy, vehicular, foot; multiple or single use; aqueducts	0	0	0	L	L	L	L	+	+	+	+	L	L	L	L	L	L	L	L	+	2
Cableways, description	30-10, p 5-21 31-60, p 2-3	capacity, length, carriage data, base stations, maintenance, power, etc.; in terms of check list p 5-21, 5-22	0	0	0	?	?	L	?	?	L	+	L	+	?	?	L	L	L	L	L	L	2
Cableways, detection	CNS		0	0	0	L	0	L	+	0	+	+	0	+	L	0	L	L	L	L	+	0	+
Cableways, uses	30-10, p 5-21		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	+	2
Clearances, horizontal and vertical	30-10, p 5-11 30-10, p 5-16	limits to 0.1 m on p 5-16	0	0	0	0	0	0	L	L	L	+	+	+	L	L	L	L	L	L	+	+	+
Culverts, detection	5-36, p 2-70 5-330, p 6-41	5-330 defines culvert as a short bridge, but CNS is using culvert as defined in 5-36, an underground passage for water	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	0	L	0	0	L	2
Expansion potential	CNS	airfields, ports, harbors, railroads, etc.; manual refers to ports and harbors, but this factor is applicable to all transportation development, and is therefore used in the latter sense here	0	0	?	L	L	L	0	0	0	L	L	L	L	L	L	+	+	+	+	+	+
Ferries, description	31-60, p 2-2 30-10, p 5-20	crossing time, type, hazards, traffic, routes, propulsion method	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	0	?	L	0	L
Ferries, detection	CNS	includes ferry terminals	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L
Fords, approaches	30-10, p 5-21	width, condition, and length	0	0	0	0	0	L	0	0	L	+	0	+	L	0	L	+	0	+	+	0	+
Fords, description	30-10, p 5-21 31-60, p 2-2	banks, load class, bottoms, hazards, bypasses, etc.	0	0	0	0	0	0	?	0	L	L	0	L	L	0	L	L	0	L	+	0	+
Fords, detection	5-30, p 15 5-36, p 2-1		0	0	0	0	0	L	L	0	L	+	0	+	L	0	L	L	0	L	+	0	+

205

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS							
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m					
Harbors, approaches and entrances	30-10, p 5-50	location, width, and depth	0	0	0	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	2	location and dimensional information can be acquired from any imagery with scale limits; depth, at best, is an inference; see water depth				
Harbors, description	30-10, p 5-50 55-8, p C-3	divisions, depth, fairways, maintenance, protective works, turning basins, types, etc.	0	0	0	L	L	L	L	L	+	L	+	L	0	L	L	L	L	L	+	2	depth information by inference only; see water depth			
Harbors, detection	CMS		L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	2					
Mass transit system	30-10, p 7-29	maintenance, equipment, capacity, type, terminals, etc.; manual lists as public transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	detection, identification, and mapping of layout is straight forward within sea's limitations; information about specific characteristics is mostly inferential; this is detection of a system, but determining whether it is part of a public transportation system is beyond the scope of remote sensing			
Navigation aids	55-8, p C-3		0	0	0	?	0	L	?	0	L	L	0	+	0	0	?	?	0	?	?	0	L	2		
Pipelines, characteristics	30-10, p 5-25	type, size, condition, etc.	0	0	0	0	0	0	0	0	0	L	0	L	L	0	L	L	0	L	L	L	L	L	3	some surficial disturbance such as clearing, moisture, and vegetation change, etc., of a thermal surface pattern must be present for detection and description
Pipelines, detection	CMS		0	0	0	0	0	0	0	L	0	L	L	0	L	L	0	L	+	0	+	2				
Pipelines, leaks	CMS		0	0	0	0	0	0	L	0	L	L	0	L	0	0	L	0	L	L	0	L	+	2	if leaks are of non-gaseous materials, then color, color infrared, multiband, thermal, etc., have at least some basis for detection; if the leak is gaseous, these techniques are not applicable unless the gas has caused vegetation damage, etc.	
Pipelines, pumping stations	30-10, p 5-26	location, function, type	0	0	0	0	0	0	L	0	L	L	0	L	0	0	0	?	0	?	L	0	L	2		
Pipelines, pumping stations, detection	30-10, p 5-26		0	0	0	L	0	L	L	0	L	+	0	+	0	0	?	0	?	+	0	+	2			
Ports, cargo handling facilities	5-30, p 15	miscellaneous cranes, wharves, etc.	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	2		
Ports, description	30-10, p 5-50	condition, obstructions, operating data, relative capacity (CMS), etc.	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	0	L	+	0	+	3			
Ports, principal activity	30-10, p 5-50	passenger, cargo, fishing, recreation, military, etc.	0	0	0	0	0	L	0	0	L	?	0	+	?	0	L	?	0	L	?	0	+	2		
Ports, shipbuilding and repair facilities	30-10, p 5-50	dry docks, cranes, etc.	0	0	0	L	L	L	L	L	L	+	L	+	L	0	L	L	L	L	+	+	+	2		
Railways, description and characteristics	CMS	sections in need of repair, rolling stock, propulsion method, service facilities, tracks, signals and control features, etc.; the above items are specified in the manual, but were combined by CMS to form this factor	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railways, detection	CMS		0	0	0	L	0	+	L	0	+	+	0	+	L	0	+	+	0	+	1					

206

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS				
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i							
Railways, grade	30-10, p 5-11	manual wants maximum grade in terms of location and direction of travel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	2	
Railways, layout	CRS	crossovers, mainline junctions, curvature, underpasses, length, etc.; above items are specified in manual, but were combined to form layout by CRS	0	0	0	L	L	+	L	L	+	L	?	L	L	L	+	+	+	+	+	+	+	+	+	+			1	
Roads, characteristics	CRS	curvature, number of lanes, limiting characteristics, construction materials, length, width, obstructions, etc.; above items specified in manual, but combined here by CRS	0	0	0	0	L	L	0	L	L	L	L	+	0	L	L	L	L	L	L	L	L	L	L	L			2	
Roads, grade	21-26, p 10-10 5-36, p 2-5	an obstruction to movement if 7% or greater	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	L	L	+	L	+	+			2				
Roads, layout	CRS	junctions, pattern, etc.	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+			1				
Roads, military load classification	5-36, p 2-4	bearing capacity; a load capacity rating system as defined in the manual	0	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	?	0	0	L			3				
Tunnels, bypasses	30-10, p 5-18 5-36, p 2-6	manual asks for efforts to establish bypasses only; we assume actual and potential	0	0	0	0	0	?	0	0	L	L	0	L	0	0	L	L	L	+	L	L			2					
Tunnels, characteristics	30-10, p 5-18 55-8, p C-3 CRS	alignment, length, portal characteristics, linings, type, etc.; above items specified in manual, but combined by CRS	0	0	0	0	0	L	0	0	L	L	L	0	L	L	0	L	L	0	L	L	L			2	lining characteristics probably cannot be determined from imagery			
Tunnels, detection	CRS		0	0	0	0	0	L	0	0	L	+	0	L	0	0	L	?	0	+	L	0	+	L		2	the openings of transportation tunnels (railway, road, etc.) are frequently and directly observed in imagery and the presence of tunnels is easy to infer even if the openings are not visible; mine tunnels must generally be inferred; the opening of a hidden tunnel system can frequently be detected by an IR thermal scanner, but only when an atmospheric low is present so that the tunnel is exhaling and only if the internal temperature is different from that of the outside; ground based acoustical systems have had indifferent results			
Waterways, approaches	30-10, p 5-33	nature, location, and identification of conspicuous objects or landmarks and approach channel	0	0	0	0	0	L	0	0	L	L	0	+	?	0	L	L	0	L	L	0	+			2				
Waterways, bank composition	55-8, p C-3		0	0	0	0	0	0	0	0	L	0	0	L	0	0	?	0	0	L	0	0	+			2	mostly inferential unless scale allows one to see riprap, etc.			
Waterways, bank slope	31-60, p 2-2		0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	L	?	L	+			2	can measure in stereo if scale is compatible with object size; otherwise it is an estimate; large scale stereo photography has application here			

207

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i			
Waterways, bottom characteristics	30-10, p 5-34 55-8, p C-3 31-60, p 2-2	composition, stream bed roughness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	inferential in all cases except if the stream is low, in this case, the bottom can be partly seen in stereo imagery	
Waterways, cross section and profile	30-10, p 5-33 55-8, p C-2		0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	L	0	?	L	+	2	inferential in all cases; measurements can be made only in dry areas of the waterway; large scale stereo imagery is applicable
Waterways, description	CBS	maintenance and repair requirements, equipment, inclined planes, towage systems, traffic, cargo handling facilities, characteristic vessel type, etc.; above items specified in manual, but combined here by CBS	0	0	0	L	0	L	L	0	L	L	0	+	?	0	?	L	0	L	L	0	L		2	
Waterways, direction of flow	CBS		0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+		2	
Waterways, layout	CBS	alignment, junctions, etc.; above items specified in manuals, but combined here by CBS	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		1	
Waterways, silting characteristics	55-8, p C-2		0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	?	0	0	L			3	
Waterways, type	30-10, p 5-33 55-8, p C-2 30-10, p 3-18 30-5, p B-2 5-36, p 1-4 21-26, p 2-5 30-20, p 5-3 5-30, p 15	river, lake, canal, etc.; same as channel, watercourse	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+		1	

