Air Force Center for Engineering & the Environment

Apache Mesa Golf Course
Environmental Management (GEM) Plan
Holloman AFB, NM

October 2010

San Antonio, Texas

Apache Mesa Golf Course Environmental Management Policy

In concert with the Holloman 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.

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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 11.4 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 = 68, Getting started (Red), Showing progress (Yellow), Advanced (Green)
- Potential ECQ = 68, Getting started (Red), Showing progress (Yellow), Advanced (Green)

Environmental challenges

The following potential environmental challenges were identified in compiling this document:

- Airfield safety
- Bird/wildlife Aircraft Strike Hazard (BASH)
- Water use
- Water quality
- Migratory birds
- Human health and safety
- Nuisance wildlife

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/).

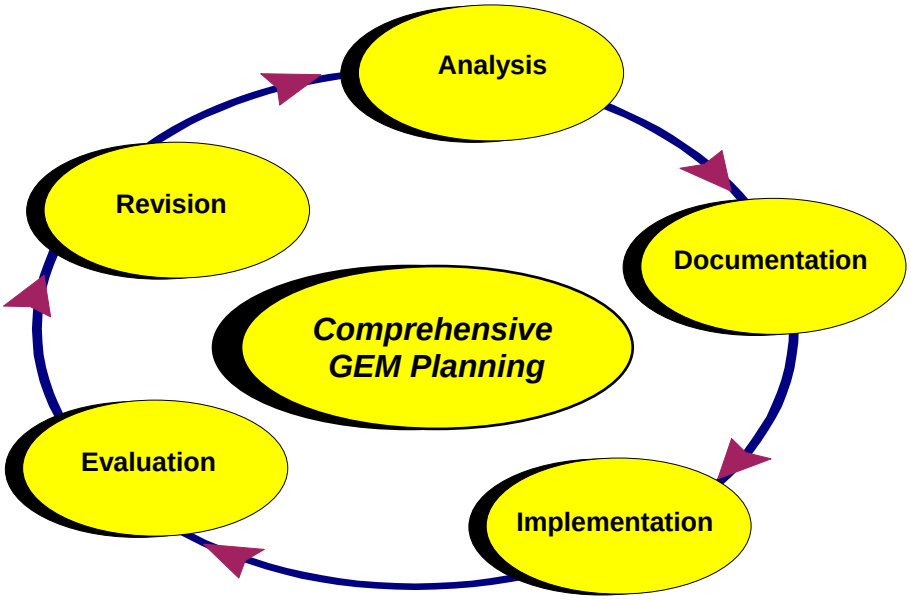
Apache Mesa Golf Course Holloman AFB, NM

Beautiful weather and surroundings highly complement Apache Mesa.

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 evolving 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. The comprehensive GEM planning process is the vehicle to document our successes while communicating directly with our customers, commanders, and local community.



GEM Process

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.

The site assistance visit accomplishes several important activities to include:

- Site visit, interviews, and data collection
- Course specific analysis & miscellaneous facility review
- Compilation of the environmental compatibility quotient checklists
- Identification of potential environmental management challenges

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.

GEM PLAN COMPONENTS

The GEM Plan will be comprised of the following components:

- 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

The Apache Mesa clubhouse is a full service facility.

Apache Mesa Golf Course Holloman AFB, NM

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.

Evaluation

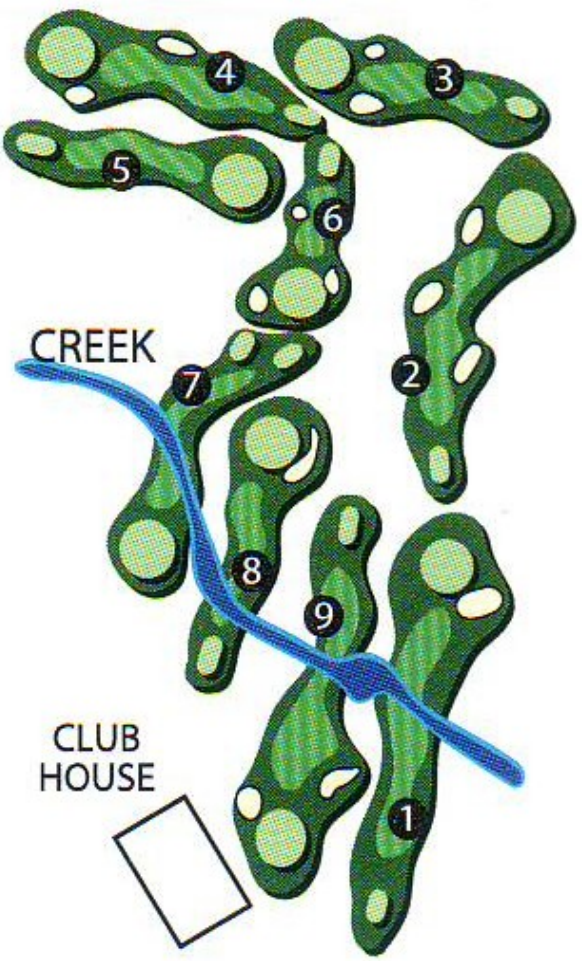
In order to ensure the highest quality of customer service and environmental stewardship, there must be continual self-evaluation and improvement. There also should be consistent, on-going measurement of the reduction or elimination of environmental impacts the newly implemented practices have on the 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 important tasks in the initial phase 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 establishes and communicates the context for the rest of the GEM Plan report.



