

# ***Headquarters U.S. Air Force***

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***Integrity - Service - Excellence***

## **Air Force Plan For Implementing New Federal Water Conservation Goal**



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### **The Air Force Water Conservation Guidebook**

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HQ AFCESA/CESC  
4 June 2002**



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# ***Air Force Water Conservation Program***

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- **Air Force strongly supports water conservation**
  - **Programs in place long before EO 13123**
  - **AF Water conservation policy established in 1996**
  - **Included ability to do water conservation project in ESPC contracts since 1998**
  - **Implemented many cost effective water conservation projects**
  - **AF Sustainable Facilities Policies include water conservation**



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# ***Air Force Water Conservation Program***

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- **Headquarters Air Force Civil Engineer Support Agency (AFCESA) is the lead agency in the Air Force's energy & water conservation programs**
  - **Develops Policy**
  - **Proponent for conservation measures**
  - **Provides technical oversight to program**
- **Problems**
  - **Water often undervalued and seen as plentiful**
    - **It is one of our most precious resources**
  - **Water seen as cheap when compared to energy cost**



# *The Federal Water Conservation Goal*

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- Mandated by EO 13123 signed by President Clinton in June 99
- Development of the goal was led by DOE with participation from all Federal Agencies and Military Services
  - Issued in Jul 00, it is called Federal Water Efficiency Goal
- Goal sets an implementation schedule for Water Efficiency Best Management Practices (BMPs)



# *The Federal Water Conservation Goal*

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- **Goal requires each base (facility) to develop a Water Management Plan (WMP)**
  - **Goal sets minimum criteria a WMP**
  - **All locations must have a WMP by 2005**



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# *Best Management Practices*

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- **BMP #1—Public Information and Education Programs**
  - **BMP #2—Distribution System Audits, Leak Detection, & Repair**
  - **BMP #3—Water Efficient Landscaping**
  - **BMP #4—Toilets and Urinals**
  - **BMP #5—Faucets and Showerheads**
  - **BMP #6—Boiler/Steam Systems**
  - **BMP #7—Single-Pass Cooling Systems**
  - **BMP #8—Cooling Tower Management**
  - **BMP #9—Miscellaneous High Water-Using Processes**
  - **BMP #10—Water Reuse and Recycling**
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# ***Best Management Practices***

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- **Goal Requires**
  - **5% of bases implement 4 BMPs by 2002**
  - **15% of bases implement 4 BMPs by 2004**
  - **30% of bases implement 4 BMPs by 2006**
  - **50% of bases implement 4 BMPs by 2008**
  - **80% of bases implement 4 BMPs by 2010**
- **Most BMPs have two major parts**
  - **Operations and Maintenance (O&M) Options**
  - **Retrofit & Replacement (R&R) Options**
- **For a BMP to be considered implemented, all O&M options must be accomplished and all cost effective R&R options must be implemented**



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# *Water Management Plans (WMPs)*

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- **The Goal Requires each location develop a WMP that contain the following**
  - **Utility information**
  - **Facility information (Walk through audit recommended)**
  - **Emergency response information**
  - **Comprehensive planning information**
  - **Method for including O&M options for the BMPs selected for implementation**



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# *Air Force Issues With Goal*

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- **A Typical Air Force Base**
  - **Can have well over 1000 separate facilities**
  - **Facility water use is generally unmetered, except reimbursable customers (Metered facilities typically less than 5% of total)**
  - **Base Water is usage determined by master meter**
  - **Limited resources to implement goal**
    - **Manpower - At each base, only one or two persons are responsible for all utility usage, tracking, billing, and conservation programs**
    - **No Funds budgeted to develop WMPs or implement BMPs**
    - **Limited or no funds for water conservation projects**
- **Requirements of Goal not easily implemented**



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# *The Water Conservation Guidebook*

- HQ AFCESA took initiative to develop a Water Conservation Guidebook For Air Force
- Purpose of the Guidebook
  - **Significantly reduce the workload of bases to comply with requirements of the water efficiency goal**
    - Lists assumptions, methodology & formulas to use in place of walk through facility audits
    - Provides methodology for calculating water use by category
    - Allows WMP to be developed from “the desktop” using available information while still meeting requirements of goal
  - Set a standard format for WMP within the Air Force
  - Standardize reporting requirements format



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# *Guidebook Methodology*

- The 105 page Guidebook is intended to walk bases through process of developing a WMP and implementing BMPs.
  - It deals exclusively with goal requirements
- The Guidebook provides:
  - Procedures for estimating water use by category
  - Methods of estimating the incremental cost of water (I.e. Actual cost of water being conserved)
  - Methodology for evaluation of the cost effectiveness of the retrofit & replacement options for each of the BMPs



