GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Appendix A

GLOSSARY OF TERMS

AIRPORT MASTER PLAN

ADOT

Glossary of Terms

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specif c aviation subject.

AIR CARRIER: An operator which: (1) performs at least f ve round trips per week between two or more points and publishes f ight schedules which specify the times, days of the week, and places between which such f ights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certif ed in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for f ight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing conf guration at their maximum certif cated landing weight. The categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of exis. ng and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulf llment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airf eld at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment def ning the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument f ight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certif cated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specif c trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious f ow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace and principally during the en route phase of f ight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central f ow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categoriza. on of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR f ight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his f nal approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specif ed portion of the airf eld used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a f ight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATIC WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed f ight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a f xed point (as the observer's heading).

B

BASE LEG: A f ight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specif c airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of elimina. ng the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identif es suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

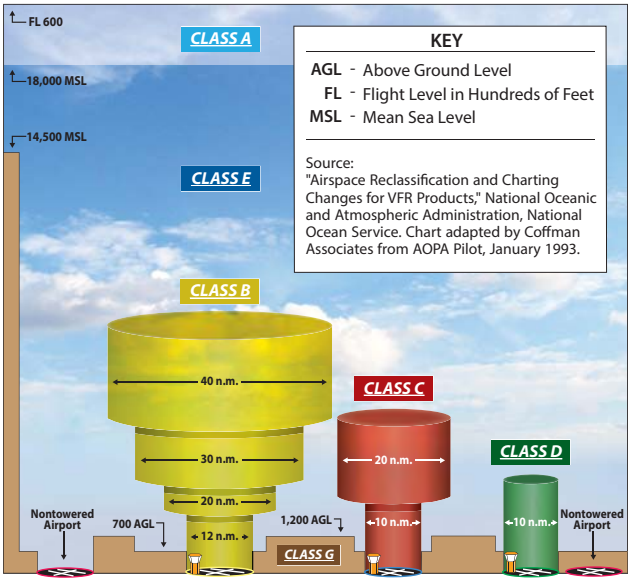
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specif ed above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when f ying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identif ed in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that extends

from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an opera. ng airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of def ned dimensions within which air traffic control services are provided to instrument f ight rules (IFR) and visual f ight rules (VFR) f ights in accordance with the airspace classif cation. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including f ight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**:
  Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The conf guration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traff c control clearance is required for all aircraft to operate in the area.

- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a f ve nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and conf gured to encompass published instrument approach procedure. Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classif ed as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be conf gured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument f ight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classif ed as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended f ight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended f ight path of an aircraft.

CROSSWIND LEG: A f ight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT/ DECISION ALTITUDE: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.

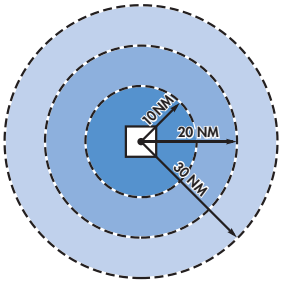
- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the accelera. on and deceleration of an aircraft aborting a takeoff.
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specif ed national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.



DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A f ight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specif ed form of development or activity, as well as any other legal rights in the property that may be specif ed in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would signif cantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the execu. ve departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A f ight path in the direction of landing along the extended runway centerline. The f nal approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A def ned area over which the f nal phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the f nal approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a signif cant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, f ight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft f ying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane f ying at f ight level 360 is f ying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national f ight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-f ight and in-f ight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certif cate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 48 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircra. turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that is specif ed as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specif c horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument f ight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of f ight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to def ne weather conditions and the type of f ight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions that are less than the minimums specif ed for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specif ed airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certif ed takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from f ights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two f xed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classif ca. on in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military f ight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The f ight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or

2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certif cates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction f nding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with f ight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircra. operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin f nal approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specif ed radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the f nal approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 that is specif ed as a rectangular surface longitudinally centered about a runway. The specif c dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve f ight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument f ight rules cancellations or departure/ landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits f ights over determined tracks within prescribed accuracy tolerances without the need to overf y ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A def ned rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially f ashing lights installed on the extended centerline of the runway usually in conjunc. on with an approach lighting system.

RUNWAY DESIGN CODE: A code signif ying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized f ashing lights, one on each side of the runway threshold, which provide rapid and positive identif cation of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY REFERENCE CODE: A code signifying the current operational capabilities of a runway and associated taxiway.

RUNWAY SAFETY AREA (RSA): A def ned surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point f ve feet above the runway centerline to any point f ve feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identif es and def nes the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transi. on between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRCRAFT: An aircraft that has a maximum certif ed takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of def ned dimensions identif ed by a surface area wherein activities must be conf ned because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classif cations include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with def ned vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument f ight rule (IFR) traffic and to identify for visual f ight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which the f ight of aircraft is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the f ight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard f ight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the f nal approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA):
See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA):
See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A def ned path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classif cation of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A def ned surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published f ight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

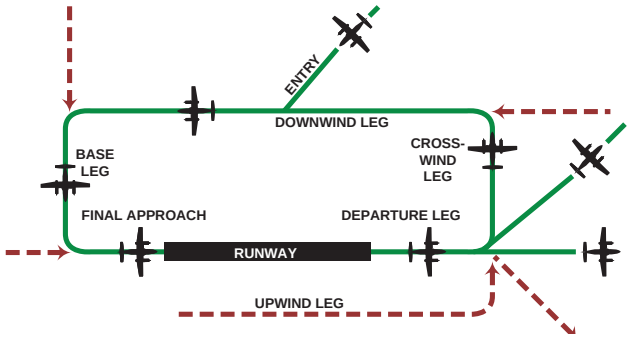
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The f rst 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic f ow that is prescribed for aircra. landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and f nal approach.



U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM):
A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

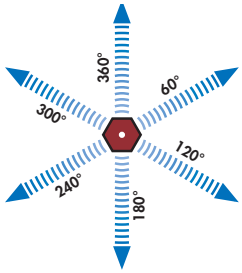
UPWIND LEG: A f ight path parallel to the landing runway in the direction of landing. See "traffic pattern."

V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identif es itself by Morse Code and may have an additional voice identif cation feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A naviga. on aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.



VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is def ned by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR f ight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/ white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting f ight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of f ight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of f ight.

Abbreviations

AC: advisory circular

ADF: automatic direction f nder

ADG: airplane design group

AFSS: automated f ight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT I conf guration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT II conf guration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircra. rescue and f re f ghting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automatic weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: f xed base operator

FY: f scal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument f ight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LOM: compass locator at outer marker

LORAN: long range navigation

MALS: medium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory commi. ee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

RRC: Runway Reference Code

RDC: Runway Design Code

REIL: runway end identif cation lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplif ed short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TDG: Taxiway Design Group

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual f ight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Appendix B

ENVIRONMENTAL OVERVIEW

AIRPORT MASTER PLAN

ADOT

Appendix B
ENVIRONMENTAL OVERVIEW

Grand Canyon National Park Airport

This Environmental Overview begins with an environmental inventory that addresses the existing conditions at Grand Canyon National Park Airport (GCN or Airport) and its environs. The inventory is intended to help identify relevant environmental issues that should be considered during preparation of the Airport Master Plan. The inventory is organized using the resource categories contained in Federal Aviation Administration (FAA) Order 1050.1F, *Environmental Impacts: Policies and Procedures* (FAA, 2015). Available information regarding the environmental conditions at the Airport and within the surrounding area has been derived from internet resources, agency maps, and existing literature.

Following the environmental inventory information, an evaluation of the potential environmental impacts of the recommended Master Plan Concept (Exhibit 6A) is provided to determine whether proposed actions would affect the quality of the environment. The evaluation uses the significance thresholds for the various resource categories contained in FAA Orders 1050.1F and 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. A preliminary determination of the most likely environmental action under NEPA for recommended projects within the proposed capital improvement program (CIP) (Exhibit 6B) is also given.

The construction of improvements depicted on the recommended Master Plan Concept will require compliance with NEPA to receive federal financial assistance. For projects that are not "categorically excluded" under FAA Order 1050.1F, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). In instances where significant

environmental impacts are expected, an Environmental Impact Statement (EIS) may be required. While this Environmental Overview is not designed to satisfy NEPA requirements for a Documented Categorical Exclusion (CatEx), EA, or EIS, it is intended to supply a preliminary review of environmental issues that might affect Master Plan implementation.

ENVIRONMENTAL INVENTORY

Air Quality

The United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) based on health risks for six pollutants: carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); lead (Pb); ozone (O_3); and two sizes of particulate matter (PM) - PM measuring between 10 and 2.5 micrometers in diameter (PM_{10}) and PM measuring 2.5 micrometers or less in diameter ($PM_{2.5}$).

An area with ambient air concentrations exceeding the NAAQS for a criteria pollutant is said to be a nonattainment area for the pollutant's NAAQS, while an area where ambient concentrations are below the NAAQS is considered an attainment area. The U.S. EPA requires that areas designated as nonattainment demonstrate how they will attain the NAAQS by an established deadline. To accomplish this, states are required to prepare State Implementation Plans (SIPs). SIPs are typically a comprehensive set of reduction strategies and emissions budgets designed to bring the area into attainment.

The Airport is in Coconino County, Arizona. According to the U.S. EPA's *Green Book – Arizona Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants*, as of February 13, 2017, Coconino County is in attainment for all NAAQS standards. Prescribed burnings within the Kaibab National Forest (NF) have the potential to exceed air quality health standards, impair visibility in Class I air sheds, and generate nuisance smoke on an intermittent basis; however, no violations of the NAAQS have been issued to the Kaibab NF, although it has burned an average of 8,500 acres per year since 2000 (USDA Forest Service, 2014).

In 1977, Congress designated all wilderness areas over 5,000 acres and all national parks over 6,000 acres as mandatory federal Class I areas, subject to the visibility protection requirements in the *Clean Air Act*. This Class I designation includes Grand Canyon National Park (GCNP) and Sycamore Canyon Wilderness. Baseline visibility conditions have been established using a measure of visibility called deciview (dv).[1] Baseline visibility for GCNP is 11.66 dv, while the baseline

[1] Deciview is the unit of measurement of haze or "haze index," and is a measure of visibility derived from light extinction designed so that incremental changes in the haze index correspond to uniform incremental changes in visual perception across the entire range of conditions from pristine to highly impaired (USDA Forest Service, Definitions website). A change of one deciview is a change in visibility that is discernible.

visibility for Sycamore Canyon Wilderness is 15.25 dv (ADEQ, 2011, Table 6.1). The State of Arizona has set target goals of 7.02 and 6.65 dv for GCNP and Sycamore Canyon Wilderness, respectively, by the year 2064 (ADEQ, 2011, Table 6.2).

Biological Resources

U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements of the *Endangered Species Act* (ESA), specifically Section 7, which sets forth requirements for consultation to determine if a proposed action "may affect" a federally endangered or threatened species. If an agency determines that an action "may affect" a federally protected species, then Section 7(a)(2) requires the agency to consult with USFWS to ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of any federally listed endangered or threatened species, or result in the destruction or adverse modification of critical habitat. If a species has been listed as a candidate species, Section 7(a)(4) states that each agency must confer with USFWS.

Additional federal laws protecting fish, wildlife, and plants include the *Migratory Bird Treaty Act,* which prohibits activities that would harm migratory birds, their eggs, or nests, and the *Bald and Golden Eagle Protection Act*, which prohibits the take (defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb") of bald and golden eagles, including their parts, nests, or eggs, without a permit. Executive Order (E.O.) 13312, *Invasive Species*, aims to prevent the introduction of invasive species as a result of a proposed action. (E.O. 11990, *Protection of Wetlands*, is discussed under the *Water Resources* section of this report.)

The Airport is adjacent to the Tusayan Ranger District of the Kaibab NF on the Coconino Plateau. Vegetation in the region is transitional between Great Basin conifer woodlands and Rocky Mountain Montane conifer woodlands with relatively homogenous stands of ponderosa pines (Town of Tusayan 2014). Piñon-juniper woodland and grasslands are also prevalent. These habitats provide suitable breeding and foraging habitat for many special-status species, such as species listed under the federal ESA, migratory birds, and state Species of Greatest Conservation Need (SGCN), as well as game, such as elk, mule deer, and wild turkey. While the Airport has cleared much of its native vegetation and installed a perimeter fence, game and other wildlife are still known to traverse the property (GCN Airport Manager, 2015).

There are five federally listed species that should be considered prior to development at the Airport, as well as one species proposed for listing as threatened, based on the USFWS's Information for Planning and Conservation (IPaC) species list (USFWS website). These species are listed in **Table B1**.

TABLE B1
***Endangered Species Act* Species List**
Grand Canyon National Park Airport

Species Name	Federal Status	Habitat Requirements	Habitat in Proximity?
Birds			
California condor	Endangered	High desert canyons and plateaus. (Current condor distribution is limited to three introduction sites, the closest of these to the Airport is near the Vermilion cliffs, [i.e., the north rim of the Grand Canyon]).	No
Mexican spotted owl	Threatened	Nests in canyons and dense forests with multilayered foliage structure.	No
Yellow-billed cuckoo	Threatened	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries).	No
Fishes			
Razorback sucker	Endangered	Riverine and lacustrine areas, generally not in fast moving water, and may use backwaters.	No
Roundtail chub	Proposed Threatened	Swift streams flowing out of the mountains. Cool, well-oxygenated water. Shallow riffles and calm pools at a stream's edge.	No
Reptiles			
Northern Mexican gartersnake	Threatened	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests.	Potential at Rain Tank[1]

Sources: USFWS IPaC and Arizona Game and Fish Department (AGFD) websites, accessed June 2017.
[1] No known occurrences based on AGFD's Environmental Online Review Tool for areas within three miles of the Airport.

There are no critical habitats in proximity to the Airport; the closest critical habitat is for the Mexican spotted owl, approximately six miles north within and around the Grand Canyon. According to the Arizona Game and Fish Department (AGFD) environmental database, there is a designated "Important Bird Area" within a three-mile radius of the Airport inside the GCNP. This area contains the Lipan and Yaki Raptor Migration Points. There are also known winter populations of the bald eagle within a three-mile radius of the Airport.

As discussed under *Water Resources*, the Airport contains a freshwater pond, located southwest off the approach end of Runway 3. This pond, known as Rain Tank, is identified as a wetland on the National Wetland Inventory maintained by the USFWS and is fed by storm water runoff, precipitation, and melted snow from the Airport (USFWS Wetland Mapper website).

Climate

Increasing concentrations of greenhouse gases (GHGs) can affect global climate by trapping heat in the Earth's atmosphere. Scientific measurements have shown that Earth's climate is warming, with concurrent impacts, including warmer air temperatures, increased sea level rise, increased storm activity, and an increased intensity in precipitation events. This climate change is a global phenomenon that can also have local impacts (IPCC, 2014). Greenhouse gases, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and O_3 are both naturally

occurring and anthropogenic (man-made). CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years. Research has shown that there is a direct correlation between fuel combustion and GHG emissions.

The International Panel on Climate Change (IPCC) estimates that from 1990-2013, aviation accounted for 4.1 percent of global transportation GHG emissions. In the U.S., EPA data indicates that commercial aviation contributed 6.6 percent of total CO_2 emissions in 2013, compared with other sources, including the remainder of the transportation sector (20.7 percent), industry (28.2 percent), commercial (16.9 percent), residential (16.9 percent), agricultural (9.7 percent), and U.S. territories (0.05 percent) (U.S. EPA, 2015). Scientific research is ongoing to better understand incremental atmospheric impacts that may be caused by aviation.

To date, there are no federal standards for aviation-related emissions. However, it is well-established that climate should be considered in NEPA analyses.

Coastal Resources

Federal activities involving or affecting coastal resources are governed by the *Coastal Barriers Resource Act*, the *Coastal Zone Management Act*, and E.O. 13089, *Coral Reef Protection*.

The Airport is in the State of Arizona, approximately 350 miles from the Pacific Ocean at its nearest point; thus, the Airport is not located within a Coastal Zone or near coastal barriers or reefs. The closest national marine sanctuary is the Cordell Bank National Marine Sanctuary, located 420 miles southwest of the Airport (USGS National Atlas website).

Department of Transportation Act, Section 4(f)

Section 4(f) of the *Department of Transportation Act* (DOT Act), which was recodified and renumbered as Section 303(c) of Title 49 United States Code (USC), states that the Secretary of Transportation shall not approve any program or project that requires the use of any publicly owned land from a historic site, public park, recreation area, or waterfowl or wildlife refuge of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

The term "use" includes not only the physical taking of such lands, but "constructive use" of such lands. "Constructive use" of lands occurs when "a project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired" (Title 23 Code of Federal Regulations [CFR] Section 771.135).

Properties listed or eligible to be listed on the National Register of Historic Properties (NRHP) are considered Section 4(f) resources. The following NRHP properties are located within two miles

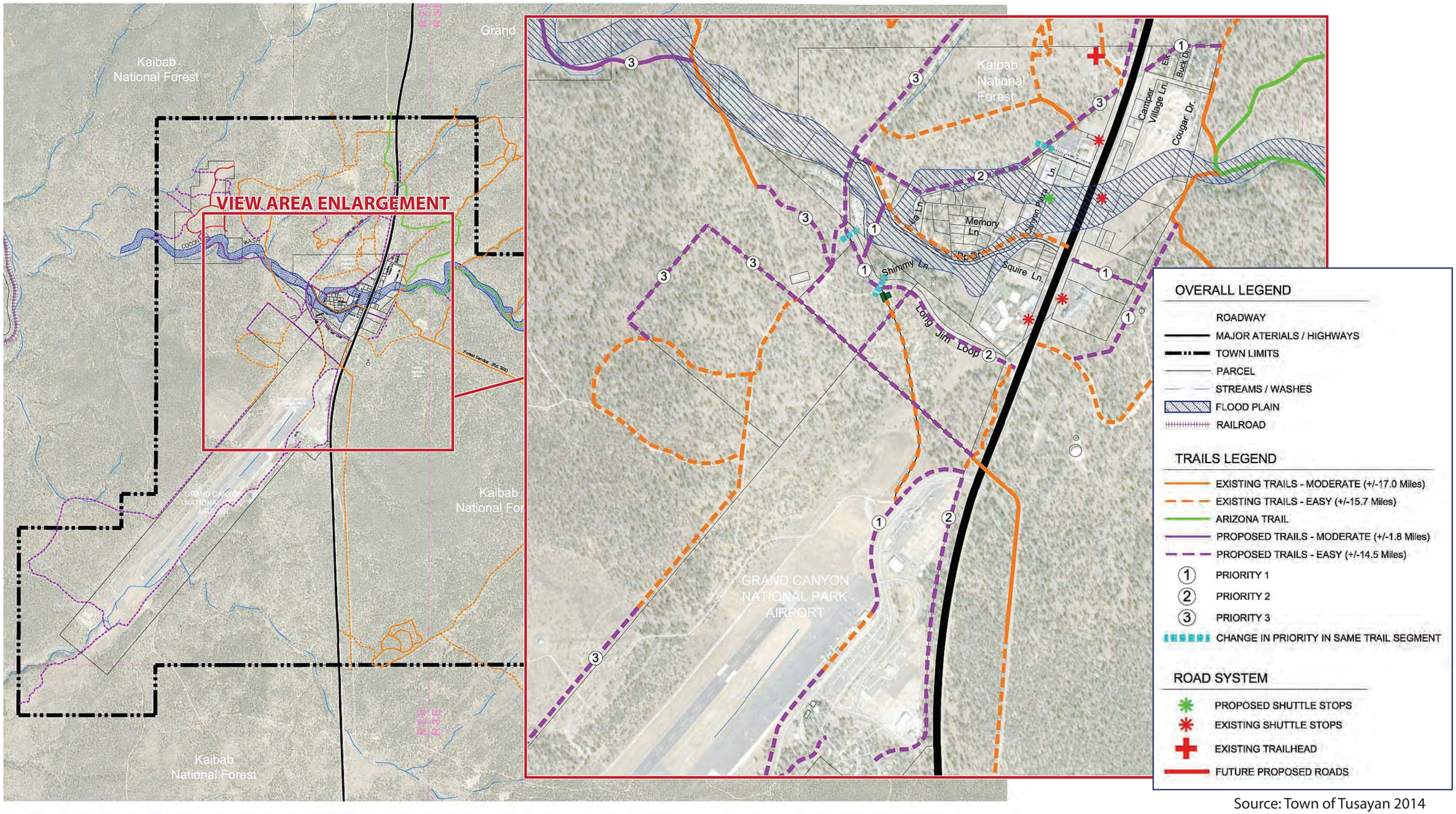
of the Airport (U.S. Department of Interior, NPS website): the Tusayan Lookout Tree, a U.S. Forest Service (USFS) fire lookout station, is located approximately 0.25 mile from the Airport's northwestern property line; the Moqui Ranger Station, a Depression-era USFS administration complex, is located approximately 1.5 miles north of the Airport. Additional NRHP properties are located along the south rim of the Grand Canyon (e.g., the Grand Canyon Railroad Station in Grand Canyon Village).

In 1982, the State of Arizona enacted into law Arizona Revised Statutes 41-512 through 41-518. These laws provide for the establishment of parkways, historic roads, and scenic roads. According to the *Coconino County Comprehensive Plan* (2015) and the Arizona Department of Transportation (ADOT) Historic Roads website, Highway 64 from Williams through Tusayan, past the south rim of the Grand Canyon, and on to Cameron (from milepost 185.51 to milepost 295.83) is designated as an Arizona Historic Road and, thus, is also a potential Section 4(f) resource.

Public recreation areas are potential Section 4(f) resources. There is a Town of Tusayan (Town) public recreation area (i.e., the first phase of a Tusayan community park) located immediately north of the Airport on the southwest side of Long Jim Loop. The park's initial phase of development is located on 13.9 acres of an 80-acre parcel acquired from the USFS by the Grand Canyon Unified School District through the *Education Land Grant Act* in 2008. Park development includes a play structure and fenced sports court. Future plans for the park include a softball field, a soccer field, and a baseball field (Town of Tusayan, 2014).

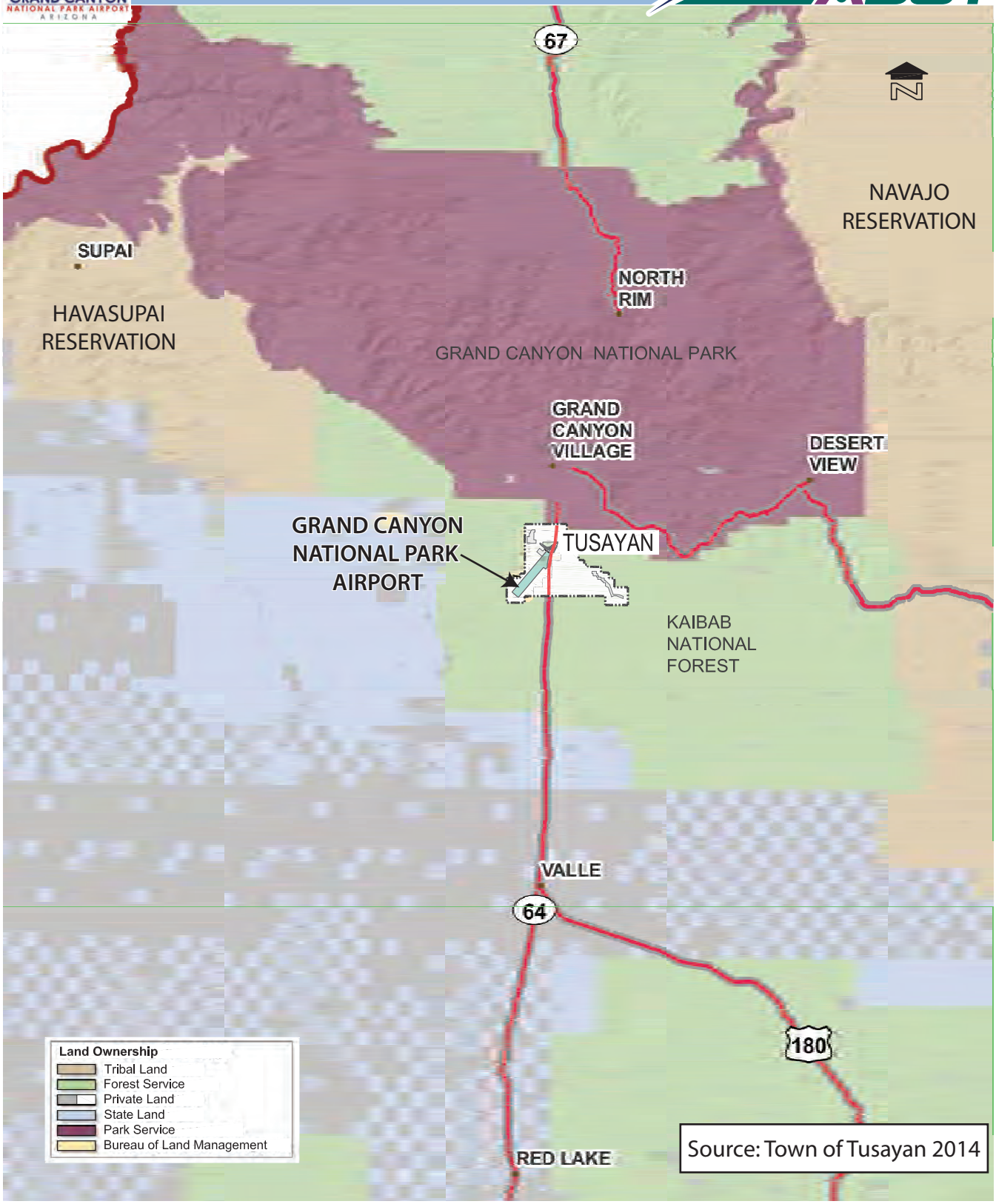
The Town also has public trails, and proposes the future development of additional trails, including trails on Airport property (**Exhibit B1**). The entire Town, including the Airport, is surrounded by the Kaibab NF (**Exhibit B2**), which provides numerous opportunities for passive recreational uses, such as hiking and biking, as well as hunting and camping. For example, the Arizona National Scenic Trail (#100) is an 800+-mile recreation trail from Mexico to Utah. In the Kaibab NF, this trail runs from the southern boundary of the Tusayan Ranger District north and northwest to Grandview Lookout Tower before heading west to Tusayan. From there, the trail leaves the Tusayan Ranger District and enters the GCNP (U.S. Department of Interior, NPS website). The Arizona National Scenic Trail is the only national trail located in Arizona (USDA Forest Service, 2014). The closest USFS campground to the Town and Airport is the Ten-X Campground, located southeast approximately two miles.

The southern limit of the GCNP is approximately 1.5 miles north of the Airport's northernmost property line (**Exhibit B2**). According to the National Park Service's (NPS) Grand Canyon website, the GCNP is over one million acres (approximately 1,900 square miles). The Grand Canyon, if measured along the Colorado River, is 277 miles from Lee's Ferry to the Grand Wash Cliffs. At its south rim, near Grand Canyon Village, the canyon is a vertical mile from rim to river and ten miles wide. In other places, it is as deep as 6,000 vertical feet and 18 miles wide. GCNP receives almost five million visitors per year, most of whom visit the south rim. The Grand Canyon has been a World Heritage Site since 1979 (U.S. Department of Interior, NPS website).



