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Draft Environmental Impact Statement for Tusayan Growth

Kaibab National Forest



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Acronyms & Abbreviations

AC	Acre
ACOE	Army Corps of Engineers
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
APS	Arizona Public Service
BDMP	Best Design and Management Practices
ca	Circa
CC&R	Covenants, Conditions, and Restrictions
CEQ	Council on Environmental Quality
CFV	Canyon Forest Village
CFV (AP)	Canyon Forest Village (Alternative Plan)
CFVC	Canyon Forest Village Council
DPS	Department of Public Safety
DUI	Driving Under the Influence
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPTE	Environmental Preservation Trust Entity
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FLEFA	Federal Land Exchange Facilitation Act
FLPMA	Federal Land Policy and Management Act
FMC	Flagstaff Medical Center
FR	Forest Road
GCIA	Grand Canyon Improvement Association
GCNP	Grand Canyon National Park
GMP	General Management Plan

GPM	Gallons Per Minute
HAZMAT	Hazardous Materials
HUD	U.S. Department of Housing and Urban Development
HWY	Highway
IGA	Intergovernmental Agreement
INM	Integrated Noise Model
KNF	Kaibab National Forest
Ldn	Day-Night Average Sound Level
M	Millions
MGY	Millions of Gallons per Year
MNA	Museum of Northern Arizona
NACOG	Northern Arizona Council of Governments
NEPA	National Environmental Policy Act
NF	National Forest
NFS	National Forest System
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
PHA	Public Housing Authority
PILT	Payment in Lieu of Taxes
RD	Ranger District
RNA	Roaded-Natural Area
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	Right-of-Way
SAS	Solar Aquatics System
SHPO	State Historic Preservation Office
SPM	Semi-Primitive Motorized
SQ.FT.	Square Feet
TCP	Traditional Cultural Property
TES	Threatened, Endangered and Sensitive Species
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VQO	Visual Quality Objective
WQARF	Water Quality Assurance Revolving Fund

Tusayan Growth DEIS
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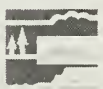
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DRAFT ENVIRONMENTAL IMPACT STATEMENT for Tusayan Growth Coconino County, Arizona









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Kaibab National Forest

Cooperating Agencies: USDI, Grand Canyon National Park
Coconino County
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Abstract

The Draft Environmental Impact Statement describes alternatives for providing improvements to transportation, housing, community facilities, and visitor services outside of Grand Canyon National Park boundaries on private or National Forest System lands in the Grand Canyon/Tusayan area. Alternatives considered are No Action, Land Exchange Option 1 (Proponent: Canyon Forest Village), Land Exchange Option 2 (Proponent: Canyon Forest Village), Townsite Act/Special Use Permit (Proponent: Grand Canyon Improvement Association), and Transportation Staging Area/Federal Housing (Proponent: Grand Canyon National Park). A preferred alternative has not been identified.

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Chapter 1 Purpose and Need for Action

Background

Grand Canyon National Park (GCNP), designated a World Heritage site, is one of the most popular tourist destinations in America. It is located in the southwestern United States on the Colorado Plateau (Figure 1.1), where the mesas, plateaus, and canyons create a colorful panorama. Nearly five million visitors enter the park each year. Visitation fluctuates from year to year but has increased by a compounded average rate of 6% annually since 1985. The park is divided by the canyon into the North Rim and South Rim areas. Visitation to date has been primarily concentrated on the South Rim, where nearly 90% of total visitation to the park occurs—the remaining 10% visit the North Rim area. As a consequence, many of the visitor and transportation facilities on the South Rim have reached, and in some cases have exceeded, capacity, and demands to develop additional services are increasing as the number of visitors continues to rise.

Currently, the South Rim is overcrowded and the road system is congested during the summer months; access by transportation modes other than private vehicles (such as biking and hiking) is not well developed or easy to use; printed information to properly orient the visitor is inadequate; food service is inadequate, resulting in long waits; and many employee housing units are substandard and need to be rehabilitated, replaced, or removed. One of the largest issues facing land managers in the Grand Canyon area, which include GCNP, Kaibab National Forest (KNF), and Coconino County is how best to meet increasing visitor demands while protecting natural and cultural resources. In 1995, the National Park Service (NPS) adopted a General Management Plan (GMP) for GCNP that outlines steps to alleviate these problems. One of the primary roles of this analysis is to examine ways of achieving some of the goals listed in the GMP using both Federal and private land outside of the park.

The South Rim area has two entrances: the south entrance at Tusayan and the east entrance at Desert View. Of all the visitors to the South Rim, 99% pass through Tusayan, on their way either to or from the park. Tusayan is a tourist-oriented community in Coconino County, Arizona. It is about one mile south of the entrance to GCNP and consists largely of motels, restaurants, gift shops, campgrounds, and grocery stores (Figure 1.2). Tusayan has continued to add visitor lodging, retail, and food and beverage services on privately owned land to support the expanding tourist market driven by increased park visitation. Historically, employee housing has been provided by employers of Tusayan, but high land values and increased demand to supply tourist facilities and services have fueled a burgeoning and largely unmet demand for employee housing and community services and facilities in Tusayan.

The Grand Canyon Improvement Association (GCIA), a group of land and business owners in Tusayan, has expressed interest in expanding the community beyond its current 144 acres. Tusayan is surrounded by the Tusayan Ranger District of the KNF, and expansion would require use of adjacent National Forest System (NFS) land. NFS land could be made available under a special-use permit, acquired under the Townsite Act, or acquired through a land exchange.

The Tusayan Ranger District includes twenty-one private inholdings (privately owned parcels of land surrounded by NFS land). Twelve of these private inholdings are controlled by a development corporation, Canyon Forest Village (CFV), which has proposed to exchange these inholdings for NFS land adjacent to Tusayan. At least three of the twelve inholdings are considered likely candidates for development. In the absence of a land exchange, the future development of these inholdings would likely increase management responsibilities for KNF, GCNP, and Coconino County. New population and new infrastructure (roads, utility corridors, etc.) related to the development of the private inholdings would impact adjacent NFS land, and Coconino County would be required to provide basic law enforcement and solid-waste disposal services. Development of private inholdings near the park could change visitor patterns, creating new management issues for GCNP as well.

The goal of this Environmental Impact Statement (EIS) is to determine the best way to provide improvements to transportation, housing, community facilities, and visitor services outside of park boundaries, and whether NFS land should be used for these purposes. The five alternatives under consideration addresses these needs in different ways. To help evaluate these alternatives, an Interdisciplinary Team (see Lead and Cooperating Agencies Section) has identified the existing and desired conditions for those areas needing improvement.

Existing Situations and Desired Conditions

A desired condition is a description of what land managers intend to achieve for a specific area. The desired conditions for the Grand Canyon/Tusayan area reflect what is necessary for the efficient management of NFS land by the KNF to meet needs related to land ownership, transportation, employee housing, community services and facilities, and visitor demands.

The GMP proposes changes to four important areas that affect land use in the Grand Canyon/Tusayan area. First, the plan calls for expansion of the mass transit system in the park and development of a transportation staging area outside park boundaries. Second, the GMP caps residential growth in the park near current levels and proposes that additional housing needs be met outside the park. Third, the plan proposes that expansion of community facilities also be accomplished outside the park. Finally, the plan allows for only minor increases in visitor services and facilities in the park. This means that the increased demand for lodging, retail, and food and beverage services created by increased visitation would have to be met outside GCNP on other Federal, tribal, state, or private lands.

Land Ownership Management

Existing Situation

- Numerous undeveloped private inholdings currently exist within the Tusayan Ranger District. Several inholdings are close to GCNP or to road access and are believed to have future development potential. The development of these inholdings could impact the management of adjacent NFS and NPS lands and create additional stress on county-provided services. Some of these inholdings have natural and cultural resource values that could be important additions to the National Forest.

Desired Condition

- The land ownership pattern within the Tusayan Ranger District facilitates efficient and effective management and use of public and private lands. Undeveloped private inholdings with important natural and cultural resource values have been acquired by the Forest Service. Development of private land is consistent with the management objectives of the KNF, GCNP, and Coconino County.

Transportation System

Existing Situation

- The majority of visitors (78%) access the park with private vehicles (GCNP 1995:161), which leads to traffic congestion and difficulty in finding parking. Other transportation modes are not well developed or easy to use.

- High visitation rates and inadequate parking near Grand Canyon Village are the primary factors leading to traffic congestion during the summer season. Insufficient parking facilities result in unauthorized roadside parking, increased traffic congestion because of reduced driving space, and greater numbers of pedestrians on the roads (GCNP 1995:162).

- Roads in and near Grand Canyon Village generally operate near capacity. By 2010, use of most of these road segments is expected to exceed capacity, and traffic congestion is expected to aggravate traffic congestion (GCNP 1995:166).

Desired Condition

- GCNP works with area partners to develop a transportation staging area and associated orientation facility outside of the park. The facility provides regional trip-planning information, restrooms, telephones, information kiosks, day parking, and access to transit service to the park. The transportation staging area is the primary site where visitors leave their vehicles and board a transit service to the park.

- Transit service, hiking, and biking are the primary year-round modes of travel for park residents and visitors to the South Rim. Most vehicles are excluded from Grand Canyon Village.

- Level of use of roads in the park is comfortable and convenient for visitors and residents.

Housing Needs

Existing Situation

- GCNP has identified a need for up to 500 housing units (100 units for NPS employees and up to 400 units for park concessionaire employees) outside of park boundaries (GCNP 1995:171).

Figure 1.1 The Four Corners area of The Colorado Plateau

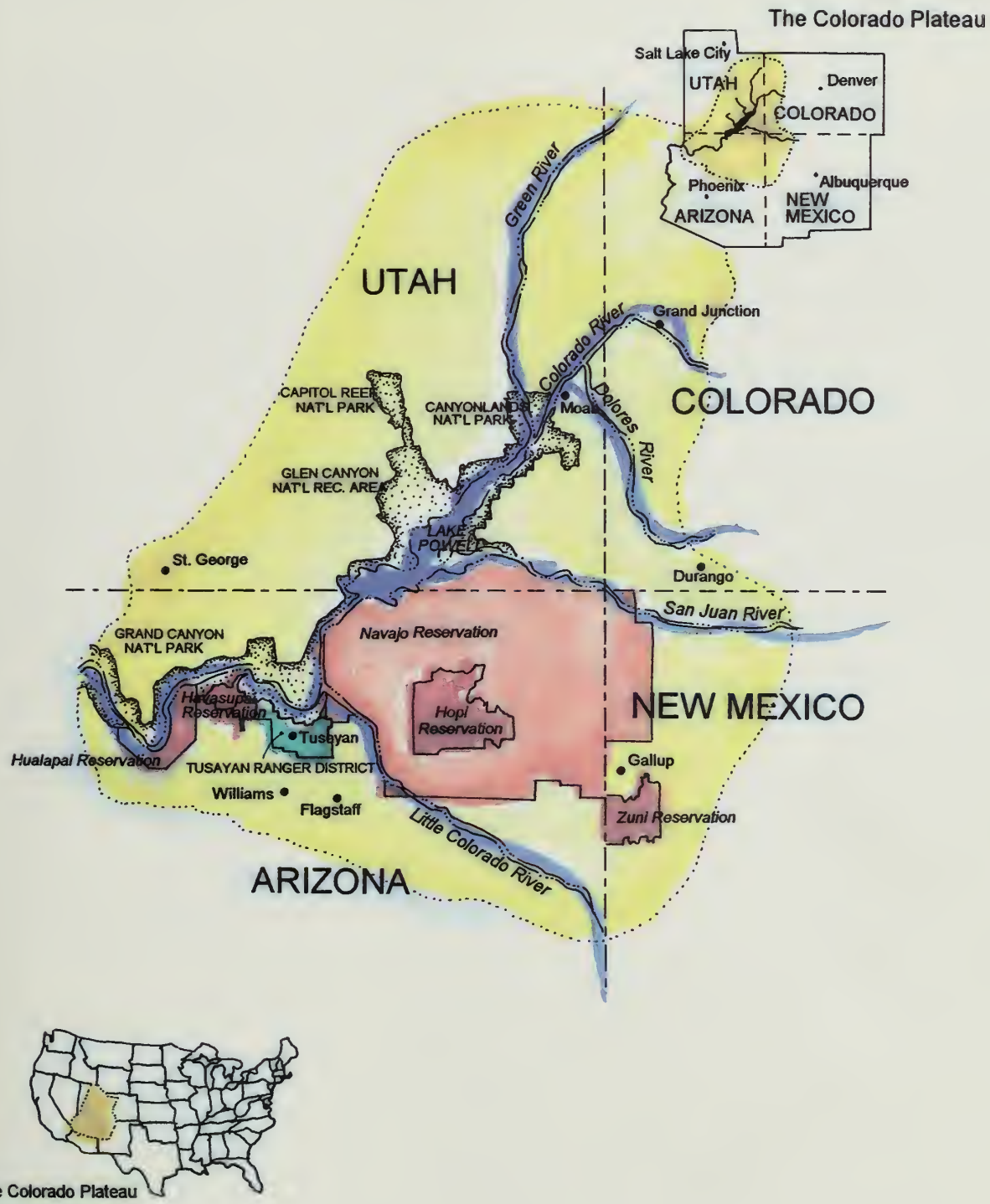
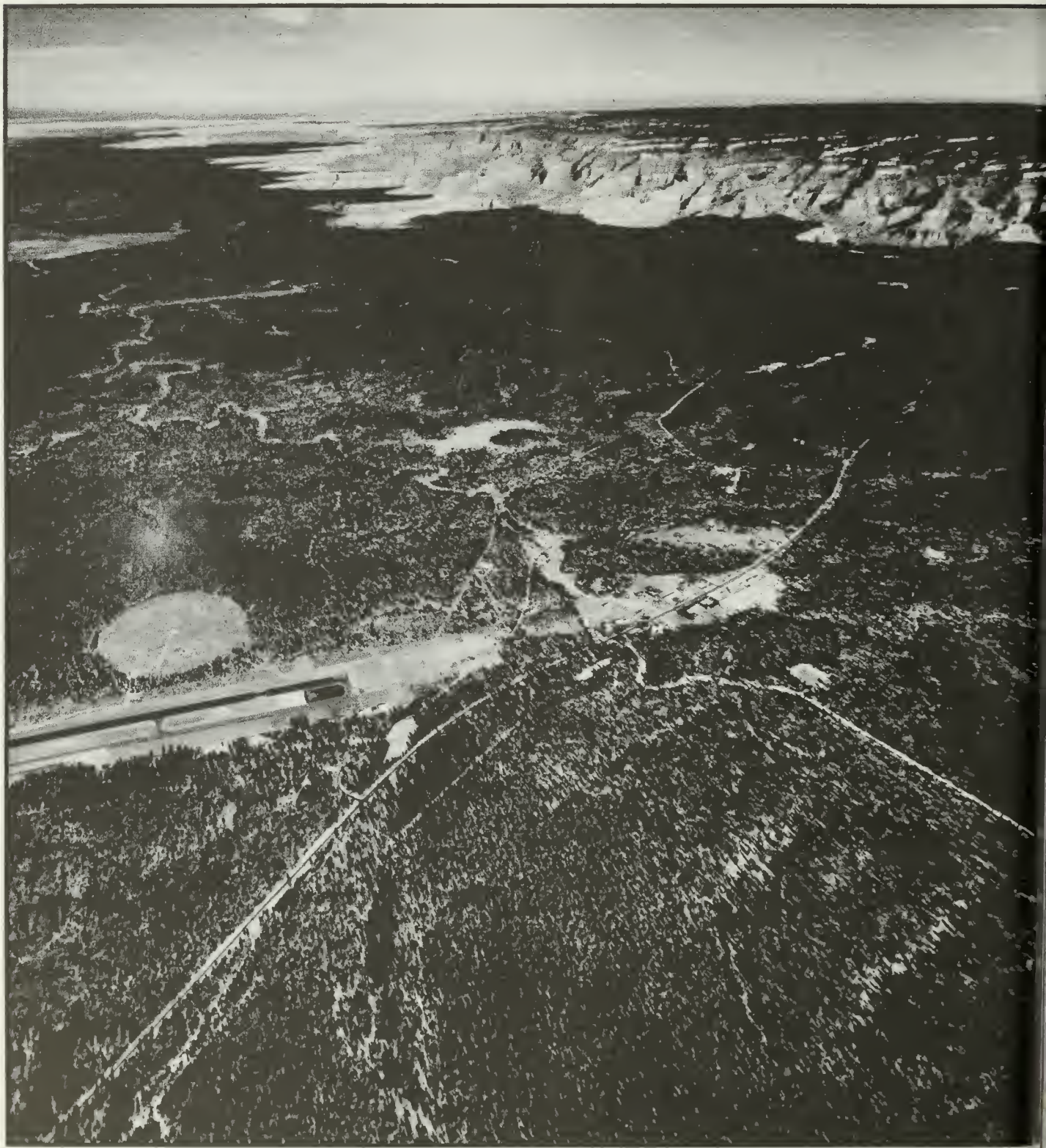


Figure 1.2 Tusayan and the Grand Canyon Area, Looking to the Northwest



Source: Rupp Aerial Photography, Inc., 19

- The population of Grand Canyon/Tusayan is estimated at about 2,300 permanent residents but grows to about 3,200 during the summer because of seasonal employment. Few housing options are available in the area for park and Tusayan business employees. Existing housing is often of poor quality and overcrowded. Many who work in the Grand Canyon area commute from Valle or from further away because housing that fits their needs is unavailable in the Grand Canyon/Tusayan area.

- The housing problem affects all employers and most employees in the area; many believe this to be the most persistent problem faced by local residents. While residentially zoned land exists in Tusayan, development of "open market" housing has not been feasible because of high land and development costs. Because housing in Tusayan is generally provided by employers, when jobs end employees risk losing their housing accommodations.

Desired Condition

- Up to 500 housing units are provided near the park to house NPS and park concessionaire employees who cannot be accommodated inside park boundaries. These units are located adjacent to Tusayan and include a variety of housing types (e.g., single-family dwellings, apartments, and dormitories).

- Residential housing is concentrated in one area, with community facilities and services in close proximity. Additional housing is provided for new employees who may come to the area in the future.

Planning For Community Needs

Existing Situation

- Development in Tusayan to date has followed market forces. The Tusayan Area Plan adopted by the Coconino County Board of Supervisors in 1995 provides some goals and policies for future development. Outside of this EIS process, there is no ongoing, comprehensive land-use planning effort or financing plan for Tusayan that provides for community facilities.

- GCNP officials desire to cooperate with other agencies and private entities to influence future development in the Tusayan area. Planning for growth in Tusayan has implications for GCNP management and the visitor experience at GCNP, KNF, northern Arizona, and outlying communities.

Currently, almost all community facilities serving the Grand Canyon/Tusayan population are located inside GCNP, including a school, a day-care facility, a library, a shared place of worship, a medical clinic, recreational facilities (indoor and outdoor), and most emergency services. As Tusayan and the resident population grow, the need to expand existing facilities or provide new facilities for schools, police and fire protection, medical services, and other community services will increase.

Desired Condition

- Community facilities and services are developed in Tusayan in a coordinated, planned fashion. Such facilities and services include additional schools; houses of worship; a day-care center; police, fire and emergency services; medical facilities; community parks; recreation centers; playgrounds; laundromats; banks; and grocery/supply stores.

- Grand Canyon Village continues to provide services for the in-park community. Expansion of these facilities occurs outside the park, as does development of any new community facilities that are needed to serve an increased resident population.