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# *Guidebook Methodology*

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- **The Guidebook provides (continued):**
  - **Format for tracking BMP implementation**
  - **Guide to Financial Resources for water conservation projects**
  - **Template for a WMP that meets the goal requirements.**
  - **POCs and sources for additional information.**
  - **Limited Technical Information**
    - **Refers readers to other sources for technical details on water conservation measures**
- **Helps a base develop a WMP that sets it on a course toward water conservation**



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# *Steps to Complete A WMP*

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- **The Guidebook outlines the 6 steps to complete a WMP**
  - **Step 1 – Collect Background Data**
  - **Step 2 – Categorize Water Base Water Use**
  - **Step 3 - Calculate Incremental Cost of Water**
  - **Step 4 – Investigate BMPs for Implementation**
    - **Calculate Simple Payback for each BMP option**
    - **Explore financing alternatives**
  - **Step 5 – Begin Implementation**
  - **Step 6 – Monitor Program**



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## ***Step 1 - Collecting Background Data***

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- **Guidebook is designed to minimize data collection effort**
- **Most information required to develop the WMP is readily available from the Base Utility Manager & Real Property Records**
- **Provides methods for developing estimates for information not readily available**
- **No walk through facility audits required**
  - **Accomplishes the intent of goal without the legwork**
- **Utilizes existing base plans for emergency response and comprehensive planning information**



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## ***Step 2 - Estimating Water Use By Category***

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- **Estimating water use by category helps focus conservation on high use applications with greatest potential for savings**
- **Guidebook breaks water use into 5 categories**
  - **Category 1 – Housing**
  - **Category 2 – Commercial**
  - **Category 3 – Irrigation**
  - **Category 4 – Leaks & Losses**
  - **Category 5 - Industrial**



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## ***Step 2 - Estimating Water Use By Category***

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- Provides methodology for calculating use by category without individual facility meter readings
- Examples:
  - Housing usage estimate based on national averages (Category 1)
  - Monthly billing comparison to estimate irrigation usage (Category 3)
  - Midnight flow readings of water & sewer to estimate leaks (Category 4)



## ***Step 3 - Calculating Incremental Cost of Water***

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- **Determining incremental cost of water is critical to determining cost effectiveness of conservation measures**
- **The “incremental cost of water” is the actual cost of water saved. For the purpose of the guidebook, it is equal to the cost of the last 10% to 20% of the water used by the base**
- **Unless purchasing on a flat rate scale, the incremental cost of water can be very different than the average cost of water, or the water rate charged reimbursable on-base customers**



## ***Step 3 - Calculating Incremental Cost of Water***

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- **Guidebook provides 6 different examples for calculating incremental water costs**
  - **Example 1 – Purchased on Flat Rate Scale**
  - **Example 2 – Purchased on Declining Sliding Scale**
  - **Example 3 – On-Base Plant**
  - **Example 4 – On-Base Plant mixed w/ purchased water**
  - **Example 5 – Purchased on Increasing Sliding Scale**
  - **Example 6 – Average & Incremental Sewer Costs**



# Step 3 - Calculating Incremental Cost of Water

## Example 3 - On-Base water plant

	Before Conservation	After Conservation
Water Production	150 Mgal/yr	120 Mgal/yr (20% Reduction)
Treatment Plant O&M	\$100,000/ yr	\$100,000/ yr
Manpower Costs (\$)	\$250,000/yr	\$250,000/yr
Pumping, Electrical, Utility Costs (\$)	\$12,000/yr	\$9,600/yr (20% reduction)
Chemical Costs (\$)	\$24,000/yr	\$19,200/yr (20% reduction)
Total Production Cost	\$386,000	\$378,000
Ave Cost of Water	\$2,573/Mgal (\$2.57/Kgal)	\$3,150/Mgal (\$3.15/Kgal)
Value of water saved		\$8,000
Incremental Cost of Water		\$266/Mgal (\$0.26/Kgal)



## ***Step 3 - Calculating Incremental Cost of Water***

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- **Even if a location has a very low Incremental Cost of Water, it can still implement 4 BMPs and meet the goal.**
  - **To get credit for implementing a BMP a location must implement the O&M options, and the cost effective Retrofit & Replacement options.**
  - **If water costs are low and none of the Retrofit & Replacement Options are cost effective, a location can get credit for the BMP by implementing only the O&M options**