Apache Mesa Golf Course Holloman AFB, NM

Apache Mesa Golf Course Layout Map

Course Description

The golf course is a significant portion of the installation morale program and adds a sense of community to this remote location. It is also a considerable luxury that imposes an enormous impact on water resources in this xeric environment. The golf course currently has nine holes and is one of the single largest users of water and chemical inputs on the base. Approximately 0.3 to 14.4 million gallons of water are used monthly. Programs that will reduce the use of water are currently being evaluated. These include changing to more drought-tolerant turf varieties and using treated wastewater effluent from the HAFB wastewater treatment plant rather than potable water.

Apache Mesa, Holloman AFB, NM

Course Details

Architect		Unknown
Year constructed		Unknown
Climate		Cold, hot windy and dry
Average annual precipitation		9 inches
Average growing season		225 days
Elevation		~ 4100’ ASL
Prevailing wind direction		SSE/NNW
Total facility acreage		~ 100 acres
Total actively maintained acreage		(Not provided) acres
Par		36-36-72 (Nine holes only)
Yardage/Rating/Slope		White/Blue- 7018/72.7/117
		Gold/Grey- 6302/69.0/116
		Red/Gold- 6070/73.0/124
Turfgrass	Tees-	Bermudagrass
	Fairways-	Bermudagrass
	Greens	Bermudagrass / Bentgrass?
	Roughs-	Mix
Irrigation source		Drinking water (Red)

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 environmental management resources and 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 relative status or quality of the environmental management program in regards to stewardship. Although several of the ECQ questions address compliance-related issues or practices, there are no formal requirements or mandates implied or actual connected to this process. The ECQ checklists establish two measures, or scores:

- **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 of the checklists. Maybe the most significant measure; the potential ECQ represents a level of compatibility that could be reached by fully implementing a particular practice or procedure.

The following ECQ checklists are a record of the interview conducted with the course manager and superintendent during the visit.

Planning & Compliance				
#	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 written Tree Management Plan?		✓	
7	Is there a readily-available and regularly updated golf course-specific Integrated Pest Management Plan?	✓		
8	Is there a map of the course's 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 facility improvements?	✓		
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	Are all employees familiar with the GEM Plan and are they trained regularly on the importance of its overall goals and objectives?			✓
12	Are environmental management issues regularly discussed during staff meetings?	✓		
13	Are the quantities and application rates of each pesticide or fertilizer used over the last year on the facility available in writing?	✓		
14	Has the golf facility maintained compliance with all environmental regulations over the past year (no notice of violations or enforcement actions)?	✓		
15	Are employees trained in their native language on GEM Plan and compliance with its intent and specific goals and objectives?	✓		
16	Does the golf manager and superintendent facilitate and assist with compilation and implementation of the GEM Plan and its inherent goals and objectives as a quantifiable portion of their daily activities?	✓		
17	Are there documented functional and/or aesthetic thresholds integrated into pest control decisions?	✓		
18	Is there a written comprehensive Golf Course Water Resources Management Plan that describes the care for each of the course's water-related activities?			✓
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 all maintenance procedures been examined to determine their potential to impact the course's identified environmental challenges?		✓	
	Totals	**12**	**4**	**4**

Operations & Maintenance				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is there a written, regularly updated and readily-available comprehensive Turfgrass Management Plan for the entire facility?	✓		
2	Does the design and condition of the Maintenance Complex facility positively contribute to the stated installation environmental stewardship goals contained in the INRMP?			✓
3	Are mowing heights maintained at levels that do not excessively stress important playing surfaces and increase chemical or fertilizer inputs?	✓		
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?			✓
7	Is there at least one project planned and funded for the next year that would mitigate the potential for environmental impacts due to the course's operational or maintenance procedures?	✓		
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	Have all aspects of the golf course property other than the course been examined for potential environmental impacts?	✓		
10	Have all employees received documented annual training that would increase their awareness of the stated installation GEM program policy and this Plan’s goals and objectives?			✓

Operations & Maintenance Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Are used oil containers in good condition, not leaking and clearly labeled?	✓		
12	Are golf course wash racks operating and maintained properly?			✓
13	Are all golf course vehicles and equipment maintained and cleaned in a manner that would eliminate the potential for spreading of disease or other contamination?	✓		
14	Is electric motor-powered equipment or vehicles being utilized where appropriate and/or required due to air quality or other environmental concerns?	✓		
15	Are waste products such as oil, grease, tires and batteries stored and disposed of properly?		✓	
16	Are hand held GPS units to map golf course areas to assist the environmental management process?			✓
17	Are energy efficiency ratings factored into equipment purchases for use throughout the facility?	✓		
18	Has the golf facility been studied to quantify and minimize solid waste streams?			✓
19	Are at least 90% of restaurant/snack bar facility plates, cups and utensils reusable rather than disposable?			✓
20	Is a web-based, course management tool used for every day decision-making and recordkeeping?			✓
	Totals	**11**	**1**	**8**

Water Resource Management				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are records of water quality monitoring activities, results and pollution control measures readily available and used to implement appropriate maintenance practices?	✓		
2	Are slow-release fertilizers and/or spoon-feeding techniques used to reduce the potential for runoff impacts and nutrient loading to water features?	✓		
3	Does the irrigation system use regularly calculated real-time evapotranspiration rates?			✓
4	Is the golf course irrigation and plumbing systems regularly monitored and maintained?	✓		
5	Have low-flow water saving devices been installed wherever possible?	✓		
6	Are sterile triploid grass carp or similar fish species used to control unwanted aquatic vegetation in major water features?	✓		
7	Is there at least one project planned and funded that would minimize or eliminate a potential water quality or erosion problem?	✓		
8	Are water features regularly monitored for algae, erosion and excessive aquatic plant growth?	✓		
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 accurate flow meters used to monitor total potable and non-potable 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 including parameters like pH, nutrient, salt or total suspended solids?	✓		
15	Is water quality data regularly collected to establish baseline conditions and maintenance procedures for all water features on the property?	✓		
16	Is at least 75% of the water used for irrigating the golf course property from recycled or other non-potable sources?			✓
17	Is there at least one project planned and funded that would decrease the course's dependency on potable water use?	✓		
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	**16**	**0**	**4**

Conservation				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized equipment maintained to minimize the potential of excessive air polluting emissions?	✓		
2	Has the entire golf course property been examined for critical habitats, 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 physically connect natural areas to facilitate wildlife movement through the course property?	✓		
6	Are required operating permits current, updated and adequately maintained?	✓		
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	Are there records maintained and readily-available documenting a 2% annual reduction in potable water use as well as a 2% reduction in overall water use?			

