

***Luke Air Force Base
Falcon Dunes Golf Club
Environmental Management Plan
Nov 09***





Falcon Dunes Golf Club Environmental Policy

In concert with the Luke 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 constantly reevaluate our processes to achieve the highest standards of environmental excellence.



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GEM 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 Environmental Excellence (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. AFI 32-7064 requires a GEM Plan as part of the Integrated Natural Resources Management Plan (INRMP).

The primary tenets of the GEM Program are to minimize or eliminate potential negative environmental impacts, attain and maintain daily compliance with all appropriate regulations, and constantly examine all aspects of golf course management to achieve the highest standards of environmental excellence.

GEM Program Process

There are five steps in the GEM program process.

- Analysis
- Documentation
- Implementation
- Evaluation
- Revision

Environmental Compatibility Quotient (ECQ)

Actual ECQ **88**
Potential ECQ **98**

Final Environmental Challenges

The following environmental challenges were identified during the GEM Plan process:

- Water conservation
- Storm water & water quality management

- Bird/wildlife aircraft strike hazard (BASH)
- Human health & safety
- Invasive species/pest control

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 completely revised during the next INRMP iteration update. The entire GEM process can be found on the regularly improved AFCEE website (<http://www.afcee.af.mil/>).

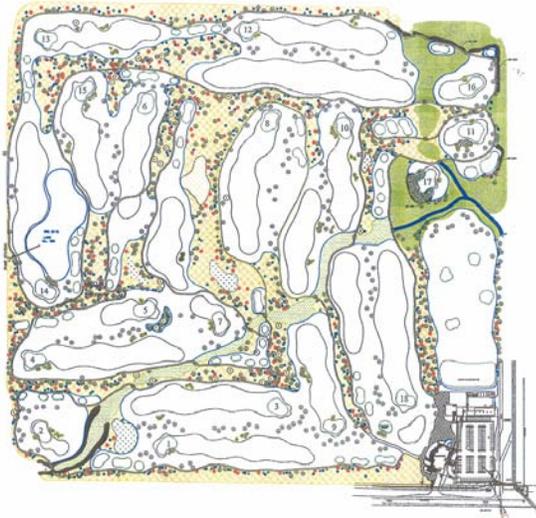
Analysis

Course details

Architect	Gary Panks
Date Constructed	December 1997
Normal Climate Condition	Hot, Dry
Average Annual Rainfall	~ 6 Inches
Average Growing Season	12 Months
Elevation	1128 ft
Winds/Prevailing Direction	Southwest
Total Facility Acreage	~ 160 Acres
Par	18 Holes: 35-36-71
Yardage	
Falcon	6611 Yards
Eagle	6035 Yards
Phantom	5641 Yards
Star Fighter	5086 Yards
Turf Grass	
Tees	Tifway Bermudagrass
Fairways	Tifway Bermudagrass
Greens	Tifway Bermudagrass
Roughs	Tifway Bermudagrass

Course description

The total cost to build the golf course and associated buildings was \$11.5 million. Valley Crest was the contractor who oversaw the building and golf course construction. Falcon Dunes Golf Course at Luke AFB in Waddell, AZ was dedicated in December of 1997.



Falcon Dunes Golf Club Layout



Falcon Dunes Golf Club Aerial Photo

Determining the Baseline (ECQ)

ECQ Categories

- Overall Management Philosophy & Documentation
- Safety, Training, And Awareness
- Compliance
- Pesticide Use, Storage, & Handling
- Pollution Prevention
- Conservation Practices
- Water Resources
- Maintenance Practices
- Customer Relations & Education
- Miscellaneous Special Projects & Activities

Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified.
- **Partial** = Practice has been initiated but needs further attention and improvement.
- **No** = Practice is not in place.

ECQ Checklists

The Environmental Compatibility Quotient (ECQ) checklists are a convenient method of assessing the overall performance, implementation, and completeness of an installation's Golf Course Environmental Management Plan. The checklists can be used in many ways including:

- As an analytical tool while compiling a Golf Course Environmental Baseline Assessment like this one.
- As a self-assessment tool for the golf course manager or superintendent.
- As an award nomination evaluation by a Golf Course Assessment Team (GCAT).



The 15th is one of the best holes @ Falcon Dunes.

Interpreting the 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:

- **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 or procedure.