Planning For Visitor Needs

Existing Situation

- The GCNP GMP identifies a lack of information and orientation materials and services available to visitors entering the park, as well as inadequate and overcrowded orientation/interpretive facilities within the park. Information that is available oftentimes is too general and is outdated. Visitors who stop at regional information centers find it difficult to obtain up-to-date information on park accommodations.

- The demand for in-park lodging and camping facilities far exceeds current supply. There are 1,033 lodging units and 433 campground sites at the South Rim of GCNP. Visitors who do not obtain reservations in the park attempt to find accommodations in Tusayan, Flagstaff, Williams, or other outlying communities, or camp in the adjacent Forest or illegally in the park.

- Grand Canyon Village offers limited food and beverage services. Visitors often experience long delays or must eat at less desirable places or times, especially during peak visitor periods.

- Since 1992, 485 hotel rooms have been constructed in Tusayan, bringing Tusayan's total lodging units to 931. Another 160 units have been approved for construction by the Coconino County Board of Supervisors. Construction of these rooms is expected to commence in 1997.

Desired Condition

- Circulation patterns in Grand Canyon Village are organized so that visitors have convenient access to the rim, can easily learn about park themes, can safely experience the entire area, and can obtain a diversity of visitor services without long waits.

- Visitors have access to more conveniently located, up-to-date, informative interpretive facilities and programs.

- Overnight accommodations are consistent with the park setting and in locations that meet the management objectives of KNF and GCNP and that consider the expectations, needs, and preferences of visitors.

- Additional food and beverage facilities both inside and outside the park can accommodate peak visitor demand. Visitors can choose from a variety of dining experiences and price levels.

Project Objectives

Based on the desired conditions, the Interdisciplinary Team has identified three project objectives to examine:

1) Land ownership patterns that facilitate efficient and effective management of public and private lands;

2) Ways to facilitate coordinated development of community (e.g., housing, school, houses of worship, day care, community center, etc.) and visitor (e.g., guest lodging, retail, food and beverage) services and facilities in the Grand Canyon/Tusayan area; and

3) Location and concepts for a transportation staging area and orientation center for visitors to GCNP.

Decision to Be Made

Lead and Cooperating Agencies

The KNF is the lead agency and is responsible for the preparation of the EIS because the project objectives involve the use of NFS land. The decision on this EIS will be made by the Regional Forester for the Southwestern Region of the Forest Service in Albuquerque, New Mexico.

In February 1995, representatives from GCNP, Coconino County, and the Northern Arizona Council of Governments (NACOG) began working with the KNF as cooperating agencies in the preparation of the EIS. The GCNP is a cooperating agency because one of the main purposes of the EIS is to evaluate management actions that are consistent with the park's GMP. Coconino County is a cooperating agency because the county has ultimate zoning authority over private land and any NFS land conveyed into private ownership. NACOG is a cooperating agency because of the council's role in regional transportation issues and its overall mission to serve the communities of northern Arizona.

The lead and cooperating agencies make up the Interdisciplinary Team. Team members are experts in resources affected by this analysis.

Decision

The decision to be made is two-fold: 1) whether or not to use NFS land for community expansion and additional visitor services and facilities, including the construction of a transportation staging area for GCNP visitors; and 2) if NFS land is to be used, what method or combination of methods of acquiring use of NFS land best meets the needs of the area.

Permitting

Various Federal, state, and local regulatory permits, approvals, and licenses would be required beyond the decision made in this EIS process for the proposed development of NFS land. These requirements could include conditional-use permits, building permits, occupancy permits, and sewage disposal licenses. Several agencies may be involved in issuing permits, approvals, and licenses, including the KNF, GCNP, the U. S. Army Corps of Engineers (ACOE), Environmental Protection Agency (EPA), the Arizona Department of Environmental Quality (ADEQ), the Arizona Department of Water Resources (ADWR), the Arizona Department of Transportation (ADOT), and Coconino County.

Relationship to Other Plans and Programs

Several plans and programs, briefly described below, influence this analysis and the implementation of the decision. These plans and programs relate to the management responsibilities of two agencies (the KNF and GCNP) and the implementation and management of projects in close proximity to the NFS land involved in this analysis. Coordination between these plans and this analysis has been an ongoing process.

Kaibab National Forest Plan

The KNF Plan (KNF 1987) outlines management objectives for the Forest regarding recreation, wildlife, timber, grazing, and other resources and land uses. The KNF Plan lists, as one of its specific real estate management objectives, generation and consideration of proposals for long-term acquisition or use of NFS land in the Tusayan area for community expansion (KNF 1987:57). Evaluation of such proposals is to be based on the following criteria:

- management objectives of the State of Arizona and GCNP
- role of proposed developments in contributing to coordinated community development
- social and economic impacts on surrounding gateway communities
- appropriate zoning changes by Coconino County
- review of development plans by both Coconino County and the KNF

All of the alternatives under evaluation are consistent with the management direction identified for NFS land in the KNF Plan.

Additionally, the KNF Plan identifies private inholdings in the Forest that are desirable for acquisition, based on a series of criteria. The private lands under consideration in this EIS are classified as desirable for acquisition because they meet one or more of the following criteria (KNF 1987:122):

- possess unique historical or cultural resources
- increase the resource outputs of the National Forest
- promote effective resource management
- block in or consolidate existing NFS land

Grand Canyon National Park General Management Plan

The GMP, adopted by GCNP in August 1995, is a plan for resource preservation and visitor use that seeks to minimize environmental effects on the park and the region. The GMP stipulates cooperation with local entities, with an emphasis on preserving regional and park resources, disseminating information, and providing a quality visitor experience. The GMP offers solutions to current problems in transportation, employee housing, community facilities, and visitor services and facilities. "The National Park Service would work jointly with adjacent entities to provide for many park needs outside park boundaries. The most appropriate locations for facilities would be considered in a regional context, taking into consideration principles of sustainable design and the need to preserve resources while providing for a quality visitor experience" (GCNP 1995:47).

Coconino County Comprehensive Plan

The Coconino County Comprehensive Plan (Comprehensive Plan) was adopted by the County Board of Supervisors on April 2, 1990. This plan contains goals that provide a direction for the County's actions and the policies of intent to accomplish the goals, and includes sections on land use, transportation, public safety, environmental quality, housing, and public facilities. Implementation of the Comprehensive Plan is achieved through the decision-making process for zoning changes, conditional use permits, and subdivisions. Before the Planning and Zoning Commission and the Board of Supervisors can approve zoning cases, the proposed zoning must conform to the goals and policies in the Comprehensive Plan. Conditions or stipulations may be attached to the approval of zoning cases to achieve compliance. The Comprehensive Plan is further enhanced by special area plans, such as the Tusayan Area Plan, which are adopted as amendments.

Tusayan Area Plan

In June 1995, the Coconino County Board of Supervisors adopted the Tusayan Area Plan, which outlines policy and direction for future development in the Tusayan area. This plan primarily addresses future land uses, aesthetics, employee housing, and environmental protection, and requires design review for such issues as architectural styles, building materials, and lighting. The Tusayan Area Plan is provided in the appendix.

Grand Canyon Regional Transportation Study

This study, prepared by NACOG, evaluates the feasibility of providing visitors the opportunity to leave their vehicles in communities outside the park and use a mass transit system to reach the South Rim. Cameron, Valle, Flagstaff, and Williams, because of their proximity to the park, were the foci of this evaluation. The study concludes that development of secondary regional transportation staging areas is feasible but that additional work would be necessary to refine the system design. Implementation would also need to be closely coordinated with GCNP and the four communities (JHK and Associates 1996).

Grand Canyon Railway Spurline EIS

A Final EIS was issued in November 1993 on the proposed Grand Canyon Railway Spurline from Grand Canyon Airport, south of Tusayan, to the Maswik Transportation Center in GCNP. The KNF and GCNP issued a Record of Decision (ROD) on December 13, 1993, that selected the construction of a 5.4-mile loop line that would branch off the existing Williams-Grand Canyon Line at Apex Siding and access the Grand Canyon Airport area between the airport and State Highway 64. The decision has not been implemented and the EIS/ROD is currently under appeal.

Grand Canyon Airport Master Plan

This plan, completed in 1991, identifies the need for a second runway to reduce holding times for aircraft attempting to land at the airport and thus reduce aircraft-generated noise around Tusayan. The plan also identifies the need for a new terminal building and other visitor-oriented facilities, including a motel and restaurant. The Environmental Assessment for this project is expected to begin in 1997, and project completion is estimated for the year 2000.

Statutory and Regulatory Authorities

Federal statutes and authorities establish a number of responsibilities for Federal agencies. Regulations pertinent to this analysis include the following:

National Environmental Policy Act

Enacted in 1969, this act requires the preparation of an EIS for proposals, legislation, and other major Federal actions significantly affecting the quality of the human environment (40 CFR § 1508). This requirement includes approval of construction projects or management activities by permit or other regulatory decision. The scope of this analysis and its proximity to GCNP have prompted the KNF to require that NEPA provisions be met by the preparation of an EIS.

National Forest Management Act

The National Forest Management Act (NFMA), enacted in 1976, has evolved into a broad-ranging statute requiring planning for each individual National Forest. NFMA regulates the process of preparing and implementing land and resource management plans for each Forest. These plans typically are revised every 10 to 15 years. All National Forest actions must be consistent with the Forest Plan.

Organic Act

Enacted in 1916, the Organic Act established the National Park Service, defined the resource management goals to be met by that agency, and established some of the management tools to be used. The Organic Act defined the mission of the NPS to "promote and regulate the use" of the park system to preserve for the enjoyment of future generations the nature of park lands as they exist at the time the park is established.

Federal Land Policy and Management Act

Authority to conduct land exchanges is provided explicitly in Section 206 of the Federal Land Policy and Management Act (FLPMA) of 1976. FLPMA is also the authority for the issuance of special-use permits, leases, or easements to occupy, use, or traverse NFS land for transportation systems and utilities.

Federal Land Exchange Facilitation Act

The Federal Land Exchange Facilitation Act (FLEFA) of 1988 amends the FLPMA, streamlining and improving the procedures for implementing land exchanges between Federal and non-Federal entities. This act recognizes land exchanges as "an important tool to consolidate landownership for purposes of more efficient

management; to secure important objectives of resource management, enhancement and development, and protection; and to fulfill other public needs" (43 U.S.C. 1716 and 1740).

Townsite Act

The Townsite Act of 1906 (34 Stat 116) allows a government entity to purchase Federal land at not less than fair market value. The purchased land can be used only for public purposes (e.g., public housing, schools, community centers), not for commercial purposes.

Interagency Agreement Between The U.S. Department of Agriculture And The U.S. Department of The Interior For Government-Furnished Housing

As part of the interagency agreement, the U.S. Department of Agriculture (USDA) and U.S. Department of the Interior (USDI) have agreed to cooperate in management of government-furnished housing. Coordination between these agencies improves the efficiency and continuity of management of government-furnished housing.

Public Scoping

The purpose of public scoping is to solicit comment from interested and affected parties, including individuals from local, state, and Federal agencies, American Indian groups, and other interested or concerned groups or individuals. Public comment is used in the NEPA process to identify issues and concerns related to the proposed action; alternatives to the proposed action are generated to address the issues and concerns so identified.

The KNF initiated public scoping in November 1993 by soliciting comments on the Tusayan Growth EIS. The KNF sent out a mailer to a list of approximately 750 addressees describing the proposed action and identifying a preliminary list of resource-related issues. This mailer, in addition to requesting written responses, invited interested and concerned parties to attend any of nine public scoping meetings scheduled throughout the region. Public scoping meetings were held between March 24 and April 27, 1994, in the Arizona communities of Flagstaff, Tusayan, Williams, Phoenix, Cameron, Kykotsmovi, Supai, Tuba City, and Peach Springs. Public announcements of these meetings appeared in several newspapers and aired on local radio stations. Several presentations have also been made to regional chambers of commerce, city councils, and other organizations. The Tusayan Growth EIS has received nationwide attention, with numerous articles and editorials in newspapers and news stories on radio and television stations.

Comments received from public scoping were analyzed to identify issues and concerns to be addressed in this EIS, which were categorized into the 14 subject headings listed below. These subjects were further distilled into issue statements. The expressed concerns related primarily to natural and cultural resources, effects on water resources, socioeconomic effects on nearby communities, and potential effects on GCNP.

- Surface and Groundwater
- Socioeconomic Environment
- Visitor Experience in and around Grand Canyon National Park
- Transportation
- Development Plan Assurances
- Cultural Resources
- Biological Resources
- Forest Service Management
- Scoping Issues (Information)
- EIS Consultants
- Appraisals
- Project Consultation and Coordination
- Purpose and Need
- Cumulative Impacts

After the initial public scoping effort, an additional public comment period conducted between October and December 1994 allowed individuals to comment on the revised purpose and need, the identified issues, and potential alternatives. Numerous letters were written to the Forest Service during this time, but no new issues or alternatives were identified.

As part of public involvement in the EIS process, the Interdisciplinary Team has prepared and distributed seven newsletters, each focusing on a different aspect of the EIS. The mailing list for the newsletters continues to grow; the latest issue was sent to over 950 addresses nationwide.

Issues Eliminated From Further Consideration

During the scoping process, several concerns were raised that were not analyzed as separate issues in this document. Some of these concerns have been addressed in the discussion of other closely related issues, while others are beyond the scope of this EIS or do not require analysis for

other reasons. The concerns not individually addressed in this EIS are water quality, water rights, scoping issues, choice of EIS consultant, appraisals of involved lands, project consultation and coordination, purpose and need, and cumulative impacts. The reasons for eliminating the analysis of these topics as discrete issues is discussed below.

Water Quality

Issue

Concerns were expressed that the development of impervious surfaces, such as parking lots, could increase pollutants such as metals, phosphorus, nitrates, dissolved and suspended solids, oil, and other chemicals in surface runoff that might reach the underlying aquifer.

Reasons for Elimination

Potential contamination of groundwater from surface runoff is considered extremely unlikely because of the depth of the aquifer (approximately 2,500 feet) and the transmissivity and filtering effects of the intervening geologic strata. Water quality is regulated by Sections 401 (State Water Quality Certification), 402 National Pollution Discharge Elimination System (NPDES), and 404 (Dredge and Fill Permits of the Clean Water Act) by ADEQ, ADWR, and EPA. These regulations, goals, and policies help prevent significant impacts to water quality through a rigorous permitting process for development projects. Coconino County regulations under the Tusayan Area Plan ensure that post-development runoff can not exceed pre-development runoff levels. Because state and Federal regulations require whatever measures necessary to ensure protection of water quality regardless of the action this issue is not analyzed further.

Water Rights

Issue

The exchange of land could affect existing water rights on the private or NFS lands.

Reasons for Elimination

Surface and groundwater rights on NFS land or private inholdings would be transferred with land ownership, or retained in present ownership if no adjustment occurs. No impacts are expected from the transfer of these water rights. ADWR regulates groundwater resources by issuing drilling permits for new wells. To date, drilling wells in the Redwall/Muav aquifer has not affected other wells tapping the same source and it is likely that permits for new wells would be granted by ADWR, if requested. Coconino County regulations, under the Tusayan Area Plan, consider adequacy of water supply in the review of all major developments requiring approval from the County.

GCNP has reserved both State and Federal water rights to protect the water supply needed for administrative purposes and the protection of resources in the park. They have limited authority to enforce their water rights on wells drilled outside their jurisdiction. If a problem is suspected, their only recourse is to quantify impacts after a well is drilled and file suit against the driller.

Scoping Issues

Issue

A project of this magnitude must be considered and evaluated with as much public participation and dialogue as possible. Issues developed during the scoping process should be carefully developed to ensure that public concerns are addressed.

Reasons for Elimination

Extensive public involvement has occurred throughout the preparation of this EIS. The KNF initiated public scoping in November 1993 and public participation and dialog concerning the issues addressed in this EIS have continued throughout the EIS process. After the initial public scoping effort, the purpose and need for the analysis were refined and preliminary alternatives were developed. The public was given another opportunity to comment on the purpose, need, and alternatives. The KNF and cooperating agencies have periodically informed the public about the project by distributing several newsletters, presenting information at various meetings, and releasing information to local news media. The KNF continues to receive and review letters from individuals and organizations concerning growth issues in the Grand Canyon/Tusayan area. A comprehensive list of issues, addressed individually in the following chapters, has evolved from these public involvement efforts.

EIS Consultant

Issue

The EIS consultant must prepare a disclosure statement to expose any potential conflict of interest. The selected EIS consultant may have a conflict of interest.

Reasons for Elimination

Several procedures are implemented by the Federal government to ensure that the NEPA process and documentation prepared by a third-party contractor are completed in an objective manner that meets the intent of the NEPA. According to regulations of 40 CFR §1506.5(c), the lead agency is responsible for final selection and approval of the third-party contractor, who then prepares the NEPA document under the direct supervision of the lead agency and Interdisciplinary Team. The lead agency reviews the EIS and has responsibility for its scope and content. The third-party contractor also must attest that it has no conflict of interest or financial interest in the outcome of the proposed project. All of these procedures have been properly implemented for the Tusayan Growth EIS.

Appraisals

Issue

Appraisals for the land exchange must be fair.

Reasons for Elimination

The appraisal process is separate from the NEPA analysis. Appraisals undertaken by the KNF are regulated by Federal laws, including the Federal Financial Institutions Reform, Recovery, and Enforcement Act of 1988; the Uniform Relocation Assistance and Real Property Act of 1970; and the Uniform Appraisal Standards for Federal Land Acquisitions (Interagency Land Acquisition Conference 1992). These laws and regulations ensure that standardized and formal procedures are used in determining the monetary value of the Federal and private lands.

By law, the value of the Federal and private lands in a land exchange must be equal. Differences in dollar value between the Federal and private lands can be balanced with acreage adjustments or addressed with a cash equalization payment by the agency or proponent of up to 25% of the value of the Federal land.

Concurrent with this EIS, there is an ongoing appraisal of the Federal and private lands involved in the alternatives by an independent professional appraiser. Based on the results of the appraisal process, adjustment may be made in the size of the Federal tract or in the amount of private lands offered in the land exchange alternatives to equalize values or "to ensure equal value of the Federal and private land." The appraisal will also determine the value of the Federal land specified for acquisition under the Townsite Act, and will serve as the basis for the fee structure for the transportation staging areas in the alternatives that authorize this facility under special use permit.

Project Consultation and Coordination

Issue

This project should consult and coordinate with all applicable local, state, and Federal agencies and laws, and with any other ongoing planning efforts.

Reasons for Elimination

As described earlier, this analysis is being coordinated with several agencies and plans, including: KNF Plan, GCNP General Management Plan, Coconino County Comprehensive Plan, Tusayan Area Plan, Grand Canyon Regional Transportation Study, Grand Canyon Railway Spurline EIS, and Grand Canyon Airport Master Plan. Project consultation and coordination is an ongoing effort and will continue throughout this EIS process.

Purpose and Need

Issue

The purpose and need statement needs to be broadened to emphasize housing and community services, and if it will include commercial development, it must explain why this project is in the public interest.

Reasons for Elimination

The purpose and need for this analysis is the subject of Chapter 1. The project objectives have been broadened to include housing and community services. The goal of this EIS is to determine how to accommodate growth in the Grand Canyon/Tusayan area to meet public interests.

Cumulative Impacts

Issue

Cumulative impacts on a variety of resources must be addressed.

Reasons for Elimination

Cumulative impacts are addressed in the analysis of all of the issues rather than as a separate, discrete issue. This organization relates impacts directly to their causes and provides greater clarity for the reader.

Issues and Evaluation Measures

In deciding what topics to address in the EIS, the Interdisciplinary Team gave serious consideration to the comments generated by individuals, organizations, and agencies. Gathering this information has been part of an ongoing process that began with the initial public scoping.