Conservation Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Has there been a demonstrated 2% annual reduction in irrigation water use starting in FY10?	✓		
12	Are a majority of plants used on the Approved Installation Plan List and are drought-tolerant native trees, shrubs, groundcovers, or their cultivars?	✓		
13	Are there areas appropriately designated and signed as "Environmentally Sensitive Zones" per The Rules of Golf?	✓		
14	Has a comprehensive energy audit been conducted for the entire golf course facility?			✓
15	Is there a comprehensive Energy Management Plan compiled for the entire golf course facility demonstrating a 3% annual reduction?	✓		
16	Is petroleum product use being tracked to demonstrate a minimum of 2% annual reduction?	✓		
17	Is there an inventory of bird and mammal species documented, maintained and readily available?			✓
18	Have all damaged or degraded habitats as result of construction projects or other work on or near the course been fully restored?	✓		
19	Has the entire property been adequately examined to protect potentially existing archaeological, cultural or historical resources?	✓		
20	Is the irrigation pump station an energy efficient, variable frequency drive?			✓
	Totals	**16**	**0**	**4**

Pesticides & Pollution Prevention				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there established, documented and communicated fertilizer and pesticide application buffer areas around water features and/or sensitive landscapes?		✓	
2	Is the pesticide mixing location and spray equipment loading area adequately covered to 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?	✓		
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 area) of each pesticide used; - the area (SF/SM) & quantity of each pesticide used; - the chemical & common name of 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 performed by licensed personnel and are they recorded and mapped?		✓	
12	Other than the 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 there an established aesthetic or functional threshold for each of the course's most common pests that may help reduce pesticide and fertilizer inputs?		✓	
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	Are all fertilizer applications performed by licensed or certified personnel and are they recorded and mapped to guide future actions?			✓
19	Are golfers adequately notified in the pro shop and on the first and tenth tees about planned application of any chemical or fertilizer?	✓		
20	Are there readily-available written pest profiles for common regional pests that include potential alternative control measures?			✓
	Totals	**14**	**3**	**3**

Apache Mesa Golf Course Holloman AFB, NM

The 1st and 10th tee demonstrates caliber of maintenance care customers can expect throughout the course.

Environmental Compatibility Quotient Summary			
Environmental Compatibility Category	**Yes**	**Partial**	**No**
Planning & Compliance	**12**	**4**	**4**
Operations & Maintenance	**11**	**1**	**8**
Water Resource Management	**16**	**0**	**4**
Conservation	**16**	**0**	**4**
Pesticides & Pollution Prevention	**14**	**3**	**3**
Totals	**69**	**8**	**23**

