REGIONAL WATER AVAILABILITY ASSESSMENT GUIDANCE
Public Works Technical Bulletins are published by the U.S. Army Corps of Engineers, Washington, DC. They are intended to provide information on specific topics in areas of Facilities Engineering and Public Works. They are not intended to establish new Department of the Army (DA) policy.
1. Purpose.
   a. The objective of this bulletin is to inform installation staff about the watershed screening application of SIRRA and to highlight ways in which this assessment can support installation water planning and management. This report details how installations can become involved in this planning process without extensive and costly procurement and provisioning activities.

   b. All PWTBs are available electronically in Adobe® Acrobat® portable document format [PDF]) through the World Wide Web (WWW) at the National Institute of Building Sciences’ Whole Building Design Guide (WBDG) Web page, which is accessible through this Universal Resource Locator (URL):


2. Applicability. This PWTB applies to engineering activities of all Continental U.S. (CONUS) Army facilities.

3. References.

4. Discussion.

a. The purpose of conducting a regional water assessment is to identify potential sustainability issues of concern on a watershed basis. Within a water system, it is important to identify critical issues and understand the implications of individual actions on that system. Regional water assessments provide valuable screening of water resources for which additional studies, planning, and actions may be recommended to ensure continued viability. Regional assessments also provide resources to improve the quality of planning and decision making for community planners, public works staff, environmental professionals, and local governments and are intended to enhance sustainable use and protection efforts for the Army’s water resources. It is the first level screening that helps inform national and broad regional stakeholders about how a local situation fits within a larger context. Similar resources are widely used in other programs, including land-use and stationing.
planning. Strategic planning within the Army includes watershed objectives, new cooperative relationships between previously divergent groups, establishment of infrastructure inventories, improvements in modeling capabilities, and design and construction of new water management facilities. This information is useful to U.S. Army installation utility staff in meeting the requirement to produce and implement a comprehensive water management plan. It is also beneficial to organizations that wish to compare regional water indicators among different regions, watersheds, and installations.

b. New strategies on sustainability within the Department of Defense focus on addressing present and future needs while strengthening community partnerships. This “across-the-fenceline” strategic thinking requires innovative tools that engage a broad segment of the community and military interest groups. These tools help to visualize the pressure, state, and response of indicators of sustainability. One such tool is the Sustainable Installations Regional Resource Assessment (SIRRA), a database of 54 indicators in 10 sustainability issue areas. The watershed application is one specialized application of SIRRA and can inform decisions affecting regional water supplies. Integrating efforts between community and military planning is essential to the long-term sustainability of water supply and demand. Tools such as SIRRA are one means to bridge the gap between regional stakeholders and the military community.

c. Water is generally considered a renewable resource. A number of stressors are contributing to growing problems with adequate sustainable access to high quality water resources. These stressors are related to (a) population growth; (b) surface and groundwater contamination from human activities; (c) globally increased water usage for agricultural, industrial, and personal uses; (d) rising global and regional temperatures; and (e) rising water demands for electrical generation and alternate energy production options. Problems with access to adequate fresh water supplies vary spatially and temporally, but are growing in extent and duration and will contribute towards political strife and regional instability in many parts of the world. Over the past decade, about 50% of the United States has been experiencing drought and/or severe drought conditions. Water issues of concern include adequate supply, increased cost of production per unit volume, quality, habitat degradation, and salinity issues. These concerns are already impacting military installations and operations in many national and international locations.
d. The greatest water challenge for the Army is that the water resource supply and demand act across several geographic scales. Watersheds and aquifers cross political boundaries and require federal, state, and local agencies to work cooperatively in addressing water problems. Army installations represent just a fraction of regional water demand, and yet, the adverse impacts of water scarcity and degradation will be borne equally by all users.