Many topics generated far less public interest or comment than others; some are plainly more important to the public than others. In analyzing these issues, the Interdisciplinary Team has endeavored to give each topic an appropriate level of study, commensurate with both the level of public concern and the significance of the impacts that could be expected to occur. The issues that emerged as of greatest concern are listed below, along with the evaluation measures that will be used to compare the alternatives. Evaluation measures provide parameters by which the impacts to specific resources of the proposed action or its alternatives can be quantified, described qualitatively, and compared.

Surface and Ground Water

Water Supply

There are currently two privately owned water systems in Tusayan (excluding the Moqui Lodge system), one owned by Anasazi Water Company and the other by Hydro-Resources Storage. Together these systems provide approximately 47% of Tusayan's water supply. The Anasazi Water Co. system was built in the mid to late 1960s; Hydro-Resources was established in 1978. Existing storage capacities are 300,000-350,000 gallons and 3,650,000 gallons, respectively. The Canyon Squire Inn has drilled two wells in Tusayan that pump groundwater from the Redwall-Muav aquifer. In addition, the Tusayan water systems purchase water from the City of Williams and GCNP, approximately 30% and 23%, respectively, of Tusayan's water supply. Development of private or NFS land would increase demand for water.

Evaluation Measures

- Estimated water demands associated with development of private or NFS lands
- Proposed water resources (location, type, and amount) to be developed and their capacities
- Long-term and regional effects on water availability
- Types of proposed conservation measures
- Cumulative effects of proposed development and other development in surrounding areas on regional water supply

Grand Canyon Water Resources

The primary groundwater resource in the Tusayan area is the Redwall-Muav aquifer, approximately 2,500 feet below the surface. Two separate sub-basins within this aquifer lie under the private and NFS lands involved in this analysis: the Havasu Springs sub-basin and the Blue Springs sub-basin. The Havasu Springs sub-basin discharges predominantly from Havasu Springs in Cataract Creek, and to a lesser extent from Hermit and Bright Angel springs and other springs and seeps in Grand Canyon. Flow through the system is believed to be in dynamic equilibrium, with discharge from springs roughly equaling aquifer recharge rates (Montgomery & Associates 1993). Additional groundwater pumping in the Tusayan area for new development could affect aquifer flow dynamics and could affect spring flow and other water-related uses and values in GCNP and on tribal land. The Blue Springs sub-basin is found along the Little Colorado River and does not appear to be affected by activity within the Havasu Springs sub-basin. Blue Springs is the major discharge point from this sub-basin, and its flow is several times larger than that of Havasu Springs. If a well is drilled on the Lower Basin inholding, which is in the Blue Springs sub-basin, it may affect discharge from Blue Springs.

Evaluation Measures

- Projected effects on Havasu Springs, Blue Springs, and other springs in Grand Canyon as a result of additional groundwater pumping

Water Transportation

Tusayan's water is supplied, at least partially, by truck from other regional sources (GCNP 1995). Increased hauling of water from surrounding areas could increase vehicle emissions and resultant air pollution and could decrease public safety on roadways. Construction of pipelines to transport water from distant sources could affect natural and cultural resources.

Evaluation Measures

- Projected number of water trucks required on roadways per day to adequately supply the existing and proposed developments and their associated impacts on air quality and highway safety
- Projected effects of pipeline construction on natural, cultural, and other resources

Socioeconomic Environment

Tusayan and the Grand Canyon Area

The community of Tusayan is the immediate gateway to the South Rim of GCNP and provides lodging, food services, air tours, and other facilities. Additional commercial development in the Grand Canyon/Tusayan area could affect revenues for existing businesses through increased competition.

Evaluation Measures

- Projected increase in demand for additional visitor facilities and timing of supply additions
- Influence of various levels of development on businesses in Tusayan and GCNP (e.g., competition and product pricing)
- Cumulative effects consider future development of private land (including private inholdings) and the associated effects on Tusayan and Grand Canyon

Other Surrounding Communities

Many of the communities in northern Arizona depend to a large extent on tourist revenue created by GCNP visitation. Large-scale development in the Tusayan area could negatively impact the economic base for a number of these communities through the loss of Grand Canyon tourist revenue.

Evaluation Measures

- Estimated percentage of GCNP visitor and related spending throughout the northern Arizona region and in individual communities
- Prospective levels of increase in the number of hotel rooms and other services in Tusayan from the proposed development(s) and potential impacts of the proposed development to local and regional markets

Housing

There is a need for additional housing for Federal and concessionaire employees within GCNP and for employees of Tusayan businesses (GCNP 1995). Issues include who would build the housing, who would pay for the housing to be built, how many units are provided, what types of housing are provided, and what distribution of housing types and affordability will be offered.

Evaluation Measures

- Projected housing needs and adequacy of allocated land in meeting those needs
- Projections for types of housing to be built
- Estimated cost ranges by type and number of each type to be built
- How proposed governance would assure affordable and available housing for area employees
- Ownership structure of housing facilities

Employment Opportunities

Development near Tusayan may provide additional employment opportunities.

Evaluation Measures

- Types and numbers of employment opportunities

Crime Rates

With local population growth and increasing visitation, crime rates have generally increased in both GCNP and the Tusayan area (Lieutenant Augenstein, Coconino County Sheriff's Department, personal communication 1994). Additional population growth and visitation resulting from development of the private and NFS lands could increase crime rates in the Grand Canyon Tusayan area.

Evaluation Measures

- Relationship between population size or density and crime rate
- Change in location of law enforcement facilities and response time to criminal occurrences

Community Infrastructure

Currently, almost all community facilities serving the Grand Canyon/Tusayan population are inside GCNP, including a school, a day-care facility, a library, a shared place of worship, a medical clinic, recreational facilities

(indoor and outdoor), and most emergency services. County and State services are limited in the Tusayan area. The South Grand Canyon Sanitary District currently operates a sewage treatment facility for local residents and businesses. Coconino County operates a compactor station and hauls solid waste to the Flagstaff landfill. Through a cooperative agreement with the Forest Service, the County maintains Forest Road (FR) 302 to this compactor facility. State facilities and services in the Tusayan area are limited to operation of the Grand Canyon Airport and maintenance of State Highway 64 by ADOT. Existing medical facilities in the Grand Canyon/Tusayan area consist of a full-service clinic in GCNP, currently operating near capacity, two NPS ambulances, and an air-evacuation helicopter (Chris Becker, Samaritan Health Center and Pharmacy at Grand Canyon, personal communication 1994). As Tusayan grows and visitation to the park increases, the need to expand existing facilities or provide new facilities for schools, police and fire protection, medical services, and other community services will increase.

Evaluation Measures

- Proposed estimated additional community, county, or state facilities needed
- Funding mechanism to construct proposed community infrastructure
- Adequacy of space made available to meet these demands
- Adequacy of existing or proposed utilities (e.g., electrical, communication) to accommodate the development
- Proposed methods and facilities for disposal of solid waste
- Capacity and ability of existing facilities to handle additional solid waste

Visitor Experience in and Around Grand Canyon National Park

Grand Canyon Experience

Generally recognized values of GCNP include global or universal appeal; scenic beauty; solitude and spiritual/inspirational qualities; recreational opportunities; natural resources, ecosystems, and research opportunities; and cultural resources. Development of private or NFS lands near Tusayan could affect some of the values of GCNP and the surrounding KNF through increased visitation and impaired or degraded quality of visitor experience from further urbanization near the park boundary.

Evaluation Measures

- Values of GCNP that would be affected by development of the private or NFS lands
- Type of development proposed and the degree to which it would detract from or enhance values associated with GCNP
- Degree to which the development would mitigate or exacerbate impacts to GCNP visitor experience currently resulting from congestion and overcrowding
- Degree to which the proposed development would improve visitor experience through the provision of additional facilities and services

Visual Quality

The State Highway 64 corridor on NFS land has special status under Public Law 77 and is considered visually sensitive. This corridor has been designated as "retention foreground and middleground" in the KNF Plan, signifying that human activities along the corridor should not dominate the landscape (KNF 1987). Most of the segment of State Highway 64 on the KNF is undeveloped and wooded, except in Tusayan and near Moqui Lodge. The level of proposed development in the Tusayan area along State Highway 64 may increase, altering visual conditions along the highway. The private inholdings under consideration for acquisition are mostly undeveloped and indistinguishable from adjacent NFS land. Development of these inholdings may change the landscape that may be visible to KNF and GCNP visitors.

Evaluation Measures

- Change in visual characteristics along State Highway 64 as a result of development under each alternative
- Change in visual characteristics in the vicinity of the private inholdings resulting from their development

Air Quality

GCNP has been designated a Class I airshed under the Clean Air Act. Class I is the cleanest standard and is subject to stringent controls for airborne pollutants. Air quality is generally good at GCNP, but it is influenced

seasonally by weather patterns, temperature inversions, and pollutants carried from the Navajo Generating Station near Page and major metropolitan areas such as Phoenix, Las Vegas, and Los Angeles (Bureau of Reclamation 1994). Locally, air quality is affected by emissions from private vehicles, buses, and trains, and from stationary sources such as wood-burning stoves. Additional development of private and NFS lands near Tusayan could result in a change in vehicle-emitted air pollution, affecting visibility in GCNP.

Evaluation Measures

- Contribution of local sources of air pollution to air quality in GCNP

- Measures implemented to reduce the effects of local sources of air pollution

Light Pollution

GCNP is a relatively remote area and is considered important for its solitude and wilderness values. Commercial and community growth in the Tusayan area may create additional light pollution for visitors looking across the canyon from the North Rim and for backcountry users at GCNP. It could also diminish night-sky visibility for visitors and residents in GCNP, the KNF, and Tusayan.

Evaluation Measures

- Projected light pollution increase from development and noticeability of this increase from various points in or adjacent to Grand Canyon

Noise

GCNP is valued for its natural quiet. Sources of noise within the park include aircraft overflights, buses, and other motorized traffic. Existing noise in Tusayan stems primarily from helicopter and airplane departures and arrivals at Grand Canyon Airport and from highway traffic (KNF and GCNP 1993). Additional development in the Tusayan area may increase noise associated with residential use, local traffic, mass transit, and air traffic in the Grand Canyon/Tusayan area.

Evaluation Measures

Projected noise, by type, in proposed residential and commercial areas and in the surrounding forest

Anticipated change in noise levels in GCNP

Influence of each alternative on the need for an additional runway at Grand Canyon Airport

Grand Canyon National Park General Management Plan

The GCNP GMP addresses transportation issues, housing needs, and water supply as primary considerations. Development of private or NFS lands near Tusayan could affect management of GCNP.

Evaluation Measures

- Degree to which the GCNP GMP and each alternative complement each other and address primary issues for this area, including traffic congestion, overcrowded visitor facilities, and housing and community service needs

- Degree to which both the GCNP GMP and each alternative ensure protection of the values for which GCNP was created

Grand Canyon Visitation

At this time approximately five million people visit GCNP each year, and park visitation has shown an overall increase since its inception (GCNP 1995). A large proportion of visitors arrive during the peak summer season, creating overcrowded conditions and high demand for overnight accommodations and food services in the park (GCNP 1995). Development of visitor facilities near Tusayan could alleviate excess demand for lodging and food services in GCNP. It is also possible that average length of visitor stay may increase, which could affect GCNP facilities, services, and resources.

Evaluation Measures

- Existing and projected annual visitation rates at Grand Canyon

- Projected change in park visitation rate from the development of private or NFS lands, and estimated effects on park facilities, services, management, and resources

- Projected change in the average length of visitor stay and estimated effects on park facilities, services, and resources

Transportation

Approximately 90% of GCNP visitation is to the South Rim area, by way of State Highway 64. Most visitors (77%) arrive by private vehicle; about 23% arrive by bus, air, or train. Many roads around Grand Canyon Village are congested during the peak visitation season, and traffic

conditions at these times typically are poor to very poor (GCNP 1995). A transportation staging area located near Tusayan could relieve traffic congestion at the South Rim by providing parking facilities and access to alternative transportation modes into the park. As park visitation continues to increase, traffic congestion in the Tusayan area and on State Highway 64 could increase as well.

Further development in the Tusayan area could result in greater use of the airport runway and other facilities. Expansion of the community in the general vicinity of the airport may increase land-use conflicts and affect public safety.

Evaluation Measures

- Existing and planned transportation systems for the area
- Projected changes in traffic congestion and management in and near GCNP
- Locations of commercial and community facilities in relation to transportation terminals

Development Plan Assurances

Development of private or NFS lands near Tusayan would require a specific plan that includes assurances that what is analyzed and proposed for development will actually be built and that development and mitigation commitments would be carried out during implementation.

Evaluation Measures

- A funding mechanism exists to ensure the development of the noncommercial components of the plan
- Effectiveness of the proposed assurances that development and mitigation commitments made in the alternative will be carried out during implementation and adhered to over the life of the development

Cultural Resources

Many archaeological sites have been recorded in the Tusayan area, most from the prehistoric Pueblo/Cohonina cultures. Historic resources in the Tusayan area are primarily related to the Atchison, Topeka and Santa Fe Railway from Williams to Grand Canyon and the Saginaw and Manistee Lumber Company established early in the twentieth century (KNF and GCNP 1993). Five American Indian groups with ties to the Grand Canyon area have entered into Tribal consultation for this project: the Havasupai, Hopi, Hualapai, Navajo, and Zuni. Development of private or NFS lands near Tusayan could impact archaeological sites, traditional cultural properties (TCPs) of local and regional American Indian groups, and historic resources associated with railroad, logging, and livestock operations.

Evaluation Measures

- Number, location, and types of archaeological, TCP, and historic sites on the involved private and NFS lands

Biological Resources

Vegetation

The affected areas on the Tusayan Ranger District consist predominantly of pinyon-juniper woodland, ponderosa pine forest, and interspersed grassland and sagebrush habitat (KNF 1985). Development of private or NFS land could affect the types and acreage of vegetation available on the Forest. A portion of the NFS land is suitable for commercial timber production, which may result in a decrease in the available timber supply.

Evaluation Measures

- Number of acres of each vegetation type and net change in type on the KNF
- Net change in acres of NFS or private land suitable for commercial timber production
- Estimated acreage of suitable timber land and timber volumes

Wildlife

Wildlife species that use NFS land or undeveloped private land in the Grand Canyon/Tusayan area include mule deer, elk, pronghorn antelope, turkey, and a variety of nongame species (KNF 1985). Development of private and NFS land could affect known deer-fawning, elk-calving, and turkey-roosting habitat, as well as other game management areas in the vicinity. It could also affect nearby wildlife movement corridors and would likely increase human disturbance of these and other wildlife populations near NFS land.

Evaluation Measures

- Number of acres of habitat on the private and NFS lands, and net change in acres of habitat on the KNF to be managed for wildlife
- Known wildlife use patterns, by species, and the presence of important or sensitive wildlife use areas on and near the private and NFS lands
- Levels of existing development near the private and NFS lands that currently affect wildlife values in these areas

Threatened, Endangered, and Sensitive Species

Plant and animal species that are candidates for or are currently on the Threatened and Endangered Species list are known to occur on the Tusayan Ranger District. Development of the private or NFS lands may affect populations of Threatened, Endangered, or Sensitive (TES) plants and/or animals.

Evaluation Measures

- Presence of TES species and the number of acres of habitat on or near the private or NFS lands
- Net change in the amount of occupied TES habitat on the KNF as a result of each alternative
- Potential effects of development of the private land on TES species

Forest Service Management

Forest Service Management Objectives

Land management objectives for the Tusayan Ranger District relate to recreational use, livestock grazing, conservation of water and soil resources, special land uses, and property boundary management. Management of NFS land adjacent to Tusayan emphasizes potential use of these lands for community expansion.

Using NFS land for development of visitor facilities and community services could affect the KNF's ability to effectively manage natural and cultural resources in the areas adjacent to development.

Evaluation Measures

- Degree to which the proposed alternatives would affect grazing operations
- Amount of additional road and utility easements needed on NFS land to support additional development
- Existing private and commercial uses of NFS land
- Degree to which the alternatives would facilitate and improve efficiency of KNF management

Public Recreational Opportunities

Recreational use on the Tusayan Ranger District includes hunting and dispersed camping as well as cross-country skiing, hiking, mountain biking, and horseback riding. Development of the private or NFS lands near Tusayan may affect recreational opportunities in the area. Development of the NFS land may affect the proposed expansion of TenX Campground.

Evaluation Measures

- Predominant recreational uses on and near the NFS land, and projected changes in use as a result of development
- Projected change in type and volume of recreational use as a result of KNF acquisition of the private inholdings
- Changes in Recreational Opportunity Spectrum classifications on the KNF as a result of the proposed alternatives

Fire-Management Programs

Fire-management objectives on the KNF emphasize use of cost-effective fire suppression techniques and fuel treatment activities, such as controlled burning to maintain firebreaks, particularly in areas with wildland/urban interfaces (KNF 1987). Development of private or NFS land near Tusayan may affect the amount of urban/wildland interface and increase fire risk. This may affect fire suppression efficiency.

Evaluation Measures

- Impact on fire suppression compatibilities with development of private or NFS land
- Projected change in fuel treatment/firebreak maintenance requirements adjacent to the private inholdings and NFS land

Preview of Remaining Sections

Issues identified during the public and agency scoping processes have been used to generate alternatives and drive the environmental analysis. Chapter 2 describes in detail each action alternative, and the NEPA-required "no action" alternative. This section also lists all applicable mitigation measures and provides a summary matrix of environmental consequences for each of the alternatives.

Chapter 3 describes the environment or existing condition that would be affected by the alternatives. It provides a discussion of the general environmental setting as a frame of reference for the reader.

Chapter 4 analyzes potential impacts of the alternatives on the various issues identified in Chapter I and the environment described in Chapter 3. Direct and indirect impacts, as well as cumulative impacts, are discussed.

Chapter 5 provides a list of people who prepared the EIS and their qualifications, as well as a list of the Interdisciplinary Team members. This section also provides a list of people who contributed to or who were consulted in the preparation of this document and the bibliography. Finally, the EIS distribution list is found in here.

Chapter 2 Description of Alternatives

Introduction

This chapter presents a description of the alternatives; alternatives eliminated from detailed study, including the rationale for their elimination; and mitigation measures associated with each of the alternatives. This chapter also provides a summary of impacts of each alternative with respect to issues raised during the scoping process.

The proposed action is the original proposal that initiated analysis under the National Environmental Policy Act (NEPA). In this instance, the original proposal (and as such, the proposed action) is Alternative B. NEPA requires that Federal agencies "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources" (42 U.S.C. 4332). Council on Environmental Quality (CEQ) regulations require analysis of a range of alternatives and the objective and equal examination of all reasonable alternatives, including the No Action Alternative (40 CFR 1502.14 [b]). The number of alternatives that constitutes a reasonable range depends on the nature of the proposed action as well as the issues and environmental impacts associated with it (46 CFR 18026). A reasonable alternative is generally defined as any alternative that is within the scope of the analysis and that meets the purpose and need of the proposal. Guidance provided by the CEQ suggests that reasonable alternatives are those that (1) are feasible from technical and economic perspectives, (2) provide a realistic range of choices to accomplish objectives, (3) reflect common-sense realities, (4) cover a full spectrum, (5) consider actions outside of current agency capabilities, jurisdiction, or legal authority, and (6) include no action.

