USDA Rural Development

Committed to the future of rural communities.

SOUTHWEST NATURAL RESOURCE TRAINING FACILITY FOR JOB CREATION

FEASIBILITY STUDY

For the Town of Springerville

By

Native American Contracting, Inc.
&
Grant Ventures, LLC

7 October 2014

TOWN OF SPRINGERVILLE TOWN COUNCIL

Mayor Mary Nedrow
Vice Mayor Susie Silva
Councilman Phelps Wilkins
Councilman Robert MacKenzie
Councilman Richard Davis

Town of Springerville Planning and Zoning Commission

Chairman Lance Greer
Vice Chairman Phillip Hanson, Jr.
Commissioner James Muth
Commissioner Kevin Burk

The Town of Springerville thanks those listed below who devoted their time, energy and ideas to help guide the development of this Plan.

Town of Springerville Steering Committee Members

- Steve West, Town Manager Town of Springerville
- Chris Chiesl, Community Development Director, Town of Springerville
- Tim Rasmussen, Public Works Director, Town of Springerville
- Heidi Wink, Finance Director, Town of Springerville
- Max Sadler, Fire Chief, Town of Springerville
- Mike Nuttall, Chief of Police, Town of Springerville
- Sharon Pinckard, Director, RV Community Center
- Sean Kienle, Airport Manager
- Greg Cross, Casa Malpais Director
- Lance Avery, Owner, Avery's
- Kevin Burk, Planning/Zoning Commissioner, Town of Springerville
- Becki Christensen, Director, Springerville Chamber of Commerce
- Kay Dyson, Past Mayor, Town of Springerville
- Kelsi Geisler, Past Vice Chairman/Planning & Zoning Commissioner, Town of Springerville
- Daniel Muth, Past Mayor, Town of Springerville
- Patricia Orona, Community Marketing and Services Director, White Mountain Regional Medical Center
- Honorable Kay Wilkins
- Councilman Phelps Wilkins

SOUTHWEST NATURAL RESOURCE TRAINING FACILITY FOR JOB CREATION FEASIBILITY STUDY

TABLE OF CONTENTS

Table of Contents

Acknowledgements Page 1

Executive Summary Page 2

I. Firefighter Training/Dispatch Center

A. Introduction Page 5

B. Description/Use of Facility Page 6

C. Methodology of Study Page 9

D. Socioeconomic Conditions Page 9

E. Positive Characteristics of Site Page 9

F. Firefighter Training Page 9

F.1 Market Needs Page 10

F.2 Suitability of Site Page 12

F.3 Laws and Regulations Page 13

F.4 Strategy for Regional Firefighter Training Facility Page 15

F.5 Factors Influencing Market Page 15

F.6 Recommendations for Regional Firefighting Training Facility Page 16

F.7 Training Costs Page 17

G. Aviation Page 16

G.1 Aviation Operation and Resources Page 17

G.2 Helitack Page 20

G.3 Air tankers Page 20

H. Community Issues and Impacts Page 20

H.1 Air Pollution Page 23

H.1.1 Impacts Page 23

H.1.2 Solutions Page 24

H.2 Biodiversity Impacts Page 25

H.3 Noise Page 26

I. Organization of Wildland Fire Dispatch in U.S. Page 27

I.1.1 National Interagency Coordination Center (NICC) Page 27

I.1.2 Geographic Area Coordination Centers (GACCs) Page 28

I.1.3 Local Dispatch Centers Page 29

J. Mission of Proposed Interagency Dispatch Center in Springerville Page 30

K. Precedent Page 30

K.1 Central Oregon Interagency Dispatch Center Page 30

K.2 Black Hills Interagency Dispatch Center Page 31

L. Southwest Coordination Center Page 32

M. Southwest Area Coordination Group Page 32

N. Interagency Dispatch Optimization Pilot Project (IDOPP) Page 33

N.1 Background and Purpose Page 33

N.2 Scope Page 34

N.3 Final IDOPP Report Page 35

O. Proposed Local EMS Dispatch Center Page 37

P. Conclusions of the Study Page 37

Q. Building Options Page 37

Q.1 Full Facility for Interagency Dispatch/Firefighter Training Page 38

Q.2 Interim Facility for Local Dispatch/Firefighter Training Page 40

R. Funding Page 42

II. Aquaculture/Aquaponics

A. Definition Page 43

B. Potential for Community and Economic Development Page 46

C. Objectives of Study Page 47

D. Methodology of Study Page 48

E. Species Selection Page 51

E.1. Growing Endangered, Threatened or Protected Fish Page 51

E.2 Best Fish Species to Grow for Market Area Page 55

E.2.1 Tilapia Page 56

E.2.2 Catfish Page 57

E.2.3 Yellow Perch Page 58

E.2.4 Shrimp Page 60

E.3 Growing Indigenous Plants/Trees for Reforestation Page 62

E.4 Growing Food Crops Page 63

E.4.1 Best Plant Varieties to Grow for Market Area Page 64

F. Advantages of Aquaponic Food Production Page 67

G. Technical Feasibility Page 68

H. SWOT Assessment of Aquaponics in Springerville Page 71

I. Suitability of Site Page 72

J. Design of Facility Page 74

K. Capital Cost Page 77

K.1 Building Page 77

K.2 Town Building Fees Page 77

K.3 Electric Page 78

K.4 Water Supply Page 78

K.5 Fees for Water Connection Page 78
K.6 Sewer System Page 78
K.7 Hydroponic Tanks Page 78
K.8 Aquaculture Tanks Page 78
K.9 Microbead Filter Page 79
L. Operational Cost Page 81
M. Profitability of Operation Page 82
N. Funding Possibilities Page 84
O. Laws and Regulations Page 86
P. Conclusions of Study Page 86

III. Wildlife Rescue/Veterinarian Training Center

A. Summary of the Project Page 89
B. Mission and Goals Page 89
C. Needs Assessment Page 90
C.1 Need for Wildlife Veterinary Services Page 90
C.2 Need for Domesticated Animal Veterinary Services Page 91
C.3 Need for Veterinary Education Page 91
C.3.1 Midwestern College of Veterinary Medicine Page 92
C.3.2 University of Arizona College of Veterinary Medicine Page 93
C.3.3 The Distributive Veterinary Clinical Education Model Page 93
D. Job Creation Page 94
E. Licensing Page 97
F. Proposed Building Features Page 97
G. Funding Page 100

Appendices

I. Endangered, Threatened and Protected Fish in Arizona

II. Aquaponics Curriculum from UVI

III. Rules and Laws for Aquaculture and Aquaponics

IV. Compatible Land Use and Airspace Protection

V. Wildlife Rescue Regulations

VI. Engineers PER Interim Facility Local Dispatch Center / Firefighter Training

a. Complete costs estimate Interim Facility

VII. Large Format Drawings (11" x 17")

a. Full Facility for Interagency Dispatch / Firefighter Training

b. Interim Facility for Local Dispatch / Firefighter Training

c. Aquaponics facility

d. Wildlife Rescue / Veterinarian Training Center

Sources

ACKNOWLEDGMENTS

We acknowledge the extraordinary assistance given throughout this process by Town staff, especially by the Town Manager, Steve West, and the Community Development Director, Chris Chiesl, whose insights and experience were generously shared. Gratitude is also due to the many community members, residents and business owners, who graciously participated in this process. A special note of thanks and acknowledgment is also due to the U.S. Forest Service in Springerville, and especially to Jim Zornes, Supervisor for the Apache-Sitgreaves National Forest, who helped us to focus on present realities related to the Interagency Dispatch Optimization Pilot Project (IDOPP) study and to direct our efforts along productive avenues regarding a new Forest Firefighter training center. Acknowledgment is also due to Congresswoman Ann Kirkpatrick and to her capable staff, especially in regard to research and communication related to the IDOPP study. Thanks to the staff in the USDA, whose comments, ideas, and recommendations shaped our approach. Particular thanks to Gary Mack, Director, USDA/Business Cooperative Program, who not only provided sound technical guidance but also helped us through innumerable procedural steps.Thanks to the leaders of regional fire departments, who carefully reviewed their departments' capabilities and described those capabilities in forms submitted to us for use in this study. We also acknowledge the encouragement provided by Shane Burgess, Vice Provost and Dean of the College of Agriculture and Life Sciences at the University of Arizona, and express gratitude for the guidance given us with respect to initiating the process to become a satellite center to the new veterinary school for off-campus, clinical veterinary training.

New Terminal Building at the Springerville Airport, completed in 2013

EXECUTIVE SUMMARY

The Town of Springerville is located in Apache County, Arizona, about 220 miles northeast of Phoenix. It is beautifully situated in the scenic area known as Round Valley in the foothills of the White Mountains. The town was founded in 1879 and incorporated in 1948. According to the 2010 federal census, its population is 1,961 residents. The estimated per capita income is $17,432, and the median household income is $34,968.
The predominant industries are utilities, construction and retail trade. Cattle ranching has been conducted around this historic, rural town since it was established, but today there is very little commercial agricultural activity.

In 2013, the Town of Springerville was awarded a Rural Business Enterprise Grant (RBEG) by the U.S Department of Agriculture, Rural Development, to investigate several potential economic development initiatives for its light industrial area at the airport. There were three major areas of study:(1)a Firefighter Training and Dispatch Center,(2) an aquaculture or aquaponics facility and (3) Wildlife Rescue/Veterinarian Training Center that can provide wildlife and endangered species rehabilitation, as well as veterinary education.

SUMMARY OF THE STUDY:

The conclusions of this study can be briefly stated as follows:

1. **FIREFIGHTER/DISPATCH MULTI-USE FACILITY**

   Phase I (Anticipated completion date for operational use 2018 pending funding)

   There is a present, regional need for enhanced firefighter training/dispatch facility, and a new, multi- purpose 10,000 sq ft facility established at the light industrial area across from the airport can meet that need. The timing appears to be right for the establishment of a local dispatch facility to take over costly services currently being provided by Apache County. This initial facility would also serve as the 'ground breaking' interface for the larger 38,000 sq foot facility that would function as the multi-use training facility for the IDOPP project.

   Phase 2 (Anticipated completion date for operational use 2020-2025 pending funding)

   An interagency fire dispatch center is problematic at this time because of the findings of the Interagency Dispatch Optimization Pilot Project (IDOPP), and the exclusion from consideration of the Town of Springerville as a possible site for such a center

   The larger 38,000 sq foot multi-use facility which would include a "Super Interagency Dispatch Center" in support of the Interagency Dispatch Optimization Project that would serve the Northeast region and adjoining counties in AZ, UT, NM, as well as a multi-use conference/classroom training facility could be added in the future once the interagency connections are in place.

   The Forest Service would support increased firefighting aviation assets at the Springerville Airport in the form of a helitack and SEAT base.

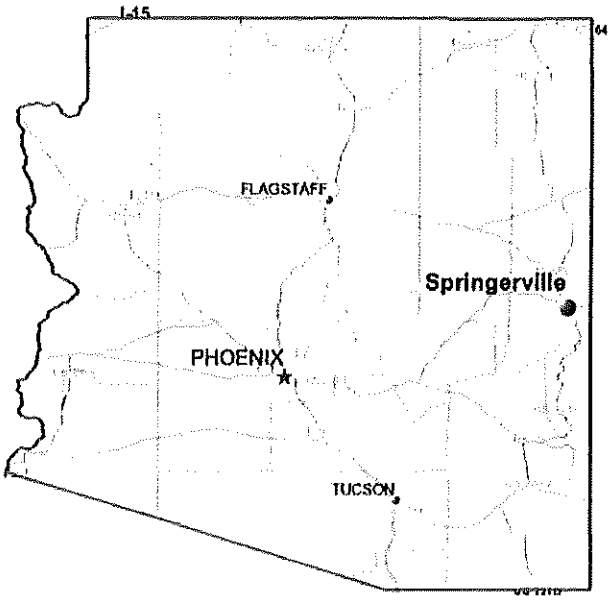
2. **AQUAPONICS** (Anticipated date for completion for operational use 2020 pending funding)

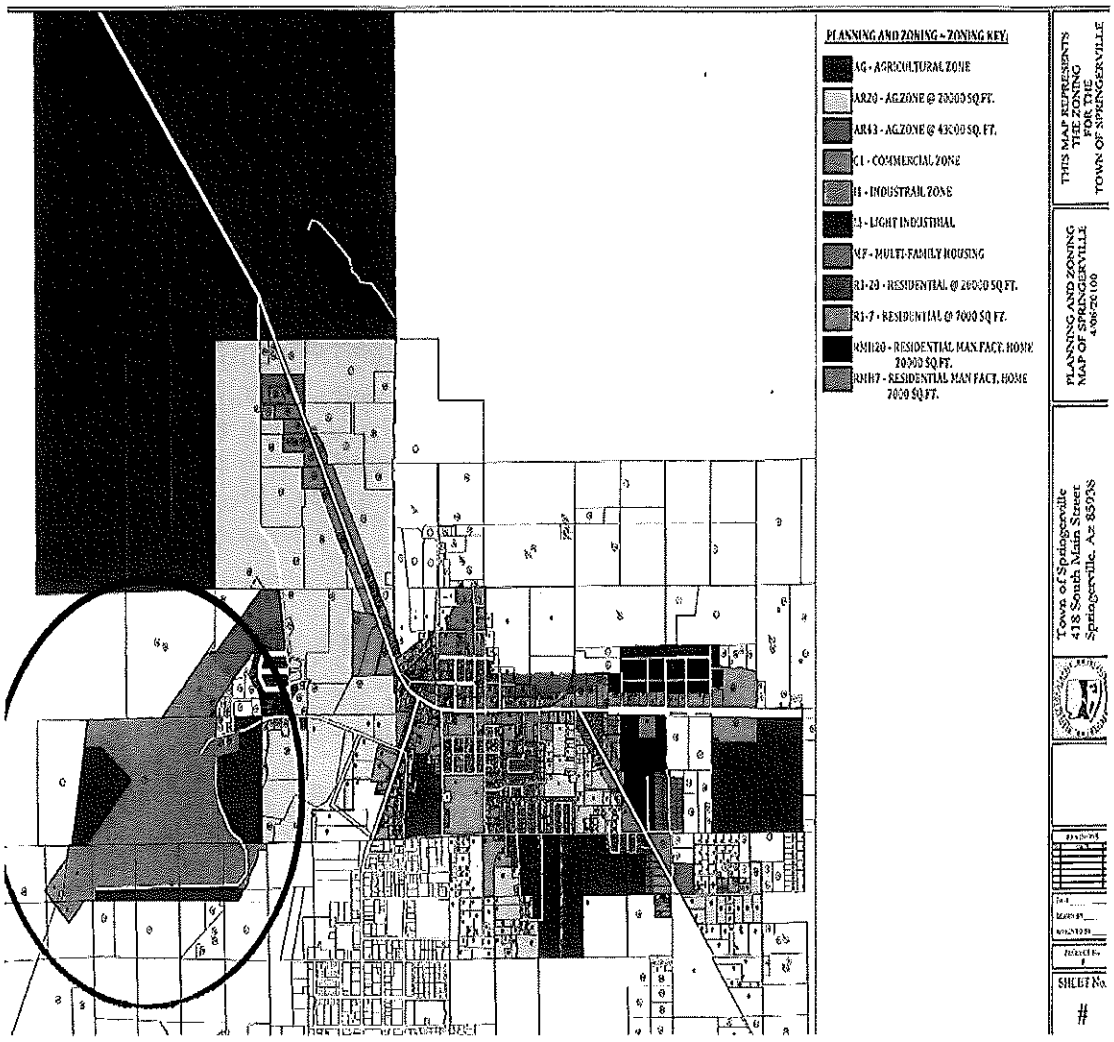
   (Indigenous plants for reforestation, endangered fish (spinedace minnow and others), marketable fish for consumption, and sustainable plants/herbs)

   Though there is no present market for endangered fish or plant species grown in an aquaponics facility, such a facility would be feasible at the light industrial area to grow fish and vegetables, especially for local consumption, though the initial capital cost to establish that business would present a challenge.

3. **SW VETERINARY TRAINING/RESCUE CENTER** (Anticipated date for completion for operational use pending funding 2020)

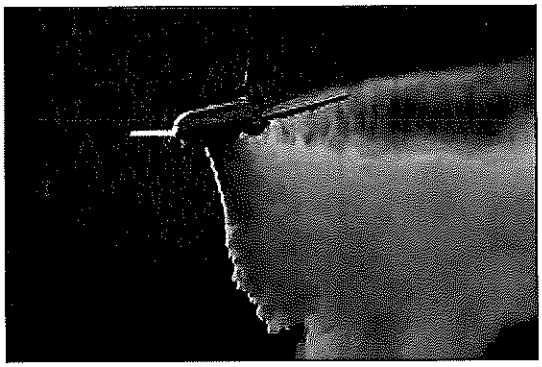
   There is a need for the capacity to provide wildlife rehabilitation and rescue in eastern Arizona together with veterinary training. There is a real opportunity to establish a satellite veterinary training facility with either the University of Arizona/Tucson or Midwestern University/Glendale under their new models of distributive veterinary medical education.

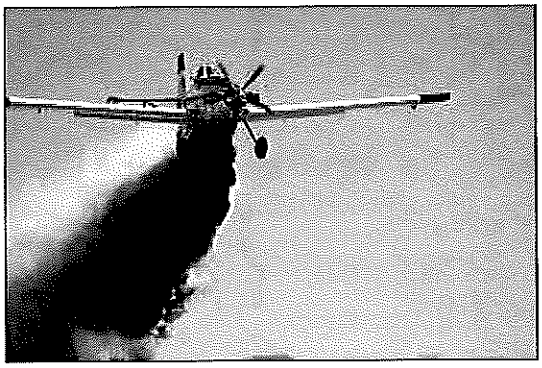




Springerville Airport relative to the Town of Springerville

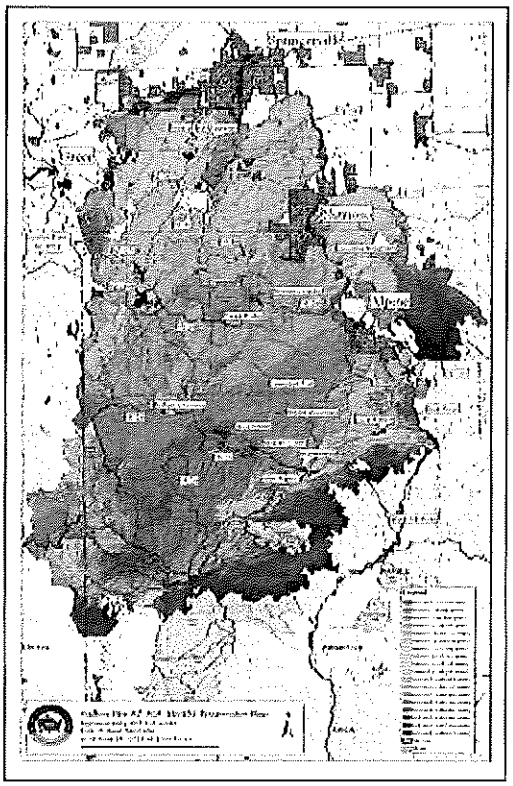
I. FIREFIGHTER TRAINING/DISPATCH CENTER





A. Introduction

The Springerville Airport is a prime location at which to build firefighting and training assets to benefit the region, which was traumatized by two recent historic wildfires. The Rodeo–Chediski Fire was a wildfire that burned in east-central Arizona beginning on June 18, 2002, and was not controlled until July 7. Several local communities in Navajo County, including Show Low, Pinetop-Lakeside, Heber-Overgaard Claysprings and Pinedale, were threatened and had to be evacuated. Many residents from these towns took refuge in Round Valley Dome. Initially there were two separate fires, one started by an arsonist and the other by a careless, stranded motorist. Eventually, the two fires merged, and by the time the fire was brought under control, 460,000 acres (720 square miles) had burned and about 400 homes were destroyed. The cost to fight the fire was $43.1 million. The second major fire was the Wallow Fire, named for the Bear Wallow Wilderness area where the fire originated. This fire came within one mile of the Round Valley area (Eagar/Springerville). The Towns were evacuated for approximately two weeks (which included pre-evacuations). It was started by a negligent camper on May 29, 2011. As of 26 June 2011, it had burned about 841 square miles in Apache, Greenlee, Graham, and Navajo counties in Arizona and Catron County in New Mexico, and is thus the biggest fire recorded in the US. Sixteen outbuildings and 32 residences were destroyed. The estimated cost to fight the fire was $109 million.



Recently, forestry and fire officials testified before the Senate Homeland Security and Governmental Affairs Subcommittee that federal, state and local firefighters need more funding and training to effectively battle wildfires. Senator Mark Begich, D-Alaska, chairman of the Emergency management Subcommittee, said that wildfires are increasing as states face drier climates and droughts. According to a document submitted by the Theodore Roosevelt Conservation Partnership, the costs of wildfire suppression have increased at an average annual rate of 22.34 percent since 1985. It said fighting wildfires cost about $375.9 million more each year that was budgeted between 2004 and 2012. Kevin O'Connor, an official with the International Association of Firefighters, suggested a pilot program to train local firefighters to battle wildland fires in high risk areas. The hearing came as crews were wrapping up efforts to stop the Slide Fire, near Sedona, Arizona, which burned 21,227 acres and cost $10.2 million, according to a report by the National Interagency Coordination Center *("Officials ask Senate for funds to train firefighters, fight wildfires,"* Paulina Pineda, White Mountain Independent, June 27, 2014, p. A6)

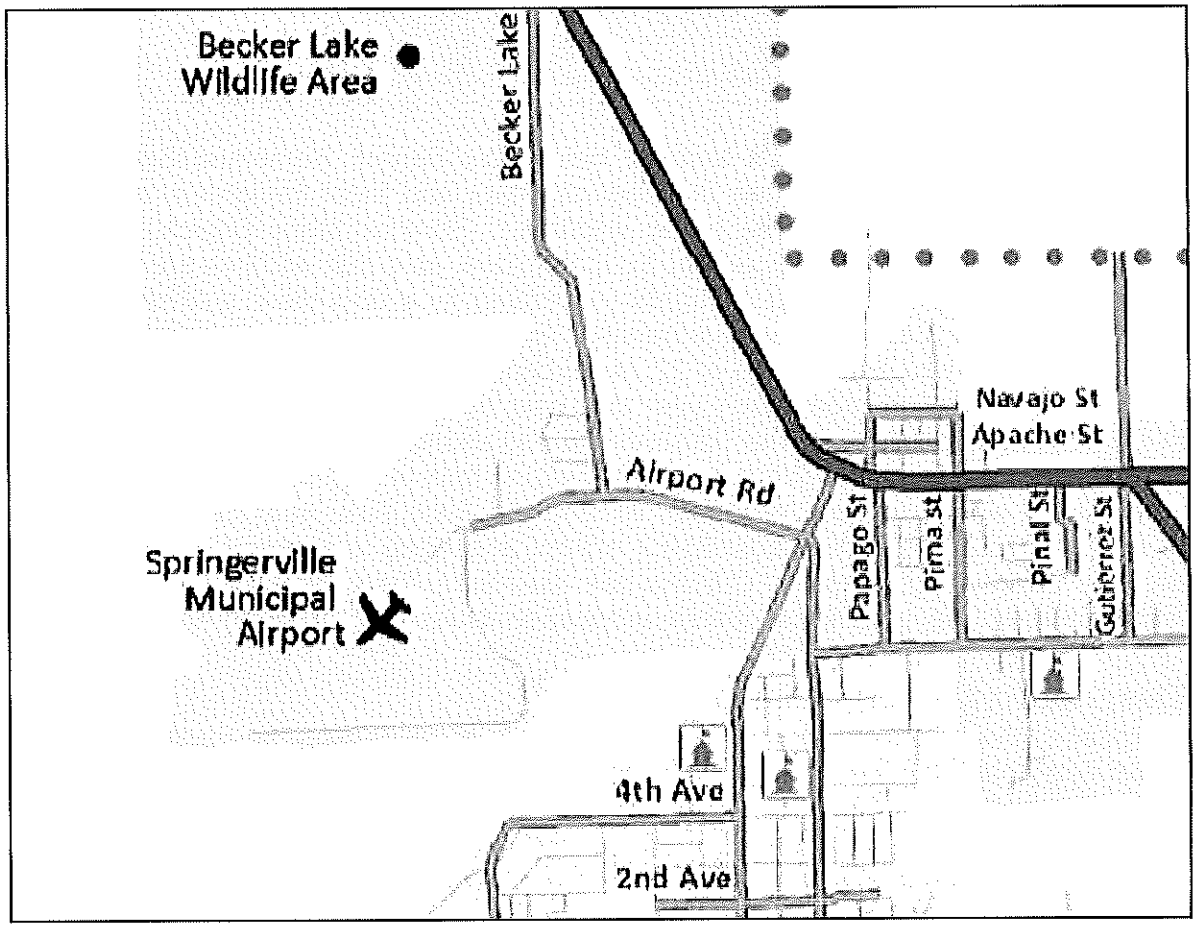
B. Description/Use of Facilities

The purpose of this research is to assess the feasibility of developing the Springerville Municipal Airport and the light industrial site adjacent to it in any or all of the following three areas:

- Improved aerial firefighting base, including enhanced runways, fueling, hanger and maintenance facilities for P-2 Neptunes, P-3 Orions, Beech King Airs, Single Engine Air Tankers, DC-10's (very large air tankers VLAT's); including retardant storage, dormitories for interagency hotshot crews and other firefighters (also can be used by trainees enrolled in academy courses); separate pilot rooms for firefighting pilots to reside while in training.

- Fire and Emergency Training Academy – in conjunction with Northland Pioneer College, Northeastern Arizona Fire Chief's Association, US Forest Service and others, for all necessary course and certifications in fire suppression, aviation, dispatch, fire investigation, incident command, prescribed fire, prevention, safety, rescue, hazmat, etc. The academy would offer training to Northwest and Southwest regions, which would require approximately 40,000 sq. foot facility with a Conference room that has a 200-seat capacity and eight breakaway instruction rooms with real-time audio-video link with dispatch center for training purposes. A Cafeteria will be required for use for firefighters during incidents and for trainees at the academy.

- Interagency Dispatch Center – separate offices or areas that are linked to US Forest Service, BIA, BLM, National Park Service, US Fish and Wildlife Service, FEMA, National Weather Service and Forest Service offices for the Southwest Region, including western New Mexico.



Lobby of New Springerville Airport Terminal Building

C. Methodology of Study

Review of online literature
Met with Congresswoman Ann Kirkpatrick
Correspondence with State Director of USDA
Survey of Arizona Fire Chiefs
Discussions with staff at Show Low Local Dispatch Center.
Discussions with staff at Springerville Forest Service headquarters.

D. Socioeconomic Conditions

According to the 2010 Federal Census, Springerville and Eagar had a land area of 44.06 miles and a population of 7,148. There were 3,155 housing units in the area in 2010, of which 2,636 were occupied. The median age was 37.4 years. 11.1% of the population lived below the poverty line. The principal economic activities were utilities, federal government, health care and retail.

POPULATION GROWTH

Geographic Area	2000	2010	Growth Rate
Study Area	6307	7148	1.33%
Springerville	1972	1961	-0.06%
Eagar	4033	4885	2.11%
Unincorporated	302	302	0.00%
Apache County	69,423	71,518	0.30%
State of Arizona	5,130,632	6,392,017	2.46%

Sources: 2000 & 2010 Federal Censuses

E. Positive Characteristics of Site

- It is in good condition and very well maintained.
- Due to its original design, orientation and spaciousness, the site has generous expansion capability.
- The site is close to Forest Service headquarters in Springerville.
- The site has adequate connectivity to all necessary utilities.
- The light industrial area is adjacent to the Springerville Municipal Airport.
- The site is well-situated with reference to the 2.76 million acre Apache-Sitgreaves National Forest.

F. Firefighter Training

There is no substitute for classroom and hands-on training for firefighters. Though firefighters in the Springerville region have access to online courses from a variety of sources, as described below, there is a present need for classroom and experiential education. Springerville can fill those needs through a multi-purpose fire training academy.

The Arizona State Forestry Division manages the State Wildland Fire Qualifications Committee made up of Division staff and representative fire department personnel from

to Central Oregon through the airport. The Forest Service is waiting on approval for the move from the U.S. General Services Administration, which manages federal government leases.

The Redmond Air Center covers 51 acres at the Redmond Airport. The new dispatch center would add about four more acres. The airport plans to build the dispatch center for between $2 million and $2.5 million and then lease it to the Forest Service. The potential move is a good opportunity for the Forest Service, because it will contribute to efficiency. Those at the Prineville Airport are very disappointed and are trying to convince the Forest Service to stay. Having the dispatch center at the small airport creates welcome economic activity. The dispatch center guides firefighting on more than 7,000 square miles of state and federally-managed land in Central Oregon. The Prineville Airport is also home to Central Oregon Helitak, a base for helicopter firefighting. There are no plans to move it. When there is a large wildfire, state and federal agencies often bring dispatchers to Central Oregon, so they can focus on that fire and all the firefighters assigned to it. Currently, there is not room for these dispatchers at the dispatch center so they use conference rooms at Forest Service offices. The new dispatch center will have room to accommodate the added dispatchers. The dispatch center has been at the Prineville Airport since 1995. The current dispatch center has about 3,500 square feet of space. The new dispatch center will have about 6,600 square feet. During wildfire season the current dispatch center has five dispatchers, a couple of operations and intelligence workers, and a manager. When there is a large wildfire, there may be as many as a dozen other dispatchers. There are no plans to increase the number of permanent dispatchers, but the new dispatch center will allow them and the temporary dispatchers to all work in the same place, adding greater flexibility
http://www.bendbulletin.com/news/1364265-151/fire-dispatch-may-relocate#

K.2 Black Hills Interagency Dispatch Center

"The Black Hills region's fire dispatch center will move from Rapid City Regional Airport to the Forest Service's Mystic Ranger District complex in south Rapid City if funding in a Senate appropriations bill survives intact. The move, not scheduled until 2013, would end a year's long wrangle among the dispatch center, the city airport and the Federal Aviation Administration, which said the center did not qualify as an aeronautical use and should not be located so close to aviation facilities. The Senate bill, which includes $1.9 million to build a new headquarters for the Northern Great Plains Interagency Dispatch Center, was passed Tuesday by the Senate Appropriations Subcommittee on Interior and Environment, according to Sen. Tim Johnson, D-S.D.

The money would fund building a stand-alone dispatch center on the Mystic Ranger District property off South U.S. Highway 16. The current dispatch center, which became operational in 2003, combines staff from the South Dakota Wildland Fire Suppression Division, the Forest Service and the Bureau of Indian Affairs. The Forest Service and the state each have three full-time permanent staff members at the center. The BIA has one.

During fire season, those ranks often swell to 20-30 staff members, according to Black Hills National Forest deputy supervisor Dennis Jaeger.

The state initially resisted the move, partly because it spent about $1.5 million to revamp the old airport terminal for the dispatch center. The interagency center was a project pushed by then-Gov. Bill Janklow to improve responses to Black Hills region wild fires.

But the FAA's determination that the dispatch center didn't meet the definition of aeronautical use could have jeopardized federal funding for the airport, said Joe Lowe,

Some local dispatch centers are also tasked with law enforcement and agency administrative workloads for non-wildfire operations. If this is the case, a commensurate amount of funding and training should be provided by the benefiting activity to accompany the increased workload. If non-wildfire workload is generated by another agency operating in an interagency dispatch center, the agency generating the additional workload should offset this increased workload with additional funding or personnel.

Local Dispatch centers are responsible for initial attack dispatching, coordination of communications, intelligence gathering and dissemination, and logistical support for local incidents and field operations.

Local dispatch centers are the focal point for the report of, and initial response to wildland fires, and under appropriate authorities, other emergency incidents at the local level. Deployment of response resources is made in accordance with local processes and procedures as outlined in the dispatch center's mobilization guide.

Each dispatch office with the responsibility for initial response to wildland fires has a pre-planned response plan that allocates resources to new wildland fires in accordance with fire management direction, initial attack agreements, and established ordering procedures. The pre-planned response plan is reviewed and updated annually prior to fire season. Additionally, each center has a method to document actions taken and resources sent to wildland fires. Centers may use either a manual or computer aided dispatch system.

Each dispatch center has maps posted that depict initial attack response areas, land ownership, jurisdictional and protection boundaries, hazards, and resource concerns. Each center ensures that Computer Aided Dispatch (CAD) and Geographic Information System (GIS) products are current and functioning.

J. Mission of Proposed Interagency Dispatch Center in Springerville

The mission of the Springerville Interagency Dispatch Center (SDC) is to provide initial attack and extended attack dispatch services through the cost-effective dispatching, timely coordination and support of all incidents, as well as prescribed fire and non-fire incidents in a tri-county area which includes Navajo County, Apache County in Arizona, and Catron County in New Mexico.

K. Precedent

Inasmuch as Springerville proposes the relocation of interagency dispatch services from Show Low to Springerville, where those offices were formerly located until 2005, the following recent dispatch center relocations are informative.

K.1 Central Oregon Interagency Dispatch Center

On June 10, 2013, the U.S. Forest Service announced its plans to move the Central Oregon Interagency Dispatch Center, which dispatches fire fighters to wildfires, from Prineville to Redmond. The move would happen in February 2015, ahead of the 2015 wildfire season. The Forest Service wants to move the dispatch center about 15 miles from the Prineville Airport to the Redmond Airport, so it can have a larger building and be closer to the resources the dispatchers are sending to fight wildfires. The Redmond Airport is already home to the Redmond Air Center, which includes a smokejumper unit, an airtanker base and a crew of elite ground-based firefighters. At the peak of wildfire season, the Forest Service and other federal land management agencies channel firefighters coming

- Procedures for tracking of all aircraft within Geographic Area boundaries;
- Mechanisms for disseminating availability and commitment status throughout the dispatch/coordination system;
- Ordering and operational procedures between the GACC, dispatch center(s) and air tanker base(s);
- Procedures for flight
- Procedures for ordering and establishing TFR's and operating guidelines for airspace de-confliction for Military Air Space (MTR, SUA, MOA) and Restricted Areas. GACCs will participate in planned air space meetings annually;
- Procedures for ordering and utilization of FAA temporary towers; and procedures for reporting through the SAFECOM system.
- Predictive Services and Intelligence
- GACC Predictive Services is responsible for providing weather, fuels and
- intelligence products that support the decision-making process at the local, state, geographic and national levels. GACCs provide timely communications on information and decisions that affect the interagency dispatch community.

GACCS ensure that procedures are in place for gathering, accessing and disseminating information, and maintain a current Standard Operating Procedure that outlines duties and procedures of the Predictive Services program. GACCs are also responsible for maintaining a Predictive Services and Intelligence website to meet these mission requirements.

Each GACC prepares an intelligence report that consolidates fire and resource status information received from each of the local dispatch centers in its area. This report is sent to NICC and to the local dispatch centers, caches, and agency managers in the geographic area. GACC Predictive Services maintains open lines of communication with interagency partners and ensures that contacts and roles are maintained and understood for the National Weather Service (NWS), NIFC, NICC, and adjacent GACCS. Predictive Services staff participate in planned briefings, meetings and conference calls, monthly/seasonal assessments, etc. GACC Predictive Services, in coordination with the NWS, has an Annual Operating Plan (AOP) that outlines products and services provided by each office. GACC Predictive Services ensures that provisions within the AOP that affect local dispatch centers are coordinated with and communicated to those centers.

I.1.3 Local Dispatch Centers

Local dispatch centers, such as the one proposed for the Town of Springerville, are located throughout the country as dictated by the needs of fire management agencies. Local dispatch centers dispatch multi- agency wildland firefighting resources within a pre-established and identified dispatch zone boundary. The principal mission of a local dispatch center is to provide safe, timely, and cost-effective coordination of emergency response for all incidents within its specified geographic area. This entails the coordination of initial attack responses and the ordering of additional resources when fires require extended attack. Local dispatch centers are also responsible for supplying intelligence and information relating to fires and resource status to their GACC and to their agency managers and cooperators. Local dispatch centers may work for, or with, numerous agencies, but should only report to one GACC.

National Interagency Coordination Center, Boise, Idaho

I.1.2 Geographic Area Coordination Centers (GACCs)

There are 11 GACCs, each of which serve a specific geographic portion of the United States. Each GACC interacts with the local dispatch centers, as well as with the NICC and neighboring GACCs. The principal mission of each GACC is to provide the cost-effective and timely coordination of emergency response for all incidents within the specified geographic area. GACCs are also responsible for determining needs, coordinating priorities, and facilitating the mobilization of resources from their areas to other geographic areas.

GACCs are responsible for, in conjunction with NICC and local dispatch centers, ensuring a coordinated response to wildland fire incidents and/or all-hazard incidents under the National Response Framework or other appropriate authorities. GACCs mobilize and position resources (personnel, aircraft, supplies, and equipment) internally among local dispatch centers to meet existing and anticipated incident, preparedness, Severity, wildland, and prescribed fire needs, regardless of geographic location or agency affiliation. GACCs coordinate movement of resources within Geographic Area boundaries and allocate resources according to Geographic Area Multi-Agency Coordinating Group (GMAC) direction when competition for wildland fire resources occurs within the Geographic Area. GACCs will ensure adequate fire suppression capability for local and/or Geographic Area managers, and enable sound planning and preparedness at all management levels. Geographic Areas will establish priorities for their incidents and wildland fires and report them to NICC. GACCs will notify NICC and adjoining GACCs of the commitment of National Resources within their Area, and will notify the local dispatch offices and the NICC of Geographic Area drawdown decision and actions.

GACCs have established authorities and procedures for managing and dispatching aviation resources. These procedures include:

- Aircraft ordering protocols for fire, logistical and administrative flights;

vehicular traffic. Also, noise impacts can extend to vehicular traffic to and from the airport, and construction noise.

I. Organization of Wildland Fire Dispatch in U.S.

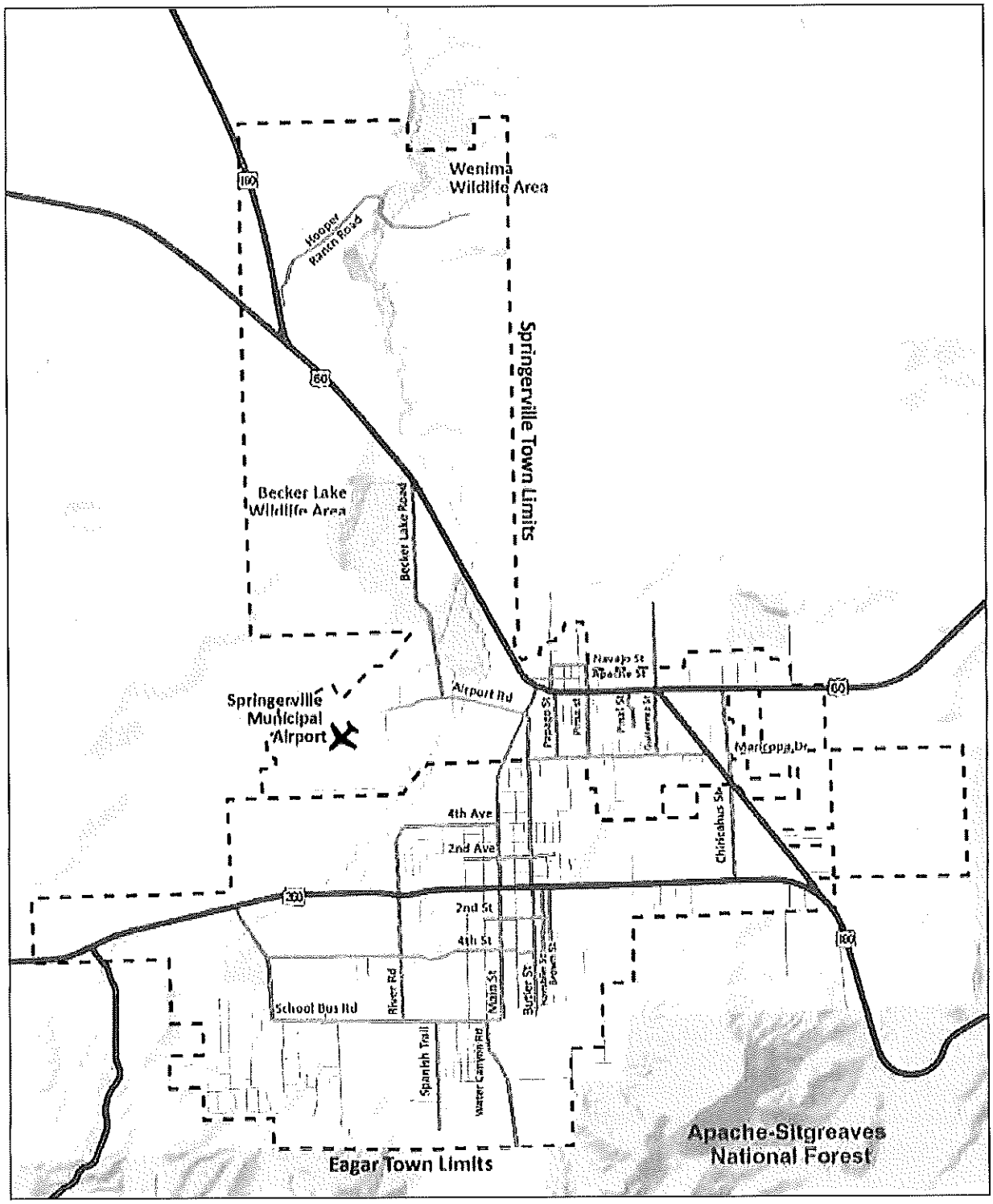
The wildland fire dispatch and coordination system in the United States has three levels (tiers):

- National- National Interagency Coordination Center (NICC)
- Geographic- Geographic Area Coordination Centers (GACC)
- Local Dispatch Centers

Logistical dispatch operations occur at all three levels, while initial attack dispatch operations occur primarily at the local level. Any geographic area or local dispatch center using a dispatch system outside the three-tier system must justify why a non-standard system is being used and request written authorization from the DOI National Office or USFS Regional Office. The following organizational information is included in this study to describe how Springerville's proposed interagency dispatch center would relate to the entire firefighting command structure.

I.1.1 National Interagency Coordination Center (NICC)

The National Interagency Coordination Center is located in Boise, Idaho. The principal mission of the NICC is the cost-effective and timely coordination of land management agency emergency response for wildland fire at the national level. This is accomplished through planning, situation monitoring, and expediting resource orders between the BIA Areas, BLM States, National Association of State Foresters, FWS Regions, FS Regions, NPS Regions, National Weather Service (NWS) Regions, Federal Emergency Management Agency (FEMA) Regions through the United States Fire Administration (USFA), and other cooperating agencies. The NICC coordinates any requests for support from foreign countries, either through Departments of Agriculture and Interior agreements (Canada and Mexico) or arrangements (Australia and New Zealand), or from the Forest Service International Programs' Disaster Assistance Support Program (DASP) through the U.S. Agency for International Development's Office of Foreign Disaster Assistance. The NICC supports non-fire emergencies when tasked by an appropriate agency, such as FEMA, through the National Response Framework. NICC collects and consolidates information from the GACCs and disseminates the *National Incident Management Situation Report* through the NICC website at http://www.nifc.gov/nicc/sitreprt.pdf.



H.3 Noise

Noise from aircraft and from traffic going to and from airports is probably the most obvious environmental impact of the aviation industry, because it is easily perceived and annoying, especially where this occurs frequently. Aircraft noise is generated by both the engine and the airframe and is most evident during landing and take-off and under frequently-used flight paths. Other sources of noise include noise generated from taxiing aircrafts, the application of reverse-thrust (an optional braking aid on landing), engine tests and on-site

Measures proposed in airport master plans and environmental statements for minimizing air pollution impacts are:

- Reduction of the total number of vehicles that commute to and from the airport.
- A system of penalties for polluting vehicles.
- Introduction of charges to promote the use of lower emission aircraft.
- Minimizing dust emissions by wheel washing, damping down and employing the use of covered vehicles for transportation.
- Construction Code enforcement relating to pollutant emission.
- Carrying out air quality assessments periodically.

H.2 Biodiversity Impacts

Biodiversity impacts refer to impacts on plants and animals. These include reduction in the type and extent of habitats; bird strike and road kill; disturbance from light pollution, noise and aircraft/vehicle movements; and air pollution.

Within proximity of the proposed development area, the Arizona Game and Fish Department has identified the following species and habitats as Species of Concern, Sensitive Species, Threatened Species or Proposed Threatened Species:

Species of Concern
Bald Eagle
California Floater
Little Colorado Sucker
Springerville Pocket Mouse
Western Burrowing Owl
Nutrioso Milk Vetch (flora)
Sensitive
Gray Catbird
Bald Eagle
Arizona Montane Vole
Little Colorado Sucker
Springerville Pocket Mouse
Northern Leopard Frog
Western Burrowing Owl
Threatened
Little Colorado Spinedace
Proposed Threatened
Mountain Plover
Yellow-billed Cuckoo

- **Ozone** is generated by photochemical reactions from NOx and volatile organic compounds, and is an indicator of photochemical smog. Ozone can irritate the eyes, nose, throat and lungs. At high levels, it can increase death rates due to lung and heart problems. It can reduce visibility. High ozone levels can be toxic to wildlife, and can lead to a reduction in growth of forests and crops, and altered species composition in semi- natural plant communities. Ozone can damage materials such as rubber, fabric, masonry, and paint.

- **Particulate matter** is a complex mixture of organic and inorganic substances. Particulates are described by their size in micrometers (μm). The size of particles is directly linked to their potential for causing health problems. Small particles less than10 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream. Of the air pollutants, particulates are worst for human health. They are responsible for up to 2.1 million premature deaths worldwide through respiratory problems each year. Particulates can damage surfaces and materials. (*https://www.iop.org/news/13/jul/page_60518.html)*

- **Sulphur Dioxide**, SO2, is a gas, but when it combines with water, it forms sulfuric acid, which is the main component of acid rain. SO2 can cause coughing, make people more prone to respiratory infections, and aggravate asthma and chronic bronchitis. SO2 can attach itself to particulates (see above) and, if these particulates are inhaled, they can cause more serious health effects. Acid rain acidifies soils and water. This can affect aquatic life, cause deforestation, and alter the species composition of plant and animal communities. Acid rain can corrode building materials and paints.

- **Volatile Organic Compounds**, VOCs, include a wide range of organic chemicals, such as hydrocarbons (e.g. methane, benzene, and toluene), halocarbons and oxygenates. VOCs have no color, smell or taste, and they easily vaporize at room temperature. Hydrocarbons can be hazardous to human health even at low levels, particularly if the exposure is long term. For instance, long-term exposure to benzene has been linked to an increased incidence of anemia and leukemia. Toluene can affect the central nervous system; and moderate levels of formaldehyde can lead to irritation of the eyes, nose and upper respiratory track. Some VOCs can cause cancer. Odors from hydrocarbons are often annoying. Some hydrocarbons play a role in the formation of photochemical smog.

H.1.2 Solutions

The local impacts of aviation-related air pollution can be significant. It is very difficult to reduce the air pollution impacts from aircraft except through more efficient operations and technology. The use of the most polluting chemicals is covered by pollution prevention and control regulations. The air pollution impacts of ground traffic can be reduced by switching to less polluting forms of transport (bicycle and bus, rather than private vehicles). Dust from construction can be controlled by soil damping and wheel washing. Some airports compile emissions inventories and carry out air quality assessments to help identify how air pollution can best be tackled.

Some of the measures that have been proposed or carried out to mitigate the effects of air pollution include measures to control the emissions or to penalize non-compliance.

H.1 Air Pollution

Airports and aviation generate air pollution through a range of sources:

- Combustion of aviation fuel, which is mostly composed of kerosene, produces nitrogen oxides (NOx), carbon monoxide (CO), sulphur oxides (SOx), hydrocarbons and particulates. It also releases the greenhouse gas carbon dioxide (CO2).

- As engines are working inefficiently on approach (as they only use about 30% of the available power) a certain amount of unburned kerosene is released. These unburned fuel droplets are a source of volatile organic compounds (VOCs) which give rise to odors.

- As aircraft tires wear during take-off and (especially) landing, they release particulate matter (PM).

- Fuel dumping by aircraft releases unburned aircraft fuel into the air. This is a rare occurrence and usually only takes place in emergencies. In these circumstances, aircraft are expected to dump fuel over water where possible, and at an altitude where they are likely to evaporate before reaching the surface.

- Vehicles travelling to and from the airport, and ground service vehicles generate NOx, CO2, particulates and (indirectly) ozone through the combustion of fuel.

- Fuel storage tanks and transfer facilities can lead to the release of VOCs.

- Aircraft and airfield maintenance (painting, metal cleaning, de-icing etc.), and emergency and fire training use complex chemicals which can release VOCs.

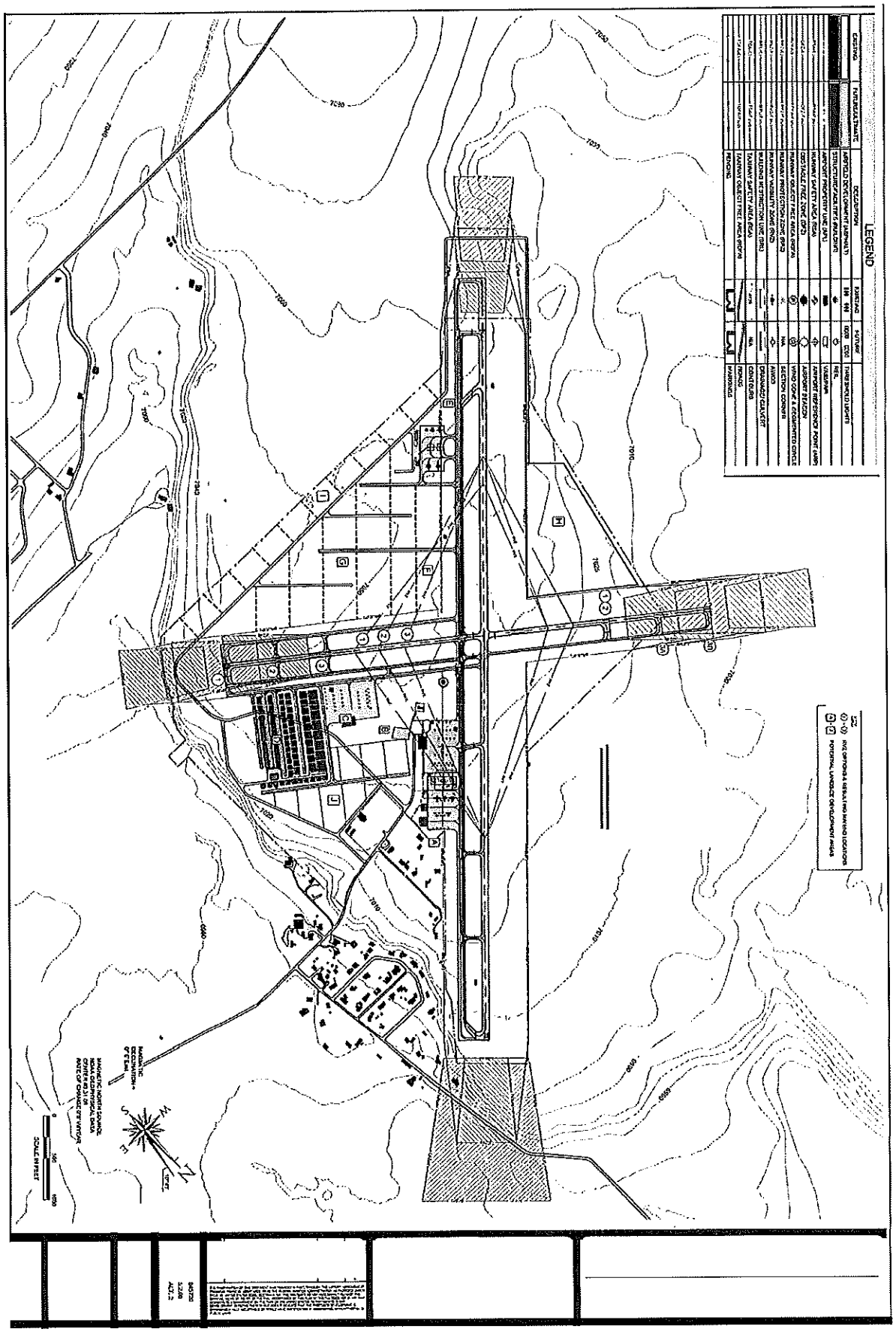
- Construction of airport-related projects can lead to dust, emissions from asphalt laying, etc.

H.1.1 Impacts

The main properties and impacts of air pollutants can be summarized as follows:

- **Carbon Monoxide**, CO, is produced when fuels are burned at too high a temperature or where there is too little oxygen. When inhaled by people and animals, CO bonds to the hemoglobin in the blood, and reduces the oxygen-carrying capacity of red blood cells. The resulting lack of oxygen in the body causes cells to die.

- **Nitrogen oxides** (NOx) are nitric oxide (NO) and nitrogen dioxide (NO2). NO is oxidized in the atmosphere to form NO2. NO2 is acidic and highly corrosive. NO has no significant human health impacts. NO2 can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of NO2 can cause chronic lung disease. High NO2 levels damage foliage, decrease plant growth, and reduce crop yield. Deposition of nitrogen compounds can lead to soil and water acidification. NOx can cause eutrophication of soils and water, which alters the species composition of plant communities and can eliminate sensitive species. NOx is a component of photochemical smog.



Springerville Airport

airport terminal and ground operations, firebase and training-facility activities, flights, access to the airport (cars, buses, parking) and associated projects such as hotels and airport-related office and light-industrial developments.

The National Environmental Policy Act (NEPA) of 1969 establishes a policy and framework for encouraging environmental protection in the United States. There are two primary objectives of NEPA:

1. Ensure that federal agencies consider every significant aspect of a proposed project's environmental impact.
2. Inform and involve the public of potential impacts and alternatives.

The NEPA process is a set of activities to gather information on, analyze, and document the potential environmental effects of the proposed project. NEPA is required when a Federal action is proposed that may have impacts on the human or natural environment. Federal actions include those that occur on Federal lands, or require the use of Federal funding, permits, facilities, equipment or employees. Federal funding generally involves grants or loans. Therefore, if federal funding is sought for any project described in this study, the town would have to comply with the requirements of NEPA.

G.2 Helitack

Helitack crews perform suppression and support operations to accomplish fire and resource management objectives.

BLM- The standard BLM exclusive-use helitack crew size for a Type 3 helicopter is a minimum of seven personnel (supervisor, assistant, squad boss, and four crew members). The standard BLM exclusive–use helitack crew size for a Type 2 helicopter is a minimum of ten personnel (supervisor, assistant, squad boss, and seven crewmembers).

NPS - Helicopter exclusive-use modules will consist of a minimum of 8 fire funded personnel. The NPS regions may establish larger crew size and standards for their exclusive use helicopter crews based on the need for an all hazard component (Fire, SAR, Law Enforcement, and EMT). Exception to minimum helicopter crew staffing standards must be approved by the National Aviation Office.

FS - Regions may establish minimum crew size and standards for their exclusive use helitack crews.

G.3 Air tankers

Air tankers are a national resource. Geographic areas administering these aircraft will make them available for initial attack and extended attack fires on a priority basis. The GACC will ensure that all support functions (e.g. dispatch centers and tanker bases) are adequately staffed and maintained to support the mobilization of aircraft during normal and extended hours.

Air tankers are operated by commercial vendors. The management of Large Air tankers is governed by the Bureau of Land Management and the US Forest Service. Air tanker types are distinguished by their load capacity:

- Very Large Air Tankers (VLAT) – 8,000 gallons or more.
- Type 1 - 3,000 to 7,999 gallons.
- Type 2 - 1,800 to 2,999 gallons.
- Type 3 - 800 to 1,799 gallons (includes single engine airtankers, and CL-215/415 Water Scoopers).
- Type 4 – up to 799 gallons (single engine airtanker, SEAT).

H. Community Issues and Impacts

This section reviews the positive and negative impacts that may be anticipated from the contemplated expansion of use and development at the Springerville Municipal Airport by way of the positioning of increased firefighting aviation assets at the airport, including helitack and single engine airtankers. Positive impacts include direct and indirect employment, social and economic benefits to the community, including people who fly, and public safety benefits accruing from the added fire-response assets at the airport. Negative impacts would include air and noise pollution, traffic concerns, and costs of land acquisition, in the event current residences bordering the airport suffer such a reduction in value as a direct result of the increased use of the airport as to constitute a taking for eminent domain purposes. These impacts can be divided between those occurring from airport construction projects and those occurring from airport operations, including the

Lobby in New Springerville Airport Terminal Building

Region.Typical agency aviation assets include: Helitack or Rappel, Aerial Supervision (ATGS, Lead, and ASM), Large Multi-Engine Airtankers, Very LargeAirtankers (VLATs), Single Engine Air tankers (SEATs), and Smokejumpers. The Forest Service has indicated its support for the establishment of a helitack base at the Springerville Municipal Airport, together with a permanent base for small airtankers.

F.7 Training Costs

According to research in 2014 of 3 fire fighter training centers in Arizona and New Mexico (National Wildland Fire Training Tucson, AZ, Arizona Wildfire & Incident Management Prescott, AZ & Sierra Blanca Wildland Fire Academy Ruidoso, NM) the current average costs per student is as follows for a 3 day course.

Course costs	$150.00
Hotel costs	$255.00
Food	$135.00
Total Course	$540.00

It is anticipated that the 10,000 sq ft facility could charge the following.

Course Costs	$150.00
Dormitory Cost	$135.00
Food	$90.00
Total Cost	$375.00

It is anticipated that this facility would offer 45- 3 day classes.

G. Aviation

During summer months, Arizona State Forestry Division contracts with commercial aviation assets including specialized single engine firefighting air tankers and other fixed wing aircraft for tactical, reconnaissance and firefighting support. The Division operates this contracted fleet of firefighting aircraft from localized airports incorporating specialized mobile support equipment for Single Engine Air Tankers (SEAT) operations. SEATs can operate from smaller, shorter and mostly non-congested municipal runways. Effective pre-positioning of these smaller specialized aircraft closer to the fire risk areas allow for the rapid response and deployment of aerial fire retardant drops on wildfires. This close support and fast action keeps fires smaller and results in lower firefighting costs.In addition to utilizing contracted aviation assets, the Division enjoys an excellent history of working jointly with the Arizona Department of Public Safety and the Arizona Army National Guard to provide supplemental helicopter and fixed wing aviation assets to support the firefighting mission. State Forestry Division aviation staff provides wildland fire related support including coordination, equipment, and training to the DPS and the Arizona Army National Guard.

G.1. Aviation Operations and Resources

Aviation resources are one of a number of tools available to accomplish fire-related land management objectives. Aviation use is prioritized based on management objectives and probability of success. The effect of aviation resources on a fire is directly proportional to the speed at which the resources can initially engage the fire, the effective capacity of the aircraft, and the deployment of ground resources. These factors are magnified by flexibility in prioritization, mobility, positioning, and utilization of the versatility of many types of aircraft.

The Office of Aviation Services (OAS) in the Department of the Interior is responsible for the coordination of aviation policy development and maintenance management within the agencies of the Department of the Interior (DOI). OAS has no operational responsibility. OAS provides aviation safety program oversight, accident investigation, and inspection/approval of aircraft and pilots for DOI agencies.

- The unique training needs of volunteer firefighters who often can only train on weekends and evenings.

- The state does not totally subsidize basic fire fighter training.

- The ability to consistently train in wildfire fighting is most appropriately accomplished on mountainous, forested terrain and urban interface zones found in the Springerville region.

- Training in fire prevention and education is a market that the federal government is beginning to focus on.

- There is a significant need for fire investigation training in the Springerville region, a need the Town of Springerville can fill.

F.6 Recommendations for Regional Fire Training Facility

The light industrial area east of the Springerville Municipal Airport is adequate for current demand. A new structure at that location to be utilized for firefighter training as well as for dispatch services is feasible. The following infrastructure improvements, listed in order of importance, must be addressed to meet the demands on either the 10,000 sq ft facility or the larger interagency multi use facility and encourage departments to utilize the facility:

- Assure adequate sewer and domestic water for overnight students or firefighters.

- Assure an adequate and reliable power supply, including on-site emergency back-up power generation.

- Provide a dormitory for 80 students or firefighters. A preliminary floor plan for the facility envisions 4 modular classrooms, each of which can accommodate 20 students. The classrooms can double as sleeping quarters for firefighters in the event of a major wildfire incident, providing additional space along with the facility's dormitory. Commercial accommodations, when available, cost a minimum of $40 per student per night, and many volunteer departments cannot afford this expense.

- Provide Food Service for 80 students or firefighters. Commercial food service is available in town only minutes away from the proposed facility. Because the training facility will often train students late into the night to meet the needs of fire departments, an on-site food service would enhance the continuity of training. For students who spend several days, or weeks, at the facility, on-site food service would greatly improve their training experience by providing greater variety in their meals. In the event of a major fire incident, firefighters will commonly return to the facility for rest and food at irregular hours, making an onsite food service most welcomed.

- Provide classrooms. A facility that provides one large room that is capable of being divided into 4 separate 20 person classrooms would provide the most utility for the fire training center. The rooms should be configured to take advantage of the latest communications and training technology.

from DOT. Addressed in NEPA documentation. No substantial or severe impact anticipated.

Wild and Scenic Rivers Act –National Park Service. Directs federal actions to avoid or mitigate adverse effects on rivers listed in the Nationwide Inventory. Addressed by NEPA review.

F.4 Strategy for Regional Firefighter Training Facility

The firefighter training facility the Town is considering for the light industrial area of the Springerville Municipal Airport is intended to supplement training activities offered in other areas of the state and make them conveniently available for firefighters in the eastern Arizona and western New Mexico region, which currently does not have a good fire training academy. There is a viable opportunity for the Town of Springerville to provide leadership in fire training matters. This strategy is designed to solidify that leadership role through solid fire training programs provided at a new multi-use facility. The facility will provide necessary infrastructure to support students in residence.

The essence of this strategy includes:

- Basic and advanced fire training programs and coursework that meet a broad spectrum of fire service training needs.
- Basic wildfire training programs, delivered to regional organizations to meet the needs of volunteer and career personnel, who cannot attend a facility in Phoenix or Tucson.
- The acquisition, evaluation, and delivery of well-recognized firefighter training curricula to facilitate consistent fire service training.
- The intention to market the facility to organizations outside the region to provide an additional source of operating revenue.

F.5 Factors Influencing Market

Factors impacting the firefighter training market in the Springerville region, especially in the realm of wildfire suppression training, include:

- The Firefighter Training Academy could link to courses provided in the state by the National Fire Academy.
- The U.S. Forest Service, in several contacts with the Town of Springerville, has indicated a desire for the town to establish a leadership role in fire training.
- The number and size of wildfires in Arizona has increased steadily since the 1990's, increasing the need for firefighters to hone skills and maintain competence.
- Firefighter deaths have increased proportionately with the increase in wildfires.
- Emergency Preparedness agencies have focused attention on the training needs for both public safety responders and private organizations that may deal with a terrorist action.