208

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBI			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i			
Antennas, characteristics and description	CRS	type, number, pattern, dimensions, direction, single or multiple element, type of feed systems, etc.; above items specified in manual but combined by CRS	0	0	0	0	0	?	?	?	L	?	?	L	0	0	0	?	0	?	?	?	?	L	2	limits of scale and acutance/resolution
Antennas, detection	CRS		0	0	0	?	0	?	?	0	L	L	0	+	?	0	?	?	0	?	L	L	L	2		
Antennas, electromagnetic characteristics	30-10, p 6-15 30-10, p 6-16	bandwidth capability, operating frequency, polarisation, radiation pattern	0	0	0	0	0	0	0	0	?	0	?	0	0	0	0	?	0	?	?	?	0	?	3	if the antenna pattern can be determined, then some inferences should be possible about its operating characteristics; for many antennas, this would require larger scale imagery; airborne ECM type gear can also determine some propagation characteristics
Power substations, detection	CRS		0	0	0	0	L	L	0	L	+	0	+	L	0	L	L	0	L	+	0	+	+	2		
Power substations, function	30-10, p 8-7	switching, converting, and transforming	0	0	0	0	0	0	0	0	?	0	0	?	0	0	?	0	0	?	0	0	?	0	2	
Power substations, type	30-10, p 8-7	distribution, transmission, industrial	0	0	0	0	?	0	0	?	0	0	?	0	0	0	0	0	?	0	0	?	0	2		
Power transmission lines, layout	CRS	placement, location, etc.; these items were specified in the manual, but were combined by CRS; this is a system layout; we are not trying to detect the conductors or supporting cables	0	0	0	L	L	L	L	L	+	L	+	L	L	L	L	L	L	L	L	L	+	2		
Power transmission lines, towers and poles	30-10, p 8-7	type (metal, wood, or concrete)	0	0	?	0	L	?	0	L	+	0	+	?	0	?	?	0	?	?	L	0	L	2	radar restricted to metal towers	
Power transmission lines, wire and cable characteristics	30-10, p 8-7		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Power plants, characteristics	CRS	cooling facilities, fuel type, handling and storage, number of hydro-turbines, engines, reactors, boilers, and/or generators, capacity (range estimates only); above items specified in manual, but were combined by CRS to form this factor	0	0	0	L	0	L	L	0	L	0	L	0	L	0	L	0	L	0	L	0	L	2		
Power plants, detection	CRS		0	0	0	+	0	+	+	0	+	+	0	+	L	0	L	0	+	+	0	+	+	2		
Power plants, type	30-10, p 8-7	conventional steam thermal, hydro-turbine storage, hydro-turbine run-of-river, internal combustion thermal, nuclear steam thermal, solar, tidal	0	0	0	L	0	L	0	L	0	L	0	+	?	0	L	0	L	0	L	0	+	2		
Telecommunications, poles	30-10, p 6-15	material, treatment, type, number of crossarms, spacing, etc.	0	0	0	?	0	?	L	L	L	+	L	+	0	0	0	0	0	0	0	L	L	1	detection and mapping of a layout is influenced by tower material, geometry, and aspect angle	

209

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			BACAR			INFRARED THERMAL			LOW LEVEL OBI			STD PHOTO INDEX			STEREO 100,000			STEREO 20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS		
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Telecommunications, support facilities	30-10, p 6-16 31-60, p 7-2	administration, housing, security, repair shops, exchanges and offices, etc.	0	0	0	0	0	?	0	0	?	L	0	L	?	0	L	?	0	?	L	0	L				2	some of the desired information (installations, housing, etc.) can be obtained from imagery; other elements, such as administration, safety, repair facilities, etc., are not obtainable in a practical sense

210<

CATEGORY: Built-up areas

CATEGORY SYMBOL: II.3

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
Built-up areas, classification	CBS	see specific factor in this category	0	0	0	L	L	L	L	L	L	+	+	+	L	L	L	L	L	+	+	+	3		
Built-up areas, detection	CBS		L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1		
Built-up areas, extent	21-26, p 2-6 30-10, p 7-28		L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1		
Control heating plants, characteristics	CBS	installation, area served, type, etc.	0	0	0	0	0	0	L	0	L	L	0	+	0	0	?	0	L	L	0	+	2		
Control heating plants, detection	30-10, p 7-28 30-20, p E-1		0	0	0	+	0	+	+	0	+	+	+	L	0	L	L	0	L	+	0	+	2		
Cultural centers	30-10, p 7-29	museums, libraries, theaters, etc.	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	L	0	L	2		
Drainage, urban	CBS	storm water and snow-melt runoff	0	0	0	0	0	0	0	0	0	0	L	0	0	L	?	0	?	+	0	+	2		
Extractive industry, capacity	CBS	range estimates only	0	0	0	0	0	0	0	0	0	?	0	0	0	0	?	0	0	+	0	+	3		
Extractive industry, detection	CBS		?	0	?	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	0	+	2		
Extractive industry, facilities	CBS	buildings and equipment	0	0	0	L	0	L	L	L	L	+	+	+	L	L	L	L	L	+	+	+	2		
Extractive industry, method of operation	CBS	surface (single or multiple trench) underground	0	0	0	?	0	?	L	0	L	+	0	+	L	0	L	+	0	+	0	+	2		
Extractive industry, product	CBS	ore, gravel, crushed or cut stone, oil, coal, gas, etc.	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	L	0	+	L	0	+	2	
Extractive industry, status	CBS	active or abandoned	0	0	0	0	0	0	L	0	L	L	0	+	0	0	L	?	0	L	L	0	L	2	
Fire fighting facilities and equipment	30-10, p 5-51 21-26, p 10-10	number of stations, equipment, water source	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	?	?	L	0	L	2	
Functional area	30-10, p 7-28 101-5, p G-2 30-5, p 15	military, residential, commercial, industrial, governmental	0	0	0	L	0	L	L	0	L	+	0	+	L	0	+	L	0	+	L	0	+	2	frequently inferential
Garbage and trash facilities	30-10, p 7-29	treatment and disposal plants (location, type, and capacity)	0	0	0	0	0	0	?	0	?	L	0	L	0	0	?	0	?	L	0	L	2	detection and location are possible; the determination of type and capacity, if possible, can only be done by inference	
Gas distribution facilities (urban areas)	CBS	pipelines, mains, trunks, controls, auxiliary installations	0	0	0	0	0	0	?	0	?	?	0	?	0	0	0	0	0	?	0	?	3	buried pipelines can sometimes be detected on photography and thermal infrared imagery	
Hospitals	30-10, p 7-29	adequacy, capacity, condition, specialization	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	2		
Industrial areas, detection	30-5, p 5-2 101-5, p G-2	manual request general information on location, extent, and type of industrial area; i.e., a park with buildings or a group of steel mills	0	0	?	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	0	+	2		

211

CATEGORY: Built-up areas

CATEGORY SYMBOL II.3

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Industrial buildings, characteristics	21-26, p 10-10	location, dimensions, capacity, status	0	0	0	?	0	L	L	0	L	+	0	+	0	0	0	?	0	L	L	0	L			2	
Industrial buildings, detection	CBS		0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	L	0	+	+	0	+			2	
Industrial waste disposal, detection	CBS		0	0	0	0	0	0	L	L	L	0	L	0	0	0	?	0	?	L	0	L			2	color, IIR, multiband of help as a function of known spectral differences	
Manufacturing plants, characteristics	CBS	facilities, product, status, etc.	0	0	0	?	0	?	?	0	?	L	0	+	?	0	?	?	0	?	L	0	+			2	
Parks and recreational areas	CBS		0	0	0	0	0	?	0	0	?	L	0	L	L	0	+	?	0	L	L	0	+			3	scale dependent; e.g., Yellowstone Park vs a small riverside park; primarily inferential and difficult to separate from natural areas
Police protection	30-10, p 7-29	detention and security areas, stations, equipment	0	0	0	0	0	?	?	0	?	?	0	?	0	0	0	?	0	?	?	0	?			2	
Population characteristics	30-10, p 8-3	nomadic, seminomadic, permanent	0	0	0	0	0	L	0	0	L	L	0	L	+	0	+	+	0	+	+	0	+			2	
Population, present	30-10, p 7-27		0	0	0	0	0	L	0	0	L	0	0	+	0	0	+	0	0	+	0	0	+			2	inferential only (estimate)
Population, significant segments	30-10, p 7-27	ethnic, religious, etc.	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	?	0	0	?			2	
Population trend	30-10, p 7-27		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L			3	requires sequential imagery with some reasonable time span
Processing plant, characteristics	CBS	such as refineries; facilities, product, status, etc.	0	0	0	?	0	L	?	0	L	L	0	L	?	0	L	?	0	L	?	0	L			2	
Religious structures	30-10, p 7-29	manual specifies churches only, but mosques, synagogues, etc., are to be included	0	0	0	0	0	0	0	0	0	L	0	+	0	0	0	L	0	L	L	0	+			2	
Schools	30-10, p 7-29 21-26, p 10-10	universities, colleges, etc.	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L			2	
Sewage treatment plants, characteristics	30-10, p 7-29	type, equipment, capacity, and type of collection; actually a type of processing plant, but CBS has defined processing plant as consumer oriented	0	0	0	0	?	?	?	0	?	L	0	L	?	0	?	?	0	?	?	L	0			2	
Sewage treatment plants, detection	CBS		0	0	0	?	0	L	L	0	L	+	0	+	L	0	L	L	0	+	L	0	+			2	
Storage facilities, capacity	30-10, p 7-29	range estimates only	0	0	0	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L			2	primarily inferential
Storage facilities, commodity stored	30-10, p 7-29		0	0	0	?	0	L	?	0	L	L	0	+	?	0	L	?	0	L	L	0	L			2	primarily inferential
Storage facilities, type	30-10, p 7-29	vessels, warehouses, open storage, grain elevators, etc.	0	0	0	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			1	

2122

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
Streets, classification and prevailing width	30-10, p 7-29	primary, secondary, tertiary; paved, unpaved, etc.; manual does not define factor, so CRS has provided comments	0	0	?	J	0	L	0	L	L	0	L	+	0	L	L	0	L	+	0	+	+	2	
Streets, condition	30-10, p 7-29	repair and improvement needed	0	0	0	0	0	0	0	?	L	0	L	0	0	0	0	?	?	0	L	+	2	scale dependent; scale of 1:10,000 preferable	
Streets, pattern	30-10, p 7-29		?	0	?	+	0	+	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	1	
Structures	30-10, p 7-28	material type, type of construction etc.; manual asks for predominant type of building	0	0	0	?	0	?	?	0	?	+	0	+	?	0	L	?	0	?	L	0	L	2	
Water supply, pumping stations	CRS		0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	2	
Water supply, storage facilities	30-10, p 7-28	type, location, capacity, condition; this factor refers to both water tanks and small, local storage reservoirs, not to large reservoirs associated with dams	0	0	0	0	0	L	0	0	L	+	0	+	?	0	L	?	0	L	+	0	+	2	
Water supply, treatment plants, characteristics	30-10, p 7-28	type, capacity, condition	0	0	0	0	?	0	0	?	0	0	L	0	0	?	0	0	?	0	0	L	2	scale limitations in many instances	
Water supply, treatment plants, detection	CRS		0	0	0	0	0	L	0	0	L	L	0	+	0	0	0	L	0	+	L	0	+	2	