Formulation of Alternatives

Five alternatives are considered in detail in this EIS. Alternatives B, C, and D are proponent derived. The alternatives are: Alternative A: No Action; Alternative B: Land Exchange Option 1; Alternative C: Land Exchange Option 2; Alternative D: Townsite Act/Special Use Permit; and Alternative E: Transportation/Federal Housing. The two proponents (Canyon Forest Village [CFV] and Grand Canyon Improvement Association [GCIA]) submitted detailed plans to the Forest Service for review by the Interdisciplinary Team. During this review, the Interdisciplinary Team examined the legal, economic, and technical adequacy of the proposals. The description of alternatives presented in this chapter was derived from information provided by the proponents. The five alternatives are briefly described below, and a detailed discussion of the alternatives begins on page 23.

Under the No Action Alternative (Alternative A), acquisition of NFS land through either land exchange or Townsite Act would not take place. National Forest System (NFS) land would not be used for community development, employee housing, or a transportation staging area as part of this NEPA process. Inholdings on the Tusayan Ranger District would remain in private ownership and would be subject to future development. Development could also occur in Tusayan on State trust land, on tribal land, and in other communities. Alternative A provides a benchmark that can be used to compare the magnitude of impacts of the other alternatives.

Alternatives B and C are land exchange alternatives involving private acquisition of NFS land directly north of Tusayan in exchange for Federal acquisition of 12 private inholdings on the Tusayan Ranger District of the KNF (See Figure 2.1). Additional private land may be secured by the proponent (CFV) or adjustments made in the size of the Federal tract to equalize values of land exchanged based on the results of the ongoing land value appraisals being completed to Federal standards. Under both of these alternatives, the NFS land acquired by the proponent would be developed for visitor and community facilities and services and would include a transportation staging area and an educational/interpretive center. Income generated by these services would subsidize community development such as housing, schools, houses of worship, fire protection, and law enforcement. Alternative C proposes conveyance of a smaller tract of NFS land into private ownership (380 acres) than proposed under Alternative B (672 acres) and would reduce the amount of visitor accommodations and retail operations than that proposed under Alternative B. The mix of community facilities provided under both alternatives is similar.

Under the Townsite Act/Special Use Permit alternative (Alternative D), proposed by GCIA, a local government entity would purchase NFS land for resident housing and community needs, and the KNF would issue a special use permit for the construction and operation of a transportation staging area. An orientation/interpretive facility would be provided on private land.

Under the Transportation/Federal Housing alternative (Alternative E), the KNF would provide land for NPS employee housing and would issue a special use permit for construction and operation of a transportation staging area directly north of Tusayan. This alternative would not involve a land exchange or Townsite Act acquisition, and NFS lands to be used for Federal employee housing and a transportation staging area would remain under Federal ownership.

Alternatives Eliminated From Detailed Study

In developing the alternatives, several actions were considered but rejected. Brief descriptions of these alternatives and the reasons for their elimination are provided below.

Use of NPS Land For General Management Plan (GMP) Directives

An alternative proposing that all parking for GCNP visitors and all park employee housing be located at Mather Point and in Grand Canyon Village was considered. This proposal was also evaluated as an alternative in the park's GMP planning process (Alternative 4) but was not selected.

An alternative that places parking and housing just inside the southern boundary of GCNP (north of Moqui Lodge) was also considered by the Interdisciplinary Team.

Reason for Elimination

One of the objectives of this analysis is to consolidate development in the Tusayan area, as called for in the GMP, and refrain from building additional visitor and community services and facilities in GCNP. Additionally, a transportation staging area would be most logically located near existing infrastructure and other visitor services. These can be found either in Grand Canyon Village or Tusayan. During the park's GMP planning process, there was overall support for locating services and facilities outside the park instead of disturbing new ground in GCNP. For these reasons, both of these alternatives were eliminated from further analysis.

GCIA Land Exchange

The original proposal that the GCIA brought to the KNF was an exchange of NFS land adjacent to Tusayan for private inholdings. The NFS land would be used for residential and community services and a transportation staging area.

Reason for Elimination

This alternative was eliminated from further consideration because GCIA chose not to offer private land for exchange, but rather to seek ownership or use of NFS land through the Townsite Act and special use permit authorities.

Land Exchange South of The Community of Tusayan

Under this alternative, up to 650 acres of NFS land in a triangular area east of Grand Canyon Airport, west of State Highway 64, and south of Tusayan would be exchanged for private inholdings. NFS land acquired by the proponent, CFV, south of the community of Tusayan would be developed to provide both visitor and community services and facilities, including a transportation staging area, lodging, retail services, food and beverage services, and visitor orientation and education. Income generated by these services and facilities would subsidize community development. Private land acquired by the KNF in the exchange would be managed for multiple uses and the conservation of natural and cultural resources.

Reason for Elimination

This alternative was eliminated primarily because the park's GMP identified the preferred location of a transportation staging area as north of the existing Tusayan community, not south as proposed under this alternative. The park prefers a location north of Tusayan to minimize costs associated with construction and operation of a shuttle system, to reduce the distance and time of the shuttle trip, and to begin the visitor experience as close to the park boundary as possible. Another objection to this alternative was that it would create a new community separate and distinct from the existing community of Tusayan.

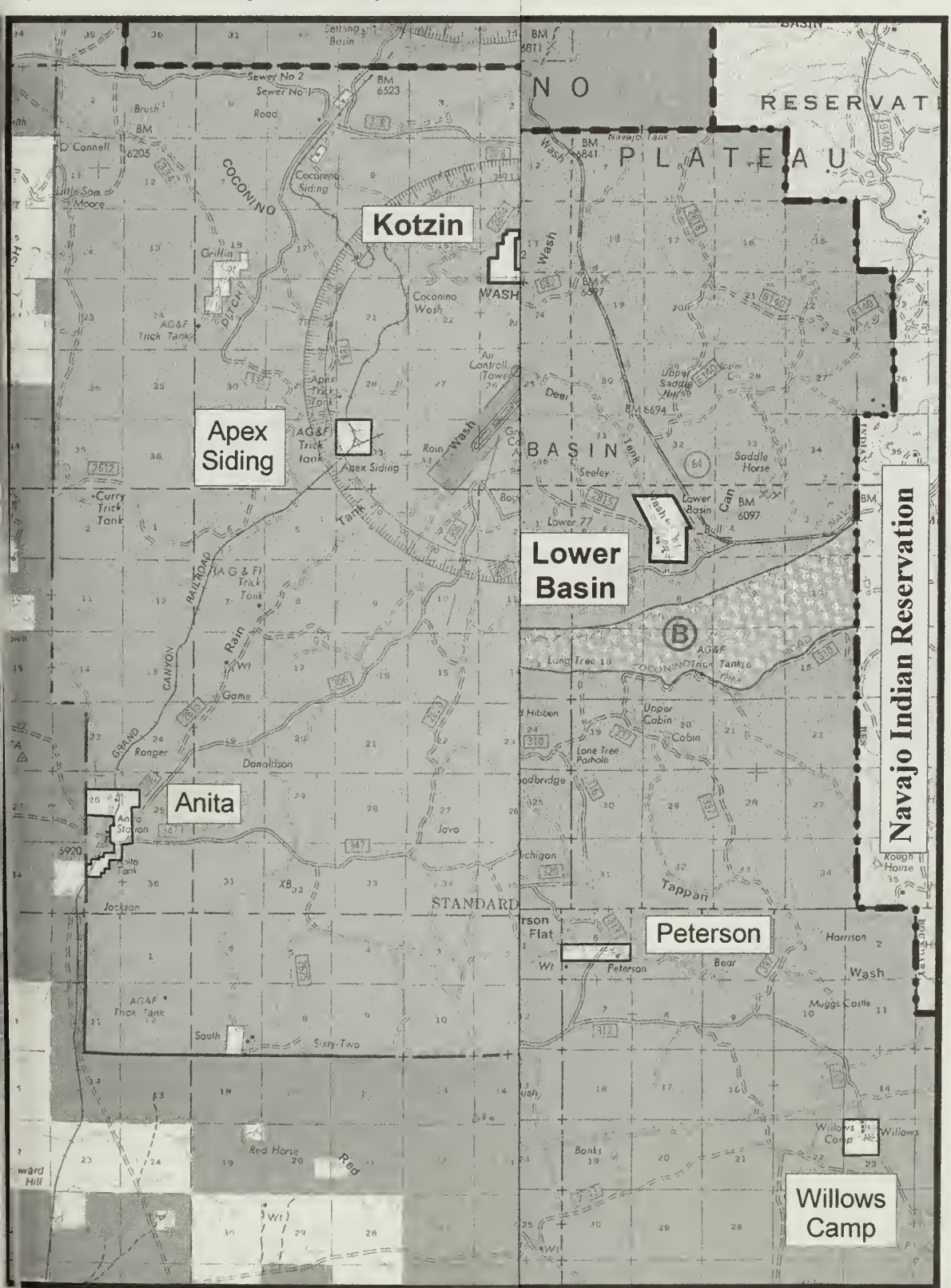
Tusayan Planning Committee Alternative

Coconino County appointed a committee (the Tusayan Planning Committee) composed of government and local business representatives and other citizens to develop an area plan that would guide Coconino County officials as they review development proposals in the Tusayan area. During the initial phase of creating the Tusayan Area Plan (provided in the Appendix), it was thought that this effort might lead to the development of a specific land use plan that could be analyzed as a separate alternative in the EIS.

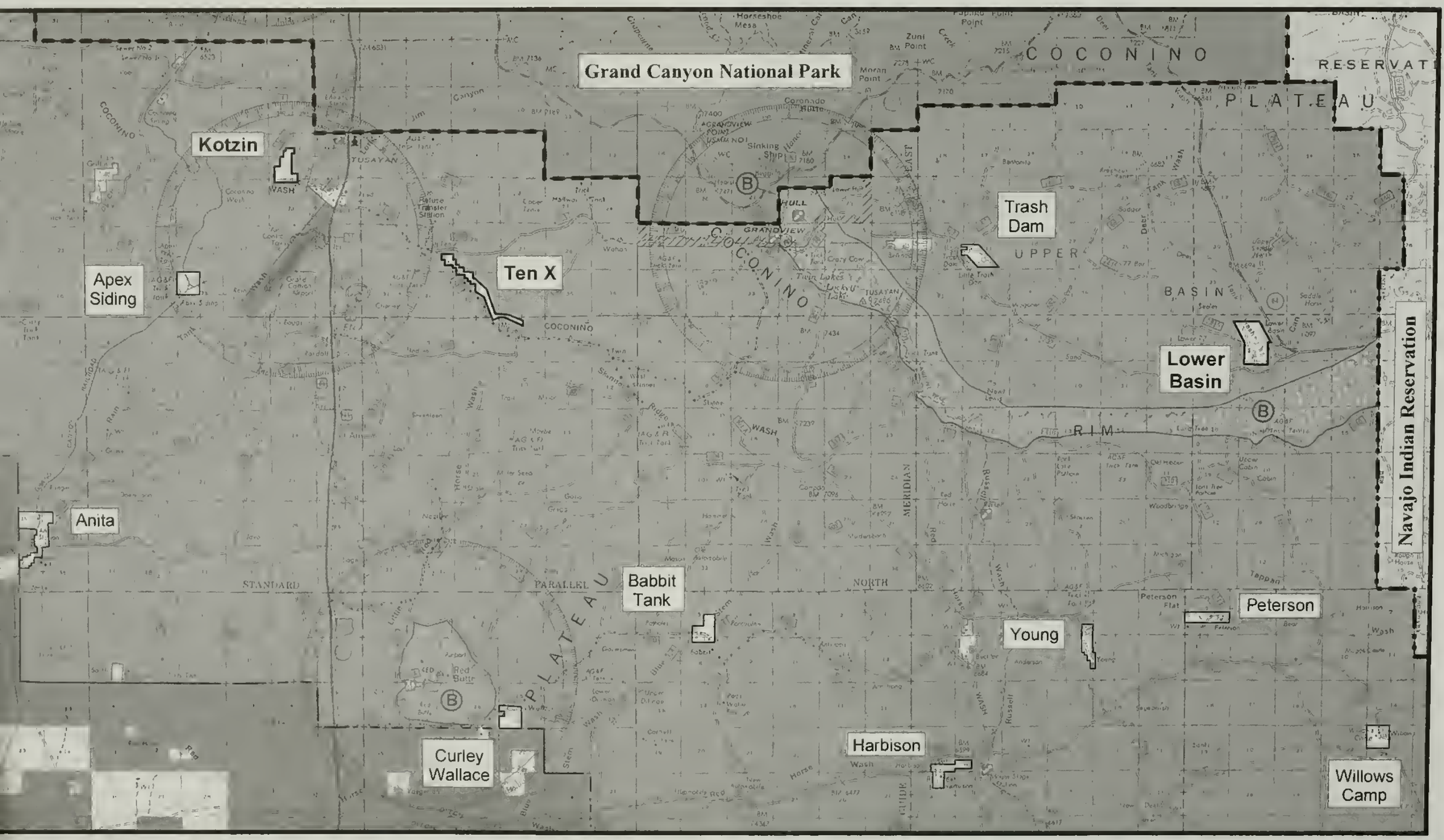
Reason for Elimination

Instead of becoming an alternative in the EIS, the Tusayan Area Plan functions as an amendment to the County Comprehensive Plan and is the official guide for future development in the Tusayan area. The Plan does not function as a proposal for development, instead, the Plan sets out goals and policies that will be used in the review of all alternatives considered in the EIS.

Figure 2.1 Private Inholdings with Development Potential u



2.1 Private Inholdings with Development Potential under Alternative A



Federal Land Acquired Under the Townsite Act and Federal Purchase of Private Inholdings

This alternative considers the option of local government entities (e.g., Housing Authority, School District, or Fire District) purchasing Federal land around Tusayan under the Townsite Act and, in a separate action, Congress appropriating money to acquire key private inholdings on the Tusayan Ranger District desired by the Forest Service. Through a separate permitting process, a transportation staging area would be located on Federal land near Tusayan to relieve transportation pressures on the park.

Reason for Elimination

This alternative was eliminated from further consideration because appropriations from Congress would be required to purchase the private inholdings, which is considered highly unlikely. The options of using the Townsite Act to purchase NFS land for community needs and issuing a special use permit for the transportation staging area are considered under Alternative D.

Exchange for Federal Land near Flagstaff and Williams

This alternative considers exchanging private inholdings in the Tusayan Ranger District for NFS land near Flagstaff or Williams. The NFS land would be used for commercial purposes, concentrating this type of development near communities with existing infrastructure that could accommodate the additional development. Additional land would be acquired near Tusayan by a government entity under the Townsite Act for public purposes. Through a separate permitting process, a transportation staging area would be located on Federal land near Tusayan to relieve transportation demands on the park.

Reason for Elimination

This alternative was eliminated from further consideration because the land exchange proponent is not interested in acquiring NFS land outside the Tusayan area. The options of using the Townsite Act to purchase NFS land for community need, and issuing a special use permit for the transportation staging area are considered under Alternative D.

Exclude Lower Basin Inholding from Land Exchange

Under this alternative, the Lower Basin inholding (shown in Figure 2.1) would not be included among the private lands offered for exchange, reducing the size of the Federal tract that would be conveyed into private ownership. Federal land near Tusayan would be developed for community and visitor services and facilities, including a transportation staging area for the park. The Lower Basin inholding, located adjacent to State Highway 64 and south of Desert View Entrance Station, would remain in private ownership and would presumably be developed for visitor services and facilities. The development of this inholding would provide an additional location near the park for visitor services.

Reason for Elimination

This alternative was eliminated from further consideration because development at Lower Basin could lead to increased visitation through Desert View Entrance Station, potentially impacting facilities, infrastructure, and the transportation system in this area of the park.

Alternatives Considered in Detail

The five alternatives that the Interdisciplinary Team deemed as legally, economically, and technically feasible are described below.

Common Elements

This section describes elements, or actions, that are common to the alternatives; some elements include the No Action Alternative, while others involve only the action alternatives (excludes No Action). The following elements are common to all alternatives, including No Action.

- Potential construction of up to 661 visitor lodging units in the Grand Canyon/Tusayan area:

Location	Number of Lodging Units
Moqui Lodge	221
GCNP Lodges	240
Domes Property	200
	661

- The GCIA has proposed redevelopment of several

private properties in Tusayan to provide additional visitor services. This proposal is fully described in Alternative D but is expected to occur to a certain degree under any of the alternatives. Redevelopment is contingent on receiving necessary zoning changes from the Coconino County Board of Supervisors. Redevelopment in Tusayan would include up to:

  - 710 new lodging units
  - 80,000 sq. ft. of new retail
  - 132,000 sq. ft. of new food and beverage services

- Compliance with all applicable Federal, state, and local laws, regulations, and ordinances, including safety, health, accessibility, environmental protection, air and water quality, and energy conservation

- Compliance with the Tusayan Area Plan

The elements listed below apply to all of the action alternatives:

- Development of a transportation staging area near Tusayan to alleviate traffic congestion at the South Rim of GCNP

- Provision of housing for Federal employees of GCNP

- Development of information and orientation facilities and services for GCNP visitors near the transportation staging area

Alternative A: No Action

Introduction

According to Federal law, every EIS must include a No Action Alternative that describes the likely result of no Federal action being taken. In the context of this EIS, no Federal action means that the Forest Service would not exchange or allow the use of NFS land to meet the visitor, community, and transportation needs described in Chapter 1, other than providing for a railroad spurline that has already undergone NEPA review and approval (Grand Canyon Railway Spurline EIS). Alternative A differs from the other alternatives in that no **definitive** plan of action is proposed. This alternative is based on the assumption that development of private land would continue in Tusayan and that new development could occur, eventually, on some of the private inholdings located within the Tusayan Ranger District as well as on other private land in outlying communities, on tribal land, and on state trust land.

The GCIA has prepared conceptual plans for the redevelopment of some of the commercial properties in Tusayan. These plans are expected to be implemented to a certain degree under the No Action Alternative, contingent on receiving the necessary zoning changes from the Coconino County Board of Supervisors. Specifics on redevelopment are more fully explained under Alternative D.

Other development in the area could occur on private inholdings within National Forest boundaries. The potential for future development and the type of development created on the private inholdings would be influenced by market conditions, existing Coconino County zoning ordinances and policies and by limitations such as remoteness, existing infrastructure or feasibility of installing new infrastructure, and access. Table 2.1 was developed by the Interdisciplinary Team to reflect the development potential of the 12 private inholdings that are controlled by CFV. Three of these inholdings, Kotzin, TenX, and Lower Basin, are considered to have the highest potential for development and are being considered for development by CFV if a land exchange does not take place. Kotzin encompasses 160 acres, TenX includes 194 acres, and Lower Basin is 320 acres. The locations of these three inholdings, relative to Tusayan and GCNP, are shown in Figure 2.1. CFV has created preliminary development plans for the Lower Basin and Kotzin inholdings and four alternative plans for the TenX inholding. A breakdown of acreage devoted to visitor and residential uses of the potential build-out of these inholdings is shown in Table 2.2. Conceptual plans for these inholdings are shown in Figures 2.2 - 2.4.

Potential development under this alternative is addressed under three primary components: (1) a visitor segment; (2) a community segment; and (3) a transportation segment. A fourth component, design features, describes the development principles for this alternative.

Visitor Segment

Visitor-related development in the Tusayan area would be subject to the goals and policies outlined in the Tusayan Area Plan. Proposals for three visitor-related development projects in Tusayan (a hotel, fast-food restaurant, and gift shop) have already been approved by the County and are discussed below. All other development within the County, but outside of the area defined in the Tusayan Area Plan would fall under the regulations set forth in the County Comprehensive Plan.