e. The guidelines provided in this bulletin document the research sponsored by the U.S. Army Corps of Engineers (USACE) System-Wide Water Resource Program (SWWRP). One product of this program was a characterization of the nation’s watersheds by using a sub-set of indicators from SIRRA. The result was a methodology to identify watersheds with potential sustainment problems and to rank the watersheds by their relative vulnerability to such problems. This work was published in ERDC/CERL TR-05-24 (Jenicek et al. 2005). Since publication, updates to this work have been sponsored by the USACE Actions for Change (AFC) program and the Army Environmental Policy Institute (AEPI). AFC has undertaken a renewed commitment to the systems approach of water resource management; in 2009, AFC supported the update of the watershed screening methodology with inclusion of 607 USACE dam locations. All data sources were updated, some indicator scales were modified, and new indicators were added. Following this update, AEPI sponsored the application of the watershed screening methodology to 2,252 hydrological unit code (HUC-8) watersheds. These results showed the locations of 411 Army installations on an overlay map. These updates were incorporated into the original methodology and made available for public use. Upon final publication of technical reports, all data and documentation will be included on the SIRRA Web site, http://datacenter.lemgroup.com/sirra/front-page/?searchterm=SIRRA.

f. Water efficiency requirements for Army facilities are found in the Energy Independence and Security Act of 2007 (EISA 2007), Executive Order 13423 (EO 13423), and Executive Order 13514 (EO 13514).

i. Section 432 of EISA 2007 establishes a framework for facility project management and benchmarking. Under this new requirement, Federal agencies must identify all “covered facilities” that constitute at least 75% of the agency facility’s energy/water use. Each facility water manager is responsible for completing comprehensive energy/water evaluations of 25% of these covered facilities each year, implementing all identified water efficiency measures, and
following up on implemented measures by measuring and verifying water savings.

   ii. EO 13423 further requires a reduction of water consumption intensity of 2% annually through the end of Fiscal Year 2015, relative to a baseline of FY 2007.

   iii. EO 13514 extends this requirement through 2020 for a total reduction in water consumption intensity of 26%. In addition, implementation is required of water reuse strategies that are consistent with state laws.

   iv. The Department of Defense’s Strategic Sustainability Performance Plan promulgates the 26% reduction in water intensity to the individual services.

   v. IMCOM’s Installation Management Campaign Plan establishes energy efficiency and security objectives that encompass the water management program. Goals include reducing consumption, institutionalizing savings and conservation procedures, providing full-time trained managers, instilling a conservation culture in our communities, and increasing efficiency and modernizing infrastructure.

   vi. The Army Energy Strategy for Installations sets the general direction in conservation of water resources while the Army Energy and Water Campaign Plan for Installations identifies tools, technologies, policies, management, and institutional requirements to achieve initiatives and approaches.

   vii. National policy was further interpreted by IMCOM and ACSIM in memorandums that adopt the Department of Energy’s 10 Best Management Practices (BMPs) for developing water management plans, increasing public awareness, and implementing conservation practices. In addition to developing water management plans, these plans must be reviewed and updated periodically.

All of these policy documents are available through the ACSIM Web site available at the following URL: 
http://army-energy.hqda.pentagon.mil/policies/water_con.asp

   g. Appendix A contains a description of the watershed screening application of SIRRA. This section highlights the components of effective and efficient regional planning and is intended to support the goals of long-term integrated water resource management.
h. Appendix B navigates through the development and use of the assessment data sets.

i. Appendix C is a set of instructions for applying the assessment results to a number of regional planning scenarios that might be encountered by Army installation staff.

j. Appendix D defines the acronyms and abbreviations used in this PWTB.

k. Appendix E cites related ERDC-CERL publications.

5. Points of Contact.

HQUSACE is the proponent for this document. The point of contact (POC) at HQUSACE is Mr. Malcolm E. McLeod, CEMP-CEP, 202-761-5696, or e-mail: Malcolm.E.Mcleod@usace.army.mil.