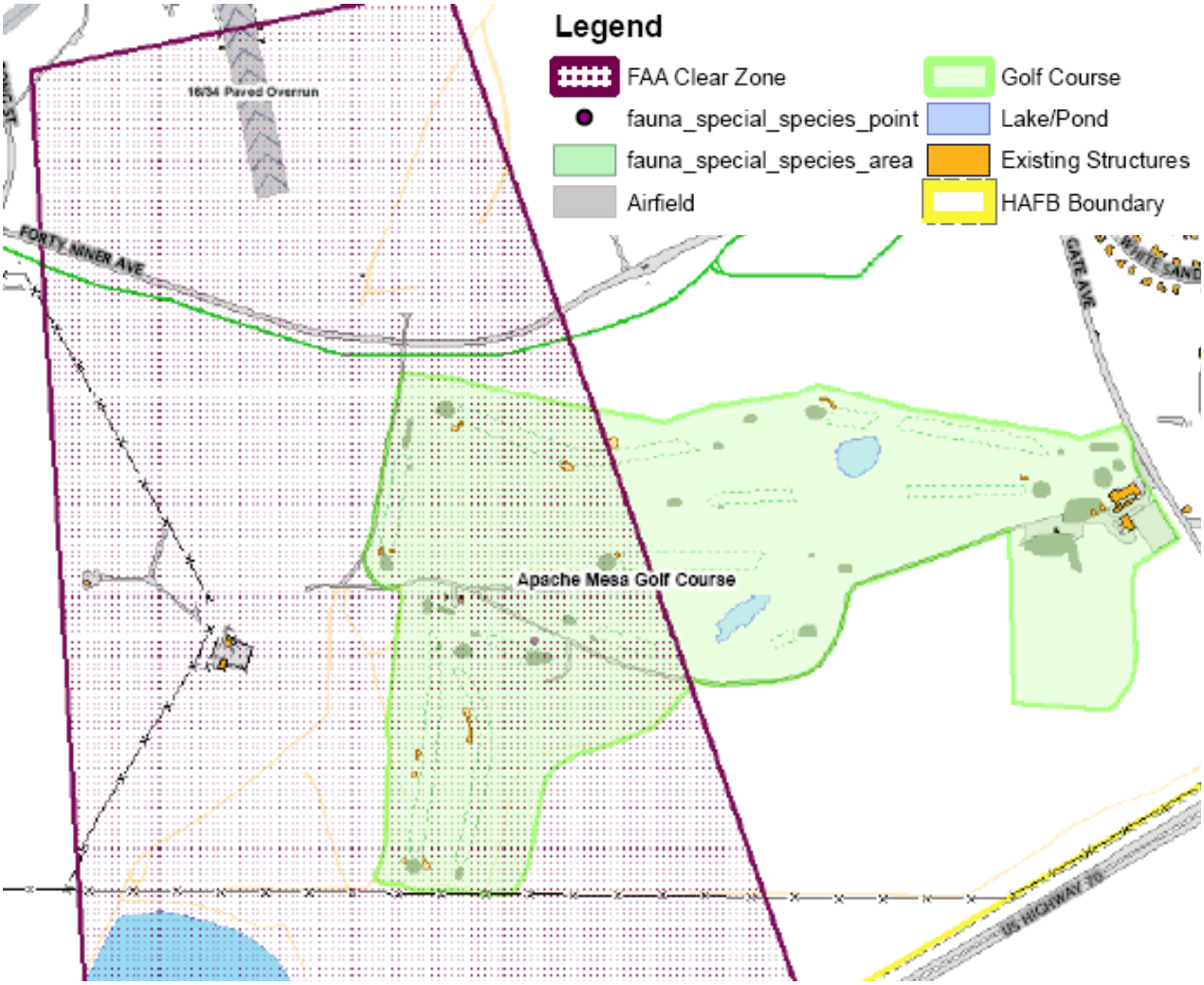
Key to checklist responses

- **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

Oct 2010 - Apache Mesa Golf Course ECQ:

- **Actual ECQ = 69, Just started (Red)**
- **Potential ECQ = 77, 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

Apache Mesa Golf Course Holloman AFB, NM

Despite the region's low rainfall, water-based challenges abound at Apache Mesa.

Environmental Challenges

One of the important results of the GEM process is the identification of significant environmental challenges to be addressed in the GEM Plan. Challenges are defined as "things that are bigger than the course". Some of the reasons behind a particular challenge are important to recognize and understand. Ideally, the golf staff will address their management approach to each challenge to accomplish course and local community environmental management objectives while still attaining acceptable levels of course playability and customer satisfaction. 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.

Identified environmental challenges

The following environmental challenges were identified during the GEM process:

- Airfield safety
- Bird/wildlife Aircraft Strike Hazard (BASH)
- Water use
- Water quality
- Migratory birds
- Human health and safety
- Nuisance wildlife

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
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 page 2), 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.

Apache Mesa Golf Course Holloman AFB, NM

No irrigation equals no turfgrass.

Apache Mesa Golf Course Holloman AFB, NM

The is no missing the Tornado when making approaches during the late afternoon.

AIRFIELD SAFETY

Portions of the Apache Mesa Golf Course are located in the civil engineering staff-mapped "FAA clear zone". According to the 2004 Air Installation Compatible Use Zone (AICUZ) study, the golf course is partially within the clear zone and Accident Potential Zone (APZ) 1. Although the location of the course within these zones is fully compatible with land use guidelines, it fully complies with qualifying notes contained in the AICUZ.

The golf course is part of the installation mission. The golf course staff should make every attempt to work closely with airfield management to ensure the highest quality mission support possible.

Driver/requirement

- AFI 32-7063, Airfield Installation Compatible Use Zones, (AICUZ)
- UFC 3-260-1, Airfield & Heliport Planning & Design

Objective

Minimize or eliminate the potential impacts to the flying mission as a result of golf course management procedures.

Management approach

- Assist installation managers in providing a safe and efficient airfield

Target

Regularly consult with installation airfield management to ensure mitigation or elimination of potential impacts.

Apache Mesa Golf Course Holloman AFB, NM

A German Air Force Tornado aircraft performs its training mission along edge of the Apache Mesa Golf Course.

BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH)

The installation BASH Plan does not mention the golf course or its management as a concern. Regardless, Apache Mesa is in the airfield's "FAA clear zone" as mapped by the civil engineering staff. The course also has two ponds that can attract undesirable bird species.

According to the INRMP, "A minimal bird-aircraft strike hazard exists at HAFB and its vicinity due to low populations of resident and migratory bird species and the distribution patterns of those species. HAFB began recording bird strike data for planes within the 49 FW Flight wherever they were flying in 1985. The first strike recorded within the HAFB flight area was in April 1994. Data indicate that most strikes occur outside of the HAFB flight area, in the various flight ranges associated with the HAFB flying mission. Within the HAFB area, a total of 82 strikes were recorded between April 1994 and July 2005 mostly sparrows and other small upland birds, two bats, two ducks and a hawk…"

With even minimal impact to the flying mission at Holloman, BASH is still an issue for the golf management team. Despite this fact, the golf staff should be an active member of the airfield management team.