ECQ Scoring Scale

Percent of Responses "Yes" or "Partial" per Category Level

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

Environmental Compatibility Quotient Checklists

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	Are environmental challenges and their approved and implemented management practices, objectives, and targets evaluated at least annually and are they regularly communicated to employees, customers, management, and <u>the local community</u> ?		√	
6	Are there signs appropriately located to warn golfers of hazards of drinking reclaimed or otherwise non-potable water?	√		
7	Are there signs posted to highlight key habitats or have appropriate areas been designated "Environmentally Sensitive Zones" per The Rules of Golf?	√		
8	Is there a general understanding by the <u>entire course management staff</u> of how their practices may potentially adversely impact the environment?	√		
9	Are the environmental impacts of pest control measures considered as part of the comprehensive GEM planning process?	√		
10	Are projects 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?		√	
11	Have all employees been familiarized with the GEM Plan and are they trained regularly on the importance of environmental performance and compliance with its goals and objectives?	√		
12	Are environmental management issues regularly discussed during staff meetings?	√		
13	Does the superintendent document the actual amount of each pesticide or fertilizer annually used on each major golf course feature (greens, tees, fairways, roughs, water features, and natural areas)?	√		
14	Has the course 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 <u>entire facility's</u> management practices?		√	
17	Are there documented functional and aesthetic thresholds integrated into pest control decisions?	√		

Planning & Compliance

#	Environmental Compatibility Indicator	Yes	Partial	No
18	Is there a written and regularly updated Integrated Pest Management Plan for the entire golf course property?	√		
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	Has course management comprehensively examined the course to determine the activities that have a potential to negatively impact an identified environmental challenge?	√		
Totals		15	4	1

Operations & Maintenance

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is contour mowing used to conserve fuel and/or to increase playability and aesthetics?	√		
2	Are there designated non-maintained or minimally-maintained buffers around 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 drainage improvements regularly implemented to improve soil health and minimize or eliminate use of pesticides or fertilizers?	√		
5	Have all playing surfaces been inventoried and mapped for soil types including soil structure, nutrient levels, organic content, compaction, and water infiltration?	√		
6	Are soil tests or plant tissue analysis used to determine turfgrass nutritional requirements?	√		
7	Are there projects planned and funded for the next year that would increase the compatibility of the course's management methods with 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 a complete examination of all aspects of the operation other than the golf course (snack bar/restaurant, clubhouse, pro shop, pesticide mixing and storage facilities, fuel storage and delivery areas, and maintenance complex) for potential negative environmental impacts?	√		
10	Are all employees encouraged to apply for education and training opportunities that may increase their awareness of the GEM Plan goals?		√	
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 racks operating properly and correctly maintained?	√		

Operations & Maintenance

#	Environmental Compatibility Indicator	Yes	Partial	No
13	Are all golf course vehicles and equipment maintained and cleaned in a manner that eliminates the potential for spreading of contamination?	√		
14	Are recycling containers located throughout the facility for use by customers and employees?	√		
15	Are grass clippings left in place (other than greens) collected, composted, and/or recycled?	√		
16	Are products that minimize unnecessary packaging purchased for use throughout the facility?		√	
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	Does the restaurant/snack bar facility utilize at least 90% plates, cups, and utensils that are reusable rather than disposable?	√		
20	Is the food storage and prep area regularly cleaned to reduce the likelihood of pest infestations and required pesticide applications?	√		
Totals		16	4	0

Water Resource Management

#	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	Has the irrigation system been completely checked for proper water distribution in all irrigated areas and are water leaks fixed in a timely manner?	√		
4	Are outdoor irrigation of non-golf course areas and indoor plumbing regularly monitored and maintained for leaks?	√		
5	Have low-flow water saving devices been installed wherever possible?	√		
6	Are recycled or other non-potable water supplies being used to irrigate at least 65% of the golf course property?	√		
7	Are there projects planned that should 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	Is runoff from parking lots cleansed by control measures such as vegetative or drainage filters prior to leaving the golf course property?			√

Water Resource Management

#	Environmental Compatibility Indicator	Yes	Partial	No
10	Are there procedures for reporting water quality problems to supervisors (as required) for appropriate action?	√		
11	Is the irrigation pumping station and associated equipment regularly checked for proper operation and leaks?	√		
12	Has the irrigation system or its components recently been upgraded to reduce inefficiency, malfunction, and overall water use and are flow meters used to monitor water use and detect potential waste?	√		
13	Is there a map of the watershed in which the golf course property resides and location(s) of floodplains and stormwater drainage that exist on the property?	√		
14	Is the quality of the water entering and leaving the property tested regularly for contaminants, pH, dissolved oxygen, and nutrients?	√		
15	Is water quality data collected to establish baseline conditions for all water features on the property?	√		
16	Are settling ponds and/or detention ponds used to effectively remove sediments and pollutants from water features?	√		
17	Are biological processes such as the addition of grass carp or white amur used to control unwanted aquatic vegetation in water features?	√		
18	Is there a written Water Resources Management Plan that delineates the care of the course's water features?		√	
19	Has the property been examined for potentially significant wetlands or associated sensitive water-based habitats?	√		
20	Has the property's water features been studied to determine the aquatic and amphibious species population?	√		
Totals		18	1	1

Conservation

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized golf course equipment checked regularly for 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	Have all potentially significant wildlife habitats and their maintenance practices been coordinated with local natural resource manager, the Fish & Wildlife Service, or other appropriate local or regional regulatory agency?	√		
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?	√		
6	If applicable, have all necessary permits been updated and their requirements satisfied in a timely manner?	√		