F.3 Laws and Regulations

Airport and Airway Improvement Act – Federal Aviation Administration (FAA). Section 509 calls for assessment of human and environmental impacts of airport improvement projects.

National Environmental Policy Act (NEPA) –FAA. Requires evaluation of human and environmental impacts for certain federal actions, including project funding through grant or loan. This translates into cost and time for an environmental review process, leading to Categorical Exclusion, Environmental Assessment, or an Environmental Impact Statement. We would anticipate a Categorical Exclusion or Finding of No Significant Impact.

Clean Water Act – Environmental Protection Agency (EPA). May require federal and/or state permit for discharge of effluent into surface waters during construction and operation. No discharges expected.

Safe Drinking Water Act –(EPA) Prevents discharge of effluent that would contaminate drinking water sources. No discharges anticipated.

Clean Air Act – (EPA) Establishes ambient air quality standards and regulates hazardous air pollutants.

Resource Conservation and Recovery Act – (EPA) Regulates use, handling, treatment and disposal of solid and hazardous waste, and use of underground storage tanks. Petroleum-based fuels are exempt from most RCRA requirements, unless spills or leaks occur.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – (EPA) Requires spills of reportable quantities to be reported and remediated by responsible parties. Spills of fuel and foam resulting in contamination must be addressed. None expected.

Occupational Safety and Health Act – Occupational Health and Safety Administration (OSHA). Requires Material Data Safety Sheets be provided and posted on site.

Endangered Species Act – US Fish and Wildlife Service. Prevents federal projects from affecting endangered species or their habitat. Addressed in NEPA review.

Fish and Wildlife Coordination Act - US Fish and Wildlife Service.Requires consultation with federal/state wildlife agencies when federal projects affect water bodies. Addressed in NEPA documentation.

National Historic Preservation Act –State Historic Preservation Office (SHPO). Section 106 requires federal projects address effects on National Register of Historic Places sites. Addressed in NEPA documentation.

Department of Transportation Act – US Department of Transportation. Evaluates impacts on publicly-owned parks, recreation areas, wildlife or waterfowl refuges, or any historic site listed on National Register of Historic Places for projects that receive funding

- Community Acceptability - The apparent willingness of a community to support a regional training facility and tolerate the associated smoke, fire, traffic, and other impacts discussed more particularly in this study.

- Educational Support - The availability of training courses, qualified instructors, and educational institutions involved in aviation, firefighting and/ or emergency response.

- Lodging/ Meals/ Recreation Facilities - The availability of local and affordable lodging, restaurants and recreation for overnight visitors.

- Commercial Air Service - The availability of commercial air carrier service to the site or a nearby airport.

- Complementary Use Facilities - The existence of other aviation, firefighting and/or emergency service facilities that would complement, or be complemented by, a regional firefighting training facility.

- Utilities - The availability of electricity, storm and sanitary sewer, telephone, water, wastewater treatment or any other utilities used to support a firefighting training facility.

- Ground Access - The ability to access/egress the site with heavy firefighting equipment, taking into consideration the use of public/private roads, crossing active airfields or water bodies, etc.

- Existing Support Facilities - The existence of firefighting facilities, equipment, and trainers; equipment/vehicle maintenance/storage facilities; classrooms; and other firefighting/rescue training aids.

- Emergency Services - The availability of a hospital, clinic, EMS, and police/fire departments in the event these services become necessary in connection with an accident or emergency.

- Utilization Restrictions - Any restrictions or impediments to the use of the site and training facility taking into consideration seasonal/ weather factors, environmental factors, and/or other conflicts.

- Miscellaneous Factors - Any other factors, positive or negative, not described above that could have an effect on the location, design, construction, and use of a training facility.

- Cost Savings - The amount of construction and operational funds saved by the availability of existing and/or planned complimentary use and support facilities.

- If overnight stays are required, ensure good accommodations.
- Safe, effective, live-fire training experience must be available on a regular scheduled basis.
- Consistent, base line SCBA (Self-Contained Breathing Apparatus) competency training, review, and testing must be accessible.
- An accredited firefighter certification testing facility would improve individual and community safety.
- Training should meet environmental regulations and minimize impact to neighbors.
- Firefighters need exposure to different instructors and methods to keep their skills sharp.
- Funding support should include development and operation sources.
- Consider alternative training delivery strategies, including internet-based training.

F.2 Suitability of Site

In order to evaluate the overall suitability of the site for a regional firefighter training academy, we have developed a set of 18 criteria. To each of these criteria, the light industrial area east of the Springerville Municipal Airport presents a favorable and positive response. Each criterion is considered important to a successful regional training facility. These criteria are briefly discussed below:

- Willing Host - The demonstrated willingness of site owner/operator to accommodate a regional firefighter training facility.
- Land Availability - The availability and overall suitability of land to support a facility taking into consideration size, terrain, obstructions, etc.
- Land Use - The compatibility of existing and future land use at the site and adjoining property.
- Travel Distance - The roadway driving distance between fire departments in the region and the site, multiplied by the number of firefighters from each fire department.
- Distance to Other Training Facilities - The approximate distance between the proposed Springerville Regional Firefighter Academy and other regional facilities that would provide comparable training.
- Environmental and Geographic Factors - The potential to impact or conflict with a wide variety of environmental issues including air quality; surface and ground water; biotic communities; preserved or historic sites; aesthetics; and other areas of federal, state, or local importance.

campus operated in Springerville. The Forest Service has indicated its support for such a facility, inasmuch as it would provide cost savings in terms of travel and lodging.

There is a potentially significant demand for fire training from the group of firefighters from eastern Arizona and western New Mexico associated with fire departments. Roughly 1000 of these fire fighters would likely use the facility, if the cost is affordable and the training of high quality. To this number, we could estimate 250 general aviation and 300 military firefighters would take advantage of training offered in Springerville.

The fire training market needs were identified in a survey conducted in April 2014 by the consultants preparing this study. The training needs identified in this survey include:

- State funding for basic fire service training.
- Curriculum and instruction brought to the firefighters.
- Ability to access live fire training locally.
- Local recruit academies.
- Computer/web based learning.
- Fire officer development.
- Fire executive development.
- Fire investigations training.
- Prevention and education training.

Although not documented by a formal study, both private industry and all levels of law enforcement have training needs that can be fulfilled by the Springerville Training Academy. Private industry training needs include:

- Training for industrial fire brigades such as those in utility and mining industries.
- Aircraft fire fighting conducted by private fire departments.
- Hazardous materials, including chemical weapons.
- Specialized tactical training, such as aircraft hostage rescue.
- Fire suppression training for activities such as clandestine drug lab interdiction

Area fire officials noted the following interests:

- Regional fire officials seek a fire training program that can focus on targeted needs.
- Locate training facilities near the students rather than moving students near the training.

across the State. This committee reviews wildland training qualification promotions for all State and local wildland firefighters. This is the method in which firefighters receive their yearly qualification card known as the "Red Card." Currently the Division tracks over 2,700 state and local personnel in Arizona's wildland firefighting qualification system. Included in this figure are 2,035 qualified base level wildland firefighters.

FEMA's Emergency Management Institute's (EMI) Distance Learning (DL) Section offers the Independent Study Program (ISP). This is a distance learning program which offers training, free of charge, to the nation's emergency management network and the general public. It serves as both an alternative means to deliver valuable training to the professional and volunteer emergency management community, and an opportunity to improve public awareness and promote disaster preparedness nationally. The Independent Study Program offers over 175 training courses by way of its training website, *http://training.fema.gov/IS/*.

- In fiscal year 2013, there were 1,974,126 course completions within the program.
- The average cost per student completion was $1.54
- The ISP customer support center provides assistance with approximately 1,796 new student inquiries each week.
- The ISP processes approximately 38,000 test submissions weekly.
- There is an average of 65 students orders placed for college credits each week, resulting in over 25,000 credits being awarded through Frederick Community College.

FEMA's Independent Study Program offers courses that support the following nine mission areas. A regional training academy at Springerville can offer these same programs.

- Incident Management
- Operational Planning
- Disaster Logistics
- Emergency Communications
- Service to Disaster Victims
- Continuity Programs
- Hazard Mitigation
- Public Disaster Communications
- Integrated Preparedness

Fifteen community colleges throughout the state, including Northland Pioneer College, provide the opportunity for students to acquire a Certificate of Completion in Fire Operations and an industry certification in Fire Fighter I/II. These afford the knowledge and practical skills necessary for certification as an entry-level firefighter. A collaborative training effort between the Springerville Regional Fire Training Academy and Northland Pioneer College would be very effective.

F.1.Market Needs

According to the Arizona State Fire Marshal Office, there are approximately 10,000 fire fighters associated with 400 fire departments state-wide. From the results of this project's survey, it appears that there is a strong demand for fire training among these Arizona-based fire departments, provided it is affordable and conveniently located. Springerville is centrally-located in eastern Arizona and close to the western New Mexico border. Firefighting personnel from eastern Arizona typically travel to Tucson or Phoenix, Arizona for fire training. The distance from Springerville to either of these cities is approximately 225 miles. The Sitgreaves National Forest Service currently sends its personnel to Tucson for various firefighter training courses, any and all of which could be offered at a

coordinator of the state wildlife division. "In the best interests of the airport and the citizens of Rapid City we chose not to carry the issue any further," Lowe said Tuesday.
Lowe said if the funding survives legislative hurdles, much work will remain to draw up plans and construct the building by 2013, when the center's lease at the airport ends.
But Lowe said he's happy about the move to the Forest Service property. "We work well with our federal partners," he said.

Jaeger said the dispatch center, even on the ranger district complex, would continue to maintain its base at the airport for air tankers that fly in to battle fires here. "Of all the options we looked at, this was the most cost effective place to put that building," Jaeger said. "We own the land and the infrastructure is already there."
Airport executive director Cameron Humphres said he was disappointed to see the dispatch center leave. "They've been a really good partner to the airport," he said. "But I'm encouraged by the fact that the Forest Service was able to put together that money to provide them a good facility at the Mystic ranger station." Humphres said the airport board had hoped to keep the dispatch center at the airport but at a location away from aviation use areas such as runways, taxiways and ramps. The current dispatch center sits right next to aircraft ramps, Humphres said. "It comes down to anytime this airport accepts federal money through the FAA we have to live by some grant assurances. One of those says we won't have nonaeronautical activities in aeronautical-use areas," he said."
http://rapidcityjournal.com/news/local/top-stories/fire-dispatch-moving-from-airport/article_6fe8d740-6b71-52de-9459-6f1ea781ede2.html

L. Southwest Coordination Center

The Southwest Coordination Center (SWCC) is the interagency focal point for coordinating the mobilization of resources between the twelve Federal and State Dispatch Centers of the Southwest Area and, when necessary, the National Coordination Center in Boise, ID. Located in Albuquerque, New Mexico, the SWCC mobilizes resources for wildland fire, prescribed fire, and other all-risk incidents. In addition, the Center provides Predictive Services and Intelligence related-products in support of incident management decision-making for wildland fire managers and on-the-ground wild land firefighters.

M. Southwest Area Coordinating Group

The Southwest Area Coordinating Group (SWCG) is comprised of representatives from each of the five Federal land management agencies and the two State land management agencies located within the States of Arizona and New Mexico. Each member of the SWCG is delegated authority to act on behalf of their respective agencies for the purposes of planning, priority setting, mobilizing and positioning resources, reallocating resources, and implementing all current agency policies, directions and standards for fire and incident management activities. The focus of SWCG is on fire, incident, fuels and smoke management activities in the Southwest Geographic Area, which includes Arizona, New Mexico, and the lands administered by the signatory agencies west of the 100th Meridian in Texas and Oklahoma.

Other fire management goals specified for the group include:

- Providing a cooperative interagency forum seeking consistency in fire and incident management within the Southwest Area. This includes an emphasis on safety, efficiency and effectiveness.

- Understanding and implementing interagency policy, direction, and coordination to the Zone Management Groups and to the Southwest Coordination Center (SWCC) for fire and incident management activities.

Specific fire management activities of SWCG include:

- Functioning as necessary as the Multi-Agency Coordination (MAC) Group.
- Coordinating and managing the Southwest interagency Incident Management Teams.
- Implementing regular revisions of the Southwest Area Mobilization Guide, the SWCG Handbook, the SWCC Operations Guide, the Southwest MAC handbook, the Southwest Single Engine Air Tanker (SEAT) Operations Guide, and the Southwest Type 2 Crew Guidelines.
- Maintaining an information system of fire intelligence and predictive services sharing.
- Developing and training fire and incident management skills in agency personnel.

N. Interagency Dispatch Optimization Pilot Project (IDOPP)

N.1 Background and Purpose

In 2008, the US Forest Service (USFS) and Department of the Interior (DOI) jointly conducted a management efficiency assessment of Wild land Fire Dispatch functions to identify whether efficiencies and cost savings are attainable through changes to location, staffing, organization, communication, technology application, and business processes. This assessment identified areas for operational improvement, identified opportunities for the function to become more efficient and cost effective, and recommended further examination of these areas. The 2008 Wildland Fire Dispatch Management Efficiency Study was specific to federal wildland fire dispatching. All non-fire functions, as well as state and local partners, were excluded.

In 2009, the Interagency Interoperability Oversight Group (IIOG) examined the results of the assessment along with issues in law enforcement dispatch and dispatch for other field going personnel. As a result of these deliberations, IIOG agreed to sponsor the Interagency Dispatch Improvement Project (IDIP) Steering Committee, which is integrated across USFS/DOI programs and agencies that use dispatch services. The IDIP was chartered to provide leadership and direction to provide an efficient and cost-effective interagency dispatch capability that meets the business needs of stakeholders at all levels through standards, integration, and interoperability.

As part of its work, the IDIP Steering Committee decided to conduct a pilot project, called the Interagency Dispatch Optimization Pilot Project (IDOPP), encompassing two geographically-defined areas to take a detailed look at how to optimize dispatch operations, including dispatch for fire, law enforcement, and other field going personnel. The pilot project covered two areas, California and the Southwest (Arizona, New Mexico, and west Texas), and included federal, state, local, and tribal stakeholders in those areas.

The California and Southwest sub-teams collaborated and compared notes in order to develop well-documented and supported alternatives to improve dispatch operations, staffing, and organization for the pilot.

The overall purposes of the dispatch optimization pilot project were to identify:

- Implementable organizational configurations for optimizing integrated interagency, multi-functional dispatching in the two selected areas;

- A toolbox of methodologies, business needs, user requirements, management issues, and questions to be answered for use by others to develop organizational configurations for optimizing integrated interagency, multi-functional dispatching; and,

- Issues and standards to help dispatch efficiently, meet business needs and address user requirements that include:
  - Mission needs/requirements
  - Technology/equipment
  - Facilities location and coverage.
  - Workload and workforce.
  - Business practices and operational standards
  - Governance.

N.2 Scope

The focus of the project was to improve program delivery of dispatch services while meeting the mission needs of the USFS and DOI, as well as state, local, and tribal stakeholders. The sub-teams assessed the current business and organizational models, identified issues and user requirements, and developed implementable alternatives to improve customer satisfaction and mission delivery while improving program efficiency and cost effectiveness. They reviewed current policy and identified where standardization and clear direction would result in increased efficiency and improved safety.The IDOPP was intended to be an open, participatory process which would solicit input from stakeholders across program areas and agencies. Unfortunately, the Town of Springerville was not included in the process.The committees considered only those sites which already had an established interagency dispatch center. However, in light of its airport development project and its desire to establish a local interagency dispatch center at the airport, the Town is taking steps to be included in the project from here on out, with a view of becoming a location for one of the super dispatch centers or a satellite, as described in the IDOPP study.

The IDOPP focused on the following issues and potential areas for improvement:

Dispatch Mission, Function, and Scope: Reviewed the services performed by dispatch offices across the various land management agencies to identify the business needs and user requirements for all program areas supported and to validate the overall mission, function, and scope of the program. Determined functions and activities that are appropriate for dispatch and those that might be best handled elsewhere.

Governance: Reviewed the structure, funding policies, decision processes, and delegation of authorities used to manage dispatch operations to determine opportunities for improved efficiency and effectiveness. Addressed how to best organize governance structures and processes for shared (agency/program) dispatch operations, including such issues as membership, authorities, roles and responsibilities, decision processes, and funding.

Dispatch Workload/Staffing: Reviewed all dispatch workload (regular as well as expanded) to determine optimal hours of operation, staffing, and organizations to meet current and projected requirements.

Dispatch Center Locations and Coverage: Assessed alternatives for the physical locations and geographic coverage of dispatch centers to provide the most efficient and effective services.

Operational Standards: Reviewed operational practices, business processes, and standards across agencies and program areas to assess where changes might increase operational efficiency while effectively meeting mission requirements.

Training Standards: Reviewed training and qualification standards for dispatch personnel and recommended changes or the creation of standards in order to ensure a well-trained and safe dispatch workforce.

Technology/Equipment Standards: Gathered information to develop functional requirements needed to support dispatch operations (e.g., radio consoles, telephone systems/sets, computer system capability, software suites/licensing, and printers) while improving consistency and compatibility.

Facility Standards: Assessed current conditions and infrastructure to assist in determining which offices should be kept or eliminated for any alternatives involving consolidation. Assess the minimum facility and other infrastructure requirements and standards needed for a dispatch office to perform at an optimal level.

Dispatch Center Typing: Assessed the range of dispatch center duties, workload, and complexity to establish a single, interagency dispatch center typing schema (e.g., recognize and be able to identify the range of capabilities within what is now classified as a "tier 3" or local interagency center and eliminate differences that currently exist between the National Park Service (NPS) and other agencies).

In examining the above issues, the IDOPP addressed these cross-cutting issues:

- Safety of field going personnel and the public;
- Risk management;
- Sustainability in operations;
- Eliminating unnecessary facilities and infrastructure;
- Opportunities to share dispatch services, personnel, and facilities among multiple program areas;
- Processes for reconciling and adjudicating competing priorities; and,
- Relative roles and functions of geographic area coordination centers and local dispatch centers.

N.3 Final IDOPP Report

Currently there are eighteen Emergency Communications/Command Centers in the Southwest that are within the scope of this project: twelve fire Centers, one dedicated Law Enforcement Center, one Law Enforcement and Search and Rescue Center (Grand Canyon) and four fourth-tiered fire dispatch centers. The total annual cost estimate for the various Centers in the Southwest is approximately $10.5 million. Dispatch center costs ranged from $1.5 million to $300,000 per year. This project gathered as much information

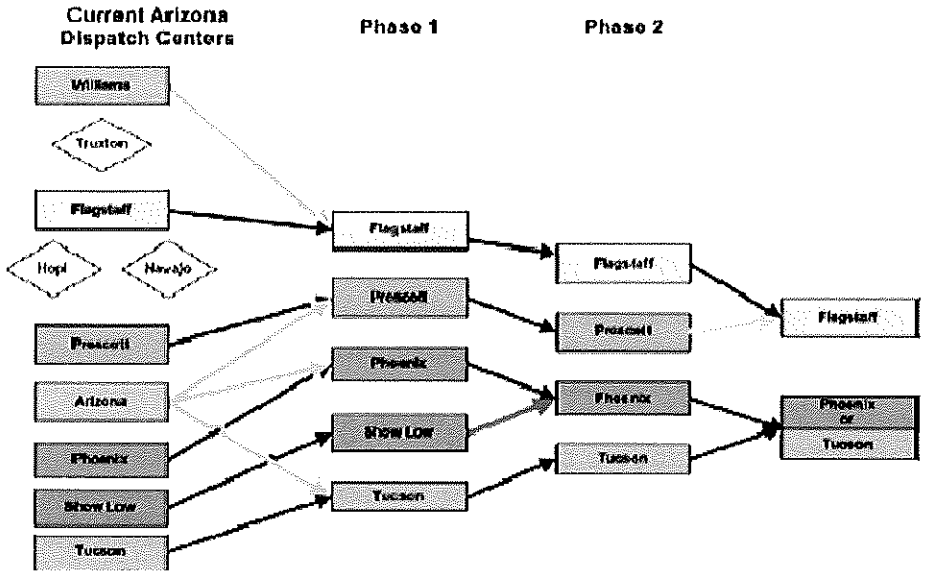
as possible to tell the story of the current dispatch/coordination system inSouthwest, but by no means is it all inclusive. The IDOPP decisions have the potential to be a blueprint for the next ten years or longer for opportunities to consolidate dispatch centers in the Southwest. Therefore, it is important for the Town of Springerville to communicate its value as an optimal site for an interagency dispatch center to the decision makers. Overall, the alternatives approved will need supportive management and willing partners throughout the Southwest in order for the project to be a success.

The recommendation from the IDOPP report was Alternative 2A for the Southwest, which would implement a three-phased approach for consolidation of wildland fire dispatch centers.

Alternative 2A consolidates the 12 Tier 3 dispatch centers into:

- 9 centers during Phase 1 (5 in Arizona and 4 in New Mexico);
- 7 centers during the Phase 2 (4 in Arizona and 3 in New Mexico)
- 4 centers during the Phase 3 (2 in Arizona and 2 in New Mexico).

The intended objective, as recommended in the Final Report, is the eventual creation of four Super Dispatch Centers, two in Arizona and two in New Mexico, after the phased consolidation process is completed. Springerville would be an ideal location for one of those Super Dispatch Centers.



Even though the final report says Flagstaff and Phoenix are chosen to become the site of the Super Centers, Flagstaff is not the pre-determined center, and Springerville still has an opportunity to convince authorities that the town is an excellent location for a super dispatch center.

> "Determining the appropriate process for consolidation- The IDOPP committee briefed the Northern Arizona Board and Line Officers in October 2012. In this meeting, it was briefed that the Flagstaff Dispatch Center was not the pre-determined location for a consolidated center. The appropriate location would

be determined by participating agencies and would be determined by many factors. This was in contradiction to the final report, which suggested the consolidated center would be located in Flagstaff, AZ. This step was included as an expectation within the Task Order." *IDOPP, Minutes of Meeting held 6/6/2013, p. 2*

O. Proposed Local EMS/Dispatch Center

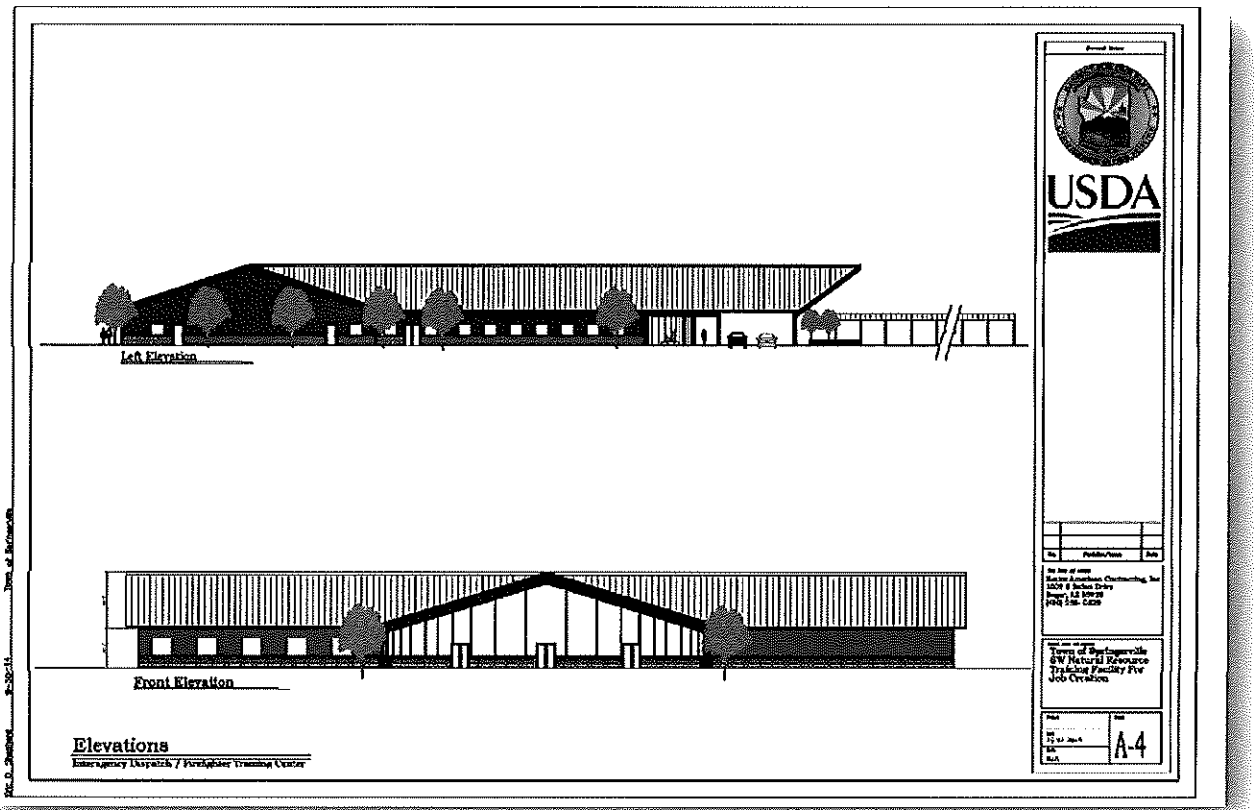
During Springerville's annual budget meeting in May 2014, it was noted that the Town's contract with Apache County for EMS/Dispatch services has increased almost 500%. After discussion, there was agreement that the cost of $110,000 per year for this service is too high, and that it would be more prudent and viable to establish a dispatch center in Springerville.

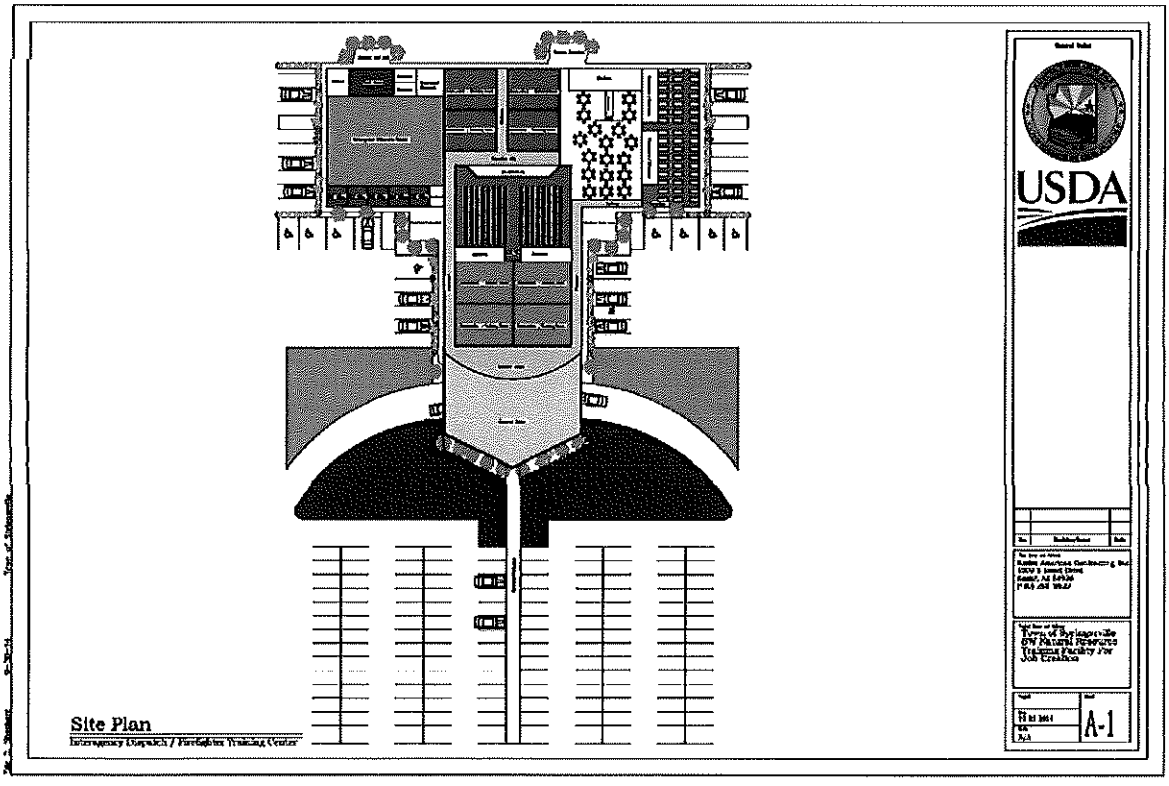
P. Conclusions of the Study

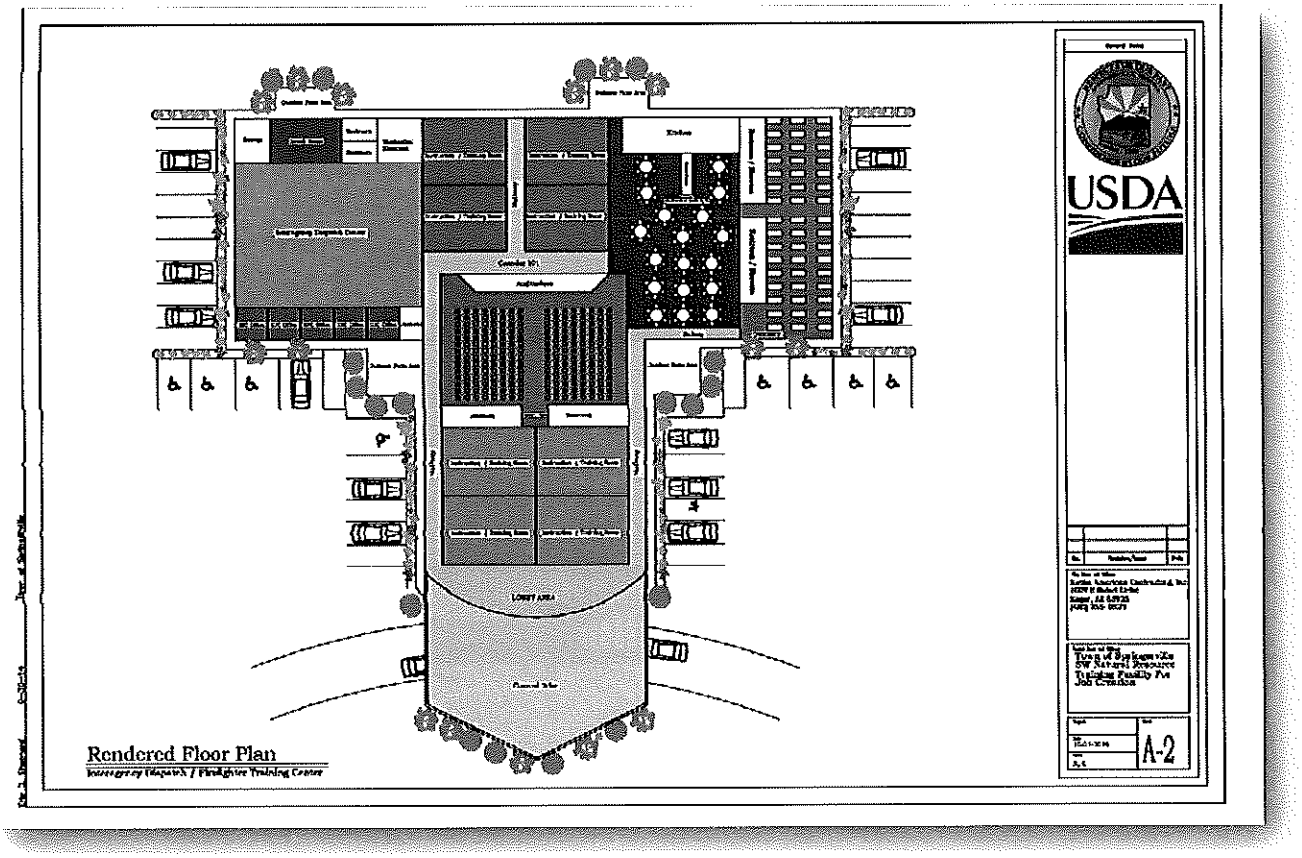
- Did not identify any legal impediments to the creation of an interagency fire dispatch center or fire training academy at the Springerville Airport.
- Given the proposed investment in high quality equipment, facilities and staff, the level and quality of services provided by a new dispatch center and fire training academy should well-exceed those currently being supplied.
- The interagency dispatch center at Springerville will improve cost and fiscal responsibility through joint interagency use of specialized fire control equipment, supplies, procurement of services, personnel and aircraft.
- With headquarters in Springerville, USFS managers can quickly drive to the dispatch center and gain an understanding of fires occurring in the protected areas.
- An interagency dispatch center located at the Springerville Airport will be better able to provide faster, more efficient response in the event of a wildfire and improve the safety and efficiency of firefighters and fire operations.
- Despite Springerville's favorable features as a location for an interagency dispatch center, it is subject to the conclusions of the IDOPP study, which recommends consolidation of present interagency dispatch centers and eventual establishment of super dispatch centers and possible satellites for those super centers. Since final selection has not yet been made for the sites of those super dispatch centers, the Town of Springerville should prepare to compete for selection by establishing a local dispatch center, which could be expanded into an interagency dispatch center in the future.

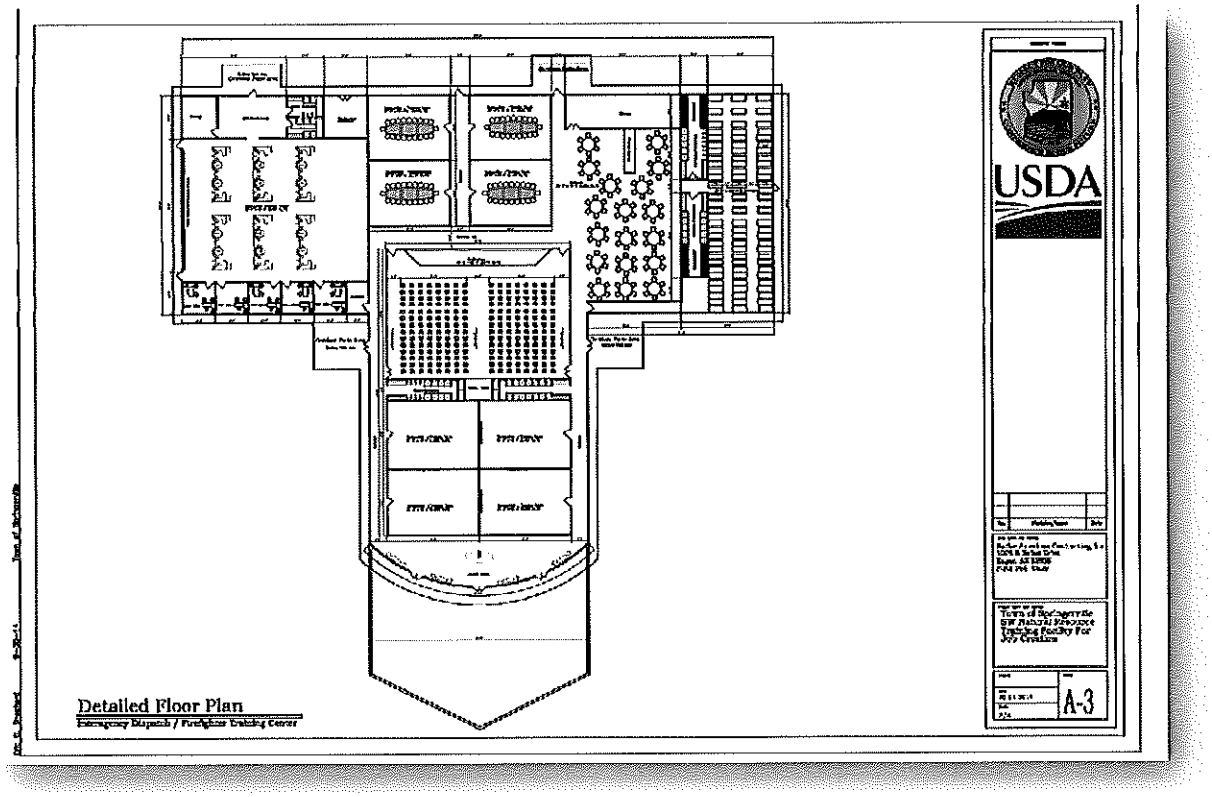
Q. Building Options -

Q.1. Full Facility for Interagency Dispatch/Firefighter Training


USDA
Left Elevation
Front Elevation
Elevations
A-4

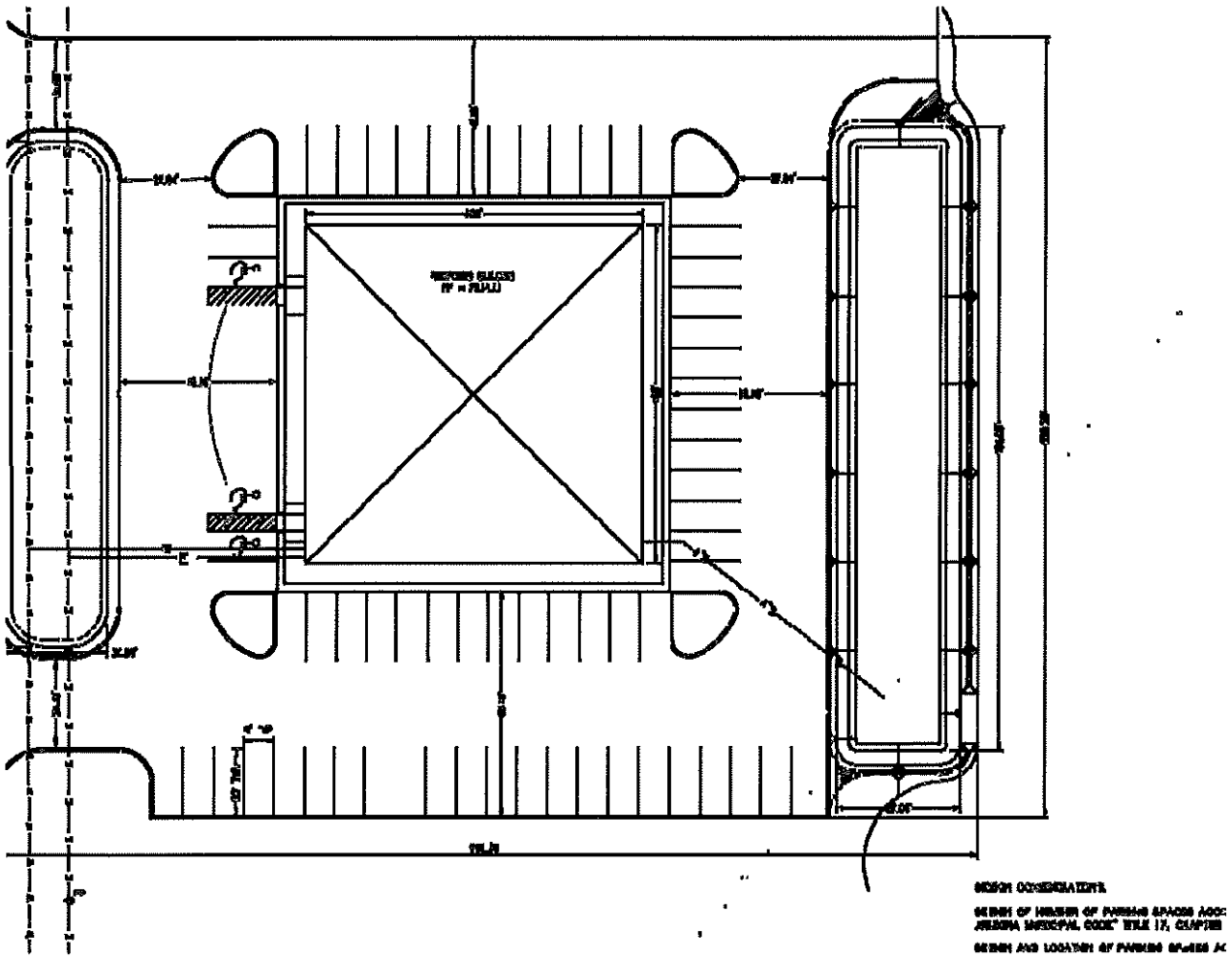

USDA
Site Plan
A-1

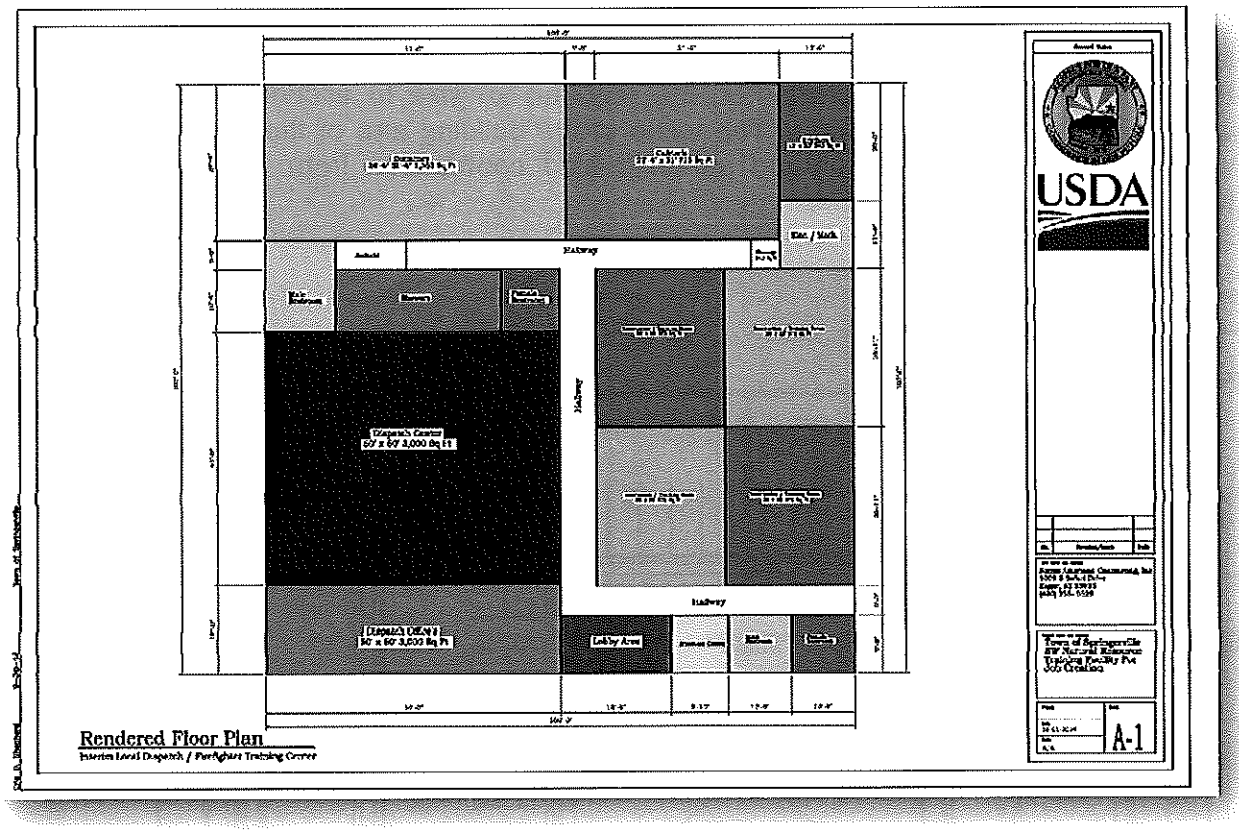

USDA
Rendered Floor Plan
A-2

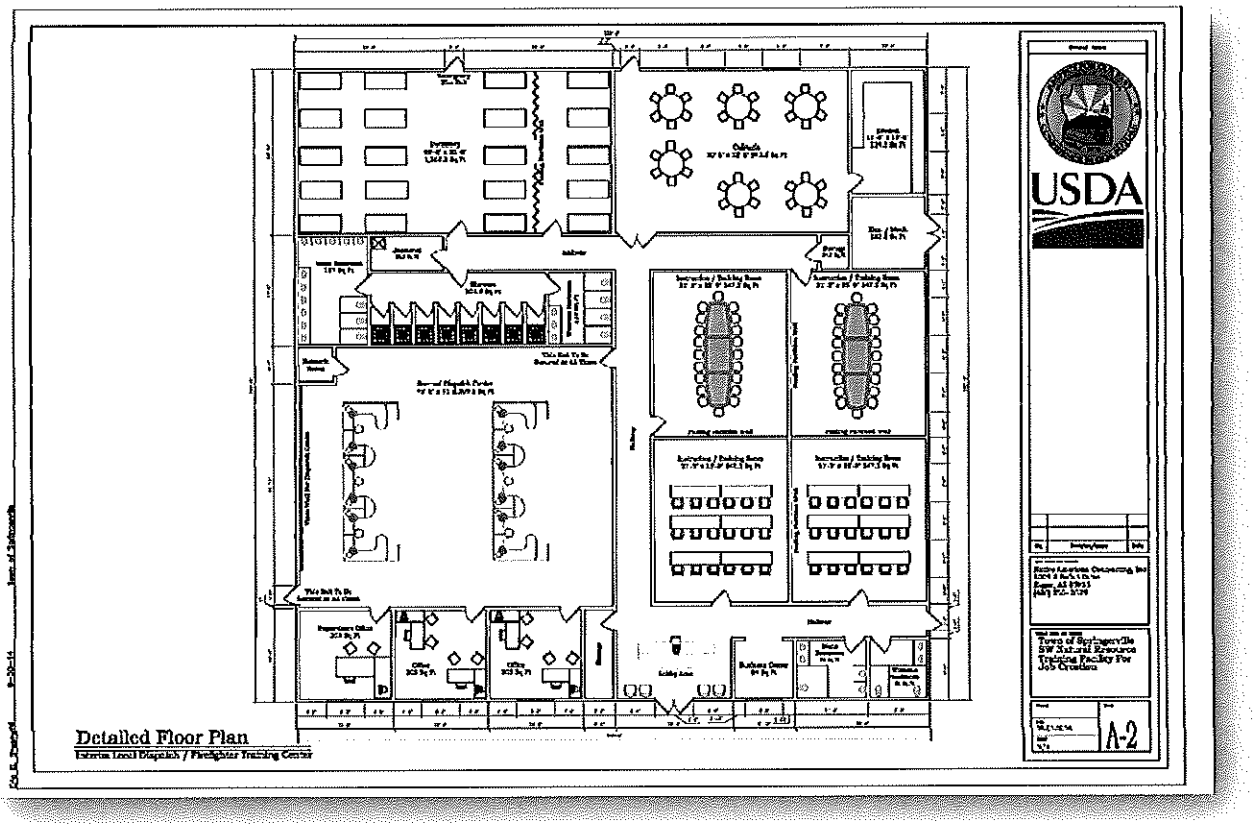

USDA
Detailed Floor Plan
A-3

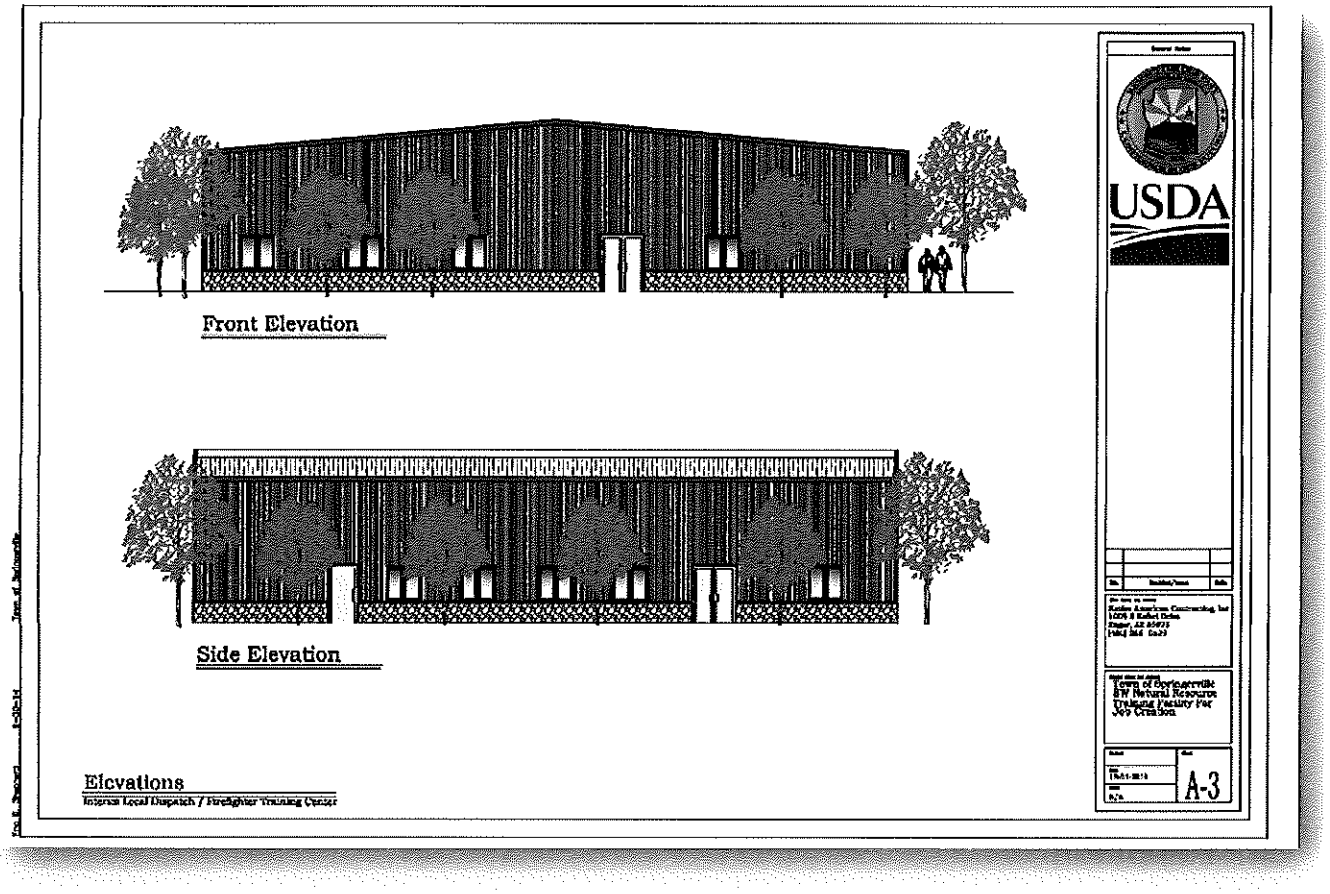
Q.2 Interim Facility for Local Dispatch/Firefighter Training

One of the options available to the Town of Springerville is to construct a new, but smaller, facility on the site in anticipation of future expansion.Based on the programmatic needs of the fire training and dispatch center, the required lot size to accommodate this facility would be approximately 2 acres. The value of the building and of the land upon which it will be erected can be leveraged as an in-kind contribution from the Town for grant funding, perhaps from the EDA.




USDA
Rendered Floor Plan
A-1


USDA
Detailed Floor Plan
A-2



R. Funding

Funding to support construction and outfitting of the new interagency dispatch center may come from a variety of sources, including the Department of the Interior Wildland Fire Facilities Fund and the USDA Forest Service IT Replacement Program. A Congressional appropriation for all or a portion of the capital cost to establish the center should be sought.

II. AQUACULTURE & AQUAPONICS

Tilapia competing for food at feeding time.

A. Definition

Aquaculture, also known as fish farming or fish culture, is the production of aquatic animals in controlled environments. In the industry, the term "seafood" refers to all farm-raised fish and shellfish, whether grown in salt or fresh water. The National Oceanic and Atmospheric Administration (NOAA), the leading US agency on aquaculture, has dedicated federal guidance and financial aid to states in order to develop aquaculture regulation, policy and physical systems. Officially, NOAA defines aquaculture as "the propagation and rearing of aquatic organisms in controlled or selected aquatic environments for any commercial, recreational, or public purpose."
http://www.nmfs.noaa.gov/aquaculture.

More than half the seafood eaten worldwide comes from aquaculture. It is the fastest growing area of food production in the world, keeping up a steady expansion of 8.4% a year since 1970. FAO 2012. *"The State of the World's Fisheries and Aquaculture."* United Nations Food and Agriculture Department, Rome. It is also one of the fastest growing segments of US agriculture. The increasing cost of fishing natural waters and the rising demand for fish has contributed to an interest in aquaculture. The United States is a major consumer of aquaculture products, importing 84% of our seafood. Half of that is from aquaculture.

Besides the production of seafood, aquaculture is also used to rebuild wild stock populations, a typical example being trout hatcheries used to restock rivers, ponds and streams. Historically, aquaculture has been used for this purpose for over 50 years. Most fish in Arizona do not originally come from the streams, rivers or lakes where they were caught, but rather they were stocked from a hatchery at some stage in their lives. Natural trout reproduction in Arizona is extremely limited, yet angler demand is high. Trout cannot

reproduce in lakes or ponds because they require cold clear-running perennial streams. Thus, the vast majority of trout caught in Arizona's public waters originate from hatcheries. The Arizona Game and Fish Department hatcheries stock trout annually into public waters for anglers to enjoy. http://www.azgfd.gov/index.html. To accomplish this, the Department maintains six fish hatcheries within the State, each of which has a dedicated source of cold, natural spring water. Those hatcheries are located as follows:

- **Cottonwood/Sedona Area:**
  Bubbling Ponds
  Page Springs
  Sterling Springs

- **Payson Area:**
  Canyon Creek
  Tonto Creek

- **Show Low/Pinetop Area:**
  Silver Creek

The hatchery fish are raised from eggs which are imported from other federal, state, or private hatcheries in the nation. Most fish are raised to catchable size before stocking, which is a targeted size of 9.5 inches. However, some lakes have abundant natural food and thus, are stocked with smaller fish such as fingerlings (3 inches) or sub-catchables (6 inches). Over time the smaller fish then grow to harvestable size within the lake. Most hatcheries have specific areas within Arizona where they stock, although there is some overlapping of waters. Five of these hatcheries (Page Springs, Canyon Creek, Tonto Creek, Silver Creek and Sterling Spring) feature various trout species. The Bubbling Ponds Hatchery focuses on Arizona's native fish such as razorback sucker, Colorado pike minnow, and roundtail chub which is a native sportfish, but the hatchery also produces a small number of largemouth bass, bluegill, and channel catfish. Arizona's smallest hatchery, Sterling Springs specializes in hatching the trout eggs and raising them to fingerling size for transfer to the Page Springs Hatchery.

Aquaponics is a hybrid food-producing method that combines aquaculture (growing fish) with hydroponics (growing plants in non-soil media and nutrient-laden water). The aquaculture part of the system consists of tanks that are used to raise fish, and the hydroponic part of the system consists of growing beds that produce herbs and vegetables. Nutrient-rich water is circulated from the fish tanks to the hydroponic growing beds where the nutrients nourish the herb/vegetable production. The uptake of the nutrients by the herbs/vegetables in turn cleanses the water before the water is circulated back to the fish tanks. The system is essentially a closed-loop configuration. The only routine losses from the system are occasional removal of a small amount of filtered solids and evaporative loss of water from the open tanks. The only routine inputs to the system are fish feed pellets, other viable food sources, such as duck weed, and minor make-up water to replace evaporative losses. Nutrients generated by the fish, either by direct excretion or microbial breakdown of organic wastes, are absorbed by plants cultured hydroponically. Fish provide most of the nutrients required for plant nutrition. As the aquaculture effluent flows through the hydroponic component of the recirculating system, fish waste metabolites are removed by nitrification and direct uptake by plants, thereby treating the water, which flows back to the fish rearing component for reuse.

Aquaponics is intended to be a highly sustainable production system that incorporates principles of water conservation, sustainable vegetable production and perhaps organic plant and animal agriculture. Systems vary in size from small indoor or outdoor home or classroom hobbyist units to immense commercial units. The systems are usually fresh-water based, but salt-water systems are used for some high-value fish or crustacean production. It should be noted that the corrosive effects of salt-water can greatly increase the establishment, maintenance and depreciation costs of the production system. Moreover, discharges of salt-water on land can harm the productivity of the land.

In traditional tank-type aquaculture systems, the fish are raised within a mostly closed system where water is recirculated. Since it is a closed system, filters are required to remove fish effluent and remove aqueous toxic compounds that result from the effluent or its decomposition. If not removed, the effluent and its toxic nitrogenous bi-products quickly reach levels that are fatal to fish. In aquaponic systems, the effluent is as passively managed as possible within the system, using sumps and biofilters. Some solids may be physically separated and removed. However, the majority of the toxic compounds are biologically converted into plant-usable nutrients through bio-conversion by beneficial bacteria within the biofilter. This nutrient-laden water is now the fertilizer component of the plant aspect of the system. The plants then remove the nutrients and the "de-nitrified" clean water is returned back to the fish, crustacean or mollusk aspect of the system as their water input.

There are four major types of hydroponic plant growth subsystems. They are:

- Ebb and Flow - This method, also known as flood-and-drain culture, requires the use of a substrate, like pea gravel or expanded clay, for the plant roots to grow in for stability. This method uses a constant inflow of water and auto-siphon device to flood then quickly drain the grow bed, usually on a 20- to 30-minute cycle. This periodic water emersion and air exposure produces an environment highly conducive to healthy plant root systems. This method has the advantage of structural support for larger and heavier fruiting plants, like peppers or tomatoes, that otherwise could be problematic.

- Deep-water Culture - This method, also known as floating-raft culture, requires the use of a platform to support the plants and holes for the roots to access the water. Styrofoam insulation is typically used as the raft, and plastic net pots support the plants. Aeration should be supplied via air stones in the water under the raft to ensure a high oxygen concentration should the water cease to circulate or become stagnant. The larger volume of water required for this method has benefits. It increases overall stability in temperature and water quality, which translates to lower overall maintenance and greater system stability.

- Nutrient Film Technique (NFT) - This method of plant culture allows the plant root systems to absorb nutrients from a thin film of water (up to ½-inch depth), while maintaining high oxygen exposure through high atmospheric air contact. NFT is typically done by emitting a small amount of water into one end of a channel or gutter, and allowing that water to flow by gravity to the other end where it drains into a common collection area. Because of the high potential surface area, this method allows for greater plant production with less water.

- Drip Irrigation - This method uses drip emitters to provide a constant supply of nutrient-rich water to plant root systems, contained in large buckets of substrate, usually expanded clay or slabs of rock wool. This method is very well suited to the production of fruiting, vine-type plants that can be grown continuously for multiple years, like cucumbers, tomatoes or some tropical fruits. Plants generally are 'trained' to grow onto a trellis or similar structure for ease of harvest and maintenance. An advantage to drip irrigation is the more inherently modular design. If one plant dies or becomes diseased, it is easy to remove that plant or unit of plants and disinfect the area without sacrificing the entire crop. Also, this method works well for large, heavy plants that need to sit on the floor, perhaps in a large pot. Although in a large substrate container, the plant and its support infrastructure can easily be maintained, repositioned or modified.

Aquaponics has several advantages over other recirculating aquaculture systems and hydroponic systems that use inorganic nutrient solutions. The hydroponic component serves as a biofilter, and therefore, a separate biofilter is not needed as in other recirculating systems. Aquaponic systems have the only biofilter that generates income, which is obtained from the sale of hydroponic produce such as vegetables, herbs and flowers. In systems employing raft hydroponics, only calcium, potassium and iron are supplemented, if unavailable in the water. The nutrients provided by the fish would normally be discharged and could contribute to pollution. Removal of nutrients by plants prolongs water use and minimizes discharge. Aquaponic systems require consistent water quality monitoring. Aquaponics increases profit potential due to free nutrients for plants, lower water requirements, elimination of a separate biofilter, and shared costs for operation and infrastructure.

Interest in aquaculture in the state of Arizona is on the rise. Currently, there are over 30 licensed aquaculture operations in Arizona, including finfish producers, marine shrimp producers, research/educational facilities and distributors. Arizona aquaculture production in 2010 was 680 metric tons. The Arizona aquaculture industry has weathered many startups and sadly almost as many failures. The lack of a strong industry and the high, new-farm failure rate can be a deterrent to those farmers and investors interested in entering into new projects. Projects throughout the state are currently growing basil, peppers, tomatoes, and different types of lettuces (butterhead, red leaf, romaine and lollo) in a closed loop recirculating system, adding only feed for the fish.Proper selection of species, location and culture practices can greatly improve the success rate of new aquaponic ventures.

B. Potential for Community and Economic Development

One of the principal aims of this feasibility study is to evaluate the airport site's potential for the development of an aquaponics or aquaculture operation. Challenges of local economic growth, health and nutrition, and environmental sustainability have become increasingly important to residents of Springerville. Other communities throughout the country have considered and implemented aquaculture or aquaponic systems as a way to meet the demands of new markets for locally grown organic foods that support healthy diets, local business, and environmental friendliness. It makes both environmental and economic sense to grow food closer to where it will be consumed. This reduces the need for transport costs and use of fossil fuels.

The Town has considered possible ways to rejuvenate local economic activity by bringing commercial aquaponics or aquaculture to Springerville. It wants to know if the ingenuity of aquaculture or aquaponics could be implemented at the light industrial zone of the airport property to meet the needs of federal or state agencies for a supply of indigenous plants or trees for reforestation after wildfires or to restock state water bodies with threatened or endangered varieties of fish. Secondly, it wants to investigate these food growing systems as a way to provide fresh and organic vegetables, herbs and fish to the local economy in an environmentally manner. Locally grown food is the foundation of a healthier, more vibrant community, and residents should have access to fresh, safe, affordable and nutritious foods.

In conjunction with these, the Town has wanted to explore the potential of linking a model sustainable food system with training programs for people who want to learn the valuable skills needed to take charge of their own food production. Throughout the state, a number of schools are introducing aquaponics as a means of teaching biology, ecology, botany, zoology, development, chemistry, mathematics, physics, sustainability and business to their students.

It is estimated that in Springerville, 95% of all vegetables and 90% of all fish consumed by residents are imported. Much of these products come from South America and Southeast Asia. Thus, there is a tremendous opportunity for local production. During the last two decades, the value of U.S. aquacultural production rose to nearly $1 billion. (*http://www.ers.usda.gov/topics/animal-products/aquaculture.aspx*)

C. Objectives of Study

A feasibility study is an analysis of the viability of an idea. This section of the feasibility study focuses on helping answer the essential question of "should we proceed with the proposed project idea of creating and operating an aquaculture or aquaponics facility at the Springerville airport?" This feasibility study represents a relatively short study. Depending upon the outcome, it may become a precursor to a more in-depth study that would be required to develop a full business plan. Feasibility studies require a site assessment, the collection and collation of site specific data, and depending upon the proposed culture species, a review of appropriate technologies and potential markets. The study usually includes a review of historical hydrological and climate data, water quality and quantity analysis, land use and ownership, available infrastructure, logistics and the availability of inputs (feed, supplies etc.). This information is used to generate a report that outlines potential development scenarios. These comprise species choice, technology requirements and production concepts, indicative investment requirements, production estimates, a risk assessment, and estimates of project profitability, market demand, and licensing and permitting procedures.

The Town's grant application to USDA Rural Development refers to several possible purposes for an aquaculture or aquaponics facility at the light-industrial area of the Springerville airport:

1. Offer programs to develop a sustainable food source for the area.
2. Grow indigenous plants/trees for reforestation after wildfires.
3. Provide an associated incubator program for additional trainings and support.
4. Grow endangered or threatened native fish to restock lakes, rivers and streams.