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

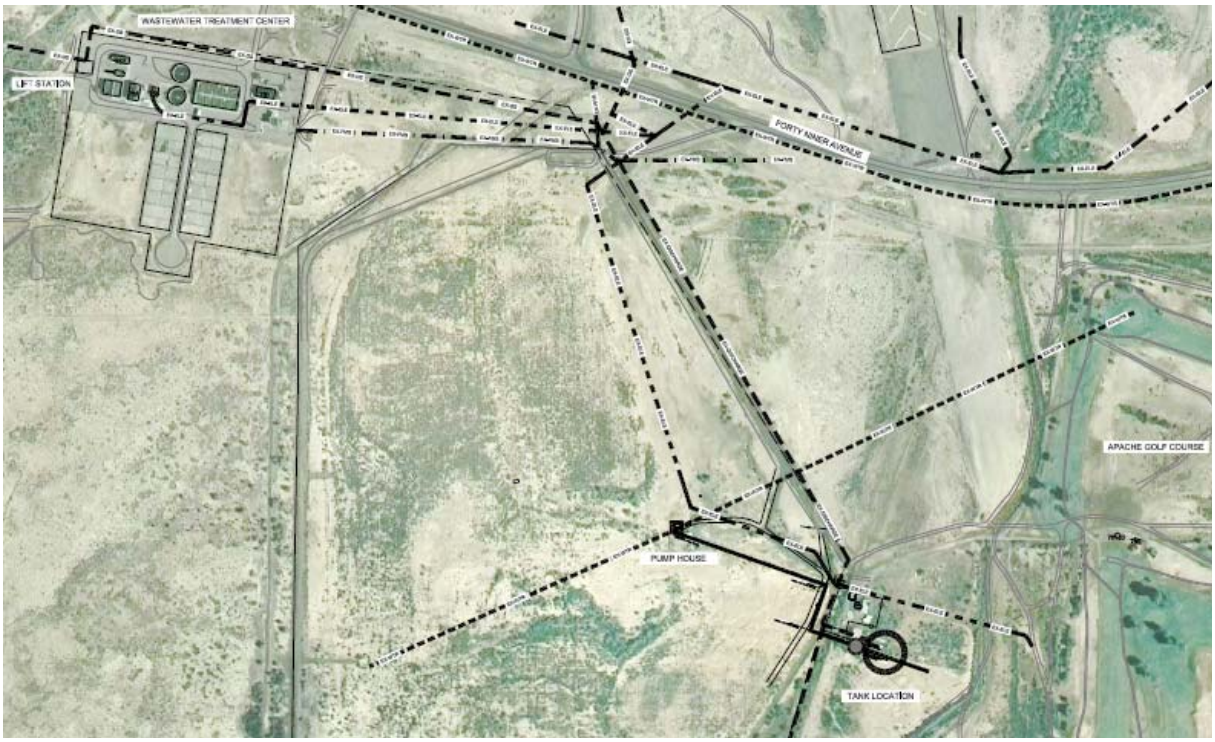
Objective
In direct support of the installation's mission, the golf staff shall continue to cooperate and assist the environmental and airfield management staffs with BASH reduction efforts to minimize or eliminate the potential for installation BASH concerns as a result of golf course management practices.

Management approach
- Coordinate pond and stream 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
- Eliminate all unnecessary vegetation around water bodies

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.

Apache Mesa Golf Course Holloman AFB, NM

Eliminating vegetation will improve the course while minimizing the potential for creating an attractive habitat for potential BASH species.



Preliminary drawings of the proposed irrigation water connection to the wastewater treatment plant. Work includes a 400,000 gallon storage tank located near the existing golf course maintenance complex.

WATER USE

Water is our most precious resource. Unfortunately, golf courses need a reliable quantity as well as quality of water to provide recreational service to the installation. According to the INRMP, "HAFB has completed an environmental assessment (EA) and signed finding of no significant impacts (FONSI) which evaluates the effectiveness and impacts associated with irrigating the Apache Mesa Golf Course with effluent from the wastewater treatment plant." The proposed action involves diverting 70 to 130 million gallons/year of the 255 million gallons per year discharged from the wastewater treatment plant to the golf course. Since supply may be an issue, the installation plans to install a tank near the course to ensure water supplies match up with demand. An alternative action cited in the EA was irrigating the golf course with a mix of potable water and WWTP effluent. The $.57M project was scheduled to begin soon after the site visit. With a payback of only 3.7 years, things should be well under control for the long haul at Apache Lakes Golf Course.

The INRMP continues "Based on unpublished Holloman AFB data from 1997 through 2006, if 100% effluent were used to irrigate the Apache Mesa Golf Course, the volume of effluent used per month would be between 23% and 33% of the average monthly effluent discharge" (see table on next page).

In the meantime, the course managers continue to abide by the City of Alamogordo watering schedule that limits irrigation to every other day during the time restrictions of "before 0900 and after 1800".

Driver/requirement

- Executive Order 13123, Greening the Government Through Efficient Energy Management
- Executive Order 13423, Strengthening Federal Environmental, Energy and Transportation Management
- Energy Independence & Security Act
- Energy Policy Act
- Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance
- City of Alamogordo Water Conservation Program Outdoor Watering Schedule