Source: Town of Tusayan 2014

Exhibit B1
TUSAYAN EXISTING AND PROPOSED FUTURE TRAILS



Revised: 5-27-2016

0 2 4 8 16
(MILES)

Exhibit B2: GENERALIZED LAND USE JURISDICTIONS WITHIN REGION

Other potential Section 4(f) resources are located much farther from the Airport and would not be affected by development at the Airport (USGS National Atlas website):

- Saddle Mountain Wilderness Area - 25 miles north
- Lake Mead National Recreation Area – 58 miles west
- Havasu National Wildlife Refuge – 154 miles southwest

Farmlands

The *Farmland Protection Policy Act* (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can also be forest land, pastureland, or other land, but not water or urban built-up land.

The U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) Web Soil Survey is a common source of information for soil types within mapped areas. However, soils within the Airport boundaries are unpublished and there are no soil maps available. The Airport is not currently farmed or irrigated. Therefore, it is unlikely that the FPPA would be applicable to development at the Airport. Soils in the area are derived primarily from the surface strata (i.e., Kaibab limestone) (Town of Tusayan, 2014).

Hazardous Materials, Solid Waste, and Pollution Prevention

Federal, state, and local laws, including the *Resource Conservation Recovery Act* (RCRA) and the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), as amended (also known as the Superfund), regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. Disturbing areas that contain hazardous materials or contaminates can cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

According to the U.S. EPA's EJSCREEN website, there are no Superfund or Brownfield sites in proximity to the Airport. Fuel storage facilities and businesses at the Airport reporting to the U.S. EPA under RCRA (for example, Papillon Helicopters) are required to comply with all applicable regulations. The Arizona Department of Environmental Quality's (ADEQ) Underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST) databases were also researched. Based on reports generated in June 2017, there have been 13 USTs at the Airport, all of which were permanently removed in the 1980s or 1990s (ADEQ UST database website). Six LUSTs have been removed; all LUSTs at the Airport have release closure dates in the late 1990s or early 2000s (ADEQ LUST database website).

Solid waste for most businesses in the Town, including the Airport, is collected by Waste Management, Inc. and taken to a recycling facility or the Painted Desert Landfill near Joseph City, Arizona, approximately 120 miles southeast of Tusayan. The closest recycling facility is in Flagstaff, Arizona, approximately 60 miles southeast of Tusayan (Town of Tusayan, 2014). The Airport currently recycles per their existing contract with Waste Management (GCN Airport Manager, 2015).

The Airport requires its tenants to implement spill prevention, control, and countermeasure plans (SPCCs) for all fuel storage and distribution facilities on Airport property. In addition, the Airport participates in the state Arizona Pollutant Discharge Elimination System (AZPDES) program under the *Clean Water Act*. An approved storm water pollution prevention plan (SWPPP) is implemented as a part of the Airport's AZPDES General Industrial permit compliance.

Historical, Architectural, Archaeological, and Cultural Resources

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*, among others. Impacts can occur when a proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance.

As discussed previously under *Department of Transportation Act*, Section 4(f), Highway 64 in proximity to the Airport is designated as an Arizona Historic Road. In addition, the Tusayan Lookout Tree, located approximately 0.25 mile from the Airport's northwestern property line, is listed on the NRHP. The Airport has not been subject to a comprehensive pedestrian ground survey for cultural resources (GCN Airport Manager, 2015).

The Airport is located 15 miles southeast of the Havasupai Indian Reservation (refer to **Exhibit B2**). Representatives of the Havasupai Tribe have attended Master Plan meetings and have indicated both their interest in airport activities that could affect their cultural properties, as well as a general interest in land use within the Town. The Havasupai reservation totals over 188,000 acres and comprises approximately 1.5 percent of Coconino County. Supai, its capital, is in the Grand Canyon and is home to approximately 500 people; it can only be reached by trail or helicopter. The Havasupai government consists of a seven-member tribal council with elections held every two years (Coconino County, 2015).

Both the Town and the Tusayan Ranger District of the Kaibab NF are within the Havasupai Tribe's traditionally used lands. From AD 1300 or earlier to the late 1850s, the Havasupai Tribe used natural resources, not just along the Grand Canyon and the Tusayan area, but throughout the Coconino Plateau. The Havasupai exchanged goods with tribes to both the east and west and often intermarried with the Hualapai, their ethnic relatives. This trade necessitated the use of

trails located all over the Plateau, including ones directed toward Rain Tank, located on the southwestern end of the Airport. In the present day, tribal members continue to use the Kaibab NF to gather medicinal plants, as well as for other traditional and cultural purposes (USDA Forest Service, 2014).

The use of Rain Tank has been documented in several ethnohistories of the Havasupai Tribe, where it is identified as a natural perennial water source (or possibly man-made by the native population) used for generations by the Havasupai (and likely Hopi) Tribe(s), both for subsistence and as a watering stop for long distance travel (Cleeland et al., 1992). Trails led from Rain Tank east to the north and south of Red Butte, as well as east through Long Jim Canyon near present day Tusayan, and then north to the south rim of the Grand Canyon.

Traditional cultural properties (TCPs) protected by the NHPA, as well as other culturally important places, such as trails and springs, are generally accommodated by the Kaibab NF. The Kaibab NF has established Memorandums of Understanding with the Havasupai Tribe, the Hopi Tribe, the Hualapai Tribe, and the Kaibab Band of Paiute Indians. According to the Forest's website, one of the primary responsibilities of its Tribal Relations program is to ensure that consultation with area tribes is conducted according to federal law and Forest Service policy (USDA Forest Service website). In addition, the Tusayan General Plan includes a policy that requires consultation with regional tribes and the State Historic Preservation Office (SHPO) for development that may affect the tribes, particularly the development of vacant parcels of ten acres or more (Town of Tusayan, 2014).

Land Use

Compatible land use evaluations for airports consider land uses near the airport to ensure those uses do not adversely affect safe aircraft operations. In addition, if an airport action would result in impacts exceeding FAA thresholds of significance which have land use ramifications, such as disruption of communities, relocation of businesses or residences, or socioeconomic impacts, the effects of the land use impacts are discussed.

Existing land use on the Airport itself includes aviation-related infrastructure, businesses, support services, and facilities. The Tusayan Town Hall, as well as the Airport's management office building, is also located within Airport property. Portions of the Airport not developed for aviation include 23 residences for various Town and Airport employees. Housing within Tusayan is limited and most residents live in employer-provided housing consisting of apartments, dormitories, or mobile/manufactured houses. Based on the U.S. Census Bureau's American Community Survey 5-Year estimates for 2011-2015, there are 135 occupied housing units within the Town, 119 of which are occupied by renters.

Tusayan General Plan. The Town of Tusayan was incorporated in 2010. **Exhibit B3** shows the Town's General Plan Land Use Map (2014). The Airport itself is designated as a Transportation land use. Adjacent land use designations on the north end include a large area designated as

Public that corresponds with land owned by the Grand Canyon Unified School District, and an 8-acre property containing the wastewater treatment plant that is designated as Special District. Residential land uses, including Low Density (single-family, 1-6 dwelling units/acre), Medium Density (single-family, 7-14 dwelling units/acre) and Multi-Family (15-30 dwelling units/acre), are designated along Long Jim Loop and RP Drive. Much of the rest of the Town is designated as Commercial or Mixed Use. The Airport is surrounded by the Kaibab NF on the southwest, south, and east, which is shown as Open Space on the Tusayan General Plan Land Use map. The Land Use map is consistent with the Town's current zoning and does not represent any "dramatic changes in land use from what currently exists" (Town of Tusayan, 2014).

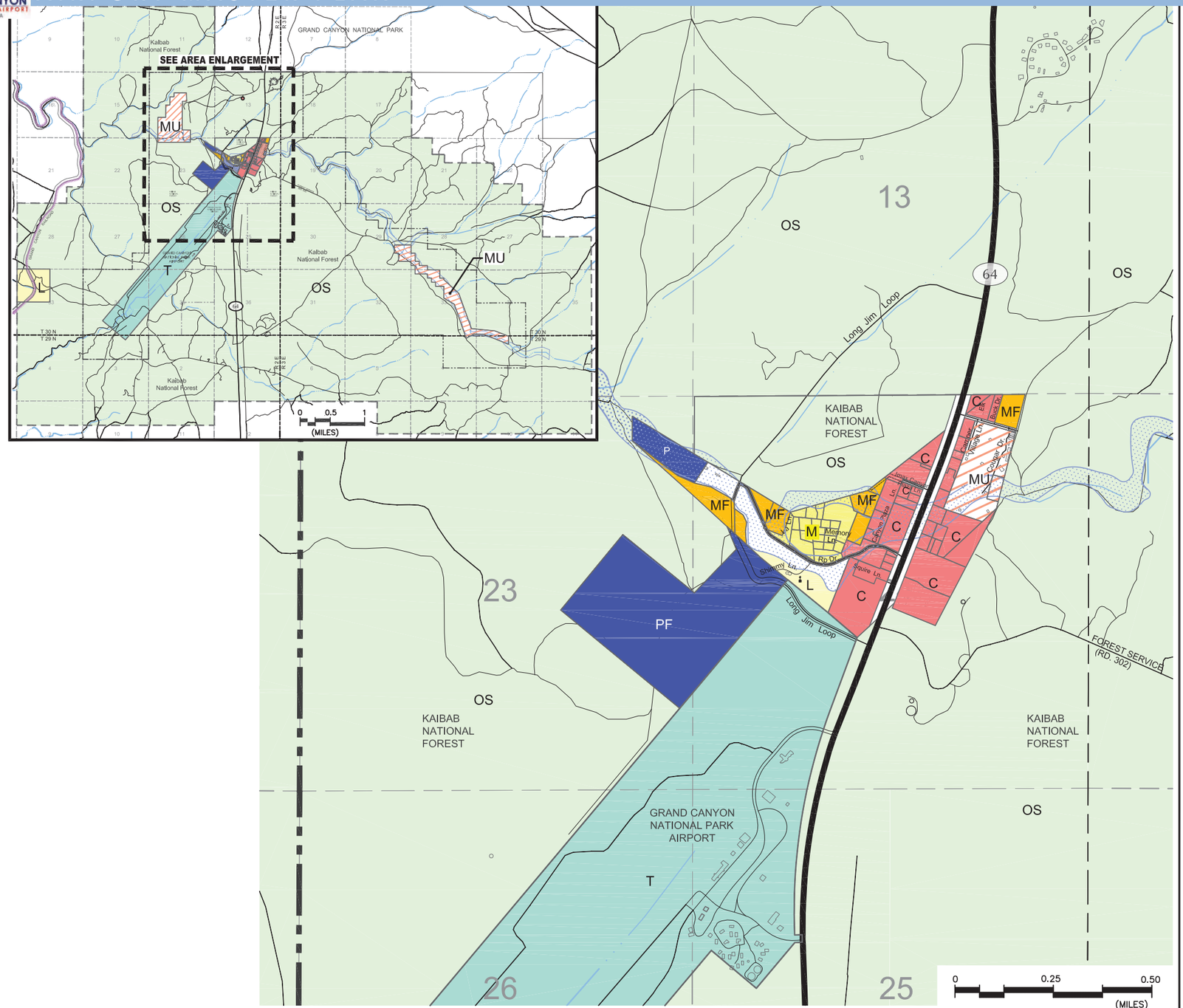
The Town's General Plan identifies the Airport as an important component of the transportation aspects of the Town, even though the Airport itself is owned and operated by ADOT. In the General Plan chapter on Land Use, it states that it is the goal of the Town to "Provide a high level of service to accommodate visitors to the Grand Canyon National Park while retaining an emphasis of preserving the natural cultural and aesthetic resources of the area." The following objective is then presented related to the Airport (Town of Tusayan, 2014):

> Objective: Continue to work with the Grand Canyon National Park, Forest Service, and Grand Canyon Airport in coordinating the development of tourist support services.

Kaibab NF Forest Plan. Since the Airport is surrounded on three sides by the Tusayan Ranger District of the Kaibab NF, the Forest's Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 2014) was also reviewed as part of this environmental inventory. The Forest Plan addresses four areas of priority for change in program direction:

- Modify forest structure and species composition to restore or maintain sustainability and restore historic fire regimes;
- Protect and regenerate aspen to ensure long-term healthy aspen populations;
- Protect and restore natural waters and wetlands to ensure healthy riparian communities; and
- Restore grasslands by reducing tree encroachment and restoring fire.

The Town, as well as the Airport, is included in the Kaibab NF's Wildland-Urban Interface (WUI) area. The *Healthy Forest Restoration Act of 2003* identifies a WUI as an area within or adjacent to an at-risk community that is identified in a community wildfire protection plan (CWPP). Two CWPPs have been prepared that include portions of the Kaibab NF. Although the Tusayan WUI zone covers 63,720 acres, due to the rapid rate that wildfire can spread over great distances in a single burning period, the Kaibab NF Forest Plan focuses its management approach on a 0.5-mile buffer around all private lands, administrative sites, fire lookouts, developed campgrounds and other permitted recreational facilities, and at-risk communication sites (USDA Forest Service,



N

LEGEND

- MULTI-FAMILY (up to 30 du/ac)
- LOW DENSITY (SINGLE FAMILY) RESIDENTIAL
- MEDIUM DENSITY (SINGLE FAMILY) RESIDENTIAL
- MIXED USE
- COMMERCIAL / LODGING
- OPEN SPACE
- PUBLIC
- TRANSPORTATION
- ROADWAY
- MAJOR ARTERIALS / HIGHWAYS
- SECTION LINE
- TOWN LIMITS
- PLANNING AREA
- STREAMS / WASHES
- FLOOD PLAIN
- RAILROAD

Source: Town of Tusayan 2014

Exhibit B3
TUSAYAN GENERAL PLAN LAND USE MAP

2014). Therefore, the WUI adjacent to the Airport includes 0.5-mile from the airport property line.

Natural Resources and Energy Supply

Natural resources available in the Tusayan area include aggregate material, timber (wood), and water. Both aggregate material and timber availability are managed primarily by the Kaibab NF. There are no active aggregate mines inside the incorporated limits of the Town; the closest active quarry is at the intersection of Forest Roads 310 and 320, approximately 17 miles southeast of the Airport (Town of Tusayan, 2014). According to the recently approved Forest Plan, the Forest will conduct mineral and mining activities to meet its "legal mandates to facilitate the development of minerals on the Kaibab NF" in a manner that "minimizes adverse impacts to surface and groundwater resources." Timber production activities occur on a sustainable basis only; wood products are also available to local tribes for traditional uses (USDA Forest Service, 2014).

Water for the Airport is supplied from a private purveyor, Hydro-Resources. The Airport stores 2.8 million gallons of water in two aboveground storage tanks, located near the south intersection of Airport Road with Highway 64. These tanks are refilled approximately twice a year (GCN Airport Manager, 2015). Hydro-Resources has four wells: two in the community of Valle and two in Tusayan. The Tusayan wells can provide enough water to meet the Town's water needs, according to a municipal water study conducted in 2011 (Town of Tusayan, 2014). (See also the discussion under *Water Resources* – Groundwater.) The Town makes extensive use of reclaimed water from the local wastewater treatment plant to serve its non-potable water needs, including toilets in hotel rooms, landscaping, and for construction purposes. The Airport also has an inactive water reclamation plant that was used to treat rainwater harvested onsite. However, due to the location of the rain containment system between the runway and the taxiway, FAA required the Airport to deactivate this system and remove the containment basins due to safety concerns.

Energy usage at the Airport includes the consumption of aviation fuel (Jet A and 100LL), gasoline and diesel fuel for vehicles and maintenance equipment, and electricity. Arizona Public Service (APS) is the electricity service provider; natural gas is not available in the Tusayan area. Information regarding specific aviation fuel storage and dispersal systems at the Airport is included in Chapter One, Inventory, while current electricity and water usage is examined in the sustainability analysis (Chapter Seven).

Noise and Compatible Land Use

Federal land use compatibility guidelines are established under 14 CFR 150, *Airport Noise Compatibility Planning*. According to 14 CFR 150, residential land uses and schools are noise-sensitive

land uses[2] that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (DNL). Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration also needs to be given to noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR 150 do not account for the value, significance, and enjoyment of the area in question (FAA, 2015). The following discussion, therefore, addresses noise issues within the Town, the Kaibab NF, and those within GCNP separately.

Town of Tusayan. As previously discussed under land use, portions of the Airport not developed for aviation include 23 residences for various Town and Airport employees. Approximately 15 residences are also located 0.1- to 0.2-mile from the Airport's northern property line off RP Drive, and a mobile home trailer park is located approximately 0.2-mile northwest of the Airport's northwestern property line off Long Jim Loop (**Exhibit B4**).

The Airport's existing DNL noise contours and fleet mix are shown in **Exhibit B5**. The Airport's existing 65 DNL and higher noise contours do not affect any noise-sensitive land uses, in this case, residences. The Town itself does not contain any schools, medical facilities, or religious facilities. The Town's existing K-12 school is located within the GCNP, although the Grand Canyon Unified School District has acquired 80 acres of USFS land adjacent to the Airport on its northwest side for future development of school facilities. There is also an emergency medical clinic in GCNP and religious services are held within Grand Canyon Village (Town of Tusayan, 2014).

Kaibab NF. Existing 65-75 DNL aircraft noise contours occur over a small portion of Highway 64 and the Kaibab NF adjacent to the existing tour helicopter landing/take off areas (**Exhibit B5**). Ambient noise levels are also likely to be higher in this area due to vehicular noise from the highway.

Grand Canyon National Park. The following information regarding the existing noise environment of the GCNP is taken partly from a Draft EIS on the GCNP's proposed *Backcountry Management Plan* (2015). By taking select noise measurements within the most common park vegetation types, as well as at the river/rapids, the EIS includes noise measurements of the backcountry split into their natural and non-natural components. Aircraft (specifically jets and propeller planes) were the only non-natural sounds heard at all the backcountry sites. For example, commercial high-altitude jet aircraft were audible at all backcountry locations, even those in specially designated Grand Canyon Flight-free Zones (U.S Department of the Interior, NPS, 2011). In addition

[2] Noise-sensitive land uses are generally residences, churches/places of worship, hospitals and health care facilities, and educational facilities. Churches/places of worship are defined as permanently established facilities intended solely for use as places of worship and are not meant to be converted to other potential uses. For a hospital/health care facility to be considered a noise-sensitive medical facility, it must provide for overnight stays or provide for longer recovery periods, where rest and relaxation are key considerations for use of the facility. Schools are facilities that provide full time use for instruction and training to students.

Exhibit B4
EXISTING LAND USE IN PROXIMITY TO AIRPORT

AIRCRAFT FLEET MIX	Existing (2015)
ITINERANT OPERATIONS	
Single Engine Piston	
Single Engine Fixed Pitch Propeller	2,767
Single Engine Variable Pitch Propeller	2,766
Single Engine Piston Subtotal	***5,533***
Multi-Engine Piston	
Beech Baron	300
Multi-Engine Piston Subtotal	***300***
Turboprop	
King Air 200	500
Beech 1900	5,000
DHC-6 Twin Otter	10,491
Cessna Caravan	10,491
C-130 Hercules	300
Turboprop Subtotal	***26,782***
Small Jet (< 30,000 lbs.)	
Citation I-VII	300
Small Jet Subtotal	***300***
Medium Jet (30,000 - 90,000 lbs.)	
Falcon 900	100
Challenger 600/604 / Citation X	50
ERJ-140/CRJ-200	200
F-18 Hornet	100
Medium Jet Subtotal	***450***
Large Jet (> 90,000 lbs.)	
Gulfstream V	50
Boeing 737-700	100
Large Jet Subtotal	***150***
Helicopter	
Bell 206	30,253
Eurocopter EC130 / AS350	30,253
McDonnell Dougles MD-900	10,000
UH-60 Blackhawk	204
Helicopter Subtotal	***70,710***
TOTAL ITINERANT OPERATIONS	**104,225**
LOCAL OPERATIONS	
Single Engine Fixed Pitch Propeller	250
Single Engine Variable Pitch Propeller	250
Turboprop (Cessna Caravan / DHC-6 Twin Otter)	250
Helicopter (Bell 206)	215
Helicopter (Eurocopter EC130 / AS350)	216
Military (UH-60 Blackhawk)	453
Military (C-130)	100
TOTAL LOCAL OPERATIONS	**1,734**
TOTAL ANNUAL OPERATIONS	**105,959**

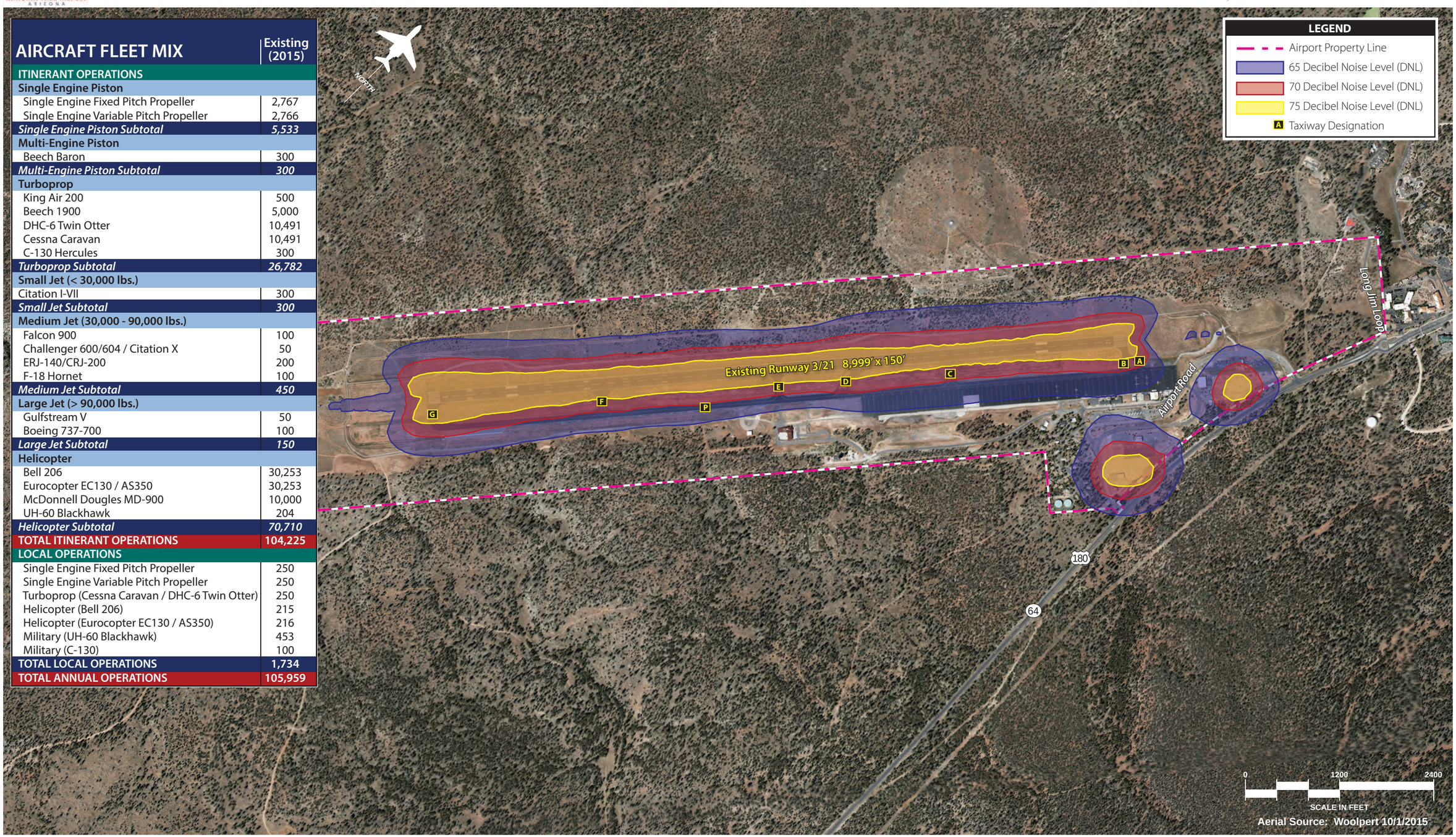


Exhibit B5
EXISTING (2015) NOISE EXPOSURE CONTOURS

to these high-altitude aircraft, non-natural noise included GCNP administrative flights (emergency and non-emergency),[3] and various types of maintenance vehicles and equipment. **Table B2** shows the percent of sounds measured in the backcountry due to non-natural and natural sources.

TABLE B2
Percent of GCNP Backcountry Non-Natural and Natural Sounds Audible from 7 a.m. to 7 p.m. Summers 2005 and 2006

Site	Non-Natural Sounds	Natural Sounds
Ponderosa Pine	34.7 – 47.7%	99.6-99.8%
Pinyon-Juniper[1]	51.9%	95.1%
Desert Scrub	33.4 – 43.2%	89.6-99.8%

Source: U.S. Department of the Interior, NPS, 2015.
[1] Measurements taken only during the Summer of 2005 due to equipment failure in 2006.

Aircraft noise over the GCNP's Developed Zone and adjacent areas include helicopter tours that operate out of the Airport. These flights are restricted to routes set by the GCNP. In addition, tours over the GNCP are not allowed between sundown and sunup. Thus, in the summer, tours occur from 8 a.m. to 6 p.m.; in the winter, tours occur from 9 a.m. to 5 p.m. Helicopter tour operations are limited to a specific number of trips within the tourist season. The current annual allocation for the Airport is 45,000 tours. Additional tours must be traded from within the existing allocation or can be conducted in the off-season if using helicopters with noise-abating technology. FAA manages this program through an agreement with the NPS.

Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks

General socioeconomic information, such as population and economic trends, are addressed in Chapter One. However, FAA Order 1050.1F specifically requires that a federal action causing disproportionate impacts to an environmental justice population (i.e., a low-income or minority population) be considered, as well as an evaluation of environmental health and safety risks to children.

Based on information from the American FactFinder website of the U.S. Census Bureau (American Community Survey, 2015), approximately 19 percent of all families living in Tusayan live below the poverty level. Approximately 48 percent of the Town residents are minority populations, 33 percent of which are of Navajo Tribal ethnicity. Approximately 16 percent of the population are Hispanic of any race. The Town's population was estimated at 355 for the year 2015, with 29

[3] GCNP contracts for helicopter support using "quiet technology" helicopters. Emergency helicopter operations account for an average of four flight hours per day during the peak use periods (May through September) and an average of 1.5 hours per day during the remaining months. Non-emergency helicopter operations average one hour per day during most of the year. GCNP also operates a fixed-wing airplane for patrols and passenger transport and has a pilot on staff (U.S Department of the Interior, NPS, 2015).

children age 14 or younger. As previously discussed, there are single-family houses, mobile/manufactured homes, and Tusayan Community Park located immediately north of the Airport's boundary. There are no schools located within Tusayan, although the Town's General Plan calls for future school development adjacent to the park (Town of Tusayan, 2014).

Socioeconomic impacts to be considered under FAA Order 1050.1F may also include potential traffic impacts related to aviation development. Highway 64 divides Tusayan into east and west sections and provides access to the south rim of the GCNP, just one mile to the north. In the past during the summer months, which is the height of the tourist season, the Town has experienced significant congestion due to vehicles in queue to enter the Park; however, the construction of additional Park entrance gates and other measures, including a GCNP shuttle, have worked to relieve this congestion (Town of Tusayan, 2014).