Aquaponics systems grow nutritious, organic foods. These systems are used with great effect in large-scale industrial food production. This program seeks to address the issues of food security, environmental sustainability, and water resource conservation by engineering an economically attractive commercial aquaponic facility with component technologies to meet the demands for local food production.

Indigenous trees and plants can be used in numerous situations and can be grown in an aquaponics environment. Reforestation is the natural or intentional restocking of existing forests and woodlands that have been depleted through wildfires or deforestation. Reforestation can improve the quality of human life by soaking up pollution and dust from the air, rebuilding natural habitats and ecosystems, and mitigating global warming, since forests facilitate biosequestration of atmospheric carbon dioxide.

There are three fundamental concerns:

1. Is there a market for the products?
2. How will the products be produced?
3. Will revenues adequately exceed costs?

D. Methodology of Study

Our general approach was as follows:

1. Determine Market Area

A practical way to analyze potential markets is to define a serviceable geographic area. When delivering a product, travel distance and time are major considerations. A one-person operation for example, might be hard-pressed to allocate even a couple of hours per day for deliveries. An enterprise with a partner or employee responsible for deliveries could market to a wider area. For purposes of this study, the initial market area has been determined to consist of a 400 miles radius from Springerville.

2. Research Potential Buyers

At the outset of the aquaculture/aquaponics portion of this study, the team initiated a market analysis to determine whether there are any species of fish or varieties of indigenous plants or trees that could be grown in a facility in Springerville, which would be purchased by any State or federal agencies, such as Arizona Department of Agriculture, Arizona Game and Fish, US Fish and Wildlife, and US Forest Service. Secondly, other customer types within the market area were considered, such as wholesalers, restaurants, seafood stores, supermarkets and consumers buying directly. In connection with this focus, we researched various fish varieties and vegetables that would appeal to consumers in the area.

3. Estimate Area Market Potential

After choosing potential products to grow, we analyzed the existing market to quantify prices we could expect to charge, volume of products we could expect to sell, the reliability of the market, and the form of products desired by the customers. In connection with this data, we determined the requirements of the aquaculture and aquaponic systems in order to produce and supply the products.

4. Draw Conclusions

After obtaining a picture of the market, market potential and project costs, we were able to estimate the feasibility of the project.

More specifically, our assessment of the feasibility of promoting an aquaculture or aquaponics facility at the Springerville Airport involved the following exercise:

A. <u>Description of the Project</u>

- Identification and exploration of business scenarios.
  - Identified alternative business models of what the project will entail, how it might be organized, and how it will generate profits. These came from the idea assessment and market assessment we completed.
  - Eliminated scenarios that did not make sense.
  - Developed the scenarios that appeared to have potential for further exploration.
- Define the project and alternative scenarios.
  - Described the varieties and quality of products to be marketed.
  - Outlined the general business model (i.e. how the business will make money).
  - Considered the technical processes, including size, location, and kind of inputs.
- Relationship to the surrounding geographical area.
  - Studied the economic and social impact on local communities.
  - Described the environmental impact on the surrounding area.

B. <u>Market Feasibility</u>

- Identify Market
  - Described the size and scope of the industry and market.
  - Estimated the future direction of the industry and market.
  - Identified the life-cycle of the industry and market. Is it emerging, growing, mature, declining?

- Industry competitiveness.
  - Researched the industry concentration. Are there just a few large producers or many small producers?
  - Researched the major competitors. Will our project compete directly against them?
  - Analyzed the barriers to entry of new competitors into the market or industry.
  - Analyzed the concentration and competitiveness of input suppliers and product buyers.
  - Researched the price competitiveness of your product/service.

- Market potential.
  - Identified the demand and usage trends of the market.
  - Examined the potential for emerging, niche or segmented market opportunities.
  - Explored the opportunity and potential for a branded product.

- Access to market outlets.
  - Identified the potential buyers of the product and the associated marketing costs.
  - Investigated the product/service distribution system and the costs involved.

- Sales projection.
  - Estimated sales.
  - Carefully identified and assessed the accuracy of the underlying assumptions in the sales projection.
  - Projected sales under various assumptions.

C. Technical Feasibility

- Facility needs.
  - Estimated the size and type of production facilities.
  - Investigated the need for related buildings, equipment, etc.

- Suitability of production technology.
  - Investigated and compared technology providers.
  - Determined reliability and competitiveness of technology (proven or unproven, state-of-the-art, etc.).
  - Identified limitations or constraints of the technology.

- Availability and suitability of site.
  - Investigated access to:
    - transportation.
    - labor.
    - production inputs (electricity, natural gas, water, etc.)
  - Investigated a potential odor & discharge problems.
  - Analyzed other environmental impacts.
  - Identified regulatory requirements.
  - Explored economic development incentives.

- Other inputs.
  - Investigated the availability of labor including wage rates, skill level, etc.
  - Assessed the potential to access and attract qualified management personnel.

D. Financial/Economic Feasibility

- Estimated the total capital requirements.
  - Estimated capital requirements for facilities, equipment and inventories.
  - Estimated working capital needs.
  - Researched grants and local and state economic development incentives.

- Budget expected costs and returns of various alternatives.
  - Estimated the expected revenue, costs, profit margin and expected net profit.
  - Estimated the sales or usage needed to break-even.
  - Assessed the reliability of the underlying assumptions of the analysis (prices, production, efficiencies, market access, market penetration, etc.)
  - Considered limitations or constraints of the economic analysis.

E. Study Conclusions

- Identified and describe alternative models.
- Compared and contrast scenarios based on goals of the Town.

E. Species Selection

Several species of fish can be produced in aquaculture or aquaponic systems, but market research is needed to determine consumer preferences and consumers' willingness to pay for the true cost of the product.There are many fish species that are well-suited to aquaculture or aquaponic systems. With respect to fish species, tilapia and barramundi are fast-growing species that adapt well to the water temperatures of most aquaponic systems. Other species, like hybrid-striped bass, bluegills, yellow perch or ornamental species like koi or pet-trade cichlids can be raised in these systems. However, each species presents its own set of unique challenges and unique markets. Crustaceans, including fresh-water, salt-water and brackish-water shrimp and prawns, and crayfish have been raised in some systems. The fish and plants selected for an aquaponic system must have similar needs as far as temperature and pH. There will always be some compromise regarding the specific needs of the fish and plants, but the closer they match in terms of environment, the greater success in propagation one will have. As a general rule, warm, fresh water, fish and leafy crops such as lettuce and herbs will do the best. In a system heavily stocked with fish, where there are higher concentrations of fish waste, fruiting plants such as tomatoes and peppers will do best.

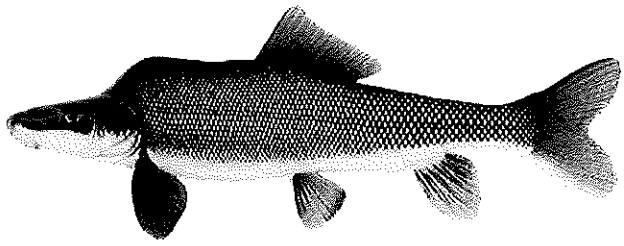
The following fish have been raised in aquaponics with good results:

- Tilapia
- Blue gill
- Sunfish
- Crappie
- Koi
- Goldfish
- Pacu
- Various ornamental fish such as angelfish, guppies, tetras, swordfish, mollies
- Carp
- Barramundi
- Silver perch, golden perch
- Yellow perch
- Catfish
- Largemouth Bass

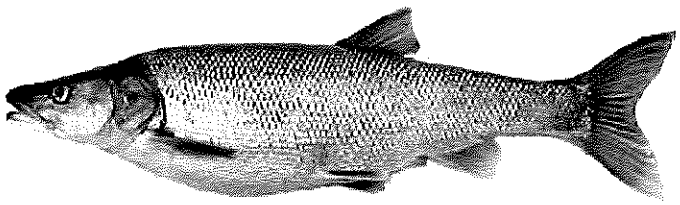
E.1. Growing Endangered, Threatened or Protected Fish

The fact that trout require sources of cold clear-running perennial streams to reproduce makes growing them in closed, recirculating aquaculture or aquaponic systems very problematic from a technical standpoint. State hatcheries managed by the Arizona Department of Game and Fish do not currently purchase fish from privately-operated fisheries. The official listing of endangered, threatened and protected fish species in Arizona is attached to this study as Appendix 1. State-run hatcheries have programs to promote the reproduction of many species on the list. The prospect of growing these species has been ruled out due to lack of a market at the present time. The following State-managed hatcheries grow all the varieties needed in Arizona in sufficient quantities.

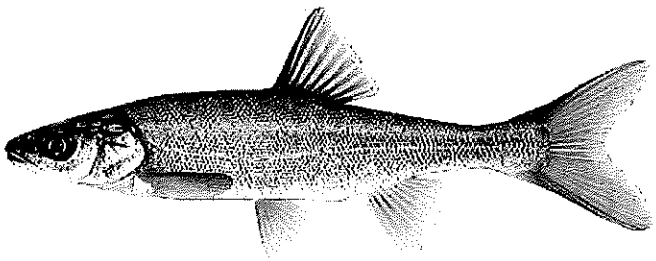
Bubbling Ponds Hatchery is located approximately 10 miles south of Sedona and 10 miles north of Cottonwood off Highway 89A on the Page Springs Road. The hatchery was purchased by the Arizona Game and Fish Commission in 1954 and has remained in operation for over 60 years. There are 17 outdoor pond basins, but only 13 are in use today. Over the years a variety of fish species has been raised here, but today the hatchery has emphasis on rearing native fishes such as razorback sucker, Colorado pike minnow, and roundtail chub. There is a Research Laboratory on the hatchery to conduct studies on native fish culture and propagation. A variety of fish species are present.



Razorback Sucker: These endangered fish live up to 50 years and grow up to 12 pounds in weight and 3 feet in length.



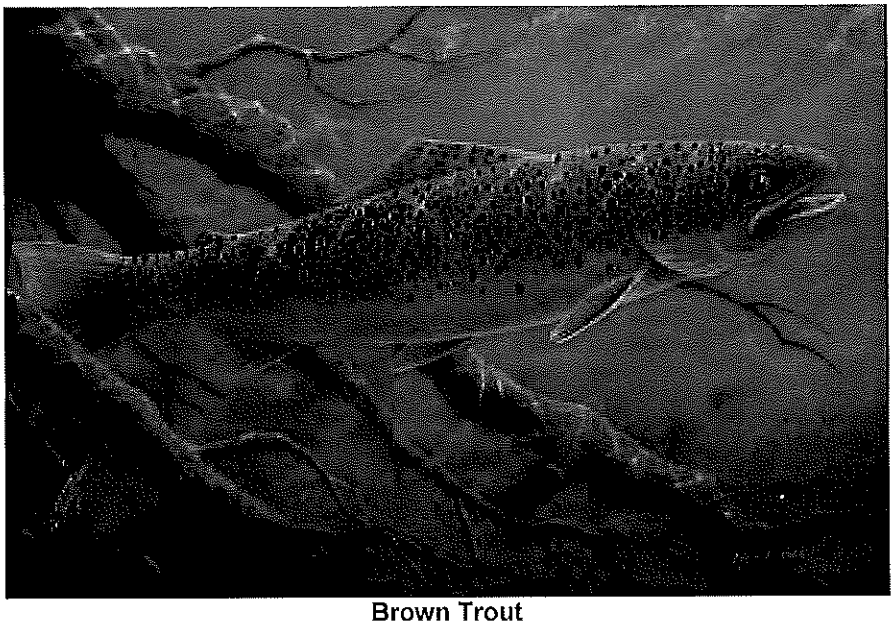
Colorado Pike minnow: These endangered fish live up to 50 years and grow up to 80 pounds in weight and 6 feet in length.



Roundtail chub is a native sportfish in Arizona that grows up to 2 feet in length.

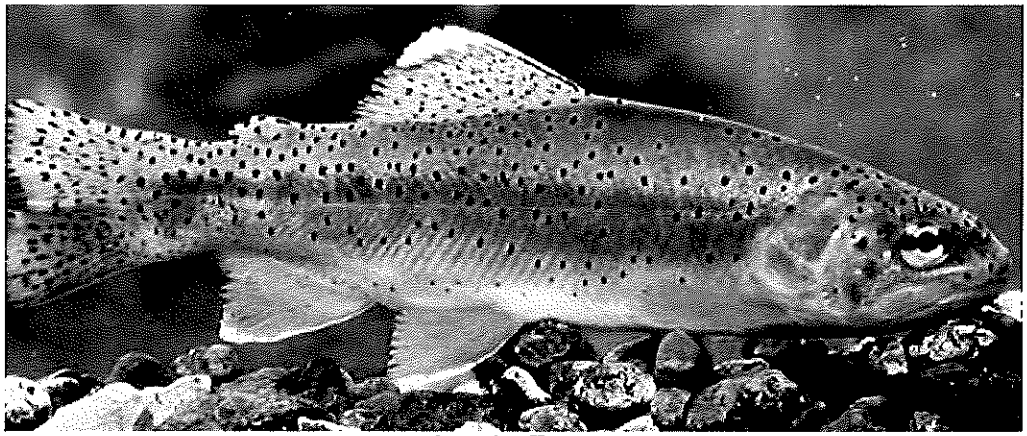
Canyon Creek Hatchery is nestled under the Mogollon Rim in the Tonto National Forest and sits at 6,600 feet in elevation near the headwaters of Canyon Creek. The hatchery is located approximately 45 miles east of Payson on Highway 260. The hatchery raises approximately 240,000 catchable-sized trout and 500,000 to 750,000 fingerlings (3 inches) each year. It is fairly common for this hatchery to have thousands of eggs and small fish in the hatchery building during the spring and summer months. To grow a fish to catchable size takes approximately 24-30 months.

Page Springs hatchery is located on beautiful Oak Creek approximately 10 miles south of Sedona and 10 miles north of Cottonwood off Highway 89A on the Page Springs Road.Page Springs raises more than 600,000 catchable rainbow trout (9.5 inches), 50,000 brown trout of assorted sizes, and around 100,000 rainbow fingerlings each year. Fish from this hatchery are distributed year-round all across the state.Water temperature at this hatchery is unique among trout culture facilities. Normally, trout are cultured in water temperatures between 45 to 55 degrees F. The water temperature from the Cave Spring here is a constant 68 F, with a flow capacity of up to 17 million gallons daily. The warmer water allows for faster growth and it takes about 9-13 months to produce a catchable size fish versus up to 24 months at other hatcheries. However, the water is too warm for transporting trout efficiently, so the hatchery has a giant ice machine capable of making 500 pounds of ice daily to cool down the water in the hatchery stocking trucks.



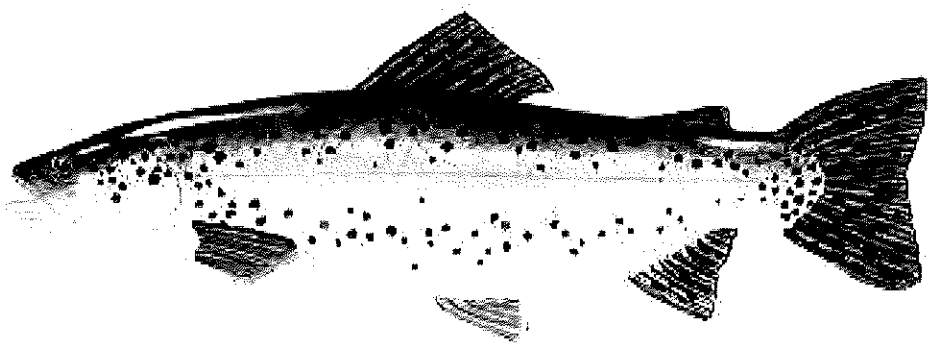
Brown Trout

Silver Creek Hatchery is located east of Show Low about 5 miles on Highway 60. The hatchery is the primary facility for growing & stocking Apache trout, which are one of the state's two native trout species (the other is the endangered Gila trout). The only place Apache trout can be caught in the world is the White Mountains of Arizona. Silver Creek is a small hatchery, producing about 80,000 catchable sized Apache trout each year. Apache trout are stocked into selected streams and lakes in the White Mountains, including Silver Creek, the East Fork of the Black River, West Fork of the Black River, Sheeps Crossing on the Little Colorado River, and the Little Colorado River at Greer.

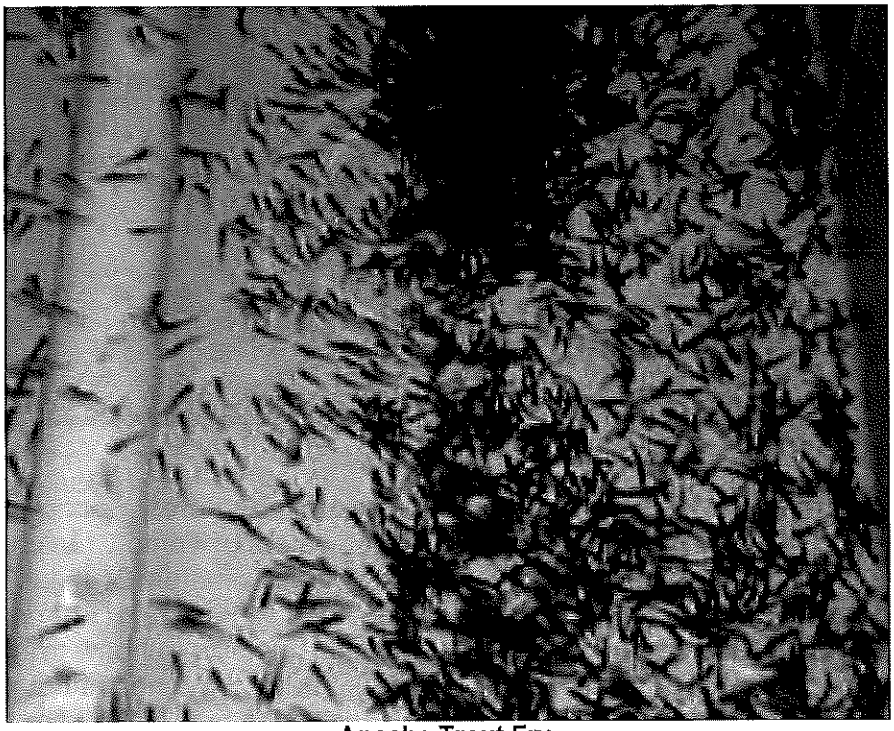


Apache Trout

Tonto Creek Hatchery is located on lands owned by the U.S. Forest Service and has been in operation since 1937. This hatchery near the headwaters of Tonto Creek beneath the Mogollon Rim in the Tonto National Forest is located approximately 21 miles east of Payson off of Highway 260. The hatchery was renovated in 1993 to modernize operations and produces and stocks approximately 140,000 catchable size rainbow trout each year, along with a smaller number of brook trout. Tonto Creek also hatches and annually raises approximately 100,000 native Apache trout to fingerling size before they are transferred to the Silver Creek Hatchery for grow out to catchable size. Apache trout eggs are provided by the U.S. Fish and Wildlife Service.



Rainbow Trout



Apache Trout Fry

E.2 Best Fish Species to Grow for Market Area

The most common aquaponic fish is tilapia which grows well under a wide range of water quality conditions. Other fish adapted to aquaponics but requiring more stringent water conditions than tilapia are largemouth bass, yellow perch, bluegills and koi. Catfish can be grown in aquaponics but would not compete economically with commercial pond culture. Barramundi is a common aquaponic fish species in Australia and also grows under a wide range of conditions but is rarely available in the United States. A brief study of the current state of the consumer and fish industry in Springerville uncovered some facts that are of interest to the study, which have implications for the development of aquaculture.

1. Consumers in Springerville lack awareness of aquaculture. A surprisingly high 75% of consumers have not heard of aquaculture, and do not know the difference between wild and farmed aquaculture products. If given the choice between wild and farmed products, they would choose the wild produce, as it is perceived to be more "natural."

2. In general, Springerville consumers are conservative in their fish choices. They tend to stick to what they know. This is a problem because the Springerville population is somewhat unfamiliar with tilapia.

3. Consumers would like to get more information about the products they purchase, such as whether they were farmed or imported. Consumers indicated a preference for local fish products.

4. Seafood buyers for restaurants, wholesalers, and supermarkets, are familiar with aquaculture products and their positive product characteristics. The buyers expected a larger percentage of the market to be supplied by aquaculture products in the future.

5. Buyers do not distinguish between aquaculture and wild products when deciding upon a purchase, but rather on the basis of required product characteristics, namely, quality, freshness, availability, appearance and price. Generally, the buyers do not know whether a product is of wild or farmed origin.

6. Restaurants and wholesale seafood outlets feature more aquaculture products than supermarkets.

A survey of local restaurants throughout the area, (Molly Butlers, Charley Clarks, Avery's) posed the question whether they would be amenable to purchasing fresh, locally-grown fish, such as tilapia, shrimp, yellow perch and catfish, to offer to their customers. Their responses reflected their present menu items. Molly Butlers would be interested, inasmuch as fish appear on their menu. Avery's, a BBQ restaurant, and Charley Clarks, a steakhouse, were not interested adding fish to their menus, even if it was locally-produced.

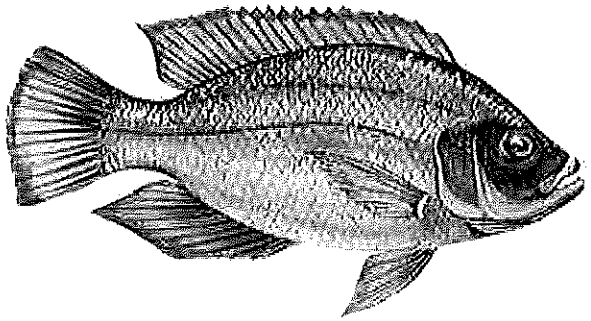
Within the Round Valley area, two restaurants (Safire and Trail Riders) and the American Legion sponsor an all-you-can-eat fish fry at least once a week. These events are quite popular, and the places are packed with customers, so the local community definitely enjoys an all-you-can-eat fish fry. They all offer catfish as the fish, which they purchase from Shamrock Foods, a wholesaler. The fish come frozen and pre-breaded, so the cooks merely pull it out of the bag and drop it in the deep fryer. When the owners of Trail Riders and Safire were asked if they had the option of buying locally-grown, fresh fish would they be interested in this to offer at their fish fries, they both gave the same answer. Yes, if the total price (price for fish and additional preparation time) was competitive. Both remarked that they would be able to charge more per plate for locally-grown fish. On the fish fry nights, they serve 60-80 customers, and each plate contains 3-4 pieces of fish. Research indicates that prices range from $4.29 - $6.48 per pound for catfish fillets and $5.49 - $7.41 per pound for Tilapia.

A recent survey of local residents revealed that 75% of the respondents would purchase fresh, locally-grown fish, if they had access to it. The other 25% said they have never had access to this type of product, but if they knew how to prepare it, they would buy it.

E. 2.1 Tilapia

Tilapia is one of the most popular fish for aquaponics. The reason is that they are considered the 'chicken' of the fish world. By that is meant that they typically enjoyed by everyone when it comes to eating. Along with the tastiness, they also are a fairly easy fish to maintain. Tilapia grow fast, breed easy and they can withstand poor water conditions.Tilapia enjoys warmer waters, thriving best in 82F-86F. They are not always a good option for colder locations, because keeping the water warm is always a battle and requires more energy. In Springerville, it is not possible to have water at these temperatures throughout the year without adding heat energy, which increases the cost of production. Temperatures too low or too high will stress the fish, reduce feeding behavior, and make the fish more vulnerable to disease. Large variations in temperature also cause stress for the fish. For this reason, temperatures should remain constant, and should remain within the correct temperature range.

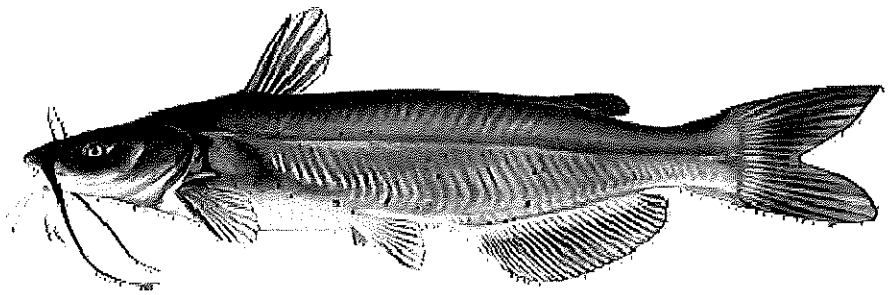
Tilapia is rapidly becoming one of the most popular seafoods in the United States with the National Marine Fisheries Service ranking it the fifth most consumed seafood. In fact, American's annual consumption of tilapia quadrupled over 4 years, from a quarter pound per person in 2003 to more than a pound in 2010. Researchers predict tilapia is destined to be one of the most important farmed seafood products of the century.



Tilapia

E.2.2 Catfish

Channel catfish are the most common for aquaponics systems. It is the official fish of Missouri, Iowa, Nebraska, Kansas and Tennessee. It is the most fished catfish species in the United States. These fish are bottom dwellers that avoid the surface of the water. Studies have shown success when the catfish are combined with other fish, as it is noted that catfish only take up the bottom 20% of the tank. Like tilapia the catfish can handle a wide range of temperatures. However, they prefer 77F-85F to thrive.



Channel Catfish

Channel catfish can be classified in one of four groups while at an aquaculture facility: brood fish—the fish that produce offspring; fry—the newly hatched fish; fingerlings—young catfish; and marketable fish. Commercial catfish monoculture makes up half the value of aquaculture in Southern states and averages 2,000 pounds of fish per acre. Catfish are usually marketed when they are about 18 months old, after they have reached between 1 and 1 1/2 pounds. The life of a farm-raised catfish begins with the careful selection and mating of two genetically superior catfish. Once eggs are laid and fertilized they are placed in controlled hatching tanks. Their water and food are monitored around the clock. After 18 days the baby catfish are strong enough to be transferred to the outdoor ponds. Varying in size from five to 20 acres, these ponds are four to five feet deep and are fed by a flow of cool water. The young fish are fed twice daily. Their food is made from soybeans, corn,

wheat and fish meal. When they are ready for harvest, the catfish are seined out of ponds (caught with nets) and placed in aerated tank trucks for live shipment to the processing plant.

Catfish can be grown in aquaponics but would not compete economically with commercial pond culture.

E.2.3 Yellow Perch

The yellow perch (Perca flavescens) is a species of perch found in the United States and Canada and is an extremely popular fish to raise in aquaponics especially in colder climates. Yellow perch look similar to the European perch but are paler and more yellowish, with less red in the fins. They have 6-8 dark vertical bars on their sides. The yellow perch is in the same family as the walleye and sauger, but in a different family from the white perch. Perch are one of the finest flavored of all panfish.

Yellow perch size can vary greatly between bodies of water, but adults are usually between 4-10 inches in length. The perch can live for up to 11 years, and older perch are often much larger than average. The maximum recorded length is 21.0 inches, and the largest recorded weight is 4.2 lbs. Large yellow perch are often called "jumbo perch".

Yellow Perch reach sexual maturity at one to three years of age for males and two to three years of age for females. Spawning occurs at the end of April or beginning of May, depositing 10,000 to 40,000 eggs upon weeds, or the branches of trees or shrubs that have become immersed in the water. After fertilization, the eggs hatch in 11 to 27 days depending on temperature and other weather conditions.

Yellow Perch

Primarily, age and body size determine the diet of yellow perch. Zooplankton is the primary food source for young and larval perch. By age one, they shift to macroinvertebrates such as midges and mosquitoes. Large adult perch feed on invertebrates, fish eggs, crayfish, mysid shrimp, and juvenile fish. They have been known to be predominantly piscivorous and even cannibalistic in some cases. About 20% of the diet in a yellow perch over 32 grams (1.1oz) in weight, consists of small fish.

Maximum feeding occurs just before dark, with typical consumption averaging 1.4% of their body weight. Their microhabitat is usually along the shore among reeds and aquatic weeds, docks, and other structures. They are most dense within aquatic vegetation since they naturally school, but also prefer small weed filled water bodies with muck, gravel, or

sand bottoms. Perch are commonly active during the day and inactive at night except during spawning when they are active both day and night.

Yellow perch spawn once a year in spring using large schools and shallow areas of a lake or low current tributary streams. They do not build a redd or nest. Spawning typically takes place at night or in the early morning. Females have the potential to spawn up to eight times in their lifetime. Two to five males go to the spawning grounds first and are with the female throughout the spawning process. The female deposits her egg mass, and then at least two males release their milt over the eggs with the total process taking about five seconds. The males stay with the eggs for a short time, but the females leave immediately. There is no parental care provided for the eggs or fry.The average clutch size is 23,000 eggs, but can range from 2,000 to 90,000. The egg mass is a jelly-like mass that is semi-buoyant and can reach up to two meters long. The egg mass attaches to some vegetation while the rest flows with the water current. Other substrate includes sand, gravel, rubble and submerged trees and brush in wetland habitat. Yellow perch eggs are thought to contain a chemical in the jelly-like sheath that protects the eggs and makes them undesirable since they are rarely ever eaten by other fish. The eggs usually hatch in eight to ten days, but can take up to 21 days depending upon temperature and proper spawning habitat. Spawning occurs in the spring when water temperatures are between 6.7°C and 12.8°C. Growth of fry is initiated at 6°C-10°C, but is inactive below 5.3°C. Larval yellow perch survival is based on a variety of factors such as wind speed, turbidity, food availability, and food composition.

Yellow Perch can tolerate much lower water temperatures than Tilapia, which is appealing from an energy savings point of view. On the other hand, Tilapia breeding seems to be more reliable and involve less time and labor. Tilapia are more prolific breeders (up to every 5 weeks), whereas Yellow Perch breed once per year. To induce spawning in Tilapia requires the same temperatures as for grow out (low 80s). However, Yellow Perch need a prolonged period of cold (45 degrees) and then a change in photoperiod to simulate winter coming into spring in order to spawn. For both species, you would move breeding pairs into a smaller, separate tank, probably with a substrate for putting eggs on, and let them breed. Female tilapia will put fertilized eggs in mouth, and after the eggs hatch and reach fry stage, they won't need to be in her mouth anymore, at which point the female can be removed from the breeding tank. Yellow Perch females just deposit their eggs, so they can be removed from breeding tank once the eggs have been laid and fertilized. After hatching, the Tilapia are easier to raise, as the fry can eat commercial powdered food, but Yellow Perch fry need some live food, such as algae and zooplankton, and a controlled photoperiod. Finally, Tilapia can grow faster and larger than the Yellow Perch. Tilapia can grow up to 1.5-2lbs in a year. Yellow perch will grow only 1/3 of a pound in a year.

The yellow perch is a highly valued food fish in the north-central region of the United States. Commercial harvests of yellow perch from the Great Lakes and Canada fail to keep pace with market demands. Fillets have a high retail market value, at times exceeding $18 per pound. High consumer demand continues to drive commercial and research interest. The costs of transporting the product to the Great Lakes region would make it economically noncompetitive with locally-grown yellow perch.

E.2.4 Shrimp

Shrimp is the largest single seafood commodity by value, accounting for 17% of all internationally traded fishery products. Approximately 75% of production is from

aquaculture. Commercial production of freshwater shrimp or prawn (Machrobrachium rosenbergii) has been the subject of research and commercial enterprise in the United States for several decades. This species is native to the tropical Indo-Pacific region of the world. Basic production techniques were developed in the late 1950s in Malaysia, and in the United States, Israel, and several Asian countries during the last three decades. The U.S. imports about 90 percent of the shrimp it consumes, with a value of about $4 billion annually.

Giant river prawns live in turbid freshwater, but their larval stages require brackish water to survive. Brackish water or briny water is water that has more salinity than fresh water, but not as much as seawater. It may result from mixing of seawater with fresh water. Technically, brackish water contains between 0.5 and 30 grams of salt per liter—more often expressed as 0.5 to 30 parts per thousand (ppt). Thus, brackish covers a range of salinity regimes and is not considered a precisely defined condition.

Macrobrachium rosenbergii, are rapacious cannibals. They need to molt approximately 11 times in the month when they are doing most their growing, and every time one of them casts off its armor, its soft, unprotected body is exposed, which makes it extremely vulnerable to other larger shrimp, which become its predators. Because of predation and cannibalism, a 50 to 60% survival rate is pretty standard. It is difficult to compete with imports from the exploding Asian aquaculture industry on price. Frozen imports from Malaysia and Southeast Asia cost about $2 a pound — half the cost of production here in the US. Instead of competing on price, US shrimpers are marketing freshness and local, safe production. As the biggest importer of shrimp (including the farmed freshwater variety), the U.S. has an interest in encouraging a domestic supply. Federal agencies like the National Oceanic and Atmospheric Administration are funding the development of new types of feed that alleviate the need for fish meal as a protein source. Some of these feeds depend on corn and soy, which this year may be an expensive addition to the supply chain.

1. Their ideal water temperature is 76-88F, the same as tilapia.
2. They eat a pellet food and also the waste from other fish like tilapia.
3. They grow in freshwater, same as tilapia, except in the larval stage.
4. Shrimp are territorial, so levels of netting are placed in the tank allowing for space.
5. They like a hard water which is compatible with Springerville's water type. Shrimp in an aquaponic system are best grown with fish, because shrimp don't produce enough waste for the plants. They do not produce enough waste, because they cannot be grown in the same high density as fish. However, shrimp are good at using waste and breaking down waste and uneaten food from fish.
6. It is important to note that in aquaponic systems using the floating raft technology to grow vegetables, shrimp can be segregated from the fish tanks and grown under the floating plant beds, thus protecting them from predacious fish in the tanks.

Giant Shrimp Grown Aquaponically

Recently, a patent-pending technology, known as super-intensive stacked raceways, was created by Dr. Addison Lawrence at the Texas AgriLife Research Mariculture Laboratory at Port Aransas, who says the system is able to produce record-setting amounts of shrimp."We're able to produce jumbo size shrimp, each weighing 1.1 ounces, known as U15 shrimp, which gives us world record production of up to 25 kilograms of shrimp per cubic meter of water using either zero water exchange and/or recirculating water," he said.At this rate of production, Lawrence said commercial shrimp producers will have the potential to vastly increase their profit margins. Also of significance is that this technology will allow shrimp farms to be built inland in proximity to major metropolitan areas and provide live, fresh-dead and fresh-frozen shrimp on a daily basis. Lawrence said based on high growth rates and high survival and production levels, economic data shows an estimated rate of return of 25 to 60%. (*http://phys.org/news/2011-09-shrimp-technology-world.html*)

There are two major challenges with growing freshwater shrimp:

1. Very low survival rate due to cannibalism and territorialism.

2. Early mortality syndrome (EMS), an emerging shrimp disease EMS first reported in China in 2009. EMS outbreaks typically occur within the first 30 days after stocking a newly prepared shrimp pond, and mortality can exceed 70%. The cost of disease in shrimp

farming has been estimated at $3 billion US dollars annually, representing up to 40% of the total production capacity of the industry. (*http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2878170/*)

E.3 Growing Indigenous Plants/Trees for Reforestation

Indigenous trees and plants can be used in numerous situations and can be grown in an aquaponics or aquaculture system. Reforestation is the natural or intentional restocking of existing forests and woodlands that have been depleted, usually through deforestation. Reforestation can be used to improve the quality of human life by soaking up pollution and dust from the air, rebuild natural habitats and ecosystems. It can mitigate global warming, since forests facilitate biosequestration of atmospheric carbon dioxide. Planting any kind of tree to produce more forest cover will absorb more carbon dioxide from the atmosphere. However, a genetically modified tree specimen might grow much faster than any other regular tree. Some of these trees are already being developed in the lumber and biofuel industries. These fast-growing trees would not only be planted for those industries but they can also be planted to help absorb carbon dioxide faster than slow-growing trees.

There are many species of indigenous plants in the region. Each variety has its own peculiar sensitivities, and these impact the design of the aquaponic system. For instance, some plants cannot tolerate continual flow of effluent from the fish tanks, because they are adapted to arid regions where rainfall is limited. These would not thrive in a hydroponic set-up, where effluent from the fish tanks was continuously flowing to their roots. Some plants are overly sensitive to higher ammonia concentrations found in fish effluent, and these would require system modifications to dilute the ammonia levels to a range the plants could tolerate. Some plants require a PH level in the acidic range and others in the alkaline range, making regular adjustments necessary. Some plants are susceptible to disease and fungal infections at higher humidity levels, mandating systems for dehumidification. Some plant varieties need certain controlled additions of micronutrients common to their adapted environments in the wild.

Growing trees. There is very little literature on this topic, because the emphasis in the industry has been on growing food crops. Some research has been performed related to tropical citrus and banana trees. Theoretically, there should be no reason trees, such as conifers, for instance, cannot be grown in an aquaponics system, as long as the particular nutritional needs of the tree are met. Trees cannot survive in systems providing a continual flow of water over their roots, as many food crops can. If it is determined that a viable market exists for trees, a greenhouse environment would be appropriate, using effluent directed to the roots on an intermittent basis to avoid flooding the roots.

The Apache Sitgreaves forest buys seedlings only on an as-needed basis. They do not have a typical spring planting rotation as some forests do. They purchase in situations such as after a forest fire or forest kill from insects. All products are bid through a competitive bid process, and the seeds are supplied by the US Forest Service. Research in the Fed Biz Opps website, the federal vehicle to announce all solicitations for products and services, revealed that federal agencies do not often or regularly solicit tree seedlings or indigenous plants. One current combined synopsis from the Kaibab Ranger District seeks 140,000 seedlings. The US Forest Service will provide the seeds, and the contractor plants them and grows them to a height of 8"-14". This is the only opportunity listed for the last 365 days in Arizona or New Mexico. An awarded contract for long leaf pine seedlings to a farm in Georgia last year was for 605,000 seedlings, and the contract price was

$112,167.00. This price computes to only $.19 per seedling. There are no General Services Administration schedules listed for tree seedlings.

If three acres of the airport property was set aside to grow seedlings, a total of 120,000 seedlings could be grown (40,000 per acre). At $.19 each, gross revenue would amount to only $22,800, against which operating costs would need to be deducted. This would not be a very profitable venture.

Federal agencies cannot be counted upon as a reliable and regular customer for indigenous tree seedlings or plants.

E.4 Growing Food Crops

Any plant commonly grown in hydroponic systems will adapt to aquaponics including the most common types – leafy salad crops, herbs, tomato, pepper, and cucumber. The number of plants you can grow is directly related to:

1. The number of fish
2. The size of the fish
3. The amount of fish food added daily

Scientists at the University of the Virgin Islands have determined that for each 2 to 3 ounces of fish food added per day, you can support 1 sq. meter of plants in raft aquaponics. For growth, the fish are fed at 3% of their estimated body weight per day.*http://www.uvi.edu/research/agricultural-experiment-station/aquaculture-home/default.aspx*

Plants that will do well in any aquaponic system:

- any leafy lettuce
- bok choy
- kale
- swiss chard
- arugula
- basil
- mint
- watercress
- chives
- most common house plants

Plants that have higher nutritional demands and will only do well in a heavily stocked, well-established aquaponic system:

- tomatoes
- peppers
- cucumbers
- beans
- peas
- squash
- broccoli
- cauliflower
- cabbage

These are of the other crops successfully grown in aquaponics:

- bananas
- dwarf citrus trees: lemons, limes and oranges
- dwarf pomegranate tree
- sweet corn
- micro greens
- beets
- radishes
- carrots
- onions
- edible flowers: nasturtium, violas, orchids

Vegetables usually account for the majority of income in aquaponic systems. This is due to the fact that it is possible to have multiple harvests in a year for vegetables, while you can usually count on only one harvest of fish in a year. For instance, it takes approximately 10 months to grow tilapia to the market size of 1 ½ pounds. It is possible to have 9 harvests of lettuce in a year's time. The United States Department of Agriculture (USDA) provides current wholesale price market commodity reports (*http://www.ams.usda.gov/AMSv1.0/*) under their market news link. However, due to the increased expense of producing aquaponically compared to field grown production, targeting niche markets such as restaurants, high end food stores, farmer's markets, and on-farm sales, where one can get near the retail price, is recommended to get the maximum return. The increased expense of growing aquaponically as compared to field growing is due to the ability to grow year-round in indoor aquaponic systems, while field gardening is limited to the 4-5 month growing season outdoors. We must also factor in the expense of electricity and gas to heat and illuminate the facility, together with the amortized cost of the facility itself.

E.4.1 Best Plant Varieties to Grow for Market Area

Plants that have been successfully raised in Arizona include many types of lettuce, greens, strawberries, beets, carrots, red chard, garlic, marigolds, celery, and a number of types of tomatoes, beans, and peas.

Market data for the current prices charged by wholesale distributors for various herbs and vegetables is in the tables below. Of particular interest is the premium prices commanded by organic produce over conventional produce, in some instances two and three times more. This information is provided through the Rodale Institute *(http://rodaleinstitute.org/farm/organic-price-report-tool/)* and is updated weekly.

Herbs			
Quality	Qty	Certified	Conv
Basil Conventional offerings light			

PQ	1 Dz	$ 12.00	$ 5.00
Chives Conventional offerings light			
PQ	1 Dz	$ 12.00	$ 18.00
Cilantro Organic pricing is for 1 Dz			
PQ	15 Ct	$ 11.00	$ 12.00
Dill Conventional offerings light			
PQ	1 Dz	$ 15.50	$ 6.00
Marjoram Conventional offerings light			
PQ	1 Dz	$ 10.00	$ 6.00
Oregano Conventional offerings light			
PQ	1 Dz	$ 10.00	$ 6.50
Parsley Organic pricing is for 1 Dz			
PQ	15 Ct	$ 11.00	$ 16.00
Rosemary Conventional offerings light			
PQ	1 Dz	$ 9.50	$ 6.50
Sage Conventional offerings light			
PQ	1 Dz	$ 9.50	$ 6.50
Sorrel Conventional offerings light			
PQ	1 Dz	na	$ 6.00
Thyme Conventional offerings light			
PQ	1 Dz	$ 9.50	$ 7.00

Vegetables			
Quality	Qty	Certified	Conv
Artichoke Conventional pricing for 24 ct			
PQ	18 Ct	$ 33.50	$ 28.50
Asparagus			
PQ	11#	$ 39.00	$ 15.00
Avocado: Hass			
PQ	48 Ct	$ 58.00	$ 42.00
Bok Choy Pricing is for baby			
PQ	20#	$ 36.00	$ 18.00
Broccoli			
PQ	14 Ct	$ 31.50	$ 5.00
Cabbage, Green			
PQ	45#	$ 32.50	$ 17.00

Carrots Conventional is for 48X1#			
PQ	24x2#	$ 28.00	$ 37.00
Cauliflower Organic pricing is for 16 ct			
PQ	12 Ct	$ 27.50	$ 15.00
Celery			
PQ	24 Ct	$ 33.50	$ 10.00
Cucumber Conventional pricing is for 55#			
PQ	20#	$ 45.50	$ 24.00
Garlic: Super Col			
PQ	30#	$ 115.00	$ 59.00
Green Beans Conventional pricing for 30#			
PQ	25#	na	$ 34.00
Lettuce: Butterleaf			
PQ	24 Ct	$ 29.00	na
Lettuce: Greenleaf			
PQ	24 Ct	$ 31.50	$ 13.50
Lettuce: Head organic pricing is for 12 ct			
PQ	24 Ct	$ 18.00	$ 13.00
Lettuce: Red Leaf			
PQ	24 Ct	$ 34.00	$ 13.50
Lettuce: Romaine			
PQ	24 Ct	$ 38.00	$ 16.00
Mushroom: Portabella			
PQ	5#	$ 26.50	$ 16.00
Mushroom: Shiitake Pricing is for 5#			
PQ	3#	$ 45.00	$ 28.00
Onions, Green			
PQ	48 Ct	$ 26.00	$ 10.00
Onions, White Med Conventional pricing is for 50#			
PQ	40#	na	$ 28.00
Onions, Yellow Med pricing is for jumbo			
PQ	40#	$ 33.00	$ 32.00
Peas: Snow			
PQ	10#	$ 41.00	$ 13.00
Peppers: Bell, Green Med Conventional pricing for 28#, large			
PQ	25#	$ 37.00	$ 23.00
Peppers: Bell, Yellow, Med conventional pricing is for extra large			

PQ	11#	$ 30.50	$ 19.50
Peppers: Jalapeno Conventional pricing is for 40#			
PQ	10#	$ 36.50	$ 26.00
Potato: Red A			
PQ	50#	$ 46.00	$ 26.50
Potato: Yukon Gold Baker A			
PQ	50#	$ 39.50	$ 29.50
Potatoes: Russet Organic pricing is for 80 ct			
PQ	70 Ct	$ 35.50	$ 15.50
Radish organic pricing for 12 ct; conventional pricing is for 48 ct			
PQ	24 Ct	$ 19.50	$ 16.00
Spinach			
PQ	24 Ct	$ 39.50	$ 13.00
Squash, Winter: Acorn Conventional pricing is for 40#			
PQ	35#	$ 45.00	$ 14.00
Squash, Winter: Butternut Conventional pricing is for 40#			
PQ	35#	$ 46.00	$ 16.00
Squash, Winter: Spaghetti Conventional pricing is for 40#			
PQ	35#	$ 45.00	$ 14.00
Tomatoes			
PQ	2 Layers 4x5	$ 24.50	$ 13.50
Zucchini Conventional is for 21#			
PQ	20#	$ 39.00	$ 9.50

A survey of some of the restaurants located in our region (Molly Butlers, Charley Clarks, Avery's) disclosed that they would be interested in fresh, locally grown organic produce, if it was available to them and the market price was "competitive." They all are currently buying from wholesalers and not directly from growers, in order to realize cost savings. They mentioned that they would only purchase from a local producer if a consistent, reliable supply could be guaranteed. They would not want to keep switching back and forth from one supplier to another. On average, they use 8-10 heads of lettuce per day, and 4-5 cucumbers per day. They all like the idea of having a local supplier of fresh strawberries. These small quantities would not justify a market limited to restaurants, and would suggest that a farmer's market should be added. A survey of local residents indicated that they would buy locally-grown, organic produce, even if it was priced higher than supermarket pricing. They were concerned for quality. Many expressed a desire that a farmer's market would be established in the Eagar-Springerville area.

F. Advantages of Aquaponic Food Production

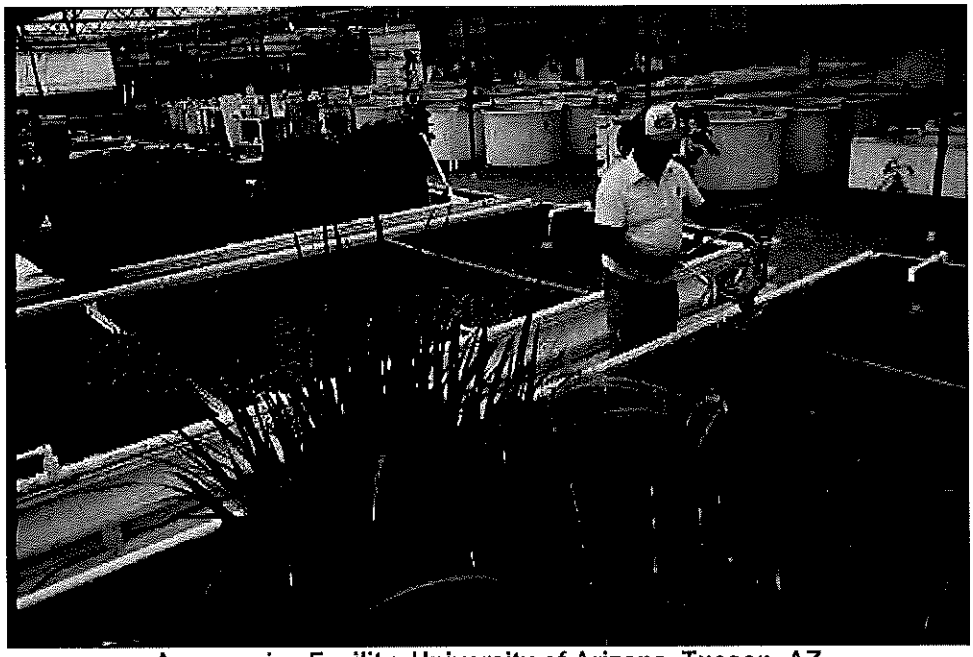
The combination of aquaculture and hydroponics is relatively new, and related research projects are generating very useful information on various aspects of feasibility. The

potential for using aquaponics to grow high quality food around the world is tremendous. Here are some of the many advantages of aquaponic food production:

- Utilizes the nutrient rich water from aquaculture that otherwise would have been a waste product or would need to be filtered in a costly manner.
- Eliminates the cost and time involved with mixing traditional hydroponic nutrients.
- Provides a truly organic, natural form of nutrients for the plants in the form of fish waste.
- Eliminates all soil borne diseases, because no soil is used.
- Uses only 5% of the water that traditional field production does, because no water is wasted, lost to soil infiltration, or consumed by weeds.
- Allows one to grow more plants in a given area through intensive spacing.
- With high stocking densities in the fish tanks, plants will quickly grow and develop.
- Eliminates need for pesticides or herbicides, making the end products healthier and safer, since they are grown in a closed and sheltered facility.
- If growing in a greenhouse, crops can be grown in an aquaponic system year-round. This allows producers to market fresh produce during seasons when trucked-in produce is at their highest seasonal prices.
- Uses approximately 10% of the land area required by conventional vegetable crops.
- Crop production time can be accelerated. For example, butterhead lettuce varieties can be produced in about 30 days, instead of the typical 60-day growing period needed for conventional production.
- Aquaponics is an adaptable process that allows for a diversification of income streams. High-value herbs, vegetables, and leafy greens, as well as fish, crayfish, worms, mushrooms, and a number of other crops may be produced, depending upon local market interest and the interests of the grower.
- These systems allow agriculture to take large innovative steps toward environmental sustainability. Because these are mostly-closed-loop systems, nutrient effluent leaving the facility is virtually nonexistent.
- Fish, plant, and other waste solids may be captured and converted into value-added fertilizer products for wholesale or retail sale.
- Projects can be scaled-up as markets and expertise develop.

G. Technical Feasibility

As stated above, aquaponics is the symbiotic cultivation of plants and aquatic animals in a recirculating environment. The nutrient-rich water produced by the fish effluent, which is water containing uneaten feed, fish wastes, and ammonia, is circulated to grow plants in hydroponic systems. The plants take up the nutrients, reducing or eliminating the water's toxicity for the aquatic animals. The technology has been proven throughout the world.



Aquaponics Facility, University of Arizona, Tucson, AZ

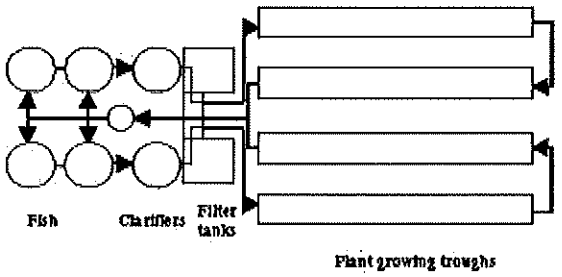
The systems are highly sustainable and can be highly efficient to operate. To create maximum efficiency and the highest return-on-investment (ROI) in a commercial system, energy inputs in terms of lighting for the plants, aeration or oxygenation of the water, and pumps or uplift systems for overall system recirculation, should be carefully considered and reflected in the design of the system. It is easy to build a working system. It is challenging to fine-tune that system for maximum efficiency in terms of:

- Lowest cost
- Lowest human intervention/operation
- Highest sustainability
- Maximum highest quality plant production, and
- Best fish growth rate and health.

The most common aquaponic systems currently in use employ either a media-filled plant bed, nutrient-film technique(NFT), or a floating raft system for the plant growing area integrated with a recirculating aquaculture tank system (RAS) for the fish production area. Almost any type of vegetable production system can be linked to an aquaculture system, including open field production, if recycling water back to the aquaculture unit is not required. However, because of the need for water conservation in Springerville, it is preferable to adopt an aquaponic system that recirculates water in a closed system, rather than one that discharges water out into agricultural fields.

Maintaining the pH of system water between 7.0 and 7.5 is probably the best average pH for the growth of the 3 organisms critical to aquaponics - vegetables, fish, and nitrifying bacteria. The unseen nitrifying bacteria play an important role converting waste ammonia, which is toxic to fish, into nitrate nitrogen, which is not toxic at levels common to aquaponics. They supply the nitrogen, which is the nutrient required in the largest amount by plants. This process of nitrification produces hydrogen ions thus reducing system water pH to unwanted acidic levels. Groundwater in Springerville contains a generous amount of calcium carbonate, which is alkaline. The pH of the water in the system must be continually monitored and adjusted, as necessary, to maintain the optimal reading. Also, ammonia levels must be kept at 1 ppm or less.

Oxygen levels must be maintained at 5 ppm or higher. Fish will die from lack of oxygen due to low aeration in water flow. There must be a backup system of power generation for predictable events causing power outages. The back-up power system must be of sufficient output to maintain water warmth and oxygenation at optimal levels for an extended and uninterrupted period of time. It must also be large enough to heat the facility, maintain pumping and filtration systems, and illuminate the facility during periods of power outages.



Common Aquaponic Layout

It is important to keep light from shining on the nutrient laden water in aquaponic tanks, or algae will form, using up valuable nutrients and reducing water quality. It is best to have non-transparent roofing over the fish tanks to block sunlight and prevent algae growth. Of course, the roofing over the hydroponic vegetable beds should be transparent to take advantage of sunlight during daytime hours.

Nutrients in aquaponic systems are continuously generated through fish waste and mineralization of organic matter. This takes time to establish in new systems. Water nutrient levels can generally be monitored using soluble salt meters. This measure will not tell you what type of nutrients are in the water, only the total electrical conductivity. Calcium, potassium, and iron are not found in adequate amounts in fish feed and so must be added separately as nutrients, depending upon their level of occurrence in the groundwater.

With regard to system sizing, the most researched aquaponic system is located at the University of the Virgin Islands (conducted by Dr. James Rakocy). It utilizes a recirculating system linked to a hydroponic floating raft system. Under those conditions, the ratio of hydroponic tank surface to fish tank surface area was 7.3:1. System sizing was based on the feeding rate ratio (the fish feed input in grams per square meter of plant growing area per day) which is 60-100 g with the lower end of this range for leafy salad crops and the higher end for fruiting crops like tomato. The amount of feed should be about 1-3% of fish

body weight per day, with younger fish receiving the higher % and older fish the lower % of feed.

Aquaponics combines the hydroponic production of plants and the aquaculture production of fish into a sustainable agriculture system that uses natural biological cycles to supply nitrogen and minimizes the use of nonrenewable resources, thus providing economic benefits that can increase over time. Critical management requirements (water quality maintenance and biofilter nitrification) for aquaculture need to be integrated with the hydroponics to successfully manage intensive aquaponic systems. Challenges to sustainability center around balancing the aquaponic system environment for the optimum growth of three organisms, maximizing production outputs and minimizing effluent discharges to the environment. The advantages of linking crop production and the culture of fish are shared startup, operating, and infrastructure costs; recirculating tank waste nutrient and water removal by vegetable plants, thus reducing water usage and waste discharge to the environment; and increased profit potential by simultaneously producing two cash crops (*Diver and Rinehart, 2010; Rakocy, 1999; Timmons et al., 2002*). Properly designed and well-managed hydroponic and aquaculture systems may be considered environmentally responsible alternatives to field-grown vegetable production and wild-caught fisheries (*Lim and Webster, 2006; Smither-Kopperl and Cantliffe, 2004; Timmons et al., 2002*). When these systems are combined, aquaponics closely fits the definition of sustainable agriculture because it combines the production of plants and animals, integrates nutrient flow by natural biological cycles (nitrification), and makes the most efficient use of nonrenewable resources (*Gold, 1999*).

Nitrogen budgets for conventional field-grown vegetable crops are often formulated with the knowledge that a portion of these inputs may be lost to the environment through leaching and runoff. As a result, farmers are under pressure to reduce or eliminate nutrient-laden water discharges to the environment. Integrating nutrient flows between aquaculture and hydroponic systems turns a waste stream into a crop production asset. Fertilizer costs can range from 5% to 10% of total crop production expenses because of the large amount of fossil fuels needed for the manufacture of fertilizer (*Hochmuth and Hanlon, 2010*). It is possible to produce most of the nutrients needed to grow crops in aquaponic systems through integrated nutrient flows with the initial input being fish feed, although some supplementation with specific plant nutrients such as calcium (Ca^{2+}), potassium (K), and iron (Fe) will be required to maximize crop yields (*Rakocy et al., 1997*). Plants' uptake of NH_4^+ and NO_3^-, as well as other recirculating system nutrients like P, reduces the waste stream in aquaponics and turns an environmental liability into a biologically produced crop production asset.

H. SWOT ASSESSMENT OF AQUAPONICS

Positive	Negative
STRENGTHS	***WEAKNESSES***
Great publicity/marketing value – locally-grown, environmentally-responsible	Consumers willing to pay potentially higher prices?
Environmentally friendly	Challenge to keep system in balance
Efficient use of water	Requires hardy fish stock
Diversified venture with two profit centers from fish and vegetables	Heavy feeders & other production requirements
High production volume	Cold weather much of year
Controlled environment	Major start-up investment

Variety of marketing channels	Marketing requirements are high
Proven technology	Rural distribution system
	Aquaculture & greenhouse production – two highly technical operations
OPPORTUNITIES	*THREATS*
Development of regional cuisine	Tilapia not part of our culture
Establish farm direct sales	Food desirability
Remarkable growth in organic and natural markets	High-value fish means high development costs
Make more healthy eating choices	Food safety & product liability issues
Worldwide demand increasing for tilapia	Wild vs. farmed fish debate
Specialty vegetable & herb market	High & rising energy costs
Potential for agri-tourism	Disease
Ecological energy alternatives	Increasing transportation costs
High value niche markets	
Branding opportunity	
Grants and tax incentives	

I. Suitability of Site

Aquaculture and aquaponic facilities are generally not found or expected to be found at an airport. However, in 2011, Chicago's O'Hare Airport opened an aeroponics facility to grow vegetables for its restaurants, and it currently helps feed 10,000 or so travelers every year. (*http://www.treehugger.com/sustainable-agriculture/vertical-garden-feeds-10000-visitors-chicago-ohare-airport.html*)

Ensuring compatible land use near federally obligated airports is an important responsibility and an issue of federal interest. In effect since 1964, Grant Assurance 21, *Compatible Land Use*, implementing Title 49 United States Code (U.S.C.) § 47107 (a) (10), requires, in part, that the sponsor:

> *"...take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft. In addition, if the project is for noise compatibility program implementation, it will not cause or permit any change in land use, within its jurisdiction, that will reduce its compatibility, with respect to the airport, of the noise compatibility program measures upon which federal funds have been expended."*

Incompatible land use at or near airports may result in the creation of hazards to air navigation and reductions in airport utility resulting from obstructions to flight paths or noise-related incompatible land use resulting from residential construction too close to the airport.

Compatibility of land use is attained when the use of adjacent property neither adversely affects flight operations from the airport nor is itself adversely affected by such flight operations. In most cases, the adverse effect of flight operations on adjacent land results from exposure of noise sensitive development, such as residential areas, to aircraft noise

and vibration. Land use that adversely affects flight operations is that which creates or contributes to a flight hazard. For example, any land use that might allow tall structures, block the line of sight from the control tower to all parts of the airfield, inhibit pilot visibility (such as glaring lights, smoke, etc.), produce electronic aberrations in navigational guidance systems, or that would tend to attract birds would be considered an incompatible land use.

A compatibility issue of concern is the supplemental high intensity metal-halide lighting that would be implemented for the hydroponic greenhouse during the winter season of limited daylight. However, light shading and greenhouse screening should sufficiently ameliorate any glare created, such that no hazard would be presented to pilots.

A greenhouse provides protection from environmental factors such as heat, cold, wind, rain and insect intrusion. In Springerville's climate, a greenhouse is required so that crops can be grown year-round. It must be attached to the indoor aquaculture facility. The topography of the airport site presents no negative indicators for a greenhouse.

Surface water sources are often not available in the arid southwest, and one is not available at the Springerville airport. Therefore, an aquaculture operation at that location will require the use of groundwater. We examined the water quality database called the Groundwater Site Inventory Database (GWSI), published by the Arizona Department of Water Resources. Specifically, water temperature, pH, alkalinity and total dissolved solids data were noted, as each of our cultured species has specific water quality concerns. Water quality requirements are species specific.

Infrastructure data are important for the assessment of a potential aquaculture/aquaponic site because they address the operational viability of a new farm. It is certainly beneficial to have easy access to an adequate labor pool, local markets and power delivery systems Locations of roads and interstates, power transmission lines, railroads and towns with their respective populations should be considered.

In addition to having sufficient supplies of good quality water, an aquaponics site should also:

1. Have a secure power supply which is not subject to lengthy power failures. An on-site emergency generator is essential for any facility and t should be sized so that it has the output necessary to ensure that the most critical components of the facility can continue to function.

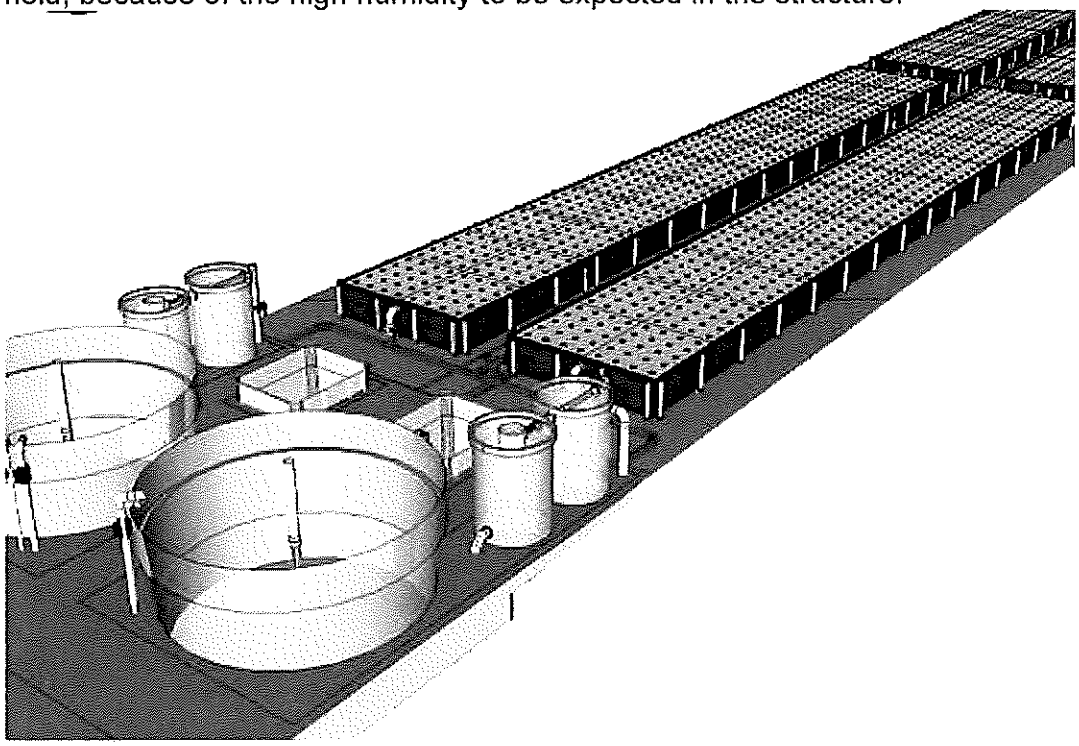
2. Have good all-weather road access for incoming materials and outgoing product.