213

CATEGORY Agriculture

CATEGORY SYMBOL II.4

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS							
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m					
Agricultural areas	5-30, p 39 30-10, p 3-21	location and extent in 30-10	L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	2								
Agricultural production data	5-30, p 39	manual requests specific numerical data, but range estimates can be made from imagery	O	L	L	O	O	L	O	O	O	+	L	O	?	L	O	?	+	O	+	+	3	this is frequently a prediction based on inferences and linked to the ability to identify crops; computer handling of digital tapes of spectral data can be of assistance (ERTS, Purdue Univ, LARS, etc.)		
Agriculture, general type	101-5, p G-2	vineyards, row crops, orchards, etc. from cultivated vegetation in the manual	?	O	L	O	O	L	O	O	L	+	O	+	L	O	+	+	O	+	+	O	+	+	2	different crops can have different textural patterns and different spectral characteristics; obviously, large scale imagery can provide more pattern details than can small scale imagery; if a crop has known spectral characteristics that differ from its surroundings and from other crops, then detection is possible by taking imagery in the spectral bands where these differences exist; this then needs for multiband, color, and color infrared photography and for density slicing and computer handling of digital tapes.
Crop identification	30-10, p 3-21	specific crop, such as peaches, beans, or bananas, etc.	O	O	O	O	O	O	O	O	?	L	O	L	?	O	L	L	O	L	L	O	L	3	ERTS and equivalent imagery have the disadvantage of very small scale; for each band there are a number of brightness levels and this provides the basis for some level of spectral identification; color, multiband, multichannel scanners, etc., can also provide, or help provide, this information; inference based on texture and pattern are limited; of most use to the analyst are knowledge of local agricultural practices and crop calendars	
Cultivation	30-10, p 3-22	method, period	O	O	O	O	O	L	O	O	L	L	O	+	O	O	L	?	O	?	L	O	+	2	any time dependent factor such as period requires sequential imagery and knowledge of local cultural practices	
Harvesting	30-10, p 3-22	method, period, product, yield, disposition and distribution; because they are unclear in the manual, we are not considering disposition and distribution	O	O	O	?	O	L	L	O	L	+	O	+	L	O	L	L	O	L	+	O	+	2		
Irrigation, detection	30-10, p 3-18	inadequately defined in manual; CRS assumes detection of systems and practices	?	O	L	?	O	L	L	O	+	L	O	+	L	O	+	L	O	L	L	O	+	2		
Planting practices	30-10, p 3-22	method, period	O	O	O	?	O	?	?	O	?	L	O	L	?	O	L	?	O	L	L	O	L	2	need sequential imagery for period	

214

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Dams, associated structures	30-10, p 3-19	conduits, spillways, outlets, intakes, gates, etc.	0	0	0	L	L	L	+	+	+	+	+	+	L	L	L	?	?	L	+	+	+			2	
Dams, detection	CRS		L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			2	can detect directly within scale limits, or infer its presence because of the shape of an impounded water body and its relation to the terrain; satellite imagery, such as ERTS, is quite limited in terms of manual procedures; however, if digital data and computer techniques can be used, then a credible job can be done
Dams, purpose	30-10, p 3-19 55-8, p C-3	power, water supply, irrigation, flood control	0	0	L	L	0	L	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+			3	
Dams, type	30-10, p 3-19	fixed, movable, gravity, etc.; earthfill, rockfill, concrete, etc.	0	0	0	?	0	L	?	0	L	+	0	+	L	0	L	L	0	L	+	0	+			2	
Dikes and levees	30-10, p 5-33	CRS assumes manual refers to man-made levees and have added dikes to represent all types of retaining walls	0	0	0	L	L	L	L	L	L	+	L	+	L	L	L	+	+	+	+	+	+			2	
Ditches	30-10, p 5-6	depth, width, lining, condition, structures (weirs, gratings, etc.), etc.	0	0	0	0	0	0	L	L	L	+	L	+	L	L	L	?	?	?	+	L	+			2	
Groins	30-10, p 5-33	part of inland waterway check list along with jetties; manual wants location, function, design, and materials	0	0	0	L	0	L	+	0	L	+	0	+	L	0	L	+	0	+	+	0	+			2	information about location is feasible with any imagery; information about design, materials, and function is mostly inferential.
Jetties	30-10, p 5-33	location, function, design, and materials	0	0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			2	information about location is feasible with any imagery; information about design, function, and materials is mostly inferential
Locks, description	30-10, p 5-33	type of gates, depth over sill, condition, etc.	0	0	0	0	0	0	L	0	L	L	0	+	0	0	L	?	0	?	L	0	L			2	
Locks, detection	CRS		0	0	0	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+			2	
Reservoirs	30-10, p 3-19	dimensions, width, capacity, etc.; associated with dams	L	L	+	+	+	+	+	+	+	+	+	+	L	+	+	+	+	+	+	+	+			1	

215

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m									
Effluent, chemical	CRS		0	0	0	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	1	color, color infrared, multiband and multichannel scanners have definite application; the user must have knowledge of spectral differences between effluent and background in order to select the proper tool			
Effluent, thermal	CRS		0	0	0	0	0	0	+	+	+	0	0	0	0	0	0	0	0	0	0	2			
Oil spills	CRS	on water, extent	0	0	0	0	?	?	L	L	L	L	L	L	0	0	L	+	L	L	+	L	2	color, multiband, and multichannel scanners have application to this factor as well as comparative photography (UV or blue band and non-filtered); sun angle is important	
Smog, detection	CRS		0	0	0	0	0	0	0	0	0	L	0	L	0	0	?	0	L	?	0	L	+	2	airborne air sampler
Smoke, detection	CRS		0	0	L	0	0	0	?	0	L	L	0	+	L	0	L	0	+	L	0	+	+	2	airborne air sampler
Water turbidity	30-10, p 3-20	used in manual in terms of defining water quality, but as turbidity is applicable to other interpretations it is included here	L	0	L	0	0	0	?	0	?	L	0	L	L	0	L	0	L	L	0	L	L	2	color and color infrared are useful for this factor; pre- and post-turbidity photos might allow for semi-quantitative estimates, otherwise, only a very general qualitative estimate can be made
Water turbidity, sources	CRS	man-induced erosion, acid mine drainage, etc.	0	0	L	0	0	0	0	0	?	L	0	L	L	0	L	L	0	L	L	0	L	2	

216 <

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS	
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				
Construction equipment	30-10, p 5-12	detection and location: manual refers specifically to railways, but factor can be applied universally, and is so intended	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2		
Construction sites, description	5-30, p 15	drainage, water supply, earthwork, acreage, power, access, soil, facilities, etc.	0	0	0	0	L	L	L	L	L	L	L	L	L	+	+	2		
Construction sites, detection	30-10, p 8-15 5-30, p 15	in the manual this is referred to as area identification and location (30-10)	0	0	0	0	L	0	L	+	+	+	+	L	0	L	+	+	2	
Earthwork requirements	5-330, p 4-22	mass diagrams; soil and rock excavation	0	0	0	0	0	0	0	0	0	0	0	0	L	L	L	+	2	the laser terrain profiler is applicable here
Foundation conditions	30-10, p 5-51	condition of material, suitability	0	0	0	0	0	0	0	0	L	0	0	L	0	0	L	0	3	
Slope, maximum stable	30-10, p 3-13	natural or cut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	3	this is a complex factor and in order to make inferences requires much auxiliary information

217

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL ORL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS	
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				
Aggregate, source	3-330, p 7-13		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2			
Borrow pits	3-36, p 4-10	manual refers to borrow pits in terms of availability of local materials	0	0	0	L	L	L	+	+	+	+	L	+	L	+	+	2		
Developmental aspects, construction resources	30-10, p 8-15	accessibility, processing requirements, etc.	0	0	0	0	0	0	0	0	+	L	0	+	0	+	+	2		
Rock, use suitability	30-10, p 3-14 CMS	degree and limiting factors of rock for binder, base course, aggregate, fill, embankments, masonry (rubble or cut stone), riprap, roofing material, subbase, untreated surfacing, etc.	0	0	0	0	0	L	0	0	?	0	0	L	0	0	L	0	3	
Sand and gravel	31-60, p 2-2 30-10, p 8-15	location and extent of sources; unexploited sources	0	0	0	0	0	L	0	0	L	0	0	L	0	0	+	0	3	
Stockpiled material	30-10, p 8-15	location, type, characteristics, quantity and loading equipment	0	0	0	L	?	L	L	L	L	L	+	L	L	L	+	+	2	
Soil, use suitability	30-10, p 3-15 CMS	binder, fills, embankments, unsurfaced roads, subgrades, topsoil, etc.	0	0	0	0	0	?	0	0	?	0	0	L	0	0	+	0	3	
Timber, use suitability	CMS	this is an evaluation of timber resources at any given site with reference to need at hand	0	0	0	0	0	0	0	0	L	0	0	+	0	0	L	0	2	

218 >

CATEGORY: Site selection

CATEGORY SYMBOL III.2

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS
			d	m	d	m	d	m	d	m	d	m	d	m	d	m			

219<

CATEGORY: Map and chart revision

CATEGORY SYMBOL: III-3

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS
			d	m	d	m	d	m	d	m	d	m	d	m	d	m		

