



***Carolina Lakes Golf Course
Environmental Management (GEM) Plan
Shaw AFB, SC***



February 2010



San Antonio, Texas



Carolina Lakes Golf Course Environmental Management Policy

**In concert with the
Shaw AFB mission,
we pledge to employ
only those management practices
that minimize or eliminate the potential
for negative impacts to the environment
and the surrounding community,
ensure compliance with all
appropriate regulations,
and to regularly reevaluate our processes
to achieve the highest standards
of environmental excellence.**

Table of Contents

Table of Contents	ii
Executive Summary	3
U. S. Air Force GEM Program	3
GEM Program process	3
Environmental Compatibility Quotient (ECQ) scores	3
Potential or Final environmental challenges	3
Where do we go from here?	4
The GEM Initiative	4
GEM Process	5
Analysis	5
GCEBA components	6
Documentation	6
U.S. Air Force GEM Plan components	7
Implementation	7
Evaluation	7
Revision	7
Course Specific Analysis	8
Course Description	8
Course Details	9
Environmental Compatibility Quotient (ECQ) Checklists	10
Determining the Environmental Compatibility Quotient (ECQ)	10
ECQ Scoring Scale	10
Planning & Compliance	11
Operations & Maintenance	13
Water Resource Management	15
Conservation	17
Pesticides & Pollution Prevention	19
Environmental Compatibility Quotient Summary	21
Environmental Compatibility Quotient Scoring Scale	21
Environmental Challenges	22
Assessing environmental challenges	23
Bird/wildlife aircraft strike hazard (BASH)	24
Environmental Restoration Program (ERP) site	26
Invasive species	28
Water quality management	30
Wetlands	33
Implementation	35
GEM Plan goals & objectives	35
Conclusion	36
The gallery	36
Bibliography	38



Executive Summary

U. S. Air Force GEM Program

The U. S. Air Force Golf Course Environmental Management (GEM) program is a proactive Air Force Center for Engineering & the Environment (AFCEE) initiative to foster a better understanding of the environmental challenges facing our golf courses worldwide.

Armed with the support and approval of the Air Force Services Agency golf program, AFCEE's goal is to facilitate the creation of an environmentally friendly golf course facility while supporting the installation mission. Chapter 11 of AFI 32-7064 requires a GEM Plan as part of the Integrated Natural Resources Management Plan (INRMP).

GEM Program process

There are five steps in the GEM program process.

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

Environmental Compatibility Quotient (ECQ) scores

The following is the summary of the environmental compatibility quotient (ECQ) scores for the site visit conducted in Month Year:

- **Actual ECQ = 63, Just started (Red)**
- **Potential ECQ = 80, Showing progress (Yellow)**

Potential or Final environmental challenges

The following potential environmental challenges were identified in compiling this Final GEM Plan:

- Bird/wildlife Aircraft Strike Hazard (BASH)
- Environmental Restoration Program (ERP) site
- Invasive species
- Water quality management
- Wetlands

Where do we go from here?

The true measure of a successful GEM program is how well is it executed in the field each and every day. The installation golf and environmental staffs should continue to analyze, document, monitor, evaluate, revise, and implement changes based on lessons learned. The GEM Plan should be updated annually and revised during the next INRMP iteration update. The entire GEM process can be found on the regularly improved AFCEE GEM program website (<http://www.afcee.brooks.af.mil/ec/golf/>).

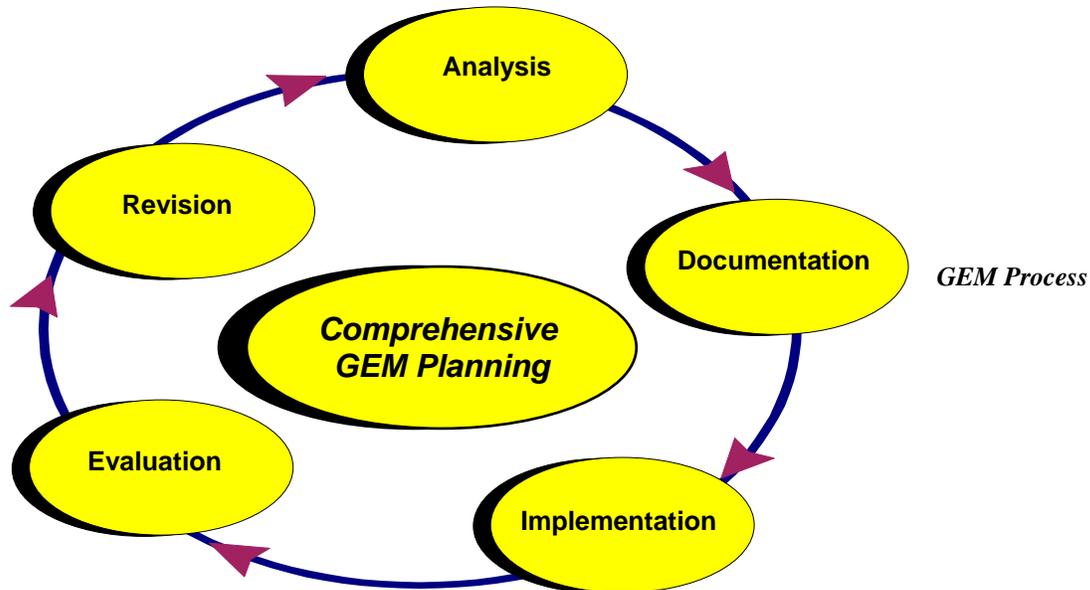


The mission is the number one priority at Shaw AFB.

The golf course environmental baseline assessment (GCEBA), or the Draft Golf course Environmental Management (GEM) Plan is the initial step in creating a successful ecosystem-based comprehensive GEM Plan. The intent of the GEM Plan is to provide an efficient management tool that will enable course managers to devote more of their efforts to caring for their customers and the golf course. Properly designed and implemented, the GEM Plan will keep the entire golf facility in compliance with the constantly changing environmental requirements while contributing to the local community.

The GEM Initiative

The goal of the GEM initiative is to facilitate the creation of an environmentally friendly approach to golf course management while protecting and promoting the great game of golf. AFCEE is dedicated to helping to identify ways that more rounds can be played on better-conditioned courses while minimizing or eliminating negative impacts to the environment. In most cases, golf courses are being managed compatibly with the environment. The comprehensive GEM planning process is the vehicle to document our successes while communicating directly with our customers, commanders, and local community.



The five steps of the GEM Process are based on continual improvement.