3. Have access to professional biological assistance from government or other sources.

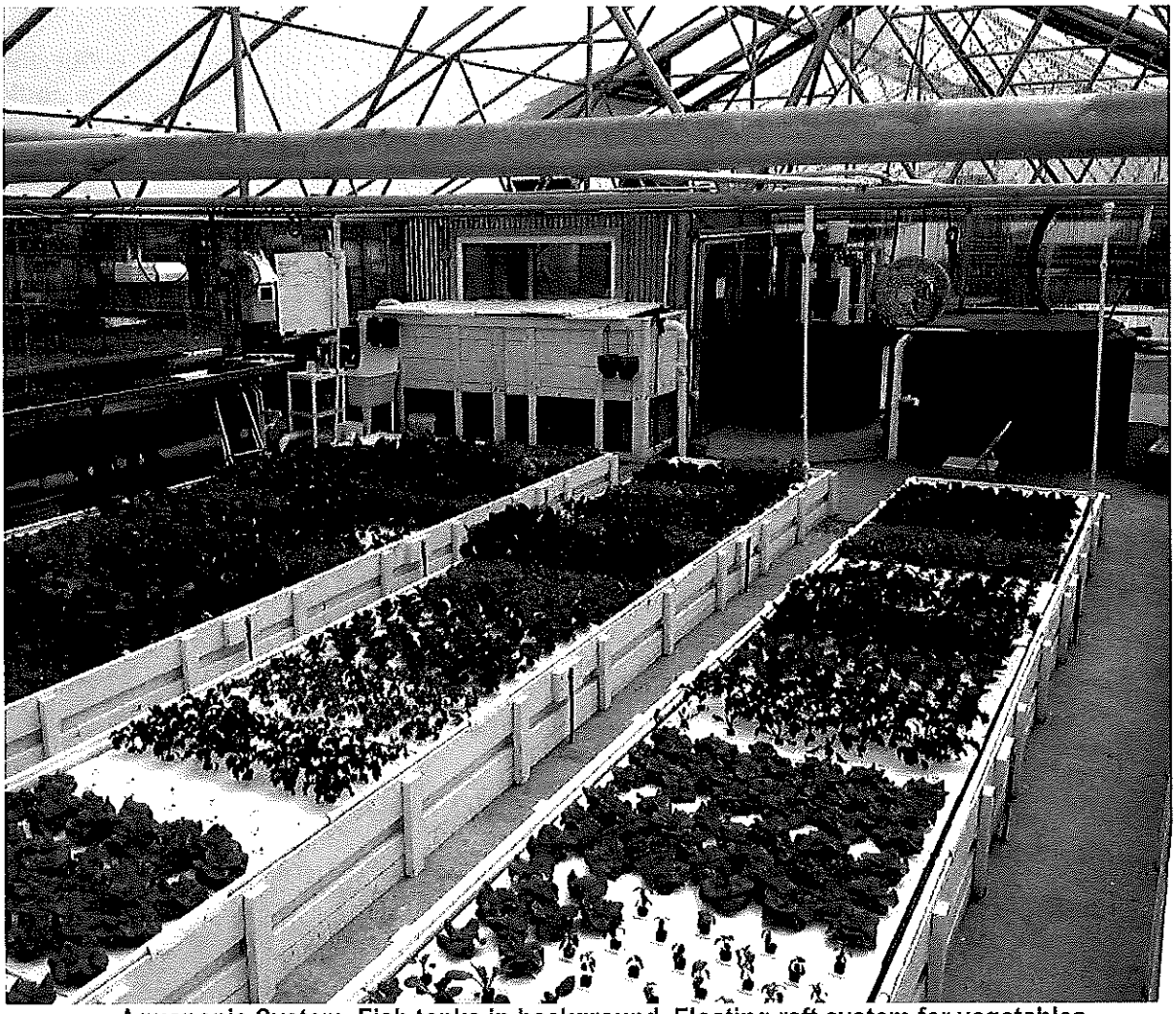
4. Be as close as possible to the market for its products.

J. Design of Facility

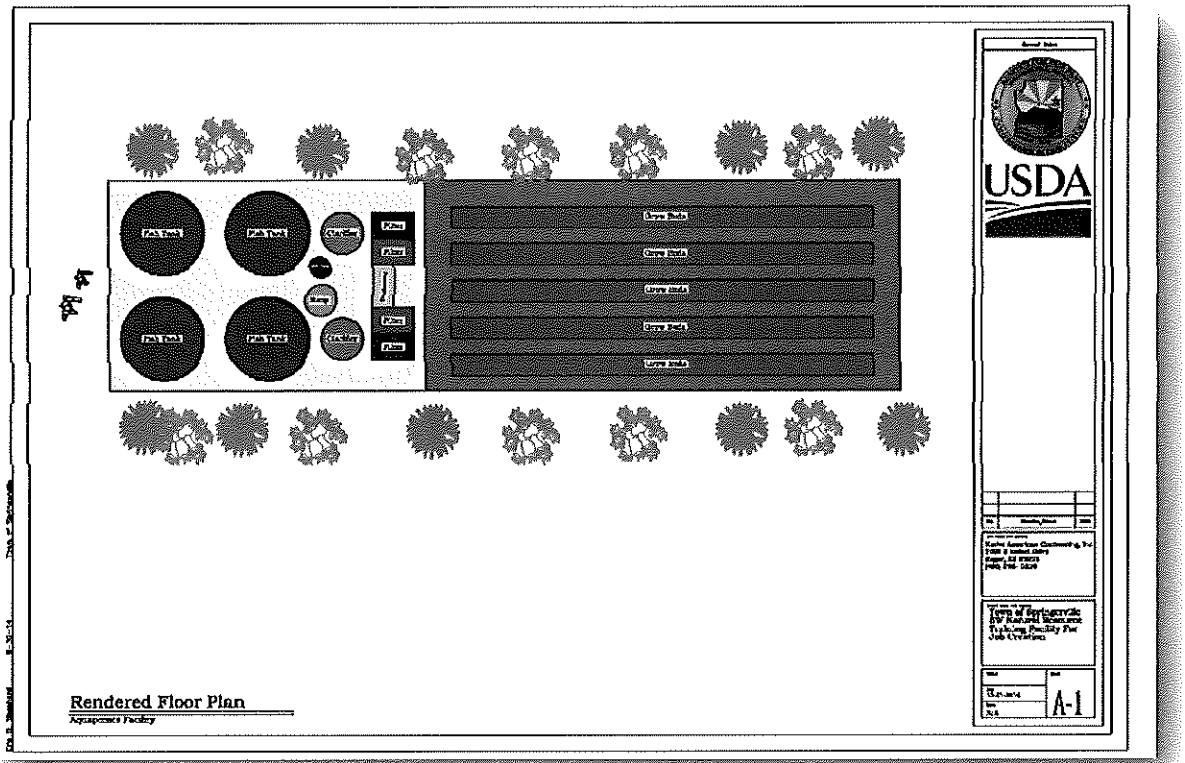
The Town contemplates an aquaponics facility having dimensions of 40 feet in width and 150 feet in length. This would be considered an initial, modest-sized facility, which could be scaled up relative to market size. Approximately 60 feet of length (2,400 square feet) will be dedicated to the fish tanks, filters, degasification tanks, pumps and other equipment. The other 90 feet of length (3,600 square feet) will contain the channels for plant growth. The plant area will look like a typical greenhouse, with transparent roof and walls. It will be attached to the aquaculture structure, which will have opaque roof and walls. Consideration will be given to structural materials that are impervious to rust and mold, because of the high humidity to be expected in the structure.

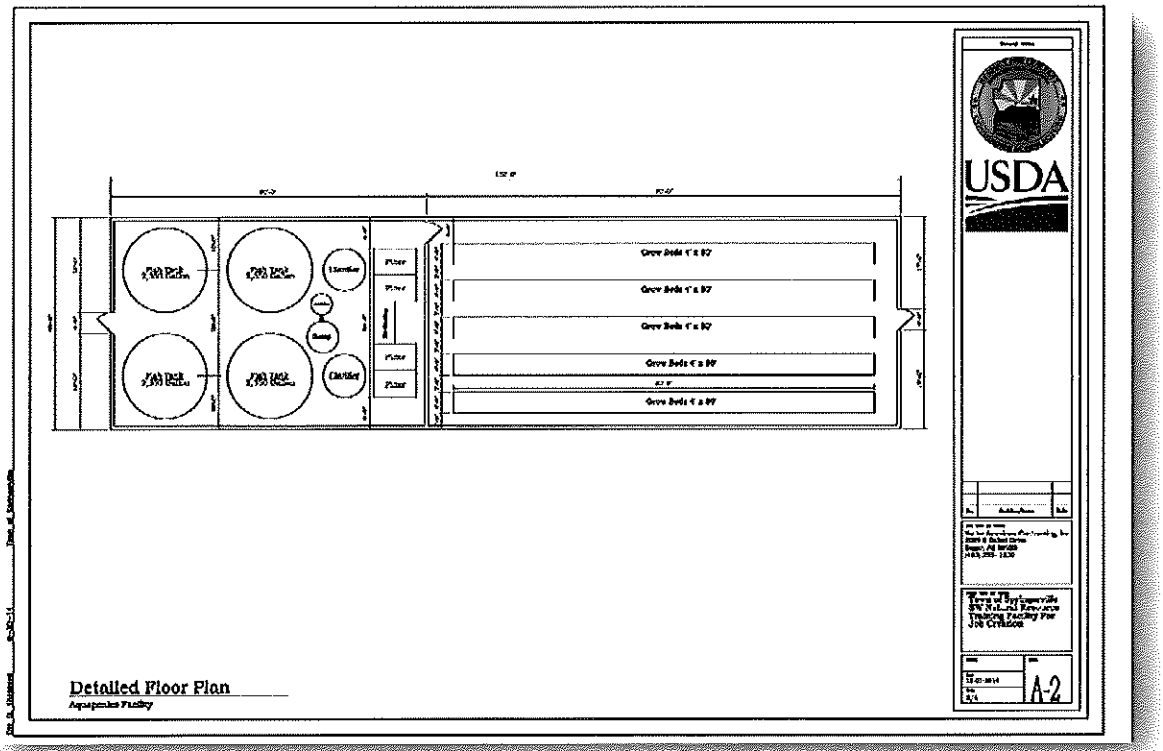


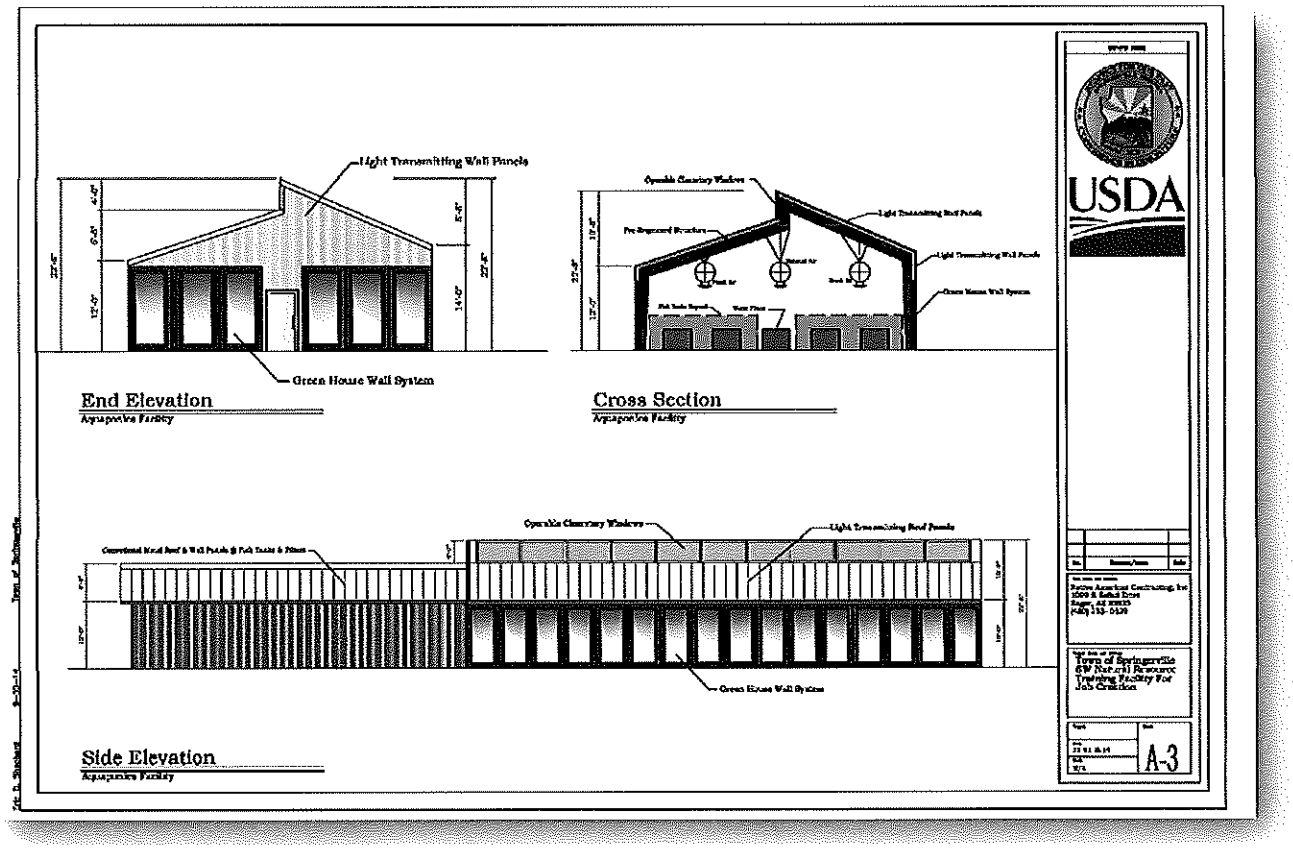
Basic layout of Aquaponic System



Aquaponic System. Fish tanks in background. Floating raft system for vegetables.


USDA
Rendered Floor Plan
A-1


USDA
Detailed Floor Plan
A-2



K. Capital Cost –

The most significant costs related to establishing an aquaponics facility are listed below:

K.1 Building

Building cost based on pre-engineered metal building system, 6,000 sf total (40' x 60' tank area = 2,400 sf, & 40' x 90' plant area = 3,600 sf)
Building materials: $9.25 sf
Building insulation (tank area): $1.25 sf
Building erection / Install: $8.25 sf
Accessories (doors, windows, vents): $3.25 sf
Total sf costs: $22.00 sf
Building package costs $22.00 x 6,000 sf= $36,000

K.2 Town Building Fees

$25,001.00 to $50,000.00 $252 for the first $25,000.00 plus 6.50 for each additional $1,000 or fraction up to $162 (maximum $414)
$50,001.00 to $100,000.00 $414 for the first $50,000, plus $4.50 for each additional $1,000 or fraction up to $225 (maximum $639)

K.3 Electric

Navopache Electric Membership Fee: $25.00
Commercial Establishment Fee: $100.00
New Service Connection to panel: $3,750.00
Total cost: $3,875.00
Added cost for additional poles or underground (Until they have an actual design they cannot give us hard costs) Estimate $25.00 per lineal foot.

K.4 Water Supply

The Town has an existing well on the site proposed for the aquaponics facility. Recently, the Town had the well tested and received a great report. The well is producing 50 - 60 GPM, so water is not an issue at the site. The Town has not pressure-tested the well yet, but will be doing so in the future to determine the need, if any, for a booster pump.

K.5 Fees for the Water Connection

Water Deposit Commercial $75.00
Water Hook-up Rates 2" meter $ 900.00
Water system capacity fee Meter Size (inches) 2.00 Compound/Turbine $ 2,463

K.6 Sewer System

The town sewer system was installed along the access road at the site and has plenty of capacity for the project. The rates for the sewer hook and tap are as follows:

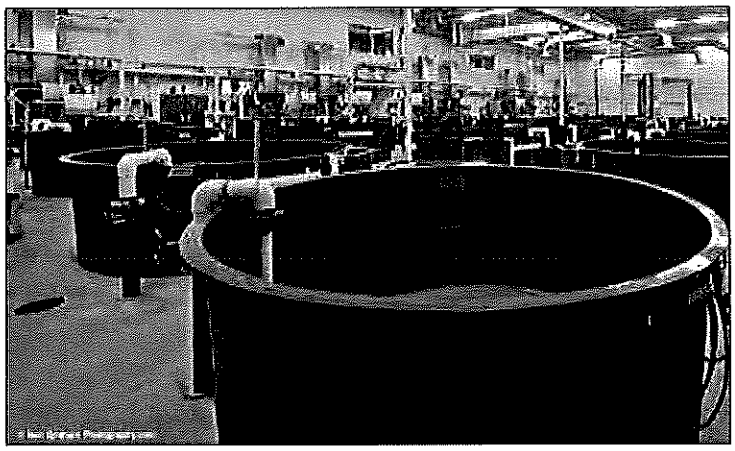
Sewer Deposit Commercial (If Sewer Only) $75.00
Sewer Connection 6-inch Tap $ 750.00
Sewer system capacity fee Water Meter Size (inches) 2.00 Compound/Turbine $10,612.

K.7 Hydroponic Tanks

Initially, there will be 5 hydroponic tanks, each 4' in width and 80' in length. These will run the length of the growing area with 2.5' in between each one. The outer tanks will be 5' from the greenhouse walls on each side. $4,000 each for a total of $20,000

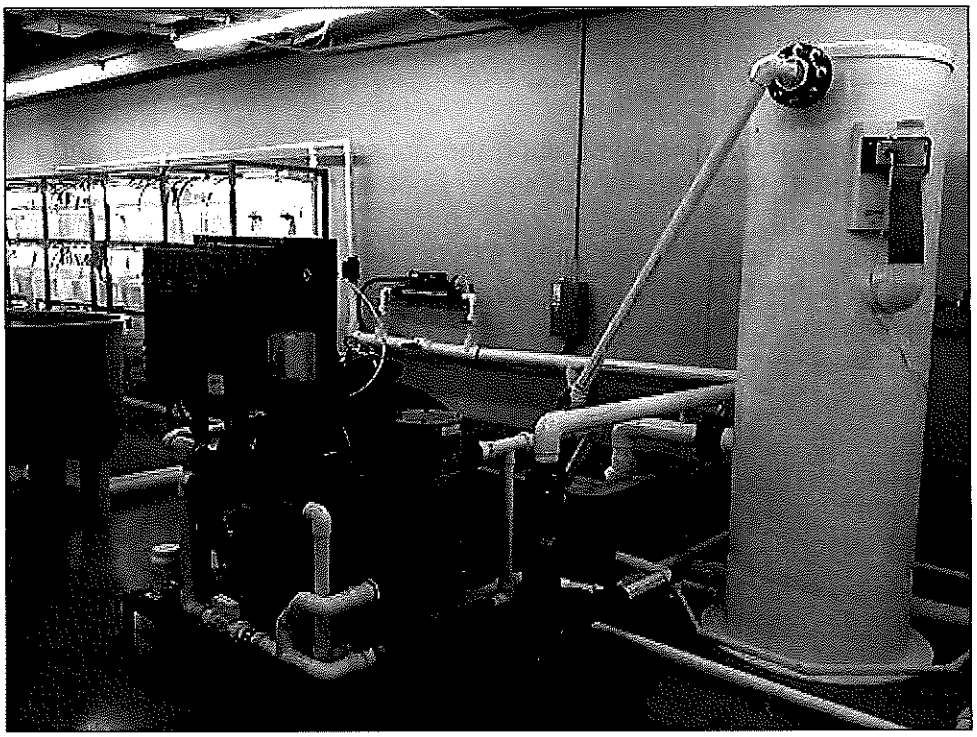
K.8 Aquaculture Tanks

Initially, there will be 4 fiberglass aquaculture tanks, 10' in diameter, 4' deep. Each tank holds approximately 2,350 gallons of water or 314.28 cubic feet. You need one cubic foot of water for each market size tilapia (1 ½ - 2 pounds). Therefore, each tank will hold about 300 full-size tilapia (600 pounds of fish). Each tank will cost approximately $4,695 for a total of $18,780.



Fish Tanks, 2,350 gallons

K.9 Microbead Biofilter



Microbead Bio-Filtration System

Bead filters are a relatively new type of biofilter. They represent the complete solution to water quality for recirculating systems. They consist of a closed vessel partially filled with small beads of plastic. Usually the vessel is filled with water, and the beads float at the top of the vessel. Water flows up through the bed of beads. The beads are small enough to trap most large suspended solids. In addition, the surface of the beads supports the growth of a biofilm. The small size of the beads means that they have a relatively large surface area per unit volume. The larger systems incorporate a mechanical stirring device such as a propeller on a shaft. Periodically the water flow is shut off and the bed of beads is agitated to dislodge the suspended solids. The solids are allowed to settle into the bottom of the vessel and then drained off. This ability to remove suspended solids and act as a biological filter is advertised as the main advantage to bead filters. These solids are a

rich agricultural additive that can be sold as a separate product. The best biofiltration systems should have the following characteristics:

- Small footprint - The biofilter should occupy as little space as possible. It is common to have culture tanks and the biofilters under cover for protection and temperature control. Space allocated for biofilters takes away area that could be used for culture tanks.

- Inert materials of construction - All materials used in the biofilters should be non-corrodible, UV resistant, resistant to rot or decay and generally impervious to chemical attack. In general, marine grade construction materials are required for reasonable working lifetimes.

- Good mechanical strength - The biofilter and its components must be tough enough to withstand the normal wear and tear of an industrial/agricultural environment.

- Low energy consumption - The energy cost (usually electricity) to operate the biofilters should be as low as possible. The largest energy users are the pumps to move water and compressors to move air.

- Low maintenance requirements - The biofilters should be self-cleaning with little or no care required for the normal life of the crop.

- Portability - The biofilters should be easily movable to facilitate changes in operation of the facility.

- Reliability - Ideally the biofilters should have no moving parts that could fail at an inopportune time. If the biofilters does have moving parts, they should be rugged and designed for a continuous operating life of several years.

- Monitorabilty - It should be easy to observe the operation of the biofilter to insure that it is operating correctly.

- Controllability - It should be easy to change operating variables to assure optimum performance.

- Turndown ratio - The biofilters should be able to work under a wide range of water flow rates and nutrient loading levels.

- Safety - The biofilter should not have any inherent dangers to either the crop or the owner/operator.

- Utility - The biofilter should effectively work to remove ammonia, nitrites, carbon dioxide, dissolved organic solids, excess nitrogen and other dissolved gases, and suspended solids, and to add oxygen.

- Scalable - A small system should work the same way as a large system. The performance per unit volume should be constant regardless of the size of the system.

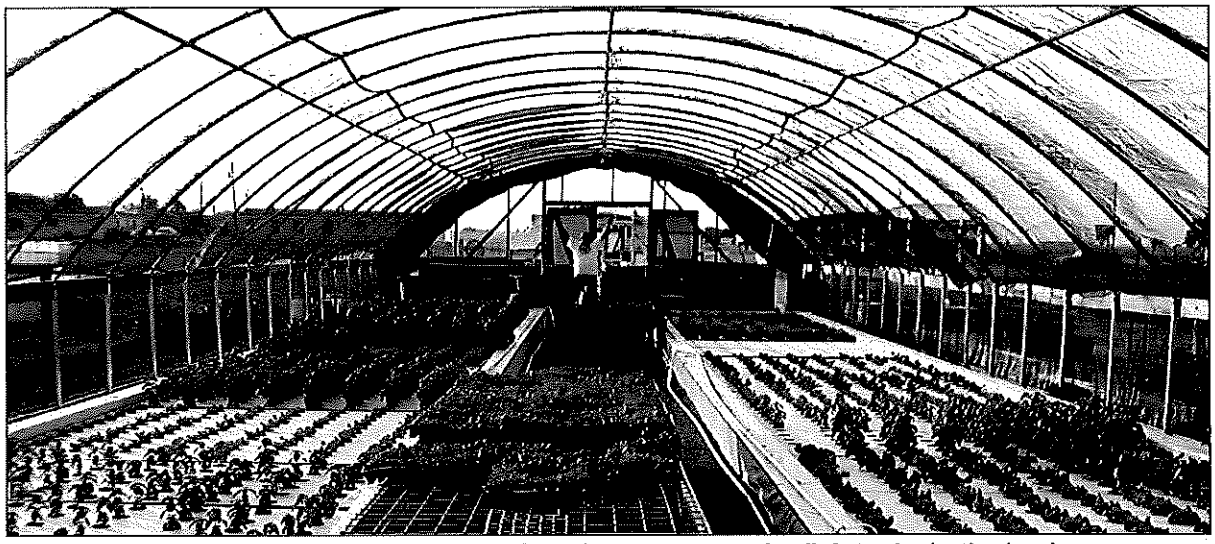
A complete system suitable for the facility would cost approximately $20,000, uninstalled.

L. Operational Cost

There are fixed costs and variable costs of production. Fixed costs are associated with those inputs which do not change over the short run, such as salaries, overhead, insurance and capital expenses. Variable costs are dependent on level of production and will change as stock is increased or decreased. They include juveniles, feed, chemicals, labor, electricity, etc. Operational expenses and potential profitability for alternative culture systems and scales of operation can be calculated by examining these two kinds of costs.

Stock (seed fingerlings, etc.), feed, and labor costs are the most expensive variable costs of an aquaculture operation. It is important to analyze these costs carefully to ensure they are accurate and manageable. Production is limited by the number of organisms stocked. Stocking rates, unit costs, growth and potential mortality of culture organisms should be carefully considered. These values can be evaluated to determine profitability, if higher than expected seed prices or mortalities are encountered.

Most fish production systems require supplemental feeding. Because of the volume and price of feeds, the equipment needed and the labor required, feeds and feeding are costly — up to 40-50 percent of total variable costs. Thus, profitability is often determined by the feeding efficiency. The amount of feed required is determined by feed conversion rates and can be estimated from formulas such as those in the University of Maryland Fact Sheet "Figuring Production Costs in Finish Aquaculture" or tables provided by feed manufacturers. Consideration should be given to projections of changing feed costs. How have nutrition, price of ingredients and feed costs changed in recent years? Are bulk purchase and storage available? This information will be useful to anticipate actual feed costs.



Typical Aquaponic Layout. Note the cover over the fish tanks in the back.

Monthly Water Rate
ADEQ Testing Fee $ 0.75
Water Adjudication Fee $ 0.75
2" meter (includes first 2,000 gal) $ 17.56

Additional Gallons above 2,000

Each additional 1,000 gallons $ 2.46
(2,001 – 10,000)
Each additional 1,000 gallons $ 3.16
(10,001+)

Monthly Sewer Rates
Commercial Base rate $ 26.37
(First 2,000 gallons, based on monthly water usage)
Usage (per 1,000 gallons) $ 2.93

M. Profitability of Operation

Aquaponics, like any business, takes an adequate investment in equipment, proper design and excellent management and marketing skills. It is essential to have an experienced and skilled fish culturist and plant grower. With those qualifications, an aquaponic farm can be quite profitable. Commercially, aquaponics is in its infancy. Most of the research and trials have been accomplished within the past twenty years. As the technology develops and is refined, it has the potential to be a more efficient, space-saving and profitable method of growing fish, vegetables and herbs. Although there are currently a small number of commercial aquaponic operations in Arizona, many people are expressing a strong interest in this sustainable method of food production.

The recommended sequence to determine the profitability of an aquaculture or aquaponics operation is a follows:

1. Calculate the growth projections of the selected fish species, hence calculating the system requirements;
2. Calculate the growth projections of the selected plant species and the system requirements.
3. Calculate the capital cost of the system;
4. Calculate the operational cost of the system;
5. Project the sales; and
6. Combine the above calculations into financials in order to determine whether the venture will be financially viable.

Production costs developed in other studies suggest that larger systems, which can capture economies of size in investment and input costs, are likely to be economically feasible. Smaller operations are much less likely to be economically feasible, especially if annual ownership costs per pound are high. (Ownership costs are annual costs associated with the ownership of capital investment items). Smaller operations with reasonable per pound ownership costs might be profitable at high-end market prices However, these operations are more sensitive to adverse price and cost movements than larger operations. They can improve their likelihood of success by increasing the size at which they market their fish and by controlling operating costs, especially by decreasing input prices for feed and fingerlings. Economies of scale also exist for operating costs, but the effect is not as strong.

If possible, fish should be sold whole at the facility to simplify marketing regulations and marketing expense, since cutting fish in any way requires special food safety regulated processing facilities, which can be expensive to build or rent and to operate.

Another option not common in aquaponics, but worth consideration, is to grow ornamental fish like Koi, which eliminates the food safety considerations and simplifies marketing regulations, provided the fish are not shipped out of state. Koi are ornamental varieties of domesticated common carp that are kept for decorative purposes in outdoor koi ponds or water gardens, rather than for consumption. With an increased use of water features and oriental themes in landscaping, koi have gained popularity in American gardens. Once difficult to purchase, they are more available in recent years and are highly valued for their bright colors, hardiness and fast growth. Large, well-marked specimens command high prices among collectors.

Transportation costs can dramatically affect delivered feed prices and the cost to bring products to market. Shipping costs are often determined more by shipment volume and ingenuity in arranging transportation and less by distance. The current rate for LTL shipments costs an average of $.75 - $.85 per mile based on current LTL prices, and weight of 250 pounds. A fuel surcharge varies according to the current fuel prices being paid. This currently is running at 29% and will change daily. Air freight is not a reasonable option for a smaller scale project, because the prices are too high. Current rates for UPS air freight service are really expensive. The best rate they offer is around $2.00 a mile plus a minimum charge.

A budget is a useful management tool, both during its development and upon its completion. The process of developing a budget forces the aquaculturist to think concretely and specifically about all input requirements and associated costs as they are expected to occur in practice. In addition, the budget development process: (1) provides a vehicle for investigating, collecting, organizing, and analyzing cost information relevant to the long-term success of the business; (2) helps the producer to think realistically and critically about the likelihood for success; (3) prepares the producer for speaking with bankers and other investors by providing the opportunity to become intimately familiar with all aspects of the enterprise; (4) allows him to be precise about costs in order to accurately project cash flow needs and generate other pro forma financial documents; and (5) enables him to make a reasonable prediction of a breakeven price. Aquaculturists who take the time and effort required to develop a good budget will benefit from that process and become better decision makers.

Input and resource costs can fluctuate rapidly, or they may simply creep up two to three percent per year. Production values (such as feed conversion ratio, death loss, feed intake, growth rate, etc.) can be hard to estimate precisely, and they can change over time, making the values difficult to track. Production systems can be difficult to model, especially if the aquaculturist has not kept good records or has not yet settled into a consistent production plan.

Specific considerations common to all aquaponic budgets are itemized below:

- Stock and Seed: Cost and sourcing and best time to purchase.
- Marketing: The form in which the products are sold. Are the fish filleted and packaged and transported to the purchaser, or are whole fish put on ice and picked up by the purchaser? The answer impacts the costs of production in terms of labor charges, necessity of a kitchen, packaging equipment, and transportation, among other things.

- Land: A land charge should be noted to reflect the opportunity cost of the land used for aquaponics. Will the property be leased to a private enterprise? How to account for land costs is always a problematic part of any budget because ownership or rental arrangements and land values are so diverse. The use of the land for aquaponics implies foregoing the return that could have been obtained from some aviation-related use of the land, for instance. Therefore, the annual land charge reflects this foregone return.

- Size of operation: What are the intended volumes of product? 20,000, 50,000, 100,000 pounds of fish? How many heads of lettuce, or pounds of tomatoes or other vegetables or fruits?

- Harvest size of fish and mortality rates: How long must the fish be kept within the system to reach marketable size? What percentage death loss can be projected?

- Feed: The budget must consider feed conversion ratio, production targets, and death loss assumptions, and use these to calculate the quantity of feed needed.

- Feed price varies by size of operation, mainly due to differences in transportation costs for different shipment sizes. Optimum growth rates and food production are effected when fish are fed a species-specific, commercially available fish food.

- Labor: There will be differences in labor usage and cost according to the type and size of the aquaponic production system.

- Electrical use: This is one of the most significant cost factors, inasmuch as power is needed for lighting and to pump water, circulate water, aerate water, heat the water and facility, and run the filters. A reliable source of energy is needed to operate the aquaponics system. If the power source is not 100 % reliable, a backup source of power is needed in order to ensure the bio-security of the produce. Renewable sources of energy are an option. However, these are expensive in terms of initial capital costs, which may prohibit the feasibility of this option.

- Repairs, taxes, and insurance.

- Harvest: Aquaponically grown products, like other fish or produce, are highly perishable; it is important to keep in mind that harvest- and post-harvest handling and related marketing considerations are critical components of any aquaponics business plan, and attention must be given to timing of harvest for optimal ripeness and freshness, packaging and boxing of produce, and transportation to market.

N. Funding Possibilities

- Community Development Block Grants.

- New Market Tax Credits.

- Anchor private businesses to create a public private partnership.

- Grant from the Economic Development Administration (EDA), part of the U.S. Department of Commerce, the federal agency formally charged with supporting and funding regional economic development and implementation projects.

- USDAoffers several programs:
  Community Facilities Loan/Grant Program.
  Value Added Development Grant.
  Business and Industry Guaranteed Loans.
  Rural Cooperative Development Grants.
  "Know Your Farmer, Know Your Food" initiative, which includes 20 grant, loan, and support programs.

- Apache County Industrial Development Authority bonding.

- Department of the Interior grants.

- The National Marine Aquaculture Initiative - Managed by the federal Sea Grant program. This grant is for demonstration projects and research to help improve aquaculture. The competition for this grant is designed to promote joint ventures that will help develop a sustainable aquaculture industry. Projects often include private companies, research institutions, universities, state governments, and coastal communities working together for a greater purpose than they would individually.

- Small Business Innovation Research (SBIR) Program - Managed by the U.S. Small Business Administration, this program is to aid innovative scientific research toward commercial aquaculture.

- NOAA Fisheries Finance Program - NOAA's Fisheries Financial Services Division manages a financial assistance program including direct loans, a tax-deferred capital construction fund and vessel and gear loss and damage. Aquaculture businesses are eligible for loans for capital construction and certain other investment costs.

- USDA-Cooperative State Research, Education, and Extension Service (CSREES) - CSREES offers a variety of funding opportunities through a variety of resources.

- NOAA has recently published a federal funding opportunity requesting applications under the FY'14 Saltonstall-Kennedy Program. NOAA anticipates awarding $5-$10 million in competitive grants focused on fisheries research and development projects, including innovative cooperative research projects with industry. Aquaculture is a research priority under this program. Projects which demonstrate the feasibility of culturing marine fish species identified as potential or suitable candidates for aquaculture, such as redfish, pompano, cod, halibut, mussels, scallops and tuna are eligible. However, projects that primarily involve business start-up or infrastructure development are not eligible for funding.

- There are several business models that can further leverage economic participation by the community and the workforce. One is the Cooperative, as this enables the company to extend the benefits of profitable operations to each and every member of the workforce and/or community.

O. Laws and Regulations

There are laws and regulations regarding aquaponics and aquaculture in Arizona. Commercial operations of any size require a license, for which the minimum cost at this time is $200 annually, or $25 for a school (research) facility. Arizona Game and Fish also requires a stocking permit, but it is free. There are certain restrictions on the stocking of tilapia as well that are detailed in the Game and Fish documentation.

References:
Arizona Department of Game and Fish, *http://www.azgfd.gov/* (Search for: Application for Aquatic Wildlife Stocking Permit)
Arizona Department of Agriculture, *http://www.azda.gov/* (Search for: Aquaculture Permits) Click on "Applications and Forms"

An aquatic wildlife stocking permit allows an individual to perform any of the following: import, purchase, possess, transport and stock any species designated on the permit at the location specified on the permit. Live aquatic wildlife shall be acquired from a licensed fish farm operator or private noncommercial fish pond that has been certified free of the diseases and causative agents specified on the permit. Native aquatic wildlife species that are not available from commercial or private sources shall be obtained and handled as directed by the Department.

The process for a permit is as follows: Complete the application form and secure approval through Regional Offices of the Arizona Game and Fish Department. Form 2710-A. There is no fee. The permit is valid only for date or dates stated on the approved permit, not to exceed 20 consecutive days. A proposal per R12-4-410 may be required if the permit is to stock an area where the wildlife has not already been introduced, or where the wildlife is not currently established, or to stock wildlife that conflicts with the Department's efforts to conserve wildlife.

Additional requirements: Must comply with all stipulations. Certificate of disease inspection of the source of the live aquatic wildlife and copy of the Aquatic Wildlife Stocking Permit shall accompany each shipment. Disease free certification inspection must have occurred within the 12 months prior to the shipment, and the Department may require inspection and certification more recent than the 12 months preceding the shipment. A commercial entity transporting live aquatic wildlife may require a transporter license from the Arizona Department of Agriculture per R3-2-1007.

All applicable State rules and laws have been attached to this study as Appendix 1. There are no applicable Federal Statutes or Rules.

P. Conclusions of Study

Our first look indicates that commercial scale aquaponics is economically feasible. Aquaponics may be more profitable than terrestrial agriculture and aquaculture. There is strong support within the Round Valley area for a local farmers' market that could supply fresh, locally grown fish and vegetables or fruits. Residents complain about the poor quality of produce offered in the area, most of which is shipped to town from great distances away. Selling produce locally would avoid high transportation costs, keep money within the area and provide a products that are highly desirable. It would also support job creation, because aquaponics and managing a farmer's market is labor intensive.

There is no current viable market within our study area for indigenous plants or for threatened or endangered fish species.

Aquaponic systems, or any relatively intensive aquaculture operation with a high productivity relative to the area used by the operation, are capital intensive ventures (*Timmons, Clark 2009*). Economies of scale occur in industries with high capital costs. This implies that any aquaponics venture should be done on a large-scale in order to maximize the efficiency of the operation. However, according to *Nerrie et al.* (2004), small and medium scale aquaponic systems are showing promise.

The Springerville population is relatively unfamiliar with the tilapia species. They are conservative with their choice of fish, decreasing their inclination to buy tilapia. Therefore, the marketing of tilapia should be addressed.

In order for a niche marketing aquaculture enterprise to be successful, it will need to enter markets that are not in direct competition with larger-scale aquaculture. There are no large-scale tilapia aquaculture enterprises in operation in Springerville. In order to demand a price premium for a product, a niche marketing approach should be used.

It is important to identify a reliable market, and even a backup market. It is also important to consider opportunity cost, where the dedicated land might be employed to more profitable uses. Aquaponics is not an industry commonly associated with airport industrial parks.

Fish production is currently not profitable for all aquaponic farms throughout the country. Vegetable production is the driving force of economic success in aquaponic enterprises. There may be some price premium for locally produced aquaponic vegetables. However, due to the increased expense of producing aquaponically compared to field grown production, targeting niche markets such as restaurants, high end food stores, farmer's markets, and on-farm sales, where one can get near the retail price, is recommended to get the maximum return. Aquaponic operations are economically feasible when growing high value crops like basil and other cooking or medicinal herbs.

In aquaponics, the grower needs to understand the fish system and the crop system and must integrate between them. Aquaponics can be a sustainable agricultural production system. Most plant nutrients can be derived from fish feed through fish digestion/excretion and biofilter nitrification, thus integrating nutrient flow. Plants can act as biofilters and take up system effluent that would otherwise be discharged to the environment. The difficulty in finding a median growing environment among plants, fish, and nitrifying bacteria culture in aquaponics has resulted in less integration of the systems than would be ideal for maximizing space and infrastructure, thus reducing the potential overall adaptability and profitability of aquaponics. Aquaponic systems management has been established for the lettuce/tilapia floating raft system.

Nearly every plant and herb grown in soil, including fruit trees, have been successfully grown in aquaponic systems across the world, from everyday herbs and vegetables to cactus and aloe vera, citrus trees, passion fruit and even mushrooms. It has been found that a food-production facility in a greenhouse environment may have greater chances for success if it is in a specialty market such as culinary or medicinal herb. Niche marketing is the key to success for most private sector aquaponics operations.

III. WILDLIFE RESCUE/VETERINARY EDUCATION CENTER

A. Summary of Project:

As conceived by the Town of Springerville, this multi-purpose facility's primary focus will be a state-of-the-art wildlife medical clinic dedicated to providing medical care to a population of animals that are under-served in the White Mountain region. Due to a lack of "ownership" of wild animals, and the lack of local, state or federal funding for their care, the health and welfare of these animals is extremely tenuous, especially during and in the aftermath of wildfire events. In addition to improving the quality of care for injured or sick animals, this project will allow the Springerville Wildlife Rescue and Veterinary Training Center, as it is tentatively named, to offer enhanced training programs for professional staff, volunteers, interns and local rehabilitators in state-of-the-art facilities and lab space. It is hoped that the center will become a satellite location in conjunction with either the new veterinary programs of the University of Arizona/Tucson or Midwestern University/Glendale to provide degree-oriented veterinary education to area students.

B. Mission and Goals:

The mission of the Springerville Wildlife Rescue and Veterinary Training Center is to create a sustainable future for wildlife in our region through medical treatment, rehabilitation, educational outreach, research, and conservation activities. To this end, the Town will focus on five primary goals:

1. Strengthening regional capacity to rescue, rehabilitate and return injured animals to the wild;
2. Providing learning opportunities and expanding community outreach programs to teach and inspire people of all ages to help protect local wildlife; and
3. Achieving long-term financial and ecological sustainability.
4. Create a distributive veterinary school in conjunction with the doctoral programs of either the University of Arizona/Tucson or Midwestern University/Chandler.
5. Possibly utilize the former Northland Pioneer College campus for classrooms.

The project is key to meeting critical needs for increased animal care by providing more appropriate clinical space and a quiet healing sanctuary for sick and injured animals, allowing outreach and educational capabilities, and bolstering community efforts to meet long-term sustainability for the organization by meeting several goals:

- To leverage high quality medical and rehabilitative services to recruit, train, and facilitate certification for interested regional rehabilitators - expanding the entire region's capacity to properly care for sick and injured animals.

- To improve current medical and supportive care through improved efficiencies resulting from the incorporation of new technologies and more effective space planning

- Developing a dynamic volunteer and intern program with more specialized workshops and trainings held within a teaching laboratory environment

- To improve and expand treatment, diagnostic, research, and administrative facilities to meet current needs and accommodate future growth.

- To acquaint the community with the work of wildlife rehabilitation, and introduce the concepts of wildlife ecology and stewardship through educational programs.

- To provide educational programs where teachers serve at-risk youth, children with developmental and emotional disabilities, and senior citizens.

- To meet, collaborate, and partner with other wildlife organizations and regional schools.

- To implement diverse strategies to increase revenues to provide for growing needs for adequate clinical, educational and administrative capacity.

C. Needs Assessment

We evaluated the feasibility of the Springerville location on the basis of:

- Wildlife population in the vicinity.
- Availability of veterinary hospitals in the region that provide services for sick and injured wildlife.
- Ease of access to the nearest veterinary facilities.
- Unmet demands of the farmers/cattle owners in the region.
- Availability of veterinary education in the region.
- Existing laws and regulations.
- Financial support and economic feasibility.

C.1 Need for Wildlife Veterinary Services

There is a current need for licensed wildlife veterinarians in eastern Arizona. These may only function under a special license from the Arizona Department of Game and Fish.Game and Fish handles calls for sick or injured wild animals at this time, and it makes referrals to the state's licensed wildlife rehabilitators. There are currently only 24 individuals or organizations that possess the required Wildlife Rehabilitation License to provide care for sick, injured or orphaned wild animals. None is located in Apache or Navajo Counties. The closest to Springerville are in Flagstaff, almost three hours away. The Department of Game and Fish supports the Adobe Mountain Wildlife Center in Scottsdale through its Heritage Fund, but it has only one full-time employee. The following is a complete list of all the licensed Wildlife Rehabilitators in the state, showing the kind of animals each is permitted to treat:

WILDLIFE REHABILITATORS

BUSINESS NAME	AREA SERVED	PHONE	MAMMALS	BIRDS	REPTILES	AMPHIBIANS
Bradshaw Mtn Wldlf Center	Mayer	(928) 632-9559	x			
Wild Wings	Flagstaff-Williams Area	(928) 774-3894	x	x		
Melanie Lashlee	Flagstaff	(928) 310-1448		x		
Cindy Wilder	Flagstaff-Williams Area	(928) 527-1418	x			

Susan Ruble	Flagstaff	(928) 606-6597				
Yuma GF Regional Office*	SW Arizona	(928) 342-0091	x	x	x	
Tucson Wildlife Center, Inc.	East Tucson	(520) 290-9453	x	x		
Robert Brandner	East Tucson	(520) 760-0574			x	x
Wildlife Rehabilitation Facility	West Tucson	(520) 743-0217	x	x		
Kathie Schroeder	Catalina	(520) 825-1076	x	x		
Mitzi Brabb	Payson, Pine, Star Valley	(928) 478-4803	x			
Jeani Garrett	North Phoenix	(602) 996-1934		x		
Gloria Halesworth	SE Valley, Ahwatukee	(480) 893-6660		x		
East Valley Wildlife	Chandler	(480) 814-9339		x		
Lesley Lee	NE Phoenix	(602) 748-7886		x		
Liberty Wildlife	Scottsdale	(480) 998-5550		x		
Southwest Wildlife	Rio Verde, Scottsdale	(480) 471-9109	x			
Desrt Cry	Queen Creek	(480) 987-3544	x			
Sherry Celine	East Phoenix	(602) 840-4611		x		
Sherri Sweet	Gilbert	(480) 988-5552	x	x		
Wild at Heart	North Phoenix, Cave Creek	(480) 595-5047		x		
Jody Kleran	Far West Phoenix	(623) 533-2348		x		
Runnin W Wildlife Center	Sedona/Verde Valley area	(928) 821-0098	x	x		
Tucson Mt. Hummingbird Rescue	West Tucson	(520) 743-0677		x		

C.2 Need for Domesticated Animal Veterinary Services

As for domesticated animals, the Springerville area currently has two full-time, fully-qualified and active veterinarians, who provide competent care to domesticated animals. One of these is currently in the process of establishing a new, larger facility in the Town of Springerville. There does not appear to be a present need for increased veterinary services for domesticated animals in the Springerville area. However, there is a critical shortage of rural farm animal veterinarians in the state of Arizona.

C.3 Need for Veterinary Education

There is an undersupply of veterinarians in the United States, especially in large animal and wild animal practice. In 2006, the Association of American Veterinary Medical Colleges (AAVMC) predicted that there will be shortage of 15,000 veterinarians in the next two decades. The U.S. Labor Department released an assessment that the job market for veterinarians is "good," while predicting that the number of jobs for veterinarians will reach 83,400 by 2020, an increase of 22,000 or 36 percent. In 2014, the National Research Council of the National Academies released a report on the veterinary workforce that cited a need for veterinarians to enter public health, agriculture and food safety areas.

There are approximately 1,800 veterinarians licensed to practice in this state. Arizona is one of 24 states in the country that currently are without an accredited veterinary medical program. There are only 28 veterinary medical colleges in the US, and nearly 11,480 students are enrolled in those 28 programs. There are no schools in New Mexico or Nevada. Currently, Arizona students interested in becoming veterinarians must compete for veterinary school admissions at out-of-state institutions, many of which favor resident students. For example, 1,600 applicants competed for 138 seats at Colorado State University last year. Only 55 of those seats are open to applicants outside Colorado, and just a handful were filled by Arizonans. Arizona students pay higher costs through nonresident or private tuition, incur more debt and often stay in the practices, or seek employment with the out-of-state veterinary practices and companies where they intern as part of the out-of-state education.

On the bright side, however, Arizona will soon be home to two veterinary colleges that collectively graduate 200 students a year. Those new veterinary colleges, one at Midwestern University in Glendale and another at the University of Arizona (UA) in Tucson, arecurrently in the accreditation process through the Association of American Veterinary Medical Colleges. Class size for each program is projected at 100 seats.

C.3.1 Midwestern University College of Veterinary Medicine

The university was founded in Chicago, Illinois in 1900. It opened its Glendale, Arizona campus in 1996 and currently has 2,600 students. The university opened a clinical psychology program in 2010 at the Arizona campus followed by a dental program in 2011. Midwestern announced November 2013 that the Arizona State Board for Private Postsecondary Education had issued formal approval for the university to open Arizona's first college of veterinary medicine. It was officially established April 24, 2012.The College of Veterinary Medicine is now on the path to becoming accredited by the American Veterinary Medical Association.The college expects to secure full accreditation in 2018 at the time its first students are graduating. Kathleen H. Goeppinger, PhD, is Midwestern University's president and CEO.

The Midwestern University College of Veterinary Medicine (MWU-CVM) presents to its students a four year program leading to the Doctor of Veterinary Medicine (DVM) degree. The first 8 quarters are a mix of classroom lectures, laboratories, simulation lab exercises with virtual clients and patients, and small group student-centered learning experiences. Hands-on live animal contact begins in the first quarter and continues throughout the program. Quarters 9-13 involve diverse clinical training, both on campus (about 85%) and at external sites (about 15%).

The more than $180 million veterinary campus will have three buildings in which to practice and teach veterinary medicine. Construction of a 76,000-square-foot classroom building, a 109,000-square-foot veterinary teaching hospital, and a 36,000-square-foot large animal teaching facility is under way. The university is in the process of designing a center for integrative research. It also plans to build more student housing and a parking deck. In all, there will be eight construction projects.

Class size is projected at 100 for Midwestern College of Veterinary Medicine, and tuition has been reported in the range of $50,000 per year. Dr. Brian K. Sidaway was announced as the founding dean.The school has been in the process of recruiting and hiring faculty, which will total 50. In addition to the faculty on-site, the veterinary college will employ a *distributive clinical model* to supplement on-campus clinical instruction. This includes a large contingent of adjunct faculty who will provide clinical instruction under the supervision of MWU faculty.

C.3.2 University of Arizona College of Veterinary Medicine/Tucson

On September 25, 2014, the Arizona Board of Regents approved a committee's recommendation for implementing a veterinary medicine degree program at the University of Arizona/Tucson. The Kemper and Ethel Marley Foundation recently donated a gift of $9 million in support of the proposed veterinary program. Students would complete the program in only four years without having to get a bachelor's degree. The program would provide students with 11 semesters of clinical training and cost about $100,000. Typically, throughout the country, veterinary education costs an average of $250,000.

The University of Arizona's preliminary plans for a veterinary medical program involve using the distributive model rather than building a teaching hospital.Located in Tucson, two hours southeast of Midwestern University's Phoenix-area campus, officials at the University of Arizona say they are poised to serve a need for veterinarians in rural counties, especially along the New Mexico border. The UA program will run year-round so students can complete their degrees faster, accumulate less debt and enter the workforce sooner. In their distributive model, the final two semesters will be spent working in private veterinary practices, government agencies or ***other community partnerships*** to secure hands-on, real-world learning in communities throughout the state. Thus far, it has been agreed that facilities for students will be built, refurbished or renovated at satellite locations in Douglas, Yuma, Maricopa and Verde Valley. Other locations for satellite schools, especially in eastern Arizona, are yet to be determined, though the Town of Springerville has communicated with the college and is currently being considered as a viable satellite location. In these settings, students will have the opportunity to learn about border health issues, rural medicine, food safety, large-scale animal production and wildlife, as well as the cattle and dairy industries.Other clinical training partners will include federal and state animal health labs and regulators, U.S. Border Patrol and Homeland Security, and animal shelter and rescue agencies. The University of Arizona/Tucson already has letters of interest from many prospective partners, so it is in the interest of the Town of Springerville to aggressively pursue a relationship with its veterinary college.

C.3.3The Distributive Veterinary Clinical Education Model

There is a growing acceptance throughout the country of veterinary education models that allow programs to forgo building teaching hospitals that can cost tens of millions of dollars. The trend among new schools is to construct smaller versions of on-campus hospitals and

contract with private practices where students can develop their clinical acumen, a system known as the distributive veterinary clinical education model.

Both Midwestern University/Glendale and the University of Arizona/Tucson are developing their programs based on the following concepts:

- Help address the critical veterinarian shortage in rural Arizona communities and tribal nations, benefit bioscience businesses and promote public health.
- Engage practicing veterinarians and have them help teach students in a hands-on clinical setting.
- Steer their veterinary students in the direction of large animal medicine, a field that is less saturated than small animal and companion animal medicine, with some regions, mostly rural, devoid of any veterinary care.
- Produce good quality, qualified veterinarians for much less cost, in much less time and get them out into the workforce sooner. (Most students have been paying an average of $50,000 annually, in tuition alone, if they can get into one of 28 accredited public and private programs in the U.S. Those programs require 8 years of study).
- As a cost-saving measure, the programs will not build a veterinary teaching hospitals, which can cost tens of millions of dollars and place a very large continuing financial burden on institutions.
- Involve existing assets in the programs, such as the colleges of Medicine, Public Health and Pharmacy, as well as food safety study groups, working ranches and farms.
- Connect with satellite centers in communities throughout Arizona, especially in rural settings.

The Midwestern University's and the University of Arizona's distributive models provide a reasonable opportunity for the Springerville Center for Wildlife to enlist with either of their programs as a satellite location for veterinary education. The Town of Springerville is now being considered by the University of Arizona/Tucson as a possible satellite location for its students to conduct clinical studies.

D. Job Creation

The new facility would require at a minimum the following positions:

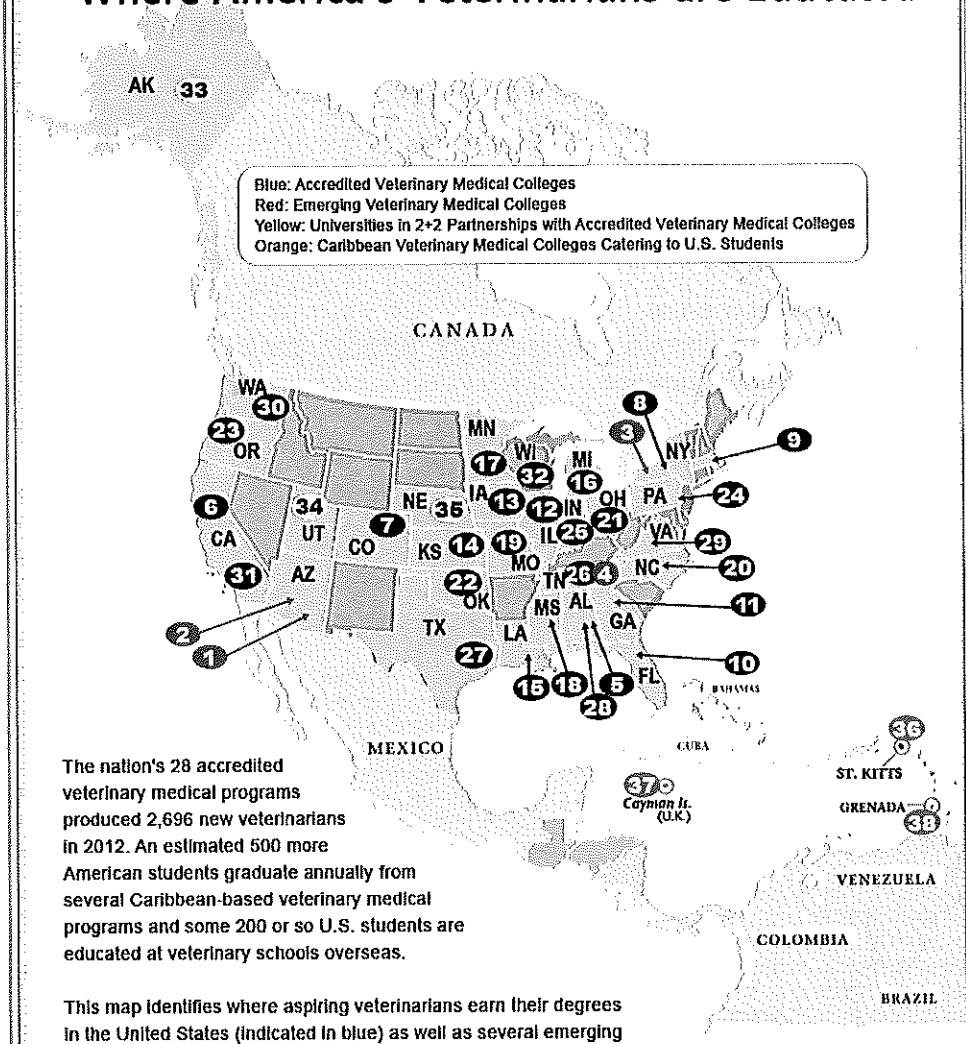
- Executive Director (full time)
- Medical Clinic Director (full time)
- Intensive Care Director (full time)
- Wildlife Specialist / Intern & Volunteer Coordinator (full time)
- Wildlife Specialist (full time)
- Senior Wildlife Specialist / Facilities Coordinator (part time)
- Education & Outreach Director (full time)
- Development Assistant (part time)
- Seasonal Wildlife Specialists (part time) (3)

- Full Time (6) Part-time (2) Seasonal (3)

Many exciting opportunities exist in veterinary medicine. Graduates can work in private general practice or in a specialty field such as:

- Anesthesiology
- Dentistry
- Cardiology
- Food animal production medicine
- Small animal surgery
- Wildlife medicine
- Research at a university or company,
- For a government agency in the areas of biosecurity, environmental quality, public health, or disease outbreak investigation.

Where America's Veterinarians are Educated



The nation's 28 accredited veterinary medical programs produced 2,696 new veterinarians in 2012. An estimated 500 more American students graduate annually from several Caribbean-based veterinary medical programs and some 200 or so U.S. students are educated at veterinary schools overseas.

This map identifies where aspiring veterinarians earn their degrees in the United States (indicated in blue) as well as several emerging programs vying to join that list (indicted in red). Additionally, joint programs known as 2+2 partnerships (indicated in yellow) allow students in Alaska, Utah and Nebraska to study in their home states for two years and finish their remaining two years at accredited colleges of veterinary medicine.

1. University of Arizona; Tucson, Ariz.
2. Midwestern University; Glendale, Ariz.
3. Millard Fillmore Gates Circle Hospital site; Buffalo, N.Y.
4. Lincoln Memorial University; Harrogate, Tenn.
5. Auburn University; Auburn, Ala.
6. University of California; Davis, Calif.
7. Colorado State University; Fort Collins, Colo.
8. Cornell University; Ithaca, N.Y.
9. Tufts University; North Grafton, Mass.
10. University of Florida; Gainesville, Fla.
11. University of Georgia; Athens, Ga.
12. University of Illinois; Urbana, Ill.
13. Iowa State University; Ames, Iowa
14. Kansas State University; Manhattan, Kan.
15. Louisiana State University; Baton Rouge, La.
16. Michigan State University; East Lansing, Mich.
17. University of Minnesota; St. Paul, Minn.
18. Mississippi State University; Starkville, Miss.
19. University of Missouri; Columbia, Mo.
20. North Carolina State University; Raleigh, N.C.
21. The Ohio State University; Columbus, Ohio
22. Oklahoma State University; Stillwater, Okla.
23. Oregon State University; Corvallis, Ore.
24. University of Pennsylvania; Philadelphia, Pa.
25. Purdue University; West Lafayette, Ind.
26. University of Tennessee; Knoxville, Tenn.
27. Texas A&M University; College Station, Texas
28. Tuskegee University; Tuskegee, Ala.
29. Virginia Tech and the University of Maryland; Blacksburg, Va.
30. Washington State University; Pullman, Wash.
31. Western University of Health Sciences; Pomona, Calif.
32. University of Wisconsin-Madison; Madison, Wisc.
33. University of Alaska; Fairbanks, Alaska
34. Utah State University; Logan, Utah
35. University of Nebraska; Lincoln, Neb.
36. Ross University; St. Kitts, Caribbean
37. St. Mathews; Grand Cayman, Caribbean
38. St. George's; Grenada, Caribbean

Source: VIN News Service research
Graphic by Tamara Rees

E. Licensing

The regulations governing wildlife rehabilitation are set forth in the Arizona Administrative Code, Title 12 (Natural Resources), Chapter 4 (Game and Fish Commission), Article 4 (Live Wildlife). The applicable Rules are R12-4-423 (Wildlife Rehabilitation License), R12-4-401 (Live Wildlife Definitions), R12-4-409 (General Provisions and Penalties for Special Licenses), R12-4-428 (Captivity Standards) and R12-4-430 (Cervids), each of which is contained in the Appendix to this study.There are no applicable federal statutes or rules.

A Wildlife Rehabilitation license, issued by the Department of Game and Fish, allows an individual to capture alive, transport, temporarily possess; rehabilitate, transfer to a practicing veterinarian for treatment or euthanasia or to another rehabilitator licensed for the wildlife, release, or euthanize an injured, diseased, orphaned or otherwise debilitated live wildlife specified on the license.

There are forms to be completed for the license, which forms are available through the Game and Fish website. http://www.azgfd.gov/ The license requires proof that the applicant is or has a licensed and practicing veterinarian that has agreed to provide and be reasonably available to provide veterinary services for the rehabilitation of wildlife. It also requires a detailed description of the facilities where the applicant will hold the wildlife in compliance with Rule 12-4-428. Other requirements are defined at the website.

F. Proposed Building Features

As contemplated in this preliminary study, some of the features in the center will include: three classrooms, a reception area, a small animal surgical prep-room, a small animal surgical room, a large animal surgical prep and recovery room, and a large animal surgical room. Three classrooms will be located throughout the center. The main classroom will be on the first floor. The other two classrooms will be on the second floor, overlooking the surgical rooms. These classrooms will be used when surgeries are going on in the surgical rooms below. An intercom system will be installed, so that whenit is engaged downstairs, students can hear the instruction upstairs as well. This system will accommodate large classes that cannot fit everyone in the surgical room and will allow the students to listen to the veterinarian teaching, while on the second floor above the surgical room.

The surgical prep-room for small animals will be fully-equipped. It will have nine kennels that to hold animals recovering from surgery. A surgical prep-sink will be installed in the room to prepare small animals for various surgeries. In the surgical prep-sink, the animal can be washed, shaved and groomed appropriately for the expected surgery.

The center will also have a surgical prep room for large animals. Unlike all the other rooms in the building, this room will be fully padded with an inch and a half of foam. This padded room will allow a large animal, such as a horse or elk, to recover from surgery. In this room, the animal can get off the surgical tranquilizers without hurting itself by running into walls. The padded floor in this room will rotate, so an animal can be easily transferred to the surgical room next door.In the large-animal surgical room, there will be many items of equipment to facilitate movement and any kind of work on large animals. There will be a hoist to lift an animal into the air and transport it to another location at the center.