2200

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL.		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m									
Aircraft, detection	CMS		0	0	0	0	+	+	+	+	+	+	+	+	+	+		2							
Aircraft, identification	CMS		0	0	0	?	?	?	L	L	L	+	+	+	0	0	L	?	?	L	L	L	L	2	
Assembly areas, potential	CMS 31-60, p 2-2		0	0	0	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	2				
Avenues of approach	5-30, p 40 101-5, p G-2 5-36, p 1-3 30-10, p 4-2 31-60, p 2-2	air, ground, water	0	0	?	0	0	L	0	0	L	0	0	L	0	0	+	0	0	+	3	this generally requires the preparation of an environmental data base by image analysis and an evaluation of slope, soils, vegetation, etc.			
Bivouac areas, detection	5-30, p 15	actual and potential	0	0	0	?	0	?	L	0	+	?	0	+	0	0	?	0	?	+	0	+	+	2	color, color infrared, multiband, and multichannel scanners also have application to this element
Camouflage	30-5, p 9-10	this reference describes briefly the general use of camouflage, not the need for camouflage information	0	0	0	L	0	L	L	0	L	0	0	0	0	0	0	0	L	0	L	+	3	remote sensing techniques can be used in two ways: 1) to evaluate a given piece of terrain to determine general type required and 2) to attempt to detect camouflage in place; CMS has arbitrarily defined camouflage in terms of detection; no one system or combination of systems is adequate; the camouflage must have a different electrical property in some part of the spectrum, or induce such a change at the site; color, false color, multichannel, etc., all have application	
Concealment, potential for	5-30, p 40 5-36, p 1-3 30-10, p 3-22 31-60, p 2-2	protection from observation	0	0	?	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	2	
Contaminated areas (CBR)	30-5, p 3-17	CBR = chemical, biological, and/or radiological	0	0	0	0	0	0	?	?	?	0	?	0	0	?	0	?	?	?	?	L	2	some conditions apply here as under camouflage; in addition, atmospheric samplers, scintillation counters, etc can provide information bits	
Cover, potential	5-30, p 40 5-36, p 1-3 31-60, p 2-2	protection from fire	0	0	0	0	0	L	0	0	?	?	0	L	0	0	?	?	0	L	L	0	+	2	
Critical points	30-10, p 5-12	landslides, avalanches, etc.; railways, highways, etc.; a critical point can be any item of interest and may be actual or potential	0	0	L	L	L	L	L	L	L	+	+	+	L	L	L	+	+	+	+	+	+	3	some artificial points are so obvious that detection is simple and direct; other critical points could be designated only by inferential procedures and a high degree of skill
Cross country movement	5-36, p 4-1 to p 4-5 30-10, p 4-3 to p 4-16		0	0	L	0	0	L	L	L	L	L	L	L	L	L	L	+	+	+	+	+	3	regional information such as mountain masses, valleys, etc can be inferred from ERTS-type imagery, and thus may have application to CCM if compatible with the specific problem	
Damage assessment	5-36, p 1-6 30-5, p 3-18	artillery, bombs, missiles, etc.; need indicated in many places, but not specific; CMS defines this item as damage to terrain by artillery, etc.; natural damage can be evaluated by the same techniques	0	0	0	L	0	L	L	L	L	+	+	+	L	L	L	+	L	+	+	+	+	2	

221

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL ORL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER SKILL LEVEL	SENSOR COMMENTS
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i		
Defenses	5-30, p 4 5-30, p 15 30-10, p 7-22	airfields, coastal, tunnels, ports, fixed installations, etc.; manuals indicate need for this information; CRS has lumped the items together to include these specific items and others like them	0	0	0	?	0	L	L	L	L	+	0	+	?	0	L	?	0	?	L	0	L	2	
Defilade positions	5-30, p 15	according to AR 310-25, this refers to protection from enfilading fire and enemy observation	0	0	0	0	0	L	0	0	0	L	0	L	L	0	L	+	0	+	+	0	+	3	inferential only and very limited without stereo; many such positions can be readily determined from imagery; other conditions would require a careful evaluation of materials, landform, slope, vegetation, etc.; this latter procedure is more inferential and demands higher levels of skill as well as diverse skills
Defoliation, susceptibility to	30-10, p 3-21		0	0	0	0	0	0	0	0	0	?	0	L	?	0	L	?	0	?	?	0	+	3	species susceptibility can be modified by water balance, presence or absence of certain elements, etc.; thus soil type, mineral content, soil/water relations, slopes, locations, etc. must be evaluated, making this an inferential type task and requiring diverse knowledge and skills
Demolition requirements	30-10, p 5-17	bridges, tunnels, towers, silos, etc.; the initial reference is bridges only, but factor can be applied universally	0	0	0	0	0	0	0	0	?	0	0	+	0	0	0	0	0	?	0	0	+	2	inferential only
Dispersal and storage areas, detection	30-10, p 4-18	actual and potential; all types of dumps	0	0	0	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	2	
Drop sites	30-10, p 3-8	potential or suitable	0	0	0	0	0	L	L	0	L	L	0	L	L	0	L	L	0	+	+	0	+	2	
Enemy command posts	30-5, p 3-7		0	0	0	0	0	0	?	0	L	?	0	L	0	0	0	?	0	?	?	0	L	2	
Enemy fortifications	21-26, p 10-10 30-10, p 7-30 101-5, p G-2 30-5, p B-2	location, extent, type, purpose, camouflage, armament, design, and description	0	0	0	L	L	L	L	L	L	L	L	L	L	L	L	?	?	?	L	L	L	3	depending on other factors (camouflage, type, location, spectral differences, magnetic differences, etc.), other sources must also be considered, e.g., color, false color, magnetometry, multiband, etc.
Enemy outposts	30-5, p 3-7		0	0	0	0	0	0	?	0	?	?	0	?	0	0	0	0	0	?	0	0	?	2	
Fields of fire, flat trajectory	30-10, p 3-22 31-60, p 2-2	reference refers to flat trajectory weapons from the standpoint of vegetation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	?	L	L	L	2	
Guerrilla	CRS 31-60, p 2-3	campsites, fires, trails, cleared areas	0	0	0	0	0	0	L	0	L	L	0	L	0	0	L	L	0	L	L	0	L	3	detection is possible under limited conditions; in most instances, inference only can be made; sequential (time separation) imagery is essential
Key terrain features	101-5, p G-3	according to the manual, this is defined as a locality which gives advantage to either side	0	0	L	L	0	L	L	0	L	L	0	L	L	0	L	+	0	+	+	0	+	3	
Landing beaches	5-30, p 4	the manual is unclear in terms of need; CRS assumes selection and assessment	0	0	0	0	0	L	0	0	L	0	0	+	0	0	L	0	L	L	0	+	+	3	
Line of sight	101-5, p G-2	includes critical relief	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	?	?	+	L	+	3	



CATEGORY: Military Aspects

CATEGORY SYMBOL IV

FACTOR	REFERENCE	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS
			d	m	d	m	d	m	d	m	d	m	d	m	d	m			
Vehicles, identification	CBS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Weapons, location of	30-5, p 4-6 31-60, p 2-2	automatic weapons, artillery, mortars, armored vehicles, antiaircraft, etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Withdrawal areas	30-5, p 3-11	allies and enemy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
Withdrawal routes	30-5, p 3-11	allies and enemy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	

221

in C. 4.

## APPLICATION TO SELECTED PROBLEMS

In order to illustrate some applications of this report, four military problems were chosen for evaluation. These were (1) Cover and Concealment, (2) Cross-Country Movement, (3) Lines of Communication, and (4) River Crossing Operations. Each problem section contains three parts: (1) a list of information needs required by the problem, (2) a remote sensor evaluation, and (3) a skill level evaluation. The information needs, or problem factors, were taken from military manuals associated with the problem and from ETL personnel. To the right of the problem factor column is a listing of evaluation factors, taken from the Categorized Evaluation of this report, which are deemed to meet the needs cited in the problem factor column. When it was not possible to find an evaluation factor to match the problem factor, it is so stated in the column.

The tabular information of each problem section is also presented in chart form. One chart shows the remote sensor versus information factor evaluation, and another shows the relation between skill level of the analyst and information requirements. In these charts, the symbols L and + have been expanded to three levels to show a finer representation of capability. The symbol L denotes limitations, and at the L1 level, these are severe. The symbols L2 and L3 indicate a decreasing order of severity. The symbol + denotes that, within practical limits, the indicated remote sensing technique is applicable to the indicated information factor, and a +3 signifies that, in general, more information can be practically derived than can be done at a +2 level. The symbols ? and 0 stand for uncertainty and lack of applicability, respectively (refer to table 4). Within the report, these symbols refer to conventional manual analysis procedures only. The symbol \*, which appears in the right column for some factors, indicates a potential for practical gain in capability through field and laboratory research. With reference to skill levels, the number 1 indicates that a minimum level of training is needed by the analyst, 2 indicates that in addition to minimum schooling the analyst requires considerable knowledge about a specialty, and 3 indicates the need for a considerable depth of knowledge, or a working knowledge about several specialties or disciplines. Refer to table 5 for complete definitions of the skill levels.