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## ***Step 4 - Investigating BMPs For Implementation***

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- **Since each Air Force Base must implement only 4 of the 10 BMPs, selecting which BMPs are easiest to implement is critical.**
- **Most bases will rely on ESPCs for funding water conservation projects. The guidebook is structured to support this**
  - **Guidebook provides assumptions, formulas, and examples to calculate cost effectiveness of projects in each BMP**
  - **If this preliminary calculation shows the project to be cost effective, it can be passed over to ESPC for implementation**
  - **ESPC either implements project, or determines that it is not cost effective**



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## *Example of Assumption*

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- **Toilet Replacement**
  - **Walk Through facility audits are suppose to determine:**
    - **Number of Toilets**
    - **Gallons used per flush**
    - **Number of uses per day**
  - **Information is used to determine the cost effectiveness of replacement with low flow toilets**
  - **In place of walk thought audits, guidebook uses assumptions and estimates to determine cost effectiveness of toilet replacement projects**



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## *Example of Assumption*

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- **Toilet Replacement (continued)**
  - **Provides assumptions for estimates**
    - **Number of toilets & urinals in commercial & industrial facilities estimated from worker population**
    - **Housing office for number of toilets in MFH and occupants**
    - **Gallons per flush estimated based on approximate age of facilities, or last major bathroom renovation**
      - **Four age groups, pre 1950, 50-80, 80-94, & 94-present**
    - **Provides Average uses per person per day (i.e. 5.1 for household, 3.0 for industrial & commercial)**
  - **Provides formula for calculating payback**



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## *Example of Assumption*

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- **Similar assumptions provided to calculate cost effectiveness of Repair & Replacement Options in most BMPs**
- **These rough calculations show if further investigation is necessary**
- **If the estimate using these assumptions show the project to be cost effective, it can be referred to the ESPC contractor for a Phase 1 study.**



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## ***Step 5 - Implementation of BMPs***

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- **O&M Options**
  - **O&M Options are generally changes in day-to-day procedures**
  - **Can be incorporated in to Reoccurring Work Program (RWP) or base maintenance contracts.**
  - **Generally very low cost to implement**
- **Repair & Retrofit (R&R) Options**
  - **Payback of 10 years or less to be cost effective**
  - **Requires capital investment**



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## ***Step 5 - Implementation of BMPs***

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### **R&R Funding Options**

- **Energy Savings Performance Contracts (ESPCs)**
  - **Primary Air Force method for funding conservation projects**
  - **Guidebook is build around using ESPC funding.**
- **Energy Conservation Invest Program (ECIP)**
- **Housing Funds (For MFH)**
- **Environmental Funds**
  - **Significant limitations exist**
- **Operation & Maintenance (O&M) Funds**
- **Utility Energy Service Contracts (UESC)**



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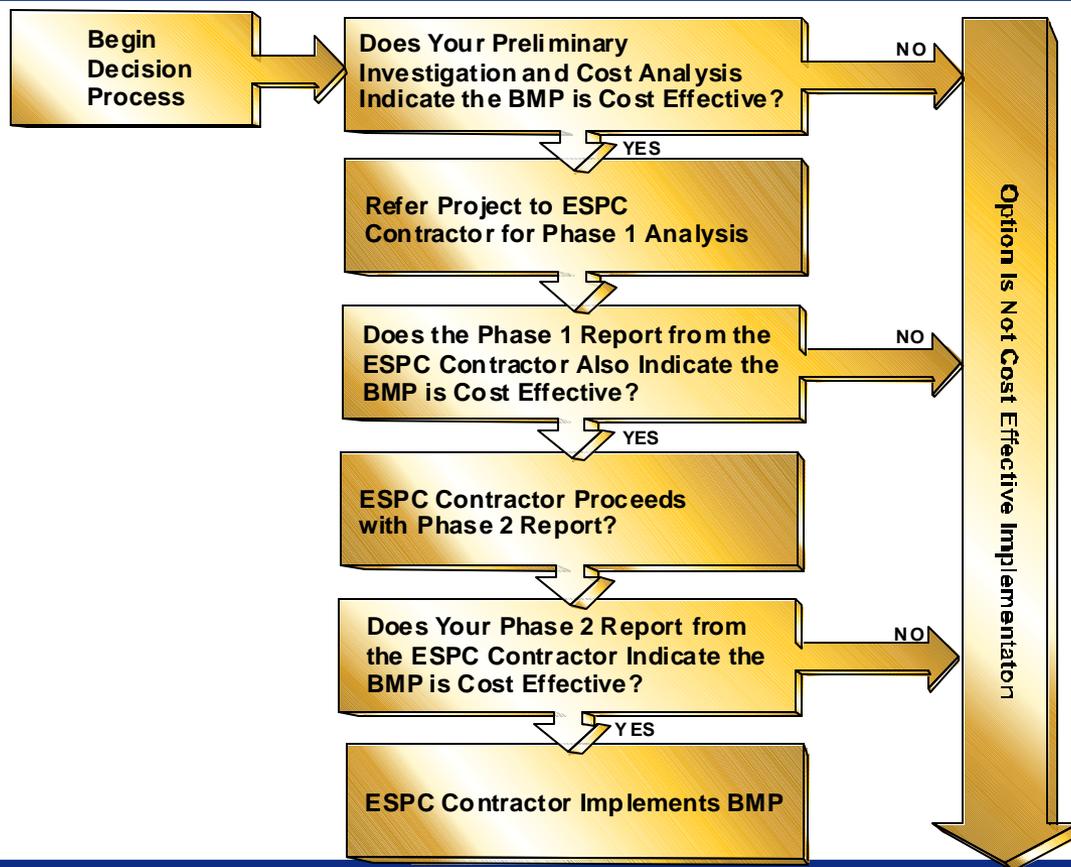
# *R&R Funding Options*