Visual Resources

Views of the Airport are screened from Highway 64 by the trees located along the highway right-of-way, except for southbound travelers at the northerly intersection of Airport Road and the highway. From this vantage point, the Papillon Helicopter landing areas and building can be seen. Views of the northern airport property are available from Long Jim Loop where it traverses the Airport. Views of the Airport are also accessible to the public from the air.

The Kaibab NF surrounds the Airport on three sides, which provides natural views of ponderosa pine trees and associated landscapes. Using helicopters, skydiving activities, and chartered airplanes, the scenic beauty of both the Forest and the GCNP are available to the public. Views of the Kaibab NF are available from public viewing areas that include Highway 64, numerous trails, and the TenX campground, as well as from the air. However, according to the ADOT Scenic Roads website, Highway 64 is not considered a scenic road by the State (ADOT Scenic Roads website).

Another scenic resource in the area, besides the Kaibab NF and the GCNP, is the night sky. Section 17.0 of the Town of Tusayan Zoning Code addresses lighting. Airport navigation lighting systems and other airport lighting required by FAA and/or the State of Arizona are exempt from the provisions of the ordinance. All other lighting at airports, including lights used for loading areas, hangars, terminal aprons, parking areas, etc., would be required to conform to all applicable standards of the code (Section 17.8). Existing lighting sources at the Airport are described in Chapter One, Inventory. The Airport is in the process of converting existing low-pressure sodium (LPS) lamps to low-emitting diode (LED) lights; all taxiway and runway lighting and signs are also being converted to LEDs (GCN Airport Manager, 2015).

Water Resources

Wetlands. Certain drainages (both natural and human-made) that are considered "waters of the U.S." come under the purview of the U.S. Army Corps of Engineers (USACE) under Sections 401

and 404 of the *Clean Water Act*; wetlands are also protected. In addition, E.O. 11990, *Protection of Wetlands,* provides definitions and calls for safeguarding wetlands. Wetlands typically exhibit three characteristics: hydrology, hydropytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained or "hydric" soils.

The Airport contains a freshwater pond, known as Rain Tank, located southwest of the end of Runway 3 (**Exhibit B6**). This pond is identified as a wetland on the National Wetland Inventory maintained by the USFWS and is fed by storm water runoff, precipitation, and melted snow from the Airport (USFWS, Wetland Mapper website). It is also considered a wildlife hazard attractant per FAA Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports* (FAA, 2007). Other waters of the U.S. may also occur on Airport property (U.S. EPA, My WATERS Mapper website).

Floodplains. E.O. 11988, *Floodplain Management,* directs federal agencies to act to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by the floodplains. The limits of base floodplains are determined by Flood Insurance Rate Maps (FIRMs) prepared by Federal Emergency Management Agency (FEMA). Based on the most recent FIRM map for the Airport (No. 04005C3825G, dated September 3, 2010), the Airport is not located within a 100-year floodplain. FEMA has mapped the entire Airport property as Zone X, Other Areas, which indicates that the Airport has been determined to be outside even the 0.2 percent annual chance floodplain (i.e., the 500-year flood). The closest 100-year floodplain is along Coconino Wash to the north of the Airport (**Exhibit B6**).

Surface waters. Much of the Coconino Plateau is located within the Colorado/Grand Canyon watershed (ADEQ emaps website). Most of the Airport is located within the Rain Tank Wash subwatershed, an approximate 155-square mile area; the very northern part of the Airport, as well as the Town, is located within the Coconino Wash Headwaters subwatershed, an approximate 207-square mile area that includes parts of the south rim of the Grand Canyon (**Exhibit B6**). Neither subwatershed contains impaired waters per the *Clean Water Act* (U.S. EPA, My WATERS Mapper website).

Drainage on the central and southern parts of the Airport is conveyed via earthen swales and concrete or pipe culverts south to Rain Tank. Drainage on the northern part of the Airport eventually drains into Coconino Wash. The Airport implements an approved SWPPP as a part of its AZPDES industrial permit under the *Clean Water Act*. This program is managed by ADEQ.

Groundwater. The Tusayan area is underlain by what Coconino County calls the R-M aquifer, which is the deepest in the county and underlies the entire county. It is only recently beginning to be developed for domestic and municipal water supplies in places like Tusayan (Coconino County, 2015). The R-M aquifer, as well as two other shallower aquifers, also supplies perennial flows to the following major rivers and creeks through springs: Grand Canyon, Havasupai Springs, Bright Angel Creek, and the Little Colorado River. The quality of the R-M aquifer is not well known. Excellent quality water has been taken from the aquifer in Tusayan and Valle, while

groundwater drawn in Williams and Havasupai has included very poor-quality water (Coconino County, 2015). None of the county is within an Arizona Department of Water Resources (ADWR) Active Management Area; therefore, any landowner can drill a water well on his or her property if it pumps less than 35 gallons per minute.

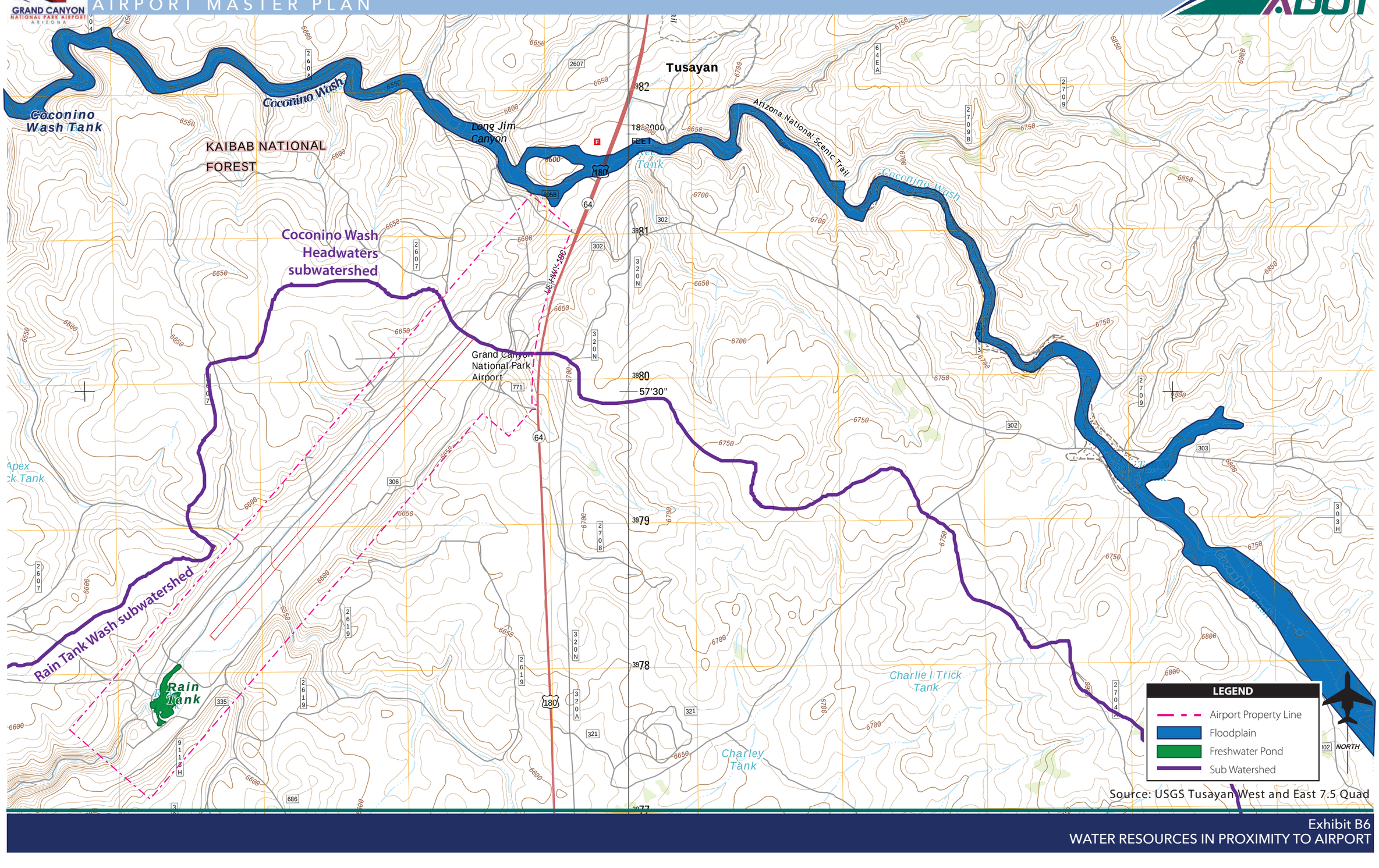
The U.S. Geological Survey (USGS) identifies the R-M aquifer in the Tusayan area as "Other Rocks." This designation includes large-to-small areas that are designated "minor aquifer," "not a principal aquifer," or "confining unit" in the Principal Aquifers' map document source, *Ground Water Atlas of the United States*. A sole source aquifer (SSA) is an aquifer that has been designated by the U.S. EPA as the sole or principal source of drinking water for an area. By definition, SSA is an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. The closest SSA to the Airport is the Upper Santa Cruz and Avra Basin Sole Source Aquifer, located approximately 220 miles south (USGS Ground Water Atlas website).

Wild and Scenic Rivers. Wild and scenic rivers refer to designations within NPS's Nationwide Rivers Inventory. Public Law 90-542 (16 USC 1271 et seq.) states that such rivers are free-flowing and possess "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values." The closest designated Wild or Scenic River segments to the Airport are on the Verde River, located 92 miles south of the Airport, and several tributaries of the Virgin River, located in Utah approximately 92 miles north (Department of the Interior NPS website).

In addition, the Colorado River is listed on the Nationwide Rivers Inventory for potential designation for a segment located approximately ten miles to the northeast. Other creeks and rivers within the GCNP (i.e., Boucher, Chuar, Clear, Crystal, Deer, Havasu, Hermit, Kwagunt, Nankoweap, Shinumo, Stone, and Tapeats Creeks, and the Little Colorado and Thunder Rivers) are also listed for potential designation (U.S. Department of Interior, NPS website).

ENVIRONMENTAL EVALUATION

Consideration of potential environmental impacts of proposed airport development projects, as discussed in Chapter Six and depicted on Exhibit 6A and Exhibit 6B, is an important component of the Master Plan process. The primary purpose of this section of the Environmental Overview is to identify significance thresholds for the various resource categories contained in FAA Order 1050.1F, Exhibit 4-1 and FAA Order 5050.4B, Table 7.1. The Master Plan development program is then evaluated to determine whether proposed actions could individually or collectively affect the quality of the environment.



Source: USGS Tusayan West and East 7.5 Quad

Exhibit B6
WATER RESOURCES IN PROXIMITY TO AIRPORT

POTENTIAL ENVIRONMENTAL CONCERNS

The following table (**Table B3**) summarizes potential environmental concerns associated with implementation of the proposed Master Plan. These concerns are related to the future construction of specific projects that could be built under the Master Plan based on the recommended CIP. Analysis under NEPA includes direct, indirect, and cumulative impacts.

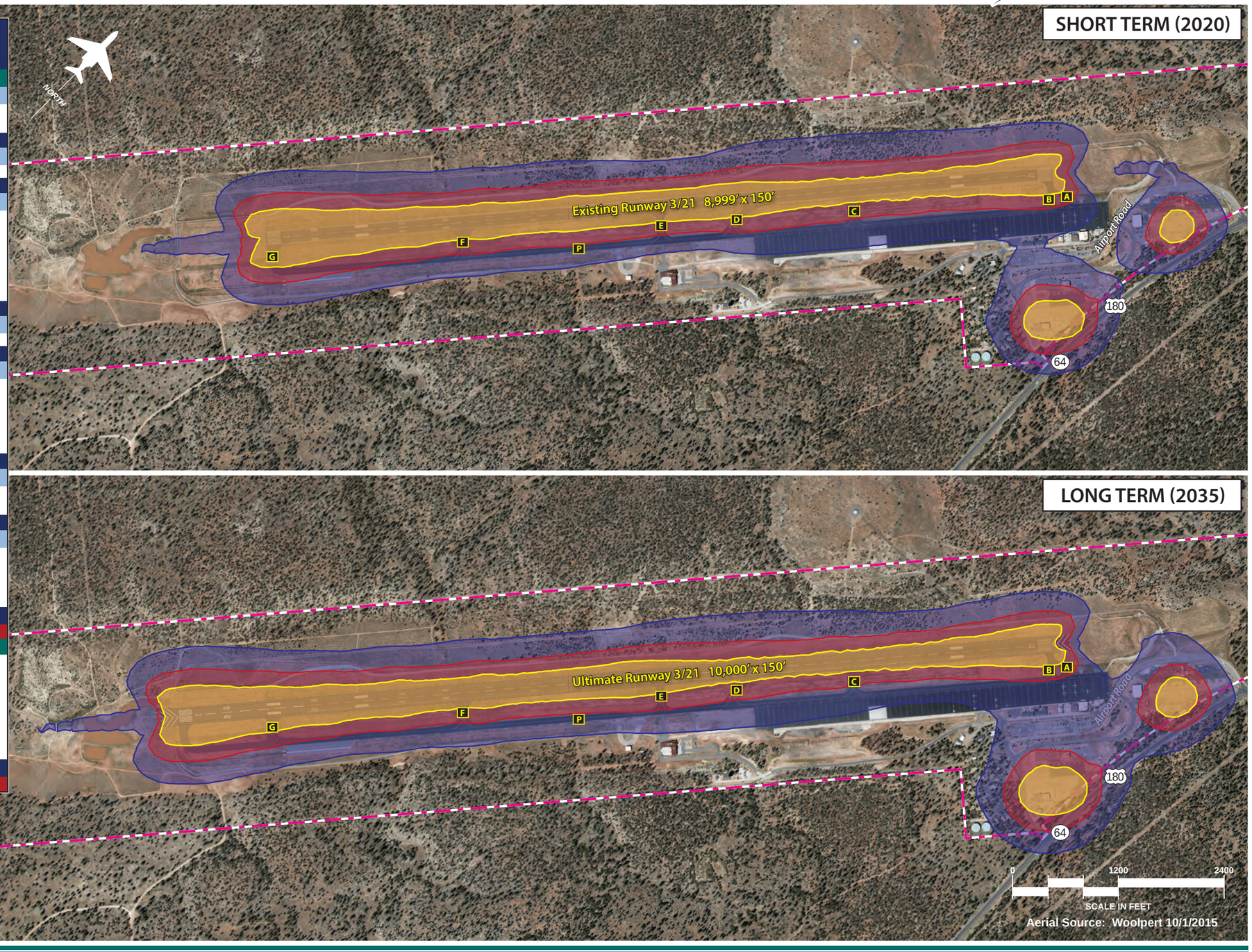
TABLE B3
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Air Quality	**The action would cause pollutant concentrations to exceed one or more of the NAAQS, as established by the U.S. EPA under the *Clean Air Act*, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations.**	Although the projected increase in operations over the 20-year planning horizon of the Master Plan would result in additional emissions, Coconino County currently meets federal NAAQS standards. Thus, general conformity review per the *Clean Air Act* is not required. According to the most recent FAA *Aviation Emissions and Air Quality Handbook* (2015), an emissions inventory under NEPA may be necessary for any proposed action that would result in a reasonable foreseeable increase in emissions due to its implementation. For construction emissions**,** a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review required for the project.
Biological Resources (including fish, wildlife, and plants)	**The USFWS determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat.** FAA has not established a significance threshold for non-listed species.	**For federally-listed species:** Potential habitat for the Northern Mexican gartersnake may exist at Rain Tank. This potential must be assessed prior to action in this area and may require consultation with USFWS. **For designated critical habitat:** None. There is no designated critical habitat located at or near the Airport. **For non-listed species:** Non-listed species of concern include those protected by the *Migratory Bird Treaty Act* and/or the *Bald and Golden Eagle Protection Act*. The potential for the presence of migratory birds and eagles should be evaluated on a project-specific basis.
Climate	**FAA has not established a significance threshold for Climate.** Refer to FAA *1050.1F Desk Reference*, for the most up-to-date methodology for examining impacts associated with climate change.	An increase in GHG emissions would occur over the 20-year planning horizon of the Master Plan based on the projected increase in operations. Project-specific analysis may be required per the FAA *1050.1F Desk Reference*, based on the parameters of individual airport projects.

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Coastal Resources	**FAA has not established a significance threshold for Coastal Resources.**	None. The Airport is not located within a designated Coastal Zone.
Department of Transportation Act: Section 4(f)	**The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource.** (Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.)	The Airport is adjacent to the Kaibab NF, which is used for passive recreational uses, and is considered a Section 4(f) resource. Local trails and parks, as well as historic Highway 64, may also be protected by Section 4(f). The Airport's expected future DNL noise contours, based on the anticipated fleet mix and operational changes, are shown in **Exhibit B7**. Although future 65 and 70 DNL contours may occur over portions of the adjacent highway, trails, and NF land, this situation would represent only a small incremental increase over the existing condition. Based on the existing noise levels, future noise levels are not likely to substantially impair the Section 4(f) resources. There may be cultural resources at the Airport that have not yet been discovered or evaluated for significance under Section 106 of the *National Historic Preservation Act*. If impacts result to a cultural site that is determined to be significant, a Section 4(f) impact could occur.
Farmlands	**The total combined score on Form AD-1006, *Farmland Conversion Impact Rating*," ranges between 200 and 260.** Form AD-1006 is used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) to assess impacts under the *Farmland Protection Policy Act*.	None. Soils at the Airport are not classified as farmland by the NRCS and the FPPA is not expected to be applicable to airport development projects.
Hazardous Materials, Solid Waste, and Pollution Prevention	**FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention.** Factors to consider are if an action would have the potential to: • Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management; • Involve a contaminated site; • Produce an appreciably different quantity or type of hazardous waste; • Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or • Adversely affect human health and the environment.	The Airport has a fuel farm and provides opportunity for aircraft maintenance activities that could involve fossil fuels or other types of hazardous materials or wastes. In addition, another self-service fuel farm is recommended in the Master Plan Concept. These operations are (or would be) regulated and monitored by the appropriate regulatory agencies, such as the U.S. EPA and ADEQ. The recommended Master Plan Concept does not anticipate land uses that would produce an appreciably different quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or permitting would be required. There are no known hazardous materials or waste contamination sites at the Airport.

AIRCRAFT FLEET MIX	Short Term (2020)	Long Term (2035)
ITINERANT OPERATIONS		
Single Engine Piston		
Single Engine Fixed Pitch Propeller	3,000	3,615
Single Engine Variable Pitch Propeller	3,000	3,615
Single Engine Piston Subtotal	***6,000***	***7,230***
Multi-Engine Piston		
Beech Baron	300	200
Multi-Engine Piston Subtotal	***300***	***200***
Turboprop		
King Air 200	1,000	1,500
Beech 1900	6,100	8,500
Bombardier Q-400	500	1,710
DHC-6 Twin Otter	12,800	16,700
Cessna Caravan	12,800	16,700
C-130 Hercules	300	300
Turboprop Subtotal	***33,500***	***45,410***
Small Jet (< 30,000 lbs.)		
Citation I-VII	400	600
Small Jet Subtotal	***400***	***600***
Medium Jet (30,000 - 90,000 lbs.)		
Falcon 900	125	200
Challenger 600/604 / Citation X	80	150
ERJ-140/CRJ-200	150	0
ERJ-170/CRJ-700	400	1,710
F-18 Hornet	100	100
Medium Jet Subtotal	***855***	***2,160***
Large Jet (> 90,000 lbs.)		
Gulfstream V	75	150
Boeing 737-700	150	400
Large Jet Subtotal	***225***	***550***
Helicopter		
Bell 206	25,400	10,000
Eurocopter EC130 / AS350	35,400	50,100
McDonnell Dougles MD-900	20,000	50,100
UH-60 Blackhawk	200	200
Helicopter Subtotal	***81,000***	***110,400***
TOTAL ITINERANT OPERATIONS	**122,280**	**166,550**
LOCAL OPERATIONS		
Single Engine Fixed Pitch Propeller	265	303
Single Engine Variable Pitch Propeller	265	302
Turboprop (Cessna Caravan / DHC-6 Twin Otter)	250	250
Helicopter (Bell 206)	215	215
Helicopter (Eurocopter EC130 / AS350)	215	215
Military (UH-60 Blackhawk)	450	450
Military (C-130)	100	100
TOTAL LOCAL OPERATIONS	**1,760**	**1,835**
TOTAL ANNUAL OPERATIONS	**124,040**	**168,385**



LEGEND

- Airport Property Line
- 65 Decibel Noise Level (DNL)
- 70 Decibel Noise Level (DNL)
- 75 Decibel Noise Level (DNL)
- A Taxiway Designation

Exhibit B7
SHORT-TERM (2020) AND LONG-TERM (2035) NOISE EXPOSURE CONTOURS

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
(Continued) Hazardous Materials, Solid Waste, and Pollution Prevention	Adversely affect human health and the environment.	Existing and future solid waste is, or would be, collected and disposed of by a contracted waste handling/removal company.
Historical, Architectural, Archaeological, and Cultural Resources	**FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources.** Factors to consider are if an action would result in a finding of "adverse effect" through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an EIS, i.e., a significant impact.	Unsurveyed areas of the Airport have the potential to contain protected cultural resources. Thus, any areas at the Airport that would be subject to ground disturbance should be surveyed for cultural resources prior to construction unless previously disturbed to the point that artifacts could no longer be intact. Data recovery (to determine the extent and significance of resources) and/or monitoring during construction activities may also be required. Native American consultation by FAA will occur under the NHPA for all federal projects. This would include any changes to Rain Tank.
Land Use	**FAA has not established a significance threshold for Land Use.** The determination that significant impacts exist is normally dependent on the significance of other impacts.	The proposed Master Plan Concept does not involve development off the Airport. However, the recommended Master Plan Concept includes potential non-aviation development on the north side of the Airport adjacent to the Tusayan Community Park (and future school site). Future development proposals for this part of the Airport should evaluate any potential issues with these adjacent land uses.
Natural Resources and Energy Supply	**FAA has not established a significance threshold for Natural Resources and Energy Supply.** Factors to consider are if an action would have the potential to cause demand to exceed available or future supplies of these resources.	Planned development projects at the Airport would result in additional demand for natural resources and energy consumption, although implementation of the Master Plan's sustainability management plan (Chapter Seven) will help to minimize additional energy and potable water usage. Furthermore, the sustainability management plan recommends expanding on-site solar-based renewable energy generation capacities, which will ultimately reduce the demand for commercial energy sources. Use of groundwater, which is the primary source of water for the area, is a sensitive issue, due to reliance on this natural resource by the Native American population within the Grand Canyon. Future water use at the Airport should, therefore, be addressed on a project-specific basis. If groundwater becomes a scarce resource in the County, mitigation may be required.

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Noise and Noise-Compatible Land Use	**The action would increase noise by DNL 1.5 dB or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe.** A factor to consider is that special consideration needs to be given to the evaluation of the significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR 150 are not relevant to the value, significance, and enjoyment of the area in question.	The Airport's future DNL noise exposure contours based on the anticipated fleet mix and operational changes are shown on **Exhibit B7**. The Airport is bound by undeveloped open space, primarily owned by the USFS, and its 65 or higher noise exposure contours do not affect any developed noise-sensitive areas. As discussed previously under *Department of Transportation Act*: Section 4(f), the forest, highway, and local trails adjacent to the Airport are considered potential Section 4(f) resources. The change anticipated in noise exposure contours during the Master Plan's 20-year planning horizon is minor and is not expected to substantially impair these public resource values, significance, or enjoyment.
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks		
Socioeconomics	**FAA has not established a significance threshold for Socioeconomics.** Factors to consider are if an action would have the potential to: • Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area); • Disrupt or divide the physical arrangement of an established community; • Cause extensive relocation when sufficient replacement housing is unavailable; • Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities; • Disrupt local traffic patterns and substantially reduce the levels of service of roads serving the airport and its surrounding communities; or • Produce a substantial change in the community tax base.	Proposed development projects would occur on the Airport itself and would not result in a physical disruption or division within Tusayan. No relocation of local housing (other than the relocation of Airport housing) or community businesses, disruption of local traffic patterns, or a substantial change in the community tax base would occur. If the Airport's commercial air service is enhanced, additional economic growth in the area is likely to occur. This potential effect should be evaluated in the appropriate environmental document.

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks (Continued)		
Environmental Justice	**FAA has not established a significance threshold for Environmental Justice.** Factors to consider are if an action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population (i.e., a low-income or minority population), due to: • Significant impacts in other environmental impact categories; or • Impacts on the physical or natural environment that affect an environmental justice population in a way that FAA determines is unique to the environmental justice population and significant to that population.	None. Proposed development projects would occur on the Airport itself and would not result in impacts to environmental justice populations.
Children's Environmental Health and Safety Risks	**FAA has not established a significance threshold for Children's Environmental Health and Safety Risks.** Factors to consider are if an action would have the potential to lead to a disproportionate health or safety risk to children.	The recommended Master Plan Concept includes potential non-aviation development on the north side of the Airport, adjacent to Tusayan Community Park (and future school site). Future development proposals in this area of the Airport should evaluate potential risks to children's environmental health and safety.
Visual Effects		
Light Emissions	**FAA has not established a significance threshold for Light Emissions.** Factors to consider include the degree to which an action would have the potential to: • Create annoyance or interfere with normal activities from light emissions; and • Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources.	Most new lighting associated with the Master Plan (such as proposed PAPIs and REILs) would remain on the airfield and other developed portions of the Airport. However, the Master Plan Concept also recommends potential non-aviation development on the north side of the Airport. Development in these areas may involve additional building security lighting. Due to the distance between the Airport and the closest residential development (i.e., the closest residence is more than 500 feet away, as well as intervening topography and vegetation), no significant lighting impacts are anticipated. Airport development should implement Section 17.0 of the Town of Tusayan Zoning Code, to the extent feasible, while taking into consideration the operational safety of the Airport. In addition, the Airport should continue to work with the GCNP to ensure that the Airport's lighting does not negatively impact the Park.

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Visual Effects (Continued)		
Visual Resources/ Visual Character	**FAA has not established a significance threshold for Visual Resources/Visual Character.** A factor to consider is the extent an action would have the potential to: • Affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources; • Contrast with the visual resources and/or visual character in the study area; and • Block or obstruct the views of the visual resources, including whether these resources would still be viewable from other locations.	None. Development planned in the recommended Master Plan Concept would not change the overall visual character of the Airport or impact the visual resources of the general area.
Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)		
Wetlands	**The action would:** **1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;** **2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;** **3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);** **4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands.** **5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or** 6. **Be inconsistent with applicable state wetland strategies.**	The Airport contains a wetland (Rain Tank) on the southwestern end of the Airport. This resource would be impacted by the recommended runway extension. It is also a wildlife hazard attractant as defined by FAA AC 150/5200-33B. As such, even if the runway extension is not constructed, measures to address the wildlife hazard may be necessary. Any such future activity at Rain Tank may require a Section 404 permit under the *Clean Water Act* and mitigation for impacts to wetlands.
Floodplains	**The action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, *Floodplain Management and Protection.***	None. There are no 100-year floodplains located on the Airport (**Exhibit B6**).