Problem: Cover and Concealment

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ELECT'S IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS									
			d	m	i	d	m	i	d	m	i	d	m	i	d	m			i	d	m	i					
Height of plant	Tree height		0	0	0	0	L	?	0	0	?	0	L	+	0	0	L	0	?	L	L	L	L	2	within limitations of scale and obscuration (including closure of trees), these factors can be measured directly in stereo imagery; average estimates for a vegetation type can also be inferred and this is the usual procedure for 1:20,000 scale imagery and smaller		
Plant spacing	Tree spacing	if trees cannot be topped, a minimum spacing of 4.5-6 m is required	0	0	0	0	0	0	L	L	0	L	L	L	0	0	L	0	0	L	L	L	L	+	2	same comments as above	
Stem diameter	Stem characteristics	diameter and height	0	0	0	0	0	0	0	0	?	?	L	0	0	L	0	0	L	0	0	L	0	0	L	3	inferential only as a probable type or species characteristic; this factor requires detailed and extensive knowledge about plant characteristics and their modification by climate, soil mantle depth, etc.
Crown diameter	NOT COVERED IN MATRIX		0	0	0	0	0	?	0	0	L	L	L	L	0	0	0	0	?	L	L	L	L	L	2		
Canopy closure	Vegetation canopy, characteristics	clearance beneath, cover, depth, average height, structure	0	0	0	0	0	?	0	0	L	L	L	L	0	0	L	?	?	L	L	L	L	+	2	within limitations of scale and obscuration, some of these needs can be approximately measured in stereo imagery; other than that, and at scales of 1:20,000 or less, these items can only be estimated as average values for identified vegetation types or species, under the existing soil/moisture conditions	
Obstacles, height	Obstacles to movement, artificial	also includes obstructions to airlanding also includes obstructions to airlanding	0	0	0	?	?	L	L	L	L	L	L	L	0	0	L	L	L	L	L	L	L	L	2		
	Obstacles to movement, natural		0	0	?	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	+	2	
Microrelief obstacles, mean spacing	Surface irregularities	boulder fields, lava flow surfaces, etc.; refers to what might be called micro-relief features - irregular areas where the irregularities are not specific landforms	0	0	0	?	0	?	?	0	L	L	0	L	0	?	0	0	?	?	0	L	0	L	2	surface irregularities can be seen directly, and measured, in stereo imagery without the scale limitations; without stereo only inferences can be made, although the inference can be on firmer ground with low level obliques	
Ground slope	Slope		0	0	0	0	0	?	0	0	0	L	0	L	0	0	L	+	+	+	+	+	+	+	2	with the exception of low level oblique (approaching profile conditions), this factor requires stereo imagery; slope can be measured directly, or, with experience, estimated as a slope class; without stereo only very general conditions can be inferred; the laser profilometer is also applicable, but the results can be influenced by surface properties	
Soil type	Soil classification, major	grading (gravel, sand, silt, clay), composition (organic, mineral) and consistency (friable, plastic)	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	0	+	0	0	+	+	3		

226

COVER AND CONCEALMENT: 1:20,000 Stereo

Remote sensor evaluation

Factors from problem matrix

	0	?	L1	L2	L3	+1	+2	+3	Research	
Crown diameter	•••	•••							#	Veg.
Stem diameter	•••	•••							#	
Height of plant	•••	•••	•••	•••					#	
Plant spacing	•••	•••	•••	•••	•••				#	
Canopy closure	•••	•••	•••	•••	•••				#	
Microrelief, surface irregularities	•••	•••								Terrain
Obstacles to movement, artificial	•••	•••								
Obstacles to movement, natural	•••	•••	•••	•••	•••					
Soil classification, major	•••	•••	•••	•••	•••				#	
Slope	•••	•••	•••	•••	•••	•••			#	

Skill level

Factors from problem matrix

	1	2	3	
Height of plant	•••	•••		Veg.
Plant spacing	•••	•••		
Crown diameter	•••	•••		
Canopy closure	•••	•••		
Stem diameter	•••	•••	•••	
Microrelief, surface irregularities	•••	•••		Terrain
Obstacles to movement, artificial	•••	•••		
Obstacles to movement, natural	•••	•••		
Slope	•••	•••		
Soil classification, major	•••	•••	•••	

227<

Problem: Cross Country Movement

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER SKILL LEVEL	SENSOR COMMENTS
			d	m	d	m	d	m	d	m	d	m	d	m	d	m		
Ground slope % (map derived)	NOT APPLICABLE																	
Slope intercept frequency (map)	NOT APPLICABLE																	
Vegetation (mean stem spacing, DBH, override diameter)	Tree spacing	If trees cannot be topped, a minimum spacing of 4.5-6 m is required	0	0	0	0	0	L	L	0	L	L	0	0	L	L	L	+
	Stem characteristics	diameter and height	0	0	0	0	0	0	0	?	?	L	0	0	L	0	0	L
Underbrush	Vegetation, general type	trees, shrubs, or grass	0	0	0	0	0	L	0	0	L	+	0	+	L	0	+	+
Rated cone index	Cannot be determined directly but can possibly be derived from the following factors:																	
	Soil classification, major	grading (sand, gravel, silt, clay), composition (organic, mineral) and consistency (friable, plastic)	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	+
	Soil moisture content	30-10 requests soil moisture content as % dry weight which cannot be obtained, but as estimates can be made from imagery, the factor is included	0	0	0	0	?	0	0	L	0	0	0	0	0	0	?	0
	Trafficability, terrain group and class of soil	groups A, B, and C and classes I, II, III, and IV	0	0	0	0	0	0	0	0	0	L	0	0	?	0	0	L
Microrelief, type of feature (point or linear)	Surface irregularities	boulder fields, lava flow surfaces, etc.; refers to what might be called micro-relief features - irregular areas where the irregularities are not specific landforms	0	0	0	?	0	?	?	0	L	L	0	L	0	0	?	?
Microrelief, mean spacing	Surface irregularities	same as above	0	0	0	?	0	?	?	0	L	L	0	L	0	0	?	?
Microrelief, mean height	Surface irregularities	same as above	0	0	0	?	0	?	?	0	L	L	0	L	0	0	?	?
Microrelief, mean face angle	Surface irregularities	same as above	0	0	0	?	0	?	?	0	L	L	0	L	0	0	?	?
Embankments (≥ 5m < CI)	Evaluated here as a separate item; it would normally be picked up with roads and railways		0	0	0	0	0	L	0	0	0	+	0	+	0	0	L	L
Escarpments (≥ 5m < CI)	normally done as part of specific landforms; inserted here as separate item		0	0	0	0	0	L	0	0	0	+	0	+	0	0	L	L
Cuts (≥ 5m < CI)	evaluated here as separate item; would normally be picked up with roads and railways		0	0	0	0	0	?	0	0	0	+	0	+	0	0	L	L

228

Problem: Cross Country Movement

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS	
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i				
Fills (2.5m < CI)	Evaluated here as separate item; would normally be picked up with roads and railways		0	0	0	0	0	?	0	0	0	+	0	+	0	0	0	L	L	?	L	+	L	+		2	
	The following items, though not specifically requested have been added:																										
	Slope		0	0	0	0	0	?	0	0	0	L	0	L	0	0	L	+	+	+	+	+	+		2	with the exception of low level obliques (approaching profile conditions), this factor requires stereo imagery; slope can be measured directly, or, with experience, estimated as a slope class; without stereo only very general conditions can be inferred; the laser profilometer is also applicable, but the results can be influenced by surface properties	
	Landforms, general type	plains, mountains, escarpments, hills, depressions	L	0	L	L	0	+	?	0	L	L	0	+	L	0	+	+	+	+	+	+	+		2	although the various types can be directly observed in stereo photography, their classification requires background knowledge; without stereo imagery the types can only be inferred	
	Landforms, specific type	bars, kames, ridges, moraines, etc.	0	0	0	L	0	+	?	0	L	L	0	L	L	0	L	+	+	+	+	+	+		3	same comments apply as above	

229 <

CROSS-COUNTRY MOVEMENT: 1:20,000 Stereo

Remote sensor evaluation

Factor from problem matrix	0	?	L1	L2	L3	+1	+2	+3	Research	
Stem characteristics	[dots]		[dots]		[dots]		[dots]		#	Veg.
Tree spacing	[dots]		[dots]		[dots]		[dots]		#	
Vegetation, general type	[dots]		[dots]		[dots]		[dots]		#	
Microrelief, mean face angle	[dots]		[dots]		[dots]		[dots]		#	Terrain
Microrelief, mean height	[dots]		[dots]		[dots]		[dots]		#	
Microrelief, mean spacing	[dots]		[dots]		[dots]		[dots]		#	
Microrelief, feature type	[dots]		[dots]		[dots]		[dots]		#	
Trafficability, terrain group and class of soil	[dots]		[dots]		[dots]		[dots]		#	
Slope	[dots]		[dots]		[dots]		[dots]		#	
Cuts ( $\geq 5m < CI$ )	[dots]		[dots]		[dots]		[dots]		#	
Fills ( $\geq 5m < CI$ )	[dots]		[dots]		[dots]		[dots]		#	
Embankments ( $\geq 5m < CI$ )	[dots]		[dots]		[dots]		[dots]		#	
Soil classification, major	[dots]		[dots]		[dots]		[dots]		#	
Escarments ( $\geq 5m < CI$ )	[dots]		[dots]		[dots]		[dots]		#	
Landforms, general	[dots]		[dots]		[dots]		[dots]		#	
Landforms, specific	[dots]		[dots]		[dots]		[dots]		#	

Skill level

Factor from problem matrix	1	2	3	
Tree spacing	[dots]	[dots]		Veg.
Vegetation, general type	[dots]	[dots]		
Stem characteristics	[dots]	[dots]	[dots]	
Microrelief, feature type	[dots]	[dots]		Terrain
Microrelief, mean spacing	[dots]	[dots]		
Microrelief, mean height	[dots]	[dots]		
Microrelief, mean face angle	[dots]	[dots]		
Embankments ( $\geq 5m < CI$ )	[dots]	[dots]		
Escarments ( $\geq 5m < CI$ )	[dots]	[dots]		
Cuts ( $\geq 5m < CI$ )	[dots]	[dots]		
Fills ( $\geq 5m < CI$ )	[dots]	[dots]		
Slope	[dots]	[dots]		
Landforms, general	[dots]	[dots]		
Landforms, specific	[dots]	[dots]	[dots]	
Soil classification, major	[dots]	[dots]	[dots]	
Trafficability, terrain group and class of soil	[dots]	[dots]	[dots]	

230<

Problem: Lines of Communication (LOC)