- **Energy Savings Performance Contracts (ESPCs)**
  - **Primary Air Force method for funding conservation projects**
  - **Guaranteed Savings**
  - **Projects funded by contractor from savings**
  - **Guidebook focuses on this method for implementing conservation projects**
  - **After project is referred to ESPC contractor, the contractor is responsible for developing project**
  - **ESPC projects have 3 Phases**
    - 1- Preliminary study
    - 2 - Detailed Study
    - 3 - Implementation & Evaluation



# ESPC Implementation Process

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# *R&R Funding Options*

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- **Energy Conservation Invest Program (ECIP)**
  - ECIP is funded through the Military Construction Program (MCP)
  - Payback less than 10 years
  - Mainly for existing facilities
  - Projects compete DoD wide for limited dollars
  - Significant effort required by base to develop project justification, funding documents, etc.



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# *R&R Funding Options*

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- **Housing Funds**
  - **Limited to projects in Military Family Housing**
  - **Significant effort required by base to develop project justification, funding documents, etc.**
- **Environmental Funds**
  - **Limited to projects where water conservation is consequence of a compliance driven project**
  - **Example: Base required to reduce wastewater treatment plant discharge due to TMDL. To comply the base implements effluent reuse project**



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## ***R&R Funding Options***

- **Operation & Maintenance (O&M) Funds**
  - **Due to limited O&M funding, projects generally limited to small scale project required limited investment**
- **Utility Energy Service Contracts (UESC)**
  - **UESC is a sole source agreement with the local utility for completion of energy or water conservation projects**
  - **Similar to ESPC but does not require (or exclude) guaranteed savings**



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## ***Step 6 - Monitoring The Program***

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- **The final step is monitoring the program**
- **A Water Management Plan using the guidebook format encourages follow-up**
- **Annual reporting format requires a review of the WMP in order to submit data**



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## ***Guidebook Appendixes***

- **FEMP Guidance to Establish Water Efficiency Improvement Goals for Federal Agencies**
- **Sample Water Management Plan**
- **Federal Water Use Indices**
- **Annual Reporting Format**
- **AFEPPM 96-2, Air Force Water Management Program**
- **Environmental Funding Policy Memorandum**
- **Air Force Water Conservation Points of Contact**



# *Getting The Air Force Water Conservation Guidebook*

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- It is available in hardcopy & electronic versions
  - Hardcopy is about 105 pages
  - Electronic version is a .pdf file approximately 2 MB
- Distribution is unrestricted (available to the public)

It can be downloaded from the HQ AFCESA website

- [WWW.AFCESA.AF.MIL](http://WWW.AFCESA.AF.MIL)
- Go to “Technical Support”
- Then to “Water Systems”
- Can be e-mailed
  - Contact me at [michael.clawson@tyndall.af.mil](mailto:michael.clawson@tyndall.af.mil)



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## *Summary*

- **Purpose of Guidebook is to reduce workload of bases to implement the Water Efficiency Improvement Goal for Federal Agencies**
- **It Walks bases through process of developing a WMP**
- **The resulting WMP provides the base with a blueprint for meeting the requirements of the goal and puts base on the path to water efficiency**



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## **Questions?**

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