Objective

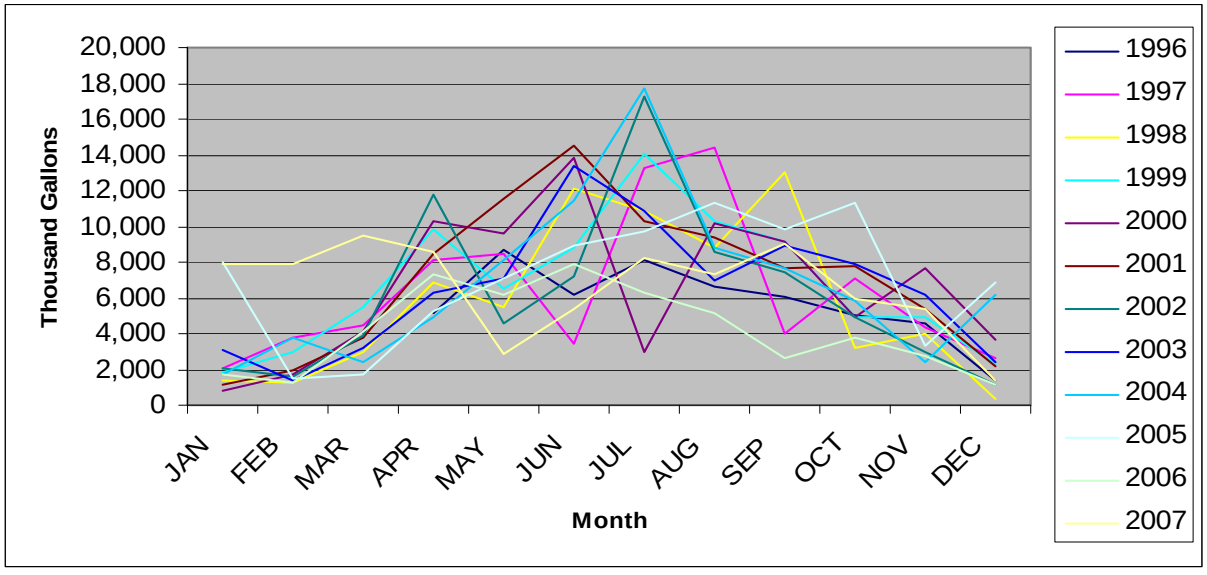
Contribute to the region-wide conservation of all water resources while still providing the best quality golfing experience for customers.

Management approach

- Compile a comprehensive Water Resource Management Plan to include a Drought Management Plan for the entire golf course facility
- Use recycled water that is not subject to restrictions during regional shortages for all irrigation of the course and its grounds
- Regularly check irrigation system for efficient operation

Target

Maintain vigilance on water conservation concerns at all times.



Information gleaned from INRMP documenting golf course water use from 1996-2004.

Apache Mesa Golf Course Holloman AFB, NM

The white calcified patina on tree trunks is a testament to the lack of quality water currently being used for irrigation purposes at the Apache Mesa Golf Course.

WATER QUALITY

Adequate supply and quality of water is imperative for just about any operation. A golf course is no different. Irrigation water high is suspended solids, high pH and overabundance of salts makes it difficult to easily grow high quality turfgrasses. On the other side of the issue, water that runs off a golf course or into a water body on the course should be free of potentially-contaminating constituents like nitrogen, phosphorous and pesticide residues. The *Drinking Water Quality Report* states that "Holloman AFB relies on surface water (75%) and groundwater (25%) for potable water", efforts to preserve surface water quality are imperative for the installation. The golf staff members appear to be doing their part as the *Golf Course Ponds Pesticide Study* state there "were no detections for any of the analytes [SVOCs, glyphosate and imazapyr]". The report also affirmed that these compounds "were not detected in any of the [eight] sediment samples".

Although the *Draft Lake Holloman Recreational Area Development EA* states that "Fishing opportunities have been intermittently available on Holloman AFB as a pond named Lance Lake located on the Apache Mesa Golf Course was opened for fishing in the summer of 2008." Fishing on a golf course is usually inconsistent with safety considerations.

Driver/requirement

- Federal Water Pollution Control Act of 1977 (Clean Water Act), as amended (33 U.S.C. 1251-1376)
- National Pollutant Discharge Elimination System (NPDES)
- Safe Drinking Water Act
- Executive Order 12088, Federal Compliance with Pollution Standards, Oct 78
- 40 CFR 144.6, Underground Injection Control (UIC)

Objective

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

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
- Direct floor drains to sanitary drains with oil/water separator
- Store drums on pallets
- Ensure spill response equipment is 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

The quality of the water in at least one of the golf course ponds is good enough to support small fish and plenty of vegetation.

Apache Mesa Golf Course Holloman AFB, NM

Target

Eliminate the potential for degradation of the water resources by immediately establishing, documenting and communicating all pesticide and fertilizer application buffers to appropriate personnel.

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 CY 2011.

Establish and map all buffers prior to the end of FY11.

New wash rack eliminates a potential water quality concern.

Apache Mesa
Golf Course
Holloman AFB, NM

Apache Mesa Golf Course Holloman AFB, NM

A Mississippi kite hangs out near the 2nd green.

MIGRATORY BIRDS

The Department of Defense participates in the Federal Partners-in-Flight Program for the conservation of neotropical migratory birds. To the extent permitted by law, and subject to budgetary limits and mission constraints, the AF will make lands and resources accessible for furtherance of the Federal Partners-in-Flight program, and provide technical expertise for planning and implementing the program. In accordance with the Migratory Bird Treaty Act (MBTA) and Executive Order 13186, avoid or minimize the negative impact of AF actions on migratory birds, and take active steps to protect birds and restore or enhance their habitat whenever possible. This includes preventing or abating pollution or detrimental alteration of the environment, as practicable, and incorporating migratory bird conservation into agency planning processes whenever possible. Notify the USFWS if unintentional take of migratory birds, reasonably attributable to AF actions, is having, or is likely to have a measurable negative effect on migratory bird populations, and implement conservation measures as specified in E.O. 13186, Chapter 3(e)(9).

All native species of birds are protected under the Migratory Bird Treaty Act (MBTA). Species found on HAFB not protected under the MBTA are the English (house) sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and rock dove (common pigeon, *Columbia livia*). Golf course managers must always be aware of any actions they take with the potential to harm protected birds and act accordingly.

The INRMP states that "…New Mexico has recorded the second highest number of bird species of any land-locked state in the U.S. More than 280 species of birds breed in New Mexico and the extensive grasslands are important for wintering birds." The document continues by listing the Ferruginous hawk, Burrowing owl, Loggerhead shrike, Crissal thrasher, Chestnut-collared longspur and the Lark bunting as priority species for conservation concerns.