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY		RACAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 100,000		STEREO 120,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
Aerial cableways	Cableways, description	capacity, carriage data, base stations, length, maintenance, power, etc.; in terms of check list, p 5-21, 5-22	0	0	?	?	L	?	L	+	L	+	?	L	L	L	L	L	2						
	Cableways, detection		0	0	0	L	0	L	+	0	+	+	0	+	L	0	L	0	L	+	0	+	2	Limited by scale, acutance/resolution, and brightness contrast	
Bridges, abutment location	Bridges, abutment characteristics	type, dimensions, material, etc.	0	0	0	0	0	0	0	0	L	L	L	0	0	0	0	?	?	0	L	2			
Bridges, abutment material	Bridges, abutment characteristics	same as above	0	0	0	0	0	0	0	0	L	L	L	0	0	0	0	?	?	0	L	2			
Bridges, type of construction of abutment	Bridges, abutment characteristics	same as above	0	0	0	0	0	0	0	0	L	L	L	0	0	0	0	?	?	0	L	2			
Bridges, cross section	Bridges, structure type	number of spans, description of spans, suspension system, description of arches, intermediate support characteristics, etc.	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	L	L	+	2		
Bridges, span length	Bridges, structure type	same as above	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	L	L	+	2		
Bridges, span type	Bridges, structure type	same as above	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	L	L	+	2		
Bridges, span cross section	Bridges, structure type	same as above	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	L	L	+	2		
Bridges, length and width	Bridges, structure type	same as above	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	L	L	+	2		
Bridges, elevation drawing	Although considered as part of "structure type" factor, these items are evaluated here, since there are variances from the average figure of merit		0	0	0	0	0	0	0	0	+	+	+	0	0	0	0	?	0	0	L	2			
Bridges, pier sketch			0	0	0	0	0	0	0	0	+	L	+	0	0	0	0	0	?	0	0	?	2		
Bridges, pier type			0	0	0	0	0	0	0	0	+	0	+	0	0	0	0	0	?	0	0	L	2		
Bridges, pier height			0	0	0	0	0	0	0	0	+	L	+	0	0	0	0	0	?	0	0	L	2		
Bridges, obstacle crossed	NOT COVERED IN MATRIX; evaluated here as a separate item; can include this in detection or structure type		0	0	0	L	0	L	L	0	L	+	0	+	L	0	+	+	0	+	+	+	2		
Bridges, overpasses, causeways, viaducts	Bridges, detection		0	0	?	+	0	+	+	0	+	+	0	+	L	0	L	+	0	+	+	0	+	2	
Bridges, bypass conditions	Bridges, bypasses	to be classified as easy, difficult, and impossible; location	0	0	0	0	0	L	0	0	L	+	L	+	L	L	L	L	L	+	+	+	+	2	
	The following items, though not specifically requested, are added:																								
	Bridges, condition	in terms of effort required to repair damage in manual	0	0	0	L	L	L	L	L	+	+	+	0	0	0	L	L	L	+	+	+	2	although detection of some types of damage might be relatively easy to do, conclusions about effort and materials needed would be mostly inferential and would be based on experience and specialized knowledge	

231 <

Problem: Lines of Communication (LOC)

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY		RADAR		INFRARED THERMAL		LOW LEVEL OBL		STD PHOTO INDEX		STEREO 1:100,000		STEREO 1:20,000		OTHER	SKILL LEVEL	SENSOR COMMENTS						
			d	m	d	m	d	m	d	m	d	m	d	m	d	m				d	m				
	Bridges, military load classification	load carrying capacity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	2	inferential only; image keys will aid the novice; measurements cannot be made on a classification, but measurements must be made on the bridge itself to develop the classification					
	Bridges, use type	dummy, vehicular, foot; multiple or single use; aqueducts	0	0	0	L	L	L	+	+	+	+	+	L	L	L	L	L	L		+	2			
Culverts (meaning uncertain)	Culverts, detection	5-330 defines culvert as a short bridge, but CRS is using culvert as defined in 5-36, an underground passage for water	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	L	0		L	2			
Ferries, crossing length	Ferries, description	crossing time, type, hazards, traffic, routes, propulsion method	0	0	0	0	0	0	0	0	L	0	L	0	0	0	?	0	?		L	0	L	2	
Ferry, bypass conditions	Not listed as such; could be covered under ferries, description (see above)		0	0	0	?	0	L	L	0	L	+	0	+	L	0	L	L	0		+	L	0	+	2
	The following item, though not specifically requested, is added:																								
	Ferries, detection	includes ferry terminals	0	0	0	L	0	L	L	0	L	L	0	L	L	0	L	L	0		L	L	0	L	2
Fords, length and width (nearest meter)	Fords, description	banks, load class, bottoms, hazards, bypasses, etc.	0	0	0	0	0	0	?	0	L	L	0	L	L	0	L	L	0		L	+	0	+	2
Fords, bypass conditions	Fords, description	same as above	0	0	0	0	0	0	?	0	L	L	0	L	L	0	L	L	0		L	+	0	+	2
Fords, cross section	Not practically obtainable; what could be inferred would come under description																								
Fords, bottom characteristics	Normally done as part of description; can also be done under "Waterways, bottom characteristics"		0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0		L	0	0	L	3
	The following item, though not specifically requested, is added:																								
	Fords, detection		0	0	0	0	0	L	L	0	L	+	0	+	L	0	L	L	0		L	+	0	+	2
Railroads, maximum grade (%)	Railways, grade	manual vents maximum grade in terms of location and direction of travel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	L	L

2324

Problem: Lines of Communication (LOC)

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBI.			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER SKILL LEVEL	SENSOR COMMENTS			
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i					
Railroads, radius of curvature	Railways, layout	crossovers, mainline junctions, curvature, underpasses length, etc.; above items are specified in manual, but were combined to form layout by CBS	0	0	0	L	L	+	L	L	+	L	L	+	L	L	L	+	+	+	+	+	+	+	+	+	1	
Railroads, component routes (layout)	Railways, layout	same as above	0	0	0	L	L	+	L	L	+	L	L	+	L	L	L	+	+	+	+	+	+	+	+	+	1	
Railroad, number of tracks	Railways, layout	same as above	0	0	0	L	L	+	L	L	+	L	L	+	L	L	L	+	+	+	+	+	+	+	+	+	1	
Railroads, yard layout	Railways, layout	same as above	0	0	0	L	L	+	L	L	+	L	L	+	L	L	L	+	+	+	+	+	+	+	+	+	1	
Railroads, layout of maintenance and repair	NOT COVERED IN MATRIX; probably could be done under railways, layout, but with less certainty than tracing tracks																											
Railroads, layout of storage facilities	Storage facilities, type	vessels, warehouses, open storage, grain elevators, etc.	0	0	0	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	1	
	Storage facilities, capacity	range estimates only	0	0	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	2	primarily inferential
Railroads, segment end points (major changes in load, bearing, number of lanes)	Railways, description and characteristics	sections in need of repair, rolling stock, propulsion method, service facilities, tracks, signals and control features, etc.; the above items are specified in the manual, but were combined by CBS to form this factor	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, type of service	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, power transfer method	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, track gauge	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, yard function	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railway condition	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, right of way width	Railways, description and characteristics	same as above	0	0	0	L	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2	
Railroads, special	NOT COVERED IN MATRIX																											
	The following item, though not specifically requested, is added: Railways, detection		0	0	0	L	0	+	L	0	+	+	0	+	L	0	+	L	0	+	+	0	+	+	0	+	1	

233 <

Problem: Lines of Communication (LOC)

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STD PHOTO INDEX			STEREO 1 100 000			STEREO 1 20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
Roads, turnouts, rest, and park areas	Roads, layout	junctions, pattern, etc.	L	O	L	L	O	L	+	O	+	L	O	L	+	O	+	+	O	+	+	O	+	+	O	+		1	
Roads, constructions	Roads, characteristics	curvature, number of lanes, limiting characteristics, construction materials, width, length, obstructions, etc.; above items specified in manual, but combined here by CRS	O	O	O	O	L	L	O	L	O	L	L	L	+	O	L	L	L	L	L	L	L	L	L	L		2	
Roads, width of travelled way (to 0.5 m)	Roads, characteristics (not to 0.5 m)	same as above	O	O	O	O	L	L	O	L	O	L	L	L	+	O	L	L	L	L	L	L	L	L	L	L		2	
Roads, classification (as in TMS-1)	NOT COVERED IN MATRIX		O	O	O	O	O	O	O	O	?	O	L	+	O	O	L	O	O	L	O	O	L	O	L	+		2	
	The following item, though not specifically requested, is added:																												
	Roads, military load classification	bearing capacity; a load capacity rating system as defined in the manual	O	O	O	O	O	?	O	O	?	O	O	L	O	O	?	O	O	?	O	O	L	O	O	L		3	
Tunnels, portal location	Tunnels, detection		O	O	O	O	O	L	O	O	L	+	O	L	O	O	L	?	O	+	L	O	+	L	O	+		2	the openings of transportation tunnels (railway, road, etc.) are frequently and directly observed in imagery and the presence of tunnels is easy to infer even if the openings are not visible; mine tunnels must generally be inferred; the opening of a hidden tunnel system can frequently be detected by an IR thermal scanner, but only when an atmospheric low is present so that the tunnel is exhaling and only if the internal temperature is different from that of the outside; ground based acoustical systems have had indifferent results
Tunnels, length	Tunnels, characteristics	alignment, length, portal characteristics, lining, type, etc.; above items specified in manual, but combined by CRS	O	O	O	O	O	L	O	O	L	L	L	L	O	L	L	O	L	L	L	L	L	L	L	L		2	
Tunnels, cross section (dimensioned sketch)	Tunnels, characteristics	same as above	O	O	O	O	O	O	O	O	O	+	L	+	O	O	O	O	O	O	O	O	O	O	O	O		2	
Tunnels, depth	Tunnels, characteristics	same as above	O	O	O	O	O	O	O	O	O	O	O	O	?	O	O	?	O	O	L	O	O	L	O	L		2	