Table 2.1 Development Potential of Private Land Proposed for Exchange by CFV

Private Inholding	Years	
	0 to 15 years	15+ years
Kotzin	Yes	Yes
TenX	Yes	Yes
Lower Basin	Yes	Yes
Apex	No	Yes
Curley Wallace	No	Yes
Trash Dam	No	Yes
Anita	No	No
Babbit	No	No
East Harbison	No	No
Peterson	No	No
Willows	No	No
Young	No	No

NOTE: Development may range from low-density residential development (permissible under current zoning) to commercial development (requiring rezoning approval by Coconino County).

Lodging, Dining, and Recreational Facilities

The County has approved construction of a 160-unit hotel (The Grand Hotel) and a Wendy's restaurant in Tusayan. Future commercial developments will likely occur according to the GCIA's plans for the redevelopment of the commercial properties in Tusayan, subject to applicable governmental approvals. These redevelopment plans are described in detail under Alternative D.

The three private inholdings could be developed as described in Table 2.2, or by any other plan for which CFV could obtain County zoning approval and any other required Federal, state, and county permits.

In addition, any of the outlying communities such as Valle, Williams, and Flagstaff, tribal land, or state land may become available for development.

Visitor Retail

The County has approved plans for a 3,200 square foot gift shop in Tusayan. Further development will likely occur in the future and is expected to follow the GCIA's plans for the redevelopment of the commercial properties in Tusayan. These redevelopment plans are described in detail under Alternative D.

A gift shop and restaurant may be established as part of the Grand Canyon Railway Spurline depot, described under the transportation segment below.

Some visitor retail would most likely be developed on the private inholdings described earlier.

Orientation/Interpretation

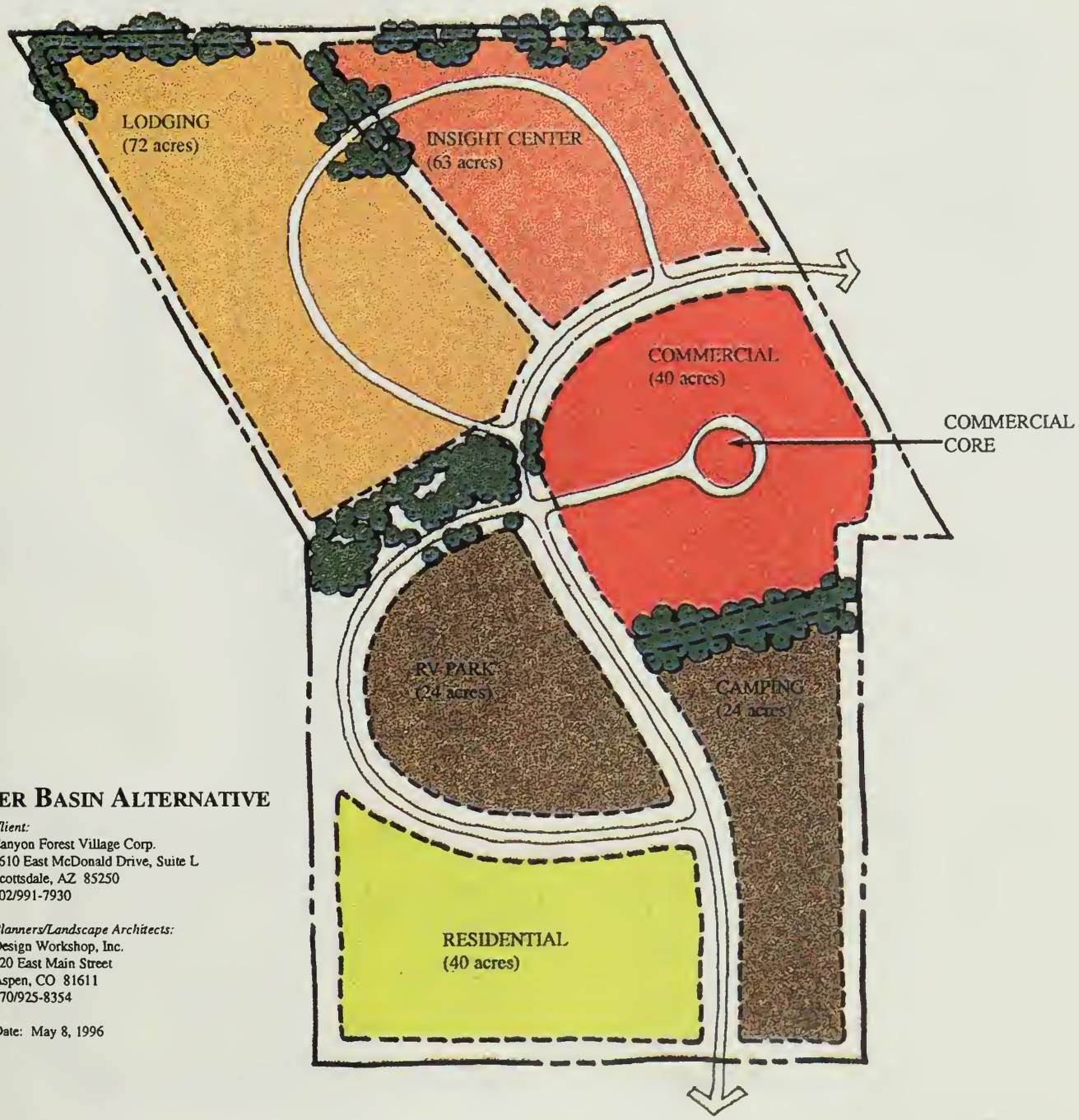
Two orientation/interpretation centers might be developed: (1) INSIGHT (CFV with the Museum of Northern Arizona), and (2) Destination Cinema (possibly with the National Geographic Society). CFV has an agreement with the Museum of Northern Arizona and detailed design concept plans for INSIGHT on either the Kotzin or the Lower Basin inholding. A more detailed listing of services and facilities to be provided at INSIGHT is presented under the land exchange alternatives (Alts. B and C). Destination Cinema is pursuing, in conjunction with the National Geographic Society, plans to build an orientation/interpretation center on private land in Tusayan; a more detailed description of this facility is provided under Alternative D.

If the Grand Canyon Railway proceeds with development of the spurline, visitor orientation and interpretation programs and materials on the park and the National Forest would be provided to visitors on the trains. Interpretive exhibits would also be provided at the train depot that could to be constructed in conjunction with the spurline at Grand Canyon Airport.

Table 2.2 Potential Development Scenarios for Three Private Inholdings Controlled by CFV

Inholding Name	Type of Development	Type of Use	Acres
Lower Basin			
	INSIGHT	Visitor	63
	Camping	Visitor	24
	Lodging	Visitor	72
	RV Park	Visitor	24
	Housing	Residential	40
	Commercial	Visitor/Residential	40
	Other	Infrastructure/Open Space/Roads, etc.	57
			320
Kotzin			
	INSIGHT	Visitor	20
	Resort	Visitor	20
	Lodging	Visitor	50
	Housing	Residential	48
	Other	Infrastructure/Open Space/Roads, etc.	22
			160
TenX			
Option #1	Resort	Visitor	28
	Golf Course	Visitor	94
	Housing	Residential	52
	Other	Infrastructure/Open Space/Roads, etc.	20
			194
Option #2	INSIGHT	Visitor	54
	Resort	Visitor	40
	Condos/Timeshare	Visitor	24
	Employee Housing	Residential	43
	Other	Infrastructure/Open Space/Roads, etc.	33
			194
Option #3	Resort	Visitor	48
	Condos/Timeshare	Visitor	43
	Casitas	Visitor	24
	Housing	Residential	40
	Other	Infrastructure/Open Space/Roads, etc.	39
			194
Option #4	Housing, 10-acre lots	Residential	155
	Other	Infrastructure/Open Space/Roads, etc.	39
			194

Figure 2.2 Concept Plan for Lower Basin Inholding



LOWER BASIN ALTERNATIVE

Client:
Canyon Forest Village Corp.
7610 East McDonald Drive, Suite L
Scottsdale, AZ 85250
602/991-7930

Planners/Landscape Architects:
Design Workshop, Inc.
120 East Main Street
Aspen, CO 81611
970/925-8354

Date: May 8, 1996

TOTAL NET ACREAGE: 263 acres
TOTAL GROSS ACREAGE: 320 acres

Figure 2.3 Concept Plan for Kotzin Inholding



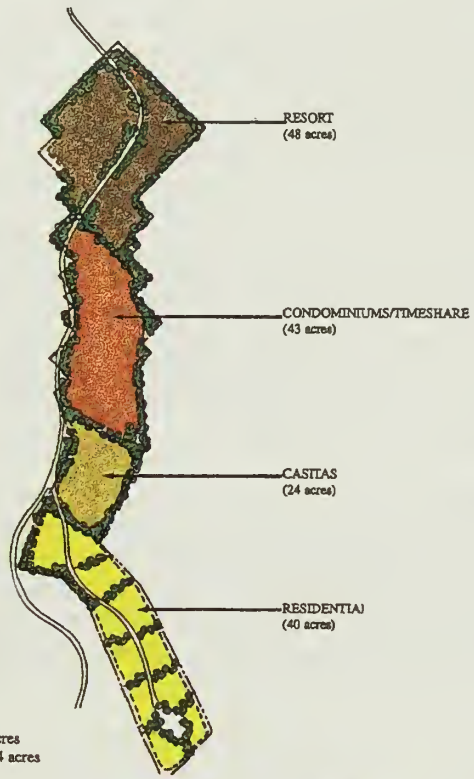
TOTAL NET ACREAGE: 138 acres
TOTAL GROSS ACREAGE: 170 acres

Figure 2.4 Concept Plans for TenX Inholding



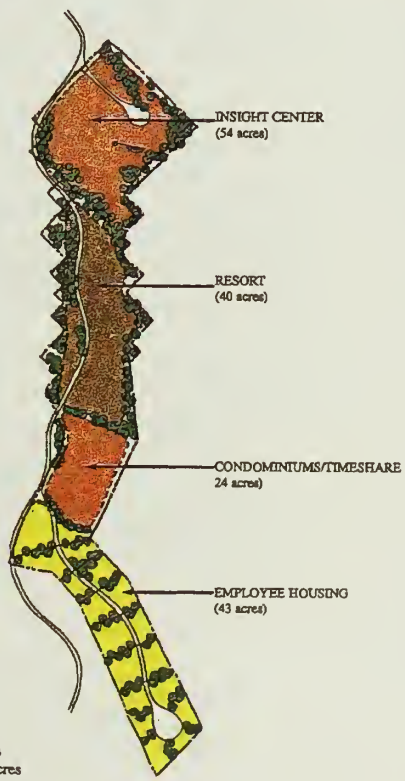
Option #1

TOTAL NET ACREAGE: 174 acres
TOTAL GROSS ACREAGE: 194 acres



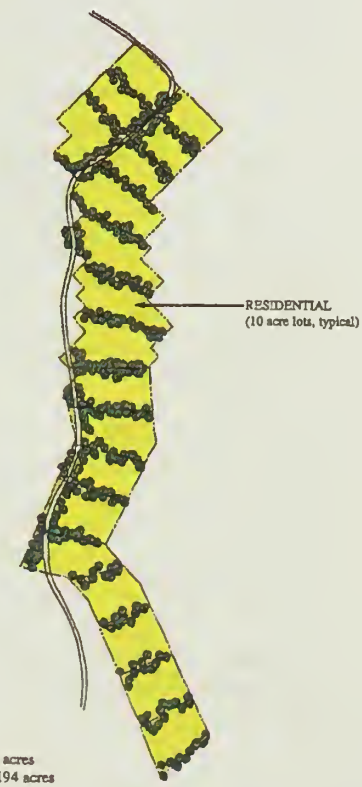
Option #3

TOTAL NET ACREAGE: 155 acres
TOTAL GROSS ACREAGE: 194 acres



Option #2

TOTAL NET ACREAGE: 161 acres
TOTAL GROSS ACREAGE: 194 acres



Option #4

TOTAL NET ACREAGE: 155 acres
TOTAL GROSS ACREAGE: 194 acres

Community Segment

Residential

Under this alternative, no construction of housing is proposed. Housing for park employees could be provided in Tusayan, or on the private inholdings, or in the outlying communities of Valle, Williams, and Flagstaff. Open-market housing has not been built to date on private land in Tusayan as there is little economic incentive for landowners to build this type of residential development.

As required by the Tusayan Area Plan, any commercial development undertaken in the Tusayan area must also include provisions for employee housing. Housing needs for Tusayan employees would continue to be met by employers in Tusayan, Valle, or elsewhere. Housing for CFV employees would likely be provided on private inholdings, as they are developed.

Community

Community services and facilities in Tusayan would consist of a fire station operated by the Fire District (which is now in the planning stage) and a wastewater treatment facility operated by the South Grand Canyon Sanitary District. Services for infrastructure presently in place would remain unchanged:

Electricity:	Arizona Public Service (APS)
Solid Waste:	Coconino County Transfer Station
Wastewater:	Moqui System (serving Moqui Lodge and Tusayan Ranger District Administrative Site) and wastewater treatment facility operated by the South Grand Canyon Sanitary District (serving the Tusayan community)
Water:	Anasazi Water Co. & Hydro-Resources
Communication:	US West Communications

Transportation to the park: Shuttle bus and private vehicle

Additional infrastructure would be required to support development of private inholdings.

Community Retail

Plans for a convenience market with gas sales have been presented for consideration by the Coconino County Planning and Zoning Commission. While no plans for any other retail shops or services targeted primarily to Tusayan residents have been presented to the County at this time, redevelopment in Tusayan or a change in plans for the private inholdings might include community retail space such as banks, supermarkets, laundromats, or video rental stores.

Transportation Segment

Under the No Action Alternative, a railroad spurline and parking area could be constructed adjacent to Grand Canyon Airport (pending the outcome of appeal). The selected alternative in the Spurline EIS entails constructing 5.4 miles of new railway line on NFS land, 20% (1.1 miles) of which would follow a historic rail alignment. The new spurline would intersect Grand Canyon Railway's existing line from Williams, Arizona, to the Maswik Transportation Area at Grand Canyon Village. Eight additional trips would be made to and from GCNP per day to shuttle up to one million visitors annually to the park. Visitor orientation/interpretation, limited retail, and basic food service would be provided on the trains and/or at the train depots.

Transportation Staging Area/Transit Center

The transportation facilities associated with the proposed Grand Canyon Railway Spurline would consist of a new depot at Grand Canyon Airport and 75 acres of parking. The proposal would also require construction of a maintenance road and storage tanks for fuel, water, and wastewater. No lodging would be provided as part of the spurline project.

Visitor and Resident Shuttle Systems

No residential shuttle system is planned under this alternative. The existing shuttle system operating in the park would likely need to be expanded to handle increased visitation. The majority of visitors would continue to use their private vehicles to access the park.

Roadway Improvements

With development of inholdings, some roadway improvements would occur, including road widening and possibly paving of dirt roads. Improvement of roads on NFS land would require a special use permit and would be subject to compliance with NEPA and other Federal, state, and local statutes, regulations, and policies.

Design Features

Design features relate to site planning and design, infrastructure, and resource conservation measures. As this alternative does not involve the use of NFS land not previously approved, new development on private lands in the area would only be subject to Coconino County zoning and building codes and/or the guidelines in the Tusayan Area Plan.

The Tusayan Area Plan sets out policies for development of residential and commercial facilities, including conformance to design standards, building codes, and zoning densities and the protection of air quality, water quality, and vegetation and wildlife. Policies outlined in the Plan also address aesthetics, noise, lighting, and issues associated with the National Forest and the National Park.

Site Planning and Design

Architectural and Landscape Design
Development in the Tusayan area would be required to comply with Coconino County policies regarding architectural style and colors outlined in the Design Review Overlay Zone for the area. Landscaping standards emphasize the use and retention of native plants, particularly drought-tolerant vegetation, and retention of trees.

Open space
The Tusayan Area Plan provides criteria for open space, requiring that between 10% and 20% of developed properties remain as open space or landscaped area, depending on the size of the development.

Infrastructure

Water
Water for development in the Tusayan area may be obtained from existing wells or from new wells drilled in Tusayan or on one or more of the inholdings. Establishment and use of new wells would require authorization by the Arizona Department of Water Resources. An analysis of the impacts of new well development is not required as part of the permitting process as long as new wells do not impact other wells using the system. New development would be required to use reclaimed water for nonpotable purposes, to install water-conserving plumbing fixtures, and to incorporate drought-tolerant plants into landscape design.

Energy
It is likely that conventional energy sources would be used for development of the private inholdings and the redevelopment of Tusayan. The Tusayan Area Plan encourages incorporation of passive solar energy into architectural and landscape design.

Waste Management
Solid waste generated as a result of inholding development and redevelopment of Tusayan would be hauled to an existing county-operated transfer station southeast of Tusayan, then to the landfill in Flagstaff.

The Tusayan Area Plan states that approval of all new developments is contingent on their ability to tie into the South Grand Canyon Sanitary District wastewater treatment facility and comply with the district's policies, rules, and regulations, or the ability of the developer to design and construct an acceptable wastewater treatment facility. New developments would be required to contribute to the costs of wastewater management and would use reclaimed water for non-potable purposes.

Resource Conservation
The Tusayan Area Plan encourages recycling and the use of water-conserving plumbing fixtures. Other resource conservation measures would be left largely to the discretion of the developer.

Project Implementation

Governance
Development of the private inholdings and redevelopment of Tusayan would require approval by Coconino County, which may require development agreements. Coconino County would be responsible for enforcement of any development agreement or zoning condition approval, as well as for ensuring that any development would be carried out according to the authorized zoning.

Implementation Schedule
Under this alternative, the redevelopment of Tusayan could potentially occur within an eight-year time frame as specified in Alternative D; however, development would likely follow market forces. No implementation schedule has been proposed for the development of the private inholdings, but development of the Kotzin, TenX, and Lower Basin inholdings is considered likely to occur within the next 15 years as park visitation increases.

Alternative B: Land Exchange Option 1

Introduction

This alternative, one of two land exchange options, is the original proposal brought forward by CFV that initiated the NEPA process. As such, it is the "proposed action" alternative in the context of the regulations for implementing NEPA.

This alternative proposes the private acquisition and development of 672 acres of NFS land directly north of Tusayan and west of State Highway 64 (Figure 2.5), with Federal acquisition of 12 private inholdings within the KNF, totaling 2,184 acres (Figure 2.1). Additional private land may be secured by CFV or adjustments may be made in the size of the Federal tract to equalize values based on results of the land appraisals. Table 2.3 lists the private inholdings offered for exchange and their acreages.

The NFS land exchanged would be used to design and build a master-planned community serving as a gateway to GCNP. The function of this gateway community would be to relieve park facilities from the pressures of increased demand by: providing visitor services and facilities outside the park; providing a transportation staging area for mass transit to the park; providing affordable housing for area employees; creating a sense of community for permanent residents of Tusayan; and developing an experiential educational and interpretative center. This development would seek to apply the philosophy of sustainable design, in which self-sufficiency, efficient use of durable materials, conservation of water and energy, and aesthetics are important factors. This alternative would subsidize housing for employees, provide community facilities, and construct state-of-the-art conservation systems for a sustainable development.

Development of the NFS land under this alternative would be phased over a minimum of twelve years following the exchange of land, approval of zoning, securing of permits and licenses, and construction of support infrastructure. Development would include three primary components: (1) a visitor segment; (2) a community segment; and (3) a transportation segment. A fourth component, design features, describes the development principles of the alternative. Figure 2.6 illustrates the projected uses of the proposed development on NFS land.