Driver/requirement

- Migratory Bird Treaty Act, as amended (16 U.S.C. 703 *et. seq.*)
- Bald Eagle and Golden Eagle Protection Act (16 U.S.C. 668a-668d)
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001
- Migratory Bird Conservation Act

Objective

Ensure that golf course management practices consider the protection of all migratory birds and their habitats.

Management approach

- Preserve and restore, where necessary, unique natural ecological communities and landscape features that are beneficial to neotropical migratory birds
- Discourage nest construction in undesirable locations such as clubhouse and other public access facilities
- Employ harassment/hazing techniques to move protected bird species
- Use approved irritants as applicable
- Utilize the depredation permit as the last option
- Work closely with installation environmental staff to document presence of migratory birds and follow all provided maintenance guidelines

Target

Immediately begin migratory bird management consultation with the installation environmental staff.

Burrowing owls are ubiquitous to the American southwest.

Apache Mesa
Golf Course
Holloman AFB, NM

Photo credit:
Kai Hildreth

Apache Mesa Golf Course Holloman AFB, NM

Slow moving storm water can be a mosquito attractant in areas like these.

HUMAN HEALTH AND SAFETY

Mosquitoes can be both a bothersome reality of living at Holloman and a hazard to human health. During some times of the year, Apache Mesa customers and employees deal with more than their share of mosquitoes. According to the INRMP, "Saltcedar [an exotic invasive plant species] located in the constructed wetlands area designed for disposing of treated effluent from the HAFB wastewater treatment plant, is of high to moderate priority for control. Saltcedar alters vegetative communities in the area, changing plant species growing in the area and reducing appropriate available habitat for shorebirds and other wildlife.

Saltcedar is also an ideal roosting/resting location for some mosquito species, which have been documented at HAFB as vectors for St. Louis encephalitis and West Nile virus. This area is near Married Family Housing on the installation, and with prevailing winds coming out of the west, minimizing potential for disease is important to the health of base residents. Control of saltcedar in this area is key to maintaining public health and military mission."

Accordingly, placing bat houses near areas of high insect abundance such as golf course ponds, wetlands, and open water, could help reduce undesirable insect populations without the use of chemicals. This is especially helpful to complement mosquito control using mosqitofish in the ponds themselves in addition to eliminating poorly drained areas would immensely improve the situation during these times.

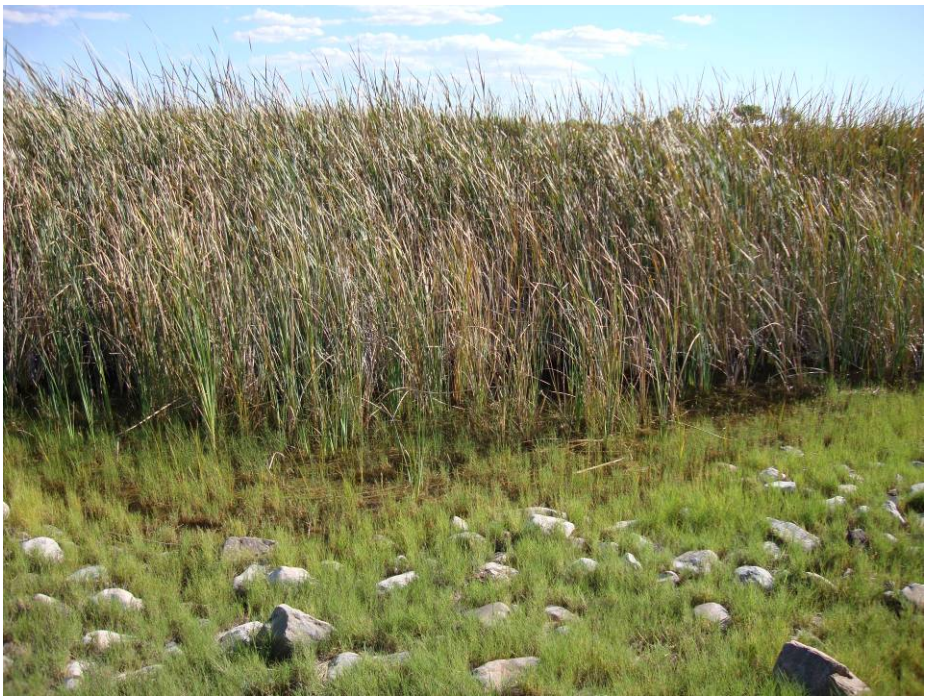
Driver/requirement

- AFI 48-102 (Medical Entomology Program)

Objective
Protect customers, employees, and installation personnel at all times from preventable health and safety concerns.

Management approach
- Begin concerted efforts to eradicate all poorly drained areas on the golf course grounds
- Continue to monitor poorly drained areas and utilize mosquito dunks (Bacillus thuringiensis) or larvacide (IGRs and/or pesticides)distributed by certified pesticide applicators in all poorly drained areas
- Consider stocking permanent water sources with approved and appropriate fish species or small larvae feeding minnows

Target
Eliminate all poorly drained areas near high use areas within 3 years.



Poorly defined storm water collection areas or ponds contribute to human health and safety challenges.

Apache Mesa Golf Course Holloman AFB, NM

Apache Mesa Golf Course Holloman AFB, NM

Photo credit: Wikipedia

Mosquitoes can be a large bother in addition to being a human health and safety hazard.

NUISANCE WILDLIFE

Many of the animal and plant species common to our installations around the world are not as welcome as others. The INRMP states that "Installation pest management personnel have primary responsibility for the control of nuisance wildlife species, although the program can receive substantial support from natural resources management personnel. The installation Integrated Pest Management Plan and Bird/ Wildlife Aircraft Strike Hazard Plan will designate the responsibilities for pest management and natural resources personnel for the control of nuisance wildlife."