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers) (Continued)		
Surface Waters	**The action would:** **1. Exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or** **2. Contaminate public drinking water supply such that public health may be adversely affected.** Factors to consider include when a project would have the potential to: • Adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values; • Adversely affect surface water such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or • Present difficulties based on water quality impacts when obtaining a permit or authorization.	The Airport has an approved SWPPP as part of its AZPDES permit. Airport projects, such as additional apron, parking lots, or other impervious surfaces, could increase the amount of runoff from the Airport. Thus, the Airport's storm water drainage system may need to be upgraded to handle additional runoff quantities, when necessary, and its AZPDES permit and SWPPP updated accordingly. An AZPDES General Construction permit would be required for all projects involving ground disturbance of over one acre. FAA's AC 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should also be implemented during construction projects at the Airport.
Groundwater	**The action would:** **1. Exceed groundwater quality standards established by federal, state, local, and tribal regulatory agencies: or** **2. Contaminate an aquifer used for public water supply such that public health may be adversely affected.** Factors to consider are when a project would have the potential to: • Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values; • Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or • Present difficulties based on water quality impacts when obtaining a permit or authorization.	See the previous discussion under Surface Water regarding water quality measures at the Airport. As previously discussed under *Natural Resources and Energy Supply,* the proposed projects would not substantially change the amount of water used by the Airport and implementation of the sustainability program (Chapter Seven) would help to prevent overuse of groundwater, which is the primary source of water for the area. However, use of groundwater in the region is a sensitive issue, due to reliance on this natural resource by the Native American population within the Grand Canyon. Future water use at the Airport should, therefore, be addressed on a project-specific basis. If groundwater becomes a scarce resource in the County, mitigation may be required.

TABLE B3 (Continued)
Summary of Potential Environmental Concerns
Grand Canyon National Park Airport Master Plan

Environmental Impact Category	Significance Threshold (per Order 1050.1F)	Potential Concern(s)
Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers) (Continued)		
Wild and Scenic Rivers	**FAA has not established a significance threshold for Wild and Scenic Rivers.** Factors to consider are when an action would have an adverse impact on the values for which a river was designated (or considered for designation) through: • Destroying or altering a river's free-flowing nature; • A direct and adverse effect on the values for which a river was designated (or under study for designation); • Introducing a visual, audible, or other type of intrusion that is out of character with the river or would alter outstanding features of the river's setting; • Causing the river's water quality to deteriorate; • Allowing the transfer or sale of property interests without restrictions needed to protect the river or the river corridor; or • Any of the above impacts preventing a river on the Nationwide Rivers Inventory (NRI) or a Section 5(d) river that is not included in the NRI from being included in the Wild and Scenic River System or causing a downgrade in its classification (e.g., from wild to recreational).	None. The closest designated Wild and Scenic river segments (i.e., Fossil Creek and Verde River) are over 90 miles from the Airport, while the closest rivers listed on the NRI are approximately 10 miles away.

Source: FAA, 2015. Order 1050.1F, *Environmental Impacts: Policies and Procedures.*

PAPI = precision approach path indicator
REIL - runway end indicator lighting

ENVIRONMENTAL ACTION SUMMARY

Prior to construction, most of the Master Plan-recommended projects would require NEPA environmental consideration and analysis. As discussed previously, the three types of environmental documentation under NEPA are the CatEx, EA, or EIS. A CatEx must meet the criteria in 40 CFR §1508.4 and FAA Order 1050.1F, and are defined as "a category of actions that do not normally require an EA or EIS because they do not individually or cumulatively have a significant effect on the human environment, with the exception of extraordinary circumstances." It is the duty of the responsible FAA official to determine whether extraordinary circumstances exist and, if so, deem the action appropriate for an EA.

An EA, at a minimum, must be prepared for a proposed action when the initial review of the proposed action indicates that it is not categorically excluded, involves at least one extraordinary circumstance, or the action is not one known normally to require an EIS and is not categorically excluded. The purpose of an EA is to document the FAA determination as to whether a proposed action has the potential for significant environmental impacts. If none of the potential impacts are likely to be significant, then the responsible FAA official shall prepare a Finding of No Significant Impact (FONSI), which briefly presents, in writing, the reasons why an action, not otherwise categorically excluded, will not have a significant impact on the human environment and the approving official may approve it. Issuance of a FONSI signifies that FAA will not prepare an EIS and has completed the NEPA process for the proposed action.

If the responsible FAA official determines that the proposed action may significantly affect the quality of the human environment, an EIS shall be prepared. An EIS is a clear, concise, and appropriately detailed document that provides agency decision-makers and the public with a full and fair discussion of significant environmental impacts of the proposed action and reasonable alternatives, and implements the requirement in NEPA §102(2)(C) for a detailed written statement.

Some of the actions normally requiring an EA are projects recommended by the proposed Master Plan (**Table B4**). However, most of the proposed improvements, unless involving extraordinary circumstances, could be evaluated in terms of NEPA compliance using one of the CatEx's listed in FAA Order 1050.1F. In addition, some projects may not require a federal action or federal funding. If a project uses only state/local funding and does not require a federal approval, a state environmental determination would be required rather than an environmental evaluation under NEPA.

TABLE B4
Anticipated Environmental Review for Future Projects
Grand Canyon National Park Airport Master Plan

Recommended Project	Expected NEPA Action
Short-Term Projects	
Install PAPI-4 and REIL on Runway 3	CatEx
Equipment purchase - lighted "X"s	CatEx
Equipment purchase - snow plows and friction trailer	CatEx
Install perimeter fencing in helicopter operating areas	CatEx
Implement No Taxi Islands/MITL at TW "A/B" and "C" intersections	CatEx
Prepare drainage master plan	CatEx*
Conduct water source analysis/study	CatEx*
Construct ADA compliance/renovations to existing terminal building	CatEx
Clear ROFA on west side of Runway 3-21	CatEx
Construct airfield culvert relocations and proper grading	EA
Relocate helicopter parking outside of ROFA (north of terminal area)	CatEx
Construct Runway 3-21 runway shoulders (25 feet wide), a 150-foot runway width correction, and pavement rehabilitation/reconstruction	CatEx
Construct airfield perimeter fencing improvements	CatEx
Replace terminal building generator	CatEx
Remove/relocate portion of perimeter access road north of runway	CatEx

TABLE B4
Anticipated Environmental Review for Future Projects
Grand Canyon National Park Airport Master Plan

Recommended Project	Expected NEPA Action
Intermediate-Term Projects	
Construct blast pads (both runway ends)	CatEx
Replace airfield generator	CatEx
Rehabilitate existing terminal roadways and parking lots	CatEx
Equipment purchase - ARFF truck	CatEx
Equipment purchase - deicing equipment	CatEx
Upgrade perimeter access road on east and west sides of airfield	CatEx or EA
Construct helipad between ARFF facility and terminal apron	CatEx
Construct dedicated Airport maintenance facility	CatEx
Replace VASI with PAPI-4 on Runway 21	CatEx
Construct new replacement terminal building, including vehicular access/parking	EA
Relocate Airport housing	EA
General airfield pavement maintenance	CatEx
Long-Term Projects	
Redevelop existing terminal area	CatEx
Implement self-service fuel farm	CatEx
Extend Runway 3-21 and parallel TW "P" southwest 1,001 feet (relocate navigational aids)	EA or EIS
General airfield pavement maintenance	CatEx

***** Although a CatEx is available for planning studies, implementation of recommended projects as a result of the study is a separate action under NEPA that may require additional analysis.

NEPA – *National Environmental Policy Act*
CatEx – Categorical Exclusion
PAPI - precision approach path indicator
REIL - runway end indicator lighting
MITL - medium intensity taxiway lights
TW - taxiway
ADA - *Americans with Disabilities Act*
ROFA – runway object free area
EA – Environmental Assessment
ARFF - aircraft rescue and firefighting
VASI - vertical approach slope indicator
EIS - Environmental Impact Statement

REFERENCES

Arizona Department of Environmental Quality (ADEQ), Air Quality Division, 2011. *Arizona State Implementation Plan Regional Haze Under Section 308 of the Federal Regional Haze Rule*, January. Available at: http://legacy.azdeq.gov/environ/air/haze/download/haze308.pdf.

ADEQ Leaking Underground Storage Tank (LUST) Database Search Results, report generated June 8, 2017. Available at: http://www.azdeq.gov/databases/lustsearch.html.

ADEQ Underground Storage Tank (UST) Database Search Results, report generated June 8, 2017. Available at: http://legacy.azdeq.gov/databases/ustsearch_drupal.html.

ADEQ website. Emaps - Watersheds. Available at: http://gisweb.azdeq.gov/arcgis/emaps/?topic=watersheds, accessed January 2016.

Arizona Department of Transportation (ADOT) website. Historic Roads and Historic Roads - Driving to the Grand Canyon along Highway 64 brochure. Available at: https://www.azdot.gov/about/historic-roads, accessed June 2017.

ADOT website. Scenic Roads. Available at: https://www.azdot.gov/about/historic-roads/scenic-roads/list-of-scenic-roads/northern, accessed June 2017.

Arizona Game and Fish Department (AGFD) website. Arizona Environmental Online Review Tool. Available at: https://azhgis2.esri.com/, accessed June 2017.

AGFD website. Species of Greatest Conservation Need, California Condor Recovery. Available at: https://www.azgfd.com/Wildlife/speciesofgreatestconservneed/californiacondors/, accessed June 2017.

Cleeland, Teri A., Hanson, John A., Lesko, Lawrence M., Weintraub, Neil S., 1992. *Native American Use of the South Kaibab National Forest*, An Ethnohistoric Overview, March. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5163023.pdf.

Coconino County, Arizona website. ArcGIS Maps, Parks and Natural Areas. Available at: http://www.coconino.az.gov/index.aspx?nid=389, accessed January 2016.

Coconino County, 2015. *Coconino County Comprehensive Plan*, adopted December 15. Available at: http://www.coconino.az.gov/index.aspx?NID=1111.

Federal Aviation Administration (FAA), 2007. Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*, August 28.

FAA, 2015. Order 1050.1F, *Environmental Impacts: Policies and Procedures* (Exhibit 4-1, Significance Determination for FAA Actions), effective date July 16.

Federal Emergency Management Agency (FEMA), 2010. Flood Insurance Rate Map No. 04005C3825G, dated September 3. Available at: http://msc.fema.gov/portal.

Grand Canyon National Park Airport (GCN) Airport Manager, 2015. Personal communication with Coffman Associates, September 2.

Intergovernmental Panel on Climate Change (IPCC). *Fifth Assessment Report*, 2014. Available at: https://www.ipcc.ch/report/ar5/syr/.

Town of Tusayan, 2014. *Tusayan General Plan 2024*, adopted on April 16. Available at: http://tusayan-az.gov/general-plan/.

Town of Tusayan Zoning Code. Available at: http://www.amlegal.com/codes/client/tusayan_az/.

U.S. Department of Agriculture (USDA) Forest Service, Definitions. Available at: http://www.fs.fed.us/air/define.htm.

USDA Forest Service, Kaibab NF website. Tribal Relations. Available at: http://www.fs.usda.gov/main/kaibab/workingtogether/tribalrelations, accessed January 2016.

USDA Forest Service, Southwestern Region, 2014. *Land and Resource Management Plan for the Kaibab National Forest, Coconino, Yavapai, and Mojave Counties, Arizona*, February (corrected May 2015). Available at: http://www.fs.usda.gov/detail/kaibab/landmanagement/planning/?cid=STELPRDB5106605.

USDA Natural Resources Conservation Service (NRCS), Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

U.S. Department of Commerce, U.S. Census Bureau, American FactFinder website. American Community Survey 5-Year Estimates, 2011-2015, Tables DP03, General Economic Characteristics, DP05, Demographic and Housing Estimates, and S2501, Occupancy Characteristics. Available at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml, accessed June 2017.

U.S. Department of the Interior, National Park Service (NPS) website. Interactive map of NPS Wild and Scenic Rivers. Available at: https://www.nps.gov/orgs/1912/plan-your-visit.htm, accessed June 2017.

U.S. Department of the Interior, NPS website. Conservation and Outdoor Recreation website, National Rivers Inventory, Arizona. Available at: http://www.nps.gov/ncrc/programs/rtca/nri/states/az2.html, accessed June 2017.

U.S. Department of the Interior, NPS, 2011. *Draft Environmental Impact Statement for the Special Flight Rules Area in the Vicinity of Grand Canyon National Park*. Grand Canyon National Park, AZ. Available at: https://parkplanning.nps.gov/projectHome.cfm?projectID=28052.

U.S. Department of the Interior, NPS, Grand Canyon National Park, 2015. *Backcountry Management Plan Draft Environmental Impact Statement*, November. Available at: http://parkplanning.nps.gov/document.cfm?documentID=69426.

U.S Department of the Interior, NPS. Grand Canyon website, Frequently Asked Questions. Available at: http://www.nps.gov/grca/faqs.htm, accessed January 2016.

U.S Department of the Interior, NPS. Kaibab NF website, Arizona Trail #101-Tusayan. Available at: http://www.fs.usda.gov/recarea/kaibab/recreation/hiking/recarea/?recid=11691&actid=50, accessed January 2016.

U.S. Department of the Interior, NPS. National Register of Historic Properties website. Available at: http://focus.nps.gov/nrhp/Download?path=/natreg/docs/Download.html, accessed via Google Earth on June 2017.

U.S. Environmental Protection Agency (EPA), Climate Change Division, Office of Atmospheric Programs. *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3*, 2009.

U.S. EPA. *Green Book – Arizona Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants*, as of February 13, 2017. Available at: https://www3.epa.gov/airquality/greenbook/anayo_az.html, accessed June 2017.

U.S. EPA. EJSCREEN website. Available at: http://ejscreen.epa.gov/mapper/index.html?wherestr=Grand+Canyon+National+Park+Airport, accessed June 2017.

U.S. EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013*.

U.S. EPA. My WATERS Mapper website. Available at: http://watersgeo.epa.gov/mwm/, accessed January 2016.

U.S. Fish and Wildlife Service (USFWS) website. Information for Planning and Conservation (IPAC) website, IPAC Trust Resource Report. Available at: http://ecos.fws.gov/ipac/, accessed June 2017.

USFWS. Wetland Mapper website, National Wetlands Inventory. Available at: http://www.fws.gov/wetlands/Data/Mapper.html, accessed June 2017.

U.S. Geological Survey (USGS). *The Ground Water Atlas of the United States*. Available at: http://water.usgs.gov/ogw/aquiferbasics/other_rocks.html.

USGS website. *The National Atlas of the United States*. Shapefiles accessed January 2016.

GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Appendix C

ENERGY AUDIT REPORT

AIRPORT MASTER PLAN

ADOT

Grand Canyon National Park Airport

Grand Canyon, Arizona

ASHRAE Level II Energy Audit Report

Provided by

Quest energy group

August 2016

The intent of this report is to estimate energy savings and potential feasibility at the Client's facility. Detail deemed appropriate has been included in the report. However, this report is not intended to serve as a detailed engineering design document, as the description of the improvements are described for the intent to document the basis of cost estimates and savings and to demonstrate the feasibility to implement the suggested improvements. It should be noted that further design efforts may be required in order to implement or evaluate some or all of the improvements evaluated as part of this report.

The Client may choose to evaluate any advice or direction provided in this report. Under no circumstances will Quest Energy Group, LLC be liable for the failure of the Client to achieve a specified amount of energy savings, the operation of Client's facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of recommended measures.

The recommendations in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, however, the findings are estimates and actual results may vary. Neither Quest Energy Group, LLC nor any of its affiliates makes any warranty, express or implied, or assumes any legal liability of responsibility for the accuracy, completeness, or usefulness of any data, information, method, product or process disclosed in this document, or represents that its use will not infringe any privately-owned rights, including but not limited to, patents, trademarks or copyrights.

Executive Summary

As part of the updated Master Plan's Sustainability Section for Grand Canyon National Park Airport, Quest Energy Group performed a comprehensive energy audit of selected buildings at the Airport to assist in identifying and prioritizing potential energy and water conservation measures (ECMs).

This audit meets or exceeds the Level II requirements established by ASHRAE, which requires a historical analysis of all building utility consumption, efficiency improvement recommendations, and a detailed financial analysis recommendation. Above and beyond the requirements for an ASHRAE Level II Audit, Quest Energy Group developed a full scale energy simulation model using eQUEST software with IPMVP compliant baseline calibration in order to validate energy savings estimates.

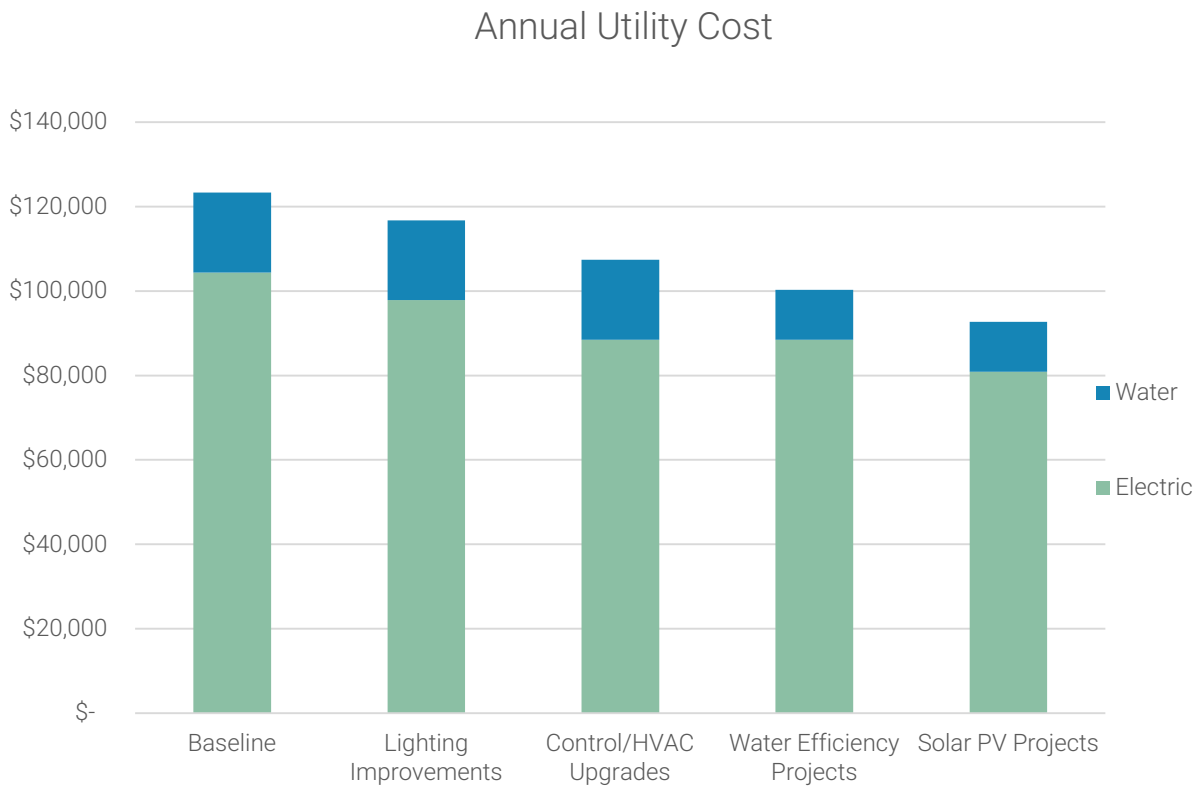
Key Audit Findings

The Arizona Department of Transportation (ADOT) spent over $120,000 on electric and water consumption during 2015 for the buildings analyzed in this study. As part of the overall operation of the property, ADOT operates as a pseudo-water utility by way of pumping and distributing potable water to several commercial and residential customers leasing land and/or buildings on the property. Therefore a significant portion of the energy consumption of the property is dedicated to this function as well as the basic energy requirements of operating an airport property.

The results of the audit yielded the following findings listed below and summarized in the following table and figure. Additionally, individual energy and water conservation opportunities are detailed within each individual building report following this Executive Summary.

- Water conservation upgrades, such as low-flow toilets, showerheads, and lavatory aerators would provide significant water and cost savings, and in most cases, have quick financial returns.
- Upgrading to heat pump technology in older buildings relying on electric heat strips would provide substantial energy savings when HVAC equipment is due for replacement.
- Small cost upgrades in the thermostats could provide immediate savings.
- The water distribution system was designed and operates in a complicated manner of bi-annual deliveries, manual operation, and wasted pumping pressure. At the next remodel of the system, control upgrades and a re-design of the system could provide an opportunity for reduced operating costs.
- Fluorescent lamps are the most prevalent forms of lighting among the buildings, though less efficient lighting technology, such as incandescent and halogen fixtures are still present. There is a significant opportunity to reduce recycling cost and save on lighting energy costs in every building.
- The planned runway lighting LED retrofit will provide excellent energy savings.
- Solar photovoltaic (PV) systems are good option in this climate, and there are a variety of applications that would provide long term cost savings. This is further discussed in the next section.

#	Run	Utility Consumption		Utility Costs			Savings
		Electric	Water	Electric	Water	Total	
		(kWh)	(gal)	($)	($)	($)	%
0	Baseline	507,782	701,663	$ 104,354	$ 18,945	$ 123,298	
1	Lighting Improvements	485,595	701,663	$ 97,830	$ 18,945	$ 116,774	5.3%
2	Control/HVAC Upgrades	418,028	701,663	$ 88,437	$ 18,945	$ 107,381	12.9%
3	Water Efficiency Projects	418,028	438,226	$ 88,437	$ 11,832	$ 100,269	18.7%
4	Solar PV Projects	335,440	438,226	$ 80,888	$ 11,832	$ 92,720	24.8%
Incremental Savings Relative to Previous Measure							
1	Lighting Improvements	22,187	-	$ 6,524	$ -	$ 6,524	5.3%
2	Control/HVAC Upgrades	67,567	-	$ 9,393	$ -	$ 9,393	7.6%
3	Water Efficiency Projects	-	263,437	$ -	$ 7,113	$ 7,113	5.8%
4	Solar PV Projects	82,588	-	$ 7,549	$ -	$ 7,549	6.1%
Total Savings vs Baseline							
	Total:	**172,342**	**263,437**	**$ 23,466**	**$ 7,113**	**$ 30,579**	**24.8%**



Solar Energy Discussion

The climate at the Grand Canyon offers an ideal location for solar energy production from solar PV systems. The plentiful sunshine and mild temperature ensure lots of productive days at high levels of efficiency (PV panels become less efficient with higher temperatures). There is already some solar PV on site; the ARFF Station has a 4.6 kW system that was installed as part of initial construction that provides approximately 6% of the building's annual energy needs.

Other sections of this report will cover some additional PV opportunities and their potential economic benefits. One general concept worth discussion is the potential addition of a large scale (1 megawatt (MW) or more) PV project on some of the available land within the airport. The following barriers would likely be encountered with such an endeavor:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- Taxpayer / public approval of funding
- Development/construction issues
- Utility connectivity and / or production arrangements
- Other airport operational constraints

In similar circumstances, other businesses have elected to form a power-purchase agreement (PPA) with a third-party developer. This would theoretically enable the airport to lease the land to a developer (solar services provider), who would build, own, and maintain the solar equipment. The solar services provider could then sell the produced energy back to the airport at a set rate. The advantage of this approach is that the solar services provider could take advantage of any tax credits not available to ADOT, thus lowering the net cost of the project, while potentially avoiding or mitigating some of the barriers mentioned above.

There is sufficient area to generate 100% of the airport's energy needs, plus much more, potentially. The figure depicted at right shows the approximate area for a 1-2MW solar array (capacity will depend on module spacing). It would only take about 300 kW to complete displace current airport usage, and less if some of the recommended efficiency measures are implemented.

A fixed tilt, ground mount PV system would produce approximately 1,600 kWh/kW of installed capacity per year. Therefore, a 2MW array would produce 3.2 million kWh, which at a retail cost of $0.07/kWh, is $224,000 in electric energy.

A tracking PV system can also sometimes be feasible for large PV systems. This system will track the position of the sun east to west along an axis. This system has a higher first cost and maintenance cost, but will produce 20-30% more energy. Azimuth Energy, which provides turn-key solar installs, was consulted for this report and can be contacted for more information about large-scale PV projects.

Methodology

The primary focus of the site audit performed was to survey the existing envelope, lighting, domestic hot water (DHW) and HVAC equipment in the buildings and provide a summary of condition, age and life of the units, and overall performance level. This audit is composed of a site visit conducted by Craig Green on May 20th 2016 as well as several phone conversations with site personnel.

Based on the information collected from the site audit, a detailed simulation model was developed using eQUEST (DOE2.2) software to analyze the baseline energy usage of the buildings. The methodology and assumptions in the modeling process are detailed below. A graphical depiction of the model is shown in each building report.

- Detailed energy models of the major energy consuming buildings were constructed based on drawings, publically available information, and/or field notes during the audit. Site inspections included verifying wall and roof constructions, glass types, lighting equipment, HVAC, DHW, and other major energy using equipment.
- Equipment operation schedules were based on operational, occupancy, and usage data and supplemented through interviews with the operations and maintenance staff and field observations.
- Lighting fixtures and schedules were input into the models based on field data.
- Representative internal equipment loads were input into the model by space type (Office, Retail, etc.).
- HVAC and DHW equipment was added to the model according to drawings and field observations, and each zone was assigned to the appropriate HVAC system. Equipment efficiencies were based on nameplate data and/or mechanical plans. Operation schedules and controls were dialed in according to maintenance staff interviews.