GEM Process

Efficient implementation is the most important aspect of any initiative where practices and procedures are examined and may undergo significant change. This is especially true of the comprehensive GEM planning process. The GEM Plan is derived from several diverse environmental regimes to include the National Environmental Policy Act and the ISO 14001 environmental management system.

There are five basic steps in the implementation of the GEM Planning process:

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

Analysis

Experienced environmental managers realize the importance of assembling all of the data relevant to a problem prior to determining its best solution. Comprehensive analysis is the most important task of the GEM process. Properly completing the analysis is paramount to the long-term compatibility of a golf course's management practices with the local community's natural resource and environmental management goals and objectives.

GCEBA COMPONENTS

The GCEBA is comprised of the following components:

- Site visit, interviews, and data collection
- Course specific analysis
- Miscellaneous facility review
- Environmental compatibility quotient checklists
- Identification of potential environmental management challenges
- Summary report

Documentation

It is not enough just to know how to create a successful golf course environmental management program. There must be a written record documenting existing site data, maintenance practices, pesticide applications, and other historical golf course activities. By documenting what we know, we will be able to determine how to make better decisions in the future. The completed GEM Plan will assist in the daily management of the course while providing a convenient vehicle to communicate to the community and customers alike the environmental issues that challenge golf course managers as well as their plans to deal with them. In order to reach established environmental stewardship goals the golf course staff must consistently employ only those management practices that minimize or eliminate potential negative impacts to the environment.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

The lakes are a primary concern both for golfers and managers.

U.S. AIR FORCE GEM PLAN COMPONENTS

The GEM Plan will be comprised of the following components:

- GCEBA report
- Map of the entire golf course facility grounds depicting locations of the significant environmental management challenges and the golf course facilities
- Booklet that describes the environmental management challenges depicted on the GEM Plan map
- Specific practices that will be employed by the golf course staff to deal with each environmental management challenge after coordination with and approval by the installation environmental staff
- Compilation of best management practices employed at the golf course in their implementation of the GEM initiative recommendations

Implementation

Positive and decisive action is the only true measure of the success of the GEM Plan. By implementing new practices, whether to knowingly improve the course's role in the environmental stewardship of the installation or to just try new ideas to determine their value, will the golf staff and golfers benefit. The installation golf staff should consider adopting the GEM Initiative process and establish an environmental policy that minimizes or eliminates any and all potential negative environmental impacts.

Evaluation

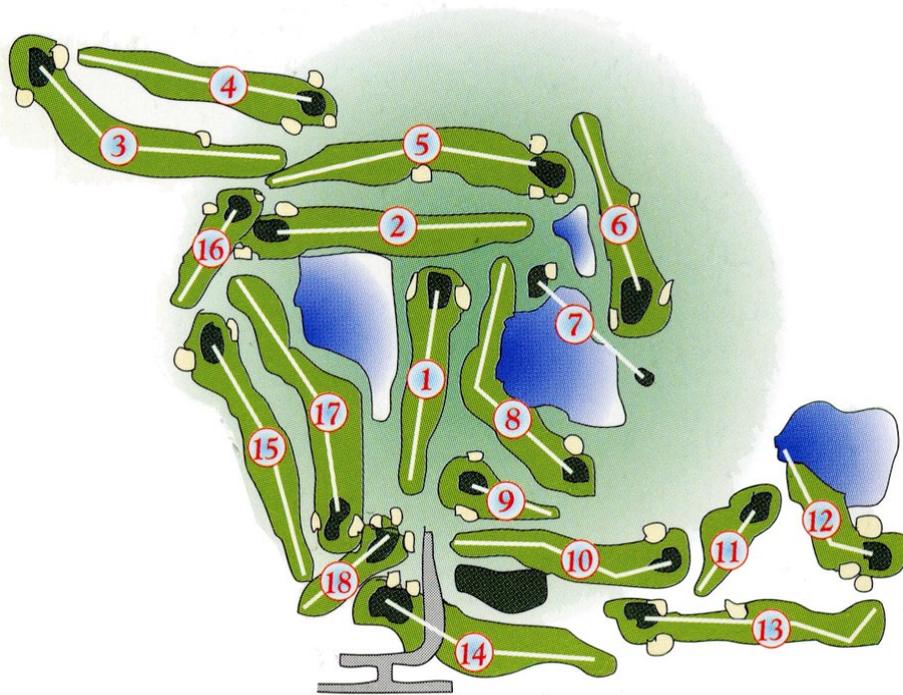
In order to ensure the highest quality of customer service and environmental stewardship, there must be continual self-evaluation and improvement. There also should be consistent, on-going measurement of the reduction or elimination of environmental impacts the newly implemented practices have on the course. For example, documenting the reduced use of inputs such as fertilizers, pesticides, and irrigation can be used to demonstrate the increased environmental stewardship of the golf course management practices as well as the overall value of the GEM initiative. It is important for golf courses to show improvement over time. Improvements can be easily accomplished by regularly evaluating golf course maintenance methods, practices, and management approaches to day-to-day issues in concert with the desire and ability to change.

Revision

The very nature of a superior GEM Plan implies that all documents be regularly maintained to represent the most current conditions. Golf course managers and superintendents should be constantly looking for ways to improve their environmental stewardship. Acting on lessons learned is right behind initial implementation as the most important aspect of a successful GEM Plan. The GEM Plan should be kept as current as possible at all times. Ideally, it should be updated annually and completely rewritten on the same cycle as the Integrated Natural Resources Management Plan.

Course Specific Analysis

One of the most pragmatic and enjoyable tasks in the baseline assessment portion of the GEM process is the course specific analysis. From a general description of the course to the details of the course's history and makeup to the various observations on course playability, aesthetics, and style of management, the course specific analysis sets the stage for the rest of the GEM Plan report.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Carolina Lakes Golf Course layout (Not up to date)

Course Description

Carolina Lakes Golf Course is truly one of the highlights of Shaw AFB. The challenging and attractive 18-hole links is situated prominently between Memorial Lake, 9th Air Force Headquarters, the senior officer quarters, and the flight line. The course is characterized by gently rolling terrain with native tree populations of loblolly pine, southern live oak, hickory, willow oak, and magnolia. A recent renovation created four new holes that will greatly contribute to the quality golfing experience of Shaw AFB customers.

Carolina Lakes includes four separate and relatively large, multi-functional water features. These lakes not only increase the interest and aesthetic quality of the course, they also gather runoff from the frequent rains that commonly occur throughout the year.