The visitor segment includes construction of 3,650 lodging units over a minimum of twelve years, 250,000 square feet of visitor-related retail and food service, and 175,000 square feet of community-related retail. The community segment includes 175,000 square feet of community retail, parks, a community center, a library, day-care, and police/fire protection services. Some of the community services and facilities, such as the post office and law enforcement, would also be used by visitors. Land would also be dedicated for the establishment of a school and one or more houses of worship. The transportation segment would consist of a transportation staging area that would serve both the visitor and community segments.

Design features of this alternative focus on creating a sustainable development with active and passive solar systems, energy and water conservation measures, earth-based construction materials, and extensive open space within the development. Figure 2.7 provides a concept plan that illustrates the location and spatial relationships of the various uses. The acres allocated for each use are listed in Table 2.4. A projected implementation schedule for these development components is provided on page 45 and 46.

Figure 2.6 Proposed Uses of NFS Land
based on percent of total land area

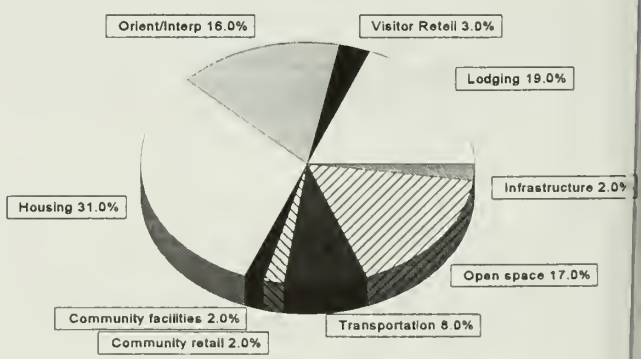


Table 2.3 Acreage of Private Inholdings Offered for Exchange under Alternative B

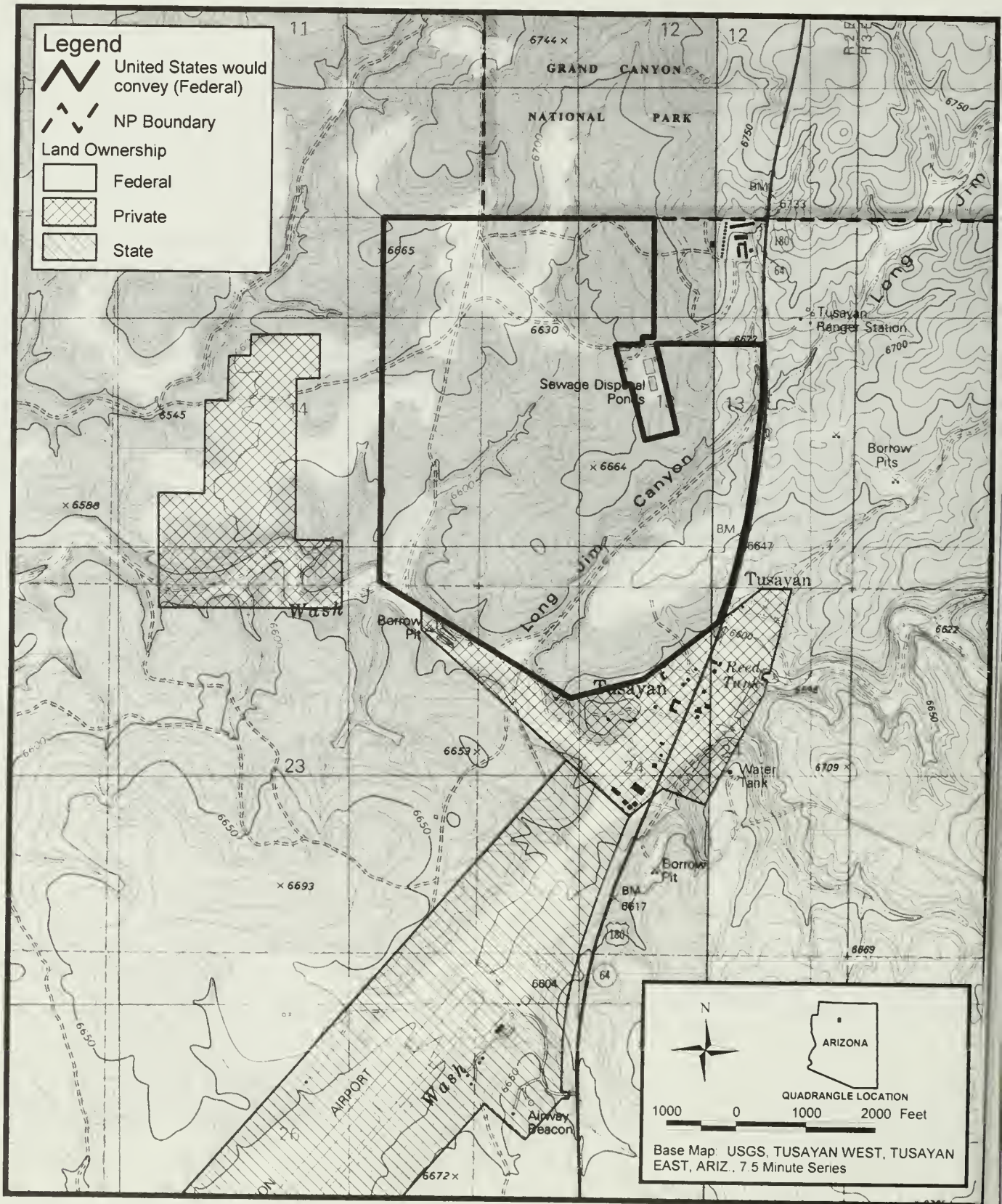
Private Inholding	Acres
TenX	194
Lower Basin	320
Curley Wallace	150
Trash Dam	146
Willows	160
Babbitt	120
Kotzin	160
Anita	318
East Harbison	160
Young	140
Peterson	156
Apex Siding	160
Total	*2,184*

Table 2.4 Proposed Uses and Associated Acreage of NFS Land under Alternative B

Use	Acres	Percentage of Total Acres
Visitor Segment		
Lodging	131	19
Retail	17	3
Orientation/Interpretation	108	16
	256	38
Community Segment		
Housing	209	31
Community Facilities	12	2
Retail	16	2
	237	35
Transportation Segment		
Transportation	54	8
	54	8
Design Features		
Open Space*	112	17
Infrastructure	13	2
	125	19
Total	*672*	*100.0*

* Dedicated open space does not include areas of open space within the other land uses, (e.g., landscaping associated with a particular lodging or retail business).

Figure 2.5 Footprint of NFS Land Involved in Alternative B



Visitor Segment

Lodging, Dining, and Recreational Facilities

Under this alternative, limited service, full service, and conference lodging services and facilities would be provided for visitors. Bed-and-breakfast facilities and cabins would be available as well. Limited service refers to accommodations consisting primarily of rooms, with some additional amenities such as reading rooms, continental breakfast, and orientation rooms or facilities within the hotel lobbies. Limited service facilities, composed of both stand-alone properties and units positioned in the village core, would total 2,540 units and comprise 65% of the visitor accommodations. Full service facilities, totaling 650 units, would provide restaurants and small boardrooms in addition to guest rooms. The conference center would include 250 guest rooms, a large, divisible meeting room, a theater-style auditorium, smaller board rooms, and other amenities. The conference center would be marketed to groups and businesses with specific environmental agendas. Pads (vacant land improved with infrastructure) would be made available for sale to prospective bed-and-breakfast operators. One- and two-bedroom cabins with kitchens and outdoor picnic facilities and a 250-space campground/RV park would also be included. Table 2.5 and Figure 2.8 outline the proportion of total visitor accommodations by type.

Figure 2.8 Lodging Types

based on a percentage of 3,900 units

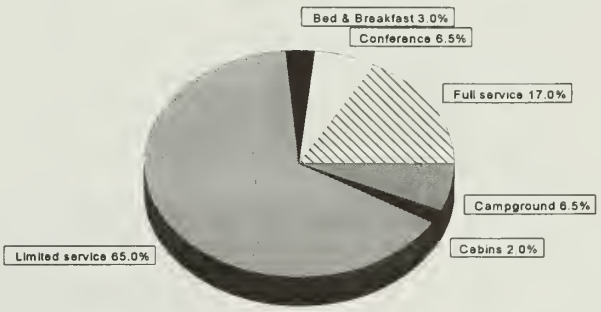


Table 2.5 Proposed Visitor Lodging Accommodations

Accommodation type	Number of units	Percentage of total visitor accommodations
Limited Service	2,540	65.0
Full Service	650	17.0
Conference	250	6.5
Bed and Breakfast	120	3.0
Cabins	90	2.0
Subtotal	***3,650***	***93.5***
Campground/RV park	250	6.5
Total	***3,900***	***100.0***

Figure 2.7 Concept Plan for Canyon Forest Village under Alternative B



Visitor Retail

Retail facilities targeted to visitors would include restaurants, shops, and services and would comprise approximately 250,000 square feet of improvements in the village core or center of the proposed development. Development of retail facilities would also be phased in based on the implementation schedule presented on pages 45 and 46. The types of facilities expected to be established are listed in Table 2.6.

Orientation/Interpretation

Under this alternative, INSIGHT, the proposed orientation/interpretation center to be developed in conjunction with the Museum of Northern Arizona, would be established near the center of the development and west of the village core. This service would have an entrance fee and would be operated as a for-profit venture.

Community Segment

Residential

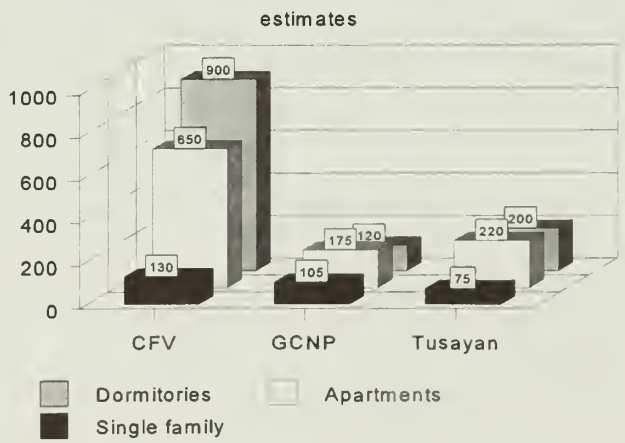
The proposed development would include housing for residents and employees of the Grand Canyon/Tusayan area. No vacation or second homes would be permitted. Housing would account for 31% of the total development. Estimates for park employee housing needs were made in coordination with the park's GMP and include 400 units. In Tusayan, CFV estimated that approximately 500 units of housing would be required to replace the existing, sub-standard inventory and meet the anticipated needs of the planned future construction by area businesses. If the project were to be fully built, 1,680 new units of housing would be required for CFV. These requirements are reflected in Table 2.8 and Figure 2.9. Housing types include single-family units, apartments, and dormitories.

Table 2.6 Expected Visitor Retail Facility Types

Art galleries/crafts	Shops/commercial	Services
Western	Hiking equipment	Tour and travel
Native American	Bicycle rental	Post office
Natural Resource	Photography	Insurance agent
	Ice cream and soda fountain	Certified public accountant
	Casual and fine dining	Legal services
	Clothing shops	Bank
	Arcade	Service station
	Bookstores and gift shops	Day-care center
	Convenience store	
	Dinner theater	
	Coffee houses and boulangerie	

INSIGHT would provide visitors with information and educational opportunities about natural resources, cultural resources, and the history of Grand Canyon and the Colorado Plateau. In general, this experiential center would include exhibition galleries, an outdoor amphitheatre, a resource center for information and educational materials, a theater, a conference center, public orientation and information facilities, administrative facilities, and various interpretive features incorporated into the site design. The services and facilities that are proposed for INSIGHT are listed in Table 2.7.

Figure 2.9 Housing type by number of units



Under Alternative B, the CFV Council would be formed, composed of representatives of local, state, and Federal agencies, environmental groups, area businesses and area residents that would establish policies for the management of area housing. The CFV Council would have responsibility to establish rental rates and resident eligibility to ensure that housing is affordable and available. Initially, the CFV Council would be capitalized by CFV and ongoing funding would be provided by assessments to the commercial enterprises of the development.

CFV would provide housing for all new businesses located in the development. Tusayan businesses or other area employers (such as ADOT, Forest Service, or DPS) could either purchase subsidized building sites from CFV to construct apartments or dormitories for their employees; or, under the jurisdiction of the CFV Council, CFV would construct apartments or dormitories for them on an as needed basis. Single-family homes would be available for purchase by all area residents, whether employed by CFV or not.

To provide an adequate supply of affordable housing, CFV would subsidize the site development costs, rental, and sales costs. Single-family homes would be available at an estimated price range of $60,000 to $110,000 based on the size of the home and lot. Apartment and dormitory units would be leased for an average monthly rate of $575 and $455 per unit, respectively. Those determined to have the greatest need would receive greater subsidy from the CFV Council resulting in lower rents when necessary

Community Infrastructure

The proposed development would include a number of community features for area residents. As part of the development, CFV would build, furnish, and maintain parks with sports and recreational facilities, a community center, a library, and a day-care facility. A school site, with infrastructure in place, would be donated to the public school system and a one million dollar cash grant would be paid to Grand Canyon Unified School District for building a new school. CFV would also construct a Coconino County Sheriff's substation, and land would be sold for the construction of one or more houses of worship and a post office. Office space would be made available for lease to a primary health care provider for the operation of a health clinic and an emergency air evacuation system

Table 2.7 Facilities at the Proposed INSIGHT Center

Public	Administrative
Facilities	
Parking	Registration and collections management
Main public lobby	Exhibit preparation area
Orientation theaters	Administrative offices
Exhibition galleries	Cultural resources
Resource center	Community meeting room
Theater	Human services and staff facilities
Conference center	Central data and communication
Restrooms	Shipping and receiving facilities
	Building management services
Features incorporated into design	Security services
Public transportation access	Mechanical, electrical, and plumbing services
Pedestrian educational trails	
Hiking and picnic areas	
Indigenous plants and natural areas	
Public art	

Table 2.8 Percent Composition by Housing Type

Housing type	Estimated number of units	Percentage of total housing
Apartments		
CFV	650	25
GCNP	175	7
Tusayan Area	220	8
Subtotal	***1,045***	***40***
Dormitories		
CFV	900	35
GCNP	120	5
Tusayan Area	200	8
Subtotal	***1,220***	***48***
Single Family		
CFV	130	5
GCNP	105	4
Tusayan Area	75	3
Subtotal	***310***	***12***
Total	***2,575***	***100***

Community Retail

Community retail would serve both area residents and park visitors and would entail approximately 120,000 square feet and 55,000 square feet of space that could be developed on improved pads near the center of the village. The types of retail facilities expected to be established are summarized in Table 2.9. The proposed mix of services and products would accommodate most routine retail needs of area residents. Pads would also be made available for lease to additional establishments, such as restaurants, banks, service stations, convenience stores, or offices. The community retail facilities would be constructed during the first three years based on the implementation schedule.

Table 2.9 Community Retail and Commercial Facilities

Services	Retail	Food and Beverage
Laundromat	Hardware	Grocery store
Service station	Pharmacy	Restaurants
Car wash	Software	Coffee house
Video	Cards and gifts	Bakery
Day-care	Convenience store	
Beauty salon	Office supply	
Movie theater	Florist	
Bank		

Transportation Segment

The transportation component of this alternative would include a transportation staging area/transit center, an associated parking lot, and a shuttle system for residents and visitors. This component would represent approximately 8% of the total land use and would be constructed and implemented in the first year of the project. A comprehensive network of hiking/biking trails would connect all parts of the development.

Transportation Staging Area/Transit Center

A transportation staging area and transit center would be established in the development to provide parking for visitors to GCNP and access to alternative transportation modes into the park and CFV. Under this alternative, the transportation staging area and transit center would lie directly west of State Highway 64, in the southern part of the proposed development (Figure 2.7). The transportation staging area would be built in phases, as needed, to reach a designed capacity of 8,000 to 10,000 vehicles. Parking would be dispersed into a series of pods or clusters designed around existing topography and vegetation. The design and specific location of the staging area would be more fully developed at the construction plan phase and could include an at-grade or below-grade parking structure. Parking would be free at the staging area. The transit center is designed to familiarize park visitors with park, local, and regional attractions, facilities and services.

Visitor and Resident Shuttle Systems

Two shuttle systems would operate under this alternative: a residential loop and a visitor loop. The residential shuttle loop would transport area residents (employees) among neighborhoods, the school, parks, businesses, and the transportation staging area. Proposed extension of this system would shuttle residents to places of employment outside the CFV area in the existing community of Tusayan. This service would be operated in cooperation with business owners in Tusayan, with a portion of the cost of operating the shuttle system charged to the participating businesses. The visitor shuttle loop would connect all lodging elements with the INSIGHT campus and transportation staging area. At the transportation staging area, visitors would board a mass transit system that would carry them to GCNP.

Roadway improvements

Some roadway improvements would be completed to ensure traffic safety and efficient flow. Under this alternative, an enhanced intersection would be constructed at State Highway 64 and Village Boulevard, the main entrance into the development. The intersection would include deceleration and acceleration lanes for both northbound and southbound traffic. At some point, a traffic signal may be placed at the intersection. Figure 2.10 illustrates the proposed improvements to State Highway 64 that would be implemented under this alternative.

Design Features

This alternative has been designed in accordance with a set of ideas that have become known as the Ahwahnee Principles (California Local Government Commission 1991). The following principles form the basis for the planning and design of CFV:

- All planning should include complete and integrated communities containing housing, shops, work places, schools, parks, and civic facilities essential to the daily life of residents.
- Community size should be designed so that housing, jobs, daily needs, and other activities are within easy walking distance of each other.
- As many activities as possible should be located within easy walking distance of transit stops.
- A community should contain a diversity of housing types to enable citizens from a wide range of economic levels and age groups to live within its boundaries.
- Businesses within the community should provide a range of job types for the community's residents.
- The location and character of the community should be consistent with a larger transit network.

This alternative is also based on a sustainable development concept, in which self-sufficiency, efficiency of use, durability of materials, water and energy conservation, and aesthetics are important factors. Sustainable design and construction is a holistic, proactive approach to building that maintains and restores the natural qualities of the site, improves energy efficiency and building performance, diminishes environmental degradation, encourages resource conservation and the use of renewable resources, and responds to the needs of developers and the occupants of their buildings. It is based on project planning, focusing on the long-term implications of building design, construction, and operation. The goal of sustainable design is to create buildings that last longer, are more comfortable to live and work in, perform better, and are sensitive to the natural environment. Specific design features proposed under this alternative are described in the following sections.

Site Planning and Design

Architectural and Landscape Design

Design of the development under this alternative would conform to, and in many instances exceed, the design philosophy and guidelines set forth by GCNP, the Tusayan Area Plan, and other guidelines to maintain the inherent character of the area. These features include the use of sustainable construction, use of rustic building styles, preservation of natural landforms and landscapes, and restoration of the landscape. Under this alternative, the residential area would not be segregated by housing type; single-family housing would be clustered with apartments and dormitories.

Open Space

Under this alternative, 112 acres or approximately 17% of the total land area would be dedicated to open space. The open space would consist of designated natural corridors, including Long Jim Canyon, which bisects the area, and other greenways connecting various parts of the development. Buildings would be appropriately spaced and walkways would be created to provide additional open space within the development.

Infrastructure

Water

An estimated average of 147 million gallons per year (mgy) would be required to maintain the development. The proposed development would obtain water from a series of five deep wells that would be drilled in Valle, Arizona, from which water would be piped to the development and stored in a tank at the transportation staging area. The water pipeline would be located within or adjacent to the Arizona Department of Transportation (ADOT) right-of-way (ROW) for State Highway 64. In the event of an emergency, additional water would be obtained from two wells near Two Guns, east of Flagstaff, Arizona, and delivered to the development by truck.