Project Information

Project Name & Location

Grand Canyon National Park Airport
Grand Canyon, AZ 86023

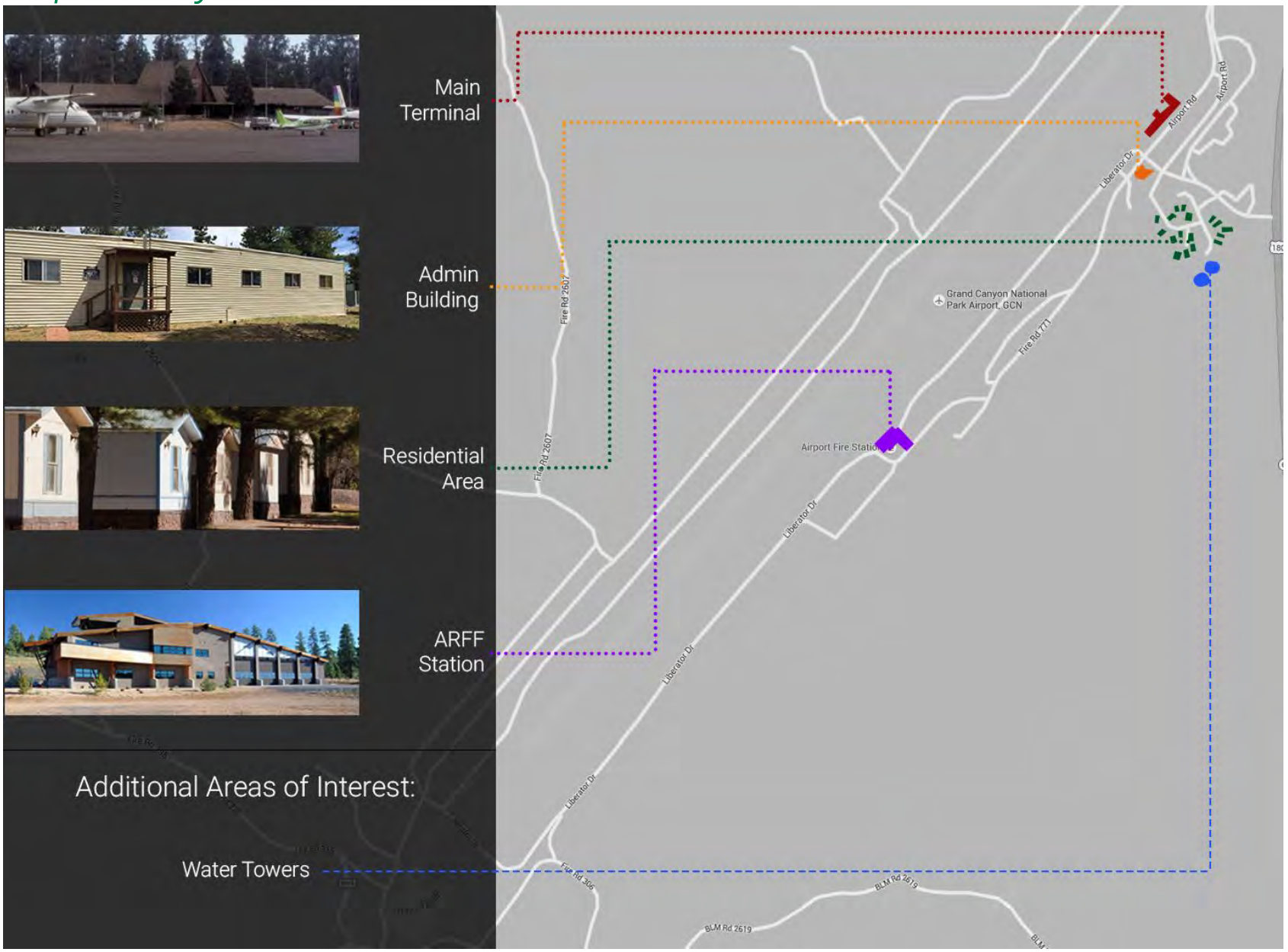
Airport Contact

Arizona Department of Transportation
Mike Thomas
871 Liberator Drive
Grand Canyon, AZ 86023
Phone: 928-638-2446
Email: mthomas2@azdot.gov

Energy Auditor and Modeling Consultant

Quest Energy Group, LLC
Craig Green, PE
1620 W. Fountainhead Pkwy, Suite 303
Tempe, AZ 85282
Phone: 480-467-2480
Email: craig@questenergy.com

Airport Layout



Baseline Utility Summary

Utility bills for 2015 and prior were collected and analyzed for all buildings in scope. A summary of all buildings' annual utility cost is provided below.

As shown, water is very nearly as expensive as electricity, which is very unusual for commercial buildings, even for heavy-water users. According to local sources, the regional water costs are nearly 2 times more than the most expensive municipality in the United States.

Meter	Total Utility Use (Average 2014-2015)		
	($)	Usage	unit
Electric	$83,038	510,582	kWh
Water*	$70,455	2,621,623	gallons
Total	**$ 153,493**		

Meter	Total Utility Cost	
	2014	2015
Electric	$ 87,087	$ 78,989
Water*	$ 58,194	$ 82,715
Total	**$ 145,281**	**$ 161,704**

* Usage includes sub-metered water from business situated on the airport property

Figure 1 – Utility Cost Summary

Baseline Model Calibration

Calibration Process

After a detailed baseline model is constructed for each building, it is important to adjust and validate the accuracy of the model results by comparing it with the real-life building behavior. This process, known as calibration, is outlined in the paragraph and Figure below.

Calibration of an energy model is initiated by running the model simulation using the actual weather data from the site over an one-year performance period. The simulated energy and power outputs are then compared to the historical utility data for the same period, and the model inputs are refined to make the simulated behavior match the actual data as closely as possible. Model input adjustments are typically made on the basis of sub-metered data, trend data, and operational details provided by the building staff. This iterative process is repeated until the accuracy of the model is within reasonable tolerances (+/- 5% MBE as recommended by IPMVP).

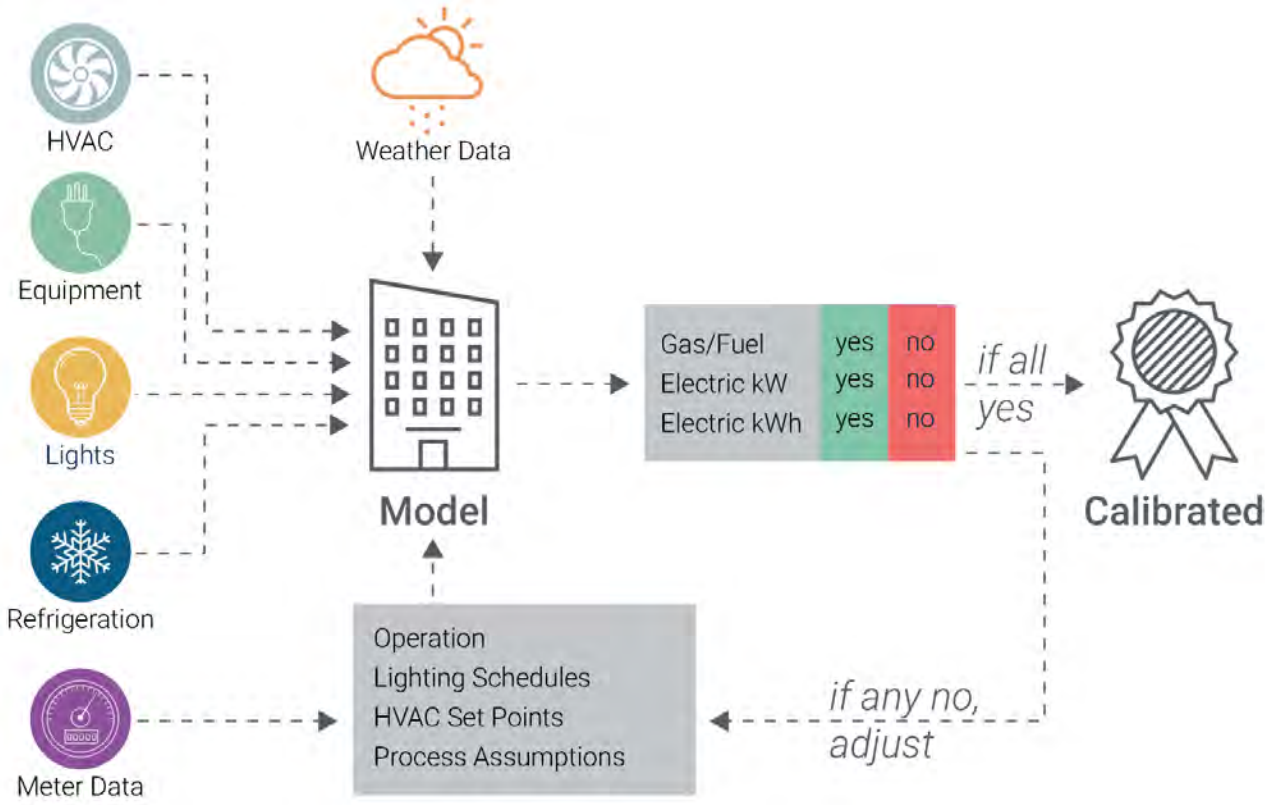


Figure 2 – Calibration Process Flowchart

Weather Analysis

A custom weather file was developed using data from the nearest weather station (Grand Canyon Airport) for the one-year analysis period (2015) in order to accurately capture the local conditions for calibration. As shown below, high temperatures can reach nearly 90°F, while low temperatures can get into the teens. This results in a building conditioning profile that is heating dominated.

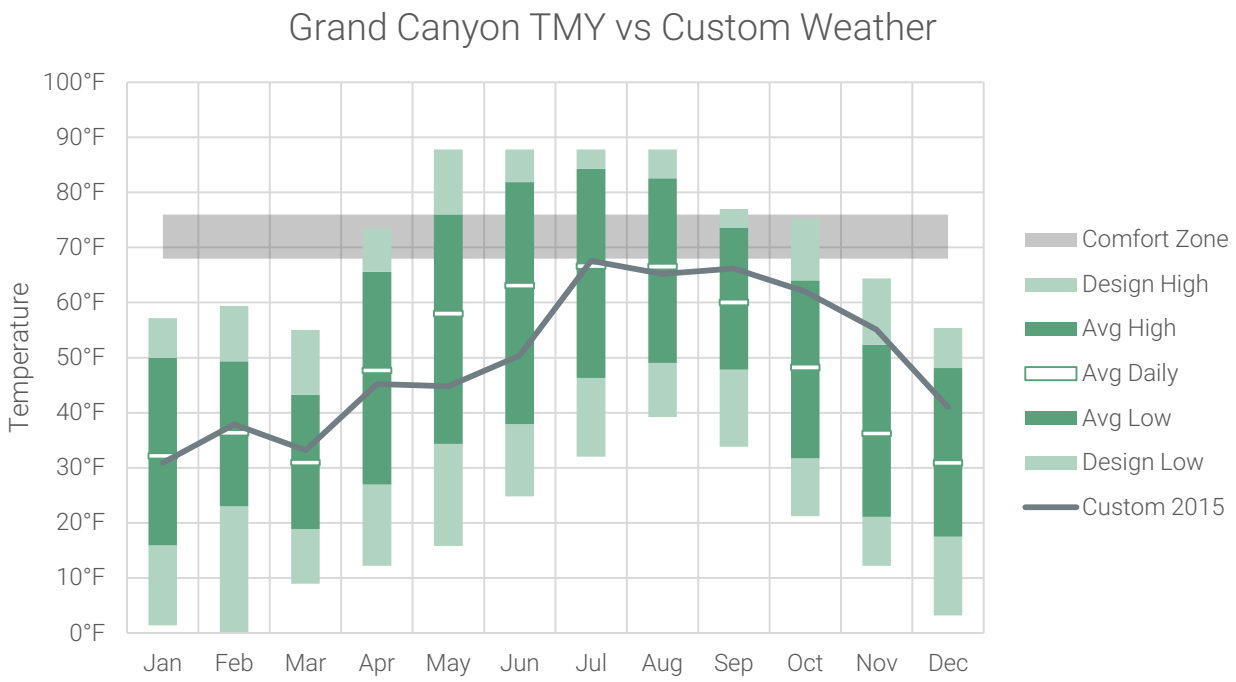


Figure 3 – Weather Summary – Grand Canyon National Park

The local weather at the Grand Canyon can be further characterized using "Degree Days", specifically Cooling Degree Days above 65°F (CDD65) and Heating Degree Days below 65°F (HDD65), shown in the below figures. A Degree Day is a measure of how much (in degrees), and for how long (in days), outside air temperature was higher/lower than a specific "base temperature" or "balance point"(65°F in this case). This illustrates the magnitudes of heating and cooling energy within a building in a given climate.

	KGCN 2015			
	Avg High	Avg Low	CDD 65	HDD 65
Jan	44.0	19.3	0	1033
Feb	55.6	23.0	0	720
Mar	41.9	24.6	0	985
Apr	62.8	27.2	0	600
May	61.1	27.7	0	639
Jun	64.2	34.6	0	468
Jul	83.4	48.9	83	47
Aug	80.4	47.8	21	48
Sep	80.6	50.6	50	32
Oct	76.3	47.4	2	99
Nov	69.9	41.2	0	283
Dec	52.4	31.3	0	719
	64.4	35.3	155	5672

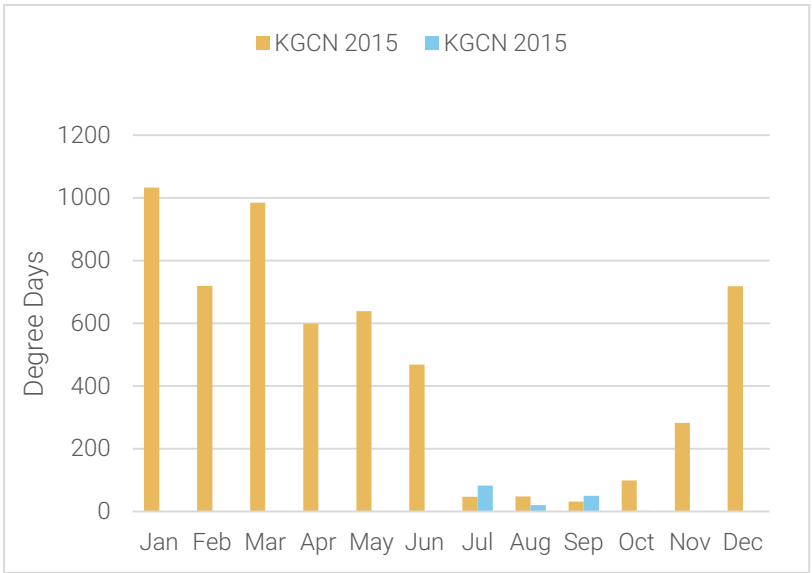


Figure 4 – Weather Profiles - Grand Canyon National Park

Baseline Energy Use Analysis & Calibration

The figures below illustrate the simulated eQUEST electrical energy usage predicted throughout the one-year period (2015) as compared to the actual historical utility data. The black line represents actual utility data provided by the Airport's electric and propane meters for the same one-year period. The model was calibrated to within IPMVP guidelines for calibration (MBE <±5%, Cv(RSME) <15%).

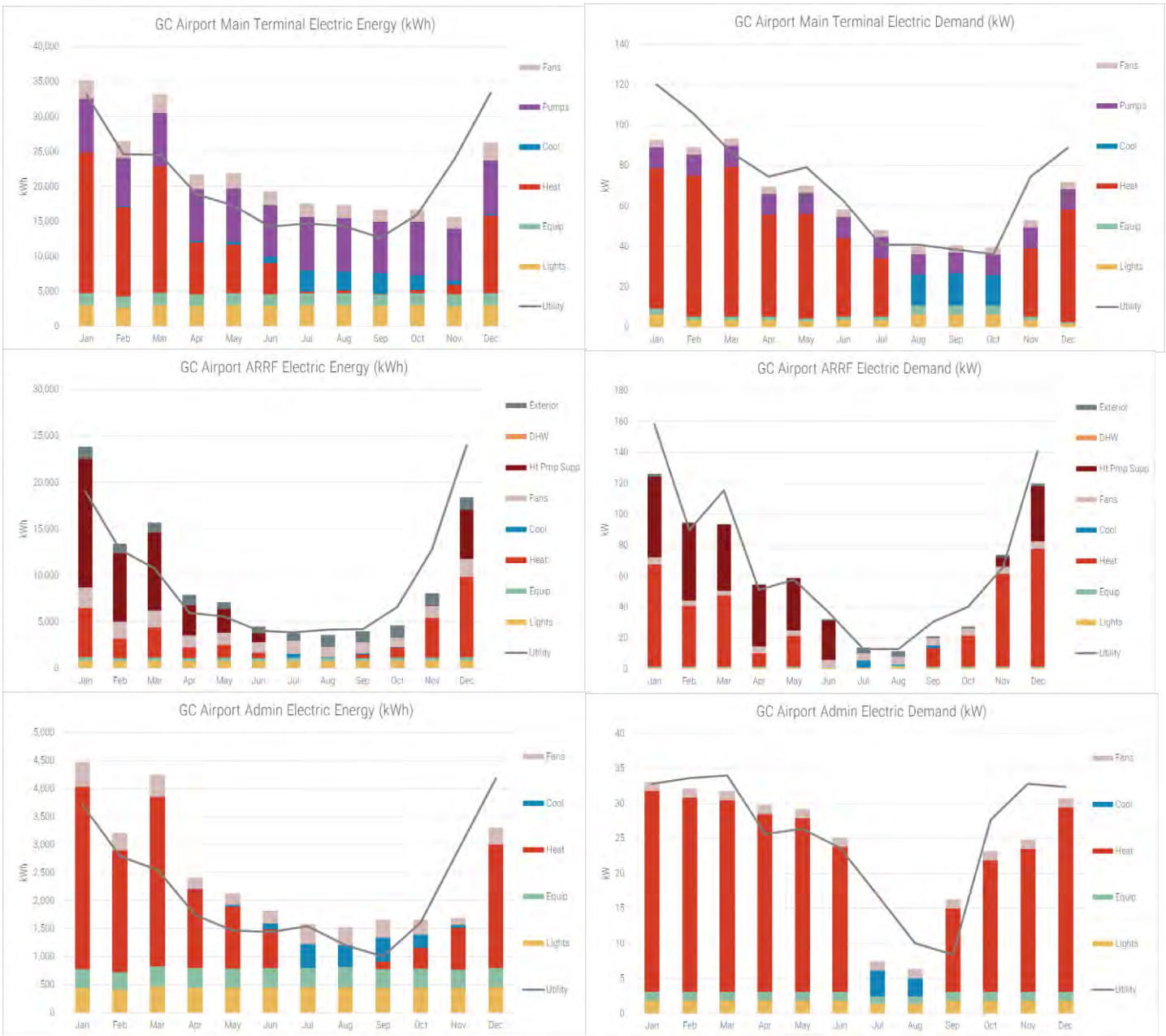


Figure 5 – Baseline Electric & Propane Energy Calibration

The general shape of most buildings' usage shows the high winter heating loads as well as a relatively minimal cooling load in the summer and a flat, weather-independent base load consisting of plug-in equipment and lights. Relative spikes in utility usage can generally be attributed to anomalies in the abnormal usage/occupancy, and differences occur due to the simulation inputs' requirements for set schedules.

Baseline Water Use Analysis & Calibration

Similar to the energy use data, Quest analyzed the provided 2015 and prior water use data for the applicable buildings. Using actual airport use and equipment data as well as industry standard assumptions for usage duration and water use intensities, a baseline water use profile was determined and compared against actual data. These comparisons are shown below in the following graphs that compare actual water use to simulated end uses of water.

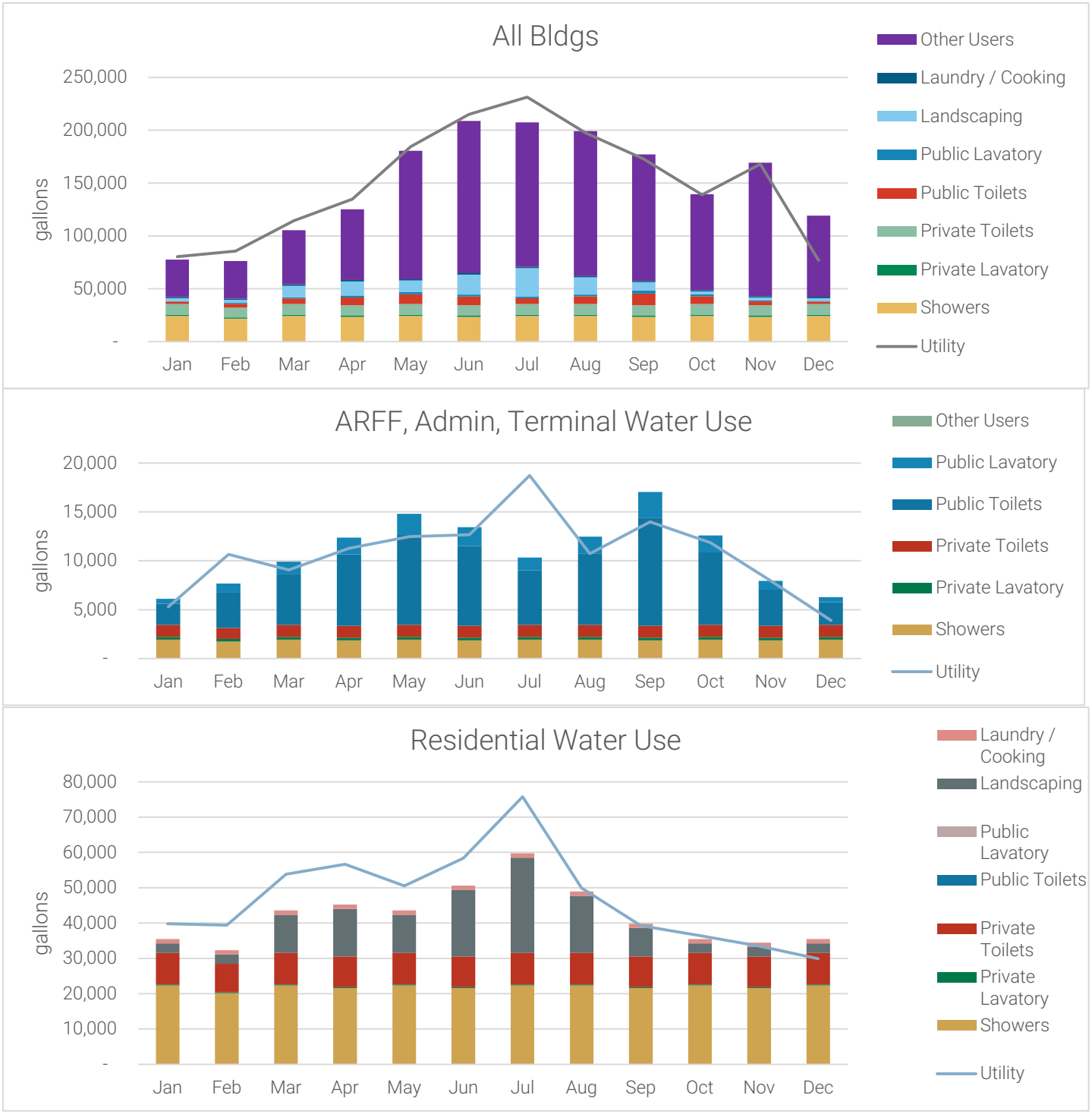


Figure 6 – Baseline Water Calibration

Baseline Water Use Discussion & Recommendations

The following conclusions and recommendations were derived from the water use analysis:

- Shown below, residential usage represents the majority of the water use ADOT pays for
  - Due to this fact, its recommended water conservation measures and practices are implemented at ADOT covered residences. This is detailed further in the report.
- Shown below, other airport property users represent the majority of overall airport water use. Unless the sale of water to these tenants is profitable (it's assumed this is a passed-cost), it's recommended that tenant water-conservation practices are encouraged on some level, as the increased usage may increase ADOT's overall electric use, as well as reduce the stored capacity for a fire-suppression event.

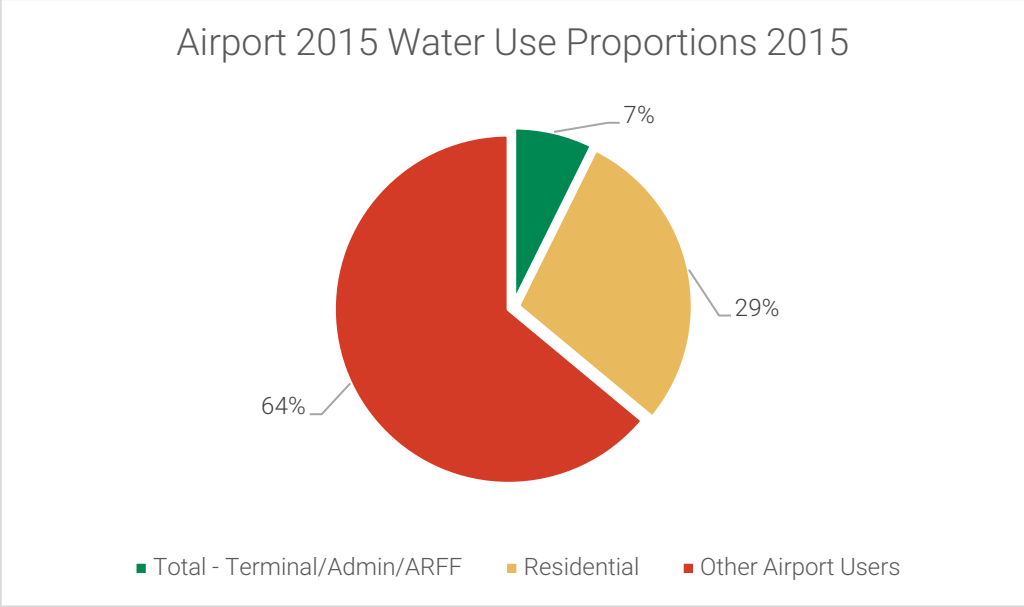
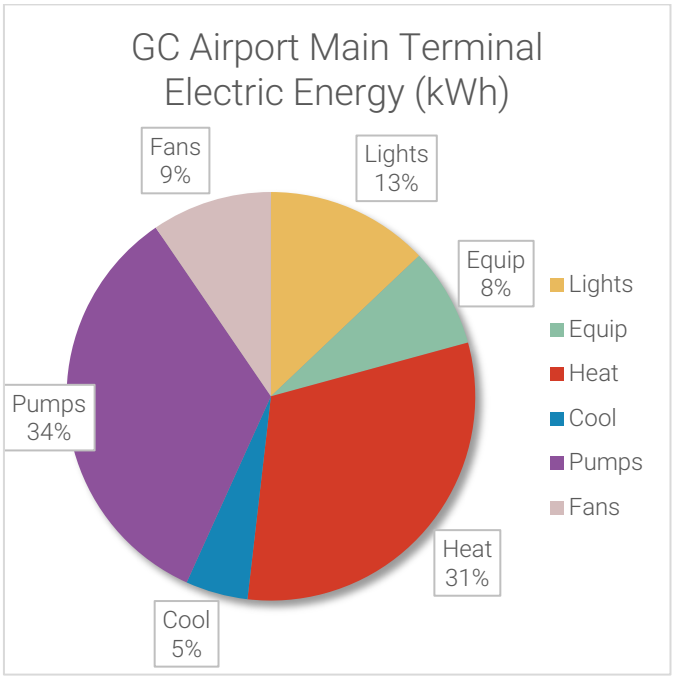


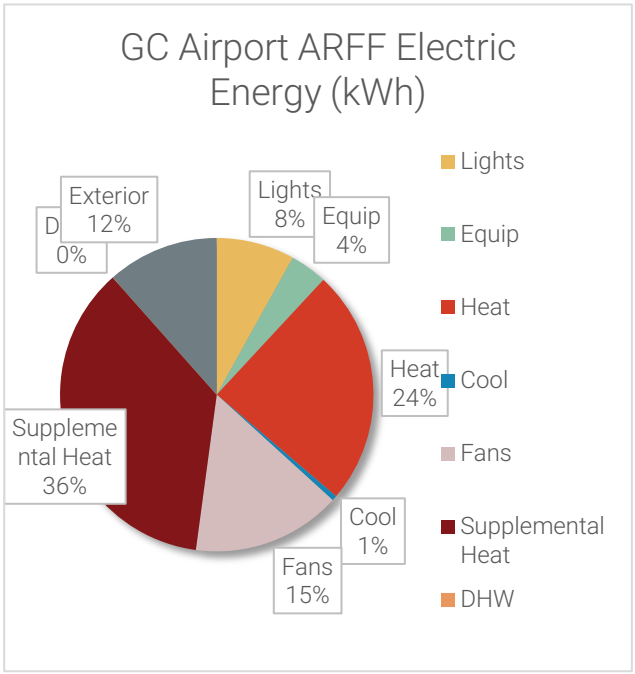
Figure 7 – Baseline Water Use Breakdown by End-User

Baseline End-use Analysis

As a result of the regional climate, there is a substantial heating load in the winter. The terminal's water room equipment also makes up a large percent of the energy use. The generally cool climate of Northern Arizona keeps cooling minimal.