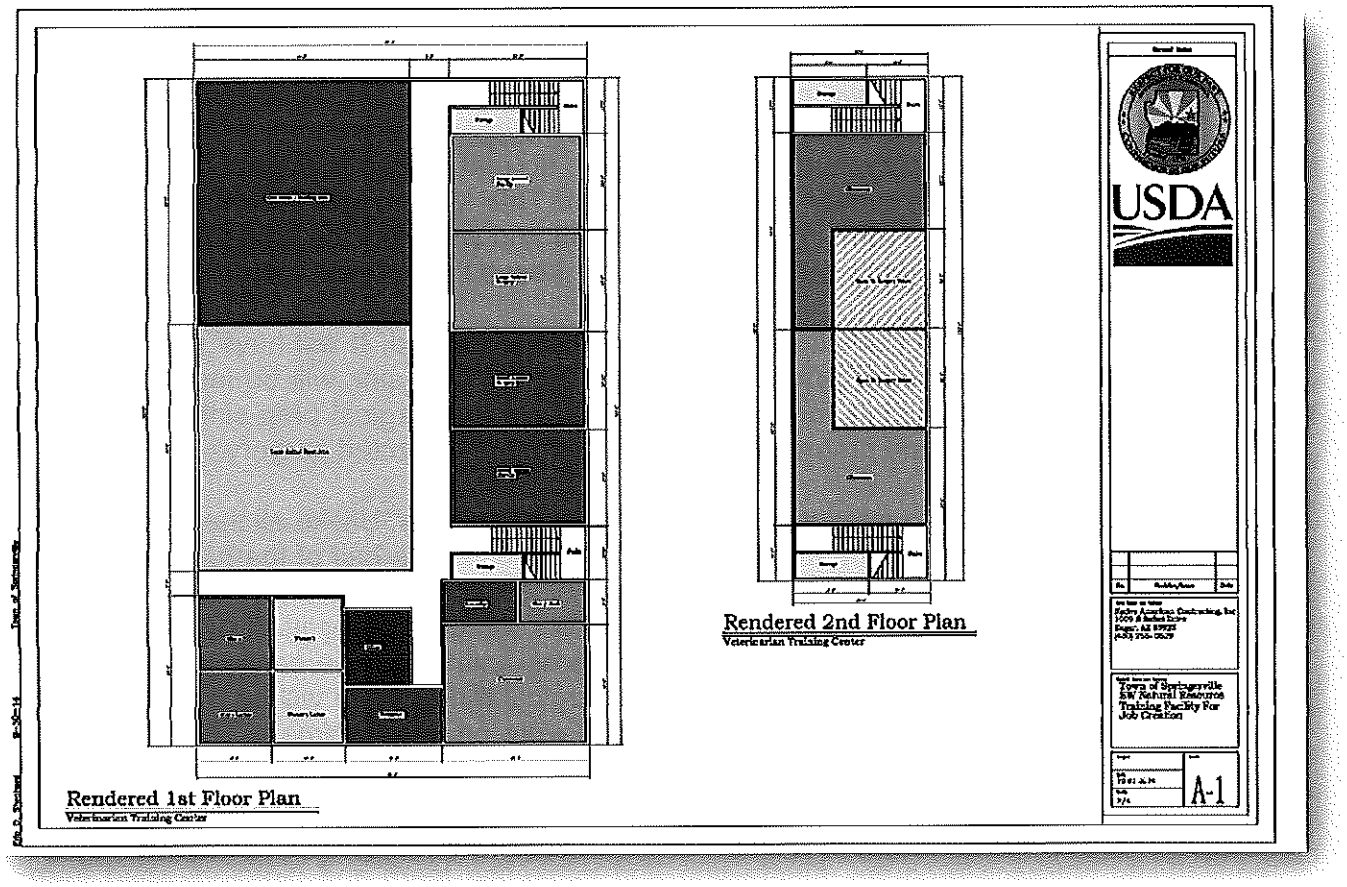
In addition, the facility will provide modest office, meeting and exhibition space for the educational outreach program, fundraising and marketing team and directors apart from

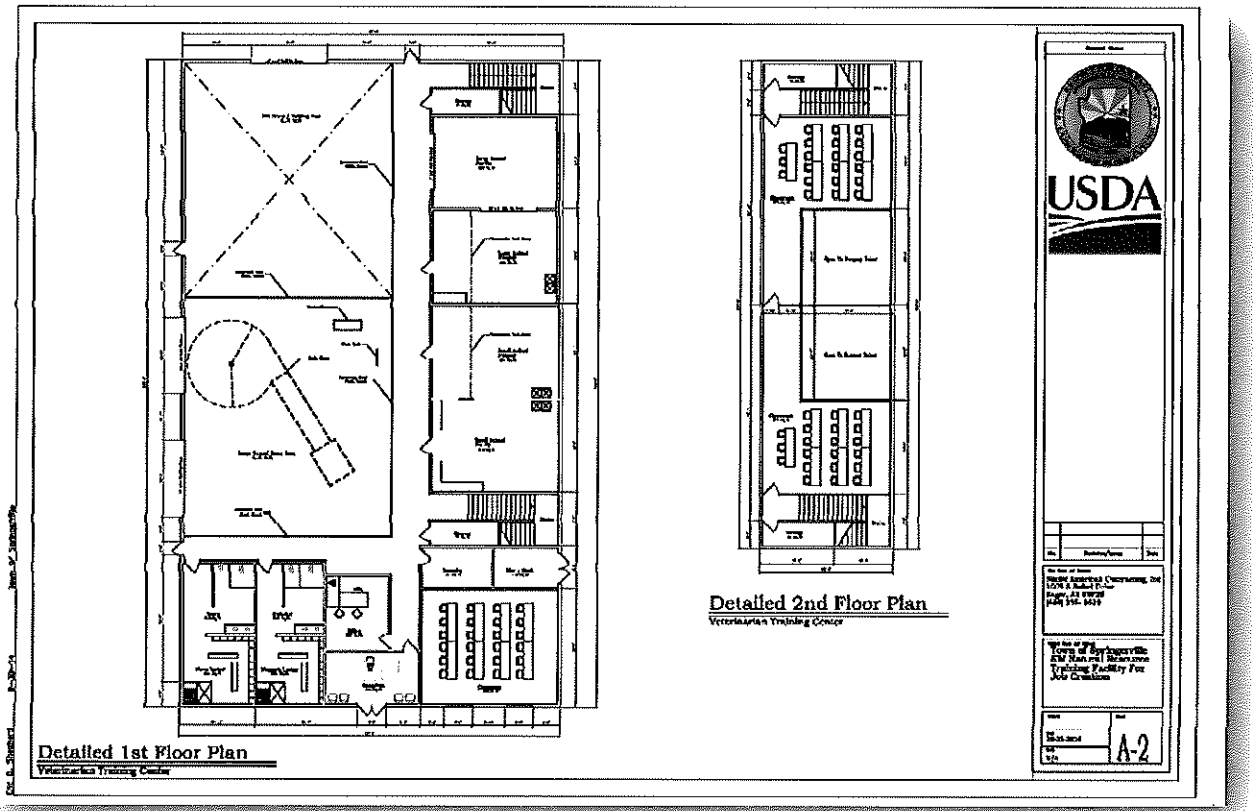
the wildlife medical and rehabilitation function, and allow appropriate administrative work space for more animal care staff and volunteers.

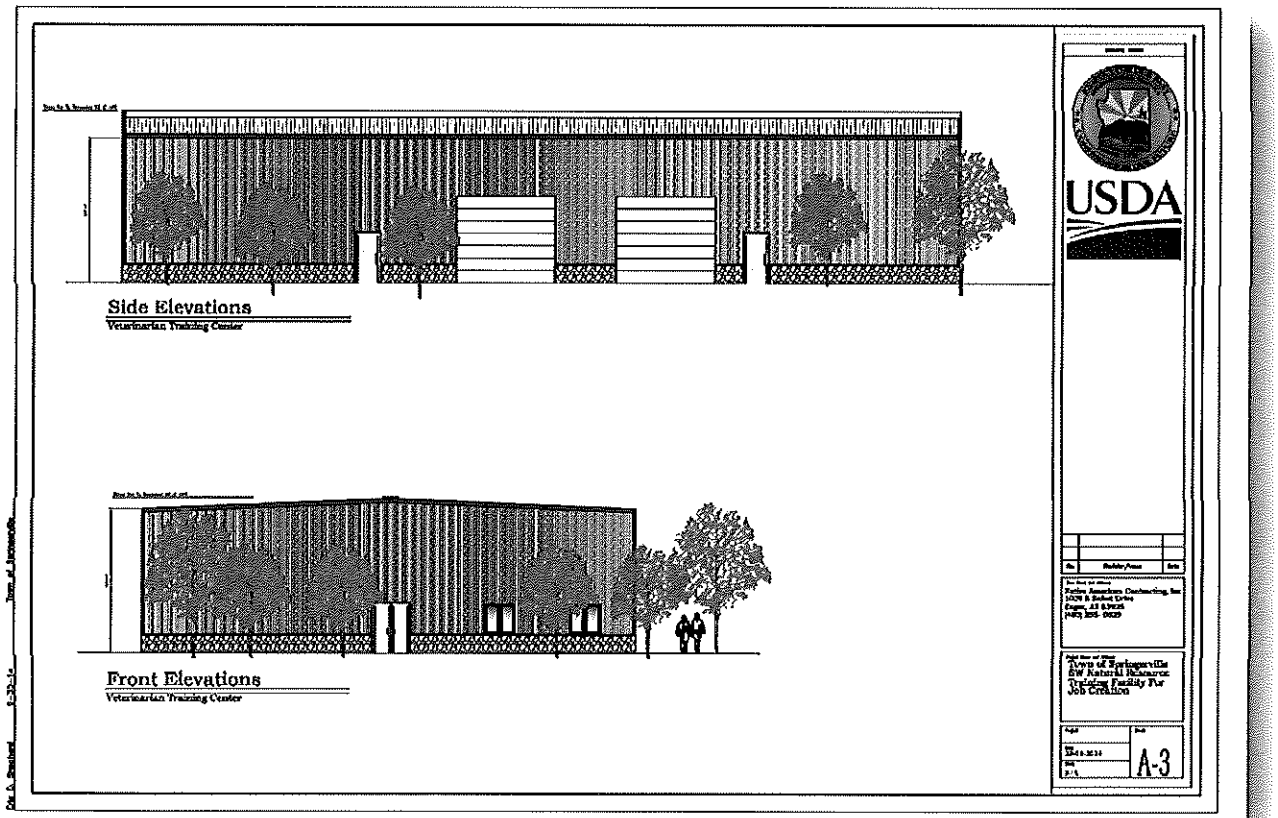
The new facility will serve as a "welcome center" for greeting the public, animal admissions, meeting with donors and other partners, separate from the medical treatment space and animal sanctuary. The plan might include a small gift shop to augment revenue and promote merchandise sales from an online store.

The building will feature sustainable concepts and will accommodate the following:

- a wildlife medical clinic and rehabilitation center, located at the light industrial area of the Springerville Airport, that includes examination and treatment rooms to accommodate individual specialists and exam procedures (radiology, dermatology, surgery, emergency/critical care, lab, physical therapy, oil spill/contamination response, and fire injury care)
- an informative and accommodating admissions area for dropping off creatures
- a workspace and library for development, education, and diagnostics research
- a multi-purpose classroom for workshops, trainings, lecture series, and outreach
- a wildlife gift shop to assist in financial sustainability
- administrative offices
- storage, maintenance, mechanical space
- plumbing to accommodate the public and laboratory research and demonstrations




Detailed 1st Floor Plan
Veterinarian Training Center
Detailed 2nd Floor Plan
Veterinarian Training Center
USDA
A-2


Side Elevations
Veterinarian Training Center
Front Elevations
Veterinarian Training Center
USDA
A-3

G. Funding

- **Heritage Fund Program.** Heritage grants are supported by up to $10 million each year from Arizona lottery proceeds. These grants are used to protect endangered species, acquire habitat for the benefit of sensitive species, provide access to outdoor recreational opportunities, and educate children and adults about wildlife. These grants are administered by the Arizona Department of Game and Fish. Applications are usually due during the last week in September each year.

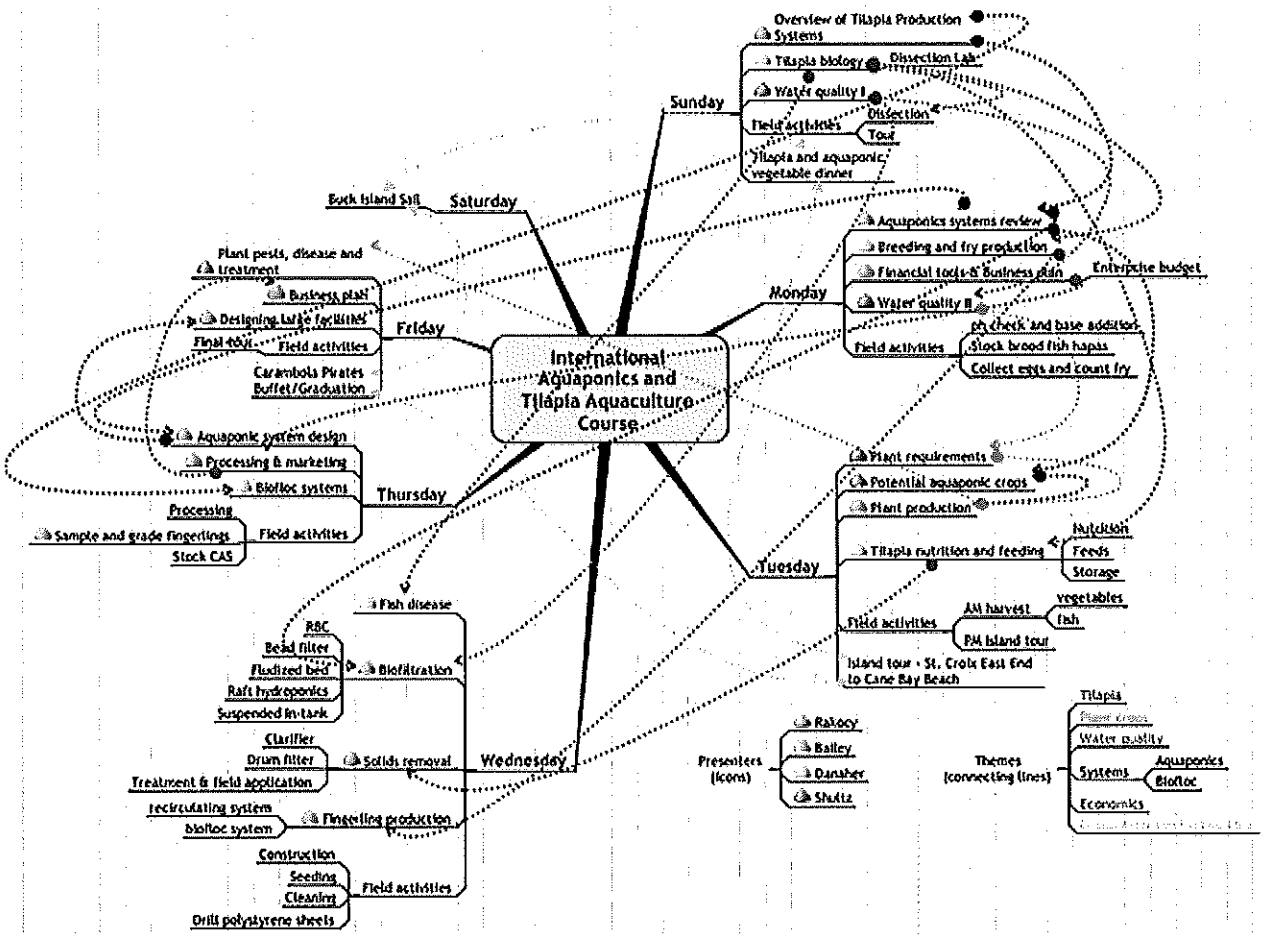
- **Foundation Grants.** There are many foundations and other organizations that offer funding opportunities for projects and programs related to wildlife rescue and conservation, or for veterinary services and education. A partial listing of some of the more prominent institutions offering financial support can be found at the following sites: http://grants.library.wisc.edu/organizations/animals.html http://www.animalsheltering.org/how-we-help/strengthen-your-shelter/financial-assistance/grant_listings.html

- **USDA Rural Development.** The USDA Rural Development Housing and Community Facilities Program offers loans and grants for essential community facilities, including municipal and private animal shelters, in communities with populations under 20,000.

APPENDIX I
ENDANGERED, THREATENED AND PROTECTED FISH IN ARIZONA

Binomial nomenclature	Common name	Protection status
Agosia chrysogaster chrysogaster	Gila Longfin Dace	Not protected
Agosia chrysogaster sp 1	Yaqui Longfin Dace	Not protected
Campostoma ornatum	Mexican Stoneroller	Endangered
Catostomus benardini	Yaqui Sucker	Endangered
Catostomus clarki	Desert Sucker	Not protected
Catostomus discobolus	Bluehead Sucker	Not protected
Catostomus discobolus yarrowi	Zuni Bluehead Sucker	Not protected
Catostomus insignis	Sonora Sucker	Not protected
Catostomus latipinnis	Flannelmouth Sucker	Not protected
Catostomus sp. 3	Little Colorado River Sucker	Not protected
Cyprinella formosa	Beautiful Shiner	Threatened
Cyprinidon arcuatus	Santa Cruz Pupfish	Extinct
Cyprinidon eremus	Quitobaquito Pupfish	Endangered
Cyprinodon macularius	Desert Pupfish	Endangered
Elops affinis	Pacific Tenpounder or Machete	Not protected
Gila cypha	Humpback Chub	Endangered
Gila ditaenia	Sonora Chub	Threatened
Gila elegans	Bonytail Chub	Endangered
Gila intermedia	Gila Chub	Endangered
Gila nigra	Headwater Chub	Not protected
Gila purpurea	Yaqui Chub	Endangered
Gila robusta	Roundtail Chub	Not protected
Gila seminuda	Virgin Chub	Endangered
Ictalurus pricei	Yaqui Catfish	Endangered
Lepidomeda mollispinis mollispinis	Virgin Spinedace	Endangered
Lepidomeda vittata	Little Colorado River Spinedace	Threatened
Meda fulgida	Spikedace	Threatened
Mugil cephalus	Striped Mullet	Not protected
Oncorhynchus apache	Apache Trout	Threatened
Oncorhyncus gilae	Gila Trout	Endangered
Plagopterus argentissimus	Woundfin	Endangered
Poeciliopsis occidentalis occidentalis	Gila Topminnow	Endangered
Poeciliopsis occidentalis sonorensis	Yaqui Topminnow	Endangered
Ptychcheilus lucius	Colorado Pikeminnow	Endangered
Rhinichthys osculus	Speckled Dace	Not protected
Tiaroga cobitis	Loach Minnow	Threatened
Xyrauchen texanus	Razorback Sucker	Endangered

APPENDIX II.
AQUAPONICS CURRICULUM



APPENDIX III.
APPLICABLE STATE RULES AND LAWS FOR AQUACULTURE AND AQUAPONICS

R12-4-401 Live Wildlife Definitions

In addition to definitions given in A.R.S. § 17-101, and for the purposes of this Article, the following definitions apply:

1. "Agent" means an individual that assists a special license holder in performing activities that are authorized by the special license to achieve the objectives for which the license was issued.
2. "Aquarium trade" means the commercial industry that lawfully trades in aquatic live wildlife and its customers.
3. "Captive live wildlife" means live wildlife that is held in captivity, physically restrained, confined, impaired, or deterred to prevent it from escaping to the wild or moving freely in the wild.
4. "Cervid" means a mammal classified as a Cervidae or member of the deer family found anywhere in the world, as defined in the taxonomic classification from Volumes I and II of Walker's Mammals of the World, Sixth Edition, 1999, and not including any later edition. A copy is available for inspection at any Department office and from the Johns Hopkins University Press, 2715 North Charles Street, Baltimore MD, 21218-4363.
5. "Circus" means a scheduled event where a variety of entertainment is the principal business, primary purpose, and attraction. "Circus" does not include animal displays or exhibits held as an attraction for a secondary commercial endeavor.
6. "Collect" means to take wildlife alive under the provisions of a scientific collecting permit.
7. "Commercial" means the buying or selling of wildlife or their parts, or the exchange of anything of monetary value for the use of wildlife.
8. "Domestic" means an animal species that does not exist in the wild, and includes animal species that have only become feral after they were released by humans that held them in captivity, or are individuals or populations that escaped from human captivity.
9. "Educational display" means a display of captive live wildlife to increase public understanding of wildlife biology, conservation, and management without requiring or soliciting payment from an audience or an event sponsor. For the purposes of this Article, "to display for educational purposes" refers to display as part of an educational display.
10. "Endangered or threatened" means wildlife that is listed in 50 CFR 17.11, revised as of August 4, 2004 not including any later amendments or editions, which is incorporated by reference. A copy of the list is available for inspection at any Department office, or it may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
11. "Evidence of lawful possession" means any license or permit that allows possession of a specific live wildlife species or individual or other documentation that establishes lawful possession. Other forms of documentation may include but are not limited to: a statement of non-requirement for a license or permit for specific live wildlife species, or individual granted by the country or state of origin.
12. "Exhibit" means to display captive live wildlife in public, or to allow photography of captive live wildlife, for any commercial purpose.
13. "Exotic" means wildlife or offspring of wildlife that is not native to North America.

14. "Fish farm" means a commercial operation designed and operated for propagating, rearing, or selling aquatic wildlife for any purpose.
15. "Game farm" means a commercial operation that is designed and operated for the purpose of propagating, rearing, or selling terrestrial wildlife or the parts of terrestrial wildlife for any purpose stated in R12-4-413.
16. "Hybrid wildlife" means an offspring from two different wildlife species or genera. Offspring from a wildlife species and a domestic animal species are not considered to be wildlife.
17. "Live baitfish" means any species of live freshwater fish designated by Commission order as lawful for use in taking aquatic wildlife under R12-4-313.
18. "Live bait" means aquatic live wildlife used or intended for use in taking aquatic wildlife.
19. "Native" means wildlife or offspring of wildlife that occurred naturally within the present boundaries of Arizona before European settlement.
20. "Nonnative" means wildlife or its offspring that did not occur naturally within the present boundaries of Arizona before European settlement.
21. "Photography" means any process that captures light to produce an exact image of wildlife or parts of wildlife on another medium.
22. "Propagate" means the production of offspring that qualify as wildlife from captive live wildlife parents.
23. "Rehabilitated wildlife" means live wildlife that is injured, orphaned, sick, or otherwise debilitated and is provided care to restore it to a healthy condition suitable for release to the wild or for lawful captive use.
24. "Restricted live wildlife" means wildlife that cannot be imported, exported, or possessed without a special license or lawful exemption. Restricted live wildlife are listed in R12-4-406.
25. "Shooting preserve" means any operation where live wildlife is released for the purpose of hunting.
26. "Special license" means any permit or license issued under this Article, including any additional stipulations placed on the license that authorizes specific activities normally prohibited by A.R.S. § 17-306 and R12-4-402.
27. "Stock" and "stocking" mean to release live aquatic wildlife into public or private waters other than the waters where taken.
28. "Wildlife of special concern" means any species listed in "Wildlife of Special Concern," published by the Arizona Game and Fish Department. A copy is available for inspection at any Department office.
29. "Zoonotic" means a disease that can be transmitted to humans from other animals.

R12-4-402. Live Wildlife: Unlawful Acts

1. An individual shall not perform any of the following activities with live wildlife unless authorized by this Chapter or A.R.S. Title 3, Chapter 16:
   - Import any live wildlife into the state;
   - 2. Export any live wildlife from the state;
   - Transport, possess, offer for sale, sell, sell as live bait, trade, give away, purchase, rent, lease, display, exhibit, propagate, stock, or release live wildlife within the state; or
   - Kill any captive live wildlife;
2. If an individual lawfully possesses wildlife, but holds it in a manner that poses an actual or potential threat to other wildlife, or the safety, health, or welfare of the public, the Department shall seize, quarantine, or hold the wildlife.

R12-4-405 Importing, Purchasing, and Transporting Live Wildlife Without an Arizona License or Permit

1. An individual may import live aquatic wildlife not listed in R12-4-406 without a license or permit from the Department under the following conditions:
   - The wildlife is lawfully possessed under a valid license, permit, or other form of authorization from another state, the United States, another country, or is possessed under a lawful exemption;
   - The wildlife is used only for the aquarium trade or a fish farm, as defined in R12-4-401, or for restaurants or markets that are licensed to sell food to the public;
   - If the wildlife is for the aquarium trade or a fish farm, the wildlife is accompanied by a valid license or permit issued by another state or the United States that allows the wildlife to be transported through this state;
   - If the wildlife is for restaurants or markets, the wildlife is killed before it is transported from the restaurant or market, or if transported alive from the market is conveyed directly to its final destination for preparation as food; and
   - If the individual is engaged in the aquarium trade and wishes to purchase aquatic live wildlife or the individual wishes to purchase aquatic live wildlife for restaurants or fish markets.
2. Aquatic live wildlife that is used in the aquarium trade shall not be used for any reason other than as a pet or in an ornamental display. An individual in the aquarium trade shall not use wildlife that is listed as restricted live wildlife under R12-4-406. An individual shall keep live aquatic wildlife that is used in the aquarium trade in an aquarium or an enclosed pond that does not allow the wildlife to leave the aquarium or pond, and does not allow other live aquatic wildlife to enter.
3. An individual shall obtain an appropriate special license listed in R12-4-409(A) before importing aquatic live wildlife for any purpose not stated in subsection (B). An individual may import aquatic live wildlife into this state if an exemption exists in this Chapter.
4. An individual may purchase, possess, exhibit, transport, propagate, trade, rent, lease, give away, sell, offer for sale, export, or kill wildlife or aquatic wildlife or its offspring without an Arizona license or permit if the wildlife is lawfully imported and possessed as prescribed under subsections (A) or (B).
5. An individual shall use and dispose of wildlife that is taken under an Arizona hunting or fishing license as prescribed by R12-4-404, or R12-4-417 and this Article, if applicable.

R12-4-406 Restricted Live Wildlife

1. Fish listed below are restricted live wildlife as defined in R12-4-401.
   - Arctic grayling, the species Thymallus arctius;
   - Bass, all species of the family Serranidae;
   - Bighead carp, the species Aristichthys nobilis;
   - Black carp, the species Mylopharyngodon piceus;
   - Bony tongue, the species Arapaima gigas;
   - Bowfin, the species Amia calva;
   - Catfish, all species of the family Ictaluridae;
   - Crucian carp, the species Carassius carassius;
   - Electric catfish, the species Malapterurus electricus;
   - Electric eel, the species Electrophorus electricus;
   - European whitefish or ide, the species Leuciscus idus and Idus idus;
   - Freshwater drum, the species Aplodinotus grunniens;
   - Freshwater stingrays, all species of the family Potamotrygonidae;
   - Gars, all species of the family Lepisosteidae;
   - Goldeye, mooneye, and all species of the family Hiodontidae;

- Herring, all species of the family Clupeidae;
- Indian carp, all of the species Catla catla, Cirrhina mrigala, and Labeo rohita;
- Lampreys, all species of the family Petromyzontidae;
- Nile perch, all species of the genus Lates and Luciolates;
- Pike or pickerels, all species of the family Esocidae;
- Pike topminnow, the species Belonesox belizanus;
- Piranha, all species of the genera Serrasalmus, Serrasalmo, Phygocentrus,
- Teddyella, Rooseveltiella, and Pygopristis;
- Rudd, the species Scardinius erythrophthalmus;
- Shad, all species of the family Clupeidae except threadfin shad, species Dorosoma petenense;
- Sharks, all species, both marine and freshwater, of the orders Hexanchiformes, Heterodontiformes, Squaliformes, Pristiophoriformes, Squatiniformes, Orectolobiformes, Lamniformes, and Carcharhiniformes, except for all species of the families Hemiscilliidae, Orectolobidae, Brachaeluridae, and Triakidae; genera of the family Scylirhinidae, including Aulohalaerlusrus, Halaelurus, Haploblepharus, Poroderma, and Scyliorhinus; and genera of the family Parascylliidae, including Cirroscyllium and Parascyllium;
- Silver carp, the species Hypophthalmichthys molitrix;
- Snakehead, all species of the family Channidae;
- South American parasitic catfish, all species of the family Trichomycteridae and Cetopsidae;
- Sunfish, all species of the family Centrarchidae;
- Temperate basses of the family Moronidae;
- Tetras, all species of the genus Astyanyx;
- Tiger fish, the species Hoplias malabaricus;
- Trout, all species of the family Salmonidae;
- White amur or grass carp, the species Ctenopharyngodon idella;
- Walking or air breathing catfish, all species of the family Clariidae; and
- Walleye, and pike perches, all species of the family Percida.

R12-4-407 Exemptions from Special License Requirements for Restricted Live Wildlife

1. An individual may import and transport live game fish and crayfish directly to restaurants or markets that are licensed to sell food to the public.
2. Restaurants and markets that are licensed to sell food to the public may possess, exhibit, offer for sale, and sell live game fish or crayfish. Live game fish and crayfish shall be killed before they are transported from the restaurant or market.
3. An individual may possess and propagate live freshwater crayfish (families Astacidae, Cambaridae, and Parastacidae) and their offspring without a special license, if the crayfish were possessed before January 1, 2001. An individual may not transport, sell, offer for sale, give away, or release live freshwater crayfish except as allowed under this Section or R12-4-316.
4. An exemption granted by this Section is not valid for any wildlife protected by federal statute or regulation unless supported by federal permission or documentation rendering the exemption lawful.

R12-4-410 Aquatic Wildlife Stocking Permit

1. An aquatic wildlife stocking permit allows an individual to perform any of the following: import, purchase, possess, transport and stock any species designated on the permit at the location specified on the permit.
2. An applicant shall apply for an aquatic stocking permit on forms provided by the

Department. Applications are available at any Department office. An applicant shall provide the following on the application:

- Name, address, telephone number, birth date, physical description, and if applicable, Department ID number;
- If the applicant will use the wildlife for a commercial purpose, the name, address, and telephone number of the applicant's business;
- The wildlife species, the number of animals per species, and the approximate size of the wildlife that will be used under the license. If the application is for use of multiple species, the applicant shall list each species and the number of animals per species;
- The name, address, and telephone number of the location where the wildlife will be held, if applicable. Otherwise, the applicant shall provide the physical location of the holding site, including river drainage, township, range, and section. If the applicant applies to hold wildlife in more than one location, the applicant shall submit a separate application for each location;
- A detailed description or diagram of the facilities where the applicant will hold the wildlife;
- The name, address, and telephone number of all wildlife suppliers from whom the applicant will obtain wildlife;
- The date wildlife will be stocked, or dates if stocking will take more than one day;
- If the applicant is applying for an aquatic wildlife stocking permit to stock wildlife in an area where the wildlife has not already been introduced, or where the wildlife is not currently established, or to stock wildlife that conflicts with the Department's efforts to conserve wildlife, a typewritten, computer or word processor printed, or legibly handwritten proposal that clearly states:
  a. The purpose for introducing the aquatic live wildlife species;
  b. The anticipated benefits from introducing the aquatic live wildlife species;
  c. The potential adverse economic impacts of introducing the aquatic live wildlife species;
  d. The potential dangers the introduced species could create for native and game fish, including whether or not the introduced species is compatible with native or game fish;
  e. The potential ecological problems that the introduced species could create;
  f. The diseases and parasites inherent in or associated with the introduced species;
  g. The anticipated hybridization concerns with introducing the species; and
  h. Any suggestions to evaluate the status and impact of the species after it is introduced; and
- The applicant's signature and the date of signing. By signing the application, the applicant attests that the information provided is true and correct to the applicant's knowledge and that the applicant's live wildlife privileges are not revoked in this state, any other state, or by the United States.

3. An aquatic wildlife stocking permit holder shall stock wildlife only on the date or dates stated on the permit. An aquatic wildlife stocking permit holder is only authorized to stock wildlife for 20 consecutive days.

4. The Department shall issue an aquatic wildlife stocking permit in compliance with R12-4-106. The Department shall deny a wildlife stocking permit if the applicant proposes to use aquatic wildlife that is not compatible with or poses a threat to any wildlife within the drainage or area where the stocking is to occur. If the Department determines that issuance of the permit will result in a negative impact to state wildlife, the Department shall deny the permit. If the Department denies the application for a permit, the Department shall proceed as prescribed by R12-4-409(D).

5 . An aquatic wildlife stocking permit holder shall obtain all aquatic wildlife, live eggs, fertilized eggs, and milt from a licensed fish farm operator or a private noncommercial fish pond that has been certified free of the diseases and causative agents specified by any additional stipulation placed on the permit by the Department at the time of application or permit renewal, as authorized by R12-4-409(F). Certification is based on a physical inspection of the fish farm or fish pond of origin performed not more than 12 months before the wildlife or biological material is shipped. The Department has the authority to require that an inspection be performed sooner than 12 months. The inspection shall be performed by a qualified fish health inspector or fish pathologist. The inspection shall be performed at the fish farm or fish pond where the wildlife or biological material is held before it is shipped. A copy of the certification shall accompany each shipment.
6. Native aquatic wildlife species shall be obtained and disposed of as directed by the Department.
7. An aquatic wildlife stocking permit holder is subject to the provisions of R12-4-409 and R12-4-428.

ARS 17-306 No person shall import or transport into the state or sell, trade or release within the state or have in his possession any live wildlife except as authorized by the commission or as defined in title 3, chapter 16.

ARS 17-238

1. The commission may adopt rules and regulations and issue licenses for the conduct of field trials, shooting preserves, private wildlife farms and zoos, or for the personal use and possession of wildlife so as to safeguard the interests of the wildlife and people of the state.
2. The commission, at its discretion and under such regulations as it deems necessary, may issue a permit to take wildlife for scientific purposes to any person or duly accredited representative of public educational or scientific institutions, or governmental departments of the United States engaged in the scientific study of wildlife.
3. A person holding a permit issued pursuant to this section may, upon advance approval by the commission, buy, sell and transport wildlife legally possessed. Each person receiving a permit under this section shall file with the department within fifteen days after requested by the department a report of his activities under the permit. The commission may revoke such licenses or permits for noncompliance with regulations.

AZ Administrative Code, Article 10. AQUACULTURE

R3-2-1001. Definitions

In addition to the definitions provided in A.R.S. § 3-2901, the following shall apply unless the context otherwise requires:

1. "Certificate of Aquatic Health" is an official document from an issuing state or an equivalent form published by the United States Fish and Wildlife Service or the United States Department of Agriculture attesting that the live aquatic animals described thereon have been inspected and are free of the diseases and causative agents set forth in R3-2-1009.
2. "Department" means the Arizona Department of Agriculture.

R3-2-1002. Fees for Licenses; Inspection Authorization and Fees

1. License fees are established as follows:
   - Aquaculture facility: $100 annually
   - Fee fishing facility: $100 annually
   - Aquaculture processor: $100 annually
   - Aquaculture transporter: $100 annually
   - Special licenses: $10 annually
2. An expired license may be renewed within 90 days after expiration by payment of a $50 late fee.
3. Upon request of the licensee, the Department shall assess the licensed facility and, if applicable, certify the facility is free from infectious diseases and causative agents listed in R3-2-1009 before issuing a Certificate of Aquatic Health. All expenses properly incurred in the certification procedure of the inspection, including time, travel, and laboratory expenses, shall be paid to the Department by the licensee requesting certification.

R3-2-1003. General Licensing Provisions

1. An applicant for a license to operate an aquaculture facility or a fee fishing facility, or to operate as an aquaculture processor or aquaculture transporter shall provide the following information on a form furnished by the Department:
   - Whether the applicant is an individual, corporation, partnership, cooperative, association, or other type of organization;
   - The name and address of the applicant;
   - A corporation shall specify the date and state of incorporation;
   - The principal name of the business, and all other business names that may be used;
   - The name, mailing address, and telephone number of the applicant's authorized agent;
   - The street address or legal description of the location of the facility to be licensed;
   - The signature of the person designated in subsection (A)(5), and the date the application is completed for submission to the Department.
2. The Department shall grant a license when all conditions are met and assign a Department establishment number to each facility.
3. All licenses expire on December 31 for the year issued.
4. A licensee shall advise the Department in writing of any change in the information provided on the application during the license year. This information shall be provided within 30 calendar days of the change.
5. To prevent the spread of diseases and causative agents listed in R3-2-1009, the Department may inspect and take samples from any facility or shipment being transported. A licensee shall notify the Department within 72 hours of becoming aware of the presence of any disease or causative agent listed in R3-2-1009. Aquatic animals found to be infected with a disease or causative agent listed in R3-2-1009 are prohibited from interstate or intrastate movement without prior written Department approval.
6. The Department shall quarantine or seize aquatic animals, alive or dead, plants, or products for examination or diagnostic study when there is a potential for spread of a disease or causative agent listed in R3-2-1009, or any other disease or causative agent that could constitute a threat to aquatic animals or plants of the state. The Department shall issue a written notice to the licensee specifying:
   - The reason for the Department's action;
   - The licensee's right to request a hearing as prescribed in A.R.S. § 3-2906.

7. A licensee shall conspicuously mark all quarantined aquatic products and quarantined areas in a manner specified by the Department.
8. A licensee shall pay all diagnostic, quarantine, and destruction costs.

R3-2-1004 Specific Licensing Provisions; Aquaculture Facility; Fee Fishing Facility; Special License Facility

1. In addition to the application requirements in R3-2-1003, an applicant for a license to operate an aquaculture facility, a fee fishing facility, or a special license facility under A.R.S. § 3-2908(A) shall provide the following information on a form provided by the Department:
   - Water sources, transmission, and conveyances;
   - Method used to dispose of tailing waters and solid wastes;
   - Number and size of ponds, raceways, and tanks, if applicable;
   - Whether hatchery facilities are included;
   - A list of all animals and plants to be authorized under the license by genus, species, and common name.
2. An application to culture or possess an aquatic animal or plant that has not previously occurred in the drainage where the facility is located shall be accompanied by a written proposal. The applicant's proposal shall include:
   - Anticipated benefits from introducing the species;
   - Anticipated adverse effects from introducing the species, as it may affect indigenous or game fish, including hybridization;
   - Anticipated diseases inherent to introducing the species;
   - Suggestions for post-introduction evaluation of status and impacts of the introduced species;
   - Structural and operational methods implemented to prevent escape of the species, if applicable.
3. Each body of water serving a facility shall be contained within the boundaries of the land owned or leased by the licensee.
4. A facility using public waters having natural or artificial inlets, rivers, creeks, washes, or canals shall provide mechanical screening approved by the Department to prevent live aquatic animals and plants, including eggs and fry, from escaping beyond the aquaculture facility boundaries or into public bodies of water.
5. An applicant for a special license under A.R.S. § 3-2908(A) shall also provide the following information to the Department at the time of application:
   - A written narrative describing the project in detail, the project purpose, the hypothesis, and the project duration; and
   - The proposed disposition of the aquatic animals or plants upon completion of the project.
6. The Department shall consider the recommendations of the Arizona Game and Fish Department, under A.R.S. § 3-2903, when determining whether to issue a license or an import permit under R3-2-1010. The Department may issue a license excluding some of the aquatic animal or plant species listed in the application.

R3-2-1005. Fee Fishing Facility

1. A licensee shall not allow an aquatic animal to be removed from a fee fishing facility unless:
   - The aquatic animal is dead;
   - The licensee provides the person removing the aquatic animal with written proof of sale identifying the:

a. Facility, by name, address, and Department establishment number issued under R3-2-1003(B);
b. Date of harvest; and
c. Number and species of aquatic animals transported from the facility.

R3-2-1006. Processor License

1. In addition to complying with the application requirements of R3-2-1003, applicants for a license to operate as an aquaculture processor as defined in A.R.S. § 3-2901(12) shall provide the following information on a form furnished by the Department:
   - Water sources, transmission, conveyances, and annual consumption in gallons or acre feet;
   - Method used to dispose of tailing waters and solid wastes;
2. A processing facility shall operate in a clean and sanitary condition during all periods of operation. The following are the minimum requirements for such establishments.
   - Each establishment shall have sanitary floors and walls impervious to water.
   - All outside windows and doors shall be screened
   - There shall be a supply of potable water
   - There shall be a sewage disposal system of such a type as not to be a breeding place for insects and not to constitute a hazard or to endanger public health.

R3-2-1007. Transporter License; Transport; Delivery

1. In addition to the application requirements in R3-2-1003, an applicant for a license to operate as an aquaculture transporter of live aquatic animals as defined in A.R.S. § 3-2901(15) shall, on a form provided by the Department:
   - Designate whether the license is for interstate or intrastate transport, or both;
   - List aquatic transporting equipment to be used, including tanks and vehicles, and vehicle license number;
   - State prior year volume or anticipated annual tonnage of live aquatic animals transported.
2. A transporter shall ensure that the aquatic transporting equipment has adequate water and oxygen at a temperature and in a quantity normal for the health of the live aquatic animals and shall be clearly marked, "Live Fish."
3. In addition to a copy of the Certificate of Aquatic Health, a transporter shall transport each container of live aquatic animals within the state with a document identifying:
   - Consignor's name, address, and telephone number;
   - Consignee's name, address, and telephone number;
   - Quantity and size of the aquatic animal being transported;
   - Genus, species, and common name of the aquatic animal being transported;
   - Date of shipment;
   - Department establishment number.
4. A transporter shall deliver live aquatic animals only to a retail outlet, as prescribed at A.R.S. § 3-2907(J) or to a person listed in R3-2-1010(B).

R3-2-1009. Disease Certification

1. A licensee requesting and receiving a Certificate of Aquatic Health shall have their facility inspected and all live aquatic animals, fertilized eggs and milt shall be found free of, but not limited to, the following diseases and causative agents:
   - Causative agent: Egtved Virus. Disease: VHS, Viral Hemorrhagic Septicemia of Salmonids.
   - Causative agent: Infectious Hematopoietic Necrosis Virus. Disease: IHN, Infectious Hematopoietic Necrosis of Salmonids.

- Causative agent: Infectious Pancreatic Necrosis Virus. Disease: IPN, Infectious Pancreatic Necrosis of Salmonids.
- Causative agent: Ceratomyxa shasta. Disease: Ceratomyxosis of Salmonids
- Causative agent: Rhabdovirus carpio. Disease: Spring Viremia of carp
- Certification is required in this case only when the original origin of the shipment is from outside the United States
- Causative agent: Renibacterium salmoniarum. Disease: BKD, Bacterial Kidney Disease of Salmonids
- Causative agent: Aeromonas salmonicida. Disease: Furunculosis
- Causative agent: Myxobolus cerebralis. Disease: Whirling Disease of Salmonids.

2. The Department may require inspection for any disease or causative agent not listed in subsection (A) when there is evidence that the disease or causative agent may constitute a threat to aquatic animals or plants, aquatic wildlife or the aquaculture industry. The Department shall send written notice to all licensees pursuant to this Chapter when implementing this subsection, naming the disease or causative agent of concern. Action to quarantine or seize aquatic animals or plants pursuant to this subsection shall not be subject to delay pending such written notice.

R3-2-1010. Importation of Aquatic Animals

1. The owner, or owner's agent, importing live aquatic animals into the state shall ensure the animals are accompanied by the following:
   - A Certificate of Aquatic Health as defined in R3-2-1001, based upon an inspection of the originating facility within the 12 months preceding the shipment;
   - A transporter license issued under R3-2-1007;
   - An import permit number issued by the Department under this Section, legibly written or typed on the certificate of aquatic health.
2. The owner, or owner's agent, of live aquatic animals, except those imported by a retail outlet as prescribed in A.R.S. § 3-2907(J), shall ensure that the animals are consigned to or in the care of:
   - An Arizona resident;
   - An aquaculture facility, fee fishing facility, or special license holder licensed by the Department;
   - A holder of an aquatic wildlife stocking permit issued by the Arizona Game and Fish Department;
   - A holder of any aquatic animal license issued by the Arizona Game and Fish Department.
3. The owner, or owner's agent, may obtain an import permit number from the Department, Office of the State Veterinarian, by providing the following information:
   - Consignor's name, address, and telephone number;
   - Consignee's name, address, and telephone number;
   - Consignee's Department establishment number issued by the Department or a copy of an aquatic wildlife stocking permit or the license issued by the Arizona Game and Fish Department;
   - Origin of the shipment;
   - Genus, species, and common name of aquatic animals to be imported;
   - Quantity and size classification of aquatic animals to be imported.
4. An import permit number remains valid for 15 calendar days from the date of issuance by the Department.
5. The Department shall refuse entry to any shipment that does not comply with this rule.

6. The Department shall quarantine and require destruction of any shipment, after its arrival, that it determines is infected with or was previously exposed to any causative agent or disease listed in R3-2-1009.

ARS 3-2901. Definitions

In this chapter, unless the context otherwise requires:

1. "Aquaculture" or "aquaculture facility" means the controlled propagation, growth and harvest of aquatic animals or plants, including fish, amphibians, shellfish, mollusks, crustaceans, algae and vascular plants.
2. "Aquatic animal or plant" means a cultured aquatic wildlife or plant propagated or maintained in an aquaculture facility for distribution or sale.
3. "Aquatic products" means aquatic animals and plants, or their by-products, that are produced, grown, managed, harvested or marketed.
4. "Aquatic wildlife" means amphibians, fish, mollusks, crustaceans and soft shelled turtles found in a state of nature.
5. "Associate director" means the associate director of the division.
6. "Container" means any restrictive enclosure used to contain aquatic products for handling, packing or shipping.
7. "Division" means the animal services division of the Arizona department of agriculture.
8. "Fee fishing" means removing aquatic animals by any harvesting method from a privately controlled body of water as authorized by a direct or indirect payment of a fee.
9. "Lot" means one or more consolidated containers identified as a single item or unit.
10. "Owner" means the person in possession of and legally entitled to dispose of aquatic products.
11. "Person" means an individual, partnership, corporation, group, company, society or association.
12. "Processor" means a person who receives and cleans, reshapes or containerizes live or dead aquatic animals or plants for distribution or resale.
13. "Propagate" means to breed or reproduce aquatic animals or plants or cause aquatic animals or plants to breed or reproduce.
14. "Supervisor" means the supervisor of aquaculture or the supervisor's authorized representative.
15. "Transporter" means a person that transports live aquatic animals or plants to persons who are licensed to resell, process or stock aquatic animals or plants.

ARS 3-2902. Supervisor of aquaculture

The associate director, with the approval of the director, may employ a supervisor of aquaculture. The supervisor shall:

1. Qualify by taking and filing the official oath of office.
2. Possess qualifications consistent with the responsibilities of his position, including:
   - A baccalaureate degree in a field directly related to aquaculture, or the equivalent practical experience;
   - Supervisory experience in aquaculture or similar related fields.

ARS 3-2903. Regulatory powers of the director

The director may:

1. Regulate the transportation, possession, sale, processing and fee fishing of aquatic animals and plants and establish licensing categories and programs for these activities as provided by this article.
2. Adopt rules as necessary to administer and enforce this article, including rules relating to:

- Container labels, bills of lading, bills of sale and similar documents that identify contents, quality and quantities of aquatic products, including the names, addresses and other identification of shippers, producers and buyers of aquatic products.
- Identification of aquatic animals that are transported whole by the consumer from a fee fishing facility.

3. Cooperate with agencies of the United States and of this state to promote the exchange of information and avoid unnecessary duplication of services and regulation. The director shall ensure that the rules adopted under this article shall not impair enforcement of restricted live wildlife rules as promulgated pursuant to title 17.
4. Cooperate with agencies of the United States and this state and universities and other academic and research institutions to promote research and the exchange of information to support and promote the interests of aquaculture.
5. Establish programs to publicize and promote the development of the aquaculture industry in this state.
6. Establish a schedule of fees to compensate for the expense of administering this article, including personnel costs. The amount of each fee shall be set according to the cost of the specific activity for which the fee is imposed.

ARS 3-2904. Quality and disease control

The director shall adopt rules and guidelines to control the quality of and diseases in aquatic animals and plants. The rules may include:

1. Routine monitoring and diagnostic procedures.
2. Criteria for quarantine, condemnation or destruction requirements.
3. Waiting periods between diagnosis and destruction.
4. Methods of destruction and sanitation.
5. Procedures and standards for compensation.

ARS 3-2905. Inspections and certification of facilities

1. The department shall establish a schedule of periodic inspections of all licensed facilities to determine and verify compliance with this article and the rules adopted under this article. By applying for and obtaining a license under this article, the licensee is deemed to consent to such periodic inspections. In addition, the director or the director's authorized representative may enter private property at any reasonable time to inspect, obtain factual data and otherwise ascertain compliance with or violations of this article. Inspections shall be on reasonable notice to the owner or manager of the facility unless reasonable grounds exist to believe that such notice would impair the enforcement of this article. If required by law, the director shall obtain a warrant for such unscheduled entry and inspection.
2. On request, and with payment of the prescribed fee, the department shall physically inspect an aquatic animal facility for infectious diseases and causative agents. The inspector shall be approved by the director. If the inspector determines that the facility is free of restrictive infectious diseases and causative agents, the inspector shall issue to the facility a certificate to that effect within ten days after completing the inspection. The certificate is valid for one year from the date of the inspection.
3. On request and without charge the department shall provide a certificate that an aquaculture facility has been inspected and certified free of restrictive diseases and causative agents within the preceding twelve months. Each shipment or lot shall be accompanied by a certificate identifying the shipment. This subsection does not apply to the transportation of live baitfish for personal use that complies with applicable rules of the game and fish commission.

ARS 3-2906. Seizure and quarantine; hearing

1. The department may seize, hold, quarantine or dispose of any lot of aquatic products that enters, leaves or is transported in this state if the lot does not comply with this article, rules adopted under this article or federal statutes or rules.
2. The owner of a lot of aquatic products that is seized, held or quarantined under this section may request a hearing on the action pursuant to title 41, chapter 6, article 10. The hearing shall be held within ten days after receipt of the request. If evidence produced at the hearing shows that the action was unreasonable, the lot shall be immediately released. Except as provided in section 41-1092.08, subsection H, any person who is adversely affected by the final administrative decision may seek judicial review pursuant to title 12, chapter 7, article 6 in the county in which the lot is held.

ARS 3-2907. Licenses; fee; exemption

1. A person may not engage in any of the following activities relating to aquaculture unless the person possesses a current valid license issued by the division:
   - Aquaculture facility activities, including selling, trading, displaying, purchasing, exporting, possessing, propagating and rearing live aquatic animals or plants;
   - Transporting live aquatic animals to persons who are licensed to resell, process or stock aquatic animals;
   - Processing facility activities, including cleaning, reshaping or packing fresh or frozen aquatic animals or plants for distribution or resale;
   - Operating a fee fishing facility that permits the public to remove aquatic animals by any harvesting method from a privately controlled body of water as authorized by the direct or indirect payment of a fee.
2. This chapter does not apply to state or federal game and fish agencies.
3. Each facility or transporter must be separately licensed with the division including payment of the prescribed fee.
4. Each license issued under this section shall state the name and business address of the licensee, the name and address of the person designated as the licensee's agent to the division, the location of the premises for which it is issued, other than a transporter, and any other information deemed necessary by the director.
5. A licensee may not transfer or convey the license to any other person or entity. The license is valid only for the named licensee and for the particular premises identified on the license. If there is a transfer or change in the ownership of a licensee or the premises identified on the license, or a change in the licensee's agent, the licensee shall notify the division within thirty days.
6. A license is valid for one year from the date prescribed by the associate director. The license may be renewed by applying and paying the required renewal fee at any time within thirty days before the license expires. If a license expires, it may be renewed within ninety days after expiration by paying an additional prescribed fee increment. A license that has been expired for more than ninety days may not be renewed.

7. An application for an original or renewal license under this section shall be submitted to the division together with the appropriate fee on a form furnished by the department. An applicant shall furnish any additional information that may be required.
8. Within thirty days after receiving the completed application, the division shall either issue or deny the license. The division shall issue a license, in the name under which the applicant proposes to conduct business, to an applicant that has satisfied the licensing procedures and requirements of this article. If the applicant fails to meet the requirements for an original or renewal license under this article, the associate director

shall notify the applicant by certified mail stating the reasons for the denial and advising the applicant of the right to request a hearing pursuant to title 41, chapter 6, article 10. The applicant must request the hearing in writing within thirty days after the date the notice is mailed. The associate director shall schedule the hearing to be held within thirty days after the request is received. If the record made at the hearing discloses that the applicant meets the qualifications and other requirements of this chapter, the hearing officer shall enter an order to that effect and direct that the appropriate license be issued. If the applicant is found to be unqualified or otherwise fails to meet the requirements of this article, the hearing officer shall enter an order to that effect.

9. The application for an original or renewal license shall be accompanied by a license fee set by the director according to the cost of administering this article, but not less than one hundred dollars.
10. A person who sells aquatic products at retail is exempt from the requirements of this section unless the person engages in any of the activities required to be licensed under subsection A.

ARS 3-2908. Special licenses

1. The division may issue special aquaculture licenses for purposes of education and research institutional needs pursuant to rules adopted by the director. Special aquaculture licenses are not renewable and may be issued for not more than three year terms.
2. The fee prescribed by the director for a special license shall not exceed one hundred dollars.

ARS 3-2909. Protecting aquatic wildlife

The Arizona department of agriculture shall prescribe restrictions on supply water and tailing water discharges from an aquaculture facility if the department or the game and fish department determines that the waters are detrimental to aquatic wildlife.

ARS 3-2910. Unauthorized removal of aquatic animals or plants from aquaculture facility; classification

A person who removes aquatic animals or plants by any method from an aquaculture facility without the consent of the owner or manager of the facility is guilty of a class 1 misdemeanor.

ARS 3-2911. Cease and desist orders; hearing; subpoena; injunctions; revocation or suspension of license; probation

1. If the associate director has reason to believe that a person is violating or has violated a provision of or rule adopted under this article or the conditions of a license issued under this article, the associate director shall give the person written notice by certified mail that the person shall appear and show cause at a hearing conducted pursuant to title 41, chapter 6, article 10 not less than thirty days after the date of mailing the notice why the person should not be ordered to cease and desist from the violation. The notice shall inform the person of the date, time and place of the hearing and the consequences of failure to appear.
2. At the hearing the administrative law judge shall issue a decision and order. The decision and order may take such form as the administrative law judge determines to be reasonable and appropriate and shall include a determination of violation, a cease and desist order or the recommendation of a civil penalty.

3. If the person continues the violation after the administrative law judge has issued a final decision and order under subsection B, the associate director may apply for a temporary restraining order or preliminary or permanent injunction from the superior court according to the Arizona rules of civil procedure. A decision to seek injunctive relief does not preclude other forms of relief or enforcement against the violator.
4. In addition or as an alternative to seeking injunctive relief under subsection C, if the associate director finds that a licensee has violated or failed to comply with this article or a rule adopted under this article, the associate director may:
   - Suspend the license for a definite period of time;
   - Revoke the license;
   - Place the person whose license has been suspended on probation. If the assistant director places the licensee on probation and allows the licensee to continue to operate, that fact shall be entered into the records of the division relating to the suspension and probation.

ARS 3-2912. Civil penalties

1. The director may assess a civil penalty in an amount not exceeding one hundred dollars per day of violation against any person who is determined pursuant to section 3-2911 to be in violation of this article, the rules adopted pursuant to this article or the terms and conditions of a license issued under this article.
2. The director shall bring any action to recover the penalties under this section in the superior court in the county in which the violation occurred.
3. In determining the amount of the penalty, the court shall consider whether the violation was knowing or willful, the past conduct of the defendant, whether the defendant should have been on notice of the violation, whether the defendant has taken steps to cease, remove or mitigate the violation and any other relevant information.
4. All monies collected as civil penalties under this section shall be deposited, pursuant to sections 35-146 and 35-147, in the state general fund.

and desist order or the recommendation of a civil penalty.

3. If the person continues the violation after the administrative law judge has issued a final decision and order under subsection B, the associate director may apply for a temporary restraining order or preliminary or permanent injunction from the superior court according to the Arizona rules of civil procedure. A decision to seek injunctive relief does not preclude other forms of relief or enforcement against the violator.
4. In addition or as an alternative to seeking injunctive relief under subsection C, if the associate director finds that a licensee has violated or failed to comply with this article or a rule adopted under this article, the associate director may:
   - Suspend the license for a definite period of time;
   - Revoke the license;
   - Place the person whose license has been suspended on probation. If the assistant director places the licensee on probation and allows the licensee to continue to operate, that fact shall be entered into the records of the division relating to the suspension and probation.

ARS 3-2912. Civil penalties

1. The director may assess a civil penalty in an amount not exceeding one hundred dollars per day of violation against any person who is determined pursuant to section 3-2911 to be in violation of this article, the rules adopted pursuant to this article or the terms and conditions of a license issued under this article.
2. The director shall bring any action to recover the penalties under this section in the superior court in the county in which the violation occurred.
3. In determining the amount of the penalty, the court shall consider whether the violation was knowing or willful, the past conduct of the defendant, whether the defendant should have been on notice of the violation, whether the defendant has taken steps to cease, remove or mitigate the violation and any other relevant information.
4. All monies collected as civil penalties under this section shall be deposited, pursuant to sections 35-146 and 35-147, in the state general fund.

APPENDIX IV.
COMPATIBLE LAND USE

Chapter 20. Compatible Land Use and Airspace Protection

20.1. Background. Land use planning is an important tool in ensuring that land adjacent to, or in the immediate vicinity of, the airport is consistent with activities and purposes compatible with normal airport operations, including aircraft landing and takeoff. Ensuring compatible land use near federally obligated airports is an important responsibility and an issue of federal interest. In effect since 1964, Grant Assurance 21, *Compatible Land Use*, implementing Title 49 United States Code (U.S.C.) § 47107 (a) (10), requires, in part, that the sponsor:

"...take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft. In addition, if the project is for noise compatibility program implementation, it will not cause or permit any change in land use, within its jurisdiction, that will reduce its compatibility, with respect to the airport, of the noise compatibility program measures upon which federal funds have been expended."

Incompatible land use at or near airports may result in the creation of hazards to air navigation and reductions in airport utility resulting from obstructions to flight paths or noise-related incompatible land use resulting from residential construction too close to the airport.

Airports present a variety of unique challenges to those involved in community planning. Height restrictions are necessary in the vicinity of airports and airways for the protection of aircraft in flight. Residential housing and other land uses near airports must remain compatible with airports and the airport approach/departure corridors. Additional concerns include the airport's proximity to landfills and wetlands that may result in hazards to air navigation created by flocks of birds attracted to the landfills or wetlands. Unusual lighting in the approach area to an airport can create a visual hazard for pilots. Also, land uses that obscure visibility by creating smoke or steam may be hazardous to flight. Each of these concerns must be addressed in community planning in order to maintain the safety of flight as well as the quality of life expected by community residents.

As communities continue to grow, areas that once were rural in nature can quickly become urbanized. A result of "urban sprawl" is the loss of open space and the resulting loss of airports and/or their utility. Many communities have relied upon their airports as an economic engine. Proximity of industrial parks and recreational areas has proven not only to be compatible, but to be mutually beneficial as well. Some communities have used the resources of an airport to contribute to the quality of life for the local community.

In addition to the basic economic value of the airport, the preservation of open space and the ability to accommodate emergency medical airlifts are specific examples of this contribution to the community. Increases in air travel are placing an increasing demand on the nation's airports. Environmental concerns and cost may prohibit the establishment of new airports. This means that to accommodate air traffic demand, maximum utility must be achieved from existing airports. For this to happen, the land use in the vicinity of airports must be reserved for compatible uses.

Grant Assurance 21, *Compatible Land Use,* relates to the obligation of the airport sponsor to take appropriate actions to zone and control existing and planned land uses to make them compatible with aircraft operations at the airport. The FAA recognizes that not all

Incompatible land use is one of the most serious problems affecting aviation today. (Above is an aerial view of residential development near the Lancaster Airport in Pennsylvania.) Zoning ordinances should be reviewed to determine what uses are currently permitted around the airport and to find out if there have been any recent changes in zoning. It is important that local land use planners become involved in the airport's master planning process by providing input on the potential impacts that future airport development plans may have on their communities. Coordination between the airport and the zoning entities is extremely important to achieve a successful cohabitation between airport and community. (Photo: FAA)

airport sponsors have direct jurisdictional control over uses of property near the airport. However, for the purpose of evaluating airport sponsor compliance with the compatible land use assurance, the FAA does not consider a sponsor's lack of direct authority as a reason for the sponsor to decline to take any action at all to achieve land use compatibility outside the airport boundaries.

In all cases, the FAA expects a sponsor to take appropriate actions to the extent reasonably possible to minimize incompatible land. Quite often, airport sponsors have a voice in the affairs of the community where an incompatible development is located or proposed. The sponsor should make an effort to ensure proper zoning or other land use controls are in place.

20.2. Zoning and Land Use Planning.

a. **Description.** Zoning is an effective method of meeting the federal obligation to ensure compatible land use and to protect airport approaches. Generally, zoning is a matter within the authority of state and local governments. Where the sponsor does have authority to zone or control land use, FAA expects the sponsor to zone and use other measures to restrict the use ofland in the vicinity of the airport to activities and purposes compatible with normal aircraft operations. Restricting residential development near the airport is essential in order to avoid noise-related problems.

Sponsors and local communities should consider adopting adequate guidelines and zoning laws that consider noise impacts in land use planning and development. Similarly, any airport sponsor that has the authority to adopt ordinances restricting incompatible land development and limiting the height of structures in airport approaches according to the standards prescribed in 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*, is generally expected to use that authority.

b. **Guidance.** There are a number of sources that can assist an airport sponsor in dealing with noise, obstructions, and other incompatible land uses. Some of these are:

(1). A *Model Zoning Ordinance to Limit Height of Objects Around Airports*, Advisory Circular (AC) 150/5190-4A.

(2). *Citizen Participation in Airport Planning,* AC 150/5050-4.

(3). Guidelines *for Considering Noise in Land Use Planning and Control,* Federal Interagency Committee on Urban Noise, June 1980.

(4). *Hazardous Wildlife Attractants on or Near Airports*, AC 150/5200-33B, August 28, 2007.

(5). *Noise Control Planning,* FAA Order 1050.11A, January 13, 1986.

(6). *Noise Control and Compatibility Planning for Airports*, AC 150/5020-1.

(7). *Federal and State Coordination of Environmental Reviews for Airport Improvement Projects.* (RTF format) – Joint Review by Federal Aviation Administration and National Association of State Aviation Officials (NASAO), issued March 2002.

(8). *Land Use Compatibility and Airports, a Guide for Effective Land Use Planning* (PDF format), issued by the FAA Office of Environment and Energy.

(9). *Compatible Land Use Planning Initiative* (PDF format), 63 Fed. Reg. 27876, May 21, 1998.

(10). *Draft Aviation Noise Abatement Policy 2000* (PDF format) 65 Fed. Reg. 43802,
July 14, 2000.