Water conservation measures to be implemented under this alternative include landscape irrigation with nonpotable water, xeriscaping, precipitation harvesting, dual plumbing of residences and lodgings for use of reclaimed water, installation of maximum water conserving fixtures and appliances in visitor and residential units, restriction of dormitory facilities to showers only, and at least 25% of guest lodging rooms with showers only. These measures would reduce water consumption by approximately 30% compared to using conventional fixtures and appliances without water conservation measures.

Energy

Under this alternative, sustainability and minimal reliance on electric power are emphasized. Energy sources used by the development would include solar, natural gas, and fuel cells. Active solar systems (i.e., using photovoltaic cells and roofing material) and passive solar design would be employed to reduce energy needs in residences, offices, and other buildings. Passive solar strategies would include strategic floor plan layout and architectural design; use of thermal mass and superinsulated walls, light colored roofing materials, and ceiling insulation; and use of high-efficiency windows. Natural gas would be used to heat residences and buildings and to power some appliances, requiring the development of a natural gas pipeline from the Red Lake area south of Valle. The natural gas pipeline would be located within or adjacent to the ADOT ROW for State Highway 64. Fuel cells are proposed for the operation of transportation shuttle systems and to meet the energy needs of commercial facilities. Proportions of total energy requirements provided by these sources are depicted in Figure 2.11.

Waste management

Solid waste would be hauled by a private contractor to the City of Flagstaff landfill, unless a regional solid waste facility is established closer to Tusayan in the future. Solid waste would be reduced through the collection and marketing of all recyclable materials.

Figure 2.11 Proposed Energy Uses

percentage of total use

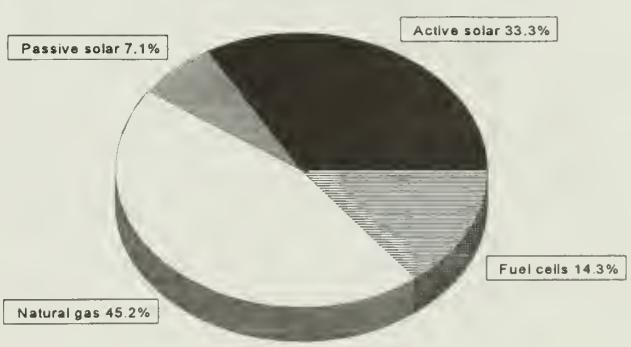
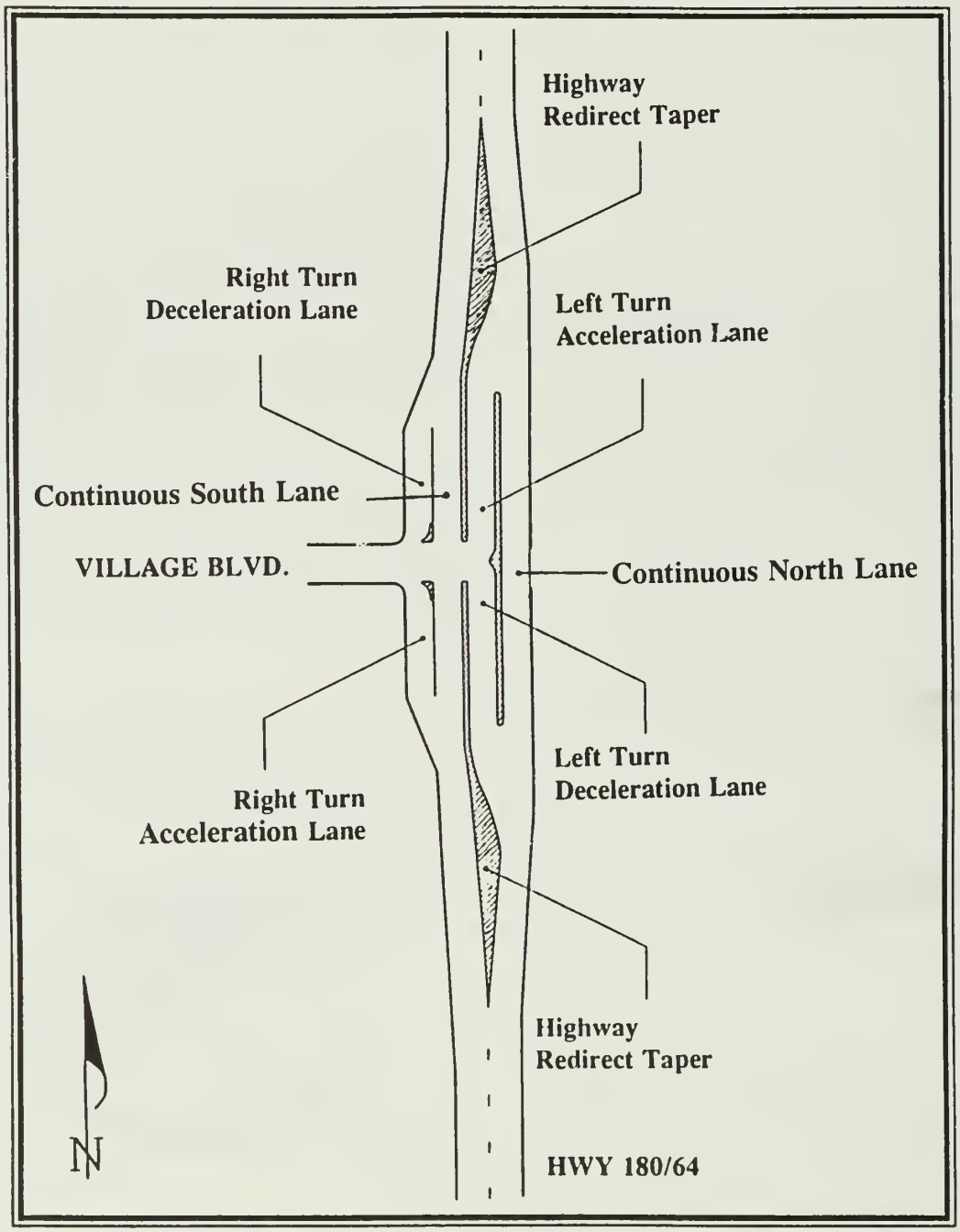


Figure 2.10 Proposed Improvements to State Highway 64 under Alternative B



Wastewater treatment and disposal would use the Solar Aquatics System (SAS). The SAS system consists of greenhouses within which solar ponds and vegetation beds treat effluent for subsequent discharge to composting reed beds and infiltration basins. This system has been shown to be highly effective in treating raw sewage. Wastewater treatment facilities would service all components of the proposed development and would produce about 322,000 gallons of reclaimed wastewater per day (approximately 80% of the total daily potable water needs). Reclaimed wastewater may be (1) discharged to natural or man-made ponds, (2) discharged to groundwater and used for aquifer recharge, (3) used for irrigation of local landscape or for stock tanks, or (4) reused for toilet flushing. Wastewater discharge or reuse would require a National Pollutant Discharge and Elimination System (NPDES) permit and an Aquifer Protection permit.

Resource Conservation

Conservation of natural resources would be achieved under this alternative through the efficient use of building materials, development design that reduces roadway and utility infrastructure, and minimal use of outdoor lighting. The use of conventional construction materials would be reduced through planning and design features and through materials reuse and recycling. Natural construction materials would be used to take advantage of local resources and to reduce air pollution and fuel consumption associated with long-distance materials transport. A clustered development design would reduce the number of roads and the amount of infrastructure required. A reduction in roads would result in lower stormwater volume, and less infrastructure would conserve construction materials. The amount of outdoor lighting would be reduced to the minimum required. Outdoor lighting levels would be below the light pollution limits of the Coconino County Lighting Code, minimizing lighting effects on night-sky viewing.

Project Implementation

Governance

Development densities and phasing proposed under this alternative would be enforced though agreements with Coconino County. A comprehensive development agreement between CFV and Coconino County containing deed restrictions and conservation easements, and covenants, conditions, and restrictions would be used to ensure achievement of development densities and phasing. Coconino County would be responsible for enforcement of the development agreement and associated conditions of County approval, as it is for other developments within Coconino County.

Two organizations would play essential roles in implementing the plan for the CFV development: the Canyon Forest Village Council (Council) and the Environmental Preservation Trust Entity (EPTE).

The Council, a non-profit corporation, would be the entity responsible for community governance in the development. The Council would carry out its activities through a board of directors, potentially composed of residential and commercial property owners within the development, local and Federal agency representatives, and environmental organizations, and through committees composed of property owners, residents, and others.

The Council would administer and enforce the covenants, conditions, and restrictions (CC&Rs) that apply to the property and govern such issues as architectural control, use restrictions, and maintenance of any open space or other "common area." The CC&Rs would run with title to all property in the development. The CC&Rs would establish a general plan of development, a procedure to ensure that all new construction and modifications to existing structures and completed lots are consistent with the plan of development, a minimum maintenance standard for all property within the development, and assessment obligations and procedures. The CC&Rs would also provide that the Council would own and maintain the common property in the development and would have the authority to enforce the provisions of the CC&Rs.

To ensure uniform architectural standards, CFV would prepare design guidelines based on the GCNP architectural character guidelines, describing the general architectural standards for the community. The design guidelines may vary for different lots according to proposed use, location, and special conditions. They would include specific requirements regarding areas of particular concern, such as setbacks, building height, impact on the natural environment, driveways, and garages. The design guidelines may also list suggested materials for construction and landscaping. In addition, the design guidelines may set standards for the construction process, such as when construction must begin and be completed and appearance of the construction site.

Initially, CFV would have the authority to review and approve all applications for new construction and landscaping or modifications to existing structures or landscaping to ensure that the development plans are firmly established. As development progresses, CFV

would transfer its responsibility for reviewing applications for construction or modifications to an architectural review committee appointed by the Council.

The CC&Rs would also establish a framework for the creation of standards governing an owner's or resident's use and maintenance of, as well as conduct upon, any lot located within the development. The provisions would be structured to allow for some initial determinations regarding permitted uses of lots and accompanying standards and to allow the Council to modify these use restrictions and rules as the needs of the community unfold. The CC&Rs may also include a list of specific rights of owners and residents that cannot be altered, such as activities that most property owners might believe to be essential. In addition, the CC&Rs would include restraints upon the leasing and ownership of property.

All homes in the development must be owned and occupied by at least one person who is a "resident" or "qualified renter." A resident is a person who lives within the development all 12 months of the year and who is employed in GCNP, in the CFV development, or in the Tusayan Ranger District of KNF, including unincorporated areas of Tusayan and other privately owned areas within the district. In addition, with the exception of employees of the NPS and the Forest Service, to qualify as a resident, an individual must have worked within GCNP or the development for at least 12 months prior to applying for resident status. A qualified renter is an individual who is employed within the CFV development, GCNP, or the Tusayan Ranger District, for as long as they remain in such employment. The CC&Rs would empower the Council to grant exceptions to resident and renter requirements in hardship situations.

In the event that a property owner or resident violates the use restrictions and rules, the Council would have the authority to enforce various sanctions, which may include levying fines, suspension of rights, suspension of services provided by the Council, and, if necessary, correcting the violation and charging the property owner for any costs.

In addition to providing housing to people who live and work in the area, a second objective of the development is ensuring that the housing is affordable. CFV would provide initial guidelines on the profile characteristics of eligible households. Employees of the service industry and entry-level Federal employees are among the targeted categories of home buyers. Income level would likely play an important role in determining program eligibility.

A certain percentage of homes throughout the development would be governed with the program restrictions. CFV would provide initial design and price-level guidelines to ensure quality construction and affordability.

Responsibility and oversight of the housing program would be the assigned to the Council. The housing program restrictions run with title to the property and apply to all future property owners.

To ensure that housing stays affordable, the future appreciation of homes would be limited through language contained in the CC&Rs. The governing documents would require that appreciation on homes subject to the restrictions be linked to some index figure such as the Consumer Price Index.

Under the recapture program, specific homes within the development would be identified as "recapture homes." Recapture homes would be kept affordable by limiting eligible purchasers to a specific group of qualified individuals and by requiring owners of the recapture homes, upon resale, to submit a portion of the appreciation that has accumulated on the home to a private administrative entity, such as the Council. The recapture fees would become part of the operating budget of the Council. Recapture fees would be used by the Council to subsidize the price of recapture homes to maintain their affordability.

The Council would also have the responsibility for maintaining the community's common areas. Responsibilities may include maintenance of common property in the development, upkeep of storm water retention and drainage systems, maintenance of pedestrian and bike pathways, and, to a limited extent, landscaping and lighting.

Funding for the Council's expenses would be raised primarily through annual base assessments charged to all commercial property owners and, potentially, residential owners. The amount of each year's assessment would be determined by the Council by dividing its budget expenses among all property owners pursuant to a formula. Residential property owners may pay the same annual base assessment. Commercial property may have a variable base assessment rate tied to square footage, gross revenue, or some other verifiable standard. Property owners would not be able to exempt themselves from the obligation to pay assessments by nonuse of the common property.

The Council also may collect neighborhood assessments, special assessments, and specific assessments. Neighborhood assessments are charged to all property owners in a distinct "neighborhood" to pay for a special service provided by the Council, such as exterior maintenance, or maintenance of special facilities, such as covered parking, that is not offered or available to other property owners in the development. In addition, property owners in a neighborhood may request that the Council provide a special service and charge the cost as a neighborhood assessment.

The Council may, with the approval of a majority of the property owners, levy special assessments to cover unbudgeted expenses such as capital improvements. The Council may also levy special assessments against individual property owners who do not comply with the restrictions to pay for the cost of correcting nonconforming conditions (e.g., removing accumulated trash) or who request a special service offered by the Council (e.g., exterior maintenance).

In addition to assessments, other funding sources for the Council may include user fees, special event fees, transfer fees, and recapture fees. User fees would be charged if a resident or non-resident of the community wants to use specific services or facilities. Special event fees would be charged to the sponsor of a special event for the use of facilities, services, or areas within the development during the event. The closing of a sale or transfer of any property within the CFV development may result in payment of a transfer fee by the seller to the Council.

The EPTE would be an institute or foundation designed to develop and implement environmental preservation and education programs for the development. The EPTE would be created by CFV and would be a tax-exempt organization funded by CFV and private donations. In addition, the Council would contribute transfer fees to help fund the EPTE. The EPTE would ensure that environmental commitments are carried out and would establish a permanent revenue source to ensure funding to enforce development and mitigation measures.

The EPTE's primary responsibility would be to preserve and enhance the natural environmental setting surrounding the CFV development through public education and various other activities. The EPTE, with the Council, will prepare environmental guidelines for incorporation into the CC&Rs to address architectural standards, construction materials, landscaping, water and energy conservation, and other sustainable design technologies. The EPTE, in conjunction with INSIGHT, would have primary responsibility for environmental education targeted to residents and property owners in the development, visitors, and school children.

Project Cost

This alternative would be funded through private investments. Construction cost for this alternative is estimated to be $670,165,000.00.

Implementation Schedule

The implementation of this alternative revolves around the need to build visitor services and facilities that generate income so that subsidized aspects of the alternative (housing, community facilities, and transportation staging area) can be built. The implementation schedule begins following the exchange of lands, approval of zoning, securing of permits and licenses, and construction of support infrastructure.

Visitor Segment

In the visitor segment, slightly over half of the lodging and all of the retail facilities would be constructed within four years. Limited-service lodging, comprising approximately 70% of all proposed overnight accommodations, would be constructed throughout the minimum 12-year development period, based on expected market demand. INSIGHT would be built within four years of implementation, with 67% completed in the first year. Infrastructure for both the visitor and community segments would be established within two years of project implementation. A projected implementation schedule for the visitor segment is provided as Table 2.10.

Community Segment

Like the visitor segment, housing components of the community segment would be phased in over the minimum 12-year implementation period to keep pace with housing demands from an increased employment base. The proposed parks, community center, day-care center, and library would be constructed by CFV in the first year. Lots for the house(s) of worship, post office, and medical facility would be made available for sale or lease in the first year. A school site with infrastructure would be developed and donated to the school district in the first year. Table 2.11 provides an implementation schedule for the community segment of the proposed development.

Transportation Segment

The transportation staging area and transit center would be constructed within the first year.

Table 2.10 Projected Implementation Schedule for Visitor Segment Facilities

Units/Area Per Year	1	2	3	4	5	6	7	8	9	10	11	12	*Total*
Visitor Accommodations **(units)**													
Limited Service	350	250	210	180	280	180	250	180	180	180	150	150	*2540*
Full Service	250		150		250								650
Conference			250										*250*
Bed and Breakfast	40	40	40										*120*
Cabins	30	30	30										*90*
Campground	250												*250*
Subtotal	*920*	*320*	*680*	*180*	*530*	*180*	*250*	*180*	*180*	*180*	*150*	*150*	*3,900*
Cumulative % of max. buildout	*24*	*32*	*49*	*54*	*67*	*72*	*78*	*83*	*88*	*92*	*96*	*100*	
Retail													
(1000 sq. ft., improvements only)													
Visitor	125	75	50										*250*
Community	26	145	4										*175*
Subtotal	*151*	*220*	*54*										*425*
Cumulative % of max. buildout	*36*	*87*	*100*										
Orientation/Interpretation													
(1000 sq. ft.)													
Pavilions	10	25	25	25									*85*
Museums	65												*65*
Theaters	25	5											*30*
Restaurants	14												*14*
Retail	40												*40*
Reception	6												*6*
Subtotal	*160*	*30*	*25*	*25*									*240*
Cumulative % of max. buildout	*67*	*79*	*90*	*100*									

Table 2.11 Projected Implementation Schedule for Community Segment Facilities

Units/Area Per Year	1	2	3	4	5	6	7	8	9	10	11	12	*Total*
Housing													
CFV													
Single family	35	35	26	3	18	2	2	2	2	2	2	1	*130*
Apartments	170	193	129	9	87	9	12	9	9	9	7	7	*650*
Dormitories	244	158	205	25	140	19	25	18	18	18	15	15	*900*
Subtotal	*449*	*386*	*360*	*37*	*245*	*30*	*39*	*29*	*29*	*29*	*24*	*23*	*1680*
Cumulative % of max. buildout	*27*	*50*	*71*	*74*	*88*	*90*	*92*	*94*	*96*	*97*	*99*	*100*	
GCNP													
Single family		21		21		21		21		21			*105*
Apartments		35		35		35		35		35			*175*
Dormitories		24		24		24		24		24			*120*
Subtotal		*80*		*80*		*80*		*80*		*80*			*400*
Cumulative % of max. buildout		*20*		*40*		*60*		*80*		*100*			
Tusayan Area													
Single family		15	15		15		15		15				*75*
Apartments		44		44		44		44		44			*220*
Dormitories		40		40		40		40		40			*200*
Subtotal		*100*		*100*		*100*		*100*		*100*			*500*
Cumulative % of max. buildout		*20*		*40*		*60*		*80*		*100*			
Total Single Family	***35***	***71***	***26***	***39***	***18***	***38***	***2***	***38***	***2***	***38***	***2***	***1***	***310***
Cumulative % of max. buildout	***11***	***34***	***43***	***56***	***61***	***74***	***74***	***87***	***87***	***99***	***99***	***100***	
Total Apartments	***170***	***272***	***129***	***88***	***87***	***88***	***12***	***88***	***9***	***88***	***7***	***7***	***1,045***
Cumulative % of max. buildout	***16***	***42***	***55***	***63***	***71***	***80***	***81***	***89***	***90***	***98***	***99***	***100***	
Total Dormitories	***244***	***222***	***205***	***89***	***140***	***83***	***25***	***82***	***18***	***82***	***15***	***15***	***1,220***
Cumulative % of max. buildout	***20***	***38***	***55***	***62***	***74***	***81***	***83***	***89***	***91***	***98***	***99***	***100***	
Total all housing	***449***	***565***	***360***	***216***	***245***	***209***	***39***	***208***	***29***	***208***	***24***	***23***	***2,575***
Cumulative % of max. buildout	***17***	***39***	***53***	***62***	***71***	***79***	***81***	***89***	***90***	***98***	***99***	***100***	
Parks	0.5*												*0.5*
Community Center	0.5*												*0.5*
School Site	10.0*												*10.0*
Houses of worship	1.5*												*1.5*
Library	*w/in village core (area undetermined)*												*NA*
Day-care	*location and area are undetermined*												*NA*
Post Office	*w/in village core (area undetermined)*												*NA*
Police/Fire	1.5*												*1.5*
Medical Services	*w/in village core (area undetermined)*												*NA*

*acres

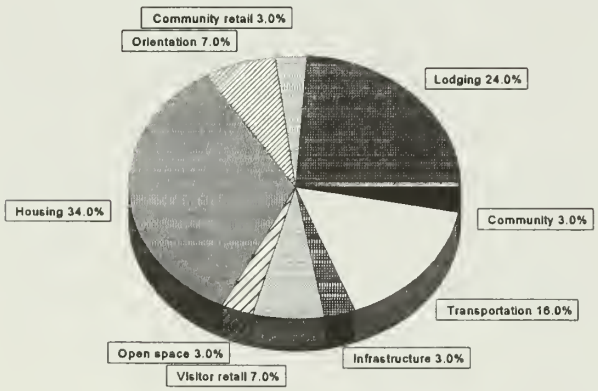
Alternative C: Land Exchange Option 2

Introduction

This is the second of two land exchange options. The CFV Alternative Plan (CFVAP) was built around a series of parameters established by the Interdisciplinary Team to reduce the size of the tract of NFS land that would be exchanged into private ownership and reduce the amount of commercial development, while still providing housing and community facilities for area residents and transportation improvements for GCNP visitors.