234

LINES OF COMMUNICATION: 1:20,000 Stereo

Remote sensor evaluation

Factors from problem matrix

	0	?	L1	L2	L3	+1	+2	+3	Research
<u>Aerial cableways, description</u>	•••	•••	•••						
<u>Aerial cableways, detection</u>	•••	•••	•••	•••	•••				
<u>Bridges, pier characteristics</u>	•••								
<u>Bridges, abutment characteristics</u>	•••	•••							
<u>Bridges, bypasses</u>	•••	•••	•••	•••	•••				
<u>Bridges, condition</u>	•••	•••	•••	•••	•••				
<u>Bridges, classification</u>	•••	•••	•••	•••	•••				
<u>Bridges, structure type</u>	•••	•••	•••	•••	•••				
<u>Bridges, dimensions</u>	•••	•••	•••	•••	•••				
<u>Bridges, use type</u>	•••	•••	•••	•••	•••	•••			
<u>Bridges, obstacle crossed</u>	•••	•••	•••	•••	•••	•••	•••		
<u>Bridges, detection</u>	•••	•••	•••	•••	•••	•••	•••		
<u>Culverts, detection</u>	•••	•••							
<u>Ferries, description</u>	•••	•••							
<u>Ferries, detection</u>	•••	•••	•••	•••					
<u>Ferries, bypass conditions</u>	•••	•••	•••	•••	•••				
<u>Fords, seasonal variation</u>	•••								
<u>Fords, bottom characteristics</u>	•••	•••	•••						
<u>Fords, detection</u>	•••	•••	•••	•••	•••				
<u>Fords, description</u>	•••	•••	•••	•••	•••				
<u>Fords, bypass conditions</u>	•••	•••	•••	•••	•••				
<u>Railways, grade</u>	•••	•••							
<u>Storage facilities, capacity</u>	•••	•••	•••						
<u>Railways, description</u>	•••	•••	•••	•••					
<u>Storage facilities, type</u>	•••	•••	•••	•••	•••				
<u>Railways, layout</u>	•••	•••	•••	•••	•••	•••			
<u>Railways, detection</u>	•••	•••	•••	•••	•••	•••	•••		
<u>Roads, characteristics</u>	•••	•••	•••	•••					
<u>Roads, classification</u>	•••	•••	•••	•••					
<u>Roads, grade</u>	•••	•••	•••	•••	•••				
<u>Roads, layout</u>	•••	•••	•••	•••	•••	•••	•••		
<u>Tunnels, characteristics</u>	•••	•••	•••	•••					
<u>Tunnels, detection</u>	•••	•••	•••	•••	•••				
<u>Tunnels, bypass conditions</u>	•••	•••	•••	•••	•••				

LINES OF COMMUNICATION: 1:20,000 Stereo

Factors from problem matrix	Skill level		
	1	2	3
Aerial cableways, detection	••••	••••	
Aerial cableways, description	••••	••••	
Bridges, pier characteristics	••••	••••	
Bridges, abutment characteristics	••••	••••	
Bridges, bypasses	••••	••••	
Bridges, condition	••••	••••	
Bridges, classification	••••	••••	
Bridges, structure type	••••	••••	
Bridges, dimensions	••••	••••	
Bridges, use type	••••	••••	
Bridges, obstacle crossed	••••	••••	
Bridges, detection	••••	••••	
Culverts, detection	••••	••••	
Ferries, description	••••	••••	
Ferries, detection	••••	••••	
Ferries, bypass conditions	••••	••••	
Fords, seasonal variation	••••	••••	
Fords, bypass conditions	••••	••••	
Fords, detection	••••	••••	
Fords, description	••••	••••	
Fords, bottom characteristics	••••	••••	••••
Railways, layout	••••		
Storage facilities, type	••••		
Railways, detection	••••		
Storage facilities, capacity	••••	••••	
Railways, grade	••••	••••	
Railways, description	••••	••••	
Roads, layout	••••	••••	
Roads, characteristics	••••	••••	
Roads, grade	••••	••••	
Roads, classification	••••	••••	••••
Tunnels, detection	••••	••••	
Tunnels, characteristics	••••	••••	
Tunnels, bypass conditions	••••	••••	

Problem: River Crossing

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL.			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
River width	Stream width		0	L	?	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	1	1	a dimension cannot be directly observed in an image; for this reason, sensors are used for direct observation; width is often obscured by vegetation, overhanging banks, etc.
River depth	Water depth		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	L	0	L	L	2	2	clear water can reveal bottom detail to some 15 m with color infrared and 3-40 m with normal color and pan film; pan film is more difficult to evaluate than color film; surface state (ripples, waves, sun glint, etc.) greatly influences the result
Character and velocity of current	Currents	tidal, littoral, stream, oceanic, undertows, etc.	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	0	?	0	0	L	?	2	2	directly observed if flow marks are visible; also possible with stereo time-lapse imagery where apparent relief is proportional to displacement	
Grasscurrents	Currents	same as above	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	0	?	0	0	L	?	2	2	same comment as above	
Undertow	Currents	same as above	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	0	?	0	0	L	?	2	2	same comment as above	
Tidal flow	Currents	same as above	0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	0	?	0	0	L	?	2	2	same comment as above	
Condition of banks	NOT COVERED IN MATRIX		0	0	0	0	0	0	?	0	0	L	0	0	0	0	0	0	?	0	0	0	L		2				
Composition of banks	Waterways, bank composition		0	0	0	0	0	0	0	L	0	0	L	0	0	?	0	0	L	0	0	0	+		2	2	mostly inferential unless scale allows one to see riprap, etc.		
Bank height	NOT COVERED IN MATRIX		0	0	0	0	L	0	0	0	0	0	L	0	0	0	0	0	L	0	0	0	L		2				
Slope of bank	Waterways, bank slope		0	0	0	0	0	0	0	L	0	L	0	0	0	0	0	0	0	L	?	L	+		2	2	can measure in stereo if scale is compatible with object size, otherwise, it is an estimate; large scale stereo photography has application here		
Condition of the riverbed	Waterways, bottom characteristics	composition, stream bed roughness	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	0	L		3	3	inferential in all cases except if the stream is low; in this case, the bottom can be partly seen in stereo imagery		
Flood conditions	Flooding, characteristics	effects, cause, duration, frequency, and type (tidal, snowmelt, direct runoff, etc.)	0	0	L	L	L	L	L	L	+	+	+	+	0	0	0	+	+	+	+	+	+		3	3	much of this rests on inferences; information about duration would require sequential imagery; the effects of flooding can be evaluated only with reference to a given problem		
	Flooding, extent		L	L	0	+	+	+	+	+	+	+	+	+	0	0	0	+	+	+	+	+	+		2	2	must either catch the high water boundary or high line mark or damage after water recedes; color and color IR are useful here		
Ice conditions	Ice, detection		0	0	0	L	0	L	+	0	L	L	0	+	0	0	0	L	0	+	L	0	+		2	2			
	Ice, general conditions		0	0	0	0	L	0	0	0	0	0	L	0	0	0	0	+	0	0	0	0	+		2	2			
	Ice thickness		0	0	0	0	0	0	0	L	0	0	L	0	0	0	0	L	0	0	L	0	L		2	2	inferential information can be derived from pattern analysis as long as the ice pattern itself is visible; thus snow cover is a handicap to photo and visual analysis as is wind for thermal imagery; monochrome radar provides a direct measurement on fresh water ice		

237

Problem: River Crossing

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL ORL			STD PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS			
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i						
General fordability, troops	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	2	
General fordability, vehicles	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	L	0	0	+	2	
Location and characteristics of crossing sites including ferds	Bridges, detection	dummy, vehicular, foot,; single or multiple use; aqueducts width, condition, and length banks, load class, bottoms, hazards, bypasses, etc.	0	0	?	+	+	+	+	+	+	+	+	+	L	L	L	+	+	+	+	+	+	+	+	+	1		
	Bridges, use type		0	0	0	L	L	L	L	L	L	+	+	+	L	L	L	L	L	L	L	L	L	L	L	L	+	2	
	Ferds, approaches		0	0	0	0	0	0	L	0	0	L	+	+	L	0	L	L	+	+	+	+	+	+	+	+	2		
	Ferds, description		0	0	0	0	0	0	?	0	L	L	0	L	L	0	L	L	0	L	L	0	L	L	0	L	+	2	
Ferds, detection		0	0	0	0	0	0	L	L	0	L	+	+	L	0	L	L	0	L	L	+	+	+	+	+	2			
Susceptibility of flow being changed	NOT COVERED IN MATRIX		0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	+	0	0	+	3				
Effects of sudden, violent storms	Flooding, potential Potential for unstable conditions in soils, rocks		0	0	0	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	3				
			0	0	0	0	0	0	0	0	0	0	0	0	L	0	L	0	0	0	+	0	0	+	3				
Natural and man-made obstacles, location and characteristics	Obstacles to movement, artificial Obstacles to movement, natural	also includes obstructions to airdropping also includes obstructions to airdropping	0	0	?	L	L	L	L	L	L	L	L	L	0	0	0	L	L	L	L	L	L	L	L	L	2		
			0	0	?	L	L	L	L	L	L	L	L	L	0	0	0	L	L	L	L	L	L	L	L	L	2		
Areas for assembly	Assembly areas, potential		0	0	0	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	2				
Areas for dispersal	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	2				
Cover near the crossing site	Cover, potential	protection from fire	0	0	0	0	0	0	L	0	0	?	?	0	L	0	?	?	0	L	L	0	+	2					
Concealment near crossing site	Concealment, potential for	protection from observation	0	0	?	L	0	L	L	0	L	+	+	L	0	L	+	+	+	+	+	+	+	+	2				
Fields of fire	Fields of fire, flat trajectory	reference refers to flat trajectory weapons from the standpoint of vegetation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?	?	?	L	L	L	L	L	2			
Ground avenues of approach to river	Avenues of approach	air, ground, water	0	0	?	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	3	this generally requires the preparation of an environmental data base by image analysis and an evaluation of slope, soils, vegetation, etc.			
Ground avenues of approach to object on far bank	Avenues of approach	same as above	0	0	?	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	3	same comment as above			
Low altitude route of approach	Avenues of approach	same as above	0	0	?	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	3	same comment as above			
Helicopter and airplane landing areas	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	L	0	0	L	0	L	0	0	0	+	0	0	+	2				
Positions for supporting weapons	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	0	0	0	L	0	L	0	0	0	+	0	0	+	2				
Positions for observation posts	Observation points	probable	0	0	0	0	0	0	L	0	0	L	?	0	L	0	L	?	0	L	?	0	L	?	0	L	2		