Conservation

#	Environmental Compatibility Indicator	Yes	Partial	No
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 exotic species on or near the course?	√		
9	Is there a readily available Drought Management Plan for the entire golf course facility?	√		
10	Are there projects planned and funded that may minimize or eliminate the course's potential negative environmental impacts?	√		
11	Is storm water collected for supplementing irrigation water supplies for use on the course or 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	Have local wildlife species and their habitats been documented and mapped?	√		
14	Does the course have a Tree Management Plan complete with planting plan and maintenance schedule?	√		
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 degraded habitats due to construction or maintenance of the course been fully restored or improved?	√		
19	Has the entire property been examined for archaeological, cultural, or historical resources?	√		
20	Are customers and employees regularly informed/trained on the golf course's conservation practices?		√	
Totals		19	1	0

Pesticides & Pollution Prevention

#	Environmental Compatibility Indicator	Yes	Partial	No
1	Are there minimally maintained, natural areas, no spray zones, and buffer areas around water features or sensitive landscapes and have they been communicated to equipment operators and pesticide applicators?	√		
2	A spill containment kit is readily available and spill containment procedures are in place?	√		
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 to contain spills?	√		

Pesticides & Pollution Prevention

#	Environmental Compatibility Indicator	Yes	Partial	No
5	Are liquid products stored below dry products and are dry materials stored on pallets or shelves to keep them off the floor?	√		
6	Are equipment or vehicle wash and wastewater kept from making direct contact with surface water?	√		
7	Is equipment cleaned with compressed air on part of the course instead of or prior to washing at a designated wash rack where pollution prevention measures are employed?	√		
8	Are gasoline, motor oil, brake and transmission fluid, solvents, and other chemicals used to operate or maintain equipment and vehicles prevented from directly or indirectly entering water bodies?	√		
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: <ul style="list-style-type: none"> - the pest and treatment type (preventative/curative); - the location (specific area) of each pesticide used; - the area and quantity of each pesticide used; - the chemical or common name of the active ingredient(s); - the date, location, or purpose of the application? 	√		
11	Is there a map of the course's "hot spots" that may require regular or special care or attention?	√		
12	Are there trained scouts on staff other than the superintendent 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 insects, fungal diseases, and weeds for all managed areas that may possibly 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 chemical applicator(s) encouraged to apply for regular training to maintain currency?	√		
17	Is the chemical storage structure/area locked, well-ventilated, fire resistant and is access limited to appropriate personnel?	√		
18	Are records of pest treatments and their effectiveness maintained and used to guide future pest control decisions?	√		
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		20	0	0

Environmental Compatibility Quotient Summary & Scoring Scale

ENVIRONMENTAL COMPATIBILITY QUOTIENT SUMMARY			
Environmental Compatibility Category	Yes	Partial	No
Planning & Compliance	15	4	1
Operations & Maintenance	16	4	0
Water Resource Management	18	1	1
Conservation	19	1	0
Pesticides & Pollution Prevention	20	0	0
Totals	88	10	2

- Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified
- **Partial** = Practice has been initiated but needs improvement or completion
- **No** = Practice is not in place

ENVIRONMENTAL COMPATIBILITY QUOTIENT SCORING SCALE	
Total Yes or Partial Responses	Environmental Compatibility Level
86-100%	Advanced (Green)
70-85%	Showing progress (Yellow)
69% or less	Just started (Red)

ECQ Summary

Apr 08 - Falcon Dunes Golf Course, Luke AFB, AZ

- Actual ECQ (# of "Yes") = **88** ("Showing progress" – Yellow)
- Potential ECQ (Actual ECQ plus # of "Partial") = **98** ("Advanced" – Green)

Environmental Challenges

One of the important results of the Golf Course Environmental Baseline Assessment (GCEBA) process is the identification of potential environmental challenges (ECs) to be addressed in the long-term GEM Planning process. After confirming each EC, the golf course staff will determine the best management approach that will satisfy the goals of the golf facility from the course playability and customer satisfaction perspectives first. Then the golf staff's preferred management approach will be coordinated with the installation's environmental staff for refinement, coordination, and approval.

The following potential environmental challenges were identified during the GCEBA process:

- Water conservation
- Stormwater & water quality management
- Bird/wildlife aircraft strike hazard (BASH)
- Human health & safety
- Invasive species/pest control

Water Conservation

The golf course is the largest and most obvious user of water associated with Luke AFB. Falcon Dunes is currently using a combination of ground water and reclaimed water (treated wastewater) for irrigation purposes; approximately 60% of the water used is reclaimed while the remaining amount is groundwater. The Arizona Department of Water Resources has determined that Falcon Dunes Golf Course is authorized to use a total of 517.08 acre-feet of water per year; the average annual water use for Falcon Dunes (using data for the years 2005, 2006 & 2007) is roughly 472.95 acre-feet. Falcon Dunes has also incorporated approximately 45 acres of xeriscape, which drastically reduces water use. The golf course does have its own weather station and a new computerized irrigation system was recently installed which provides better watering control and more accurate water use readings.