Questions and/or comments regarding this subject should be directed to the technical POC:

U.S. Army Engineer Research and Development Center
Construction Engineering Research Laboratory
ATTN: CEERD-CF-E (Elisabeth Jenicek)
2902 Newmark Drive
Champaign, IL 61822-1076
Tel. (217) 373-7238
FAX: (217) 373-6740
E-mail: elisabeth.m.jenicek@usace.army.mil

FOR THE COMMANDER:  

[Signature]

JAMES C. DALTON, P.E
Chief, Engineering and Construction
Directorate of Civil Works
APPENDIX A:
The National Watershed Sustainability Analysis

This national watershed screening methodology seeks to identify those watersheds containing Army installations for which additional studies, planning, or actions may be recommended for continued viability and sustainability of Army operations. Screening by itself does not provide a diagnosis of “at risk” watersheds, but it is the first key step in the process. Through application of the SIRRA tool, this methodology aims to identify watersheds with potential sustainment problems, rank watersheds by their relative vulnerability to such problems, and refer for further study those watersheds containing critical Army installations and which are flagged as potentially “at risk” during screening. National screening allows comparisons between regions through the use of color-coded maps for the set of water supply indicators, for the set of water demand indicators, and for overall watershed health.

Today’s water managers are tasked with securing adequate supplies of clean water for current and future needs. Yet, unlike land management programs which are guided by broad national policies and administered as continuing operations, water resource initiatives are traditionally developed as individual projects and each is separately justified. The objectives of individual water projects are usually sought by an intensive one-time effort. Additionally, rules that govern the right to use water are developed and administered at the state level, even though water resources do not respect state or international boundaries.

The Fort Bragg region of North Carolina is an example of traditional resource management. Due to severe droughts in 2003, Fort Bragg implemented strict water conservation guidelines. Within one year, the installation had reduced its water use by nearly 70%. Figure A-1 illustrates this reduction and also highlights Fort Bragg’s significance as a proportion of total regional water use. Prior to 2003, Fort Bragg consumed less than 1% of total regional water demand. While Fort Bragg successfully reduced its water demand, the regional residential and agriculture sector use increased by millions of gallons per year. Thus all watershed activity must be taken into account as installation staff seeks to ensure adequate future water supplies.
The Army Strategy for the Environment, along with other strategic documents such as the more recently published Strategic Plan for Army Sustainability, identifies the need for a system-wide approach to water management. Each emphasizes coordination between water suppliers and users in support of long-term integrated water resource management. The System-Wide Water Resource Program (SWWRP) was one initiative of USACE which was designed to assemble and integrate the diverse components of water resource management. The watershed application of SIRRA was one product of SWWRP. The watershed screening methodology examines water supply, demand, and policy issues at a regional level (HUC 8 watershed). Such screening facilitates the transfer of knowledge among Army program managers, installation Department of Public Works (DPW) staff, and community water resource managers; it also supports effective and efficient development of water management plans. Originally published in 2005, the watershed screening indicators were updated in 2009.

The updated watershed screening methodology is comprised of the 27 water supply and demand indicators contained in SIRRA that are listed in Table A-1. The mapping of water data can make clear where issues are geospatially linked and can facilitate a

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1 Source: ERDC/CERL TR-10-DRAFT “Strategic Sustainability Assessment Pilot Study Final Results: Fall Line Region of the Southeast”
variety of practical actions. Geographic Information System (GIS) mapping also supports the development of effective policy and the emergence of research insights. Regions can be displayed by pointing and clicking on a map or by searching for an installation by name using the SIRRA tool at http://datacenter.leamgroup.com/sirra. This unique system visually links water data to geographical locations and to demographic and economic information about the region.

Each indicator datum is linked to the HUC8 watershed boundary layer. This enables viewing water resources at a common geospatial scale. Common mapping formats can help local, state, and national policy makers stay on top of changing water trends on a regional basis and anticipate future resource needs.