Carolina Lakes Golf Course Aerial Photo, Shaw AFB, SC

Course Details

Architect	E. R. Riccoboni / John LaFoy
Year constructed	1954 / 2009
Climate	Humid
Average annual precipitation	43 inches
Average growing season	240 days
Elevation	250 feet above sea level
Prevailing wind direction	NE/SW
Total facility acreage	130 acres
Total actively maintained acreage	118.7 acres
Par	36-35-71
Turfgrass	419 Hybrid Bermuda
Tees-	Common Bermuda
Fairways-	328 Hybrid Bermuda
Greens	Bermuda/Bahia
Roughs-	
Irrigation source	Groundwater well (Yellow)

Environmental Compatibility Quotient (ECQ) Checklists

Many diverse and complex aspects of golf course management have been revealed through the literature search conducted to compile this study. In order to simplify the process, these aspects have been summarized into eight main topics and incorporated into five distinct environmental compatibility categories.

- Planning & Compliance
- Operations & Maintenance
- Water Resource Management
- Conservation
- Pesticides & Pollution Prevention

The environmental compatibility quotient (ECQ) checklist questions have been compiled using examples from several sources including Audubon International, Center for Resource Management, and Committed to Green. The ECQ checklists represent the best method currently available to determine the relative environmental compatibility of a golf course's management practices. The checklists can be used in many ways including:

- As a tool to establish a current snapshot or baseline of a golf course's relative environmental compatibility
- As a tool to identify areas for improvement or to demonstrate current successes
- As a self-assessment tool for the golf course manager and superintendent
- As documentation for an environmental award nomination
- As documentation for regulatory requirements or inquiries from customers, the media, or the general public

Determining the Environmental Compatibility Quotient (ECQ)

The ECQ compiled for an installation's course is a snapshot of the overall performance and compliance with the GEM Plan. There are two measures obtained as a result of using the ECQ checklists to determine the status or quality of the environmental management program: 1) determining the actual and; 2) potential environmental compatibility quotients.

- **Actual ECQ-** the total percentage of "Yes" responses for all ten checklists. This number represents the current level of the golf course management practice compatibility with the environment.
- **Potential ECQ-** the total percentage of "Yes" responses plus the total percentage of "Partial" responses for all ten checklists. Maybe the most significant measure; the potential ECQ represents a level of compatibility that could be reached by finalizing or fully implementing a particular practice.

ECQ Scoring Scale

Percent Responses Yes
or Partial per Category Level

90-100%	Advanced (Green)
70-89%	Showing progress (Yellow)
69% or less	Getting started (Red)

The following ECQ checklists are a record of the interview conducted with Carolina Lakes Golf Course superintendent during the visit to Shaw AFB, SC.

<u>Planning & Compliance</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Has management demonstrated that environmental stewardship is an important part of their responsibilities by initiating the Comprehensive Golf course Environmental Management (GEM) Planning process?	✓		
2	Is the GEM Plan complete, updated regularly, and readily available to employees and customers?		✓	
3	Has the golf course adopted and posted an environmental policy?	✓		
4	Is a map of the property highlighting environmental challenges posted for employees and customers?			✓
5	Does management conduct a comprehensive annual evaluation for each identified environmental challenge and its management approach, objective, and target?		✓	
6	Does the course have a Tree Management Plan complete with planting plan and maintenance schedule?		✓	
7	Is there a written and regularly updated Integrated Pest Management Plan for the entire golf course property?	✓		
8	Is there a map of the course's "hot spots" or specific areas that may require regular special care or attention?			✓
9	Is there an up-to-date comprehensive golf course development plan or master plan that details the desired short- and long-term improvements to the facility?			✓
10	Is there at least one project planned and funded for the next year that would increase the compatibility of the course's management program with comprehensive GEM planning goals and objectives?		✓	

Planning & Compliance Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Have all employees been familiarized with the GEM Plan and are they trained regularly on the importance of environmental performance and compliance?		✓	
12	Are environmental management issues regularly discussed during staff meetings?	✓		
13	Are the actual amounts of each pesticide or fertilizer used on the facility available in writing for every application over the last year?	✓		
14	Has the facility attained full certification in the Audubon Cooperative Sanctuary Program or similar industry-recognized environmental management program?			✓
15	Are employees trained in their native language on the benefits of minimizing potential negative impacts?	✓		
16	Are comprehensive written records maintained to measure and document the environmental compatibility of the entire facility's management practices?	✓		
17	Are there documented functional or aesthetic thresholds integrated into pest control decisions?		✓	
18	Is there a written comprehensive Water Resources Management Plan that delineates the care of each of the course's water features?			✓
19	Are employees trained on what to do in case of a spill and have spill containment kits been provided at all appropriate locations?	✓		
20	Have the maintenance activities and their performance been examined to determine the potential to negatively impact an identified environmental challenge?	✓		
	Totals	9	6	5

<u>Operations & Maintenance</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is there a written, regularly updated and comprehensive Turfgrass Management Plan for each type of turf and playing area?	✓		
2	Are there designated natural or minimally-maintained buffers around sensitive landforms or features and/or core wildlife habitats?	✓		
3	Are green, tee, and fairway mowing heights maintained at levels that do not excessively stress important playing surfaces?	✓		
4	Are aeration, topdressing and other drainage improvements regularly implemented to improve soil health and minimize or eliminate inputs of pesticides or fertilizers?	✓		
5	Are soil tests or plant tissue analysis regularly used to determine turfgrass nutritional requirements?	✓		
6	Is the information collected in soil tests and plant tissue analysis integrated into a regularly updated Nutrient Requirement Plan and map?		✓	
7	Is there at least one project planned and funded for the next year that would improve the course's protection of the environment?		✓	
8	Are all appropriate employees trained to be familiar with (national, federal, state, and OSHA) regulations that apply to storage and handling of potentially hazardous materials used on the property?	✓		
9	Has there been an examination of all aspects of the operation for potential negative impacts for the snack bar/restaurant, clubhouse, pro shop, pesticide mixing and storage facilities, fuel storage and delivery areas, and maintenance complex?	✓		
10	Have all employees received documented training that would increase their awareness of environmental stewardship goals and objectives?			✓