Driver(s)/Requirement(s)

- Arizona Department of Water Resources may reduce the amount of water Falcon Dunes is authorized to use per year.
- Ensuring that there is a constant supply of water during the drier parts of the year.



One of the two Luke AFB holding ponds for reclaimed water

Objective(s)

- Contribute to the region wide conservation of all water resources while still providing the best quality golfing experience for the Falcon Dunes customers.
- Research possibilities for increased water storage to use more reclaimed water or research to see if other potential sources of water are available.
- Research possibility to convert more golf course area to xeriscape.



Falcon Dunes Golf Course weather station

Management Approach

- Maintain new computerized irrigation system in good working order
- Continue to use as much reclaimed water as possible in lieu of groundwater
- Perform regular golf course inspections to ensure everything is operating effectively



Recycling wood chips to create cart path in xeriscape area

Target

Maintain vigilance on water conservation concerns at all times.



Xeriscaping interspersed throughout the golf course

Storm Water & Water Quality Management

Luke AFB was required to obtain storm water discharge coverage under both the Multi-Sector General Permit (MSGP) and the Small Municipal Separate Storm Sewer System (MS4) General Permit. The MSGP requires Luke AFB to identify potential pollutant sources from industrial processes (outdoor areas where equipment is stored while awaiting maintenance, is cleaned or is maintained). Facility 2201 is the golf course maintenance building and has been identified as a potential pollutant source. The Small MS4 General Permit requires Luke AFB to implement Best Management Practices (BMPs) to limit the amount of pollutants entering waters of the United States. Because the storm water discharged from Luke AFB does not enter an impaired/unique waterway only visual water quality monitoring is required. The golf course does contain several dry wells that are used only to control/contain storm water.



Area of Dysart drain which requires bank stabilization

Driver(s)/Requirement(s)

- Preventing potential pollutants generated from the golf course maintenance building from entering the Dysart drain.
- Maintaining/Installing bank stabilization along the Dysart drain
- Arizona Department of Environmental Quality and/or the Environmental Protection Agency may implement stricter storm water requirements.



Vegetation clippings along Dysart drain prior to being tilled in



56 Civil Engineer Squadron tilling in vegetation clippings



Dysart drain bank after clippings have been tilled in

Objective(s)

- Work with Luke AFB Civil Engineer Squadron to install permanent bank stabilization along the steeper portions of the Dysart drain.
- Comply with all storm water requirements while still providing the best quality golfing experience for the Falcon Dunes customers.
- Use all chemicals properly.



Designated vehicle wash area



Fine screen in vehicle wash area to catch small grass clippings

Management Approach

- Follow pollution prevention best management practices as outlined in the Luke AFB Storm Water Pollution Prevention Plan for industrial maintenance activities
- Perform bank stabilization on the less steep portions of the Dysart drain bank where grass and vegetation clippings can be tilled in
- Follow Luke AFB pesticide management plan
- Irrigate wisely to prevent runoff
- Perform regular golf course inspections to check dry wells and to check for drainage issues



One of the Falcon Dunes dry wells

Target

Maintain vigilance on storm water and water quality concerns at all times.



Storm water drainage into Xeriscape



Drains along cart paths to prevent erosion

Bird/Wildlife Aircraft Strike Hazard (BASH)

The Falcon Dunes Golf Course has habitats that attract birds (primarily dove and quail) which in turn poses a significant bird attractant and threat to the Luke AFB flying mission. To deal with this problem and be compliant with the Migratory Bird Treaty Act, Luke AFB has in place a Bird Wildlife Strike Hazard Plan. In order to make the golf course a less attractive habitat for birds/wildlife, the trees, shrubs, and pond are maintained and managed to the maximum achievable degree in order to prevent this. The idea behind active landscape management is to encourage bird/wildlife dispersal and limit the amount of bird/wildlife elimination. The Falcon Dunes pond was designed to be a deep lake as far from the flight path as possible with steep concrete sides which reduces the attractiveness to possible

water fowl; this pond is used to hold reclaimed water which in turn is used to irrigate the golf course.

Falcon Dunes is currently subject to two conflicting mandates. One is that Luke AFB must reduce the bird air strike hazard while the other is that Luke AFB must implement a Watchable Wildlife Program. Unfortunately, encouraging watchable wildlife could increase wildlife in the vicinity of the airfield, which in turn could increase BASH. Fortunately, both mandates can be satisfied at Luke without incurring a major trade-off in implementation. One reason for this is that Falcon Dunes already has a sizeable population of vertebrates for visitors to observe. These range from cottontails (rabbits) through roadrunners. Several species of birds present at Falcon Dunes tend to remain local and usually fly low to the ground, thereby reducing Bash. Furthermore, the Watchable Wildlife program at Luke encompasses Fort Tuthill Recreation Area for which guided walks are available. Also, an online wildlife and plant photo album has been created for Fort Tuthill, and is planned for Luke proper. Thus, Luke AFB as a whole has both a BASH program and a Watchable Wildlife program.