(11). *Airport Noise Compatibility Planning Toolkit – FAA's Initiative for Airport Noise and Compatibility Planning*, issued by the FAA Office of Environment and Energy.

c. **Master Planning and Zoning.** The airport master planning process provides a means to promote land use compatibility around an airport. Incompatible land uses around an airport can affect the safe and efficient operation of aircraft. Withinan airport'snoise impactareas,residential and public facilities – such as schools, churches, public health facilities, and concert halls – are sensitive to high noise levels and can affect the development of the airport. Most commercial and industrial uses, especially those associated with the airport, are compatible with airports. An airport master plan is a published document approved by the governmental agency or authority that owns/operates the airport. The airport master plan should be incorporated into local comprehensive land use plans and used by local land use planners and airport planners to evaluate new development within the airport environs. Integration of airport master plans and comprehensive land use plans begins during the development of the master plan. Local municipalities surrounding the airport boundaries must be contacted to collect information on existing land uses in and around airports. Local comprehensive land use plans are also reviewed to determine the types of land uses planned for the future.

Additionally, sponsors should monitor local zoning ordinances to determine what uses are currently permitted around the airport and whether there have been any recent changes in zoning. It is important for local land use planners to become involved in the review and development of the airport's master planning process. They can provide input on potential impacts that future airport development plans may have on communities surrounding the airport. Any conflicts or inconsistencies between airport development plans and the local comprehensive plans should be noted in the airport master plan. The information on future airport expansion and development contained in the airport's master plan should be incorporated in the development of comprehensive land use plans or their subsequent updates or amendments to ensure land use compatibility with the airport. During the development of such plans, planners should coordinate and consult with the airport staff so that the airport's future plans for expansion can be taken into consideration. Local land use planners should review the airport's master plan to determine how future airport projects could affect existing and projected land uses around the airport. Other opportunities for coordination and communication between the airport and local planning agencies include the FAA noise compatibility planning process. (See chapter 13 of this Order, *Airport Noise and Access Restrictions*, for information on aircraft noise compatibility planning.)

Noise compatibility studies provide opportunities for input from airport users, local municipalities, communities, private citizens, and the airport sponsor on recommended operational measures and land use control measures that could minimize or prohibit the development or continuation of incompatible land uses. The airport master plan is also a tool to ensure that planning among federal, state, regional, and local agencies is coordinated. The incorporation and review of these plans provides for the orderly development of air transportation while protecting the public health, safety, and welfare. The legal structure of airport ownership will determine its power to regulate or influence land uses around the airport. Municipalities or counties with this regulatory authority need to be aware of existing and long- term airport development plans and the importance of using that authority to minimize development of incompatible land uses.

d. **Reasonable Attempt.** In cases where the airport sponsor does not have the authority to enact zoning ordinances, it should demonstrate a reasonable attempt to inform surrounding municipalities on the need for land use compatibility zoning. The sponsor can accomplish this through the disseminationof information, education,or ongoing communicationwithsurrounding municipalities. Depending upon the sponsor's capabilities and authority, action could include exercising zoning authority as granted under state law or engaging in active representation and defense of the airport's interests before the pertinent zoning authorities. The sponsor may also take action with respect to implementing sound insulation, land acquisition, purchase of easements, and real estate disclosure programs or initiatives to mitigate areas to make them compatible with aircraft operations. Sponsors without zoning authority may also work to change zoning laws to protect airport interests.

e. **Definition of Compatible Land Use.** Compatibility of land use is attained when the use of adjacent property neither adversely affects flight operations from the airport nor is itself adversely affected by such flight operations. In most cases, the adverse effect of flight operations on adjacent land results from exposure of noise sensitive development, such as residential areas, to aircraft noise and vibration. Land use that adversely affects flight operations is that which creates or contributes to a flight hazard. For example, any land use that might allow tall structures, block the line of sight from the control tower to all parts of the airfield, inhibit pilot visibility (such as glaring lights, smoke, etc.), produce electronic aberrations in navigational guidance systems, or that would tend to attract birds would be considered an incompatible land use. For instance, under certain circumstances, an exposed landfill may attract birds. If open incineration is regularly permitted, it can also create a smoke hazard.

f. **Definition of Concurrent Land Use**. In some cases, concurrent land use can be an appropriate compatible land use. Concurrent land use means that the land can be used for more than one purpose at the same time. For example, portions of land needed for clear zone purposes could also be used for agriculture purposes at the same time, which would be consistent with Grant Assurance 21, *Compatible Land Use.*

g. **Pre-existing Obstructions.** (1) Historically, some airports were developed at locations where preexisting *structures* or natural terrain (for example, hilltops) would constitute an obstruction by currently applicable standards. If such obstructions were not required to be removed as a condition for a grant agreement, the execution of the agreement by the government constitutes a recognition that the removal was not reasonably within the power of the sponsor.

(2) There are many former military airports that were acquired as public airports under the Surplus Property Act, where the existence of obstructions at the time of development was considered acceptable. At such airports where obstructions in the approach cannot feasibly be removed, relocated, or lowered, and where FAA has determined them to be a hazard, consideration may be given to the displacement or relocation of the threshold.

20.3. Residential Use of Land on or Near Airport Property.

a. **General.** The general rule on residential use of land on or near airport property is that it is incompatible with airport operations because of the impact of aircraft noise and, in some cases, for reasons of safety, depending on the location of the property. Nonetheless, the FAA has received proposals to locate residences immediately adjacent to airport property or even on the airport itself, as part of "airpark" developments. "Airpark" developments allow aircraft owners to reside and park their aircraft on the same property, with immediate access to an airfield. Proponents of airparks argue that airparks are an exception to the general rule because aircraftowners will accept the impacts of living near the airport and will actually support the security and financial viability of the airport.

b. **FAA position.** The FAA considers residential use by aircraft owners to be no different from any residential use, and finds it incompatible with the operation of a public use airport. It is common for private airparks to impose restrictions on the use of the airfield, such as night curfews, because aircraft owners have the same interest as other homeowners in minimizing noise and sleep disturbances at home. The FAA has no problem with such restrictions at private unobligated airparks operated by the resident owners for their own benefit. At federally obligated public-use airports, however, the existence of the incompatible land use is not acceptable. First, aircraft owners are entitled to the same protection from airport impacts as any other residents of the community. Second, the likelihood that residents of an airpark will seek restrictions on the use of the airport for the benefit of their residential use is very high, whether or not they own aircraft. A federally obligated airport must provide reasonable access to all users. Restrictions on the use of the airport for the benefit of airpark residents is not consistent with the obligation to provide reasonable access to the public.

c. **On-airport and off-airport residential use.** The general policy against approval of on-airport and off-airport residential proposals is the same. There are, however, different considerations in the review and analysis of on-airport and off-airport land use. The FAA has received proposals for airparks or co-located homes and hangars both on the airport itself or off of the airport, with "through-the-fence" access.

20.4. Residential Airparks Adjacent to Federally Obligated Airports.

a. **General.** In several instances, the FAA has received requests from airport sponsors and developers interested in developing residential airparks adjacent to federally obligated airports. These types of development include "through-the-fence" access to the airport and generally include aircraft hangars or parking co-located with individual residences.

The FAA has no problem with private residential airparks since there is no federal obligation for reasonable access. Residential owners can limit access to the airport as they wish. However, FAA approval of such developments on federally obligated airports

cannot be justified. First, residential property owners tend to seek to limit airport use consistent with their residential use, which is contrary to the obligation for reasonable public access to the airport. Second, developers can tend to view Airport Improvement Program (AIP) grants for the airfield as a subsidy of the development, increasing the value of the airpark development at no cost to the developer or residents. The FAA's AIP program is not a funding mechanism for improving or subsidizing private and residential development.

Any residential use existing on the airport or any residential use granting "through-the-fence" access is an incompatible land use.

Any residential use on an airport or residential use granting "through-the-fence" access is an incompatible land use.

b. FAA Position. Permitting development of a residential airpark near a federally obligated airport, through zoning approval or otherwise, would be inconsistent with Grant Assurance 21, *Compatible Land Use*. The FAA expects sponsors to oppose zoning laws that would permit residential development near airports.

For this purpose, the FAA considers residential use to include: permanent or long-term living quarters; part-time or secondary residences; and developments known as residential hangars, hangar homes, campgrounds, fly-in communities or airpark developments – even when co- located with an aviation hangar or aeronautical facility.

Allowing residential development on federally obligated airports is incompatible with aircraft operations and conflicts with several grant assurance and surplus property requirements, as mentioned above. Residential development inside federally obligated airports is inconsistent with federal obligations regarding the use of airport property.

Accordingly, the FAA will not support requests to enter into any agreement that grants access to the airfieldforthe establishment of a residential airpark since that access would involve a violation of Grant Assurance 21, *Compatible Land Use.*

c. "Through-the-Fence." Off-airportresidential airparksareprivately ownedandmaintained residential facilities. They arenotconsidered aeronauticalfacilities eligibleforreasonable accesstoafederally obligatedairport.The airport sponsor is under no federal obligation to allow "through-the-fence" access for these privatelyowned residential airparks. Allowing such access in most cases could be an encumbrance on the airport in conflict with Grant Assurance 5, *Preserving Rights and Powers.* In addition, residential hangars with "through-the-fence" access are considered an incompatible land use at federally obligated public use airports. (For additional information on "through-the-fence" agreements, see paragraph 12.7, "Agreements Granting 'Through- the-Fence' Access" in chapter 12 of this Order, *Review of Aeronautical Lease Agreements.*)

d. Releases. The FAA will not release airport property from its federal obligations so that it can be used for residential development. Also, the FAA will not release airport land for off-airport use with "through-the-fence" access to the airfield. Obligated airport land may not be released unless the FAA finds that it is no longer needed for airport purposes. Since the requested off- airport use would involve basic airport functions such as aircraft parking and taxiing, the FAA could not find that the property was no longer needed for an

airport use. A request to release airport land for a residential airpark will be denied as inconsistent with both policies.

20.5. Residential Development on Federally Obligated Airports.

a. **General.** This guidance sets forth FAA policy regarding residential development on federally obligated airports, including developments known within the industry as residential hangars and airpark developments. FAA airports district offices (ADOs) and regional airports divisions are responsible for ensuring that residential developments are not approved when reviewing a proposed ALP or any other information related to the airports subject to FAA review. There is no justification for the introduction of residential development inside a federally obligated airport. It is the sponsor's federal obligation not to make or permit any changes or alterations in the airport or any of its facilities that are not in conformity with the ALP, as approved by the FAA, and that might, in the opinion of the FAA, adversely affect the safety, utility, or efficiency of the airport.

b. **Background.** The FAA differentiates between a typical pilot resting facility or crew quarters and a hangar residence or hangar home. The FAA recognizes that certain aeronautical uses – such as commercial air taxi, charter, and medical evacuation services – may have a need for limited and short-term flight crew quarters for temporary use, including overnight and on-duty times. There may be a need for aircraft rescue and firefighting (ARFF) quarters if there is a 24- hour coverage requirement. Moreover, an airport manager or a fixed-base operator (FBO) 45 duty manager may have living quarters assigned as part of his or her official duties. Living quarters in these cases would be airport-compatible if an airport management or FBO job requires an official presence at the airport at off-duty times, and if the specific circumstances at the airport reasonably justify that requirement.

However, other than the performance of official duties in running an airport or FBO, the FAA does not consider permanent or long-term living quarters to be an acceptable use of airport property at federally obligated airports. This includes developments known as airparks or fly-in communities, and any other full-time, part-time, or secondary residences on airport property – even when co-located with an aviation hangar or aeronautical facility. While flight crew or caretaker quarters may include some amenities, such as beds, showers, televisions, and refrigerators, these facilities are designed to be used for overnights and resting periods, not as permanent or even temporary residences for flight crews, aircraft owners or operators, guests, customers, or the families or relatives of same.

The definition of flight crew is limited to those individuals necessary for the operation of an aircraft, such as pilot-in-command (PIC), second in command, flight engineer, flight attendants, loadmasters, search and rescue (SAR) flight personnel, medical technicians, and flight mechanics. It does not include the families, relatives, or guests of flight crewmembers not meeting the preceding definition.

An effort to obtain residential status for the development under zoning laws may indicate intent to build for residential use. Airport standards, rules, and regulations should prevent the introduction of residential development on federally obligated airports. The FAA expects the airport sponsor to have rules and regulations to control or prevent such uses, as well as to oppose residential zoning that would permit such uses since these uses may

create hazards or safety risks between airport operations and nonaeronautical tenant activities. If doubts exist regarding the nature of a proposed facility, the airport sponsor may ask FAA to evaluate the proposed development. Also, the FAA may conduct a land use inspection to determine the true nature of the development; the FAA would then make a determination on whether the facility is compatible with the guidance provided herein.

c. **Authority and Compliance Requirements.** Allowing residential development, including airport hangars that incorporate living quarters for permanent or long-term use, on federally obligated airports is incompatible with airport operations. It conflicts with several grant assurance requirements.

Under Grant Assurance 5, *Preserving Rights and Powers*, an airport sponsor should not take any action that may deprive it of its rights and powers to direct and control airport development and comply with the grant assurances. The private interests of residents establishing private living can conflict with the interests of the airport sponsor to preserve its rights and powers to operate the airport in compliance with its federal obligations. It should not be assumed that the interests of the sponsor and that of a homeowner located on the airport will be the same or that because the homeowner owns an aircraft, he or she will automatically support the airport on all aviation activities. In addition, local laws relating to residences could restrict the airport operator's ability to control use of airport land and to apply standard airport regulations.

Under Grant Assurance 19, *Operation and Maintenance*, airport sponsors will not cause or permit any activity or action that would interfere with the intended use of the airport for airport purposes. Permanent living facilities should not be permitted at public airports because the needs of airport operations may be incompatible with residential occupancy from a safety standpoint.

Under Grant Assurance 21, *Compatible Land Use*, airport sponsors, to the extent possible, must ensure compatible land use both on and off the airport. Residential development in the vicinity of airports may result in complaints from residents concerned about personal safety, aircraft noise, pollution, and other quality-of-life issues. Bringing residential development onto the airport, even in the form of residential hangars, increases the likelihood that quality-of-life issues may lead to conflicts with the airport sponsor and appeals for restrictions on aircraft operations. Moreover, an airport sponsor permitting on-airport residential living quarters will have greater difficulty convincing local zoning authorities to restrict residential development off-airport. Therefore, airport sponsors are encouraged to:

(1). Explicitly prohibit the development of residential living quarters on the airport in all tenant leases and subleases.

(2). Develop minimum standards that require the explicit advanced approval of all tenant subleases by the airport sponsor.

(3). Include clauses in all tenant leases stating that unauthorized development of residential living quarters may be declared an event of default under the lease and that the airport sponsor may declare any noncomplying subleases null and void.

(4.) Convert any existing living quarters into nonresidential use at the earliest opportunity, especially if the airport sponsor holds title to the living quarters.

d. Conclusion. Permitting certain on-airport development, including residential development, conflicts with several federal grant assurances and federal surplus property obligations. Such residential development may have some or all of the following undesirable consequences:

(1). Aircraft noise complaints.

(2). Proposed restrictions or limitations on aircraft and/or airport operations brought by the residential tenants.

(3). The execution of easements, leases, and subleases that encumber airport property for nonaeronautical uses at the expense of aeronautical uses.

(4). Increased likelihood of vehicle/pedestrian deviations (V/PDs) due to residents, guests, and unsupervised children unfamiliar with an operating airfield environment; unleashed pets roaming the airfield; and the interaction between private vehicles and aircraft that compromise safe airfield operations.

(5). Increased public safety and legal liability risks, including fire hazards, if codes have been compromised by the co-location of residential living quarters within hangars and other aeronautical facilities.

(6). Line-of-sight obstructions and operational limitations due to the greater height of two-story hangars.

e. Summary. Residential development, either standing alone or collocated as part of a hangar or other aeronautical facility, is not an acceptable use of airport property under the federal grant assurances or surplus and nonsurplus property federal obligations. The ADOs and regional airports divisions have the responsibility for ensuring that residential development is <u>not</u> approved as part of a review of a proposed ALP and that airport property is not released for residential development.

20.6. through 20.10. reserved.

APPENDIX V
WILDLIFE RESCUE REGULATIONS

R12-4-401. Live Wildlife Definitions

In addition to definitions given in A.R.S. § 17-101, and for the purposes of this Article, the following definitions apply:

1. "Agent" means an individual that assists a special license holder in performing activities that are authorized by the special license to achieve the objectives for which the license was issued.
2. "Aquarium trade" means the commercial industry that lawfully trades in aquatic live wildlife and its customers.
3. "Captive live wildlife" means live wildlife that is held in captivity, physically restrained, confined, impaired, or deterred to prevent it from escaping to the wild or moving freely in the wild.
4. "Cervid" means a mammal classified as a Cervidae or member of the deer family found anywhere in the world, as defined in the taxonomic classification from Volumes I and II of Walker's Mammals of the World, Sixth Edition, 1999, and not including any later edition. A copy is available for inspection at any Department office and from the Johns Hopkins University Press, 2715 North Charles Street, Baltimore MD, 21218-4363.
5. "Circus" means a scheduled event where a variety of entertainment is the principal business, primary purpose, and attraction. "Circus" does not include animal displays or exhibits held as an attraction for a secondary commercial endeavor.
6. "Collect" means to take wildlife alive under the provisions of a scientific collecting permit.
7. "Commercial" means the buying or selling of wildlife or their parts, or the exchange of anything of monetary value for the use of wildlife.
8. "Domestic" means an animal species that does not exist in the wild, and includes animal species that have only become feral after they were released by humans that held them in captivity, or are individuals or populations that escaped from human captivity.
9. "Educational display" means a display of captive live wildlife to increase public understanding of wildlife biology, conservation, and management without requiring or soliciting payment from an audience or an event sponsor. For the purposes of this Article, "to display for educational purposes" refers to display as part of an educational display.
10. "Endangered or threatened" means wildlife that is listed in 50 CFR 17.11, revised as of August 4, 2004 not including any later amendments or editions, which is incorporated by reference. A copy of the list is available for inspection at any Department office, or it may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
11. "Evidence of lawful possession" means any license or permit that allows possession of a specific live wildlife species or individual, or other documentation that

establishes lawful possession. Other forms of documentation may include but are not limited to: a statement of nonrequirement for a license or permit for specific live wildlife species, or individual granted by the country or state of origin.

12. "Exhibit" means to display captive live wildlife in public, or to allow photography of captive live wildlife, for any commercial purpose.
13. "Exotic" means wildlife or offspring of wildlife that is not native to North America.
14. "Fish farm" means a commercial operation designed and operated for propagating, rearing, or selling aquatic wildlife for any purpose.
15. "Game farm" means a commercial operation that is designed and operated for the purpose of propagating, rearing, or selling terrestrial wildlife or the parts of terrestrial wildlife for any purpose stated in R12-4-413.
16. "Hybrid wildlife" means an offspring from two different wildlife species or genera. Offspring from a wildlife species and a domestic animal species are not considered to be wildlife.
17. "Live baitfish" means any species of live freshwater fish designated by Commission order as lawful for use in taking aquatic wildlife under R12-4-313.
18. "Live bait" means aquatic live wildlife used or intended for use in taking aquatic wildlife.
19. "Native" means wildlife or offspring of wildlife that occurred naturally within the present boundaries of Arizona before European settlement.
20. "Nonnative" means wildlife or its offspring that did not occur naturally within the present boundaries of Arizona before European settlement.
21. "Photography" means any process that captures light to produce an exact image of wildlife or parts of wildlife on another medium.
22. "Propagate" means the production of offspring that qualify as wildlife from captive live wildlife parents.
23. "Rehabilitated wildlife" means live wildlife that is injured, orphaned, sick, or otherwise debilitated and is provided care to restore it to a healthy condition suitable for release to the wild or for lawful captive use.
24. "Restricted live wildlife" means wildlife that cannot be imported, exported, or possessed without a special license or lawful exemption. Restricted live wildlife are listed in R12-4-406.
25. "Shooting preserve" means any operation where live wildlife is released for the purpose of hunting.
26. "Special license" means any permit or license issued under this Article, including any additional stipulations placed on the license that authorizes specific activities normally prohibited by A.R.S. § 17-306 and R12-4-402.
27. "Stock" and "stocking" mean to release live aquatic wildlife into public or private waters other than the waters where taken.
28. "Wildlife of special concern" means any species listed in "Wildlife of Special Concern," published by the Arizona Game and Fish Department. A copy is available for inspection at any Department office.
29. "Zoonotic" means a disease that can be transmitted to humans from other animals.

Historical Note

Adopted effective April 28, 1989 (Supp. 89-2). Amended effective January 1, 1995; filed in the Office of the Secretary of State December 9, 1994 (Supp. 94-4).

Amended by final rulemaking at 9 A.A.R. 3186, effective August 30, 2003 (Supp. 03.Amended by final rulemaking at 12 A.A.R. 980, effective May 6, 2006 (Supp. 06)

R12-4-423. Wildlife Rehabilitation License

1. For the purposes of this Section, the following definitions apply:
   - "Agent," in addition to the definition in R12-4-401, means the same as "sublicensee" or "subpermitee" as these terms are used in federal regulations that this Section references.
   - "Assistant" means an individual who is not designated as an agent, as defined in R12-4-401 and this Section, who assists a wildlife rehabilitation license holder, and is under the direct supervision of the license holder at the premises described on the license.
   - "Migratory birds" means all species listed in 50 CFR 10.13, revised October 1, 1999, not including any later amendments or editions, which is incorporated by reference. A copy of the incorporated material is available for inspection at any Department office, or it may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
   - "Taxa" means groups of animals within specific classes of wildlife occurring in the state with common characteristics that establish relatively similar requirements for habitat, food, and other ecological or behavioral factors pertinent to establishing standards of housing, care, or rehabilitation.
2. A wildlife rehabilitation license allows an individual to capture alive; transport; temporarily possess; rehabilitate; transfer to a practicing veterinarian for treatment or euthanasia or to another rehabilitator licensed for the wildlife; release; or euthanize an injured, diseased, disabled, orphaned, or otherwise debilitated live wildlife specified on the license. The license also allows an individual to export, transfer to a licensed zoo, or dispose of wildlife as directed in writing by the Department. A wildlife rehabilitation license holder shall not display for educational purposes, exhibit, or permanently possess wildlife held under the license. The Department may add stipulations to a license, as stated in R12-4-409, if the Department finds it is necessary to do so after reviewing an application for a license, submitted as prescribed by subsection (D), and evaluating the activities that an applicant proposes to perform.
3. Before applying for a wildlife rehabilitation license, an individual shall take an examination administered and supervised by the Department that covers wildlife rehabilitation; handling, transport, humane treatment, and nutritional, behavioral, developmental, ecological, and habitat requirements of wildlife; captivity standards established under R12-4-428; human and wildlife safety considerations; and state laws regarding wildlife rehabilitation, specifically R12-4-409 and this Section. An individual shall make an appointment with the Department to take the examination during normal business hours. An individual may request that the test be written or tape-recorded. The Department shall mail the results to the individual within 30 calendar days of the examination. The Department shall consider only those parts of the examination that are applicable to the taxa of wildlife for which the license is sought in establishing the qualifications of the applicant.
4. An applicant shall apply for a wildlife rehabilitation license using a form available from

the Department. The applicant shall provide the following information:

- Name, address, telephone number, birthdate, physical description, and (if applicable) Department ID number;
- Documentation of one or more of the following;
  a. A valid, current license issued by a state veterinary medical examination authority that authorizes the applicant to practice as a veterinarian;
  b. A minimum of six months of experience performing wildlife rehabilitative work for an average of at least eight hours per week for the taxa or species of animal in subsection (D)(5) that is listed on the application; or
  c. A current and valid license, permit, or other form of authorization issued by another state or the federal government that allows the applicant to perform wildlife rehabilitation;

3. Documentation that the applicant has answered correctly at least 80% of the questions on the examination in subsection (C), and that the applicant took the examination within five years of applying for the license;
4. One or more of the following supporting documents:
   a. A typed, computer or word processor printed, or legibly handwritten statement signed by the applicant that affirms that the applicant is a licensed, practicing veterinarian;
   b. A typed, computer or word processor printed, or legibly handwritten statement signed by the Department's Adobe Mountain Wildlife Center Coordinator that the Center will assist the applicant in providing rehabilitative treatment for the wildlife to be held under the license; or
   c. A typed, computer or word processor printed, or legibly handwritten statement signed by a licensed, practicing veterinarian that the veterinarian is reasonably available to give veterinary services requested by the applicant as necessary to facilitate rehabilitation of wildlife. The license holder shall be responsible for any veterinary expenses.
5. The wildlife taxa or species that will be used under the license. The Department shall only issue a wildlife rehabilitation license for the following taxa or species of wildlife:
   a. Amphibians: all amphibians;
   b. Reptiles: all reptiles;
   c. Birds:
      i. Non-passerines, birds in any order other than those named in (ii) through (vi);
      ii. Raptors, birds in the orders Falconiformes or Strigiformes;
      iii. Quails, birds in the order Galliformes;
      iv. Doves, birds in the order Columbiformes;
      v. Hummingbirds, birds in the order Trochiliformes; and
      vi. Passerines, birds in the order Passeriformes;
   d. Mammals:
      i. Nongame mammals;
      ii. Bats: all bats;
      iii. Big game mammals other than cervids: bighorn sheep, bison, black bear, javelina, mountain lion, and pronghorn antelope; and
      iv. Carnivores: bobcat, coati, coyote, foxes, raccoons, ringtail, skunks, and weasels; and

e. The Department shall not issue a wildlife rehabilitation license for the following wildlife species unless the applicant specifically states the species on the license application:
i. Arizona ridge-nosed rattlesnakes;
ii. Banded rock rattlesnakes;
iii. Desert massasaugas:
iv. Flat-tailed horned lizards;
v. Gila monsters;
vi. Eagles; and
vii. Notwithstanding the taxa listed in subsections (D)(5)(a) through (d), species listed in Federal Endangered and Threatened Wildlife and Plants, 50 CFR 17.11, revised as of August 4, 2004, and species listed in Wildlife of Special Concern;

6. If the applicant is applying for a wildlife rehabilitation license to perform authorized activities with migratory birds, evidence showing that the applicant meets the following criteria:
   a. The applicant is at least 18 years old; or
   b. The applicant has a parent or legal guardian cosign the application and the signature is notarized;
7. A typed, computer or word processor printed, or legibly handwritten narrative that describes the following:
   a. The method of disposing of the wildlife that the applicant prefers: export, transfer to a licensed zoo, or another method as directed in writing by the Department; and
   b. If the applicant applies to perform authorized activities with taxa or species of wildlife that are listed in subsection (D)(4)(e), a statement of the applicant's training and experience in handling, capturing, rehabilitating, and caring for the taxa or species;
8. The name, address, and telephone number of the location where the wildlife will be held, if applicable. Otherwise, the applicant shall provide the physical description of the location, including township, range, and section;
9. A detailed description or diagram of the facilities where the applicant will hold the wildlife, and a description of how the facilities comply with R12-4-428 and any other captivity standards prescribed by this Section;
10. If the applicant is authorizing an agent, the information stated in subsections (D)(1), (3), (5), (6), (7), (8), (9), and (11), as applicable to the agent. The agent shall sign and date the affidavit stated in subsection (D)(11), but shall omit (d). By signing the affidavit, the agent attests that the information provided is true and correct to the agent's knowledge and that the agent has not had live wildlife privileges revoked in this state or any other state or the United States.
11. The applicant's signature and the date of signing. By signing the application, the applicant attests to the following:
    a. The information the applicant has provided is true and correct to the applicant's knowledge;
    b. The applicant is applying for the license for the sole purpose of restoring wildlife to the wild through rehabilitative activities;
    c. The applicant understands that all wildlife held under the license remains the property of the state and shall be returned to the Department upon request;

d. The applicant is solely responsible for all expenses incurred and all actions taken under the license, including all actions and omission of all agents and assistants when they are performing activities authorized under the license;
e. The applicant shall conduct rehabilitation at the location listed on the license; and
f. The applicant's live wildlife privileges are not revoked in this state, any other state, or the United States.

13. The Department shall issue a wildlife rehabilitation license in compliance with R12-4-106. The Department may deny a license or limit a license based upon the training and experience of the applicant. If the Department denies the application for a wildlife rehabilitation license, the Department shall proceed as prescribed by R12-4-409(D).
14. A wildlife rehabilitation license expires on December 31 of the third year following the date of issuance of the license. A wildlife rehabilitation license holder shall renew the license before it expires as stated in R12-4-409(M). If the license holder applies to renew the license as prescribed by subsection (D), the license holder may reference supportive material previously submitted to the Department if the license holder is not changing the species, location, or design of the facility where the wildlife will be held. The license holder shall retake the examination in subsection (B) if written reports submitted under subsection (S) indicate that the applicant did not perform any rehabilitative activities under the license.
15. A wildlife rehabilitation license holder shall capture, remove, transport, and release wildlife under this Section in a manner that is least likely to cause injury to the affected wildlife.
16. A wildlife rehabilitation license holder shall keep a current log that records the information specified under subsection (S).
17. A wildlife license holder shall participate in one of the following during the license period:
    a. Eight or more hours of continuing education sessions on wildlife rehabilitation, offered by the Department at no fee. The Department shall provide each license holder with a minimum of 30 calendar days' notice of the sessions; or
    b. Eight or more hours of continuing education sessions on wildlife rehabilitation offered by an accredited university or college; the National Wildlife Rehabilitation Council, R.R. 1, Box 125 E Brighton, IL 62012; or the International Wildlife Rehabilitation Council, P.O. Box 3007, Walnut Creek, CA 94598.
18. A wildlife rehabilitation license holder shall obtain written authorization from the Department before allowing an individual to act as an agent. The agent shall have the authorization in possession and available for Department inspection while performing activities authorized by the license. The Department may suspend or revoke the license holder's license for violation of this Section by an agent.
19. A wildlife rehabilitation license holder may make a written request at any time during the license period to amend the license to add or delete an agent, to add or delete premises where wildlife is held, or to obtain authority to rehabilitate additional taxa of wildlife. To amend the license, the applicant shall submit the following:
    a. To add or delete an agent, the information stated in subsections (D)(1), (3), (5) through (9), and (11), as applicable to the agent;
    b. To add or delete premises, the information stated in subsection (D)(1), (5), (8),

(9), and (11); and

c. To obtain authority to rehabilitate additional taxa or wildlife, the information stated in subsection (D)(1) through (9) and (11).

20. A wildlife rehabilitation license holder may accept donations from the public to compensate for expenses related to activities authorized under the license, or to provide materials or facilities necessary to perform those activities.

21. A wildlife rehabilitation license holder authorized to rehabilitate wildlife taxa or species listed in subsection (D)(5)(d)(iii) and (iv) or (D)(5)(e) shall contact the Department within 24 hours of receiving the individual animal to obtain instructions in handling that animal. While awaiting instructions, the license holder shall ensure that emergency veterinary care is provided as necessary.

22. Except when the Department has authorized possession for a longer period, a wildlife rehabilitation license holder shall not possess a bird longer than 180 days or other wildlife longer than 90 days; and all wildlife not releasable after these time-frames may be retained, transferred, disposed of, or euthanized as authorized by the Department. All wildlife held under the license remains the property of the state and shall be returned to the Department upon request. A license holder shall submit a written request to the Department to hold wildlife for longer than specified in this subsection. The Department may require the license holder to provide a typed, computer or word processor printed, or legibly handwritten statement signed by a licensed veterinarian listing the medical reasons for the extension if there is a dispute between the Department and the license holder regarding the medical necessity for the requested extension. The Department shall grant or deny a request for extension within 10 days of receipt of the request or the veterinarian's statement. The license holder may continue to hold the specified wildlife while the Department considers the request. The Department shall deny a request for extension in writing and shall include in the written denial specific, time-dated directions on disposition of the animal.

23. A wildlife rehabilitation license holder may hold wildlife under the license after the wildlife reaches a state of restored health only for the amount of time reasonably necessary to make humane disposition of the wildlife, but not for longer than has been authorized under subsection (N). Rehabilitated wildlife shall be released at an ecologically appropriate time of year, into a habitat suitable to sustain it and:

a. In the same geographic area from which the animal was originally obtained except that birds may be released at any location statewide within the normal range of that species in ecologically suitable habitat; or

b. In an area designated by the Department; and

c. Without immediate threat to the animal of injurious contact with humans.

24. To permanently hold rehabilitated wildlife that is unsuitable for release, a licensee wildlife rehabilitation license holder shall apply for and obtain a wildlife holding license under as prescribed by R12-4-417.

25. Unless otherwise stipulated in the license, a wildlife license holder shall dispose of all wildlife that is euthanized or that otherwise dies while held under license within 30 days of death by burial or incineration, except that the license holder shall transfer all carcasses of endangered or threatened species, wildlife of special concern as defined in R12-4-401, or eagles to the Department.

26. A wildlife rehabilitation license holder shall ensure that a copy of the license, including any stipulations placed on that license, accompanies any shipment or transport of wildlife under this Section, and is available for Department inspection at each of the premises authorized by the license.
27. Before January 31 of each year, a wildlife rehabilitation license holder shall file a written report on activities performed under the license for the previous calendar year. The license holder shall report on a form available from the Department. The written report shall contain the following information:
    a. The name, address, date of birth, and telephone number of the licensee and all agents;
    b. The permit or license number of any federal permits or licenses that relate to any rehabilitative function performed by the license holder; and
    c. An itemized list of each animal held under the license during the calendar year for which activity is being reported. For each animal held by the license holder or agent, the itemization shall include the: name of the species; condition that required rehabilitation; source, location, and date of acquisition; if reasonably determinable, age class at acquisition; status at disposition or end-of-year relative to the condition requiring rehabilitation; and method, place, and date of disposition. A copy of the rehabilitator's federal permit report of activities related to federally-protected wildlife satisfies this reporting requirement for federally protected wildlife.
28. A wildlife rehabilitation license holder is subject to R12-4-409, R12-4-428, and R12-4-430.

R12-4-409. General Provisions and Penalties for Special Licenses

A. Special licenses are listed as follows:
1. Aquatic wildlife stocking permit, prescribed by R12-4-410;
2. Game bird field training permit, prescribed by R12-4-416;
3. Game bird field trial license, prescribed by R12-4-415;
4. Game bird hobby license, prescribed by R12-4-419;
5. Game bird shooting preserve license, prescribed by R12-4-414;
6. Live bait dealer's license, prescribed by R12-4-411;
7. Private game farm license, prescribed by R12-4-413;
8. Scientific collecting permit, prescribed by R12-4-418;
9. Sport falconry license, prescribed by R12-4-422;
10. White amur stocking and holding license, prescribed by R12-4-424;
11. Wildlife holding license, prescribed by R12-4-417;
12. Wildlife rehabilitation license, prescribed by R12-4-423;
13. Wildlife service license, prescribed by R12-4-421; and
14. Zoo license, prescribed by R12-4-420.

B. An applicant for any special license listed in subsection (A) shall submit an application to the Department for that license according to the Section that prescribes requirements for that special license. Applications for special licenses are available at any Department office. The Department shall either grant or deny a special license within the overall time-frame prescribed for that special license under R12-4-106, and in a manner consistent with A.R.S. Title 41, Section 6, Article 7.1. By signing the

application, the applicant attests that they are authorized or have permission to conduct special license activities at any locations specified in the application.
C. In addition to any criteria prescribed by a special license's governing Section, the Department shall deny a special license to an applicant if:
1. The applicant's live wildlife privileges are revoked or suspended in this state, any other state, or by the United States;
2. The applicant has been convicted of illegally holding or possessing live wildlife within three years of applying for a special license;
3. The applicant knowingly provides false information on an application; or
4. The applicant submits an incomplete application.
D. If an individual obtains a special license despite meeting any criteria for denial, the license shall be void and of no effect from the date of issuance. If an applicant is denied a special license listed in subsection (A), the Department shall provide a written notice to the applicant that states the reason for denial with references to the statutes or rules on which the denial is based. The applicant may appeal the denial to the Commission as prescribed in A.R.S. Title 41, Chapter 6, Article 10.
E. Special license holders are not exempt from any municipal, county, state or federal statutes, rules, or ordinances. A special license does not authorize an individual to engage in any activity using wildlife if the wildlife is protected by federal regulation. A special license holder may only engage in authorized activities using federally-protected wildlife if the license holder possesses a valid license, permit, or other form of documentation issued by the United States that authorizes the license holder to use that wildlife in a manner consistent with the special license.
F. The Department has the authority to place additional stipulations on a special license at the time of application or renewal if necessary to conserve wildlife populations, prevent introduction and proliferation of wildlife diseases, prevent wildlife from escaping, or for public health or safety.
G. A special license holder shall keep live wildlife in a facility according to the captivity standards prescribed by R12-4-428, or if applicable, as otherwise required by the Section that prescribes captivity requirements under the special license. The Department may authorize one of its employees to make a reasonable inspection of a facility to ensure that it complies with all requirements prescribed by this Article. The Department shall ensure that an inspection does not inadvertently transmit disease among facilities.
H. A special license holder shall keep records according to the Section that prescribes requirements for the special license. The license holder shall make the records available for inspection to any authorized Department employee upon reasonable request.
I. If a disease or other emergency condition exists that poses an immediate threat to the public or the welfare of wildlife, including wildlife held under a special license, as determined by a person with relevant expertise, the Department shall immediately order a cessation of operation under the special license and, if necessary, order humane disposition or quarantine of any contaminated or threatened wildlife. The license holder shall perform disease testing, submit biological samples to the Department or its designee, quarantine the wildlife, or destroy the wildlife as directed by the Department. The license holder shall ensure that any disease giving rise to an emergency condition

under this subsection is diagnosed by an individual or individuals professionally certified to make the diagnosis. Once operation has ceased and an emergency no longer exists, subsection (J) applies.

J. If a condition exists, including disease or any violation of this Article, that poses a threat to the welfare of wildlife, including the wildlife held, or the public, but the threat does not constitute an emergency, the Department shall provide the license holder a written notice of the condition, by certified mail or personal service, specifying a reasonable time for the license holder to cure the noticed condition. Failure of the license holder to cure the noticed condition within the time specified by the Department is a violation under subsection (K). If a licensee receives three notices under this subsection for the same condition within a two-year period, the Department shall treat the third notice as a failure to cure.

K. The Department has the authority to do any or all of the following as it deems necessary: file criminal charges; suspend a special license; seize, or seize in place any wildlife held under a special license, and unless the license holder appeals the conviction, humanely dispose of the wildlife, if a special license holder:

1. Violates any provision of this Section;
2. Violates any provision of the special license that the individual possesses, including any stipulations applied by the Department;
3. Violates A.R.S. § 13-2908, relating to criminal nuisance;
4. Violates A.R.S. § 13-2910, relating to cruelty to animals;
5. Is convicted of any other criminal offense involving cruelty to animals;
6. Refuses to allow reasonable inspection of facilities, wildlife, or required records; or
7. Fails to keep records or submit reports if required by this Section or the Section that governs any special license, listed in subsection (A), that the individual possesses.

L. An individual may appeal to the Commission any Department action listed in subsection (K), except filing of criminal charges, as prescribed by A.R.S. Title 41, Chapter 6, Article 10.

M. All special licenses listed in subsection (A) expire on December 31 for the year issued unless otherwise specified in the governing Section. If the special license holder does not submit an application to the Department for a new license by the date that the license expires, any live wildlife possessed under the license is considered unlawfully possessed, and the Department has the authority to seize it. If the special license holder submits an application for a new license on or before the date that the license expires, the license holder's current license remains valid until the Department grants or denies the new special license. If the Department denies the new license, and the license holder appeals the denial to the Commission as prescribed by subsection (D), the license holder may continue to hold the wildlife until the date that the Commission makes its final decision on the denial.

N. If the special license holder chooses to renew the license, the license holder shall submit an application for a new license as required by the governing Section.

O. If required by the governing Section, a special license holder shall submit an annual report to the Department before January 31 of each year on activities performed under the license for the previous calendar year. If the license holder is acting as a representative of an institution, organization, or agency for the purposes of the special license, the annual report is due within 30 days after the license holder's termination of

affiliation with that entity. The special license holder shall submit the following information and any additional information required by the governing Section.
1. The license holder's name, address, telephone number, and special license number;
2. The number and species of all restricted live wildlife obtained and the date when it was obtained;
3. The source of all restricted live wildlife obtained and the date when it was obtained;
4. The number of offspring propagated by all restricted live wildlife; and
5. If applicable, the number, species, and date of disposition and manner of disposition of all wildlife, including the names and addresses of individuals to whom the wildlife was sold, bartered, or given, if authorized.

Historical Note

Adopted effective April 28, 1989 (Supp. 89-2). Amended effective January 1, 1995; filed in the Office of the Secretary of State December 9, 1994 (Supp. 94-4). Amended by final rulemaking at 7 A.A.R. 2732, effective July 1, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 3186, effective August 30, 2003 (Supp. 03-3). Amended by final rulemaking at 12 A.A.R. 980, effective May 6, 2006 (Supp. 06-1

R12-4-428. Captivity Standards

A. An individual who holds a special license listed in R12-4-409(A) shall keep all wildlife held under the license in as humane a manner as the activities authorized by the license allow, to safeguard and protect the interests of the wildlife held. A special license holder subject to the provisions of this Section shall comply with the minimum standards for humane treatment prescribed by this Section. For the purposes of this Section, "animal" means any wildlife held under a special license, unless otherwise indicated.

B. A special license holder shall ensure that all facilities required by the special license meet the following minimum standards.

1. The facility shall be constructed of material and be of a strength appropriate for the nature of the animal held. The facility shall be properly braced and constructed of material of sufficient strength to resist any force the animal may be capable of exerting against it. The facility shall be constructed in such a manner as to reasonably prevent the animal's escape or the entry of unauthorized individuals or animals. The facility shall be structurally sound and shall be maintained in good repair to protect the animals that are held from injury and to facilitate the humane practices prescribed by this Section.
2. If required to comply with related provisions of this Section, there shall be safe, reliable and adequate electric power to the facility. All electric wiring shall be constructed and maintained in accordance with all applicable governmental building codes. Electrical construction and maintenance shall be sufficient to ensure that no animal has direct contact with any electrical wiring or electrical apparatus and is fully protected from any possibility of shock or electrocution from electric conducting materials.
3. Every animal shall be supplied with sufficient potable water to meet its needs. If potable water is not accessible to the animal at all times, it shall be provided as often as necessary for the health and comfort of the animal, and the license holder shall ensure that the level of available water is monitored once daily or more often as the needs of the animal dictate. All water receptacles shall be kept in clean and sanitary condition.

4. Food shall be wholesome, palatable, and free from contamination, and of sufficient appeal, quantity, and nutritive value to maintain in good health each animal that is held. Each animal's diet shall be prepared based upon the nutritional needs and preferences of the animal with consideration for the age, species, condition, size, and type of the animal, and all veterinary directions or recommendations in regard to diet. The quantity of food supplied to each animal shall be sufficient to meet its needs and keep it in good health. Each animal shall be fed as often as its needs dictate, taking into consideration hibernation, veterinary treatment or recommendation, normal fasts, or other professionally accepted humane practices. The license holder shall ensure that the level of available food for each animal is monitored once daily, except for those periods of time when professionally accepted humane practices dictate that the animal not consume any food during the entire day. Food and food receptacles, if used, shall be sufficient in quantity and accessible to all animals in the facility and shall be placed to minimize potential contamination. Food receptacles shall be kept clean and sanitary at all times. Any self-feeding food receptacles shall function properly and the food they provide shall not be subject to deterioration, contamination, molding, caking, or any other process that would render the food unsafe or unpalatable for the animal to be fed. Appropriate means of refrigeration shall be provided for supplies of perishable animal foods.

5. The facility shall be kept sanitary and regularly cleaned as the nature of the animal requires and allows. Adequate provision shall be made for the removal and disposal of animal waste, food waste, unusable bedding materials, trash, debris and dead animals not intended for food. The facility shall be maintained to minimize the potential of vermin infestation, disease, and unseemly odors. Excreta shall be removed from the primary enclosure facility as often as necessary to prevent contamination of the animals and to minimize hazard of disease and to reduce unseemly odors. The sanitary condition of the facility shall be monitored by the licensee at least daily. When the facility is cleaned by hosing, flushing or the introduction of any chemical substances, adequate measures shall be taken to ensure the animal has no direct contact with any chemical substance and is not directly sprayed with water, steam or chemical substances or otherwise wetted involuntarily.

6. A sanitary and humane method shall be provided to rapidly eliminate excess water from the facility. If drains are utilized, they shall be properly constructed and kept in good repair to avoid foul odors, and installed so as to prevent backup or accumulation of debris or sewage.

7. No animal shall be exposed to any human activity or environment that may have an inhumane or harmful effect upon the animal that is inconsistent with the purpose of the special license.

8. Facilities shall not be constructed or maintained in proximity to any physical condition which may give rise to any health threat to the animal including, but not limited to, trash or garbage collection sites and/or pools of standing water. All individuals that care for the animals shall maintain themselves in a sufficiently clean condition when dealing in or around the animal so as to minimize any threat to the health of the animal.

9. All animals housed in the same facility or within the same enclosed area shall be compatible and shall not pose a substantial threat to the health, life or well-being of any other animal in the same facility or enclosure, whether or not the other animals are held

under a special license. This shall not apply to live animals placed as food items in the enclosures.
10. Facilities for the enclosure of animals shall be constructed and maintained to provide sufficient space to allow each animal adequate freedom of movement to make normal postural and social adjustments. The facility area shall be large enough and constructed in a manner to allow the animal proper and adequate exercise as is characteristic to each animal's natural behavior and physical need. Facilities for digging or burrowing animals shall have secure safe floors below materials supplied for digging or burrowing activity. Animals that naturally climb shall be provided with safe and adequate climbing apparatus. Animals that naturally live in an aquatic environment shall be supplied with sufficient access to safe water so as to meet their aquatic behavioral needs.
11. A special license holder shall ensure that a sufficient number of properly trained personnel are utilized to meet all the humane husbandry practices prescribed by this Section. The license holder shall be responsible for the actions of all animal care personnel and all other individuals that come in contact with the animals.
12. The facility and holding environment shall be structured to reasonably promote the psychological well-being of any primate held under a special license.
13. Except for wildlife hobby license holders that possess fewer than 50 birds and license holders that possess animals for less than one year, a special license holder shall designate a veterinarian licensed to practice in this state as the primary treating veterinarian for each individual species of animal to be held under any special license issued. The license holder shall ensure that all animals in their care receive proper, adequate and humane veterinary care as the needs of each animal dictate. Each animal held for one year or more and each facility used shall be inspected by the attending veterinarian at least once every year. Every animal shall receive veterinary care whenever it appears that the animal is ill, wounded, diseased, infected by parasites or behaving in a substantially abnormal manner, including but not limited to exhibiting loss of appetite or disinclination to normal physical activity. All medications, treatments and other directions prescribed by the attending veterinarian shall be properly administered by the licensee. No prescription medicine or medical treatment shall be administered by any license holder unless under the direction of a veterinarian.
14. Any animal that is suspected of or diagnosed as harboring any infectious or transmissible disease, whether or not the animal is held under a special license, shall be isolated immediately upon suspicion or diagnosis from any animal to whom such disease could be transmitted. The isolated animal shall continue to be kept in a humane manner and in a facility as required by this Section. When there is an animal with an infectious or transmissible disease in any animal facility, whether or not the animal is held under a special license, the facility shall be reasonably sanitized so as to reasonably eliminate the chance of other animals being exposed to infection. Sanitation procedures may include, but not necessarily be limited to, the washing of facilities or animal-related materials with hot water and appropriate antibacterial chemical agents and appropriate soaps or detergents; the appropriate application of steam under pressure; and the replacement of gravel, sand, water, food, or dirt. All residue of chemical agents utilized in the sanitation process shall be reasonably eliminated from the facility before any animal is returned to the facility. Parasites and avian and

mammalian pests shall be controlled and eliminated so as to ensure the continued health and well-being of all animals.

C. A special license holder shall ensure that all indoor facilities meet the following standards in addition to those set forth in subsection (B).

1. Heating and cooling facilities shall be supplied that are sufficient to regulate the temperature to protect the animals from extremes of temperature as the nature of the wildlife requires and to provide a healthful and humane living environment and prevent discomfort to the animal. The ambient temperature shall not be allowed to fall below nor rise above temperatures compatible with the health, comfort, and humane care of any animal.

2. Indoor facilities shall be adequately ventilated by natural or mechanical means to provide for the healthful and humane keeping of any animal and prevent the discomfort of any animal. The facility shall be provided with fresh air, either by means of windows, doors, vents, fan, or air conditioning sufficient to meet the humane needs of any animal and shall be constructed to minimize drafts, odors and moisture condensation.

3. Indoor facilities shall have lighting by either natural or artificial means, or both, that is appropriate to the nature of the animals being kept. Lighting shall be of a quality, distribution, and duration as is appropriate for the needs and nature of the animals held. Lighting shall be utilized in regular cycles as the animal's needs may dictate. Lighting of uniform distribution and sufficient intensity to permit routine inspection and cleaning of the facility shall be available. Lighting shall be designed to protect the animals from excessive or otherwise harmful aspects of illumination.

D. A special license holder shall ensure that all outdoor facilities meet the following standards in addition to those set forth in subsection (B).

1. If sunlight is likely to cause overheating or discomfort of any animal, sufficient shade by natural or artificial means shall be provided to allow all animals kept outdoors to humanely protect themselves from any harmful effects of direct sunlight.

2. Sufficient natural or artificial shelter appropriate to humanely protect animals from normally expected local climatic conditions through the year shall be provided for all animals to prevent any discomfort or harm to the animals. No animal shall be exposed to any climatic condition that is potentially harmful to the animal.

Individual animals shall be acclimated to outdoor climatic conditions before they are housed in any outdoor facility or otherwise exposed to the extremes of climate.

E. If an animal must be handled, the special license holder that possesses it shall ensure that the animal is handled in an expeditious and careful manner to ensure no unnecessary discomfort, behavioral stress, or physical harm to the animal. An animal that is transported shall be transported in an expeditious, careful, and humane fashion. During periods of transport, an animal shall be made as humanely secure as reasonably possible. No animal shall be transported in any manner that poses a substantial threat to the life, health, or behavioral well-being of the animal. All facilities and services used to transport the animal shall provide for the basic humane needs of the animal during periods when the animal is held in a transportation facility, including but not necessarily limited to providing the animal with adequate food, water, sanitary conditions, and ventilation, and any medication as prescribed by the attending veterinarian. If any animal is placed on public exhibit or educational display, such animal shall be handled in a manner minimizing the risk of harm to members of the public and to the animal:

Minimization of risk shall include but not necessarily be limited to sufficient distance existing between the animal and the viewing public to assure the safety of both the public and the animals. Any restraint used on any animal shall be humane in nature and not likely in either its design or use to cause physical harm or discomfort to the restrained animal except when discomfort is necessary to control the animal due to its size or strength.

F. The Department may impose additional requirements on facilities that hold animals if it becomes necessary to meet the needs of the particular animal and to ensure public health and safety. Any additional special license facility requirements shall be set forth in writing by the Department at the time the special license is issued. Any additional requirements for housing facilities shall specify the reason necessitating the additional measures.

Historical Note

Adopted effective April 28, 1989 (Supp. 89-2). Amended by final rulemaking at 12 A.A.R. 980, effective May 6, 2006 (Supp. 06-1).

R12-4-430. Importation, Handling, and Possession of Cervids

A. For the purposes of this Section, the following definitions apply:

1. "Native cervid" means any member of the deer family in the genus Alces, common name moose; the genus Odocoileus, common name white-tailed and mule deer; or the genus Cervus, common name red deer, wapiti, and elk; or the genus Rangifer, common name reindeer and caribou.
2. "Wildlife disease" means a disease that poses a health risk to wildlife in Arizona.
3. "Zoo" means any facility licensed by the Arizona Game and Fish Department under R12-4-420.

B. Except as provided in R12-4-418, upon the effective date of this Section, no new special licenses will be issued for live cervids.

C. An individual, including any special license holder, shall not import a live cervid into Arizona except as allowed in subsection (K).

D. Except as allowed under subsection (L), an individual shall not transport a live cervid within Arizona except to:

1. Export the live cervid from Arizona for a lawful purpose;
2. Transport the live cervid to a facility for the purpose of slaughter, when the slaughter will take place within five days of the date of transport;
3. Transport the live cervid to or from a licensed veterinarian for medical care; or
4. Transport the live cervid to a new holding facility owned by, or under the control of, the cervid owner, when all of the following apply:

a. The current holding facility has been sold or closed;

b. Ownership, possession, custody, or control of the cervid will not be transferred to another individual; and

c. The owner of the cervid has prior written approval from the Director of the Arizona Game and Fish Department.

E. An individual who lawfully possesses a live cervid held in captivity on the effective date of this Section, except any cervid held under a private game farm, wildlife holding, or zoo license, shall, within 30 days of the effective date of this Section, provide the Department with a written report that contains the following:

1. Name, address, and telephone number of the person possessing the live cervid;
2. Number, genus, and species of any live cervid held; and
3. Location where the live cervid is held.

F. An individual who lawfully possesses a live cervid held in captivity on the effective date of this Section, except any cervid held under a private game farm, wildlife holding, or zoo license, may continue to possess the live cervid and shall only dispose of the live cervid by the following methods:
1. Exportation,
2. Euthanasia, or
3. As otherwise directed by the Department.

G. An individual who lawfully possesses a live cervid under a private game farm, wildlife holding, or zoo license shall not move, or allow another to move, the cervid from the premises of the game farm, wildlife holding facility, or zoo except to:
1. Export the live cervid from Arizona for a lawful purpose,
2. Transport the live cervid to a facility for the purpose of slaughter, or
3. Transport the live cervid to or from a licensed veterinarian for medical care.

H. In addition to the recordkeeping requirements of R12-4-413, R12-4-417, and R12-4-420, an individual who possesses a live native cervid under a private game farm, wildlife holding, or zoo license on the effective date of this Section, and subsequent to the effective date of this Section for progeny, shall:
1. Permanently mark each live native cervid with either an individually identifiable microchip or tattoo within 30 days of the effective date of this Section;
2. Permanently mark the progeny of each live native cervid with either an individually identifiable microchip or tattoo; and
3. Within 30 days of the effective date of this Section, and annually by December 15, provide the Department with a report listing the following for each live native cervid in the licensee's possession:
a. Name of the license holder,
b. License holder's address and telephone number,
c. Number and species of live native cervids held,
d. The microchip or tattoo number of each live native cervid held, and
e. The disposition of all native cervids that were moved or that died in the six months before the effective date of this Section or during the current reporting period.

I. The holder of a private game farm, wildlife holding, or zoo license shall ensure that the head of a native cervid that dies while held under the special licenses (except a native cervid that is slaughtered as allowed under this Section, R12-4-413, R12-4-417, and R12-4-420) is submitted within 72 hours of the time of death to the University of Arizona Veterinary Diagnostic Laboratory for chronic wasting disease analysis. The licensee shall ensure that the shipment of the deceased animal's head is made by a common, private, or contract carrier that utilizes a tracking number system to track the shipment. The Arizona Game and Fish Department shall pay for the cost of the laboratory analysis. The holder of a private game farm, wildlife holding, or zoo license shall include the following information with the shipment of the deceased animal's head:
1. Name of the license holder,
2. License holder's address, and
3. License holder's telephone number.

J. If a zoonotic or wildlife disease, as determined by a person with relevant wildlife disease expertise, exists in any facility or on property holding cervids, and the zoonotic or wildlife disease poses an immediate threat to wildlife or humans, including those animals held under special license, the Arizona Game and Fish Department's Director shall order the immediate quarantine of all wildlife held at the facility or on the property. The Director may suspend the provisions of any applicable special license and order the humane disposition of any affected animal based on an assessment of the threat to public or wildlife health, safety, or welfare. An individual who possesses a cervid where an identified zoonotic or wildlife health risk exists shall, as ordered by the Director, quarantine the wildlife, test the wildlife for disease, submit a biological sample to the Department or its designee, and, if necessary, destroy and dispose of the wildlife as directed by the Department.

K. A holder of a zoo license may import any live cervid, except a native cervid, for exhibit, educational display, or propagation only if the cervid is quarantined for 30 days upon arrival, and the cervid is procured from a facility that complies with the following requirements:

1. The exporting facility has no history of chronic wasting disease or other diseases that pose a serious health risk to wildlife or humans, and there is accompanying documentation from the facility certifying that there is no history of disease at the facility;
2. The cervid is accompanied by a health certificate issued by a licensed veterinarian in the jurisdiction of origin, and the health certificate is issued within 30 days of import; and
3. The cervid is accompanied by evidence of lawful possession as defined in R12-4-401.

L. A holder of a zoo license may transport within Arizona any live cervid, except a native cervid, for the purpose of procurement or propagation only if the cervid is quarantined for 30 days upon arrival at its destination, and only if the cervid is procured from a facility that complies with the following requirements:

1. The originating facility has no history of chronic wasting disease or other diseases that pose a serious health risk to wildlife or humans, and there is accompanying documentation from the facility certifying that there is no history of disease at the facility;
2. The cervid is accompanied by a health certificate issued by a licensed veterinarian in the jurisdiction of origin, and the health certificate is issued within 30 days of transport; and
3. The cervid is accompanied by evidence of lawful possession as defined in R12-4-401.

M. An individual who possesses a cervid shall comply with all procedures for tuberculosis control and eradication for cervids prescribed in the USDA publication "Bovine Tuberculosis Eradication - Uniform Methods and Rules," USDA APHIS 91-45-011, effective January 22, 1999. This material is incorporated by reference in this Section but does not include any later amendments or editions. A copy is on file with the Secretary of State and is available from any Department office, or it may be ordered from the USDA APHIS Veterinary Services, Cattle Disease and Surveillance Staff, P. O. Box 96464, Washington D.C. 20090-6464.

N. An individual who possesses a cervid shall comply with the procedures for the prevention, control, and eradication of Brucellosis in cervids as prescribed in the United States Department of Agriculture publication "Brucellosis in Cervidae: Uniform Methods

and Rules" U.S.D.A. A.P.H.I.S. 91-45-12, effective September 30, 1998, revised effective May 14, 1999. This material is incorporated by reference in this Section but does not include any later amendments or editions. A copy is on file with the Secretary of State and is available from any Department office, or it may be ordered from the USDA APHIS Veterinary Services, Cattle Disease and Surveillance Staff, P. O. Box 96464, Washington D.C. 20090-6464.

O. An individual who possesses a cervid shall comply with the procedures for the prevention, control, and eradication of Brucellosis in cervids as prescribed in the United States Department of Agriculture publication "Brucellosis Eradication: Uniform Methods and Rules" U.S.D.A. A.P.H.I.S. 91-45-11, effective February 1, 1998. This material is incorporated by reference in this Section but does not include any later amendments or editions. A copy is on file with the Secretary of State and is available from any Department office, or it may be ordered from the USDA APHIS Veterinary Services, Cattle Disease and Surveillance Staff, P. O. Box 96464, Washington D.C. 20090-6464.

P. The Department has the authority to seize, destroy, and dispose of, at the owner's expense, any cervid possessed in violation of this Section.

Historical Note

New Section made by final rulemaking at 9 A.A.R. 3186, effective August 30, 2003 (Supp. 03-3). Amended by final rulemaking at 12 A.A.R. 980, effective May 6, 2006 (Supp. 06-1).

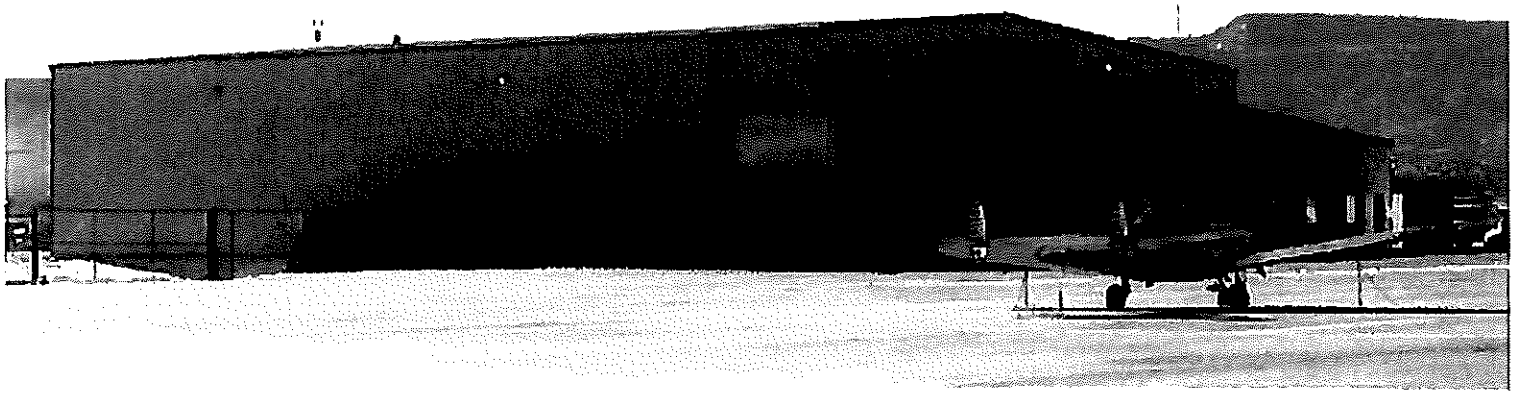
APPENDIX VI
Preliminary Engineers Report
Interim Facility Local Dispatch / Firefighter Training Center

Complete Cost Estimate
Interim Facility Local Dispatch / Firefighter Training Center

Preliminary Engineering Report

Southwest Natural Resources Training Facility Phase I:

Firefighter Training and Dispatch Facility



Revised

October 13, 2014

Town of Springerville, Arizona

Prepared by:
Bowman Consulting Group, LTD.
305 E. 4th Street
Safford, AZ 85546
928-428-3898

Registered Professional Engineer (Civil)
CERTIFICATE NO.
54517
CHAD M.
CROCKETT
Date Signed 10-13-14
ARIZONA, U.S.A.

Expires 6/30/16

Bowman
CONSULTING

Table of Contents

Preliminary Engineering Report Governing Requirements 1
Section 1 – Description 1
Section 2 – Verification Statement 3
Section 3 – Sketches and Schematics 3
Section 4 – Feasibility Analysis 4
Section 5 – Method of Construction 4
Section 6 – Construction Contracts 4
Section 7 – Cost Estimate 5
Section 8 – Real Property Acquisition 6
Section 9 – Required Permits 6
Section 10 – Project Schedule 6
APPENDIX A 9

Preliminary Engineering Report
Southwest Natural Resources Training Facility Phase I:
Firefighter Training and Dispatch Facility

Preliminary Engineering Report Governing Requirements

The following preliminary engineering report was prepared in accordance with the United States Economic Development Association's (EDA) March 3, 2013 minimum report requirements. In total the report consists of ten EDA required sections. Due to limitations in heading space an abbreviated section description is included as part of each section heading. The EDA section heading in its entirety can be found italicized as the first paragraph in each section.

Section 1 – Description

Description of Project Components.

The Town of Springerville wishes to construct Phase One of the Southwest Natural Resources Training Facility (SNRTF). The SNRTF is a planned multiuse center. The SNRTF will consist of several buildings ranging in size and use. As part of the facility a multiuse center with a 200 seat auditorium/conference center is planned. A greenhouse is planned to assist in reforestation in areas affected by wild land fires. In addition, the greenhouse will serve as a sustainable food production facility. An endangered species training facility will also be included as part of the SNRTF. A firefighting training facility will also be part of the facility. The last major component of the facility is an interagency dispatch facility. The goal of the dispatch facility is to provide a location where various government agencies can house their dispatch operations.