Operations & Maintenance Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are containers used to store used oil for equipment maintenance in good condition, not leaking, and clearly labeled?	✓		
12	Are oil/water separators and/or golf course wash pad(s) operating properly and correctly maintained?		✓	
13	Are all golf course vehicles and equipment maintained and cleaned in a manner that eliminates the potential for spreading of disease or other contamination?	✓		
14	Are biodiesel and/or ethanol products utilized everywhere they may be appropriate?			✓
15	Are waste products such as oil, grease, tires, and batteries stored in a covered container and disposed of properly off site?	✓		
16	Does the superintendent use hand held GPS units to assist in GIS mapping of the golf course areas?			✓
17	Are energy efficiency ratings factored into equipment purchases for use throughout the facility?	✓		
18	Has the entire facility been studied to quantify solid waste streams to identify functions that produce the greatest quantities?			✓
19	Are at least 90% plates, cups, and utensils in use by the restaurant/snack bar facility reusable rather than disposable?	✓		
20	Does course management utilize a web-based golf course planning tool for every day decision-making and recordkeeping?			✓
Totals		12	3	5

<u>Water Resource Management</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are written records of water quality monitoring activities, results, and pollution control measures readily available?	✓		
2	Where appropriate, are slow-release fertilizers and/or spoon-feeding techniques used to reduce the potential for runoff impacts and nutrient loading to water quality?	✓		
3	Does the irrigation system operate using computerized controllers based on real-time evapotranspiration rates?		✓	
4	Are the golf course sprinklers and outdoor irrigation of non-golf course areas and indoor plumbing regularly monitored and maintained for proper distribution and leaks?	✓		
5	Have low-flow water saving devices been installed wherever possible?		✓	
6	Is at least 65% of the irrigation water for the golf course property recycled or non-potable?	✓		
7	Is there at least one project planned and funded for the next year that may eliminate or minimize a potential water quality or erosion problem?		✓	
8	Are water features regularly monitored for algae, erosion, excessive aquatic plant growth, eutrophication, and sedimentation?	✓		
9	Are low impact design (LID) principles such as using vegetative or drainage filters to cleanse parking lot runoff prior to leaving the property?			✓
10	Are there signs appropriately located to warn golfers of the potential hazard of drinking recycled or otherwise non-potable water?			✓

Water Resource Management Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are there flow meters for monitoring total water use?	✓		
12	Has the irrigation system or its components recently been upgraded to reduce or eliminate inefficiency and overall water use?	✓		
13	Is there a map of the watershed in which the golf course property resides and location(s) of floodplains and storm water drainage that exists on the property?	✓		
14	Is the quality of the irrigation water regularly checked to determine overall quality or nutrient, salt or total suspended solid parameters?	✓		
15	Is water quality data regularly collected to establish baseline conditions and maintenance procedures for all water features on the property?	✓		
16	Are settling ponds and/or detention ponds used to effectively remove sediments and pollutants from entering important water features?			✓
17	Are biological processes such as the addition of grass carp or white amur used to control unwanted aquatic vegetation in major water features?			✓
18	Have the property's Water Quality Management Zones been identified and mapped based on industry-standard risk factors?			✓
19	Has the property's water features been studied to determine the aquatic and amphibious species population?	✓		
20	Has the property been examined for potentially significant wetlands or associated sensitive water-based habitats?	✓		
	Totals	12	3	5

<u>Conservation</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized equipment maintained for efficient operation that would minimize the potential of creating excessive air polluting emissions?	✓		
2	Has the entire golf course property been examined for critical habitats, state species of concern, and threatened or endangered species?	✓		
3	Are all manmade ponds or other large water features adequately lined to minimize or eliminate losses?			✓
4	Are employees encouraged to minimize their trips around the course to conserve on the use of fossil fuels?	✓		
5	Have efforts been made to connect natural areas to facilitate wildlife movement through the course property by returning an area to its natural state or revising maintenance procedures?	✓		
6	Have all necessary permits been secured and are they updated and their requirements satisfied in a timely manner?	✓		
7	Are recycling containers conveniently provided for customer and employee use throughout the golf course facility?		✓	
8	Has there been a study to determine the presence of invasive species on or near the course?	✓		
9	Is there a comprehensive and readily available Drought Management Plan for the entire golf course facility?			✓
10	Is there at least one project planned and funded that may minimize or eliminate the course's potential negative environmental impacts?		✓	

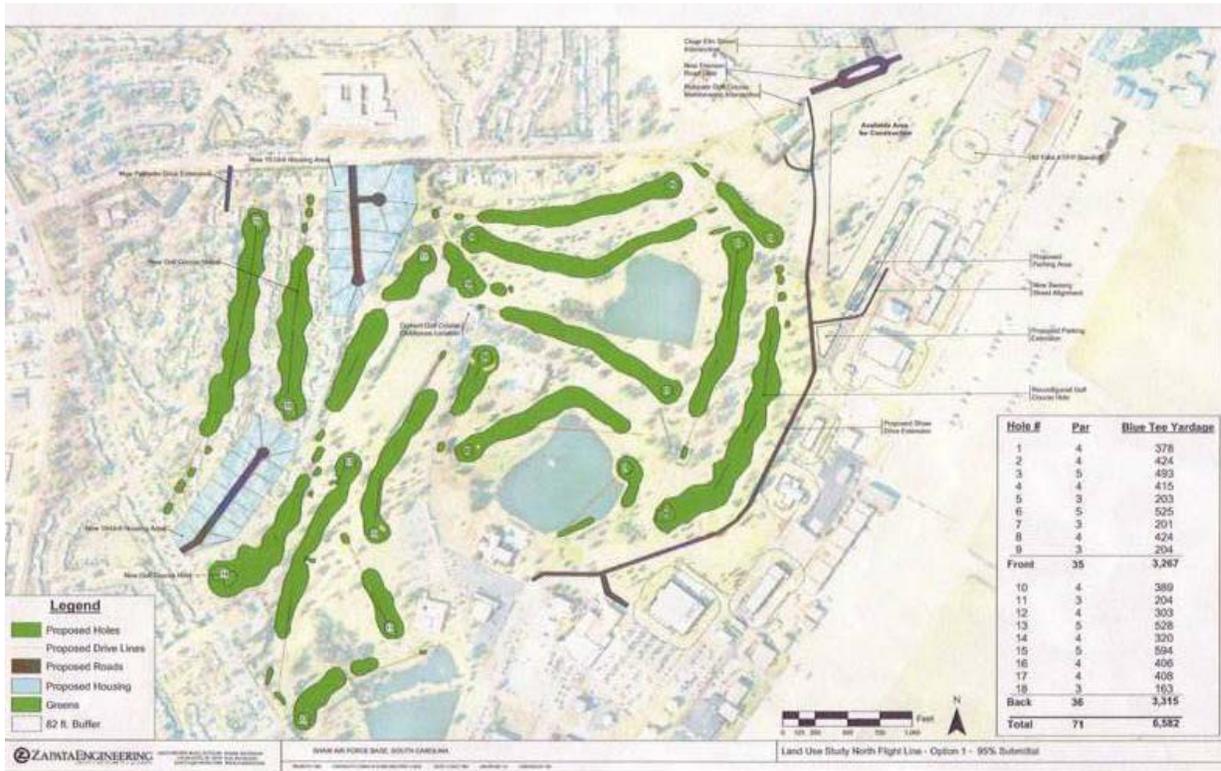
Conservation Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Does management harvest storm water to supplement irrigation water supplies for use anywhere on the golf course facility grounds?	✓		
12	Are at least 85% of plants used in landscaped areas drought-tolerant native trees, shrubs, groundcovers, or their cultivars?	✓		
13	Are there signs posted to highlight key habitats or have appropriate areas been designated "Environmentally Sensitive Zones" per The Rules of Golf?	✓		
14	Has a comprehensive energy audit been conducted for the entire golf course facility?			✓
15	Are all employees trained to understand that poor management practices may adversely impact worker and environmental health and welfare?	✓		
16	Is there an inventory of bird and mammal species documented, maintained, and readily available?	✓		
17	Are food, shelter, and nesting attributes of plant species for landscape development considered during the design/selection process?	✓		
18	Have all damaged or degraded habitats due to construction or maintenance of the course been fully restored?	✓		
19	Has the entire property been examined for archaeological, cultural, or historical resources?	✓		
20	Is the irrigation pump station a variable speed model for energy efficiency?	✓		
Totals		15	2	3