Driver(s)/Requirement(s)

- Ensuring golf course is properly maintained to limit the likelihood migrating birds will find it an attractive habitat.
- Maintaining a proper balance between limiting BASH concerns and providing a Watchable Wildlife program



Golf course pond designed with steep concrete sides

Objective(s)

- Maintain golf course landscape to reduce potential BASH concerns while providing a habitat for low threat vertebrates
- Ensure management practices keep BASH concerns a priority
- Research to discover new and more efficient practices to reduce BASH concerns

Management Approach

- Continue to limit the occurrence of highly attractive trees and shrubs
- Continue to coordinate with installation natural resources manager, airfield management, and contracted USDA personnel in regards to BASH concerns and Watchable Wildlife program
- Continue to coordinate with Civil Engineer Squadron personnel for necessary mowing and trimming along the banks of the Dysart drain
- Comply with depredation permit at all times
- Employ animal control specialist(s); duties of employee could encompass both LAFB proper and Falcon Dunes.
- Perform regular golf course inspections to check for BASH concerns

Target

- Maintain vigilance on BASH concerns at all times.



Golf course pond in use with steep concrete sides

Human Health and Safety

The primary concern in regards to human health and safety is standing water which can become stagnant and a breeding ground for mosquitoes. The two areas of concern are the golf course pond and the Dysart drain which runs along the north and east perimeters of the course. The golf course pond contains three large aerators which do not allow the water to become stagnant; the Dysart drain on the other hand can and does intermittently contain standing water. Storm water runoff containing sediment and other debris tends to build up in the Dysart drain and therefore inhibits water flow. This area has been identified by the golf course as a problem and it has been elevated to the Civil Engineer Squadron; Luke AFB currently uses a larvicide to combat the mosquito population in this area. In the golf course pond fish (*Gambusia affinis*) or small larvae feeding minnows are stocked and are the preferred method for controlling mosquito populations.

Driver(s)/Requirement(s)

- Ensuring fish stocked in the golf course pond do not become a BASH concern.
- Properly maintaining the Dysart drain to prevent standing water.
- Keeping mosquito populations under control so they do not become a human health and safety concern.



Standing water in the Dysart drain along east perimeter

Objective(s)

- Control mosquito populations to prevent both a human health and safety concern and a BASH concern
- Research and implement control measures to prevent sediment and debris from entering the Dysart drain.
- Attempt to outline a probable cleaning schedule for the Dysart drain to remove built up sediment, vegetation and debris.



Standing water, sediment and vegetation growth in Dysart drain

Management Approach

- Stock pond with fish to control mosquito populations
- Use pesticide sparingly along Dysart drain to control mosquito populations and vegetation growth
- Coordinate with Civil Engineer Squadron to properly maintain Dysart drain
- Perform routine Dysart drain and golf course pond inspections to check current/potential problems

Target

Maintain vigilance on mosquito population and habitat to mitigate human health and safety concerns at all times.

Invasive Species/Pest Control

The Falcon Dunes Golf Course has an active pest management program; pesticides are maintained onsite and are under the oversight of the Luke

AFB Entomology shop. Pesticides are used sparingly and wherever probable non-chemical means are employed to eliminate pests. The xeriscape areas of the golf course are designed to incorporate as many native species as practical.



Pest management chemical storage area

Driver(s)/Requirement(s)

- Controlling the number of pests and invasive species within the golf course boundaries.
- Eliminating as much as possible the habitat for pests and invasive species.
- Properly maintaining and tracking all pesticides used on the golf course.
- Possibly having to limit or eliminate pesticide chemical usage if regulations become stricter.
- Implementing pollution control measures to minimize or eliminate pesticide runoff.



Pest control using non-chemical means

Objective(s)

- Continue to document all pesticide and fertilizer application rates and locations
- Continue to adhere to smart fertilizer and pesticide application practices to limit the amount which could runoff into the course pond and the Dysart drain
- Research possibilities to remove and replace invasive species with native species
- Eliminate to the maximum amount possible invasive species and pest habitat



Native species used throughout the golf course

Management Approach

- Maintain pesticides in a specifically designed facility within a controlled area
- Continue to operate pest management under the oversight of the Luke AFB Entomology shop
- Use non-chemical means to eliminate certain pests
- Continue to apply pesticide and fertilizer by hand around high interest areas like the pond and Dysart drain
- Include native species to the maximum extent possible
- Perform regular golf course inspections to check for pest and invasive species concerns

Target

Maintain vigilance on pest and invasive species concerns at all times.