Table A-1. Water supply and demand indicators.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Source</th>
<th>Data Year</th>
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<tr>
<td><strong>Water Supply</strong></td>
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<td></td>
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<td>A1 Streamflow Long-term Average</td>
<td>U.S. Geological Survey (USGS)</td>
<td>1901-2005</td>
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<td>A7 Groundwater Depletion</td>
<td>U.S. Geological Survey (USGS)</td>
<td>2000</td>
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<tr>
<td>A8 Drought Sensitivity</td>
<td>National Drought Mitigation Center and National Climatic Data Center (NCDC)</td>
<td>2008</td>
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<td>A10 Coastal Sea-level Rise</td>
<td>U.S. Geological Survey (USGS)</td>
<td>2001</td>
</tr>
<tr>
<td>A14 Seismic Zones</td>
<td>U.S. Geological Survey (USGS)</td>
<td>2008</td>
</tr>
<tr>
<td>A15 TES Richness</td>
<td>NatureServe</td>
<td>2005</td>
</tr>
<tr>
<td>A16 TES Hotspot</td>
<td>NatureServe</td>
<td>2005</td>
</tr>
<tr>
<td>A17 Water Quality</td>
<td>Journal of American Water Resources Association (JAWRA)</td>
<td>1999</td>
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<tr>
<td><strong>Water Demand</strong></td>
<td></td>
<td></td>
</tr>
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<td>D3 Consumption Rate</td>
<td>U.S. Geological Survey (USGS)</td>
<td>1995-2000</td>
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<tr>
<td>D7 Regional Population Projection</td>
<td>U.S. Census Bureau</td>
<td>2000, 2030</td>
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<td>D8 State Smart Growth Plans</td>
<td>American Planning Association (APA)</td>
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<td>D9 Proximity to MSA</td>
<td>U.S. Census Bureau</td>
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<td>D10 Institutional Flexibility</td>
<td>American Water Works Association (AWWA)</td>
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APPENDIX B: Accessing and Navigating Data sets

Methodology

The watershed screening methodology that evolved from SIRRA focuses specifically on water resources. SIRRA is an indicator-based screening tool for assessing relative vulnerabilities and overall sustainability on a regional scale. The results identify regions and sustainability issues that require further study by using additional data sources. SIRRA was developed under the Strategic Environmental Research and Development Program (SERDP) and the Army’s Research, Development, Test and Evaluation (RDT&E) program, and it was recognized as the 2006 SERDP Project of the Year. SIRRA provided auditable data for the Army stationing analysis for Base Realignment and Closure (BRAC) 2005, and has been used to evaluate existing installations’ abilities to absorb additional forces and a region’s capability to support new installations. It is also used to support the Installation Strategic Sustainability Planning (ISSP) process.

The analysis methodology consists of characterizing watershed supply and demand indicators at the HUC8 watershed level using the SIRRA issue-based indicator framework. Each indicator is linked to the watershed boundary file. For each watershed, indicator ratings are aggregated to form an overall vulnerability score (mapped in Figure B-5). The following steps were followed to accomplish this.

Step 1: Compile data for 27 indicators for all HUC8 watersheds. Collect indicator data from national sources. This data is reported at various scales. For example, the U.S. Geological Survey (USGS) reports withdrawals at the county level, the U.S. Census Bureau (USCB) reports population projections at the state level, and NatureServe reports threatened and endangered species at the ecoregion level. Intersect each indicator level with the HUC8 watershed boundaries (Figure B-1) and determine an overall indicator score for each watershed. Rules to accomplish this change in reporting level vary based on the indicator. Watershed values may be based on a weighted average, “worst” rating, or

most common value. Documentation can be found in the metadata on the SIRRA Web site.

Step 2: Establish the vulnerability rating levels for indicator data. The SIRRA metadata includes the sustainment rating thresholds and the selection logic for the 27 indicators used in this application. Once sustainment ratings were determined, they were assigned numbers. This allowed indicators to be weighted and scored based on their criticality to watershed sustainment:

- very low vulnerability = 1
- low vulnerability = 2
- moderate vulnerability = 3
- vulnerable = 4
- high vulnerability = 5

Indicator sets often include “not-available” data values—specifically for water sustainment indicators in Alaska and Hawaii where the data source does not report conditions in these regions. To ensure that these “not-available” data values neither hurt nor help watersheds, these values were either entered as “moderately sustainable,” or the rating was interpolated from the surrounding nearby regions. Figure B-2 depicts vulnerability classifications and thresholds for indicator A1. The A1 benchmark thresholds were determined by the USGS Water Resources Department staff.
Step 3: Sum the individual indicator ratings for each watershed to arrive at an overall score. To arrive at a final sustainment/vulnerability score for the watershed, simply add the indicator rating values (i.e., 1, 2, 3, 4, or 5). The higher this total, the more vulnerable the watershed is considered to be or the more stress it incurs due to development and key issue stresses. The lower the score, the less vulnerable the watershed is to environmental and key issue stresses. The indicator vulnerability score and final sustainment score for each watershed can be found on the SIRRA Web site. Figure B-3 shows the results of this summation process for a set of watersheds. Note that any subset can be summed for a specific application (i.e. total demand or supply vulnerability score.) Furthermore, additional attributes or weighting can be applied by the user. Appendix C discusses such applications.