The remainder of the energy cost consists of interior and exterior lighting, plug loads, and ventilation and distribution equipment.





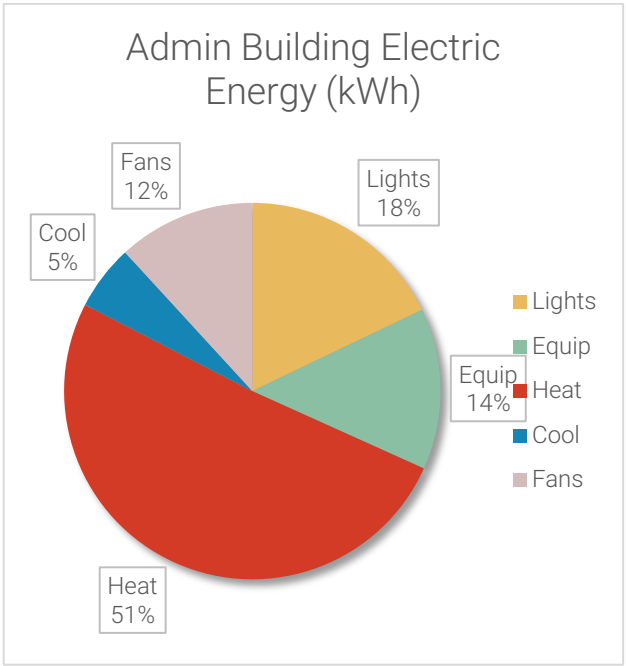


Figure 8 – Baseline Energy Breakdown by End-Use

Building Reports

Main Terminal

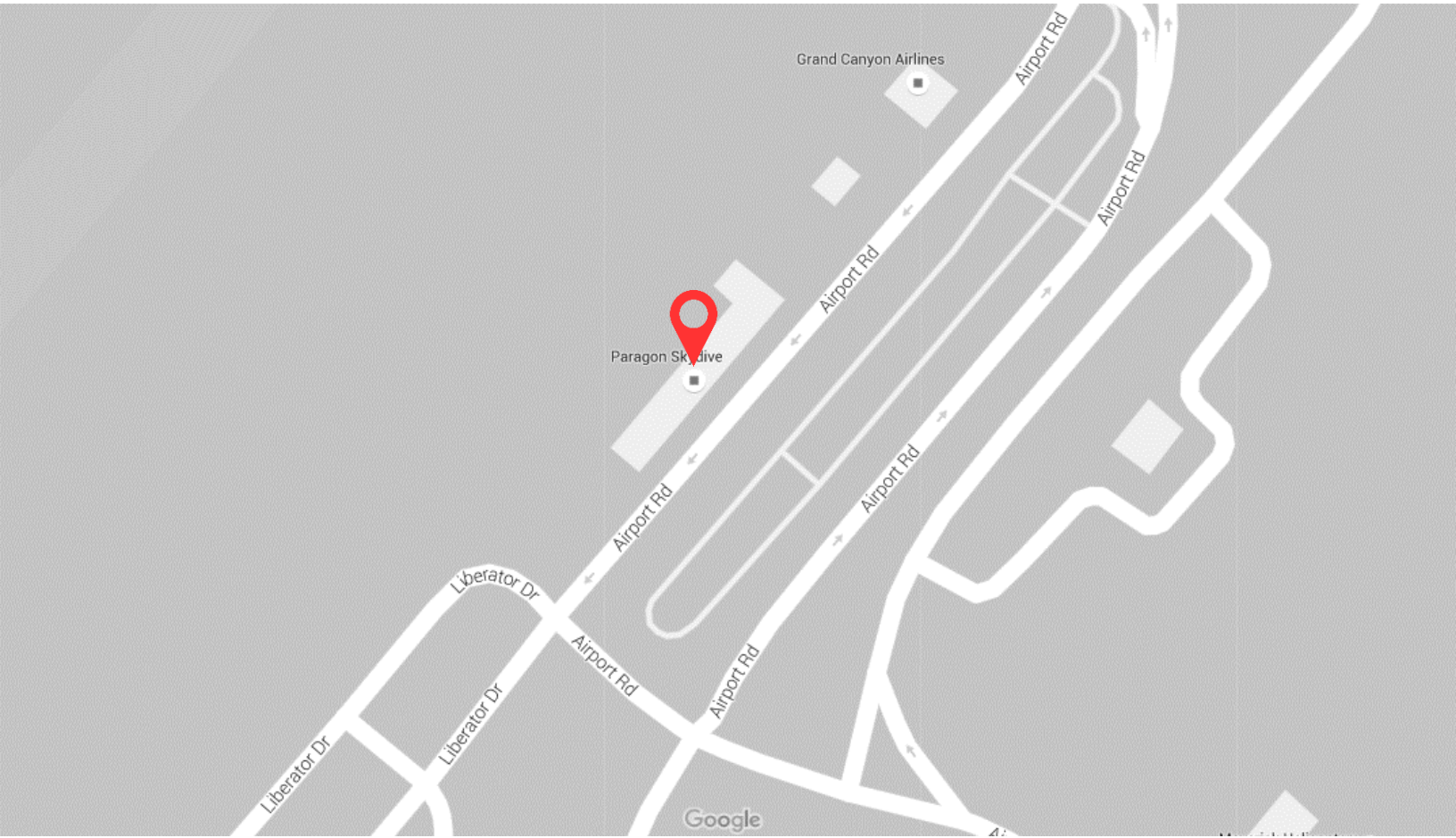
ARFF Station

Administration Building

Other Airport Electric Users

Main Terminal

Main Terminal



Building Description

The Grand Canyon National Park Airport Main Terminal building is a 14,000 A-Frame structure located on the main drive of the Airport property. This building features a lobby and gift shop space, passenger holding areas, ticketing and office support spaces. Additionally, an add-on part of the building houses the pumping, treatment and control equipment for the Airport's water distribution infrastructure. A discontinued water treatment center is included in this space as well; this equipment was once used to treat rainwater from the runway. The construction of the terminal is wood framed with an attic roof and dual pane windows. The building was originally constructed in the 1950's. According to operations staff, the south wall of the terminal is largely un-insulated. The building is heated and cooled with a couple of 10 ton split system air-conditioners with electric heat strips.

Square Footage:	14,000
Stories:	1
Year Built:	1950's
Occupancy:	Airport
Construction:	Wood Framed
Heating:	Electric Heat
Cooling:	Air-Conditioning (AC)
Other Enduses:	Pump Center

Operational Schedules

- Occupied Year Round
  - 6am-7pm (Winter)
  - 6am-8pm (Summer)
- Internal load estimates derived from site observations and staff interviews (additionally supplemented with California Utilities standard guidelines).

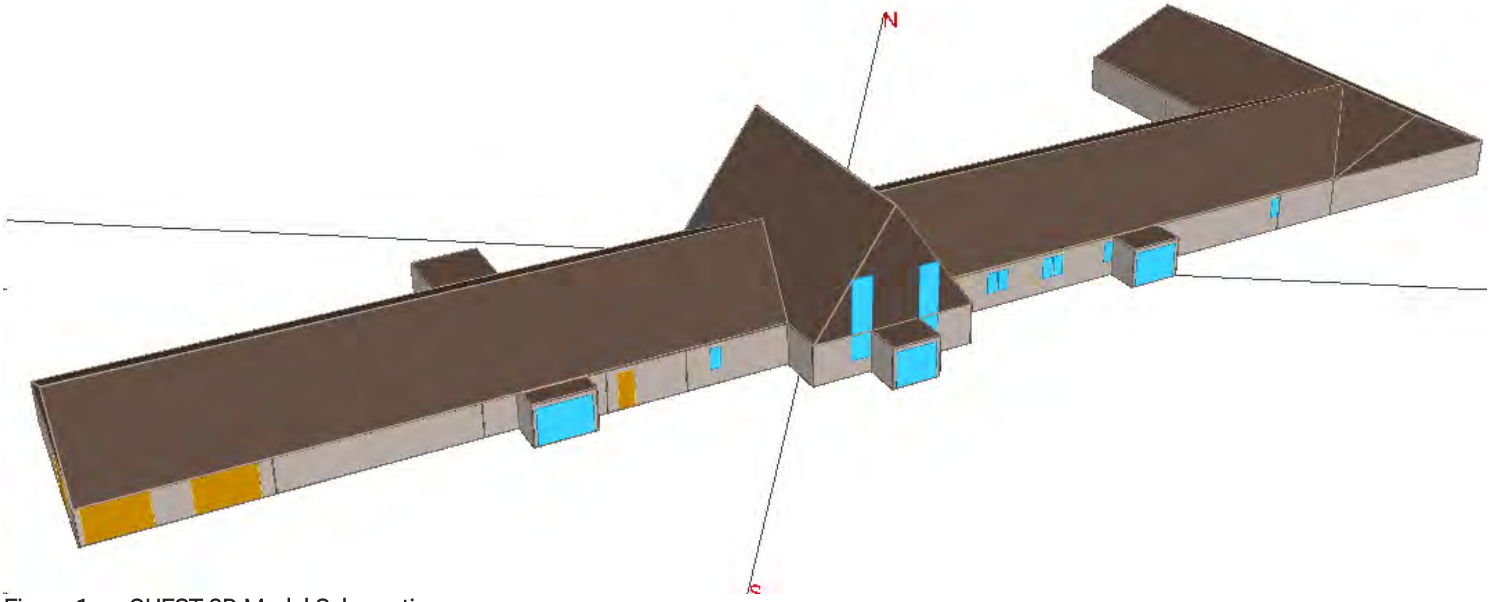


Figure 1 – eQUEST 3D Model Schematic

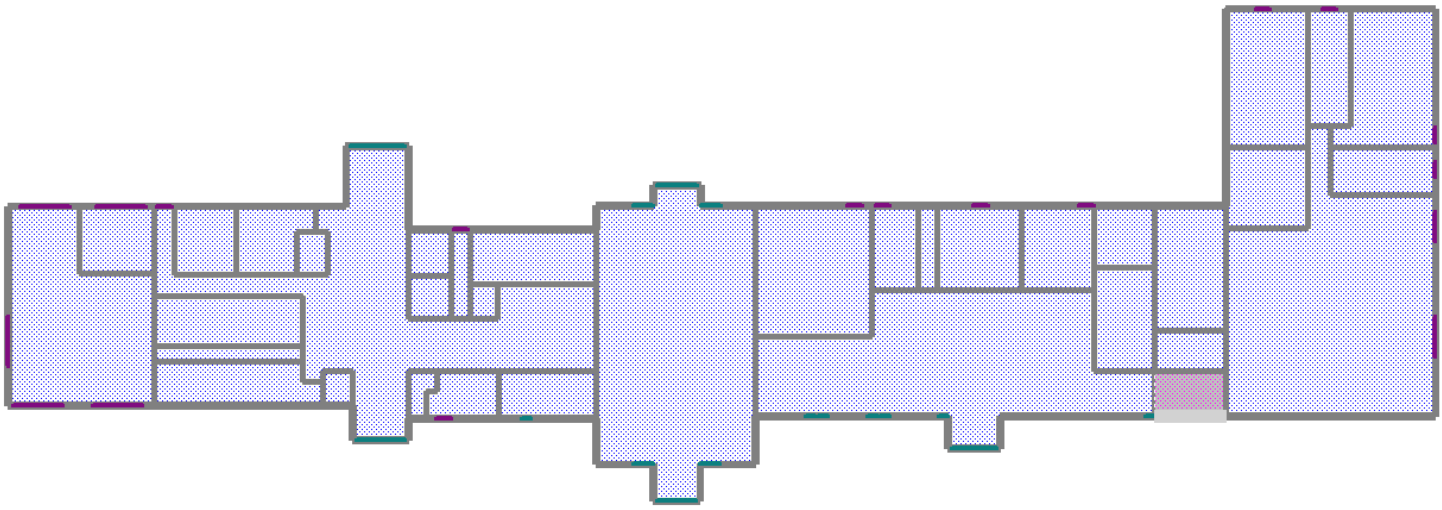
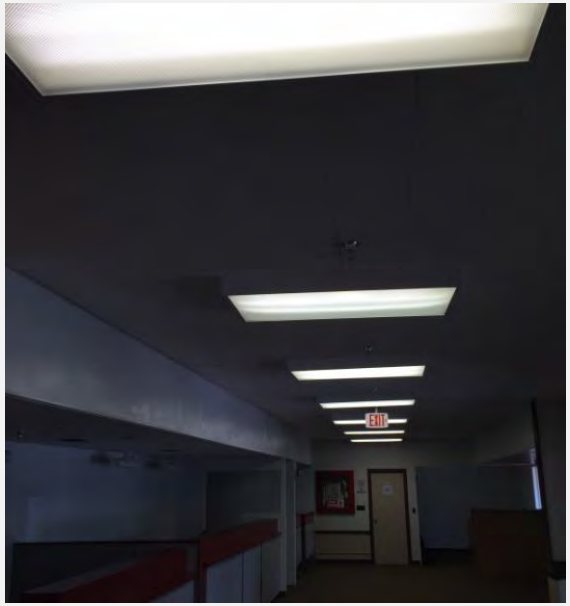


Figure 2 – eQUEST 2D Floorplan Schematic

Energy Conservation Measures

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T01	Insulation Exterior Walls	According to Airport personnel, the south wall of the terminal building is not insulated (wood framed only). 	Adding R-13 batt insulation in uninsulated areas. If 2x6 cavities exist, use R19 batt insulation. Caulk and seal all other penetrations to reduce building leakiness.	Costing was roughly estimated at $15,000. A detailed cost estimate would be required from a general contractor to estimate the materials and equipment to remove and replace exterior wall material.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T02	LED Lighting Upgrade	The majority of lighting in the terminal is 4' T8 fluorescent fixtures. Some areas utilize screw-in compact bulbs. The lobby was found to have less efficient halogen lights in some of the can fixtures. 	Replace interior lighting with LED fixtures. Use 8-14W A-Lamps to replace CFLs. For cost efficiency and safety, use LED-T8 replacement tubes compatible with fluorescent ballasts in cases of linear T8 troffers and strip fixtures for cost efficiency. If lighting levels are found to be acceptable, some of the 3 and 4 lamp T8 fixtures may be able to be reduced to 2 or 3 lamp LED fixtures. Utilize new fixtures only when deemed aesthetically or electrically necessary. Utilize other specialty lamps/bases as needed.	Lighting power densities in the existing model are reflective of site findings. The reduced lighting power due to lower wattage LED lighting fixtures was simulated. Costing information from Crescent Electrical Supply Co. was used. This information can be found in the Appendix.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T03	HVAC Upgrade	The current split system condensing units and their indoor air-handlers are at the end of their useful life. The current units are 10.3 EER units with electric heat. Per airport personnel, 10% outside air is brought in through louvers. Per airport personnel, they will be replaced with packaged roof-top heat pumps. 	Quest recommends the current plan for adding the packaged rooftop heat pumps with the following specific details: • Select a high efficiency heat pump. 12.0 EER cooling efficiency and 3.4 COP heating efficiency are good starting points. • Utilize an air-side economizer, which allows the unit to bring in 100% OA when outdoor conditions allow for free-cooling. Make sure the building can extract the excess outdoor air to avoid excessive pressurization. • Utilize CO_2 sensors in the return air stream to keep OA levels minimum (shut) unless necessary to improve ventilation. With the several outside doors, plenty of OA will enter the building as is, and there would be little need to bring in extra OA. The CO_2 sensor will ensure the indoor air quality remains safe.	Average OA ventilation was assumed to be required only 2% of the time. A standard dry-bulb economizer control was assumed. Costing listed is the assumed cost premium for the economizer (typically ~$1,000), high efficiency option (typically ~$500/ton), and CO_2 sensors (~$1500/ea)

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T04	Reduce Infiltration	The three (3) south entry doors are motion controlled on the exterior of a vestibule, which contains no secondary door to stop entering air. As a result, any passing or entering people open the door wide, allowing (mostly) cold air to enter the building. 	Adding secondary doors on the other side of the vestibule would prevent much of the outside air from rushing into the terminal. Alternatively, air-curtains could be added that would, ideally, be equipped with a temperature sensor to restrict operation when it's acceptable to have OA enter the building.	Its assumed infiltration would be reduced by 20% on the three doors. $1,000 per door was assumed for costing, though this can vary depending on specific airport requirements.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T05	Water System Improvements	The terminal's water system room houses the pumping, control, and treatment equipment to distribute water to the various buildings on the airport property. It involves a complicated delivery system that features bi-annual water deliveries from the local water provider, Hydro. During delivery water is pumped through an underground 375,000 gallon storage tank, up to two (2) 1,500,000 gallon storage tanks on a hill above the Admin building. During normal operation, water is periodically released from the storage tanks to maintain the levels at the underground tank. Water is recirculated and chlorinated within this tank. When about to go out to distribution, the water is added to a pressurized (via a small air compressor) storage tank that gives the water enough pressure to reach the end buildings. At least two (2) 20HP pumps provide recirculation and pressurization functions during normal operation. Two (2) large 150HP pumps are in place to provide high water volume in the case of a fire. They are rarely used for that purpose, but are exercised monthly.	According to some of the airport operators, this complicated system could be simplified by utilizing the existing pressure from the elevation of the storage tanks. Utilizing automated controls to regulate the release of water along with variable speed drives to maintain a constant water pressure was the main recommendation from staff. This solution offers decent cost saving opportunities, but likely comes with a very expensive design and implementation cost. This should be considered only with a larger system upgrade project. 	It was estimated that 80% of recirculation pump energy as well as air compressor energy could be eliminated with this project. Costs for implementation are largely unknown. Detailed engineering design would be needed to determine materials, equipment, and other upgrades.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T06	Low-Flow Toilets	The existing toilets in public restrooms have a water efficiency rating of 1.6 GPF. 	These toiles are frequently used by airport passengers. Due to the high regional cost of water ($0.027/gal) utilizing low-flow 1.0 GPF toilets would provide a substantial cost savings. This measure offers moderate economic return based on water cost savings. However, there is very little incremental cost above a standard efficiency toilet. Therefore, the optimum economic situation for replacement occurs when the restroom is renovated or a toilet is due for replacement.	Flush rates was estimated based on passenger data, assuming 80% of visitors using the restrooms. A $400/toilet cost was assumed based on regional plumbing costs and typical high performance toilets. A high-performance toilet should be utilized to ensure minimal customer complaints and/or increased custodial workloads. The water savings would have an associated electrical savings for the airport as pumping requirements would be reduced. This is difficult to quantify and not included to enable a conservative estimate.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T07	Low Flow Faucet Aerators	The current faucets have a timed function that requires the user to press a button to get water for a few seconds to wash their hands. However, the faucets emit 2.2 GPM in flow. 	Replacing the current aerators with low-flow 0.5 GPM aerators would provide a significant water savings at minimal cost.	Usage was estimated based on passenger data, assuming 80% of visitors using the restrooms. $10 per aerator is assumed for eight (8) sinks. It's possible this cost could be lower. The water savings would have an associated electrical savings for the airport as pumping requirements would be reduced. This is difficult to quantify and not included to enable a conservative estimate. Normally, there is some hot water heater savings on this measure, but the hot water is not connected on these sinks.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
T08	30kW Solar PV System	The front of the terminal building faces southeast with a pitched roof. The northern (passenger holding/water room) side of the building's roof is largely unobstructed. 	If the terminal building will be used for the foreseeable future, a photovoltaic (PV) solar system can be installed on the northern portion of the building, and possibly some areas of the other sides of the building. A 30kW system would potentially fit on the roof, generating approximately 45,000 kWh/yr in renewable energy. This would equate to roughly $3600 in annual energy savings. The National Renewable Energy Laboratory's (NREL) PVWatt calculator was used in sizing the area for the solar system. Because the water equipment is always running, there would be no concern with generating more than building's energy demands and dealing with utility buy-back issues.	It's assumed that due to the off-south orientation, 1500 kWh/kW of generation is possible (~1650-1700kWh/kW is possible for south orientation). A cost of $2.75/W is assumed for the installed cost. Like all PV projects, the simple payback on the project is not good (22 years), but advanced economic models have shown positive cash-flow within 10 years once the various economic factors are incorporated in the analysis. A good PV system has a 25 year warranty. Azimuth Energy was consulted for guidance and budgetary pricing.

Analysis Results

Economic Results Summary

Results of the analysis show that substantial savings can be achieved if the recommended envelope, lighting, mechanical and plumbing measures are implemented. Key findings from the analysis include:

- Major HVAC savings are achievable with new high efficient units and reducing the ventilation and infiltration loads.
- When due for upgrading, re-designing the water plant operation and adding proper controls will save a significant amounts of energy.
- Lighting energy can be reduced significantly. Utility incentives and disposal fee reductions will improve the return on investment.
- Significant water savings is achievable with low water use toilets and new faucet aerators.
- The orientation of the building and local climate make a solar PV system a good choice for long term cost savings.

Economic results are summarized in the table below. Estimated implementation costs for each measure are summarized in the Appendix.

ECM	Measure Description	Estimated Initial Cost	Estimated Utility Savings	Estimated APS Incentive	Simple Payback (Yrs)
T01	0+Insulate Walls	$ 15,000	$ 387	$ 458	37.58
T02	T01+LED Lighting	$ 3,211	$ 947	$ 1,272	2.05
T03	T02+HVAC Upgrade	$ 15,000	$ 5,281	$ 1,200	2.61
T04	T03+Reduce Infiltration	$ 3,000	$ 1,589	$ 1,012	1.89
T05	T04+Water System Improvement*	$ 50,000	$ 5,394	$ 7,468	9.27
T06	T05+Low Flow Toilets	$ 2,800	$ 739	$ -	3.79
T07	T06+Low Flow Faucet Aerators	$ 80	$ 360	$ -	0.22
T08	T07+30kW PV System**	$ 82,500	$ 3,685	$ -	22.39

Figure 3 – Economic Results Summary

* Placeholder cost. Should be priced during planned significant replacement or upgrade project.
** A long-term cash-flow analysis should be considered as opposed to the Simply Payback method. This should include such factors as financing, tax, module degradation, and maintenance costs.

Detailed Annual Results

Detailed annual results are shown in the Tables and Figures below. The top half of the table represents annual energy costs and consumption for each measure. The second half of the table shows the incremental savings for each measure.

#	Run	Utility Consumption		Utility Costs			Savings
		Electric	Water	Electric	Water	Total Cost	
		(kWh)	(gal)	($)	($)	($)	%
0	Baseline	275,722	90,210	$ 29,291	$ 2,436	$ 31,727	
T01	0+Insulate Walls	271,555	90,210	$ 28,904	$ 2,436	$ 31,340	1.2%
T02	T01+LED Lighting	259,988	90,210	$ 27,957	$ 2,436	$ 30,393	4.2%
T03	T02+HVAC Upgrade	206,707	90,210	$ 22,676	$ 2,436	$ 25,112	20.8%
T04	T03+Reduce Infiltration	197,507	90,210	$ 21,087	$ 2,436	$ 23,523	25.9%
T05	T04+Water System Improvement*	129,617	90,210	$ 15,693	$ 2,436	$ 18,129	42.9%
T06	T05+Low Flow Toilets	129,617	62,853	$ 15,693	$ 1,697	$ 17,390	45.2%
T07	T06+Low Flow Faucet Aerators	129,617	49,517	$ 15,693	$ 1,337	$ 17,030	46.3%
T08	T07+30kW PV System**	84,617	49,517	$ 12,008	$ 1,337	$ 13,345	57.9%
Incremental Savings Relative to Previous Measure							
T01	0+Insulate Walls	4,167	-	$ 387	$ -	$ 387	1.2%
T02	T01+LED Lighting	11,567	-	$ 947	$ -	$ 947	3.0%
T03	T02+HVAC Upgrade	53,281	-	$ 5,281	$ -	$ 5,281	16.6%
T04	T03+Reduce Infiltration	9,200	-	$ 1,589	$ -	$ 1,589	5.0%
T05	T04+Water System Improvement*	67,890	-	$ 5,394	$ -	$ 5,394	17.0%
T06	T05+Low Flow Toilets	-	27,357	$ -	$ 739	$ 739	2.3%
T07	T06+Low Flow Faucet Aerators	-	13,335	$ -	$ 360	$ 360	1.1%
T08	T07+30kW PV System**	45,000	-	$ 3,685	$ -	$ 3,685	11.6%
Total Savings vs Baseline							
	Total:	191,105	57,975	$ 17,283	$ 19,528	$ 18,429	57.9%