Damage from Chilean Palo Verde roots pushing up concrete cart paths

GEM Plan Goals, Objectives and Best Practices

GEM Plan Goals

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

- Implement a customer education program
- Compile and implement a course-specific Integrated Pest Management Plan
- Designate and document “minimally-maintained” or natural vegetative buffer areas around pond, river, stream, or lake edges and communicate to mower operators and pesticide applicators

GEM Plan Objectives

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

- Compile a written Water Feature Management Plan
- Compile a Tree Management Plan
- Install consistent and attractive signage around the course and grounds that would increase the awareness of the average golfer to the environmental management practices employed

GEM Plan Best Practices

Best practices are defined as any action, method, practice, or result that has proven its value and worth over time.

- Incorporate Agronomist input
- Compiled and implemented a Golf Course Master Plan
- Continue education attendance to increase environmental awareness of key staff members
- Installed the Toro Site Pro irrigation software which allows us to have 135 different programs to keep water and utility use down
- Installed own weather station that helps us in getting accurate water use
- Course does not take grass clippings and wood chips to the dump. It plows them back into the soil which reduces soil erosion, dust generation and organic matter filling up dump sites. This practice also stabilizes the soil.
- Golf course traps gophers rather than using poison.

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Attachment A: Tree Management Plan

The golf course has 6 Tree types originally planted: 1) Blue Palo Verde (18 each), 2) Palo Brea (167 each), 3) Desert Willow (23 each), 4) Desert Ironwood (17 each), 5) Texas Ebony (25 each), 6) Chilean mesquite (910 each). Historically Evergreen Elms have been used to replace the Chilean mesquites; Chilean mesquites are very labor intensive. There is one Live oak down by the Driving range. The policy as of June 2008 is that trees are removed as needed and are only replaced sparingly; this is because the course has matured a lot and it now requires contractor support to maintain these trees which increases the overall operational costs.

Tree Staking

The ultimate goal is to remove the stakes from the tree as soon as possible. Tree stakes provide support around the tree and should be loose enough to let the tree move around in order to help strengthen the trunk. But the stakes must not be too loose as to let the tree fall and/or damage supporting roots. Stakes must be angled in such a way to not pose a hazard to the branches and they should not touch the trunk of the tree. Stake ties must be loose enough so the tree will not grow into the ties and cause damage. All newly planted young trees must have as a minimum two stakes installed (three is better).

Tree Planting

The overall philosophy of the golf course is to use native trees as much as possible; the primary focus of tree selection is based on maintenance intensity throughout the life of the tree. The philosophy does include a mixture of flowering/non-flowering trees. Trees are replaced on an as needed basis. The following procedures will be followed when planting trees:

Trees planted in the turf areas

Tree will be planted at ground level with a temporary soil berm (tree well) placed around the base of the tree to ensure sufficient water reaches the roots. When back filling the hole for the tree ensure water is placed into the hole while the soil is being placed in the hole; as a normal practice fill the hole half with soil than water it good, finish filling up the hole with soil and water again making sure there are no air pockets. If the soil sinks after a week or so then the planting was done incorrectly. Always water a tree after planting. Use extra water to get the air pockets out of the soil. Keep trees moist for at least three weeks with supplemental hand watering if needed. Five to ten gallons of supplemental water may be needed for trees planted on the sides of slopes. All trees will be secured within one week of planting with three steel stakes.

Trees planted in the native areas

Trees will be planted recessed down three inches around the ball with a temporary soil berm (tree well) around the tree ball. Never cover more than the top of the root ball (plant the tree as deep as it was planted in the container). Make sure the bottom of the pit is compacted so the tree does not settle after watering. When back filling the hole for the tree ensure water is placed into the hole while the soil is being placed in the hole; as a normal practice fill the hole half with soil than water it good, finish filling up the hole with soil and water again making sure there are no air pockets. These trees will need extended care until they can go without water like the established trees - this may take 3 or 4 months. Extra water will probably be necessary even if it means bringing out 5 to 15 gallons in buckets. All trees will be secured within one week of planting with a least two steel stakes.

Tree Maintenance Schedule

Tree pruning and maintenance is performed on a weekly basis because the native trees grow three to four times faster than normal. Trees are staked initially when planted and afterwards on an as needed basis. Trees are replaced as needed or when trees become damaged beyond repair.

Attachment B: Water Resource Management Plan

Water Conservation

The Arizona Department of Water Resources has determined that Falcon Dunes Golf Course is authorized to use a total of 517.08 acre-feet of water per year; the average annual water use for Falcon Dunes (using data for the years 2005, 2006 & 2007) is roughly 472.95 acre-feet, roughly 90% of the total amount allocated. Falcon Dunes over the last several years has converted approximately 45 acres to xeriscape, which drastically reduces water use. The golf course will continue to investigate the feasibility of converting additional acres to xeriscape and implement that change as funding and need arise. The golf course has installed its own weather station and a new computerized irrigation system which provides better watering control and more accurate water use readings. As technology improves, the golf course will continue to evaluate better watering control methods and implement them as funding and the need arises.