NOTE: The indicators are not weighted and each is treated equally. There could be some weighting for certain indicators applied to a location, but that was not attempted for this application. Users are advised to review the indicators that lead to a high or low sustainability score and interpret the score based on specific local data sources and stakeholder knowledge.
Figure B-3. Example of summing to determine a watershed’s vulnerability score.

Data sets and Results

The data set of 27 water indicators screens 2,252 U.S. watersheds for watershed vulnerability. The results are presented both in a sample spreadsheet and a national geospatial (map) form (Figures B-4 and B-5, respectively). Visualization of data allows users to identify environmental issues that are critical to sustainability and look at economic, social, and environmental characteristics.

Figure B-4. Sample spreadsheet of indicator screening for watershed vulnerability.
Figure B-5. Map of watershed vulnerability scores.
Watershed Vulnerability Scores

This analysis produced 27 indicator ratings as well as a synthesis “score” for each of 2,252 watersheds. Of the 567 Army installations studied, 160 (28%) lie within watersheds that are highly vulnerable to water crisis situations, whereas 59 installations (10%) are unlikely to face severe water shortages (e.g. lie within low vulnerability watersheds). Highly vulnerable installations tend to be in the South Atlantic-Gulf, Lower Colorado, Mid-Atlantic, and California basin regions.

All locations have some vulnerability to sustainability problems, as evidenced by the fact that the lowest rating score was still significantly higher than the lowest possible score. The highest scored watershed was much closer to the highest possible score. This indicates that watersheds do vary and that not all of the indicators are low for any given location. The national watershed screening identifies watersheds with potential sustainment problems, ranks watersheds by their relative vulnerability to such problems, and refers those watersheds identified during screening as containing critical Army installations and which are flagged as “at risk” for further evaluation and study.

The watershed vulnerability scores underpin global water concerns previously discussed. Those concerns are (a) available supply is shrinking, (b) demand is growing, and (c) quality is being degraded. Although regions and installations may not yet encounter these effects, the watersheds and their basins are. Given the interconnectedness of watersheds, the local level threats are real. Installations may not yet be subject to local resource constraint, but supply, demand, quality, and water rights are all threatening the system.

Access
Updates to the Watershed Screening Methodology are available through the SIRRA Web site at: http://datacenter.lemgroup.com/sirra/. Indicator Maps include updated and additional indicator layers. Located within the “Applications” folder are the documentation, maps, and spreadsheets published for each application which are available for download (Figure B-6).
Figure B-6. The watershed screening application on the SIRRA Web site.

Framework Limitations

Users are encouraged to think of the watershed screening as an initial step in a series of increasingly localized studies. The national screening can help to prioritize local studies for regions with more critical water quantity and quality problems. It is also advisable to examine the individual indicator ratings when assessing a region’s water sustainability, rather than roll-up scores. High and low ratings can balance each other and result in a satisfactory overall rating. Some indicators are critical to regional water sustainability and may outweigh all others, though they only comprise 1/27th of the roll-up score.

Vulnerability scores represent a generic evaluation of the potential for environmental problems and the general sustainability of any given watershed. The ranking methodology is meant to provide only a screening tool, not a final definitive evaluation of the sustainability of a watershed or a U.S. Army installation. The screened information requires further detailed studies which are specific to a watershed and its region. In other words, this methodology screens for certain issues and identifies watersheds considered to have potential
problems, as determined by the chosen set of indicators. A watershed may score high on an indicator that is statewide in scope, yet the vulnerability score could be inaccurate for that particular location.