Figure 4 – Annual Results Summary

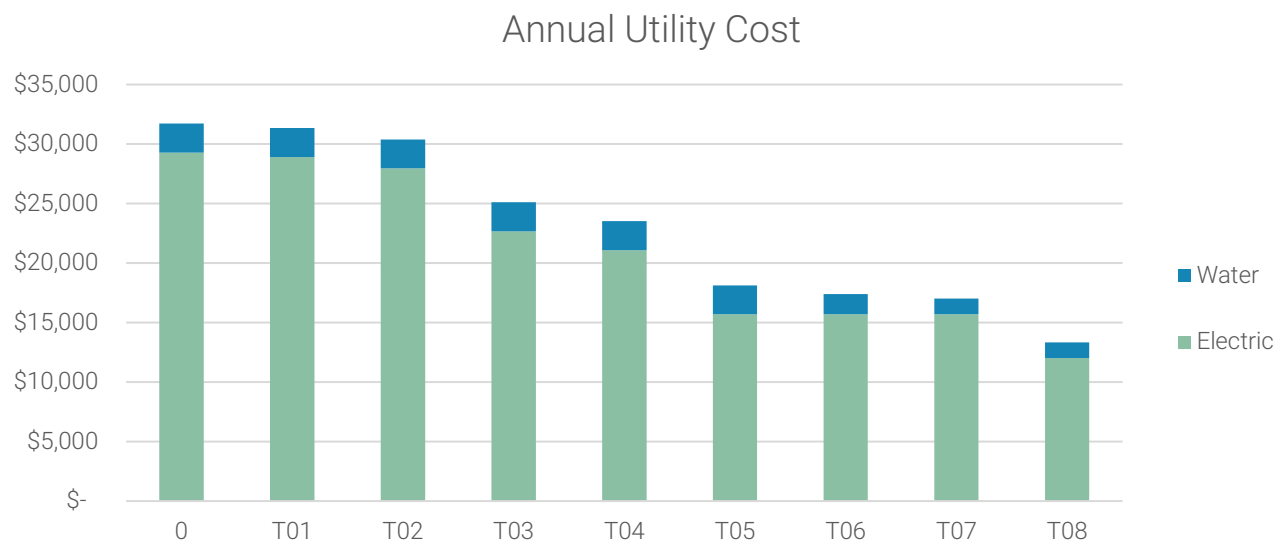


Figure 5 – Annual Utility Cost by Type

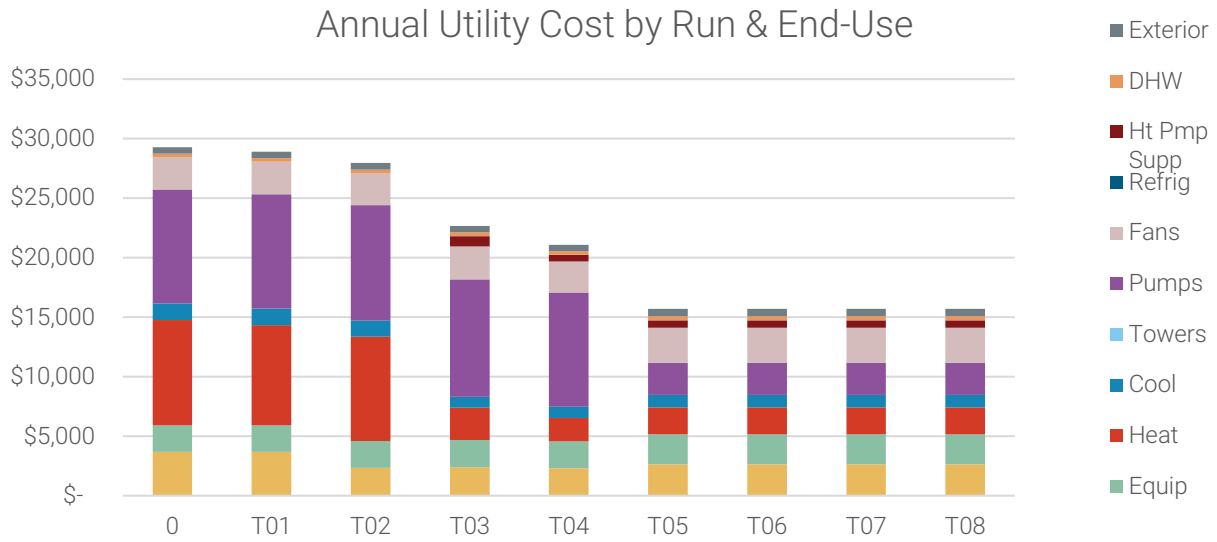
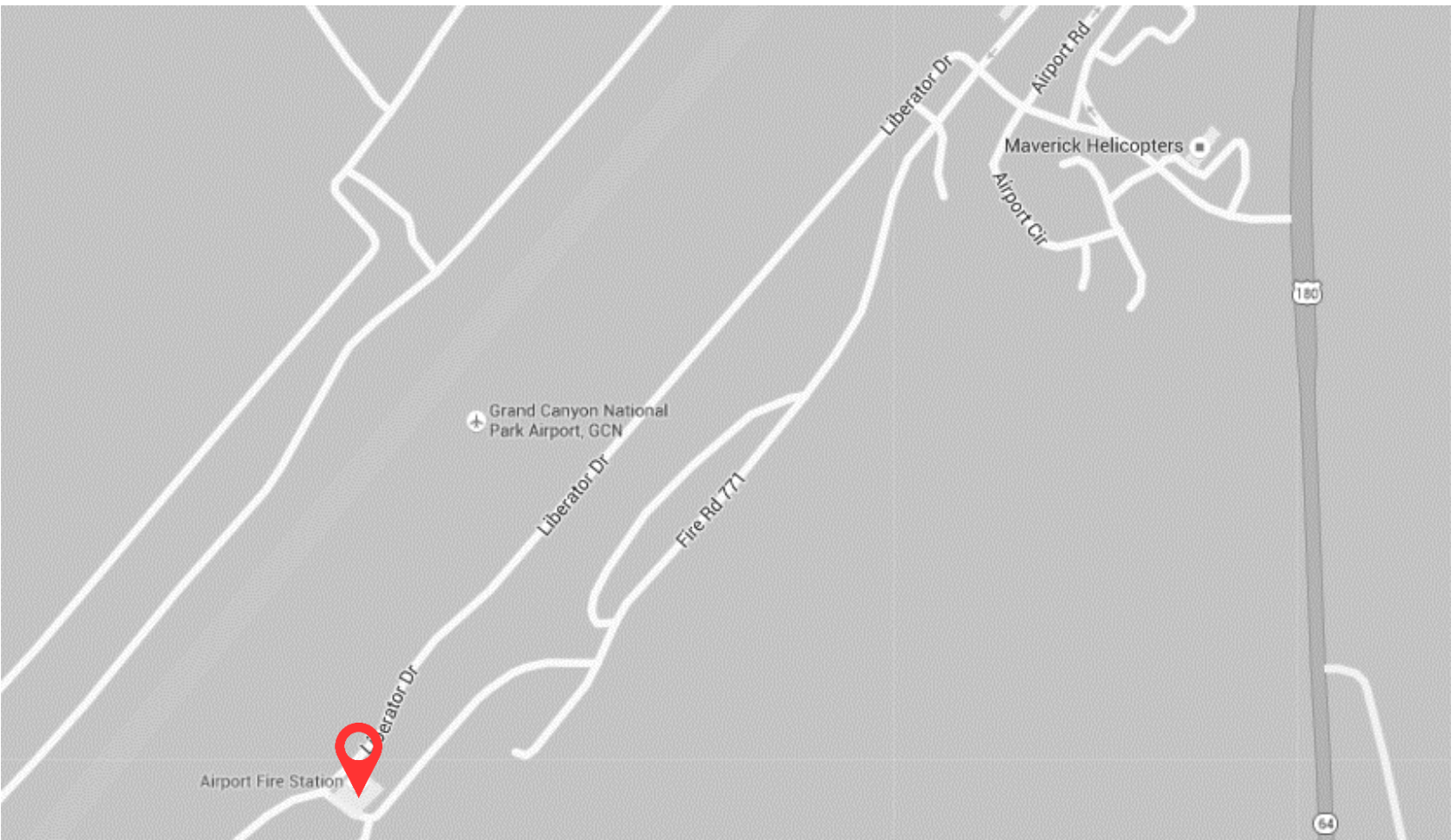


Figure 6 – Annual Utility Cost by Run & End-Use

ARFF Station

ARFF Station



Building Description

The Grand Canyon National Park Aircraft Rescue and Fire Fighting Facility (ARFF) building is a 22,000 sf building located at the southwest portion of the airport, just below the control tower. This building was designed in 2010, receiving the US Green Building Council's (USGBC) Leadership in Energy and Environment Design (LEED) Gold award. This is the second most prestigious level of the LEED certification, just below Platinum.

The building features two (2) large garage bays on each side of 'L' shaped building for fire trucks and snow removal vehicles. The center structure of the facility provides the infrastructure for the fire crew, including showers, exercise center, full kitchen, and meeting and bunk rooms. The building was designed for the potential of full, 24/7 operation, but as things stand at the time of the study, the building is only sparsely used. Only 2-4 fireman are on staff at any given time, leaving the majority of the building largely unused. The construction of the building is concrete block (CMU) with high efficiency windows. The building is heated and cooled with a split system heat pumps. The facility also has a small 4.6 kW photovoltaic (PV) solar system as well as a solar thermal water heating system. The garage bays have passive heating system featuring roof mounted translucent panels to pre-heat air. The primary heating system in this area is large electric infrared heaters.

Square Footage:	22,000
Stories:	3
Year Built:	2010
Occupancy:	Fire Station
Construction:	CMU
Heating:	Electric Heat & Heat Pump
Cooling:	AC

Operational Schedules

- Occupied Year Round
  - 6am-8pm
- Internal load estimates derived from site observations and staff interviews (additionally supplemented with California Utilities standard guidelines).

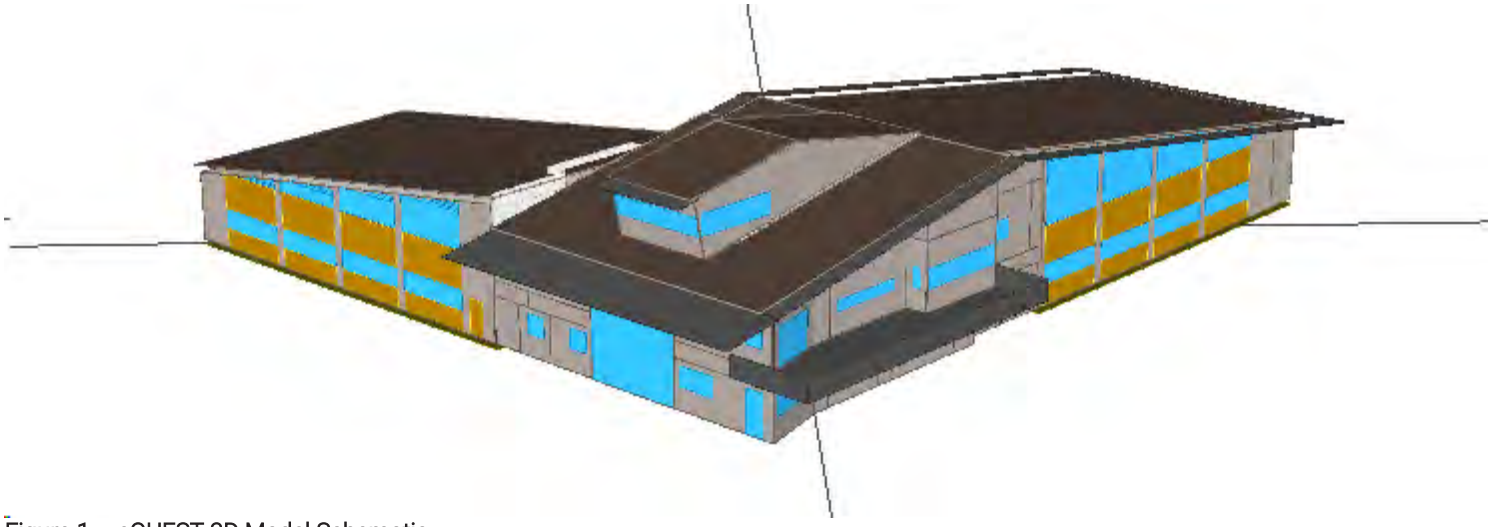


Figure 1 – eQUEST 3D Model Schematic

Figure 2 – eQUEST 2D Floorplan Schematic

Energy Conservation Measures

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
AR1	EMS Computer	During construction of the building, the energy management system (EMS) front end computer that would enable centralized control of the HVAC system was value-engineered out of the project. The lack of centralized can cause inefficient operation by allowing occupants to abuse settings. Notably, the large infrared heaters could stand for more intelligent control. While they are set to only maintain a non-freezing setting in the bays, they are wired to come on all at once, resulting in huge demand charges for the Airport. 	Add the hardware and computer equipment to enable control over all HVAC systems. Add the necessary control points and wiring to stage the infrared heaters on, and to restrict their operation while the doors are open. Consider smaller space heaters if occupant comfort is a concern with open bay doors to minimize demand spikes.	It was estimated that 50% of the demand could be reduced with better control. This measure will also aid in the efficiency of maintenance operation on the equipment as it ages. Accurate costing will require a consultation from a controls contractor to inventory the current equipment.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
AR2	Low Flow Showers	The current shower heads emit 2.5 GPM in flow.	Replace current showerheads with a low flow option, 1.75 GPM or lower. This will contribute to both domestic hot water energy savings and water consumption savings. Quest also recommends that high pressure, quality showerheads are selected to minimize employee complaints. Normally, there is some hot water heater savings on this measure, but the hot water is mostly free via the solar thermal hot water panels	Baseline usage was estimated through assumed employee behaviors using the showers. The true cost of this measure will vary with the quality and architectural features of the showerhead. A high quality $30 Moen fixture was assumed along with an estimated installation cost $20 ($50 total).
AR3	Low Flow Faucet Aerators	The current faucets emit 2.2 GPM in flow.	Replacing the current aerators with low-flow 0.5 GPM aerators would provide a significant water savings at minimal cost. The water savings would have an associated electrical savings for the airport as pumping requirements would be reduced. This is difficult to quantify and not included to enable a conservative estimate. Normally, there is some hot water heater savings on this measure, but the hot water is mostly free via the solar thermal hot water panels	Baseline usage was estimated through assumed employee behaviors using the restroom. $10 per aerator is assumed for ten (10) sinks. It's possible this cost could be lower.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
AR4	Additional PV (25 kW)	The existing 4.6 kW solar PV system is located on the upper part of the southwest roof. Beyond some existing solar thermal panels, there is a large amount of exposed roof that could potentially support additional solar PV panels. 	A 25kW system would potentially fit on the roof, generating approximately 37,500 kWh/yr in renewable energy. This would equate to roughly $3000 in annual energy savings. The National Renewable Energy Laboratory's (NREL) PVWatt calculator was used in sizing the area for the solar system. Although the current system is not likely large enough to generate more than the current building demand, a significantly larger system would, which would hurt the economics of the project. A battery storage system (such as Tesla) could help mitigate this, but would have its own negative impact of project economics. Therefore, it's recommend that an expanded PV system is not added until there is sufficient daytime energy use to displace with solar energy without over generation issues.	It's assumed that due to the off-south orientation, 1500 kWh/kW of generation is possible (~1650-1700kWh/kW is possible for south orientation). A cost of $2.75/W is assumed for the installed cost. Like all PV projects, the simple payback on the project is not good (20 years), but advanced economic models have shown positive cash-flow within 10 years once the various economic factors are incorporated in the analysis. A good PV systems has a 25 year warranty. Azimuth Energy was consulted for guidance and budgetary pricing.

Analysis Results

Economic Results Summary

Results of the analysis show that substantial savings can be achieved if the recommended mechanical and plumbing measures are implemented. Key findings from the analysis include:

- Improvement to the controls of the building may help limit high demand charges as well as save energy and improve the maintenance efficiency of the building.
- Significant water savings is achievable with low water use showers and new faucet aerators.
- An expanded PV system would further enhance building efficiency.

Economic results are summarized in the table below. Estimated implementation costs for each measure are summarized in the Appendix.

ECM	Measure Description	Estimated Initial Cost	Estimated Utility Savings	Estimated APS Incentive	Simple Payback (Yrs)
AR1	0+EMS Computer	$ 5,000	$ 1,293	$ 404	3.55
AR2	AR1+Low Flow Showers	$ 500	$ 739	$ -	0.68
AR3	AR2+Lavatory Aerators	$ 200	$ 360	$ -	0.56
AR4	AR3+Additional PV (25 kW)	$ 68,750	$ 3,343	$ -	20.57

Figure 3 – Economic Results Summary

Additional Notes & Considerations

- Upgrading to LED light was not recommended as there is not enough lighting operation (and subsequent savings) to justify the upgrade cost. However, as lights burn out, it's recommended the LED replacement lamps be used in lieu of the like-for-like florescent option. This will gradually improve the energy performance of the building any further, as well as reduce the long term recycling and maintenance fees.

Detailed Annual Results

Detailed annual results are shown in the Tables and Figures below. The top half of the table represents annual energy costs and consumption for each measure. The second half of the table shows the incremental savings for each measure.

#	Run	Utility Consumption		Utility Costs			Savings
		Electric	Water	Electric	Water	Total Cost	
		(kWh)	(gal)	($)	($)	($)	%
B0	Baseline	117,037	90,210	$ 18,109	$ 2,436	$ 20,545	
AR1	0+EMS Computer	113,364	90,210	$ 16,816	$ 2,436	$ 19,252	6.3%
AR2	AR1+Low Flow Showers	113,364	62,853	$ 16,816	$ 1,697	$ 18,513	9.9%
AR3	AR2+Lavatory Aerators	113,364	49,517	$ 16,816	$ 1,337	$ 18,153	11.6%
AR4	AR3+Additional PV (25 kW)	75,864	49,517	$ 13,473	$ 1,337	$ 14,810	27.9%
Incremental Savings Relative to Previous Measure							
AR1	0+EMS Computer	3,673	-	$ 1,293	$ -	$ 1,293	6.3%
AR2	AR1+Low Flow Showers	-	27,357	$ -	$ 739	$ 739	3.6%
AR3	AR2+Lavatory Aerators	-	13,335	$ -	$ 360	$ 360	1.8%
AR4	AR3+Additional PV (25 kW)	37,500	-	$ 3,343	$ -	$ 3,343	16.3%
Total Savings vs Baseline							
	Total:	41,173	45,328	$ 4,636	$ 6,841	$ 5,742	27.9%

Figure 4 – Annual Results Summary

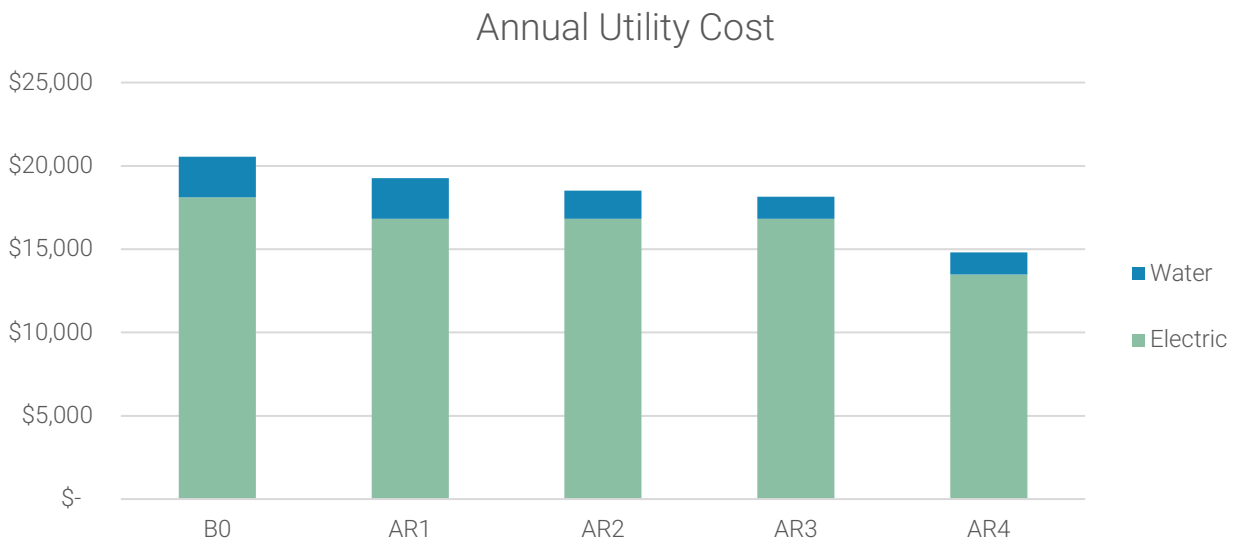


Figure 5 – Annual Utility Cost by Type

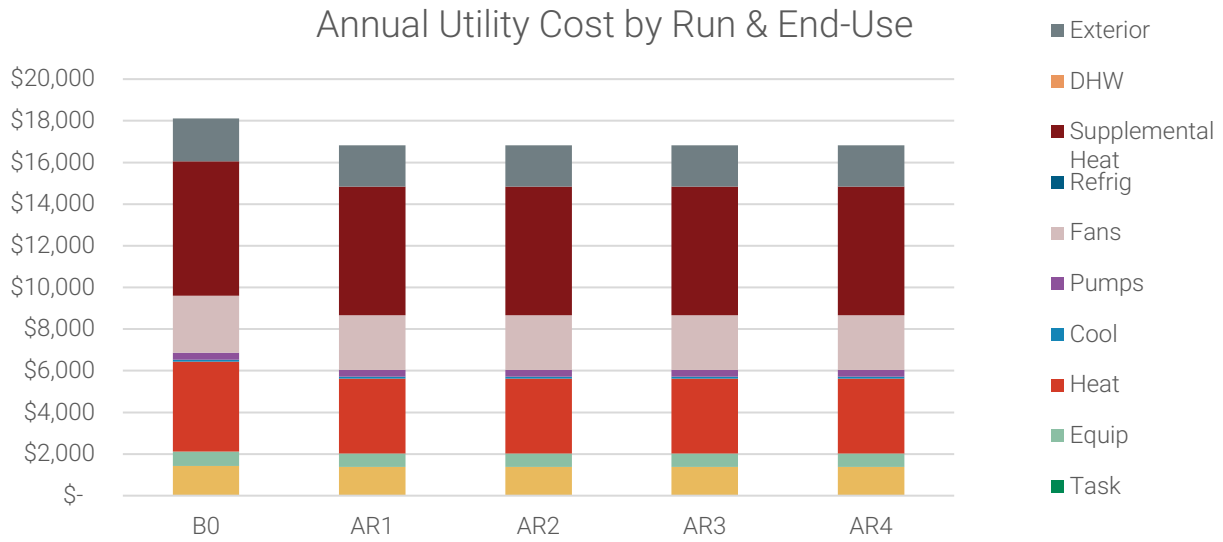
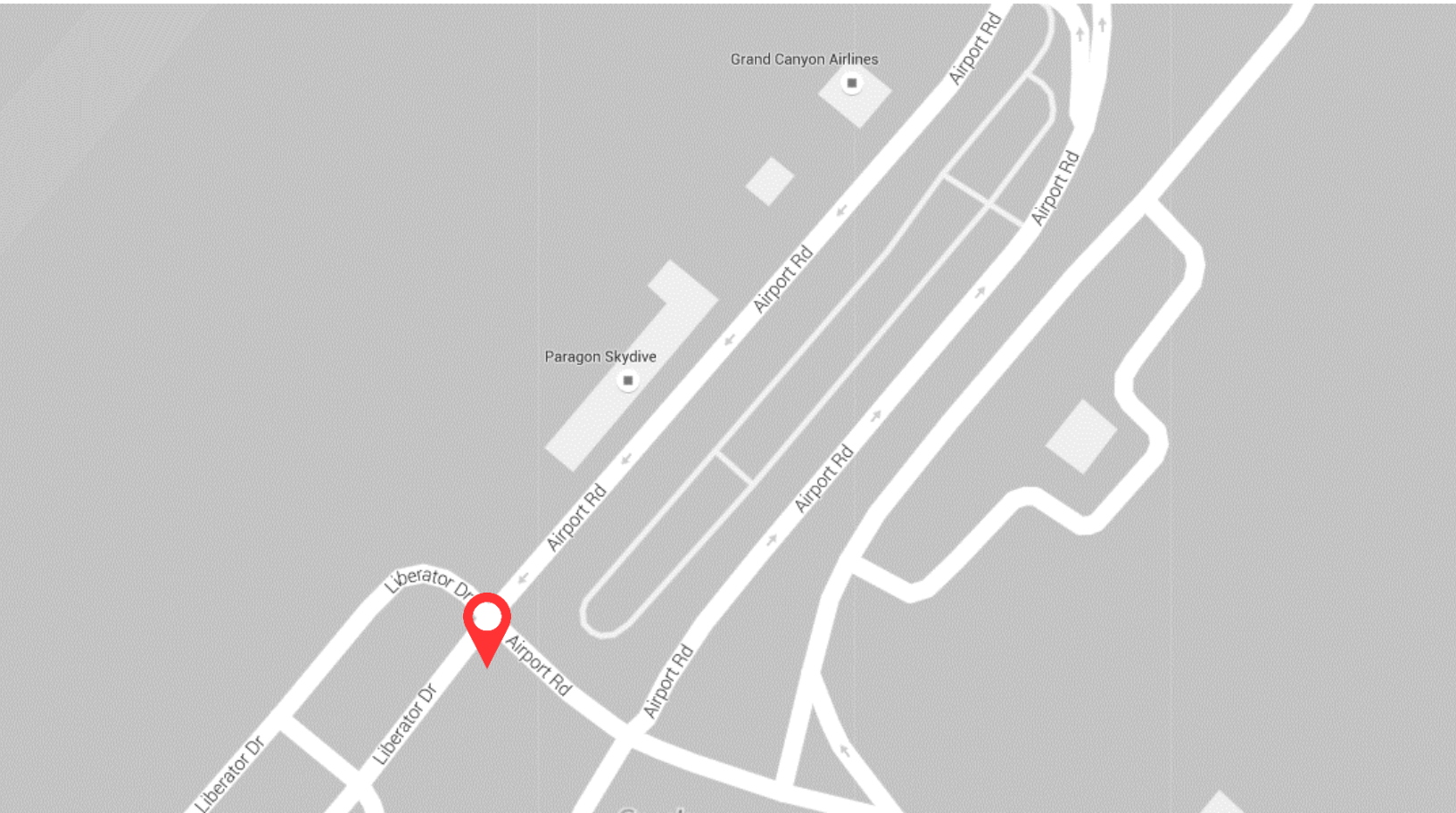


Figure 6 – Annual Utility Cost by Run & End-Use

Admin Building

Administration Building



Building Description

The Grand Canyon National Park Airport Administrative Office (Admin) building is located just a short distance from the main terminal. This building houses the office space of the airport administrative and facilities staff. It was constructed with combined modular buildings of an older ~1980's vintage; the insulation and windows are accordingly less insulated. The building is cooled and heated via four (4) wall-mounted air-conditioning units with electric heat strip. The primary building energy end-uses, other than HVAC, are lighting and office equipment.

Like the ARFF station, the Admin building is lightly occupied, with several vacant offices. Additionally, many of the staff spend much of the work day in the field and outside of the building. Only 1-2 employees are consistently in the space. There has been some discussion about moving operations to the open space in the ARFF station and either eliminating or leasing the building to a commercial customer.