Phase one of the Southwest Natural Resources Training Facility consists of a proposed 10,000 square foot building. The proposed building will be located on the east side of Airport Road (See Figure 1 – Location Map next page). The location of the proposed building is delegated for non-aviation related activities. However, a proposal to the Federal Aviation Administration (FAA) will be required for the release of airport obligation.

The purpose of Phase One of the proposed facility is twofold. First, the proposed facility will provide a location for the Town of Springerville to conduct dispatching operations for police and fire fighting. Currently Apache County conducts dispatch operations for the Town of Springerville through an intergovernmental agreement. Apache County recently informed the Town of Springerville that they are willing to continue to provide dispatch services to the Town through a new intergovernmental agreement. However, the cost of dispatch services provided by Apache County will increase by approximately five times according to the Town of Springerville. The dispatch operation portion of the proposed building will consist of a dispatch operator's room and three offices. Dispatch operations will occupy approximately 2,640 square feet of the proposed building. Approximately 2,030 square feet will consist of the secured dispatch room.

Figure 1 – Location Map

Second, the proposed building will house a wild land firefighter training facility. The wild land firefighting portion of the building will consist of four instruction/training rooms, cafeteria, kitchen, dormitory, changing rooms, and restrooms including shower facilities. The proposed instruction/training rooms are approximately 548 square feet each. The instruction/training rooms are laid out with common folding partition walls allowing for the creation of larger instruction/training rooms as situations may require. Wild land firefighting training will occupy approximately 2,192 square feet of the proposed building.

Other components of the proposed facility include a dormitory with accompanying bathroom and shower facilities that encompass an area of approximately 1862 square feet. A cafeteria with kitchen facilities encompasses an area of approximately 1,000 square feet. The remaining area of the building consists of a lobby, hallways, business center, storage, janitorial, and an electrical and mechanical control room.

The project site area encompasses approximately 1.5 acres. Water service will be provided by the Town of Springerville via a six inch diameter water pipeline which runs parallel to Airport Road. Sewer

service will be provided by the Town of Springerville via an eight inch diameter sewer pipeline located to the east of the proposed project site. Electrical service will be provided by Navopache Electric Co-op via electrical power lines located to the west of the proposed site parallel to Airport Road.

The proposed building will be a prefabricated metal building designed and built to applicable local, state, and national building codes. The structure will consist of steel girders and columns. It is assumed the proposed building foundation will either be a reinforced concrete slab on grade or a post tensioned slab on grade. Spread footers may be required to support the column loads depending on soil bearing capacity. However, at this point in the design process the exact type of building foundation is not of major concern as during the design process the appropriate type of foundation will be designed based on a geotechnical soil analysis. The roof and side walls of the proposed building will be constructed of metal roofing and sheeting material. The proposed building will be prefabricated to allow for framed doors and windows. The building will have a free span with no interior columns to allow for maximum versatility of building space. Exterior walls and the ceiling will be insulated to industry standards. Interior walls of the proposed building will be framed using steel studs and will be sheeted with drywall.

The proposed building will be equipped with a Heating Ventilation and Air Conditioning (HVAC) system to allow for interior climate control. The proposed HVAC system will be zoned to allow for differential temperature control in the various sections of the proposed building. Electrical and communication receptacles will be located throughout the proposed building as necessary to accommodate the function of each area of the proposed building. CAT5 wiring or similar networking wiring will also be strategically installed throughout the proposed building.

The dispatch area of the proposed building will constantly secured. Access to the dispatch area will only be permitted through electronic key card or similar type of security. Dispatch networking and communication lines will not be interconnected to other areas of the building to help prevent any type of electronic security breach.

Section 2 – Verification Statement

A statement verifying the project components described in the engineering report are consistent with the EDA investment project description that is provided in Section A.2 of Form ED-900.

The proposed project components as described in the engineering report are consistent with the EDA investment project description that is provided in Section A.2 of Form ED-900.

Section 3 – Sketches and Schematics

Sketches of schematics showing the general layout and location of the existing site conditions and of the project components as well as location of project beneficiary(s) identified in Section B.5 of Form ED-900 that provide economic justification for the project, if any.

Preliminary project site plan, and grading & drainage plan are located in the accompanying Appendix.

Section 4 – Feasibility Analysis

A feasibility analysis for the constructability of the project

The proposed project is to be located on property owned by the Town of Springerville on the east side of Airport Road near the Springerville Municipal Airport. The site selected will allow for future phases of the Southwest Natural Resources Training Facility to be added to the proposed project. The location of the proposed building is delegated for non-aviation related activities. However, a proposal to the FAA will be required for the release of airport obligation.

Based on site observation and discussion with Town of Springerville officials, the soil on the proposed site consists of hard, rocky soil. While construction of utility infrastructure and horizontal improvements may be slower at times due to soil conditions, this should not be cause of concern for the overall success of the project. There are multiple existing buildings that have been successfully constructed near the proposed project site in the same soil conditions. The close proximity of existing utilities to the proposed project site should help reduce concerns in regard to trenching for utilities. The existing water pipeline, sewer pipeline and electrical lines are all within 80 feet of the proposed building.

Section 5 – Method of Construction

The proposed method of construction.

It is proposed that the entire project will completed through a sealed competitive bid process. First, a sealed competitive bid process will be completed in order to obtain a design firm to create construction plans. After construction plans are created and approved, the Town of Springerville will then go out for a sealed competitive bid for construction.

Section 6 – Construction Contracts

The number of construction contracts anticipated.

It is anticipated that the entire project will be awarded to a general contractor through a sealed competitive bid process. As a result, there will be one contract between the Town of Springerville and the selected contractor. The contractor however, may choose to use sub-contractors for various portions of the overall project construction. Contracts with sub-contractors will be solely between the prime contractor and the sub-contractor. The Town of Springerville will not enter into any type of contract with sub-contractors.

Section 7 – Cost Estimate

A current detailed construction cost estimate for each of the project components.

Item No.	Description	Quantity	Unit	Unit Price	Total Item Price
1	General Requirements	1	EA	$47,675.00	$47,675.00
2	Survey and Site Layout	1	EA	$15,000.00	$15,000.00
3	Prefabricated steel building (shell only)	10,000	S.F.	$9.50	$95,000.00
4	Building Foundation	10,000	S.F.	$4.30	$43,000.00
5	Site clearing and grubbing	7,300	S.Y.	$0.50	$3,650.00
6	Rough Grading	7,300	S.Y.	$1.00	$7,300.00
7	Asphaltic concrete pavement sub-grade preparation	3,972	S.Y.	$2.00	$7,944.00
8	4" thick asphaltic concrete pavement aggregate base course	440	Ton	$25.00	$11,000.00
9	4" thick asphaltic concrete pavement	440	Ton	$140.00	$61,600.00
10	MAG sidewalk (Detail No. 230)	2544	S.F.	$4.50	$11,448.00
11	MAG Type "B" Single Curb (Detail No. 222)	1770	L.F.	$10.00	$17,700.00
12	Grouted rip-rap	335	S.Y.	$13.00	$4,355.00
13	Pavement parking line striping (painted)	1518	L.F.	$1.30	$1,973.40
14	Pavement handicap parking marking (painted)	3	EA	$500.00	$1,500.00
15	1.5" Water meter capacity & installation fee	1	EA	$2,316.00	$2,316.00
16	2" water service pipeline	82	L.F.	$25.00	$2,050.00
17	6" Sewer pipeline capacity & installation fee	1	EA	$7,387.00	$7,387.00
18	6" sewer service pipeline	87	L.F.	$35.00	$3,045.00
19	6" Fire water pipeline capacity & installation fee	1	EA	$1,100.00	$1,100.00
20	6" fire water pipeline	82	L.F.	$42.00	$3,444.00
21	Electrical service	1	EA	$15,000.00	$15,000.00
22	Electrical service wire	70	L.F.	$65.00	$4,550.00
23	Diesel powered backup generator	1	EA	$30,000.00	$30,000.00
24	Landscaping	1	EA	$30,000.00	$30,000.00
25				Total	$428,037.40
26				5% Contingencies	$21,401.87
27				Grand Total	$449,439.27

Contingencies for construction were set at 5% due to the preliminary nature of this report and the assumptions made in relation to construction. Assumptions made include but are not limited to soil conditions, electrical power load, and landscaping costs.

Section 8 – Real Property Acquisition

If the budget includes costs for real property acquisition, the Applicant should include a current fair market value appraisal.

The existing property for the proposed project is currently owned by the Town of Springerville.

Section 9 – Required Permits

A list of all permits required for the proposed project and their current status.

It is anticipated that three permits will be required for this project including a Building Permit, Stormwater Construction General Permit, and a Release of Airport Obligation. All permits will be obtained by the contractor after award of the contract except for the Release of Airport Obligation which will be obtained by the design firm prior to the construction bid process. As of today no permits have been obtained. A description of each permit is provided below.

Building Permit – A building permit will be required from the Town of Springerville for this project. It is anticipated the building permit application process will require approximately one to two months.

Stormwater Construction General Permit (CGP) – In accordance with the Arizona Department of Environmental Quality a (CGP) will be required for this project. In order to submit for a CGP a Stormwater Pollution Prevention Plan (SWPPP) will need to be created. It is anticipated that the contractor will be responsible for the development of a SWPPP. The time required to obtain a CGP is anticipated to be two to four weeks.

Release of Airport Obligation – The location of the proposed building is such that it is delegated for non-aviation related activities, however, a proposal to the FAA will be required for the release of airport obligation. It is anticipated the release of airport obligation process will require approximately six to nine months.

Section 10 – Project Schedule

An overall estimated project schedule.

i. Design period – The design period will require approximately nine months to complete. This timeframe includes the necessary review process between the Town of Springerville and the design firm. This timeframe does not include the time required to make any revisions to the construction plans that may be required by permitting agencies. In order to reduce and/or eliminate any revisions required by permitting agencies, it is suggested that permitting agencies be involved throughout the design process.

ii. Period of time to obtain required permits – Assuming applications for building permits as well as the release of airport obligation can be submitted simultaneously the estimated time to obtain required permits is six to nine months.

iii. Period of time to obtain any required easements of rights-of-way – Not applicable.

iv. Solicitation of bids and awarding of contracts – The solicitation of bids will involve the following:

a. Bid Solicitation – The bid solicitation will last for six weeks. Bids will be solicited on the Town of Springerville website, the local newspaper, as well as through a bid solicitation company out of the Phoenix metropolitan area.

b. Bid Packages – Bid packages will be prepared by the design firm. The bid package will include all of the necessary contract and construction documents including a bid schedule, construction plans, and technical specifications.

c. Pre Bid Meeting – A mandatory pre bid meeting will be held at the Town of Springerville two weeks after the bid solicitation is released. The purpose of the pre bid meeting is twofold. The first purpose of the pre bid meeting is to provide an opportunity for the potential contractors to see the construction site conditions. The second purpose of the pre bid meeting is to answer any questions and make any project clarifications to potential contractors.

d. Bid Opening – The bid submittal date and time will be specified in the bid solicitation. Bids that are received after the specified date and time will be returned to the submitter and will not be considered as a viable bidder. At the specified date and time the bids will be opened and read aloud. The bid opening will be conducted as an open meeting for any potential bidders and the public to attend.

e. Design Firm's Bid Review and Recommendation – The design firm will review the bid documents that were opened during the bid opening. This review will include a thorough evaluation of each submittal to determine if each bidder has the necessary documentation, bonding and licenses in order to complete the project. Any bidders who have incomplete information or who do not have the appropriate licenses will be noted. The design firm will then make a recommendation to the Town of Springerville as to who the design firm feels the contract should be awarded to. It is anticipated this process will require one week to complete.

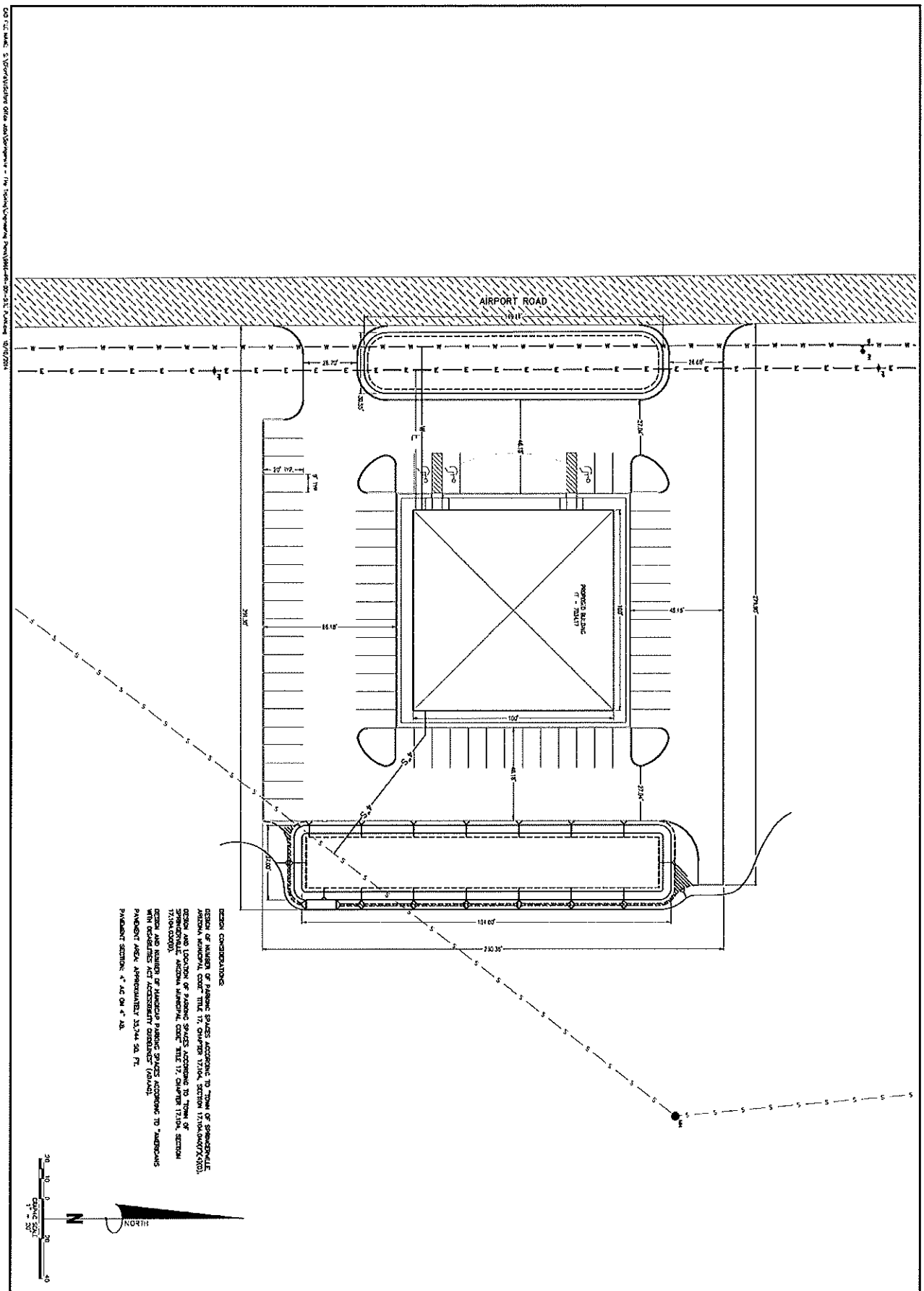
f. Contract Award – Ultimately the contract award is determined by the Town of Springerville Town Council. The town council will review the design firm's bid review and recommendation. The town council will then vote in an open council meeting setting to award the contract to the chosen contractor. The amount of time required for contract award will vary depending on the date of the next available town council meeting with respect to the bid opening. Town council meetings are held on a biweekly schedule on the first and third Thursday of the month.

g. Notice of Award/Non Award – Notice of award/non award will be sent to each bidder via conventional mail after the award has been announced at the council meeting.

h. Notice to Proceed – The notice to proceed will be issued after the notice of award is issued and once all of the appropriate bonding is in place. It is anticipated the notice to proceed will be issued approximately four to six weeks after the notice of award to allow time for the successful contractor to obtain the necessary bonding.

v. Construction period – Construction is estimated to last six to nine months. Construction should be planned such that foundation and site work takes place during the months of April through October to avoid freezing temperatures.

APPENDIX



DESIGN CONSIDERATIONS

DESIGN OF NUMBER OF PARKING SPACES ACCORDING TO TOWN OF SPRINGERVILLE, ARIZONA MUNICIPAL CODE TITLE 17, CHAPTER 17.04A, SECTION 17.04A.040(7)(C)(10).

DESIGN AND LOCATION OF PARKING SPACES ACCORDING TO TOWN OF SPRINGERVILLE, ARIZONA MUNICIPAL CODE TITLE 17, CHAPTER 17.31A, SECTION 17.31A.020(B).

DESIGN AND NUMBER OF HANDICAP PARKING SPACES ACCORDING TO 'AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES' (ADAAG).

PAVEMENT AREA: APPROXIMATELY 35,744 SQ. FT.

PAVEMENT SECTION: 4" AC ON 4" AB.

PRELIMINARY

SHEET 1 of 2

SITE PLAN

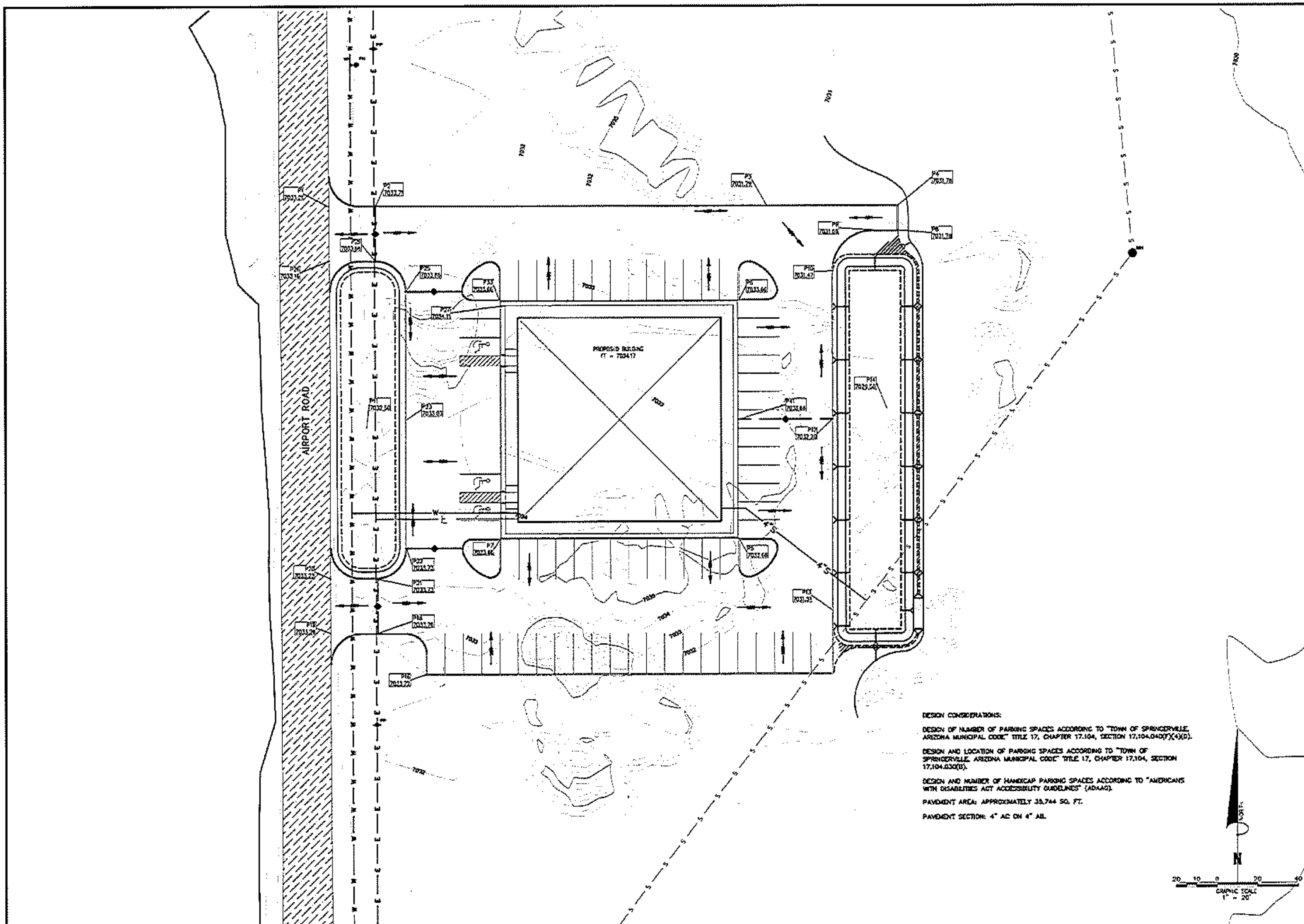
SOUTHWEST NATURAL RESOURCES TRAINING FACILITY

PHASE I: FIREFIGHTER TRAINER - DISPATCH FACILITY

SPRINGERVILLE, AZ — APACHE COUNTY

Bowman Consulting Group, Ltd.
305 E. 49 Street
Safford, Arizona 85546
Phone: (928) 428-3698
Fax: (928) 428-7995
www.bowmanconsulting.com

Bowman CONSULTING



Bowman
CONSULTING

Bowman Consulting Group, Ltd.
Safford, Arizona 85546
www.bowmanconsulting.com

GRADING PLAN

SOUTHWEST NATURAL RESOURCES TRAINING FACILITY
PHASE I: FIREFIGHTER TRAINER - DISPATCH FACILITY
SPRINGERVILLE, AZ
APACHE COUNTY

PROJECT NUMBER

PRELIMINARY

PLAN STATUS

DATE	DESCRIPTION	
JTU DESIGN	JTU DRAWN	CHKD
SCALE	H: V:	
JOB No. 9986-01-001		
DATE: SEP 2014		

SHEET 2 OF 2

CAD FILE NAME: ...GRADING PLAN.dwg 10/10/2014

Project Name:	Local Dispatch / Firefighter Training Center	**JOB NO:**	26-12
Client:	Town of Springerville	SF FIN	10,000
Architect:	TBD	SF UNFIN	0
Location:	Springerville, AZ	**SF TOTAL**	10,000

CSI Division	Class Name	Cost		Cost/sf
00 00 00	PROCUREMENT AND CONTRACTING REQ	$65,000.00		$6.50
01 00 00	GENERAL REQUIRMENTS	$47,675.00		$4.77
02 00 00	EXISTING CONDITIONS	$15,000.00		$1.50
03 00 00	CONCRETE	$43,000.00		$4.30
04 00 00	MASONRY	$7,300.00		$0.73
05 00 00	METALS	$0.00		$0.00
06 00 00	WOOD, PLASTICS AND COMPOSITES	$4,500.00		$0.45
07 00 00	THERMAL AND MOISTURE PROTECTION	$10,000.00		$1.00
08 00 00	OPENINGS	$23,820.00		$2.38
09 00 00	FINISHES	$126,779.50		$12.68
10 00 00	SPECIALTIES	$33,100.00		$3.31
11 00 00	EQUIPMENT	$25,500.00		$2.55
12 00 00	FURNISHINGS	$44,800.00		$4.48
13 00 00	SPECIAL CONSTRUCTION	$95,000.00		$9.50
14 00 00	CONVEYING EQUIPMENT	$0.00		$0.00
21 00 00	FIRE SUPPRESSION	$43,300.00		$4.33
22 00 00	PLUMBING	$77,700.00		$7.77
23 00 00	HVAC	$58,700.00		$5.87
25 00 00	INTEGRATED AUTOMATION	$8,500.00		$0.85
26 00 00	ELECTRICAL	$84,195.00		$8.42
27 00 00	COMMUNICATIONS	$168,000.00		$16.80
28 00 00	ELECTRONIC SAFETY AND SECURITY	$5,000.00		$0.50
31 00 00	EARTHWORK	$17,529.00		$1.75
32 00 00	EXTERIOR IMPROVEMENTS	$143,183.40		$14.32
33 00 00	UTILITIES	$38,883.00		$3.89
35 00 00	WATERWAY AND MARINE CONSTRUCTION	$0.00		$0.00
	SUBTOTAL	**$1,186,464.90**		$118.65
	SALES TAXES (AZ Factored Tax Rate)	$66,264.06	5.59%	$6.63
	CONTINGENCY	$59,323.25	5.00%	$5.93
	GENERAL OVERHEAD	$47,458.60	4.00%	$4.75
	PROFIT	$94,917.19	8.00%	$9.49
	TOTAL ESTIMATE	**$1,454,428.00**		**$145.44**

Local Dispatch / Fire Fighter Training Center

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
00 00 00	PROCUREMENT AND CONTRACTING REQ	$65,000.00	Div Total			
00 11 19	request for proposal					$0.00
00 11 53	request for qualifications					$0.00
00 25 13	pre-bid meetings					$0.00
00 25 16	pre-proposal meetings					$0.00
00 31 43	permit application					$0.00
00 31 46	permits - mitigations - fees					$0.00
00 41 00	bid forms					$0.00
00 60 00	project forms	Architectural & Engineering Fees	Lump Sum	1	$65,000.00	$65,000.00
00 61 00	bond forms					$0.00
00 62 00	certificates and other forms					$0.00
01 00 00	GENERAL REQUIRMENTS	$47,675.00	Div Total			
01 10 00	summary					$0.00
01 31 00	project management and coordination		Months	9	$1,500.00	$13,500.00
01 31 13	project coordination		Months	9	$800.00	$7,200.00
01 31 14	facility services coordination					$0.00
01 31 19	project meetings		Lump Sum	1	$1,500.00	$1,500.00
01 31 23	project website					$0.00
01 31 26	electronic communication protocols					$0.00
01 32 00	construction progress documentation					$0.00
01 32 13	scheduling of work					$0.00
01 32 16	construction progress schedule					$0.00
01 32 19	submittals schedule					$0.00
01 32 23	survey and layout data					$0.00
01 32 26	construction progress reporting					$0.00
01 32 33	photographic documentation					$0.00
01 32 43	purchase order tracking					$0.00
01 33 00	submittal procedures					$0.00
01 35 00	special procedures					$0.00
01 35 23	owner safety procedures					$0.00
01 35 43	environmental procedures					$0.00
01 35 46	indoor air quality					$0.00
01 35 53	security procedures					$0.00
01 40 00	quality requirements					$0.00
01 41 00	regulatory requirements					$0.00
01 42 00	references					$0.00
01 43 00	quality assurance					$0.00
01 43 36	field samples					$0.00
01 43 39	mockups					$0.00
01 45 00	quality control					$0.00
01 46 23	testing and inspection services		Lump Sum	1	$5,000.00	$5,000.00
01 50 00	temporary facilities and controls					$0.00
01 51 00	temporary utilities		Months	9	$250.00	$2,250.00
01 51 13	temporary electricity					$0.00
01 51 19	temporary fuel oil					$0.00
01 51 23	temporary hvac					$0.00
01 51 26	temporary lighting					$0.00
01 51 33	temporary telecommunications					$0.00
01 51 36	temporary water					$0.00
01 52 00	construction facilities					$0.00
01 52 13	field offices and sheds		Months	9	$450.00	$4,050.00
01 52 16	first aid facilities					$0.00
01 52 19	sanitary facilities		Months	9	$125.00	$1,125.00
01 53 00	temporary construction					$0.00
01 54 00	construction aids					$0.00
01 54 16	temporary hoists					$0.00
01 54 19	temporary cranes					$0.00
01 54 23	temporary scaffolding and platforms					$0.00
01 55 00	vehicular access and parking					$0.00
01 56 00	temporary barriers and enclosures					$0.00
01 56 23	temporary barricades					$0.00
01 56 26	temporary fencing		Months	9	$250.00	$2,250.00
01 56 39	temporary tree and plant protection					$0.00
01 57 00	temporary controls					$0.00
01 57 13	temporary erosion and sediment control					$0.00
01 57 16	temporary pest control					$0.00
01 57 19	temporary environmental controls					$0.00
01 57 23	temporary storm water pollution control					$0.00
01 60 00	product requirements					$0.00
01 70 00	execution and closeout requirements					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
01 71 13	mobilization		Lump Sum	1	$2,500.00	$2,500.00
01 71 23	field engineering					$0.00
01 71 33	protection of adjacent construction					$0.00
01 73 00	execution					$0.00
01 74 00	cleaning and waste management					$0.00
01 74 13	progress cleaning					$0.00
01 74 16	site maintenance					$0.00
01 74 19	construction waste management and disposal		Months	9	$200.00	$1,800.00
01 74 23	final cleaning		Lump Sum	1	$5,000.00	$5,000.00
01 75 00	starting and adjusting					$0.00
01 76 00	protecting installed construction					$0.00
01 77 00	closeout procedures		Ea	1	$1,500.00	$1,500.00
01 93 13	facility maintenance procedures					$0.00
02 00 00	EXISTING CONDITIONS	$15,000.00	Div Total			
02 01 00	maintenance of existing conditions					$0.00
02 01 50	maintenance of site remediation					$0.00
02 05 00	common work results for existing conditions					$0.00
02 05 19	geosynthetics for existing conditions					$0.00
02 06 00	schedules for existing conditions					$0.00
02 21 00	surveys	Survey & Site Layout	Ea	1	$15,000.00	$15,000.00
02 22 00	existing conditions assessment					$0.00
02 24 00	environmental assessment					$0.00
02 25 00	existing material assessment					$0.00
02 26 00	hazardous material assessment					$0.00
02 31 00	geophysical investigations					$0.00
02 32 00	geotechnical investigations					$0.00
02 41 13	selective site demolition					$0.00
02 41 16	structure demolition					$0.00
02 42 00	removal and salvage of construction materials					$0.00
02 43 00	structure moving					$0.00
02 50 00	site remediation					$0.00
02 60 00	contaminated site material removal					$0.00
02 70 00	water remediation					$0.00
02 80 00	facility remediation					$0.00
03 00 00	CONCRETE	$43,000.00	Div Total			
03 11 00	concrete forming					$0.00
03 11 19	insulating concrete forming					$0.00
03 15 00	concrete accessories					$0.00
03 16 00	concrete anchors					$0.00
03 21 00	reinforcing steel	footers & grade beams	SQ FT	10,000	$0.15	$1,500.00
03 22 00	welded wire fabric reinforcing	slab on grade	SQ FT	10,000	$0.20	$2,000.00
03 24 00	fibrous reinforcing					$0.00
03 25 00	composite reinforcing					$0.00
03 30 00	cast-in-place concrete	Building Foundation & Footers	SQ FT	10,000	$2.20	$22,000.00
03 31 00	structural concrete					$0.00
03 31 16	lightweight structural concrete					$0.00
03 31 23	high-performance structural concrete					$0.00
03 33 00	architectural concrete					$0.00
03 35 00	concrete finishing	forming & finish work		10,000	$1.50	$15,000.00
03 37 00	specially placed concrete					$0.00
03 37 16	concrete pumps					$0.00
03 38 00	post-tensioned concrete					$0.00
03 39 00	concrete curing					$0.00
03 40 00	precast concrete					$0.00
03 47 00	site-cast concrete					$0.00
03 47 13	tilt-up concrete					$0.00
03 48 00	precast concrete specialties					$0.00
03 50 00	cast decks and underlayment					$0.00
03 60 00	grouting					$0.00
03 70 00	mass concrete					$0.00
03 80 00	concrete cutting and boring	saw cutting control joints	Lump Sum	1	$2,500.00	$2,500.00
04 00 00	MASONRY	$7,300.00	Div Total			
04 20 00	unit masonry					$0.00
04 22 00	concrete unit masonry					$0.00
04 23 00	glass unit masonry					$0.00
04 24 00	adobe unit masonry					$0.00
04 25 00	unit masonry panels					$0.00
04 26 00	single-wythe unit masonry					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
04 27 00	multiple-wythe unit masonry					$0.00
04 43 00	stone masonry	Wainscot walls & Building Perimeter	LF	400	$18.25	$7,300.00
04 50 00	refractory masonry					$0.00
04 57 00	masonry fireplaces					$0.00
04 57 33	modular masonry fireplaces					$0.00
04 73 00	manufactured stone masonry					$0.00
05 00 00	METALS	$0.00 Div Total				
05 05 23	metal fastenings					$0.00
05 12 00	structural steel framing					$0.00
05 20 00	metal joists					$0.00
05 21 00	steel joists framing					$0.00
05 40 00	cold-formed metal framing					$0.00
05 41 00	structural metal stud framing					$0.00
05 42 00	cold-formed metal joist framing					$0.00
05 50 00	metal fabrications					$0.00
05 70 00	decorative metal					$0.00
06 00 00	WOOD, PLASTICS AND COMPOSITES	$4,500.00 Div Total				
06 05 23	wood, plastic and composite fastenings					$0.00
06 05 73	wood treatments					$0.00
06 05 83	shop-applied wood coatings					$0.00
06 10 00	rough carpentry					$0.00
06 11 00	wood framing					$0.00
06 12 00	structural panels					$0.00
06 15 00	wood decking					$0.00
06 16 00	sheathing					$0.00
06 16 13	insulating sheathing					$0.00
06 16 23	subflooring					$0.00
06 16 26	underlayment					$0.00
06 16 43	gypsum sheathing					$0.00
06 16 63	cementitious sheathing					$0.00
06 17 13	laminated veneer lumber					$0.00
06 17 23	parallel strand lumber					$0.00
06 17 25	laminated strand lumber					$0.00
06 17 27	oriented strand lumber					$0.00
06 17 33	wood I-joists					$0.00
06 17 36	metal-web wood joists					$0.00
06 17 43	rim boards					$0.00
06 17 53	shop-fabricated wood trusses					$0.00
06 18 13	glued-laminated beams					$0.00
06 20 23	interior finish carpentry		Lump Sum	1	$4,500.00	$4,500.00
06 22 13	standard pattern wood trim					$0.00
06 25 00	prefinished paneling					$0.00
06 26 00	board paneling					$0.00
06 42 00	wood paneling					$0.00
06 42 16	wood-veneer paneling					$0.00
06 42 19	plastic-laminate-faced wood paneling					$0.00
06 42 99	interior handrails					$0.00
06 43 00	wood stairs and railings					$0.00
06 44 13	wood turnings					$0.00
06 44 16	wood pilasters					$0.00
06 44 19	wood grilles					$0.00
06 44 23	wood corbels					$0.00
06 44 26	wood cupolas					$0.00
06 44 29	wood finials					$0.00
06 44 33	wood mantels					$0.00
06 44 36	wood pediment heads					$0.00
06 44 39	wood posts and columns					$0.00
06 46 13	wood door and window casings					$0.00
06 46 16	wood aprons					$0.00
06 46 19	wood base and shoe moldings					$0.00
06 46 23	wood chair rails					$0.00
06 46 26	wood cornices					$0.00
06 46 99	wood crown					$0.00
06 50 00	structural plastics					$0.00
06 51 13	plastic lumber					$0.00
06 53 00	plastic decking					$0.00
06 63 00	plastic railings					$0.00
06 66 00	custom ornamental simulated woodwork					$0.00
06 71 13	composite lumber					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
06 72 13	composite joist assemblies					$0.00
06 73 13	composite structural decking					$0.00
06 81 00	composite railings					$0.00
06 83 00	composite paneling					$0.00
07 00 00	THERMAL AND MOISTURE PROTECTION	$10,000.00 Div Total				
07 11 00	damproofing					$0.00
07 13 00	sheet waterproofing					$0.00
07 14 00	fluid-applied waterproofing					$0.00
07 19 00	water repellents					$0.00
07 21 00	thermal insulation					$0.00
07 21 13	board insulation					$0.00
07 21 16	blanket insulation	ceilings at interior (in addition to roof)	SQ FT	10,000	$0.70	$7,000.00
07 21 19	foamed-in-place insulation					$0.00
07 21 23	loose-fill insulation					$0.00
07 21 26	blown insulation					$0.00
07 21 99	visqueen					$0.00
07 22 00	roof and deck insulation					$0.00
07 30 05	roof felt and underlayment					$0.00
07 31 00	shingles and shakes					$0.00
07 31 13	asphalt shingles					$0.00
07 31 16	metal shingles					$0.00
07 31 19	mineral-fiber cement shingles					$0.00
07 31 29	wood shingles and shakes					$0.00
07 31 33	composite rubber shingles					$0.00
07 31 53	plastic shakes					$0.00
07 32 13	clay roof tiles					$0.00
07 32 16	concrete roof tiles					$0.00
07 32 19	metal roof tiles					$0.00
07 32 26	plastic roof tiles					$0.00
07 41 00	roof panels					$0.00
07 41 13	metal roof panels					$0.00
07 41 43	composite roof panels					$0.00
07 42 13	metal wall panels					$0.00
07 42 43	composite wall panels					$0.00
07 44 00	faced panels					$0.00
07 46 23	wood siding					$0.00
07 46 26	hardboard siding					$0.00
07 46 33	plastic siding					$0.00
07 46 46	fiber-cement siding					$0.00
07 52 00	modified bituminous sheet roofing					$0.00
07 53 00	elastomeric membrane roofing					$0.00
07 54 00	thermoplastic membrane roofing					$0.00
07 56 00	fluid-applied roofing					$0.00
07 57 00	coated foam roofing					$0.00
07 58 00	roll roofing					$0.00
07 61 00	sheet metal roofing					$0.00
07 62 00	sheet metal flashing and trim					$0.00
07 71 23	manufactured gutters and downspouts					$0.00
07 72 26	ridge vents					$0.00
07 72 27	eave vents					$0.00
07 72 29	roof exhaust vents		Ea	4	$750.00	$3,000.00
07 72 36	smoke vents					$0.00
07 77 00	wall specialties					$0.00
07 81 00	applied fireproofing					$0.00
07 81 33	mineral-fiber fireproofing					$0.00
07 84 00	firestopping					$0.00
07 87 00	smoke containment barriers					$0.00
08 00 00	OPENINGS	$23,820.00 Div Total				
08 11 00	metal doors and frames					$0.00
	exterior doors and frames	Not including "store front" @ lobby	Ea	5	$500.00	$2,500.00
	interior doors and frames		Ea	21	$350.00	$7,350.00
08 14 13	carved wood doors					$0.00
08 14 16	flush wood doors					$0.00
08 14 23	clad wood doors					$0.00
08 14 29	prefinished wood doors					$0.00
08 14 33	stile and rail doors					$0.00
08 14 73	sliding wood doors					$0.00
08 14 76	bifolding wood doors					$0.00
08 15 00	plastic doors					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
08 16 00	composite doors					$0.00
08 16 13	fiberglass doors					$0.00
08 16 73	sliding composite doors					$0.00
08 16 76	bifolding composite doors					$0.00
08 17 00	integrated door opening assemblies					$0.00
08 30 00	specialty doors and frames					$0.00
08 31 13	access doors and frames					$0.00
08 31 16	access panels and frames					$0.00
08 32 00	sliding glass doors					$0.00
08 33 23	overhead coiling doors					$0.00
08 34 00	special function doors					$0.00
08 35 00	folding doors and grilles					$0.00
08 38 00	traffic doors					$0.00
08 41 00	entrances and storefronts	lobby area	Ea	1	$1,500.00	$1,500.00
08 44 33	sloped glazing assemblies					$0.00
08 50 00	windows	exterior windows	Ea	15	$450.00	$6,750.00
08 50 66	window screens					$0.00
08 56 00	special function windows					$0.00
08 60 00	roof windows and skylights					$0.00
08 71 00	door hardware	interior & exterior	Ea	27	$160.00	$4,320.00
08 74 00	access control hardware					$0.00
08 79 00	hardware accessories					$0.00
08 79 13	key storage equipment					$0.00
08 81 13	decorative glass glazing					$0.00
08 83 00	mirrors	bathrooms	Ea	4	$350.00	$1,400.00
09 00 00	FINISHES	$126,779.50	Div Total			
09 21 13	plaster assemblies					$0.00
09 21 16	gypsum board assemblies @ interior walls	Studs, drywall (2-sides), tape, texture	LF	847	$40.00	$33,880.00
	gypsum board assemblies @ exterior walls	Studs, drywall (1-side), tape, texture	LF	400	$22.00	$8,800.00
09 21 16.23	gypsum board shaft wall assemblies					$0.00
09 21 16.33	gypsum board area separation wall assemblies					$0.00
09 22 13	metal furring					$0.00
09 22 16	non-structural metal framing					$0.00
09 22 26	suspension systems					$0.00
09 22 36	lath					$0.00
09 25 00	other plastering					$0.00
09 30 13	ceramic tiling	lobby and bathrooms	SQ FT	915	$3.50	$3,202.50
09 30 16	quarry tiling					$0.00
09 30 19	paver tiling					$0.00
09 30 23	glass mosaic tiling					$0.00
09 30 26	plastic tiling					$0.00
09 30 29	metal tiling					$0.00
09 30 33	stone tiling					$0.00
09 30 36	concrete tiling					$0.00
09 30 39	brick tiling					$0.00
09 31 00	thin-set tiling	Showers (Base)	SQ FT	128	$4.00	$512.00
	thin-set tiling	Showers (Walls)	SQ FT	256	$5.00	$1,280.00
09 32 00	mortar-bed tiling					$0.00
09 33 00	conductive tiling					$0.00
09 34 00	waterproofing-membrane tiling					$0.00
09 51 00	acoustic ceilings					$0.00
09 53 00	acoustical ceiling suspension assemblies	all ceilings (2' x 4' grid system)	SQ FT	10,000	$3.39	$33,900.00
09 54 00	specialty ceilings					$0.00
09 57 00	special function ceilings					$0.00
09 61 13	acoustic underlayment					$0.00
09 61 00	flooring treatment					$0.00
09 62 12	asphaltic plank flooring					$0.00
09 62 19	laminate flooring	cafeteria and dorms (VCT with base)	SQ FT	2,232	$2.50	$5,580.00
09 62 23	bamboo flooring					$0.00
09 62 29	cork flooring					$0.00
09 63 00	masonry flooring					$0.00
09 64 00	wood flooring					$0.00
09 65 00	resilient flooring					$0.00
09 66 00	terrazzo flooring					$0.00
09 67 00	fluid-applied flooring					$0.00
09 68 00	carpeting	Commercial grade (Medium duty)	Sq Yd	725	$25.00	$18,125.00
09 70 00	wall finishes					$0.00
09 72 00	wall coverings					$0.00
09 75 00	stone facing					$0.00
09 77 00	special wall surfacing					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
09 80 00	acoustic treatment					$0.00
09 84 00	acoustic room components					$0.00
09 91 13	exterior painting					$0.00
09 91 23	interior painting	sq ft of floor area	SQ FT	10,000	$2.15	$21,500.00
09 93 13	exterior staining and finishing					$0.00
09 93 23	interior staining and finishing					$0.00
09 94 13	textured finishing					$0.00
09 94 16	faux finishing					$0.00
09 94 19	multicolor interior finishing					$0.00
09 96 00	high-performance coatings					$0.00
09 97 00	special coatings					$0.00
10 00 00	SPECIALTIES	$33,100.00	Div Total			
10 11 00	visual display units					$0.00
10 12 00	display cases					$0.00
10 14 00	signage & street numbers		Ea	1	$200.00	$200.00
10 21 13	toilet compartments					$0.00
10 21 16	shower & dressing compartments					$0.00
10 22 19	demountable partitions					$0.00
10 22 33	accordion folding partitions	instruction training and dormitory	Ea	5	$3,500.00	$17,500.00
10 26 00	wall and door protection					$0.00
10 26 13	corner guards					$0.00
10 26 19	bumper guards					$0.00
10 28 13	toilet accessories					$0.00
10 28 16	bath accessories	partition walls, etc	Lump Sum	1	$9,500.00	$9,500.00
10 28 19	tub and shower doors	shower doors	Ea	8	$575.00	$4,600.00
10 28 23	laundry accessories					$0.00
10 28 99	grab bars	ADA bathrooms	Ea	2	$225.00	$450.00
10 31 00	manufactured fireplaces					$0.00
10 32 19	fireplace screens					$0.00
10 32 23	fireplace doors					$0.00
10 35 00	stoves					$0.00
10 41 00	emergency access and information cabinets					$0.00
10 43 00	emergency aid specialties					$0.00
10 44 00	fire protection specialties					$0.00
10 50 00	storage specialties					$0.00
10 51 00	lockers					$0.00
10 55 00	postal specialties					$0.00
10 56 13	metal storage shelving					$0.00
10 56 16	fabricated wood storage shelving					$0.00
10 56 17	wall-mounted standards and shelving					$0.00
10 56 23	wire storage shelving					$0.00
10 56 29	storage racks					$0.00
10 57 13	hat and coat racks					$0.00
10 57 23	closet and utility shelving					$0.00
10 70 00	exterior specialties					$0.00
10 71 16	storm panels					$0.00
10 73 13	awnings					$0.00
10 73 16	canopies					$0.00
10 73 23	car shelters					$0.00
10 73 26	walkway coverings					$0.00
10 73 33	marquees					$0.00
10 74 00	exterior clocks					$0.00
10 74 23	cupolas					$0.00
10 74 33	weathervanes					$0.00
10 74 43	below-grade egress assemblies					$0.00
10 74 46	window wells					$0.00
10 75 00	flagpoles		Ea	1	$850.00	$850.00
10 80 00	other specialties					$0.00
10 84 13	exterior gas lighting					$0.00
11 00 00	EQUIPMENT	$25,500.00	Div Total			
11 13 00	loading dock equipment					$0.00
11 20 00	commercial equipment	commercial kitchen @ cafeteria	Lump Sum	1	$22,500.00	$22,500.00
11 24 19	vacuum cleaning systems					$0.00
11 30 00	residential equipment					$0.00
11 31 13	residential kitchen appliances					$0.00
11 31 23	residential laundry appliances					$0.00
11 33 00	retractable stairs					$0.00
11 34 00	residential ceiling fans					$0.00
11 40 00	food service equipment	serving equipment at cafeteria	Lump Sum	1	$3,000.00	$3,000.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
11 50 00	educational and scientific equipment					$0.00
11 60 00	entertainment equipment					$0.00
11 70 00	healthcare equipment					$0.00
11 82 00	solid waste disposal equipment					$0.00
11 91 00	religious equipment					$0.00
11 91 13	baptisteries					$0.00
11 92 00	agricultural equipment					$0.00
11 93 00	horticultural equipment					$0.00
11 95 00	arts and crafts equipment					$0.00
12 00 00	FURNISHINGS	$44,800.00	Div Total			
12 10 00	art					$0.00
12 20 00	window treatments	exterior window coverings	Ea	11	$150.00	$1,650.00
12 30 00	casework - cabinets - hardware	business center cabinets	Ea	1	$1,500.00	$1,500.00
12 31 00	manufactured metal casework					$0.00
12 32 13	manufactured wood-veneer-faced casework					$0.00
12 32 16	manufactured plastic-laminate-clad casework					$0.00
12 35 00	specialty casework					$0.00
12 36 13	concrete countertops					$0.00
12 36 16	metal countertops					$0.00
12 36 19	wood countertops					$0.00
12 36 23	plastic countertops					$0.00
12 36 23.13	plastic-laminate-clad countertops					$0.00
12 36 40	stone countertops					$0.00
12 36 53	laboratory countertops					$0.00
12 36 61	simulated stone countertops					$0.00
12 40 00	furnishings and accessories					$0.00
12 44 16	shower curtains					$0.00
12 46 19	clocks					$0.00
12 46 33	waste receptacles					$0.00
12 48 00	rugs and mats					$0.00
12 50 00	furniture					$0.00
	cafeteria tables & chairs		Ea	6	$850.00	$5,100.00
	dispatch desks & chairs		Ea	5	$1,200.00	$6,000.00
	dispatch offices desks & chairs		Ea	5	$950.00	$4,750.00
	lobby area reception desk & chair		Ea	1	$1,100.00	$1,100.00
12 60 00	multiple seating					$0.00
	conference room tables & chairs		Ea	2	$4,200.00	$8,400.00
	training room table & chairs		Ea	6	$1,000.00	$6,000.00
						$0.00
12 90 00	other furnishings	dormitory beds (American Bedding)	Ea	20	$495.00	$9,900.00
12 92 00	interior planters and artificial plants					$0.00
12 93 13	bicycle racks		Ea	1	$400.00	$400.00
12 93 23	trash and litter receptors					$0.00
12 93 33	manufactured planters					$0.00
12 93 43	site seating and tables					$0.00
13 00 00	SPECIAL CONSTRUCTION	$95,000.00	Div Total			
13 11 00	swimming pools					$0.00
13 12 13	exterior fountains					$0.00
13 12 23	interior fountains					$0.00
13 17 00	tubs and pools					$0.00
13 19 00	kennels and animal shelters					$0.00
13 20 00	special purpose rooms					$0.00
13 21 00	controlled environment rooms					$0.00
13 24 16	saunas					$0.00
13 27 53	security vaults					$0.00
13 30 00	special structures					$0.00
13 31 00	fabric structures					$0.00
13 32 00	space frames					$0.00
13 34 00	fabricated engineered structures					$0.00
13 34 13.13	greenhouses					$0.00
13 34 13.16	solariums					$0.00
13 34 13.19	swimming pool enclosures					$0.00
13 34 13.23	sunrooms					$0.00
13 34 13.26	conservatories					$0.00
13 34 18	post frame building systems					$0.00
13 34 19	metal building systems	PEMB , building erection, Insulation	SQ FT	10,000	$9.50	$95,000.00
13 34 23	fabricated structures					$0.00
13 36 00	towers					$0.00
13 40 00	integrated construction					$0.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
13 50 00	special instrumentation					$0.00
14 00 00	CONVEYING EQUIPMENT	$0.00	Div Total			
14 10 00	dumbwaiters					$0.00
14 20 00	elevators					$0.00
14 40 00	lifts					$0.00
14 42 00	wheelchair lifts					$0.00
14 70 00	turntables					$0.00
14 80 00	scaffolding					$0.00
14 90 00	other conveying equipment					$0.00
14 91 00	facility chutes					$0.00
21 00 00	FIRE SUPPRESSION	$43,300.00	Div Total			
21 07 00	fire suppression systems insulation					$0.00
21 10 00	water-based fire suppression systems					$0.00
21 12 00	fire suppression standpipes					$0.00
21 13 00	fire suppression sprinkler system		SQ FT	10,000	$4.25	$42,500.00
21 20 00	fire extinguishing systems	wall mounted fire extinguishers	Ea	8	$100.00	$800.00
21 30 00	fire pumps					$0.00
21 40 00	fire suppression water storage					$0.00
22 00 00	PLUMBING	$77,700.00	Div Total			
22 07 00	plumbing insulation					$0.00
22 09 00	instrumentation and control for plumbing					$0.00
22 10 00	plumbing piping	rough-in and connections	SQ FT	10,000	$6.50	$65,000.00
22 30 00	plumbing equipment					$0.00
22 40 00	plumbing fixtures		Lump Sum	1	$12,000.00	$12,000.00
22 47 00	drinking fountains and water coolers	drinking fountains	Ea	2	$350.00	$700.00
22 50 00	pool and fountain plumbing systems					$0.00
23 00 00	HVAC	$58,700.00	Div Total			
23 07 00	hvac insulation					$0.00
23 10 00	facility fuel systems					$0.00
23 20 00	hvac piping and pumps					$0.00
23 21 13	hydronic piping					$0.00
23 30 00	hvac air distribution	ductwork, registers, grills, etc	SQ FT	10,000	$2.25	$22,500.00
23 38 13	commercial kitchen hoods		Ea	1	$1,200.00	$1,200.00
23 40 00	hvac air cleaning devices					$0.00
23 50 00	central heating equipment					$0.00
23 60 00	central cooling equipment					$0.00
23 70 00	central hvac equipment	heat pumps (Split system)	SQ FT	10,000	$3.50	$35,000.00
23 80 00	decentralized hvac equipment					$0.00
25 00 00	INTEGRATED AUTOMATION	$8,500.00	Div Total			
25 10 00	integrated automation network equipment		SQ FT	10,000	$0.85	$8,500.00
25 30 00	integrated auto instrumentation and terminal devices					$0.00
25 50 00	integrated automation facility controls					$0.00
26 00 00	ELECTRICAL	$84,195.00	Div Total			
26 09 13	electrical power monitoring					$0.00
26 09 16	electrical controls & relays					$0.00
26 09 17	programmable controllers					$0.00
26 09 23	lighting control devices					$0.00
26 09 33	central dimming controls					$0.00
26 09 43	network lighting controls					$0.00
26 09 61	theatrical lighting controls					$0.00
26 10 00	med voltage electrical distribution & service	building electrical system	SQ FT	10,000	$3.75	$37,500.00
26 20 00	low voltage electrical transmission					$0.00
26 30 00	facility electrical power generation and storing equip	Backup Generator Power Supply	Ea	1	$30,000.00	$30,000.00
26 40 00	electrical and cathodic protection					$0.00
26 51 00	interior lighting		SQ FT	10,000	$1.49	$14,900.00
26 52 00	emergency lighting		Ea	15	$85.00	$1,275.00
26 53 00	exit signs		Ea	8	$65.00	$520.00
26 54 00	classified location lighting					$0.00
26 55 00	special purpose lighting					$0.00
26 56 00	exterior lighting					$0.00
27 00 00	COMMUNICATIONS	$168,000.00	Div Total			
27 10 00	structured cabling	CAT5, phone, video, audio (RI)	SQ FT	10,000	$1.55	$15,500.00
27 20 00	data communications	networking, racks, wireless, etc	Lump Sum	1	$10,000.00	$10,000.00
27 30 00	voice communications	phones, fax	Lump Sum	1	$2,500.00	$2,500.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
27 40 00	audio-video communications	cabinets, monitors, network	Ea	5	$5,500.00	$27,500.00
27 50 00	distributed communications monitoring systems	Dispatch equipment (5- Stations)	Ea	5	$22,500.00	$112,500.00
27 60 00	wireless transceivers					$0.00
						$0.00
28 00 00	ELECTRONIC SAFETY AND SECURITY	$5,000.00	Div Total			$0.00
28 10 00	electronic access control and intrusion detection	dispatch area only	Lump Sum	1	$5,000.00	$5,000.00
28 20 00	electronic surveillance					$0.00
28 30 00	electronic detection and alarm					$0.00
28 40 00	electronic monitoring and control					$0.00
31 00 00	EARTHWORK	$17,529.00	Div Total			
31 09 00	geotechnical instrumentation and monitoring					$0.00
31 11 00	clearing and grubbing		SY	7,300	$0.50	$3,650.00
31 12 00	selective clearing					$0.00
31 13 00	selective tree and shrub removal and trimming					$0.00
31 14 00	earth stripping and stockpiling					$0.00
31 22 13	rough grading		SY	7,300	$1.00	$7,300.00
31 22 16	fine grading					$0.00
31 22 19	finish grading		SY	1,112	$2.00	$2,224.00
31 23 13	subgrade preparation					$0.00
31 23 16	excavation					$0.00
31 23 19	dewatering					$0.00
31 23 23	fill					$0.00
31 23 33	trenching and backfilling					$0.00
31 30 00	earthwork methods					$0.00
31 31 00	soil treatment					$0.00
31 32 00	soil stabilization					$0.00
31 33 00	rock stabilization					$0.00
31 34 00	soil reinforcement					$0.00
31 35 00	slope protection					$0.00
31 36 00	gabions					$0.00
31 37 00	riprap		SY	335	$13.00	$4,355.00
31 40 00	shoring and underpinning					$0.00
31 50 00	excavation support and protection					$0.00
31 51 00	anchor tiebacks					$0.00
31 52 00	cofferdams					$0.00
31 54 00	ground freezing					$0.00
31 60 00	special foundations and load-bearing elements					$0.00
31 62 00	driven piles					$0.00
31 63 00	bored piles					$0.00
31 68 00	foundation anchors					$0.00
32 00 00	EXTERIOR IMPROVEMENTS	$143,183.40	Div Total			
32 11 16	subbase courses		SY	3,972	$2.00	$7,944.00
32 11 23	aggregate base courses		Tons	440	$25.00	$11,000.00
32 11 26	asphaltic base courses					$0.00
32 11 36	concrete base courses					$0.00
32 12 13	asphalt paving		Tons	440	$140.00	$61,600.00
32 12 33	flexible paving surface treatments					$0.00
32 12 36	seal coats					$0.00
32 13 13	concrete paving					$0.00
32 13 16	decorative concrete paving					$0.00
32 15 00	aggregate surfacing					$0.00
32 16 13	curbs and gutters		LF	1,770	$10.00	$17,700.00
32 16 23	sidewalks		SQ FT	2,544	$4.50	$11,448.00
32 16 33	driveways					$0.00
32 17 13	parking bumpers					$0.00
32 17 16	speed bumps					$0.00
32 17 23	pavement markings		LF	1,518	$2.30	$3,491.40
32 18 00	athletic and recreational surfacing					$0.00
32 30 00	site improvements					$0.00
32 31 00	fences and gates					$0.00
32 32 00	retaining walls					$0.00
32 34 00	fabricated bridges					$0.00
32 39 00	manufactured site specialties					$0.00
32 70 00	wetlands					$0.00
32 71 00	constructed wetlands					$0.00
32 72 00	wetlands restoration					$0.00
32 80 00	irrigation		Ea	1	$5,000.00	$5,000.00
32 90 00	planting		Ea	1	$12,500.00	$12,500.00
32 92 00	turf and grasses		Ea	1	$12,500.00	$12,500.00

CSI Division	CLASS TITLE	DESCRIPTION	UNIT	QUANITY	RATE	EXTEND
33 00 00	UTILITIES	$38,883.00 Div Total				
33 10 00	water utilities	water service to building	Lump Sum	1	$4,366.00	$4,366.00
33 20 00	fire water pipeline	fire protection to building riser	Lump Sum	1	$4,544.00	$4,544.00
33 30 00	sanitary sewerage utilities	sewer service to building	Lump Sum	1	$10,423.00	$10,423.00
33 36 00	utility septic tanks & fields					$0.00
33 40 00	storm drainage utilities					$0.00
33 50 00	fuel distribution utilities					$0.00
33 60 00	hydronic and steam energy utilities					$0.00
33 70 00	electric utilities	electrical service & wire to building	Lump Sum	1	$19,550.00	$19,550.00
33 80 00	communications utilities					$0.00
35 00 00	WATERWAY AND MARINE CONSTRUCTION	$0.00 Div Total				
35 21 00	shoreline protection					$0.00
35 42 00	waterway bank protection					$0.00
35 51 00	floating construction					$0.00
35 52 00	offshore platform construction					$0.00
						$0.00
	TOTALS:	$1,188,114.90				$1,188,114.90

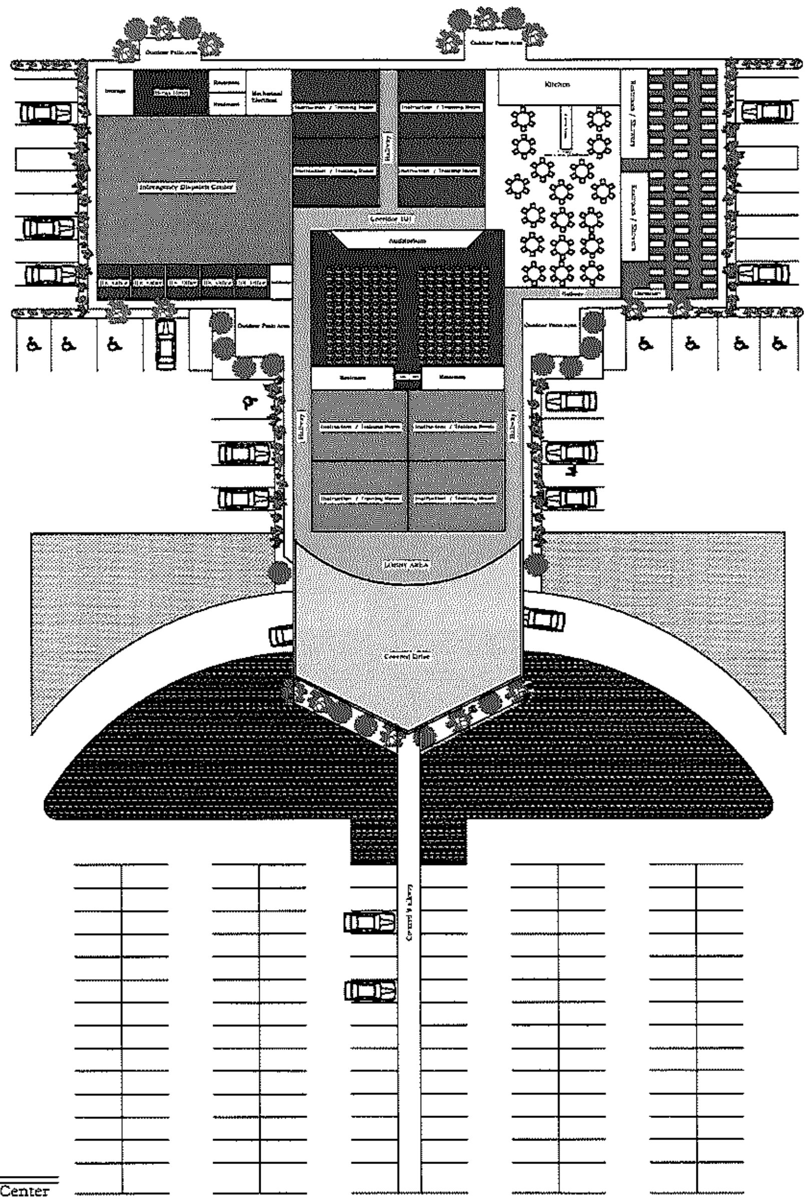
APPENDIX VII
Larger Form Drawings (11" x 17")

Full Facility for Interagency Dispatch / Firefighter Training

Interim Facility for Local Dispatch / Firefighter Training

Aquaponics Facility

Wildlife Rescue / Veterinarian Center



Site Plan

Interagency Dispatch / Firefighter Training Center

General Notes

USDA

No.	Revision/Issue	Date

Firm Name and Address
Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Project Name and Address
Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