The golf staff mentioned that species such as rabbit, gopher, badger, mosquito, crabgrass, African rue, skunks and brass button weed meet the definition of nuisance wildlife. Mosquitoes can be especially bothersome at some times of the year.

The Lake Holloman Operation Plan states "Mosquito surveillance is an ongoing program conducted by HAFB Public Health and Entomology personnel from February through October. Surveillance methods include larval dipping surveys in potential breeding habitats and light traps for adult mosquitoes. Pest Management receives twice-weekly reports on the number of mosquitoes trapped. Specific monitoring sites are located on the golf course, on the jogging course, at the junction of Dillard Draw and Highway 70, and on the west area of the base. Pest Management has not done larval surveys in the wetlands (D. Carlton, pers. comm., September 2003). Mosquito specimens are sent to off-base health laboratories for identification and arbovirus assays. Both WVN and St. Louis encephalitis have recently been documented in mosquitoes at HAFB. Mosquito control at HAFB involves a combination of

mechanical, educational, biological, and chemical methods. Insecticides are used primarily in residential areas. Chemical fogging is employed in the cantonment area and at the golf course. Mosquitofish, biological agents, and a growth regulator are used in larval breeding areas."

Driver/requirement

- Customer expectations for acceptable quality playing conditions
- Real property protection
- Land use conflicts
- Risk to human health and safety
- Threat to military operations

Objective

Minimize the damage caused by controllable nuisance pests and negative human/wildlife encounters.

Management approach

- After complete and comprehensive coordination with all appropriate installation personnel, take all permitted actions to control nuisance pests

Target

Eliminate a significant portion nuisance species on the actively maintained portions of the golf course by 2012 as permitted or allowed by the installation environmental management staff.

Rabbits have proven to be an extremely troublesome pest.

Apache Mesa Golf Course Holloman AFB, NM

Photo credit: Wikipedia

Implementation

No plan is worth the time it took to compile it if it does not generate or include active implementation in the field. The golf course management staff should use the following goals and objectives as the roadmap for their future. The GEM Plan is an example of the quality a cooperative effort can produce. Let's get something done and better take care of the environment, our community and our customers.

GEM Plan goals & objectives

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

- Post GEM Plan and environmental challenges map to enlighten employees and customers
- Ensure that all employees are familiar with the GEM Plan and document their annual awareness training
- Examine all maintenance practices to determine their potential to impact identified environmental challenges
- Integrate results of soil tests or plant tissue analyses into a Nutrient Requirement Plan
- Conduct a solid waste stream study and ensure that all recyclable wastes are disposed of properly
- Provide recycling containers throughout the course for use by employees and customers
- Secure alternate irrigation source and utilize it for at least 75% of course needs
- Establish, document and communicate fertilizer and pesticide application buffers around water features or sensitive landscapes
- Establish aesthetic and/or functional thresholds for each of the course's primary pests

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

- Compile comprehensive Water Resource Management to include drought management and water quality management zoning, Tree Management Plans for the entire golf course property
- Ensure that all pesticide applications are recorded, mapped and performed by licensed personnel

Apache Mesa Golf Course Holloman AFB, NM

Although many tree species survive in the eastern New Mexican environment, many struggle and lack high aesthetic quality.

Conclusion

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).

Sustainable installations are possible with a coordinated and concerted effort by all. Implement the GEM program, as it embraces continual improvement and environmental stewardship while steadfastly supporting the missions of the installation and the U.S. Air Force.

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.

Many undesirable species were installed in the past.

Eliminate high maintenance situations like this one.

Large expanses of the course are inhospitable at best.

Maintenance complex wash rack needs improvements.

Only appropriate tree species should be installed.

Afghan pines are water efficient desert natives.

Kitchen is the engine behind successful snack bar.

Maintenance facility yard is full of DRMO-bound stuff.

Native vegetation provides low maintenance greenery.

Shelters are not ADA compliant.

Driving range utilizes artificial turfed greens as targets.

Overall, the playing surfaces are nicely maintained.

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.

_____, *Air Installation Compatible Use Zone*, Holloman AFB, NM, 2004.

_____, *Integrated Natural Resource Management Plan*, DRAFT, June 2010.

49 CES/CEAN, *Storm Water Pollution Prevention Plan*, Holloman AFB, December 2008.

49th Fighter Wing, *Draft Lake Holloman Recreational Area Development Environmental Assessment*, January 2009.

_____, *2009 Drinking Water Quality Report for Holloman AFB,* Public Water System Identification PWSID) NM3562719.

Bhate Associates, *Golf Course Ponds Pesticide Study*, Holloman AFB, NM, Technical Memorandum Letter Report, July 2006.

City of Alamogordo, *Outdoor Water Schedule*, web site, http://ci.alamogordo.nm.us/Water_Conservation/Outdoor_Watering_Schedule.htm, accessed 29 Sep 10.

City of Alamogordo, *Water Conservation Overview*, web site, http://ci.alamogordo.nm.us/Water_Conservation/Water_Conservation_ Overview.htm, accessed 29 Sep 10.

49th FW Public Affairs, *Holloman golf course set to undergo a makeover*, AF Print News website article, http//www.holloman.af.mil/news/story_print.asp?id=123111914.

49th Wing Safety, *Bird Aircraft Strike Hazard Plan*, June 2010**.**

Johnson, Kristine and Freehling, Michael, *Operational Plan for the Lake Holloman Wetlands Complex Area, Final Report*, Natural Heritage New Mexico, University of New Mexico, March 2005.

Wikipedia, website, http://en.wikipedia.org/wiki/, accessed Nov/Dec 10.

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