<u>Pesticides & Pollution Prevention</u>				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there established, documented and communicated minimally maintained and fertilizer and pesticide application buffer areas around water features or sensitive landscapes?		✓	
2	Is the equipment wash rack adequately covered to minimize or eliminate collection of precipitation?	✓		
3	Does the chemical storage area have a sealed metal or concrete floor and are all pesticides handled over an impermeable surface?	✓		
4	Does the chemical storage area have a lip along the edges and does it have at least 150% of total storage volume secondary containment?	✓		
5	Are liquid products stored below dry products and are dry materials stored on pallets or shelves to keep them off the floor?	✓		
6	Has the least toxic pest control strategy been identified for each of the most common pests and is it always used first when an action threshold is reached?	✓		
7	Is equipment cleaned with compressed air or blowers on part of the course instead of or prior to washing at a designated wash rack where pollution prevention measures are employed?	✓		
8	Are leachate potentials of pesticides considered in the integrated pest management process?	✓		
9	Does the fuel storage/delivery area comply with local, state, federal, or other applicable regulations?	✓		
10	Are written records maintained of all applications of pesticides to include: - the pest and treatment type (preventative/curative); - the location (specific playing area) of each pesticide used; - the area (SF/SM) and quantity of each pesticide used; - the chemical or common name of the active ingredient(s); - the date, location, or purpose of the application?	✓		

Pesticides & Pollution Prevention Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are all pesticide applications recorded and mapped to guide future pest control decisions?		✓	
12	Other than the head superintendent, are there trained scouts on staff to monitor turf and plant health and pest problems?	✓		
13	Are there scouting forms utilized and are they collected and organized into a report or guide for use in future pest control decisions?			✓
14	Is IPMIS being used to track activities including surveillance and biological, cultural, mechanical, and chemical controls?	✓		
15	Are current copies of all Material Safety Data Sheets (MSDS) for all chemicals used anywhere on the golf course property maintained and readily available?	✓		
16	Are fertilizers and pesticides stored in separate facilities?	✓		
17	Is the chemical storage structure/area locked, well ventilated and fire resistant and is access limited to appropriate personnel?	✓		
18	Is there a regularly updated Water Pollution Abatement Plan readily available for the golf course property?			✓
19	Are golfers adequately notified in the pro shop and on the first and tenth tees about the day's planned or recently completed spraying of any chemical or fertilizer?		✓	
20	Are there written pest profiles for common regional pests along with alternative potential control measures readily available?	✓		
Totals		15	3	2



This map shows the current, newly renovated golf course layout.

Environmental Compatibility Quotient Summary			
Environmental Compatibility Category	Yes	Partial	No
Planning & Compliance	9	6	5
Operations & Maintenance	12	3	5
Water Resource Management	12	3	5
Conservation	15	2	3
Pesticides & Pollution Prevention	15	3	2
Totals	63	17	20

Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified
- **Partial** = Practice has been initiated yet is not completed
- **No** = Practice is not in place

February 2010 - Carolina Lakes Golf Course ECQ:

- Actual ECQ = 63, Just started (**Red**)
- Potential ECQ = 80, Showing progress (**Yellow**)

Environmental Compatibility Quotient Scoring Scale	
Total Yes or Partial Responses	Environmental Compatibility Level
90-100%	Advanced (Green)
70-89%	Showing progress (Yellow)
69% or less	Just started (Red)



Environmental Challenges Map

Environmental Challenges

Along with the newly established baseline, the GEM Plan consists of a map and description of the final environmental challenges and the prescribed approach to their management.

The following environmental challenges were identified during the GEM process:

- Bird/wildlife Aircraft Strike Hazard (BASH)
- Environmental Restoration Program (ERP) site
- Invasive species
- Water quality management
- Wetlands

Assessing environmental challenges

The assessment of the environmental challenges is probably the most crucial as it provides a prioritized list of coordinated actions significant to the long-term success of the golf facility. The finalized GEM Plan will include the description, driver or requirement, management practice, objective, and target:

DESCRIPTION

Once the challenge has been identified, a short description and a few historical or statistical details assist greatly in understanding the key factors in devising management practices.

DRIVER/REQUIREMENT

Challenges are defined as “things that are bigger than the course”. Some of the reasons behind why a particular issue becomes a challenge are important to recognize and understand. A driver or requirement may be a local, regional, or national law, regulation, or initiative that creates the requirement to protect species, habitat, or preserve a resource such as open space or unique ecosystems.

OBJECTIVE

Objectives are the overall goals for environmental performance focusing specifically on management activities associated with each challenge and the potential for impacts. The objective should directly relate to the environmental policy.

MANAGEMENT APPROACH

A course’s approach to managing environmental challenges in accordance with the driver or requirement, environmental policy (see inside front cover), and established objectives and targets is the heart of the GEM Plan.

TARGET

The target is the time frame and/or quantifiable unit of measure to achieve the established objectives.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

One of the new holes recently constructed as a result of AT/FP requirements and other mission-related projects at Shaw AFB.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Buffers around lakes may not be conducive to good BASH management.

BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH)

A bird/wildlife aircraft strike hazard exists at Shaw AFB due to both the locale of the installation and the numerous migratory bird species. The lakes on the golf course are a strong attraction. In years past, waterfowl were actually raised on site by well-meaning U.S. Air Force personnel. In addition, swans were encouraged to "hang out". The problem is when these beautiful creatures interact with swiftly moving and delicate machines like an F-16.

According to the 20th Fighter Wing BASH Plan, Air Traffic Control (20 OSS/OSAT) coordinates with golf course management and CEV prior to golf course hazing of waterfowl. It prescribes that the golf course management must request approval from the control tower prior to hazing, and will also advise when hazing operations are complete.

Existing and potential hazards to aircraft operations posed by wildlife include waterfowl issues associated with ponds on the Carolina Pines Golf Course as they "attract waterfowl on a year-round basis, with periods of greatest intensity during the spring (nesting) and fall and winter migratory seasons". All of the golf course impoundments provide good habitat for migrating and resident waterfowl potentially increasing the potential BASH risk.

Driver/requirement

- Bird/Wildlife Aircraft Strike Hazard (BASH) Plan, 91-212
- AFI 13-213, Airfield Management
- AFI 32-1053, Pest Management Program
- FAA Advisory Circular 150/5200-33A, Hazardous Wildlife Attractants On Or Near Airports
- AFI 91-202, The U. S. Air Force Mishap Prevention Program

- AFPAM 91-212, Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques
- UFC 3-260-01, Airfield and Heliport Planning and Design
- AFPD 91-2, Safety Programs

Objective

In direct support of the installation's mission, the golf staff shall continue to cooperate and assist the environmental and airfield management staffs with BASH reduction efforts.

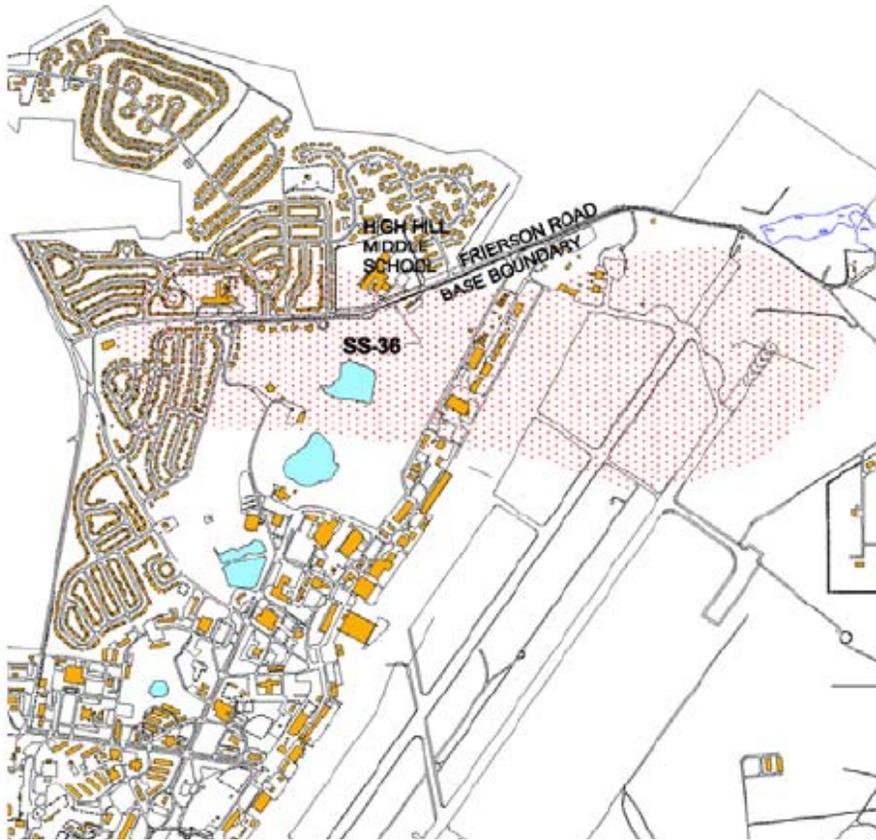
Management approach

- Coordinate with wing flight safety, golf course management and CEV prior to golf course hazing of waterfowl and allow a minimum 30-minute break in local flying prior to receiving approval
- Golf course management will request control tower approval prior to hazing and will also advise when hazing operations are complete
- Coordinate pond maintenance procedures with installation environmental management staff
- Install only BASH-approved plant material listed in the INRMP
- Secure membership on BASH Working Group and attend all meetings
- Ensure minimally-maintained or non-play areas are mowed in accordance with airfield mowing criteria or on a requirement basis (7-14") wherever practicable in accordance with AFPAM 91-212
- Report large bird concentrations to Airfield Manager or designated representative
- Coordinate with Airfield Manager or designated representative and flight safety officer to ensure golf course improvements are deconflicted with BASH program and do not increase bird hazard for flight operations

Target

After securing membership on the BASH Working Group, assess, identify and eliminate 25% of the BASH conditions on the course prior to the next iteration of the natural resources management plan.

Complete Tree Management Plan that identifies BASH-potential species and implement annual maintenance schedule.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

SS-36 site map.

ENVIRONMENTAL RESTORATION PROGRAM (ERP) SITE

The Shaw AFB restoration program is one of the U.S. Air Force's best. There are no known ERP sites actually on Carolina Lakes Golf Course facility property. The Management Action Plan documenting the closest known site, SD-29, is available on compact disc. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site is currently a Remedial Action Operation (RA-O). There is a newly installed shallow groundwater monitoring well just south of the 12th green in association with the remediation of SD-29. There is no action required of the golf course staff on this issue except awareness of the relative proximity of a potential environmental challenge site.

According to a NEPA document, the "former ERP site OT-25 is located southeast of the golf course maintenance area (Buildings 595, 604, 614). The site consists of a septic tank and drain field that accept water used to wash golf course maintenance equipment and human waste. The tank has been found to contain volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and pesticides at concentrations below action levels. A DD signifying closure of the site was drafted in August 1995 and approved in September 1995. The site is now closed (Air Force, 2007d)".