The methodology of this analysis is based on national data sets and does not factor in unique or site-specific conditions. As a national level screening tool, the information represents entire counties, states, or ecoregions. As such, this data will not always agree with local data sources for specific watersheds or managed units within a county, watershed, or ecoregion. There are tradeoffs between using this standardized approach, which allows the use of national-level data to evaluate regional aspects of the watershed, and using an approach that considers solely watershed specific data. The best recommendation is to examine the scores to determine which data is most important and then evaluate its significance. Note that any decision relevant to a specific watershed location should always be informed by more than this analysis alone.

Vulnerability scores offer a view of watershed health at a given moment in time, a “snapshot view.” It would be advisable, therefore, to seek other historical snapshots and to track watershed ratings over time. This would show watersheds as degrading or improving over time and/or project life spans. In other words, looking at a watershed over time would show whether moderately vulnerable regions tend to become more or less vulnerable; whether policy choices or project implementation plans alter the vulnerability trend; and whether vulnerabilities tend to differ in different regions.

Time comparisons also could significantly expand the depth of vulnerability scores. These scores could potentially be improved by weighting specific indicators relative to their potential impact on mission sustainment. For example, streamflow levels may not be as critical to an installation with low water demand as compared to an installation with high water demand. In this situation, the low demand installation would put less emphasis on highly vulnerable streamflow when summing indicator vulnerability scores. Therefore, the regional sustainability ranking approach could provide a weighted summary of assessment indicators that determine an overall mission sustainment or vulnerability rating for each watershed. Both time comparisons and weighting applications are viewed as additional capabilities that may be added to this screening tool to assess watersheds containing installations where additional studies, planning, and actions are recommended to ensure continued mission support.
APPENDIX C:
Applications of the SIRRA Watershed Assessment

Regional screenings are a systematic, focused, interdisciplinary use of science to improve the quality of planning and decision making among diverse groups of stakeholders. There are several specialized applications of the watershed assessment using all or a sub-set of the 27 existing indicators, including assistance in meeting the requirements of EO 13423. These methods are captured in macro-enabled spreadsheets and GIS layers that can be queried to support the user’s needs. The following are example applications aimed to provide assistance to installation Directors of Public Works as well as USACE Districts and Divisions for using this methodology to support long-term integrated water resource management.

Watershed Screening

Sample Questions:

In the Fort Bliss region, what are the critical issues to supporting EO 13423 water reduction goals and sustaining water supplies? What topics deserve the highest priority for regional collaboration?

Analysis Steps:

1. At the SIRRA Web site, create an Indicator Map zoomed into the region (watersheds) of Fort Bliss, TX.

2. Display each of the 27 water-related indicator layers and refer to the attributes while noting the vulnerability values for those that are “red” and “orange” within the selected watersheds. Red- and orange-colored indicators are those most critical to further investigation.

3. Use the SIRRA Indicator Data spreadsheet tool to highlight the Fort Bliss vulnerability scores. Note the high vulnerability watershed indicators. Figure C-1 is an example from the Army Installations Water Sustainability Assessment of a spreadsheet output that summarizes the strengths and weaknesses of watersheds surrounding Fort Bliss.
Figure C-1. Watershed screening application sample.

Discussion:

The watershed vulnerability scores form a helpful screening tool that links numerous sustainability data and provides relative characterizations of a region based on that information in a quick and efficient format. It supports a systems approach by focusing on hydrological and ecological linkages, rather than political boundaries. Users are encouraged to use the national screening as an initial step in a series of increasingly localized studies. The national screening can help prioritize local water issues of concern. It is also advised to examine the individual indicator ratings, rather than roll-up scores, when assessing a region’s water sustainability and to identify the indicators that are critical to regional water sustainability. Regional watershed assessment is a first step toward balanced growth and collaboration within watersheds.

Installation Screening

Sample Questions:

What percentage of Army National Guard (ANG) installations is vulnerable to drought conditions? Of those installations, which are set for stationing increases due to BRAC 2005?