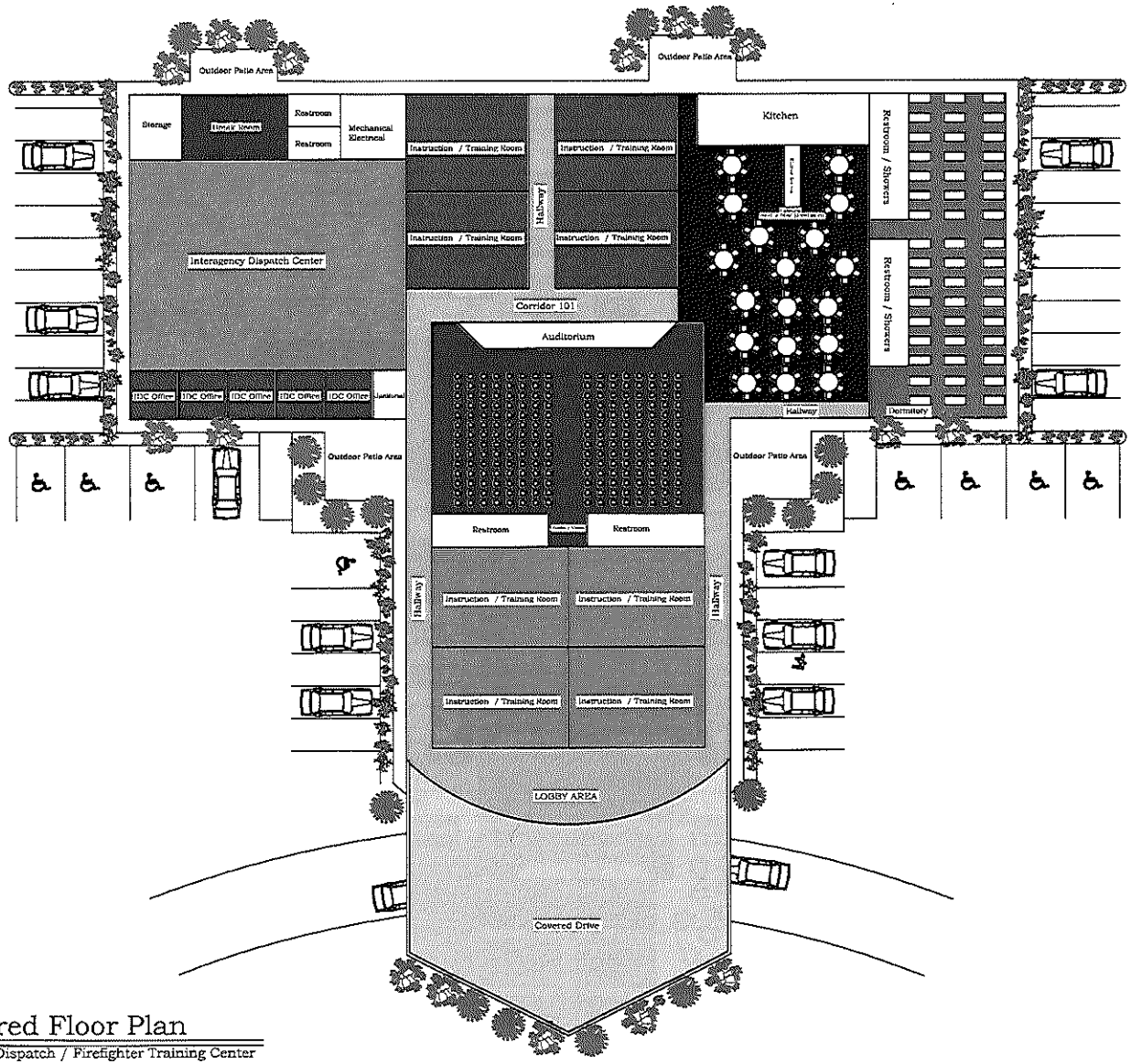
Project

Date
10-01-2014

Scale
N/A

Sheet
A-1

Eric D. Shepherd 9-30-14 Town of Springerville



Rendered Floor Plan

Interagency Dispatch / Firefighter Training Center

Eric D. Shepherd 9-30-14 Town of Springerville

General Notes

USDA

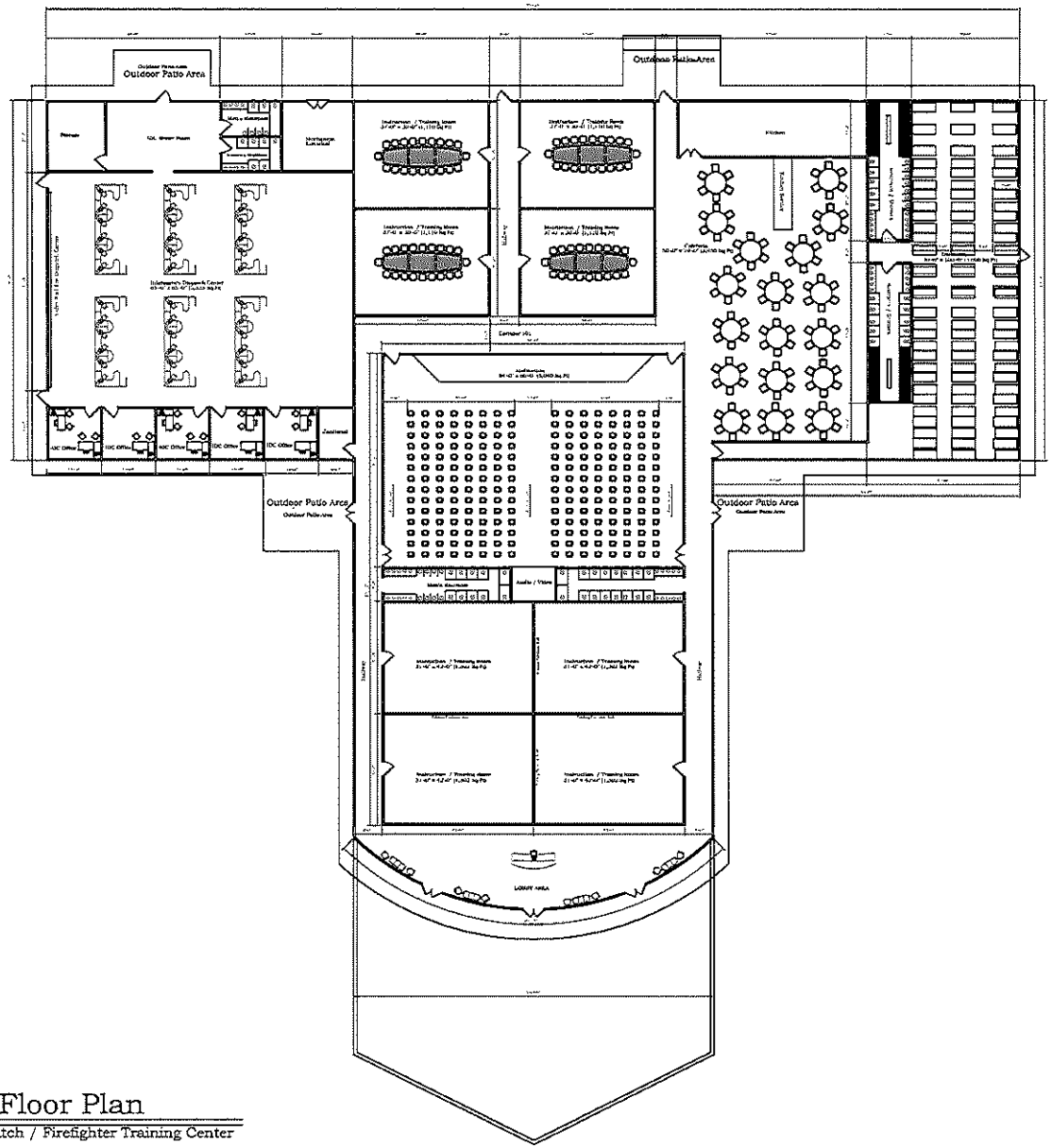
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource Training Facility For Job Creation

Date: 10-01-2014
Scale: N/A

Sheet: A-2



Detailed Floor Plan

Interagency Dispatch / Firefighter Training Center

Eric D. Shepherd 9--30--14 Town of Springerville

General Notes

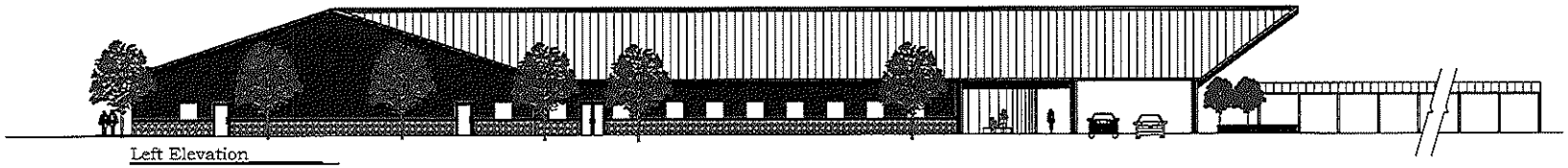
USDA

No.	Revision/Issue	Date

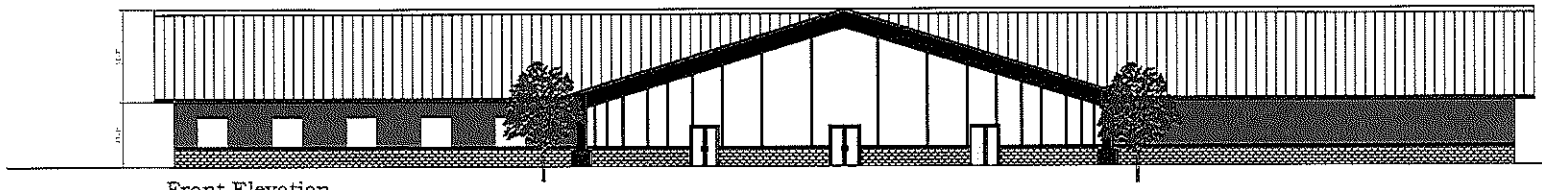
Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Date: 10-01-2014
Scale: N/A
Sheet: A-3



Left Elevation



Front Elevation

Elevations

Interagency Dispatch / Firefighter Training Center

General Notes

USDA

No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Project	Sheet
Date: 10-01-2014	A-4
Scale: N/A	

Town of Springerville 9-30-14 Eric D. Shephard

Rendered Floor Plan

Interim Local Dispatch / Firefighter Training Center

Town of Springerville

9-30-14

Eric D. Shepherd

General Notes

USDA

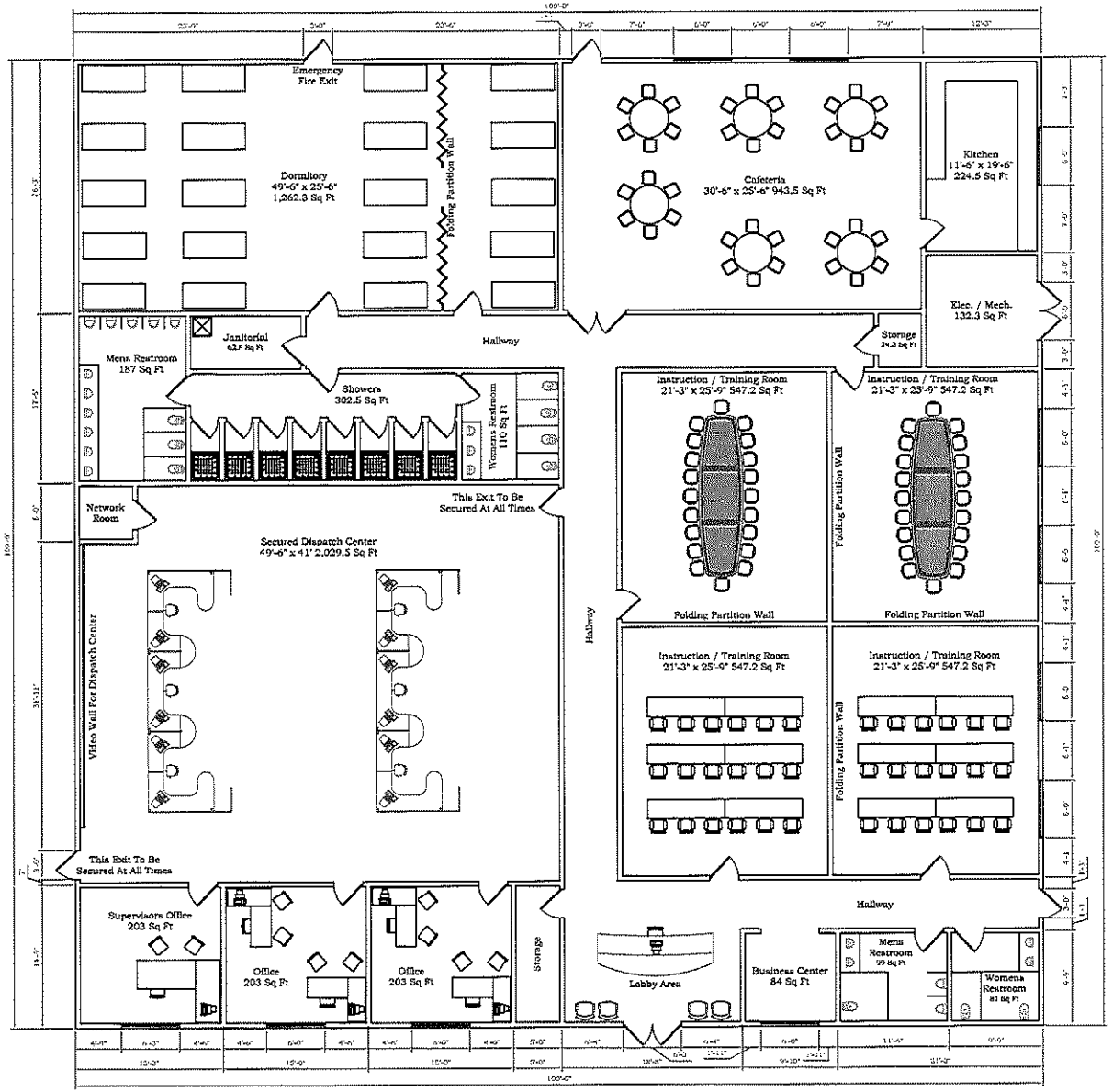
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Project
Date
10-01-2014
Scale
N/A

Sheet
A-1



Detailed Floor Plan

Interim Local Dispatch / Firefighter Training Center

Eric D. Shepherd 9-30-14 Town of Springerville

General Notes

USDA

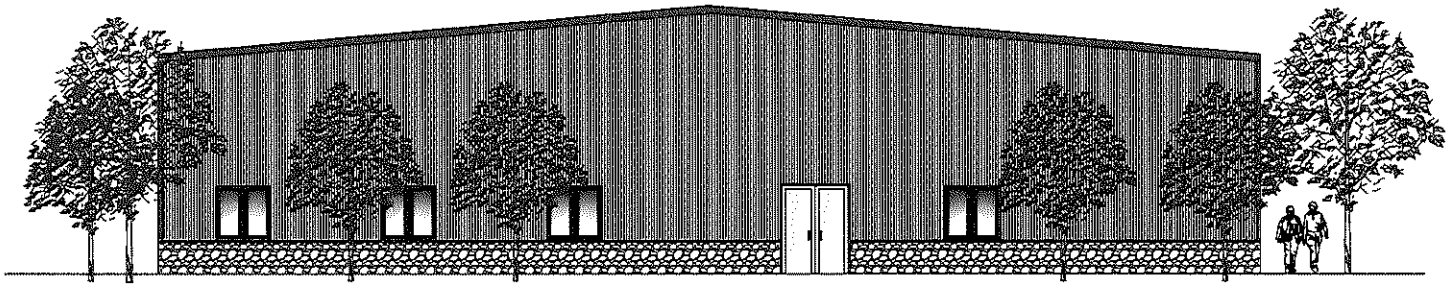
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safuri Drive
Eagar, AZ 85925
(480) 255- 0529

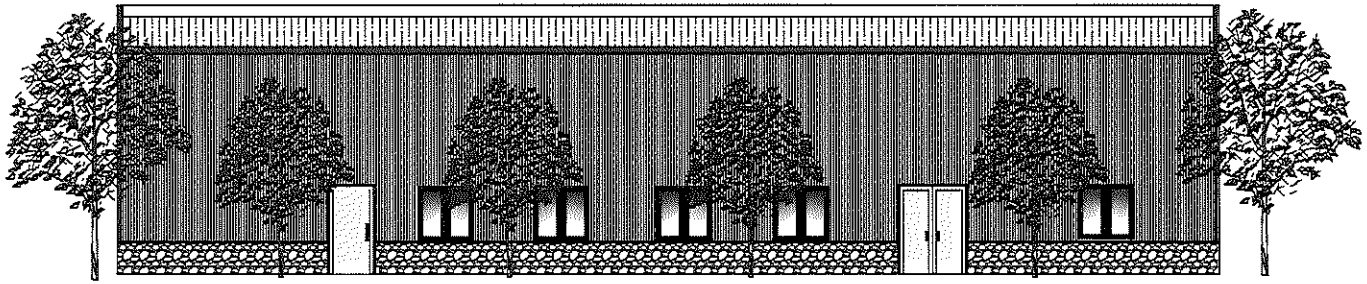
Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Date: 10-01-2014
Scale: N/A

Sheet: A-2



Front Elevation



Side Elevation

Elevations

Interim Local Dispatch / Firefighter Training Center

General Notes

USDA

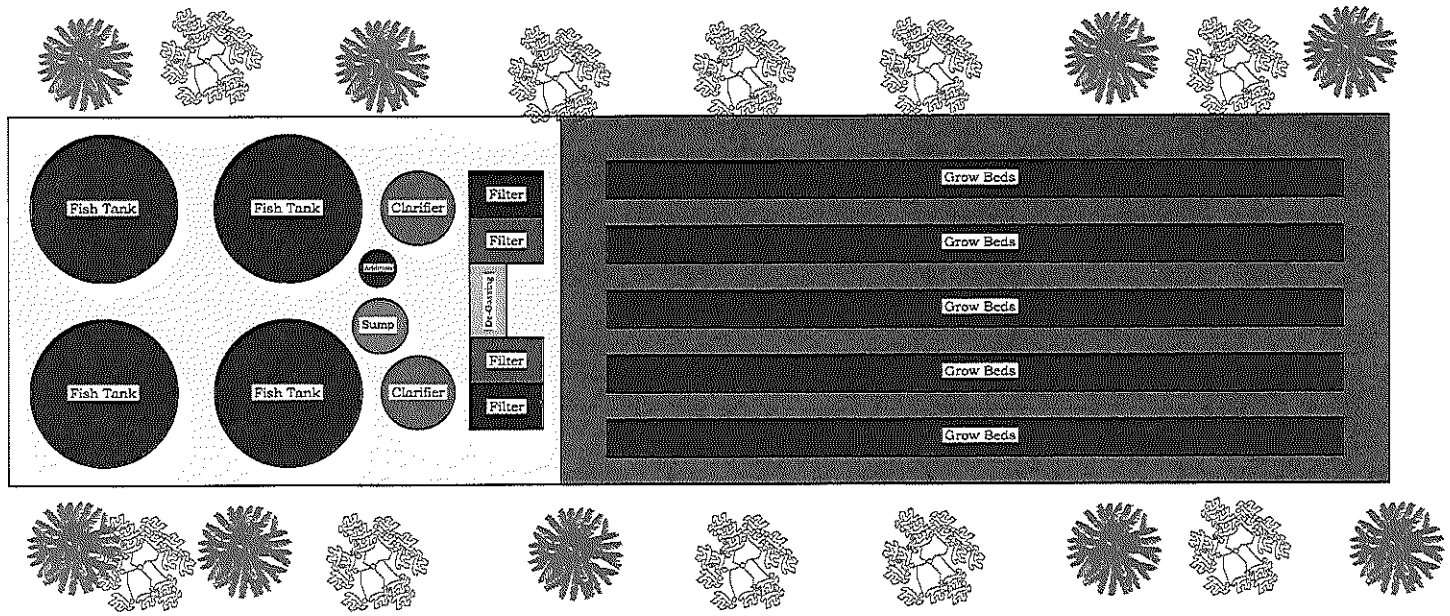
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Project Name and Address
Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Project	Sheet
Date: 10-01-2014	A-3
Scale: N/A	

Eric D. Shepherd 9-30-14 Town of Springerville



Rendered Floor Plan

Aquaponics Facility

General Notes

USDA

No.	Revision/Issue	Date

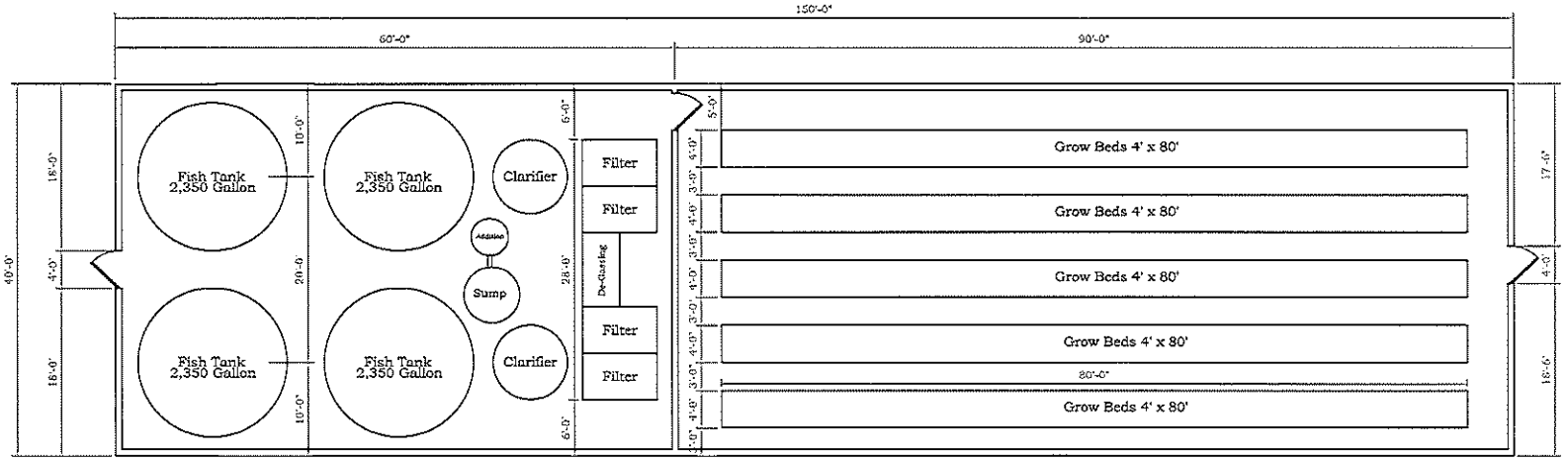
Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource Training Facility For Job Creation

Date: 10-01-2014
Scale: N/A

Sheet: A-1

Eric D. Shepherd 9-30-14 Town of Springerville



Detailed Floor Plan

Aquaponics Facility

General Notes

USDA

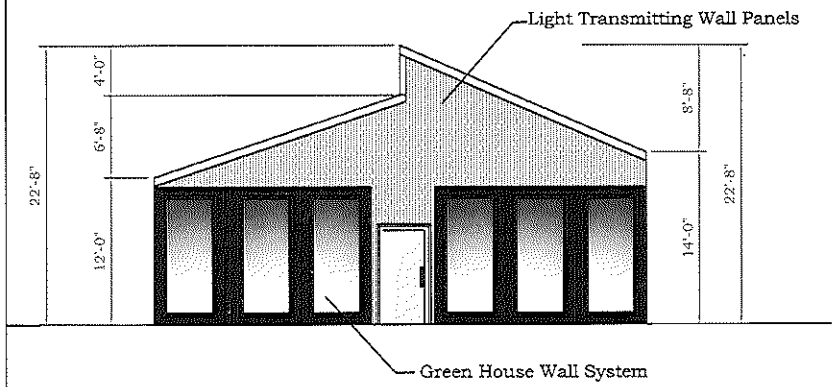
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

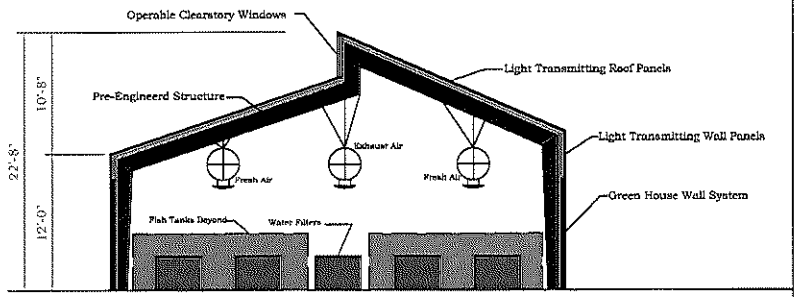
Date: 10-01-2014
Scale: N/A
Sheet: A-2

Eric D. Shepherd 9-30-14 Town of Springerville



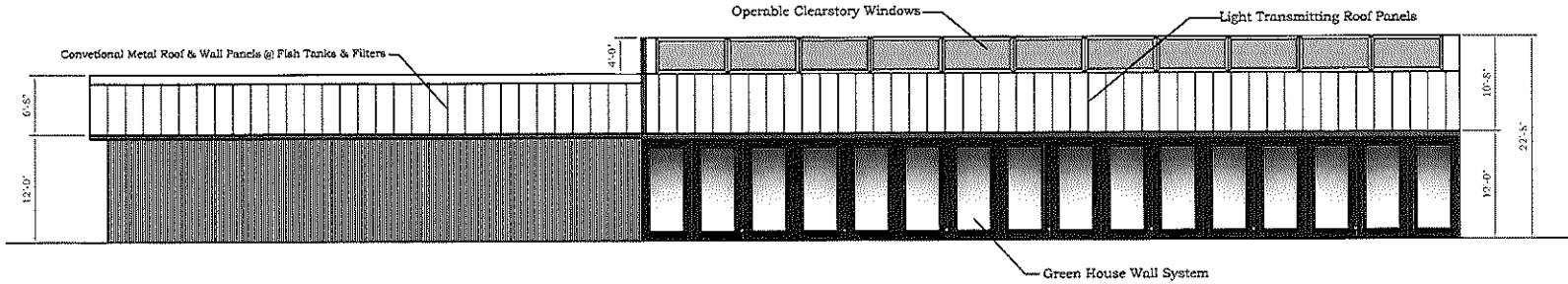
End Elevation

Aquaponics Facility



Cross Section

Aquaponics Facility



Side Elevation

Aquaponics Facility

General Notes

USDA

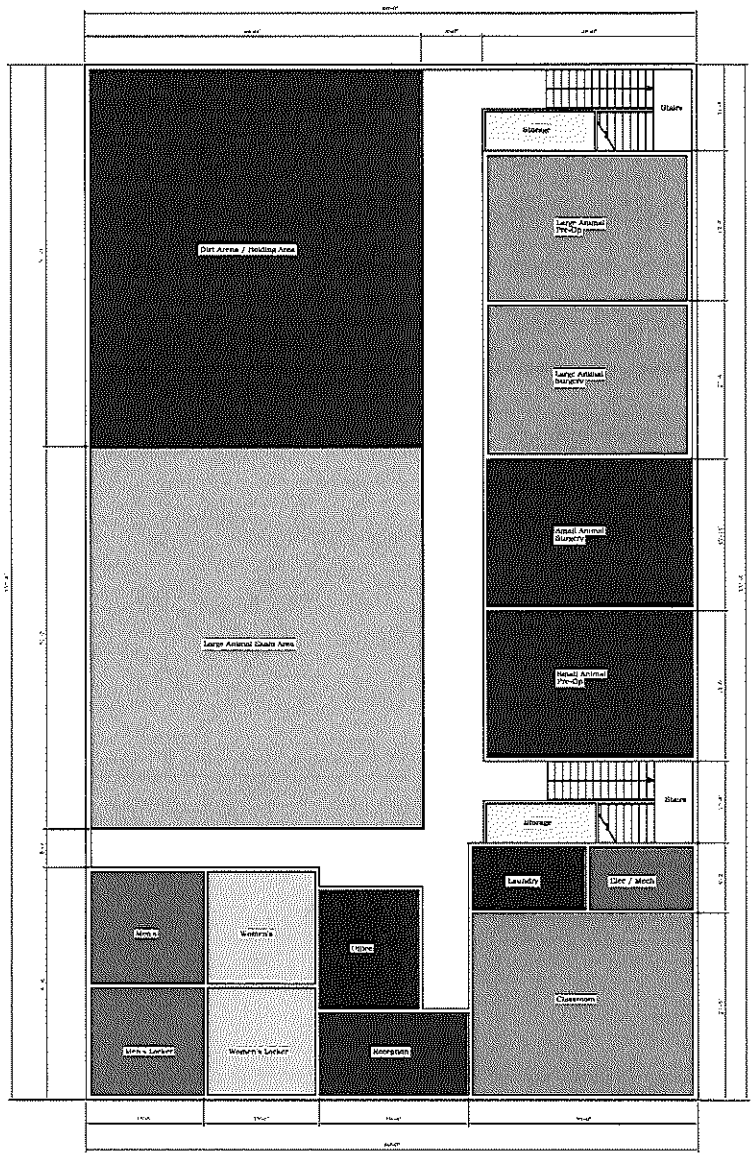
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource Training Facility For Job Creation

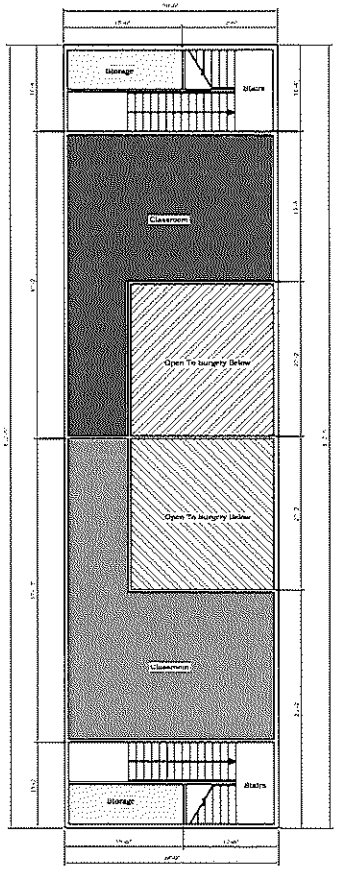
Date	10-01-2014
Scale	N/A
Sheet	A-3

Eric D. Shepherd 9-30-14 Town of Springerville



Rendered 1st Floor Plan

Veterinarian Training Center



Rendered 2nd Floor Plan

Veterinarian Training Center

General Notes

USDA

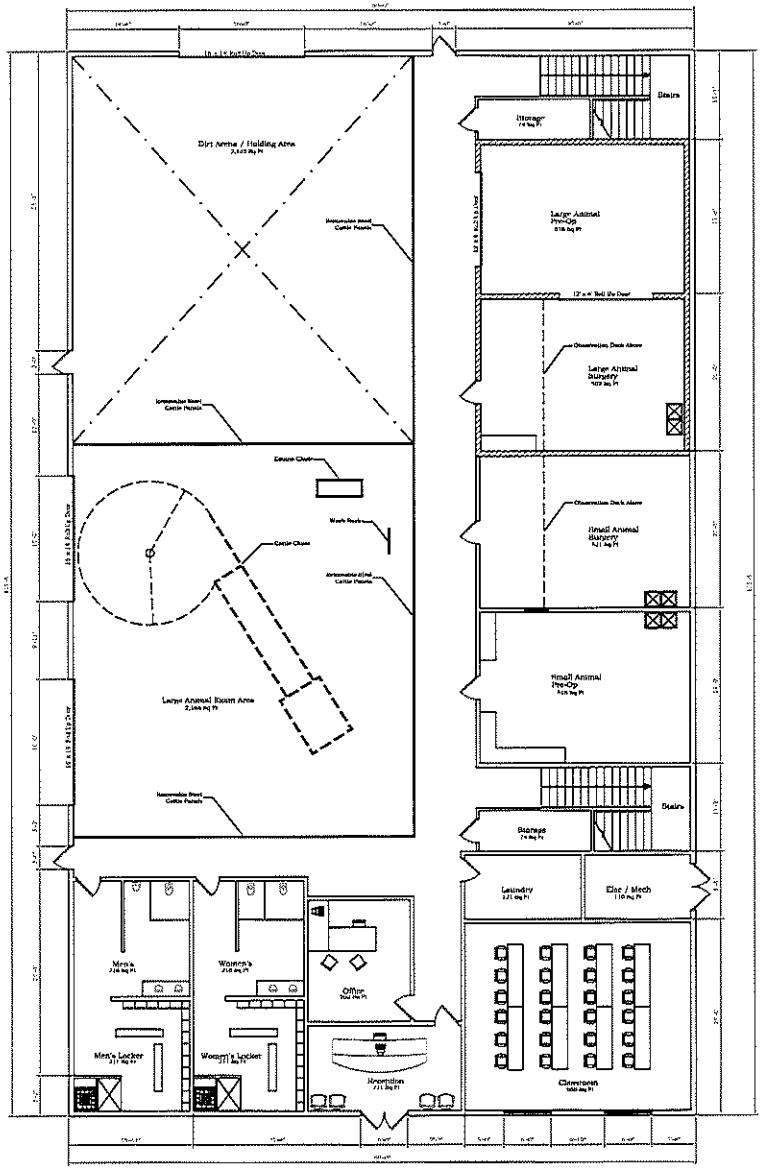
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource Training Facility For Job Creation

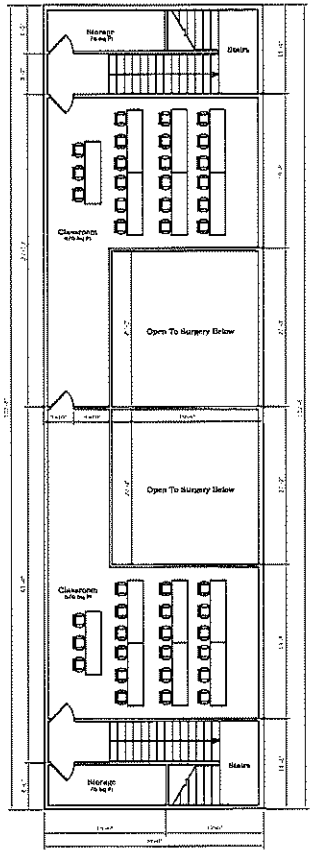
Date: 10-01-2014
Scale: N/A
Sheet: A-1

Eric D. Shepherd 9-30-14 Town of Springerville



Detailed 1st Floor Plan

Veterinarian Training Center



Detailed 2nd Floor Plan

Veterinarian Training Center

General Notes

USDA

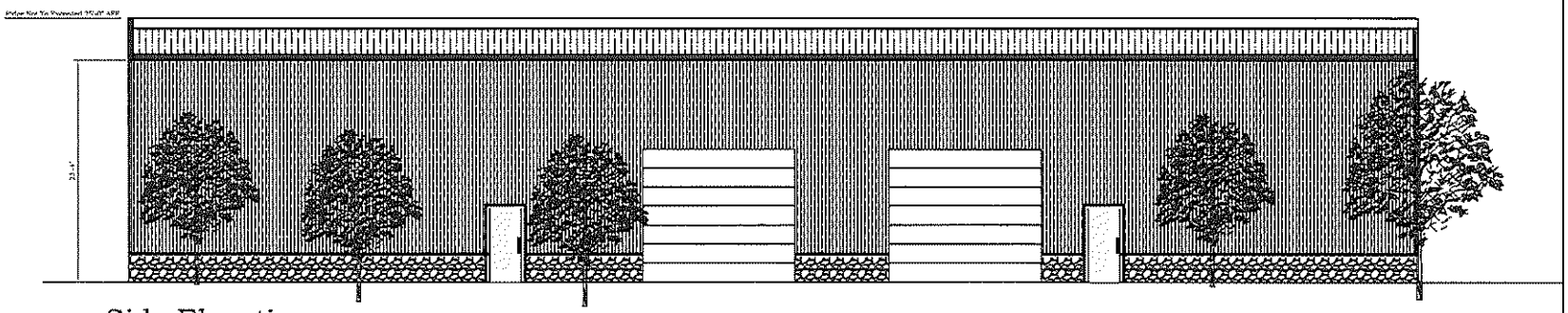
No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Town of Springerville
SW Natural Resource Training Facility For Job Creation

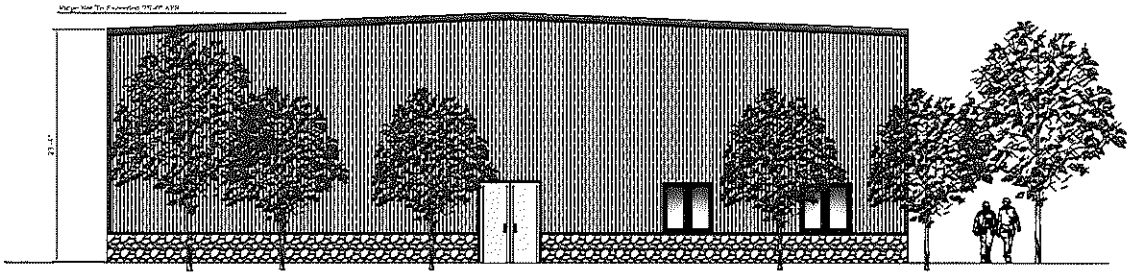
Project	Sheet
Date: 10-01-2014	A-2
Scale: N/A	

Eric D. Shepherd 9-30-14 Town of Springerville



Side Elevations

Veterinarian Training Center



Front Elevations

Veterinarian Training Center

General Notes

USDA

No.	Revision/Issue	Date

Native American Contracting, Inc
1009 S Safari Drive
Eagar, AZ 85925
(480) 255- 0529

Project Name and Address
Town of Springerville
SW Natural Resource
Training Facility For
Job Creation

Project	Sheet
Date: 10-01-2014	A-3
Scale: N/A	

Eric D. Shepherd 9-30-14 Town of Springerville

SOURCES

I. FIREFIGHTER TRAINING/DISPATCH CENTER

Airport Leases – An Airport Owner and Management Reference Document, (2011), Wisconsin Department of Transportation

Aircraft Rescue and Firefighting (ARFF), http://arffwg.org/

Aircraft Rescue and Firefighting Info, http://arffwg.org/?option=com_kunena&view=entrypage&defaultmenu=126&Itemid=124

Appendix to Southwest Sub-Team Report – Alternatives for Consolidation of Wildland Fire Dispatch Centers in Southwest, IDOPP, 31 Jan 2013

Barnes, I. (2001) Training Evolution. Fire Chief, http://firechief.com/mag/firefighting_training_evolution/index.html.

Booth, B. (2006) Seven Traps That Can Turn Your Training Facility into a Disaster. Lake Forest, CA: Interact Business Group.

Boulder County Regional Fire Training Centers (2010), 2010 Annual Rprt. Boulder, CO.

Bounds, A. (2010) "Long-Awaited Boulder Regional Fire Training Center Opens," Boulder Daily Camera – http://www.dailycamera.com/portlet/article/html/fragments.

Congressional Fire Services Institute, http://www.cfsi.org/

Dayringer, D. (2005) Tulsa re Department Fire Training Facility Recommendations. Emmitsburg, MD; National Fire Academy.

Emergency Management Institute – EMI, http://training.fema.gov/

Evans, B. (2009) Assessing the Training Facility Needs for Norfolk Fire-Rescue. Emmitsburg, MD: National Fire Academy.

Federal Aviation Administration, http://www.faa.gov/

Federal Emergency Management Agency – FEMA, http://www.fema.gov/

IDOPP, http://www.iiog.gov/idopp.php, Interagency Interoperability Oversight Group

IDOPP Final Report, Jan. 31, 2013, http://www.fs.fed.us/fire/management/assessments/IDOPPFinalReport.pdf

IDOPP Index, http://fam.nwcg.gov/gacc/swcc/swcg/committees/task_groups/IDOPP/
Knutson, D. (2010) "Governor Nixes Firefighting Training Facility." Oakdale Lake Elmo Review, http://oakdaleelmoreview.com/print.aps?ArticleID=6152

Lombardi, D. (2008) "Identifying Alternative Funding Sources to Ensure the Sustainability of the West Metro Fire Rescue Training Center." Emmitsburg, MD: National Fire Academy.

McCormack, J. (2010) "Create Your Own Training Facility," Fire Engineering, 163. http://fireengineering.com

National Fire Academy, http://www.usfa.fema.gov/training/nfa/

National Fire Protection Association (2012) NFPA 1402: Guide to Building Fire Service Training Centers (2012 ed.) Quincy, MA.

National Interagency Coordination Center, http://www.nifc.gov/nicc/index.htm

National Wildfire Coordinating Group – NWCG, http://www.nwcg.gov/

Northern Arizona Board, IDOPP, Meeting Notes, 6 June 2013

Round Valley Multimodal Transportation Study, (2012), Final Report

Show Low Interagency Dispatch Center, http://www.wildfireaz.com/arizona-dispatch-centers/show-low-interagency-dispatch/

Southwest Coordination Center, http://gacc.nifc.gov/swcc/admin/about/zones.htm

U. S. Fire Administration, http://www.usfa.fema.gov/

Waldron, D. (2010) Assessing the Feasibility of a Fire Department Strategic Alliance for Londonderry, NH. Emmitsburg, MD: National Fire Academy.

Wilmoth, J. (2009) Training by Design. Fire Chief. http://firechief.com/station-design/training-facilities-fire-station-architecture-200904/index.html.

Arizona Agencies

Department of Emergency Management, http://www.dem.azdema.gov/

Department of Fire, Building and Life Safety, http://www.dfbls.az.gov/

Department of Homeland Security, http://www.azdohs.gov/

Emergency Response Commission, https://www.azserc.org/Default.aspx

Arizona Fire Degree Programs

Arizona Western College,
http://www.azwestern.edu/academic_services/degrees_and_certificates/career_and_technical_education/occupational_degrees/Fire_Science.html

Central Arizona College,
http://www.centralaz.edu/Home/Academics/Divisions_and_Programs/Fire_ScienceEmergency_Medical_Technology/Fire_Science.htm

Chandler-Gilbert Community College,
http://www.cgc.maricopa.edu/Academics/nursing/firescience/Pages/Home.aspx

Cochise College, http://www.cochise.edu/

Coconino Community College,
http://www.coconino.edu/academics/curriculum/collegecatalog/Pages/AASFireScience.aspx

Eastern Arizona College, http://eac.edu/

Estrella Mountain Community College, http://www.estrellamountain.edu/programs/fire-science

Glendale Community College, http://www2.gccaz.edu/academics/departments/public-safety-science/fire-science-technology

Mesa Community College,
http://www.mesacc.edu/departments/fire-science-emt

Mohave Community College, http://www.mohave.edu/academics/certificates/firescience

Northland Pioneer College, http://www.npc.edu/program/fire-science-frs

Paradise Valley Community College,
http://www.paradisevalley.edu/academics/firescience

Phoenix College, http://www.phoenixcollege.edu/academics/programs/fire-science

Pima Community College, https://www.pima.edu/programs-courses/credit-programs-degrees/public-safety/fire-science/fire-science-cert.html

Yavapai College, http://www.yc.edu/

Associations and Organizations

International Association of Fire Chiefs – IAFC, http://www.iafc.org/

International Association of Firefighters – IAFF, http://client.prod.iaff.org/#

International Association of Fire Service Instructors – ISFSI, http://isfsi.org/

National Association for Search and Rescue – NASAR, http://www.nasar.org/

National Fire Protection Association – NFPA, http://www.nfpa.org/

National Volunteer Fire Council – NVFC, http://www.nvfc.org/

North American Fire Training Directors – NAFTD, http://www.naftd.org/

Professional Firefighters of Arizona – PFFA, http://pffaz.org/

Volunteer Firefighters of Arizona – VFFA, http://www.vffaz.org/

Western Fire Chiefs Association – WFCA, http://www.wfca.com/

II. AQUACULTURE AND AQUAPONICS

Adler, P. (2001) Overview of economic evaluation of phosphorus removal by plants. Aquaponics J. 5:15–18.

Adler, P.R., Harper, J.K., Takeda, F., Wade, E.D., Summerfelt, S.T. (2000) Economic evaluation of hydroponics and other treatment options for phosphorus removal in aquaculture effluent. HortScience 35:993–999.

Adler, P.R., Takeda, F., Glenn, D.M., Summerfelt, S.T. (1996) Utilizing byproducts to enhance aquaculture sustainability. World Aquaculture 27:24–26.

Al-Hafedh, Y. S. and A. Alam, Beltagi, M.S. 2008. Food Production and Water Conservation in a Recirculating Aquaponic System in Saudi Arabia at Different Ratios of Fish Feed to Plants. Journal of the World Aquaculture Society 39(4):510-520.

Amanor-Boadu, V. (2007). Assessing the Feasibility of Business Propositions. Agriculture Marketing Resource Center. <http://www.agmrc.org>

American Farmland Trust (2009) Farming on the Edge Report. <http://www.farmland.org/resources/fote/default.asp>.

Aquaponics No Ka `Oi. (2012) "Where to Get Stuff on Maui." Website. http://apnko.com/en/resources/where-to-get-stuff-on-maui

ATR Venture Private Limited. (2007). Aquafarming, Future Technology in Aquaculture http://www.aquaculturetech.com

Bernardo, L.M., Clark, R.B., Maranville, J.W. (1984) Nitrate/ammonium ratio effects on nutrient solution pH, dry matter yield, and nitrogen uptake of sorghum. J. Plant Nutr. 7:1389–1400.

Bialczyk, J., Lechowski, Z., Dziga, D., Mej, E. (2007) Fruit yield of tomato cultivated on media with bicarbonate and nitrate/ammonium as the nitrogen source. J. Plant Nutr. 30:149–161.

Blancheton, J.P. (2002). Developments in Recirculation System for Mediterranean Species. Science Direct, Aquaculture Engineering Volume 22

Boyd, Claude E and Tucker, Craig S. (1998). Pond Aquaculture Water Quality Management. Kluwer Academic Publisher. Boston .USA

Bugbee, B. (2003) Nutrient management in recirculating hydroponic culture. Acta Hort. 648:99–112.

Burrows and Combs, (1968). R.E. Burrows and B.D. Combs, Controlled environments for salmon propagation. Prog. Fish Cult. 30, pp. 123–136

Calberg, Conrad, Colt, J.E., Orwicz, K., Bouck, G., (2007). Water quality considerations and criteria for high-density fish culture with supplemental oxygen. Presented at the Fisheries Bioengineering Symposium 10, American Fisheries Society, Bethesda, MD, pp. 372–385.

Campbell, N.A., Reese, J.B. (2002) Biology (Pearson Education, San Francisco, CA), 6th ed.

Chapman, F.A. (2000) Culture of hybrid tilapia: A reference profile (Univ. Florida, Dept. Fisheries Aquatic Sci., Florida Coop. Ext. Serv. Cir. 1051), <http://edis.ifas.ufl.edu/FA012>. 27 Oct. 2010.

Chaverria, C.J., Hochmuth, G., Hochmuth, R., Sargent, S. (2005) Fruit yield, size, and color responses of two greenhouse cucumber types to nitrogen fertilization in perlite soilless culture. HortTechnology 15:565–571.

Colt, J.E., Tchobanoglous, G. (1976) Evaluation of the short-term toxicity of nitrogenous compounds to channel catfish, Ictalurus punctatus. Aquaculture 8:209–224.

Council for Agricultural Science and Technology (2010) Agricultural productivity strategies for the future: Addressing US and global challenges (Issue Paper No. 45. Council for Agricultural Sci. Technol, Ames, IA).

Curtis, M.J and Howard, A.C (1993). Economics of Aquaculture, Food Product Press 2003-212, New York

Diver, S. (2006). Aquaponics – Integration of Hydroponics with Aquaculture. ATTRA – National Sustainable Agriculture Information Service. www.attra.ncat.org/attar-pub/PDF/aquaponic.pdf or www.attra.ncat.org/attra-pub/aquaponic.html. (June 2011).

Diver, S., Rinehart, L. (2010) Aquaponics—Integration of hydroponics and aquaculture (Appropriate technology transfer for rural areas: Horticulture systems guide), <http://attra.ncat.org/attra-pub/aquaponic.html>. 27 Oct. 2010.

Department of Agriculture White Paper. http://hawaii.gov/hdoa/add/White%20Paper%20D14.pdf/ (July 2012).

Duning, Rebecca D, Losordo, Thomas M and Hobbs, Alex O. (1998). The Economics of Recirculating Tanks Systems, a Spreadsheet for Individual Analysis, Southern Regional Aquaculture Center, SRAC Publication No. 456.

Eickhout, B., Bouwman, A.F., van Zeijts, H. (2006) The role of nitrogen in world food production and environmental sustainability. Agr. Ecosyst. Environ. 116:4–14.

Farming Freshwater Prawns, http://library.enaca.org/Shrimp/Publications/FAO_Macrobrachium_manual_2003.pdf

Fedoroff, N.V., Battisti, D.S., Beachy, R.N., Cooper, P.J.M., Fischhoff,A., Hodges, C.N., (2010) Radically rethinking agriculture for the 21st Century. Science 327:833–834.

Fowler, P., (1994) Microcontrollers in recirculating aquaculture systems (Univ. Florida, Energy Ext. Serv. EES–326).

Fox, B.K., R. Howerton, C.S. Tamaru. June 2010. Construction of Automatic Bell Siphons for Backyard Aquaponic Systems. College of Tropical Agriculture and Human Resources University of Hawaii Manoa. Biotechnology–10:1-10.

Francis-Floyd, R., Watson, C., (2009) Ammonia in aquatic systems (Univ. Florida, Dept. Fisheries Aquatic Sci., Florida Coop. Ext. Serv. FA-16), <http://edis.ifas.ufl.edu/FA031>. 27 Oct. 2010.

Ghaly, A.E., Kamal, M., Mahmoud, N.S. (2005) Phytoremediation of aquaculture wastewater for water recycling and production of fish feed. Environ. Intl. 31:1–13.

Gold, M.V. (1999) Sustainable agriculture: Definitions and terms. <http://www.nal.usda.gov/afsic/AFSIC_pubs/srb9902.htm>. 27 Oct. 2010.

"Growing Fish in the Arizona Desert?" http://westernfarmpress.com/management/growing-fish-arizona-desert

Growing Power, Inc. (Community food systems) http://www.growingpower.org/aquaponics.htm

Gutierrez-Wing, M., Malone, R.F. (2006) Biological filters in aquaculture: Trends and research directions for freshwater and marine applications. Aquacult. Eng. 34:163–171.

Hagopian, D.S., Riley, J.G. (1998) A closer look at the bacteriology of nitrification. Aquacult. Eng. 18:223–244.

Hardesty, S.D. (2010) Do government policies grow local food? Choices. <http://www.choicesmagazine.org/magazine/article.php?article=113>. 25, 1, pp 28–31. 15 June 2010.

Hart, Stephen D., Yellow Perch Culture Guide http://www.ncrac.org/NR/rdonlyres/6296E4D7-8D07-4CBD-BDC4-D7CE9FFD2212/0/YellowPerchPub.pdf

Hochheimer, J.N., Wheaton, F. (1998) Biological filters: Trickling and RBC design. 291–318. Proc. 2nd Intl. Conf. Recirculating Aquaculture.

Hochmuth, G. (2000) Nitrogen management practices for vegetable production in Florida (Univ. Florida, Hort. Sci. Dept., Florida Coop. Ext. Serv. Cir. 222).

Hochmuth, G.J. (2001) Fertilizer management for greenhouse vegetables, Florida greenhouse vegetable production handbook (Univ. Florida, Hort. Sci. Dept., Florida Coop. Ext. Serv. HS787), <http://edis.ifas.ufl.edu/CV265>. Vol. 3, 27 Oct. 2010.

Hochmuth, G.J. (2001) Greenhouse cucumber production: Florida greenhouse vegetable production handbook (Univ. Florida, Hort. Sci. Dept., Florida Coop. Ext. Serv. HS790), <http://edis.ifas.ufl.edu/cv268>. Vol. 3, 27 Oct. 2010.

Hochmuth, G.J., Hanlon, E.A. (1995) IFAS standard fertilization recommendations for vegetable crops (Univ. Florida, Hort. Sci. Dept., Florida Coop. Ext. Serv. Cir. 1152).

Hochmuth, G.J., Hanlon, E.A. (2010) Commercial vegetable fertilization principles (Univ. Florida, Soil Water Sci. Dept., Florida Coop. Ext. Serv. SL319), <http://edis.ifas.ufl.edu/cv009>. 14 May 2010.

http://theaquaponicsource.com/

http://www.ers.usda.gov/topics/animal-products/aquaculture.aspx, Economic Research Service, USDA.

http://seagrant.wisc.edu/home/Topics/Aquaculture.aspx, University of Wisconsin Sea Grant Institute

http://www.aquaculturecertification.org/ - A nongovernmental body established to certify social, environmental and food safety standards at aquaculture facilities throughout the world.

http://hdoa.hawaii.gov/, State Aquaculture Development Program, Hawaii Department of Agriculture

http://www.nmfs.noaa.gov/aquaculture National Oceanic and Atmospheric Administration (NOAA) - Fisheries market news and statistic summaries (aquaculture results by catch, available grants, new marine product food safety guidelines, endangered natural stocks, export guidelines for shipments to the European Union, links and addresses of many National Marine Fisheries Support Offices, and other information

http://www.agcensus.usda.gov/Publications/2002/Aquaculture/index.asp Census of Aquaculture (2005), USDA, 2006.

Hughey, T.W. 2005. Barrel-ponics (a.k.a. Aquaponics in a Barrel). Available: http://www.aces.edu/dept/fisheries/education/documents/barrel-ponics.pdf. (June 2011).

Jerardo, A. (2008) What share of US consumed food is imported? Amber Waves, Feb. 2008. <http://www.ers.usda.gov/AmberWaves/February08/DataFeature/>

Keener, H., (2009) Ohio State University Hydroponic Crop Program (Wooster, OH), <http://www.oardc.ohio-state.edu/hydroponics/drade/index.php>.

Lennard, W.A., Leonard, B.V. (2006) A comparison of three different hydroponic sub-systems (gravel bed, floating and nutrient film technique) in an aquaponic test system. Aquacult. Intl. 14:539–550.

Leung, P., Loke, M. (2008). Economic Impacts of Increasing Hawai'i's Food Self-Sufficiency. Cooperative Extension Service College of Tropical Agriculture and Human Resources University of Hawaii Manoa. Economic Issues. E1-16:1-7.

Liao, P.B. and Mayo, R.D., (1974), Intensified fish culture combining water reconditioning with pollution abatement. Aquaculture **3**, pp. 61–85.

Lim, C., Webster, C.D. (2006) Tilapia: Biology, culture, and nutrition (Food Products Press, Binghamton, NY).

Losordo, Thomas M, Masser, Michael P. and Rakosy, James. 1998. Recirculating Aquaculture Tanks Production System, an Overview of Critical Considerations. Southern Regional Aquaculture Center, SRAC Publication No. 451. Lasordo, T. 1998b. Recirculating aquaculture production systems: The status and future. Aquaculture Magazine 24(1):38-45.

Losordo, T.M., Westerman, P.W. (2007) An analysis of biological, economic, and engineering factors affecting the cost of fish production in recirculating aquaculture systems. J. World Aquacult. Soc. 25:193–203.

Masser, M. P, Rakosy, J and Losordo, T. M. (1999). Recirculating Aquaculture Tanks Production System, Management of Recirculating System. Southern Regional Aquaculture Center, SRAC Publication No. 452.

National Research Council (NRC). 2011. Nutrient Requirements of Fish. National Academy Press, Washington, D.C.

Nelson, R.L. (2007) Ten aquaponic systems around the world. Aquaponics J. 46:8–12.

NexTag Comparison Shopping. 2008 Pinnacle Pump< http://www.nextag.com>*

O"Rouke, P.D. (2007). Aquaculture Network Information Center <http://aquanic.org/>

Piedrahita, R. H. (2003). Management of Aquaculture Effluents, Department of Biological and Agricultural Engineering, University of California, Science Direct, Aquaculture Volume 226, Issues 1-4.

Pillay, T.V and Kutty, M.N. (2005). Aquaculture Principal and Practices, Blackwell Publishing, United Kingdom. Bijo UNU – Fisheries Training Programme 38

Preis Roboter, (2008). Triton Sandfilter <http://www.preisroboter.com>

Rakocy, J.E. (1999). The Status of Aquaponics Part 1. Aquaculture Magazine 2(3):2-5.

Rakocy J.E. (1997) in Tilapia aquaculture in the Americas, Integrating tilapia culture with vegetable hydroponics in recirculating systems, eds Costa-PierceB.A., Rakocy, J.E. (World Aquaculture Soc, Baton Rouge, LA), Vol. 1, pp 163–184.

Rakocy, J.E., Bailey, D.S., Shultz, K.A., Cole, W.M. (1997) Evaluation of a commercial-scale aquaponic unit for the production of tilapia and lettuce. 4th Intl. Symp. on Tilapia in Aquacult. 1:357–372.

Rakocy, J.E., Bailey, D.S., Schultz, R.C., Thoman, E.S. (2004) Update on tilapia and vegetable production in the UVI aquaponic system. <http://ag.arizona.edu/azaqua/ista/ista6/ista6web/pdf/676.pdf>. 27 Oct. 2010.

Rakocy, J.E., Losordo, T.M., Masser, M.P. (2006) Recirculating aquaculture tank production systems: Aquaponics—Integrating fish and plant culture (Southern Reg. Aquaculture Ctr. Pub. No. 454).

Rakocy, J.E., Bailey, D.S., Shultz, R.C. and Eric S. Thoman. (2004). Update on Tilapia and vegetable production in the UVI aquaponic system, p. 676-690. In: New Dimensions on Farmed Tilapia: Proceedings of the Sixth International Symposium on Tilapia in Aquaculture, Held September 12-16, 2004 in Manila, Philippines. Available: http://ag.arizona.edu/azaqua/ista/ista6/ista6web/pdf/676.pdf. (June 2011).

Rakocy, J. (2011). Aquaponics Q and A - The answers to your questions about aquaponics.

Recirculating Aquaculture Systems. 2nd Northeastern Regional Aquaculture Center Publication No. 01-002.

Resh, H.M. (2004) Hydroponic food production (New Concept Press, Mahwah, NJ), 6th ed.

Roosta, H.R., Schjoerring, J.K. (2007) Effects of ammonium toxicity on nitrogen metabolism and elemental profile of cucumber plants. J. Plant Nutr. 30:1933–1951.

Seawright, D.E., Stickney, R.R., Walker, R.B. (1998) Nutrient dynamics in integrated aquaculture-hydroponics systems. Aquaculture 160:215–237.

SeQual Technologies Inc. (2008). SeQual Industrial Oxygen Products. <http://www.sequal.com>

Shnel, N., Barak, Y., Ezer, T., Dafni, Z., van Rijn, J.(2002) Design and performance of a zero-discharge tilapia recirculating system. Aquacult. Eng. 26:191–203.

Solar Components Corporation. (2008). Aquaculture Tanks. http://www.solar-components.com/AQUA.HTM

Speece, R.E. (1973). Trout metabolism characteristics and the rational design of nitrification facilities for water reuse in hatcheries. Trans. Am. Fish. Soc. **2** (1973), pp. 323–334.

Summerfelt, S.T., Timmons, M.B., Watten, B.J., (2000) Tank and raceway culture. In: Robert, R. Stickney (Ed.), Encyclopedia of Aquaculture. Wiley, New York, pp. 921–928.

Summerfelt, Steven T, Bebak, Julie and Tsukuda, Scot. 2001. Fish Hatchery Management. 2nd Edition, PA Fish and Boat Commission.

Tetzlaff, B.L., Heidinger, R.C. (1990) Basic principles of biofiltration and system design (Southern Illinois Univ. Carbondale, Fisheries Illinois Aquaculture Ctr. Bul. 9).

The State of World Fisheries and Aquaculture, (2012) produced by the Food and Agriculture Organization of the United Nations.

Timmons, M.B., Ebeling, J.M., Wheaton, F.W., Summerfelt, S.T., Vinci, B.J. (2002) Recirculating aquaculture systems (Northeastern Reg. Aquaculture Ctr. Pub. No. 01–002), 2nd ed.

Timmons, M.B, Holder, J.L and Ebeling, J. M. (2004) Application of Microbead Biological Filters. Biological & Environmental Engineering, Cornell University, Ithaca N.Y.

Tocher, D. R. (2010). Fatty acid requirements in ontogeny of marine and freshwater fish. Aquaculture Research. 41:717-732.

Tyson, R.V., Simonne, E.H., Treadwell, D.D., White, J.M., Simonne, A. (2008) Reconciling pH for ammonia biofiltration and cucumber yield in a recirculating aquaponic system with perlite biofilters. HortScience 43:719–724.

Tyson, R.V., Simonne, E.H., Treadwell, D.D., Davis, M., White, J.M. (2008) Effect of water pH on yield and nutritional status of cucumber grown in recirculating hydroponics. J. Plant Nutr. 31:2018–2030.

Tyson, R.V., Simonne, E.H., White, J.M., Lamb, E.M. (2004) Reconciling water quality parameters impacting nitrification in aquaponics: The pH levels. Proc. Florida State Hort. Soc. 117:79–83.

University of Minnesota Extension.
http://www.extension.umn.edu/distribution/cropsystems/components/7399_02.html (accessed on 10/17/12).

USDA National Agriculture Library, Aquaculture and Soilless Farming
http://afsic.nal.usda.gov/aquaculture-and-soilless-farming

U.S. Department of Agriculture ERS (2010) Data sets: Loss-adjusted food availability spreadsheets.
<http://www/ers/usda.gov/Data/FoodConsumption/FoodGuideSpreadsheets.htm>

"Vegetable and Fish Co-Production,"
http://ocextension.ifas.ufl.edu/uf_workshop/pdffiles/Aquaponics%20Vegetable%20and%20Fish%20Co-Production%202013.pdf

Watten, B.J., Busch, R.L. (1984) Tropical production of tilapia (Sarotherodon aurea) and

tomatoes (Lycopersicon esculentum) in a small-scale recirculation water system. Aquaculture 41:271–283.

Western Regional Aquaculture Center http://depts.washington.edu/wracuw/

Yellow Perch – North Central Regional Aquaculture Center: http://api.ning.com/files/bc3ep2MzyD2fic2hDSJwj1zaV6XzRt59RQQZgGpeF

III. WILDLIFE RESCUE/VETERINARY SERVICES CENTER

Association of American Veterinary Medical Colleges, http://aavmc.org/

Fiala, Jennifer, "University of Arizona eyes 2015 opening for veterinary program," VIN News Service, Sep. 10, 2014, http://news.vin.com/VINNews.aspx?articleId=33755

Larkin, Malinda, "Arizona veterinary program being reconceptualized," JAVMA News, June 15, 2014. https://www.avma.org/News/JAVMANews/Pages/140615i.aspx

Midwestern University College of Veterinary Medicine, https://www.midwestern.edu/programs-and-admission/az-veterinary-medicine.html

North American Veterinary Medical Education Consortium, Meeting 2: Report, "Veterinary Education Models," http://www.aavmc.org/data/files/navmec/navmecmeeting2report.pdf

Stewart, Portia, "Fast forward for veterinary school," June 1, 2013, DVM360, http://www.agweb.com/article/new_veterinary_degree_program_at_university_of_arizona_NAA_University_News_Release/

University of Arizona, "New Veterinary Degree Program at University of Arizona, September 2, 2014,http://www.agweb.com/article/new_veterinary_degree_program_at_university_of_arizona_NAA_University_News_Release/

UA News, "$9 Million gift to support the University of Arizona's veterinary and surgical program," Aug. 22, 2014, http://uanews.org/story/9-million-gift-to-support-the-university-of-arizona-s-veterinary-medical-and-surgical-program

Wright, Lesley, The Republic, "Midwestern University opens first AZ vet school in Glendale," http://www.azcentral.com/story/news/local/glendale/2014/06/03/midwestern-university-opens-first-az-vet-school/9900441/