Square Footage:	4,000
Stories:	1
Occupancy:	Office
Construction:	Wood Framed
Heating:	Electric Heat
Cooling:	Air Conditioning
Other Enduses:	Office Equipment

Operational Schedules

- Occupied Year-Round
  - Monday-Friday (8:00am - 5:00pm)
  - Occasional weekend use

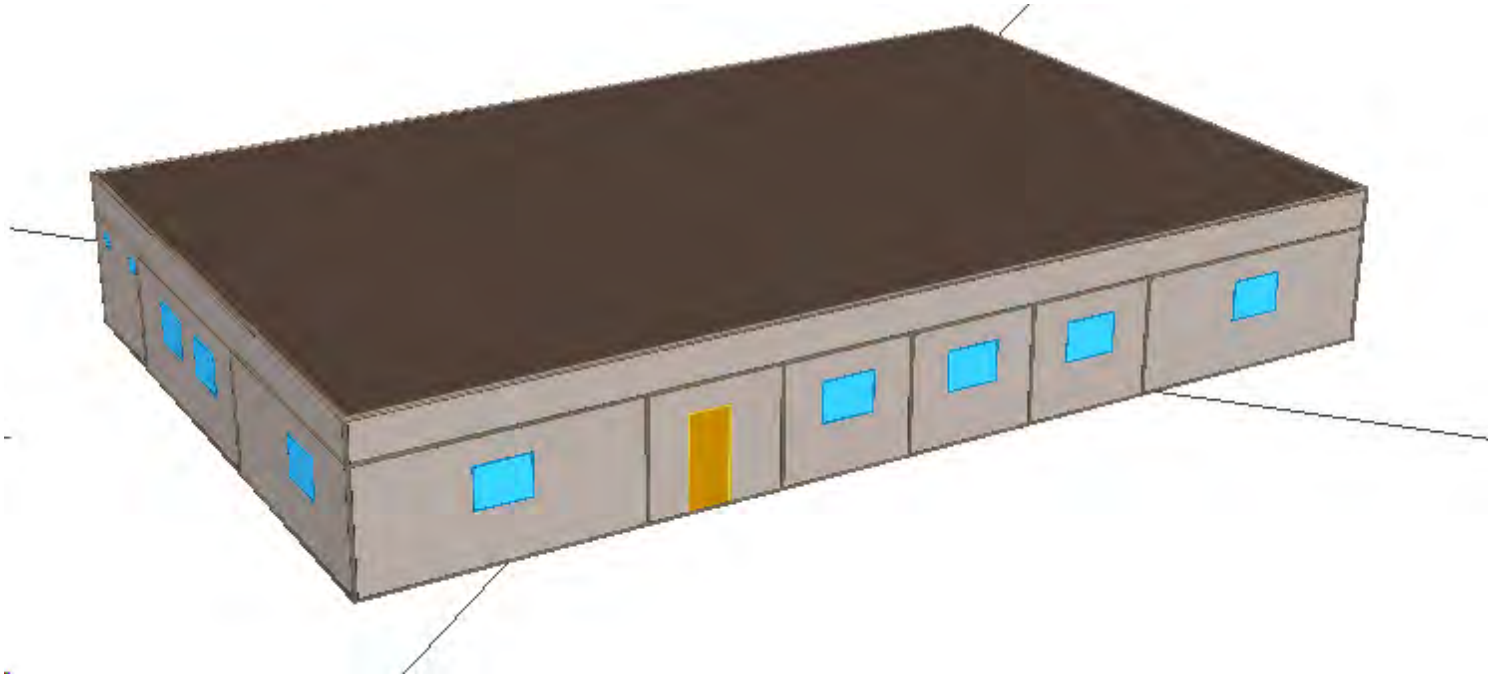


Figure 1 – eQUEST 3D Model Schematic

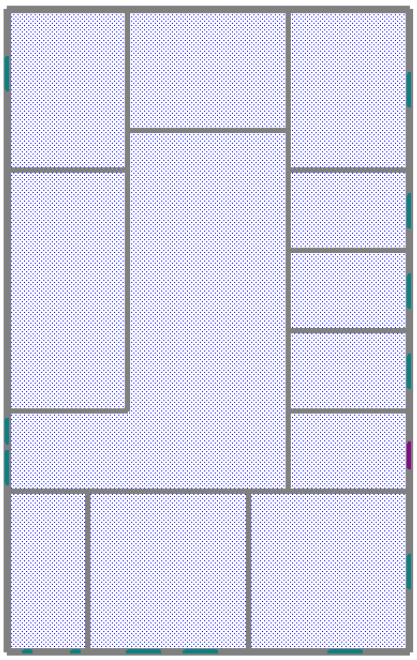


Figure 2 – eQUEST 2D Floorplan Schematic

Energy Conservation Measures

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
A01	LED Lighting Upgrade	The majority of lighting in the building is 2x4 T8 fluorescent troffer fixtures. 	Replace interior lighting to LED fixtures. Use 8-14W A-Lamps to replace CFLs. For cost efficiency and safety, use LED-T8 replacement tubes compatible with fluorescent ballasts in cases of linear T8 troffers and strip fixtures for cost effectiveness. If lighting levels are found to be acceptable, some of the 3 and 4 lamp T8 fixtures may be able to be reduced to 2 or 3 lamp LED fixtures.	Lighting power densities in the existing model are reflective of site findings. The reduced lighting power due to lower wattage LED lighting fixtures was simulated. Costing information from Crescent Electrical Supply Co. was used. This information can be found in the Appendix.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
A02	Re-Program Thermostats	The four (4) programmable thermostats currently provide a cooling setback after hours and on the weekend, but the heating settings are not providing the same weekend setback. As a result, the building is being unnecessarily heated on Saturday and Sunday. Additionally, the thermostats are programmed to come on at the same time (each unit). When this occurs in the morning, a large simultaneous power demand occurs, which creates a high charge from the utility company. 	The existing thermostats should be replaced with new thermostats that will allow for easy, but temporary overrides in the case someone needs to work on a weekend. The new thermostats should also be programmed to start heating and cooling schedules at 15 minute or wider intervals to avoid coincidental demand charges.	Equipment costs were generated from an online listed price for a thermostat that would meet the recommended performance. The performance from a similar Bard (same manufacturer as current) heat pump was used in the simulation.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
A03	Heat Pump Upgrade	The existing wall mounted AC units are older, and only have a few more years of serviceable life. Manufacturer's information suggest they have a 10 EER cooling efficiency, though they are likely less efficient due to wear and tear. These units use electric strip heat for the primary heat source, which is the most inefficient form of heating. 	If the admin staff will continue to use this building for the next 10-20 years, it's recommended that the AC units be changed out for heat pumps when they are due for replacement. Heat pumps are 2-3 times more efficient than electric heating for most of the year. When it's extremely cold out, the heat pumps will still use their backup electric heat as the primary heat source, but energy savings will still occur for much of the heating season. Additionally, the newer units will be slightly more efficient than the existing units.	The estimated cost used represents the assumed *incremental* cost of the cost premium from the like-for-like electric heat option to a heat pump. The assumed values of the proposed heat pumps are based off a comparable Bard heat pump, which is the same manufacturer of the current AC units.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
A04	Low Flow Toilets	The existing toilets in the restrooms have a water efficiency rating of 1.6 GPF.	Due to the high regional cost of water ($0.027/gal) utilizing low-flow 1.0 GPF toilets would provide a substantial cost savings. This measure offers poor economic return based on water cost savings and full cost of a new toilet. However, there is very little incremental cost above a standard efficiency toilet. Therefore, the optimum economic situation for replacement occurs when the restroom is renovated or a toilet is due for replacement.	Baseline usage was estimated through assumed employee behaviors using the restroom. A $400/toilet cost premium was assumed for a typical high efficiency toilets. A high-performance toilet should be utilized to ensure minimal employee complaints and/or increased custodial workloads. The water savings would have an associated electrical savings for the airport as pumping requirements would be reduced. This is difficult to quantify and not included to enable a conservative estimate.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
A05	Low Flow Faucet Aerators	The current faucets emit 2.2 GPM in flow.	Replacing the current aerators with low-flow 0.5 GPM aerators would provide a significant water savings at minimal cost. The water savings would have an associated electrical savings for the airport as pumping requirements would be reduced. This is difficult to quantify and not included to enable a conservative estimate.	Baseline usage was estimated through assumed employee behaviors using the restroom. $10 per aerator is assumed for four (4) sinks. It's possible this cost could be lower.

Analysis Results

Economic Results Summary

Results of the analysis show that substantial savings can be achieved if the recommended lighting, mechanical and plumbing measures are implemented. Key findings from the energy analysis include:

- When due for replacement, upgrading to heat pump units will save a significant amount of heating and cooling energy.
- Lighting energy can be reduced significantly with an LED retrofit. Utility incentives and disposal fee reductions will also improve the return on investment.
- Improvement to the controls of the building may help limit high demand charges as well as save energy and improve the maintenance efficiency of the building.
- Significant water savings is achievable with low water use toilets and new faucet aerators.

Economic results are summarized in the table below. Estimated implementation costs for each measure are summarized in the Appendix.

ECM	Measure Description	Estimated Initial Cost	Estimated Utility Savings	Estimated APS Incentive	Simple Payback (Yrs)
A01	0+Lighting Upgrade	$ 496	$ 188	$ 178	1.69
A02	A01+New Programmable Tstat	$ 400	$ 1,761	$ 160	0.14
A03	A02+Heat Pump Upgrade	$ 7,200	$ 1,058	$ 696	6.15
A04	A03+Low Flow Toilets	$ 1,600	$ 74	$ -	21.65
A05	A04+Low Flow Faucet Aerators	$ 40	$ 35	$ -	1.15

Figure 3 – Economic Results Summary

Additional Notes & Considerations

- Upgrading the windows of the building was considered, but ultimately not included due to the high first cost. It's assumed that the AC units would be replaced sooner, and a more efficient heating system would mitigate much of the benefit of the improved windows. With heat pumps, all new efficient windows would likely save less than $200 annually, but would cost over $2,000. Given the possibility that the building may not be utilized in the long term, this would not be a prudent investment.

Detailed Annual Results

Detailed annual results are shown in the Tables and Figures below. The top half of the table represents annual energy costs and consumption for each measure. The second half of the table shows the incremental savings for each measure.

#	Run	Utility Consumption		Utility Costs			Savings
		Electric	Water	Electric	Water	Total Cost	
		(kWh)	(gal)	($)	($)	($)	%
0	Baseline	31,429	8,973	$ 6,898	$ 242	$ 7,140	
A01	0+Lighting Upgrade	29,809	8,973	$ 6,710	$ 242	$ 6,952	2.6%
A02	A01+New Programmable Tstat	25,519	8,973	$ 4,949	$ 242	$ 5,191	27.3%
A03	A02+Heat Pump Upgrade	19,196	8,973	$ 3,891	$ 242	$ 4,133	42.1%
A04	A03+Low Flow Toilets	19,196	6,235	$ 3,891	$ 168	$ 4,059	43.1%
A05	A04+Low Flow Faucet Aerators	19,196	4,943	$ 3,891	$ 133	$ 4,024	43.6%
Incremental Savings Relative to Previous Measure							
A01	0+Lighting Upgrade	1,620	-	$ 188	$ -	$ 188	2.6%
A02	A01+New Programmable Tstat	4,290	-	$ 1,761	$ -	$ 1,761	24.7%
A03	A02+Heat Pump Upgrade	6,323	-	$ 1,058	$ -	$ 1,058	14.8%
A04	A03+Low Flow Toilets	-	2,738	$ -	$ 74	$ 74	1.0%
A05	A04+Low Flow Faucet Aerators	-	1,293	$ -	$ 35	$ 35	0.5%
Total Savings vs Baseline							
	Total:	12,233	7,037	$ 3,007	$ 3,236	$ 3,127	43.6%

Figure 4 – Annual Results Summary

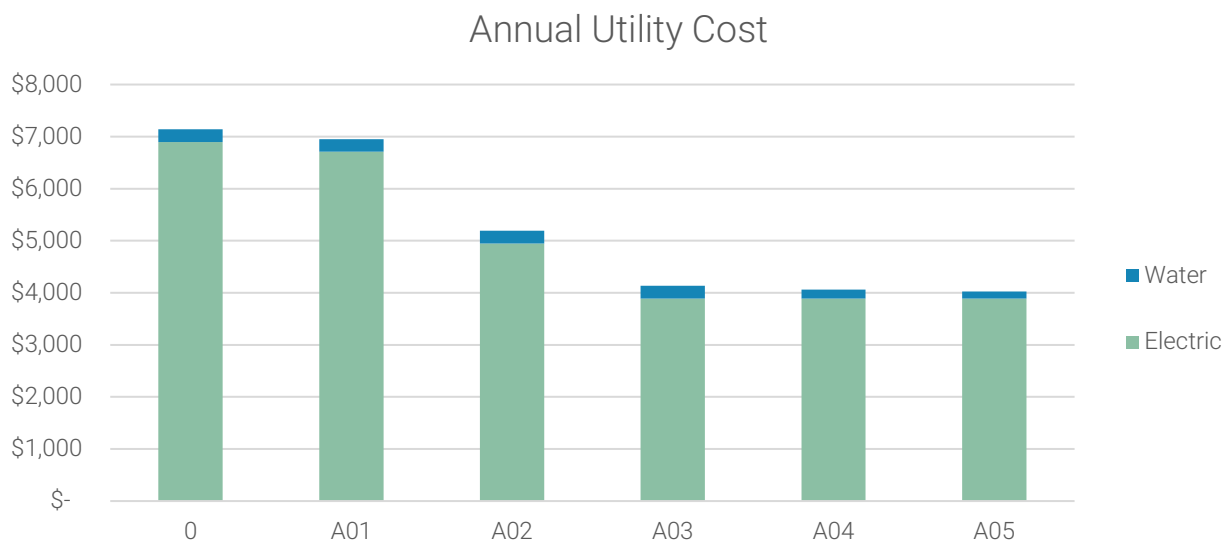


Figure 5 – Annual Utility Cost by Type

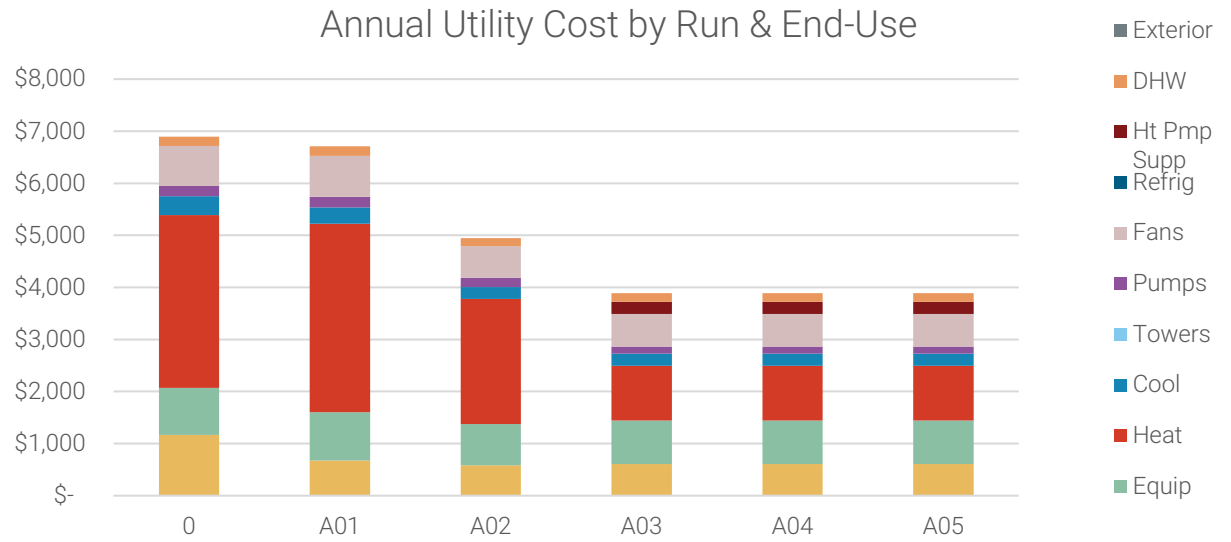


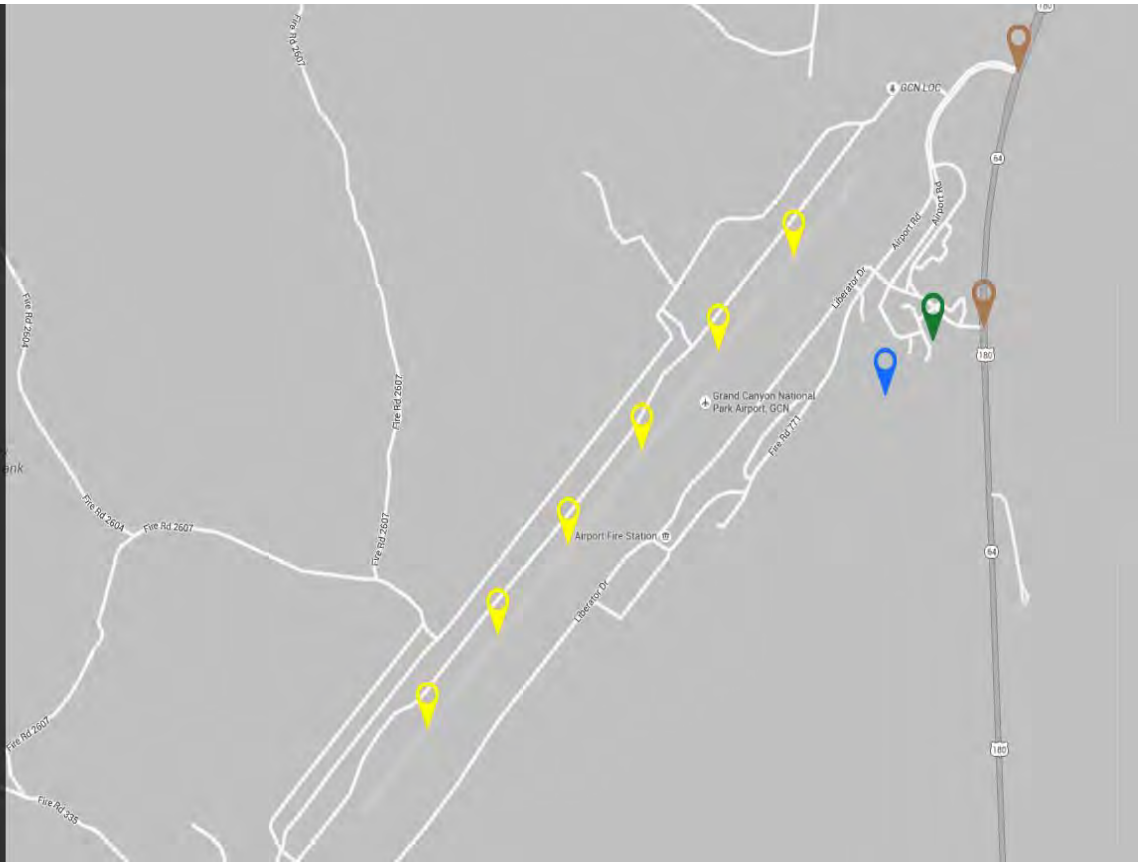
Figure 6 – Annual Utility Cost by Run & End-Use

Additional Energy Users

Additional Energy Users

Additional Usage Areas:

- Runway Lighting
- Water Towers
- Airport Entrances
- Residential Area



Building/Equipment Description

In addition to the Main Terminal, ARFF Station, and Admin Building, there are few other meters and energy/water users under ADOT's ownership. These include the terminal lighting, some residential houses, and few small meters providing lighting or other necessary functions for the Airport's operation. These range from such items as the beacon for the runway, the entrance lights from the highway, the maintenance barn, and the water tanks.

Operational Schedules

Entrance Lighting Schedule

- Dusk to Dawn

Apron Lighting Schedule

- 7:45pm-10:00pm

Energy Conservation Measures

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
X01	Apron Lighting Upgrade	The current runway lighting consists of metal halide fixtures with 1-2 heads. 	The airport is in the process of retrofitting the lights to an LED solution. This involves removing every other pole, and adding a 3-light head to the remaining poles.	Per feedback from the airport, they are expecting a 20% lighting energy savings. Reduced power due to equivalent LED retrofit equipment were simulated. In addition to energy savings, the airport will realize maintenance labor savings from this measure.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
X02	Residential Water Conservation	The airport provides housing to employees in certain circumstances. The residential water use is sub-metered but ultimately paid by the airport. Some water is used for lawns and other landscaping functions. Much of it goes toward showering, dishwashers, etc.	All fixtures (showerhead, bathroom faucets) in the residential complex should be retrofitted to low-flow (1.75 GPM showers, 0.5 GPM faucets). Landscaping should transition to a xeriscape, water-tolerant concept. Low-water use appliances should be selected when due for replacement.	It's recommended that affected employees be provided clear explanations as to why (any) changes may be occurring, as well as the why they're important from an environmental perspective. It's assumed 36, 0.8 GPM toilets ($150) are purchased, 36, 1.5GPM showerheads ($25), 36, 0.5GPM aerators ($10). Landscaping water use was assumed to decrease by 10% through employee communication. Product information can be found in the Appendix.

#	Measure	Existing Condition	Recommended Action	Key Assumptions and Notes
X03	Solar Entrance Lights	The North and South entrances to the airport have individual meters, which are charged approximately $20/month per meter. These entrances use almost no energy (the North entrance hasn't had usage in over a year)	Eliminate the meter charge by utilizing solar powered lighting fixtures. Cancel the APS accounts and decommission the meters. These fixtures would be able to run proportionally to the amount of solar energy the integrated solar panel can collect per day. Cloudy or partially cloudy days would limit how long the lights could run. Since the North lights have not been on for over a year, it's assumed that sign illumination is not a critical function.	$3,750 per fixture was used from a budgetary quote from Crescent Electric Supply. It's recommended the fixtures and panel are permanently installed to limit theft risk. There are many potential options for the lighting equipment choice. Its recommended ADOT contact Dan Franey at Crescent Electric Supply or another lighting equipment provider to find a suitable product for this application and their needs.

Analysis Results

Economic Results Summary

Results of the analysis show that substantial savings can be achieved if the recommended envelope, lighting, mechanical and plumbing measures are implemented. Key findings from the energy analysis include:

- The runway lighting retrofit project will provide good energy and maintenance savings.
- Directly facilitating water conservation efforts in the residential properties is a sound business move given the expensive water cost.
- Adding solar powered entrance lighting would eliminate costly meter fees.

Economic results are summarized in the table below. Estimated implementation costs for each measure were provided by contractors summarized in the Appendix.

ECM	Measure Description	Estimated Initial Cost	Estimated Utility Savings	APS Incentive	Simple Payback (Yrs)
X01	0+Apron Lighting Upgrade	TBD	$ 5,389	$ 990	TBD
X02	X01+Residential Water Conservation	$ 6,660	$ 4,807	$ -	1.39
X03	X02+Solar Enterance Lights	$ 7,500	$ 522	$ -	14.38

Figure 1 – Economic Results Summary

Additional Notes & Considerations

- Other solar applications to remove meter charges (similar to X03) were considered but ultimately not included due to the need for reliability on those other loads as well as the relatively high cost for small standalone solar PV systems.
- Providing CFL or LED lamps to residential housing as well as doing basic weather proofing is recommended to further minimize utility costs at these sites.

Detailed Annual Results

Detailed annual results are shown in the Tables and Figures below. The top half of the table represents annual energy costs and consumption for each measure. The second half of the table shows the incremental savings for each measure.

#	Run	Utility Consumption		Utility Costs			Savings
		Electric	Water	Electric	Water	Total	
		(kWh)	(gal)	($)	($)	($)	%
B0	Baseline	83,594	512,270	$ 50,056	$ 13,831	$ 63,887	
X01	0+Apron Lighting Upgrade	74,594	512,270	$ 44,667	$ 13,831	$ 58,498	8.4%
X02	X01+Residential Water Conservation	74,594	334,249	$ 44,667	$ 9,025	$ 53,691	16.0%
X03	X02+Solar Enterance Lights	74,506	334,249	$ 44,145	$ 9,025	$ 53,170	16.8%
Incremental Savings Relative to Previous Measure							
X01	0+Apron Lighting Upgrade	9,000	-	$ 5,389	$ -	$ 5,389	8.4%
X02	X01+Residential Water Conservation	-	178,021	$ -	$ 4,807	$ 4,807	7.5%
X03	X02+Solar Enterance Lights	88	-	$ 522	$ -	$ 522	0.8%
Total Savings vs Baseline							
	Total:	9,088	178,021	$ 5,911	$ 4,807	$ 10,717	16.8%

Figure 2 – Annual Utility Cost by Type

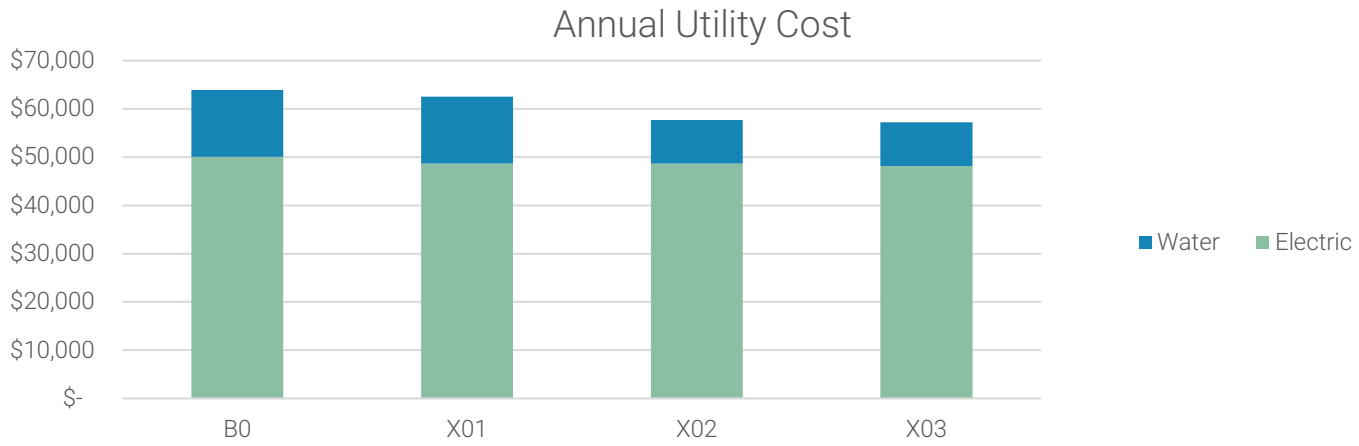


Figure 3 – Annual Results Summary

Appendix 1:
Equipment Specifications

This appendix is available online at

https://www.azdot.gov/planning/CurrentStudies/grand-canyon-national-park-airport-master-plan/overview

Appendix 2: Equipment Pricing

This appendix is available online at

https://www.azdot.gov/planning/CurrentStudies/grand-canyon-national-park-airport-master-plan/overview

Appendix 3:
Solar PV Documentation

This appendix is available online at

https://www.azdot.gov/planning/CurrentStudies/grand-canyon-national-park-airport-master-plan/overview

GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Appendix D

FAA FORECAST APPROVAL

AIRPORT MASTER PLAN

ADOT

U.S. Department
of Transportation
Federal Aviation Administration

Western-Pacific Region
Airports Division
Phoenix Airports District Office

3800 N Central Ave.
Suite 1025
Phoenix, AZ 85012

July 18, 2017

Mr. Lee McCleary
Arizona Dept. of Transportation
Grand Canyon National Airport
Acting Airport Manager
1324 N. 22nd Ave
MD128A
Phoenix, AZ 85009

Mr. McCleary,

Grand Canyon National Park Airport (GCN), Grand Canyon, Arizona
Aviation Activity Forecast Approval

The Federal Aviation Administration (FAA) has reviewed the aviation forecast submitted for the airport master plan update for Grand Canyon National Park Airport dated June 6, 2017. The FAA approves these forecasts for airport planning purposes, including Airport Layout Plan development.

In summary, while the difference between the FAA TAF (Terminal Area Forecast) and Grand Canyon National Park Airport forecast update regarding total operations is not within the 10 percent and 15 percent allowance for 5 and 10 year planning horizons, the airport forecast update appropriately explains these differences due to the fact that the Master Plan forecast includes enplanements for airline/air carrier and air tour activities. The future enplanements with air tour activities make up 90 percent, 87 percent, and 81 percent for the five (5), ten (10), and twenty (20) year forecasts respectively. Additionally, the TAF calls for significant decreases in passenger enplanements for future years, and this information is not consistent with current, and historical passenger enplanement activity at the airport. The current Master Plan forecasts are projecting growth in air tour enplancements over the long term period and are substantially higher than the TAF projections. This forecast was formulated using current data and appropriate methodologies; therefore, the FAA locally approves this forecast for planning purposes at the Grand Canyon National Park Airport.

Approval of this forecast *does not* need to be sent to FAA Headquarters for review even though the 5 and 10 year forecasts exceed benchmarks established in the FAA's Guidance on Review & Approval of Local Aviation Forecasts published in 2008. Adequate justifaction was provided as to why the total operations for the airport are not within the appropriate allowances.

It is important to note that the approval of this forecast does not guarantee future funding for large-scale capital improvements as future projects will need to be justified by current activity levels reached at the time the projects are proposed for implementation. If you have any questions about this forecast approval, please call me at 602-792-1072

Sincerely,

Jared M. Raymond
Airport Planner

cc: Matt Smith, Airport Grant Manager, ADOT
Sonya Herrera, Division Manager, ADOT
Matt Quick, Associate, Coffman Associates