Analysis Steps:

1. Using the indicator spreadsheet from the Army Installations Water Sustainability Assessment, sort by ANG then by A8 Drought Sensitivity indicator, then by BRAC2005 Action. This
is a ranked list of ANG installations by their associated watershed drought sensitivity. Count those with associated “5” or “4” A8 values to determine which are vulnerable to drought and divide that number by the total number of ANG installations to calculate the percentage vulnerable to drought conditions. Highlight those targeted for BRAC 2005 action.

2. From the SIRRA Web site, create an Indicator Map displaying the Drought Sensitivity (A8) indicator. Note “ANG” mission installations with BRAC 2005 gains. The result visualizes where ANG installations are located in relation to drought conditions (Figure C-2).

![Figure C-2. Map relating installation screening application.](image)

Discussion:

The Army’s post-event reviews of hurricanes Rita and Katrina stressed the need to incorporate new and changing information into planning and decision-making on the watershed scale. Federal agencies are faced with the challenge of making choices that simultaneously serve their mission, adhere to policies and laws, and avoid or mitigate negative effects. Agency analysts need the ability to create multiple scenarios based on the best

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3 Base Realignment and Closure (BRAC) 2005 actions were acquired from DoD Base Closure and Realignment Report, 2005. Actual actions may differ.
information available, propose and evaluate alternatives, and measure the impacts. Regional watershed assessment supports expanded inputs to decision-making in a cost-effective manner through the use of geospatial tools. Clear and concise maps of emerging risk factors (such as drought) can effectively help evaluate the distribution of impacts on mission activities and inform mitigation or adaptation actions and priorities.

Ranking is yet another option to prioritize decision making. The results of this analysis can be further disaggregated to look only at installations with specified primary missions or to look at individual watershed indicators that are critical to mission sustainment. A caution when doing this is that data is regional in scope and may not reflect localized conditions.

**Topic Screening**

**Sample Questions:**

What region and/or specific installations would potentially have the greatest benefit from implementation of a new-construction water-efficiency BMP pilot study?

**Analysis Steps:**

1. Using the indicator spreadsheet from the Army Installations Water Sustainability Assessment, expand Total Demand Vulnerability Score. Sort data by Water Basin and calculate subtotals by averaging D3 Consumption Rate and D7 Population Projection. Highlight those basins where both D3 and D7 are vulnerable. These are regions where water conservation for new or existing construction may have the greatest impact due to the fact that population is projected to increase significantly and per capita consumption rates are currently above the national average.

2. From the SIRRA Web site, create an Indicator Map displaying those basins noted as vulnerable from step 1. For those installations within a vulnerable basin, note those installations where the sum of attribute D3 and D7 is equal to or greater than 8. These installations are those where water conservation for new or existing construction may have the greatest impact (Figure C-3).
The U.S. Army owns millions of square feet of facilities. Therefore, effective asset management and planning is a priority. Regional watershed assessment identifies strengths and weaknesses of watersheds to inform stationing and infrastructure decisions and prioritization actions. With accurate knowledge of the systems, sustainment problems can be addressed with effective allocation of resources. It is also advised to weight critical indicators when conducting specific analyses. Ranking risk factors helps to determine the most appropriate pathway to a sustainable future given regional conditions and also promotes long-term integrated planning.
# Appendix D

## Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Spellout</th>
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<tbody>
<tr>
<td>AFC</td>
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<td>ACSIM</td>
<td>Assistant Chief of Staff for Installation Management</td>
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<tr>
<td>AEPI</td>
<td>Army Environmental Policy Institute</td>
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<td>ANG</td>
<td>Army National Guard</td>
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<td>BMPs</td>
<td>best management practices</td>
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<td>Base Realignment and Closure</td>
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<td>Construction Engineering Research Laboratory</td>
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<td>MTR</td>
<td>military training routes</td>
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<td>National Environmental Policy Act</td>
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<tr>
<td>PWTB</td>
<td>Public Works Technical Bulletin</td>
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<tr>
<td>RDT&amp;E</td>
<td>Research, Development, Test and Evaluation</td>
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<tr>
<td>SERDF</td>
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<td>SIRRA</td>
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<td>SWWRP</td>
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Appendix E:
Related ERDC-CERL Publications


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