2307

Problem: River Crossing

PROBLEM FACTOR	MATRIX FACTOR	FACTOR COMMENTS	ERTS IMAGERY			RADAR			INFRARED THERMAL			LOW LEVEL OBL			STL PHOTO INDEX			STEREO 1:100,000			STEREO 1:20,000			OTHER	SKILL LEVEL	SENSOR COMMENTS							
			d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i	d	m	i										
Positions for radar sites	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	0	0	0	L	0	0	L	0	0	0	0	0	0	0	0	+	0	0	+	2		
Positions for combat service support installations	NOT COVERED IN MATRIX		0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	+	2		
Road nets and approaches	Roads, layout	junctions, pattern, etc.	L	0	L	L	0	L	+	0	+	L	0	L	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	1		
Road widths	Roads, characteristics	curvature, number of lanes, limiting characteristics, construction materials, width length, obstructions, etc; above items specified in manual, but combined here by CBS	0	0	0	0	L	0	L	0	L	L	L	L	+	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2		
Road surfaces	Roads, characteristics	same as above	0	0	0	0	L	0	L	0	L	L	L	L	+	0	L	L	L	L	L	L	L	L	L	L	L	L	L	L	2		
Road capacity	Roads, military load classification	bearing capacity; a load capacity rating system as defined in the manual	0	0	0	0	0	?	0	0	?	0	0	0	L	0	0	0	?	0	0	?	0	0	?	0	0	?	0	0	L	3	
Rail nets to and from site	Railways, layout	crossovers, mainline junctions, curvature, underpasses, length, etc.; above items are specified in manual, but were combined to form layout by CBS	0	0	0	L	L	+	L	L	+	L	?	L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1		
Road and rail routes beyond projected bridgehead	Railways, layout Roads, layout	same as above junctions, pattern, etc.	0	0	0	L	L	+	L	L	+	L	?	L	L	L	+	+	+	+	+	+	+	+	+	+	+	+	+	+	1		
Effects of precipitation on soil trafficability	Soil classification, major	grading (sand, gravel, silt, clay), composition (organic, mineral), and consistency (friable, plastic)	0	0	0	0	0	?	0	0	?	0	0	L	0	0	L	0	0	0	0	0	0	0	0	0	+	0	0	+	3		
	Trafficability, terrain group and class of soil	groups A, B, and C and classes I, II, III, and IV	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	L	3	These elements require the ability to evaluate soil parameters obtained inferentially from imagery with reference to trafficability standards and criteria	
Effects of precipitation on river conditions	Flooding, potential		0	?	0	0	0	0	0	0	0	L	0	0	L	0	0	L	0	0	0	0	0	+	0	0	+	3					
Visibility	Visibility		0	0	0	0	0	0	0	0	?	L	0	L	0	0	0	0	0	0	0	0	0	L	0	0	?	2	any comparison of a filtered image (e.g., blue band, UV, etc.) to an unfiltered image can provide information about haze, etc.; a laser can also provide information as a function of scatter; however, this need cannot be met, in a practical sense, by remote sensing; radar, of course can track clouds and cloud cycles				
Effects of wind and precipitation on the use of smoke and incendiaries	NOT COVERED IN MATRIX		0	0	0	0	0	0	0	0	0	0	0	?	0	0	?	0	0	?	0	0	?	0	0	?	0	0	?	2			



RIVER CROSSING: 1:20,000 Stereo

Remote Sensor Evaluation

Factors from problem matrix

0 ? L1 L2 L3 +1 +2 +3

Research

Factors from problem matrix	0	?	L1	L2	L3	+1	+2	+3	Research	
Currents	•	•								
River depth	•	•								
Conditions of riverbed	•	•	•	•						
Bank slope	•	•	•	•						
Bank height	•	•	•	•						
Bank condition	•	•	•	•					#	River Characteristics
Ice conditions, thickness	•	•	•	•	•					
River width	•	•	•	•						
Effects of storms, instability	•	•	•	•	•					
Effects of storms, flooding	•	•	•	•	•					
Potential for flow change	•	•	•	•	•					
Crossing sites, bridges, use type	•	•	•	•	•					
General fordability, vehicles	•	•	•	•	•					
General fordability, troops	•	•	•	•	•					
Ice, detection	•	•	•	•	•					
Bank composition	•	•	•	•	•					
Crossing sites, fords, detection	•	•	•	•	•	•	•			
Crossing sites, fords, description	•	•	•	•	•	•	•			
Crossing sites, fords, approaches	•	•	•	•	•	•	•			
Ice conditions, general description	•	•	•	•	•	•	•			
Crossing sites, bridges, detection	•	•	•	•	•	•	•			
Flood conditions, extent	•	•	•	•	•	•	•			
Flood conditions, characteristics	•	•	•	•	•	•	•		#	
Road capacity	•	•								Terrain Considerations
Road surface	•	•	•	•						
Trafficability	•	•	•	•						
Trafficability, terrain group and class of soil	•	•	•	•					#	
Road widths	•	•	•	•						
Positions for observation posts	•	•	•	•						
Fields of fire	•	•	•	•						
Positions for combat service support	•	•	•	•	•					
Positions for radar sites	•	•	•	•	•					
Helicopter and airplane landing	•	•	•	•	•				#	
Low altitude route of approach	•	•	•	•	•					
Concealment near crossing site	•	•	•	•	•				#	
Cover near crossing site	•	•	•	•	•				#	
Road nets beyond projected bridgehead	•	•	•	•	•	•	•			
Rail nets beyond projected bridgehead	•	•	•	•	•	•	•			
Rail nets to and from site	•	•	•	•	•	•	•			
Road nets and approaches	•	•	•	•	•	•	•			
Avenue of approach to objective	•	•	•	•	•	•	•		#	
Avenue of approach to river	•	•	•	•	•	•	•		#	
Areas for dispersal	•	•	•	•	•	•	•		#	
Areas for assembly	•	•	•	•	•	•	•		#	
Obstacles, artificial	•	•								
Obstacles, natural	•	•	•	•	•					

RIVER CROSSING: 1:20,000 Stereo

Factors from problem matrix	Remote sensor evaluation							Research			
	0	?	L1	L2	L3	+1	+2			+3	
Factors influencing use of chemicals, etc.	••									#	Weather
Effects of wind, etc., on smoke, etc. Visibility	••		L1								
Effects of precipitation on soil trafficability	••	••	••								
Effects of precipitation on river conditions	••	••	••	••	••						
Local resources, cableways, description	••	••	••							#	Local Resources
Local resources, boats, barges, and ferries	••	••	••								
Local resources, lumber	••	••	••	••							
Local resources, structural steel	••	••	••	••	••						
Local resources, cableways, detection	••	••	••	••	••	••					
Local resources, manufacturing plants	••	••	••	••	••	••	••				
Local resources, timber	••	••	••	••	••	••	••	••			
Local resources, stockpiled material	••	••	••	••	••	••	••	••			
Local resources, sand and gravel	••	••	••	••	••	••	••	••			
Local resources, extractive product	••	••	••	••	••	••	••	••			
Local resources, extractive industry, detection	••	••	••	••	••	••	••	••			

242<

RIVER CROSSING: 1:20,000 Stereo

Factors from problem matrix

Skill level

	1	2	3	
Crossing sites, bridges, detection	••••			River Characteristics
River width	••••			
Flood conditions, extent	••••	••••		
Ice conditions, general description	••••	••••		
Crossing sites, fords, approaches	••••	••••		
Crossing sites, fords, description	••••	••••		
Crossing sites, fords, detection	••••	••••		
Bank composition	••••	••••		
Ice, detection	••••	••••		
General fordability, troops	••••	••••		
General fordability, vehicles	••••	••••		
Crossing site, bridges, use type	••••	••••		
Ice conditions, thickness	••••	••••		
Bank condition	••••	••••		
Bank height	••••	••••		
Bank slope	••••	••••		
River depth	••••	••••		
Currents	••••	••••		
Flood conditions, characteristics	••••	••••	••••	
Potential for flow change	••••	••••	••••	
Effects of storms, flooding	••••	••••	••••	
Effects of storms, instability	••••	••••	••••	
Conditions of riverbed	••••	••••	••••	
Road nets and approaches	••••			Terrain Considerations
Rail nets to and from sites	••••			
Rail nets beyond projected bridgehead	••••			
Road nets beyond projected bridgehead	••••			
Areas for assembly	••••	••••		
Areas for dispersal	••••	••••		
Cover near crossing site	••••	••••		
Concealment near crossing site	••••	••••		
Low altitude route of approach	••••	••••		
Helicopter and airplane landing	••••	••••		
Positions for radar sites	••••	••••		
Positions for combat service support	••••	••••		
Fields of fire	••••	••••		
Positions for observation posts	••••	••••		
road widths	••••	••••		
Road surface	••••	••••		
Avenues of approach to river	••••	••••		
Avenues of approach to objective	••••	••••	••••	
Trafficability, terrain group and class of soil	••••	••••	••••	
Trafficability	••••	••••	••••	
Road capacity	••••	••••	••••	
Obstacles, natural	••••			
Obstacles, artificial	••••			

RIVER CROSSING: 1:20,000 Stereo

Skill level

Factors from problem matrix

	1	2	3	
Visibility	•••••	•••••		Weather
Effects of wind, etc., on smoke, etc.	•••••	•••••		
Factors influencing use of chemicals, etc.	•••••	•••••	•••••	
Effects of precipitation on river conditions	•••••	•••••	•••••	
Effects of precipitation on soil trafficability	•••••	•••••	•••••	
Local resources, extractive industry, detection	•••••	•••••		Local Resources
Local resources, extractive product	•••••	•••••		
Local resources, stockpiled material	•••••	•••••		
Local resources, timber	•••••	•••••		
Local resources, manufacturing plants	•••••	•••••		
Local resources, cableways, detection	•••••	•••••		
Local resources, cableways, description	•••••	•••••		
Local resources, structural steel	•••••	•••••		
Local resources, lumber	•••••	•••••		
Local resources, boats, barges, and ferries	•••••	•••••		
Local resources, sand and gravel	•••••	•••••	•••••	

244<