Driver/requirement

- AFI 32-7020, The Environmental Restoration Program
- Resource Conservation Recovery Act (RCRA)
- Comprehensive Environmental Response, Compensation, and Liability Act, (CERCLA)
- Superfund Amendments and Reauthorization Act (SARA)

Objective

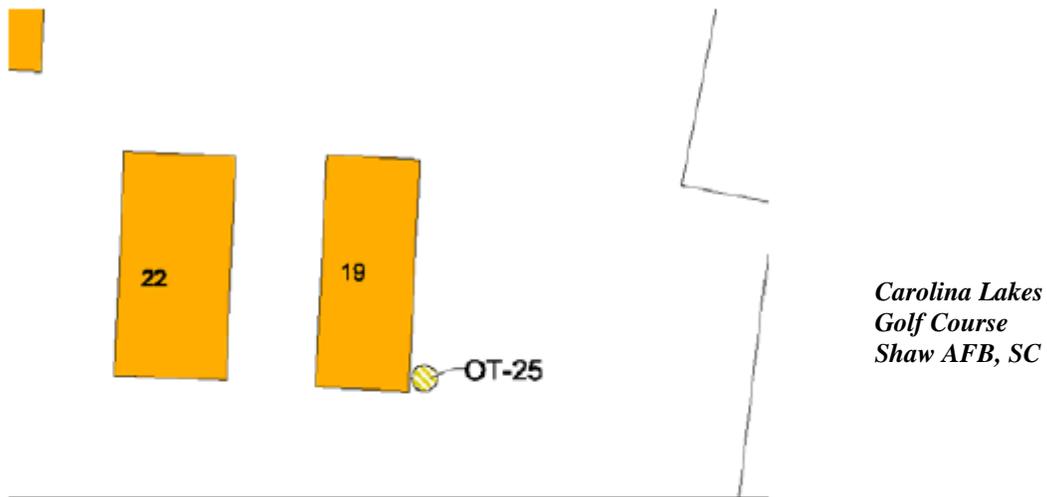
Ensure daily compliance with restoration program site requirements.

Management approach

- Abide with all specified land use controls (LUCs)
- Work closely with installation restoration program manager to ensure compliance

Target

Immediately integrate direction into regular maintenance practices.



OT-25
OT-25 Site map



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Not only is this area the site of the 7th hole lake overflow, newly constructed bridge and the golf course wetlands, it is perfect for the establishment of invasive species.

INVASIVE SPECIES

The INRMP lists several invasive exotic plant species that have a chance to occur on the golf course at Shaw AFB. They include Chinaberry, common bamboo, Japanese honeysuckle, common reed, common privet, and white poplar. None of these species should ever be planted on the golf course grounds. Any that may be existing need to be controlled or eliminated. The INRMP has several control methods listed to deal with these non-native species that become part of an ecosystem and may act as "predators, pathogens, or disrupters". The INRMP also lists Chinese tallow, kudzu, and hydrilla as potential invasive species of the installation.

Driver/requirement

- Federal Noxious Weed Act of 1974
- Executive Order 13112, Invasive Species, February 3, 1999
- National Invasive Species Act (1996)
- Plant Protection Act (2000)
- Federal Noxious Weed Act of 1976 (7 U.S.C. 2801)

Objective

Prevent introduction and establishment of invasive species to reduce their impact on the environment, economy and health of the United States.

Management approach

- Never knowingly install a listed or potentially invasive species
- Regularly inspect likely areas for invasives to establish themselves
- Work with installation environmental staff to contain or reduce invasives
- When possible, restore native species and habitat conditions
- Train all pertinent employees on the latest invasive species identification and

control measures

- Restore disturbed areas dominated by invasive species to natural vegetation where practical and consistent with mission requirements
- Utilize native or indigenous plant materials whenever possible

Target

Assist the environmental staff with the compilation of an invasive species survey and completion of an approved plan to reduce identified species prior to the end of FY10.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Invasives seem to thrive in wet soils and plenty of sunshine.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

*Photo credit:
Jack Anthony*

Kudzu vine is one of South Carolina's nemesis invasives.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Memorial Lake as viewed from the 12th teeing area.

WATER QUALITY MANAGEMENT

The protection of water quality may be the primary environmental concern for Shaw AFB environmental managers. All of the installation ponds are located within heavily developed areas of the installation and discharge into the storm water sewer system by way of ditches and culverts. Located adjacent to the 12th hole is the 5.5-acre Memorial Lake. It is used extensively for fishing, resting, picnics and walking. According to the INRMP, a wide flashboard riser is located about 50 feet from shore and may be used to manipulate the water level. Much of the pond's banks have slow drop offs. The small degree of sloping allows ample sunlight to reach the pond's floor and provides excellent habitat for a variety of aquatic vegetation and domestic dabbling for ducks and geese, which present a bird/aircraft strike hazard. The pond has chronic weed and algae problems due to pond design, golf course runoff, and the waterfowl population.

The pond left of the 1st fairway is about 5.5 acres in size. It has a relatively new flashboard riser as the water control device. This pond suffered a complete fish kill in 1996 due to low dissolved oxygen levels. Alligator weed occupies approximately half the shoreline out to the depth of about 3 feet. Blue-green algae were also present in heavy amounts. All water quality factors were within acceptable ranges although a significant fish die-off occurred during May 1996 killing 80 to 90 percent of the fish population. This was attributed to extremely low dissolved oxygen concentrations. The INRMP contains several recommendations for maintaining this water feature mostly focused on creating a higher quality fishery.

The pond along the 8th hole is approximately 7.3 acres in size. This pond is used for golf course irrigation purposes. According to the INRMP, it "receives fertilizer run off from the golf course". This pond provides irrigation for the golf course by a well and pump. A portion of this pond is accessible for fishing. The pond is approximately 7.3

acres in size and it (purportedly) receives fertilizer run off from the golf course. Alligator weed is present along most of the shoreline and it extends about 10 feet into the water. Blue-green algae are present in heavy amounts across the entire pond. Visibility in the water is only 3 or 4 inches. Alligator weed is the primary problem plant. Some scattered cattail and rushes were also noticed. All water quality factors were within acceptable ranges.

Outfall #002 located west of the runway drains 563 acres including 200 golf course acres.

Driver/requirement

- Clean Water Act, Section 401
- National Pollutant Discharge Elimination System (NPDES)
- Safe Drinking Water Act
- Federal Water Pollution Control Act of 1977 (Clean Water Act), as amended (33 U.S.C. 1251-1376)

Objective

Ensure that golf course management practices never diminish installation or community water quality.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

The teeing area and most of the fairway on the 12th abut Memorial Lake.