Lake Management

Prior to golf course construction, Luke AFB properly designed the pond to address future concerns/problems like with plants, algae, birds and bank erosion. Luke AFB takes water samples three times a day, which ensures the pH and possible containments are identified before reaching the golf course. The lake is over 22 feet deep in the center and has concrete edging that descends four feet below the ground surface. There is no vegetative growth, algae are kept under control with algaecides and the concrete edging prevents/inhibits erosion and bird use/nesting. The pond contains three bubbling aerators that are mounted to the lake bottom and are equally dispersed in the lake for better aeration control. Combining the aerators and the amount of water used each day, there is very little if any stratification which makes for good irrigation. Fish are used as a backup to control algae growth and insects.

Attachment C: Drought Management Plan

The following chart outlines the drought management steps that will be followed based on the severity of the drought. The Evapotranspiration rate (ET) is the key which determines the irrigation requirements. This plan can be changed at any time as dictated by the severity of the drought.

	Greens	Collars	Tees	Fairways	Roughs
Stage One	100% ET Raise Mowing Height (RMH) 5/32"	100% ET & RMH to 0.5"	90% ET & RMH to 0.5"	Reduce 90% ET & RMH to 0.625"	75% of ET & RMH to 1.5"
Stage two	90% ET & RMH to raise mowing height 0.185	80% ET & RMH 0.75"	80% ET & RMH 0.75"	75% ET & RMH to 0.75"	75% ET & RMH Already at Max height. Grass will not be growing much anyway
Stage three	75% ET & RMH to raise mowing height to 0.25"	65% ET & RMH 0.75"	65% ET & RMH 0.75"	65% ET & RMH to 1"	50% ET Already at Max height. Grass will not be growing much anyway
Stage four	50% ET. RMH 5/16"and supplement with hand watering	45% ET & RMH 0.75"	45% ET & RMH 0.75"	65% ET 1"	Water 100% ET once every two weeks

Note:

1. Reduce Nitrogen applications to turf.
2. Applications of wetting agents to greens and tees monthly.
3. Applications of wetting agents to mounds and southwest facing areas on both Roughs and Fairways monthly that tend to dry up.
4. Slice dry areas monthly to ensure good water penetration to the roots
5. Golfers restricted to cart paths only in Stage two
6. Daily have a Hot spot program for problem areas (Daily scouting to find these areas) but skip days on normal watering. Water hot spots only.

Attachment D: Map of Golf Course Environmental Challenges

Golf Course

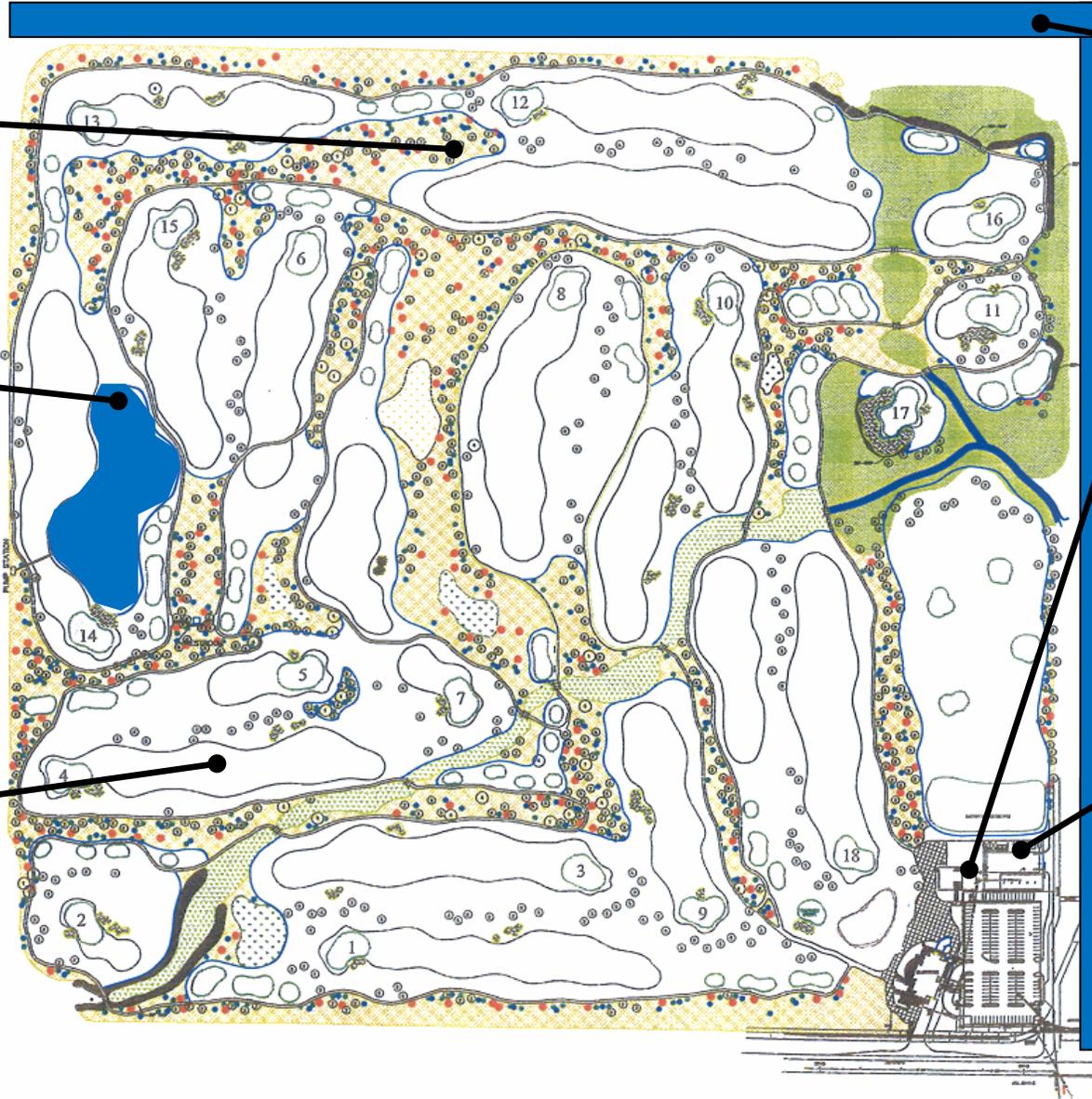
Concern: Invasive Species, Pest Control.
The use of native species is the policy but personnel must continuously inspect the course for invasive species and pests.