Management approach

- Consult with installation environmental staff to ensure that golf course maintenance practices are fully compliant with complex water-related regulations
- Compile a comprehensive Water Resource Management Plan for the entire golf course facility

- Establish, document and communicate pesticide and fertilizer application buffers around all water features
- Directed floor drains to sanitary drains with oil/water separator
- Store drums on pallets
- Spill response equipment available and personnel are trained
- Cover all dumpsters
- Store materials and waste inside buildings or cabinets
- Cover wash rack and collect and regularly dispose of grass clippings properly
- Perform all repair activities under a covered area
- Cover and berm pesticide/herbicide storage and mixing areas
- Store flammables in properly located, secure cabinets
- Use drip pans under dispensing units
- Regularly perform visual inspections of the area
- Properly install adequate security fencing

Target

Maintain positive relationship with civil engineering and environmental staffers to attain and maintain compliance without delay on all water-related regulations and requirements.

Correct all potentially non-compliant water resource aspects prior to the end of CY2010.

Establish and map all buffers prior to the end of CY2010.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Application buffers can improve lake water quality in a short time.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

Golf course wetlands occur behind the 6th hole.

WETLANDS

There are over 5400 acres of wetlands on Shaw AFB. The golf course contains three artificial ponds developed on the golf course that potentially offer habitat for a fairly large number of wetland species. Inconsistently prescribed maintenance practices have contributed to supporting nama, water-spider orchid, meadow beauty, bugle-weed, ludwigia, downey lobelia, smartweed, and other native wetland plants. Pond bank maintenance practices have caused concern BASH managers.

Driver/requirement

- Clean Water Act, Section 404
- National Pollutant Discharge Elimination System (NPDES)
- Executive Order 11990, Protection of Wetlands
- AFI 32-7041, Water Quality Compliance 10 Dec 03

Objective

Ensure that all water bodies continue to be free of pollutants potentially attributable to a golf course management practice.

Management approach

- Establish, document and communicate fertilizer and pesticide application buffers to all appropriate employees or service providers
- Consult with environmental staff prior to any changes in creek bed or pond bank maintenance
- Comply with all requirements included in the approved installation SWPPP
- Ensure all spill prevention procedures and spill kits are in place and all pertinent employees are adequately trained to correctly and promptly perform required actions in an emergency situation

- Compile a comprehensive Water Resource Management Plan for the entire golf course facility

Target

Eliminate the potential for degradation of the water resources at the golf course by establishing, documenting and communicating all pesticide and fertilizer application buffers to appropriate personnel prior to the end of the year.

Maintain positive relationship with civil engineering and environmental staffers to attain and maintain compliance without delay on all water-related regulations and requirements.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

This area adjacent to Memorial Lake in the 12th fairway is a potential candidate for wetland status and management.



*Carolina Lakes
Golf Course
Shaw AFB, SC*

The finishing hole at Carolina Lakes Golf Course.

Implementation

Setting goals and objectives is an important step in the implementation of an installation's GEM Plan. Implementation is the single best evidence that the installation GEM team is working well together in their task of supporting the mission.

GEM Plan goals & objectives

Goals are defined as actions or results that should be accomplished in the next year.

- Post policy statement and environmental challenges map for employees and customers
- Ensure that all employees receive documented environmental awareness and stewardship training
- Install signs at all water features warning of the potential hazard of drinking non-potable water
- Request an energy audit for the entire golf course facility

Objectives are defined as actions or results that are desired to be accomplished prior to the next INRMP update in 2012.

- Compile comprehensive golf course development plan to guide short- and long-term improvements
- Compile written Water Resource Management Plan that delineates the care of each of the course's water features and includes a Drought Management Plan for the entire golf facility

Conclusion

Carolina Lakes Golf Course and Shaw AFB, SC have a long history of golf course environmental management excellence. They were the first Air Force installation to allow testing of the then still emerging GEM program ideas. They are also the first installation to receive a third visit from AFCEE furthering their stewardship and sustainability. Recently partially redone, the course is looking better than ever. Carolina Lakes also has new leadership as both the manager and superintendent are newcomers to South Carolina. Combining these facts with the stellar approach the installation has always taken in mission accomplishment and mission support, the Air Force's "jewel of the Carolinas" will continue to shine well into the future.

The gallery

On the following pages are some of the more revealing photographs of challenges, maintenance practices and other areas of the golf course facility.



Clubhouse tabbed for improvements in past.



Cart barn is spacious and well managed.



Maintenance complex is relatively new.



New holes during recent construction.



Family of ducks enjoy the amenities as much as the golfers.



The short 7th may be the signature hole at Carolina Lakes.



Area near the 11th has always been diverse.



Shelter is ADA compliant.



Pro shop fulfills customer needs.



Looking down on the 18th green.

Bibliography

Audubon International, Environmental Performance Audit, *Integrated Environmental Management*, Golf Course Superintendents Association of America, New Orleans, LA, February 2000.

The Center for Resource Management, *Golf & the Environment: Charting a sustainable future*. Environmental Principles for Golf Courses in the United States, Salt Lake City, UT, 1996.

Bushman, William H., *A Process to Quantify the Environmental Compatibility of Golf Course Management Practices*, University of Texas at San Antonio, Thesis, The University Of Texas At San Antonio, College of Sciences, Department of Earth and Environmental Sciences, May 2003.

Bushman, William H., *Comprehensive Golf Course Environmental Management Planning*, Golf Course Superintendents Association of America, Atlanta, GA, February 2006.

20th Fighter Wing/SAIC, *Final Shaw Air Force Base Infrastructure Project Environmental Assessment*, Air Combat Command, 20th Fighter Wing, Shaw AFB, South Carolina, September 2008.

20th Fighter Wing, *Final Integrated Natural Resources Management Plan, 2007-2011*, Nov 07.

20th Fighter Wing (20 CES/CEOUE), *Shaw Air Force Base Pest Management Plan*, 1 January 2006.

20th Fighter Wing, (20 FW/SEF), *Shaw Air Force Base Plan 91-212, Bird Aircraft Strike Hazard (BASH)*, 1 Oct 2007.

_____, *Shaw Air Force Base Environmental Restoration Program Site Summaries*, Shaw AFB, SC, Dec 07.

URS Group, Inc., *Final Oil/Water Separator Management Plan*, Shaw AFB, SC, Nov 08.

Zapata Engineering, P.A., *Storm Water Pollution Prevention Plan for Shaw AFB, SC*, Mar 07.



**Air Force Center for Engineering & the Environment
Technical Division
Built Infrastructure Branch**

For additional assistance or more information, please contact:
AFCEE GEM Program Manager – 210-395-8391 - DSN 969-8391
AFCEE/TDB, 2261 Hughes Ave, Suite 155, Lackland AFB, TX 78236-9853
afcee.td.awag@brooks.af.mil?subject=golf

Please visit our Golf Course Environmental Management Program website:
<http://www.afcee.brooks.af.mil/ec/golf/>