Irrigation Lake

Concern: BASH, Human Health & Safety.
During the initial golf course design, the lake was located as far from the flight pattern as possible and was designed with steep concrete banks to discourage birds (especially waterfowl) from using the lake. The wildlife biologist for Luke AFB has alternative measures in place to reduce BASH incidents.

Turf Areas

Concern: Water Conservation.
Golf course is using 90% of its annual allocation of irrigation water. 45 acres have already been converted to xeriscape and a weather station and computerized irrigation system have been installed to better control watering.



Dysart Drain System

Concern: BASH, Human Health & Safety, Storm Water Management.
Drain is normally is dry which allows silt from the steep slopes on the north and east side of the course to settle into the drain causing bank erosion and silt laden storm water runoff.

Maintenance Yard

Concern: Storm Water Management.
Identified as a potential pollutant source because of the type of maintenance performed and materials stored outdoors. Golf course has BMPs in place to control polluting storm water.

Pesticide Building

Concern: Pest Control, Storm Water Management.
Contains very few pesticides in varying quantities and has secondary containment to handle five times the amount currently stored in the building.

Attachment E: Golf Course Environmental Briefing

Our Earth has a limited supply of mined energy (Coal, Gas and Oil) and without all of us pitching in to reduce how we use it we will run out of these resources sooner than later. Our Earth also has a hard time renewing the damage we have leveled on it during the last 50-100 years. Out of all the water on the earth only 2.8% of it is fresh water that can be used for growing crops and drinking.

For us at Falcon Dunes golf course, we want to do our part in trying to have a great golf course but do it as environmentally friendly as possible. We have to be careful of what we put inot the water, air and soil at our golf course. As good stewards we should be applying these same principles wherever we go and live.

We can all recycle and ensure we get rid of paints, oils, other contaminates and their respective containers in the recommended environmentally friendly way. All pesticides have a label which identifies how to dispose of the product safely for both you and the environment.

Area of Concern	Environmental Impact	What We Can Do to Help
Improper handling of petroleum products (example: after changing the oil at work or at home)	Soil and ground/surface water contamination	Be extra careful when filling up equipment. If small amounts are spilled, clean it up immediately
Improper disposal of empty or used containers of petroleum products, paints, cleaning chemicals and pesticides	Air, soil and ground/surface water contamination	Follow disposal instructions on products; for paints ensure the material has dried (indoors to prevent air pollution) before disposing in any type of solid waste dumpster
Emptying chemicals and petroleum products down drains/toilets	Soil and ground/surface water contamination	Do not dispose of any hazardous materials via the sanitary sewer at work or home; dispose of materials as outlined on the product label
We all tend to use items that make or lives easier or save time (example: Styrofoam cups, Plastic containers/utensils, Paper plates)	Consumes natural resources, uses up vital landfill space faster than normal, contributes to water/air pollution	Bring a non-throw-away cup to work and use while here, changing behavior needs to occur both at work and at home
Throwing plastic, glass and metal in solid waste dumpsters	Uses up vital landfill space faster than normal, consumes natural resources, contributes to water/air pollution	Make recycling a habit at work and at home, our natural resources are limited and recycling helps to offset our nations consumption needs
Improper use of water, failing to turn off water when it's not needed, not fixing water leaks in a timely manner	Consumes a natural resource, can contribute to water pollution	Turn off water when not needed, call CE to fix leaking fixtures at work and have them fixed as soon as possible at home, ensure the irrigation system is operating correctly and is not leaking, change the irrigation schedule

As employees and supervisors we all need to be vigilant in how we use Air Force resources which includes but is not limited to equipment, water, energy and supplies. Improper use of chemicals can lead to fines and jail time.