Figure 2.13 Proposed Uses of NFS Land

based on percent of total land area



This alternative proposes the private acquisition and development of 380 acres of NFS land directly north of Tusayan and west of State Highway 64 (Figure 2.12). In exchange, the KNF would acquire 12 private inholdings, totaling 2,184 acres, within the Tusayan Ranger District south of GCNP, based on appraisals of the Federal and private land. Additional private land may be secured by CFV or adjustments made in the size of the Federal tract to equalize values based on results of the land appraisals. Locations of private inholdings are depicted in Figure 2.1, and associated acres are listed in Table 2.3.

Like Alternative B, this alternative incorporates visitor, community, and transportation components. The reduced acreage of NFS land proposed for exchange would reduce the total amount of visitor facilities, and these services and facilities would be developed at higher densities than those under Alternative B.

The visitor segment includes construction of 2,250 lodging units over a minimum of 12 years, 180,000 square feet of community retail, parks, a community center, a library, day-care, and police/fire protection services. Some of the community retail, services, and facilities would also be used by visitors. Land would also be dedicated for the establishment of a school and one shared house of worship. The transportation segment would consist of a transportation staging area that would serve both the visitor and community segments.

To maintain economic viability, design features focus on the creation of a mixed-use gateway community rather than a model of sustainable development. The mixed-use gateway community would have less open space, use conventional construction methods and designs, and emphasize function rather than aesthetics. Figure 2.13 depicts the proposed uses for the NFS land, and Table 2.12 provides acreage associated with the components of the proposed development. Figure 2.14 provides a concept plan for proposed uses of the NFS land. Specific components of visitor, community, and transportation segments and proposed design features are discussed below.

Visitor Segment

Lodging, Dining, and Recreational Facilities

Limited- and full-service lodging facilities would be provided for visitors. Limited-service lodging facilities would total 1,550 units. Full-service lodging facilities would total 350 units. Bed-and-breakfast facilities would total 100 units and would be made available as pads for sale to prospective bed-and-breakfast operators. In addition, a 250-space campground/RV park would be constructed under this alternative. Table 2.13 and Figure 2.15 outline the percentage of total visitor accommodations by lodging type.

Figure 2.12 Footprint of NFS Land involved in Alternative C

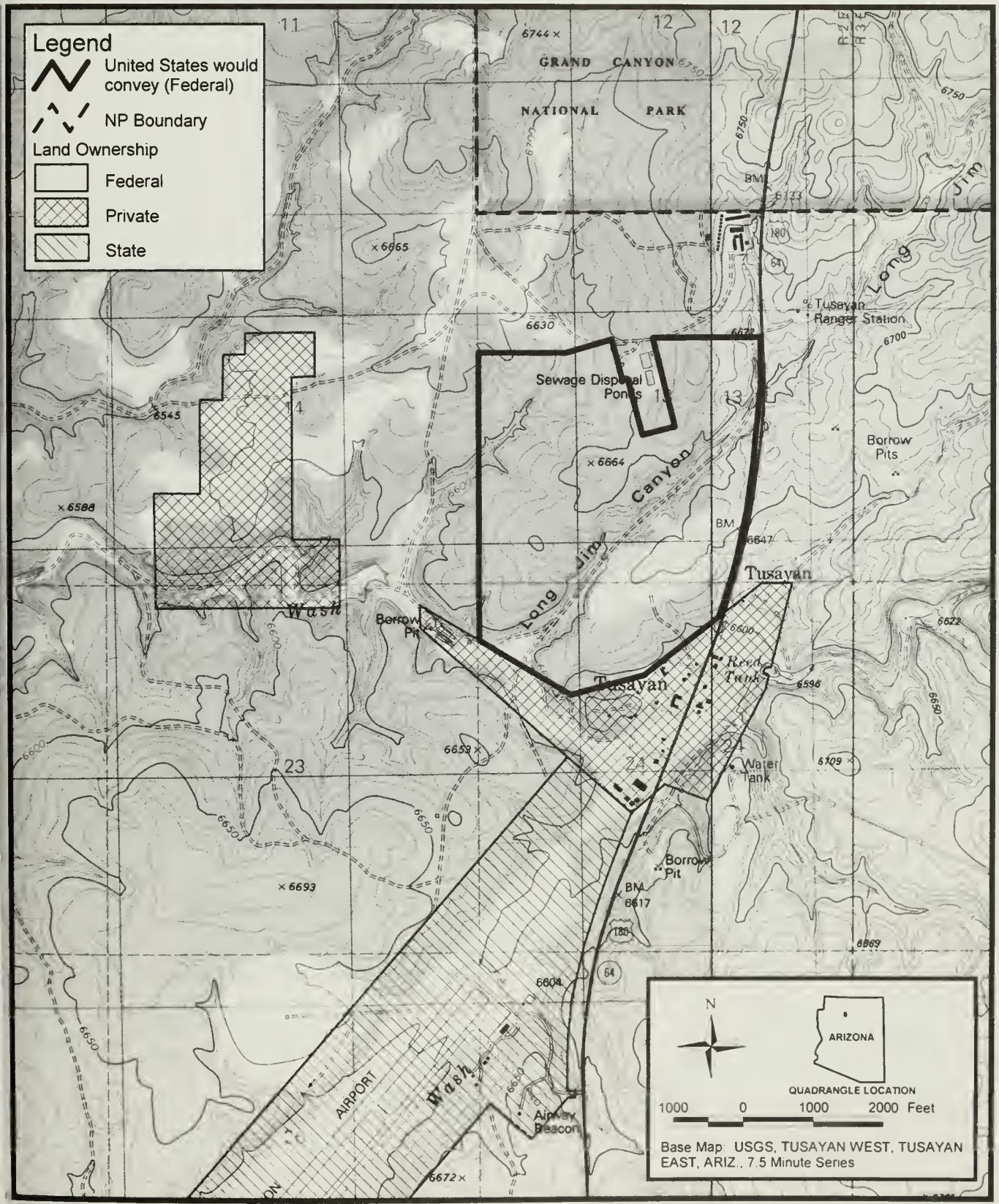
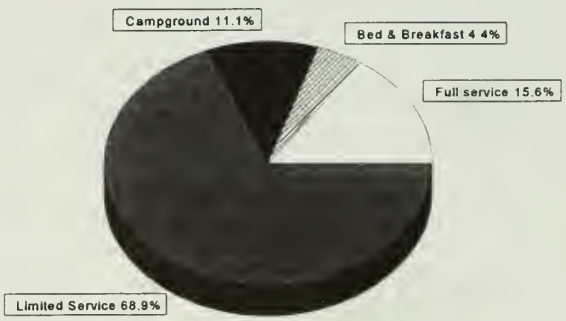


Table 2.12 Proposed Uses and Associated Acreage for NFS Land by Acres

Use	Acres	Percentage of Total Acres
Visitor Segment		
Lodging	90	24
Retail	25	7
Orientation/Interpretation	25	7
Community Segment		
Housing	131	34
Community Facilities	12	3
Retail	13	3
Transportation Segment		
Transportation	62	16
Design Features		
Open Space	10	3
Infrastructure	12	3
Total	***380***	***100***

Figure 2.15 Visitor Lodging Accommundations
based on a percentage of 2,250 units

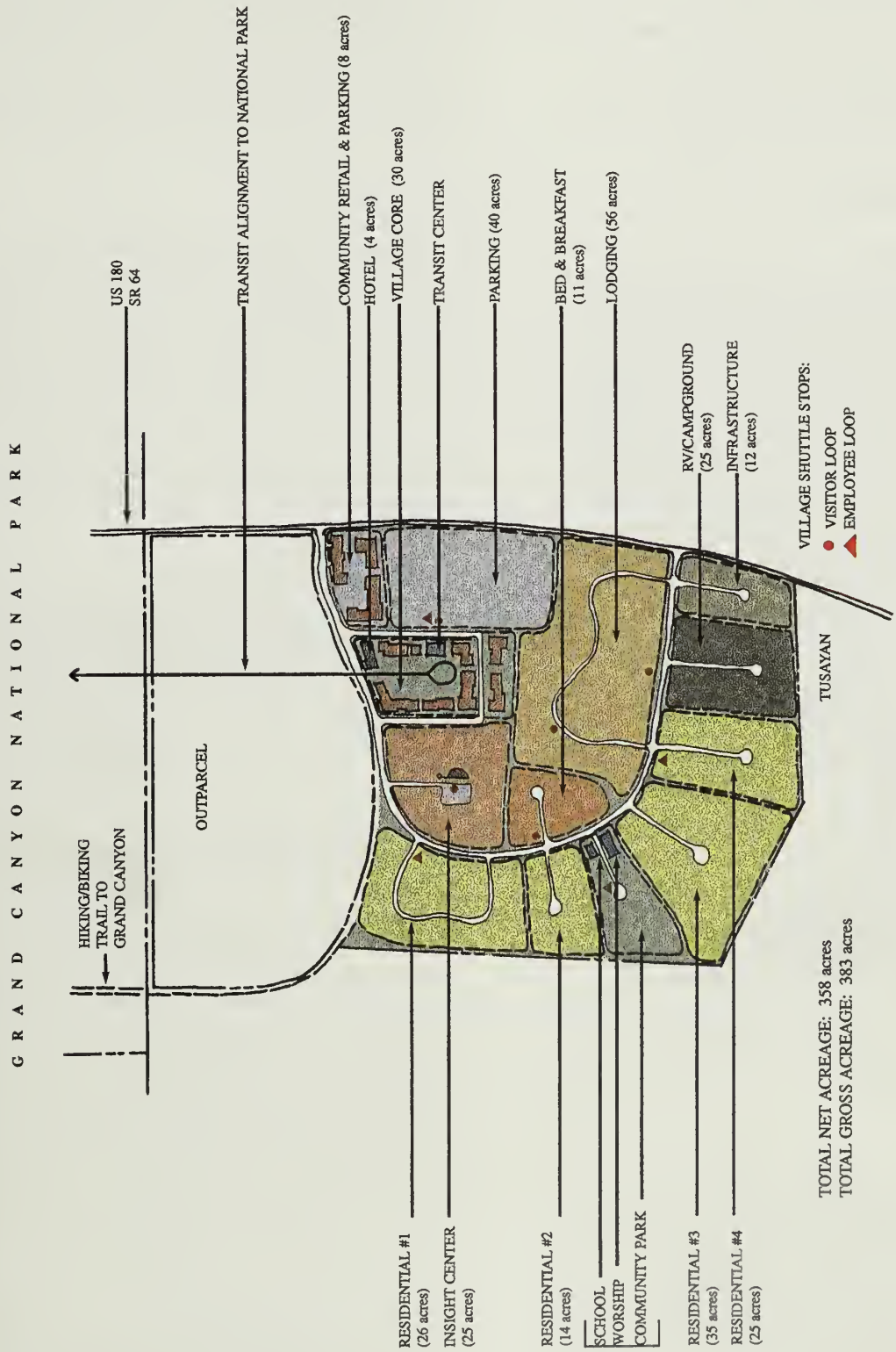


Visitor Retail
Under this alternative, retail facilities targeted to visitors would be built on 180,000 square feet in the village core. Visitor retail would be constructed according to the implementation schedule presented on pages 54 and 55. The types of facilities expected to be established are the same as described in Alternative B (see Table 2.6).

Table 2.13 Proposed Visitor Lodging Accommodations

Accommodation type	Number of units	Percentage of total visitor accommodations
Limited Service	1,550	69
Full Service	350	16
Bed-and-Breakfast	100	4
Subtotal	***2,000***	***89***
Campground/RV Park	250	11
Total	***2,250***	***100***

Figure 2.14 Concept Plan for Canyon Forest Village under Alternative C



Orientation/Interpretation

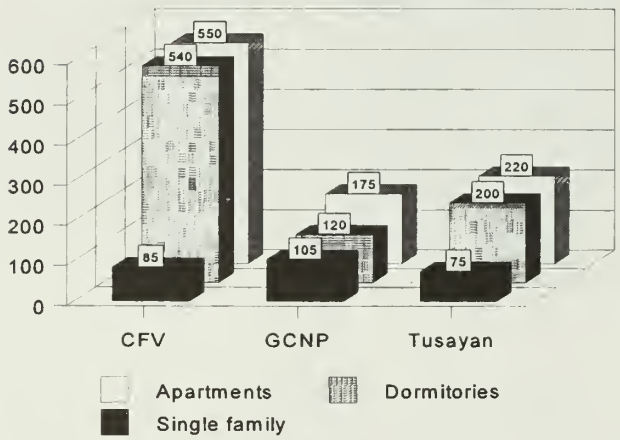
Under this alternative, INSIGHT, the proposed experiential learning center to be developed in conjunction with the Museum of Northern Arizona, would be established on a 25-acre site near the center of the development and west of the village core. The services and facilities provided at INSIGHT would be the same as those described in Alternative B (see Table 2.7).

Community Segment

Residential Housing

This alternative proposes the construction of single-family units, apartments, and dormitories for area employees. Housing would account for 34% of the development. Estimates for park employee housing needs were made in coordination with the park's GMP and include 400 units. In Tusayan, CFV estimated that approximately 500 units of housing would be required to replace the existing, sub-standard inventory and meet the anticipated needs of the planned future construction by area businesses. 1,175 new units of housing would be required for CFV if the project were to be fully built. These requirements are reflected in Table 2.14 and Figure 2.16. Housing types include single-family units, apartments, and dormitories.

Figure 2.16 Housing Type by Number of Units



A council would be established with this alternative as described under Alternative B to ensure that housing is available and affordable for area employees. The minimum price range for single family units, which would consist entirely of modular construction units, would be about $65,000. Rental rates for apartments would average $640 per month. Average monthly dormitory rental rates would be $455 per unit.

Community Facilities

This alternative proposes the establishment of parks, a community center, a library, a day-care facility, and a Coconino County Sheriff's substation. A school site with infrastructure would be donated to the local school district. Land would be sold or leased for a shared house of worship, a post office, and medical services, including a health clinic and an emergency air evacuation system.

Community Retail

Community retail, comprising 80,000 square feet, would be established near the center of the development. Essentially the same types of establishments would be developed under this alternative as are proposed under Alternative B (see Table 2.9). Approximately 44,000 square feet of improvements would be made available as leased pads for the establishment of restaurants, a bank, a service station, a convenience store, and offices. Development of the community retail component would be phased in during the first three years of implementation.

Transportation Segment

A transportation staging area and resident and visitor shuttle systems are proposed under this alternative. The transportation component of this alternative would represent approximately 16% of the total land use. Both the staging area and the shuttle system would be constructed and implemented in the first year of the project.

Transportation Staging Area

Under this alternative, the transportation staging area/ transit center would be located adjacent to State Highway 64 between Moqui Lodge and the IMAX theater, north of Long Jim Canyon, and would provide parking and other facilities for visitors to GCNP. The staging area would be physically and visually separated from State Highway 64 through the use of landscaping, fencing, and/or walls and because of its location north of Long Jim Canyon. Natural vegetation would be retained in islands to mitigate visual effects from the highway. The transportation staging area would be built in phases as needed to reach a designed capacity of 8,000 to 10,000 vehicles. Parking would be dispersed into a series of pods or clusters designed around existing topography and vegetation. The design and specific location of the staging area would be more fully developed at the construction plan phase and could include an at-grade or below-grade parking structure. Parking would be free at the staging area. The transit center is designed to familiarize park visitors with park, local, and regional attractions facilities and services.

Table 2.14 Percent Composition by Housing Type

Housing type by employer	Estimated number of units	Percentage of total housing
Apartments		
CFV	550	26
GCNP	175	8
Tusayan Area	220	11
Subtotal	*945*	*45*
Dormitories		
CFV	540	26
GCNP	120	6
Tusayan Area	200	10
Subtotal	*860*	*42*
Single Family		
CFV	85	4
GCNP	105	5
Tusayan Area	80	4
Subtotal	*270*	*13*
Total	*2,075*	*100*

Visitor and Resident Shuttle Systems

The shuttle systems proposed under this alternative would be the same as those described under Alternative B (see page 39).

Roadway Improvements

The proposed improvements to State Highway 64 that would be implemented under this alternative are the same as those under alternative B, illustrated in Figure 2.10.

Design Features

Design features define the principles on which this alternative is based. They relate to infrastructure, materials and uses, and open space or buffers. This alternative, because of cost considerations, is not as strongly based on a sustainable development concept as Alternative B. The focus is on providing a mixed-use community, with essential components, in a compressed land area. This alternative would use minimal natural buffers, and the village would be more urban in character than under Alternative B. Specific design features proposed under this alternative are described below.

Site Planning and Design

Architectural and Landscape Design

Design of the development under this alternative would conform to guidelines set forth by GCNP, the Tusayan Area Plan, and other guidelines to maintain the inherent character of the area. Materials such as wood veneer, glass-fiber reinforced concrete, and exposed aggregate would be used rather than more natural stone and wood products. Residential communities would be linear, with traditional street and subdivision design.

Open space

Under this alternative, 10 acres, or less than 3% of the total land area, would be dedicated to open space. Terrain features such as Long Jim Canyon would be incorporated into site planning rather than left in their natural state. Buffering under this alternative would consist of required setbacks along the frontage with State Highway 64 and screen walls, fences, and limited natural vegetative buffers at code-required setbacks.

Infrastructure

Water

An estimated average of 140 mgy would be required to maintain the development. The proposed development would obtain water from a series of five deep wells that would be drilled in Valle, Arizona, from which water would be piped to the development and stored in a tank at the transportation staging area. The water pipeline would be located within or adjacent to the ADOT ROW for State Highway 64. In the event of an emergency, additional

water would be obtained from two wells near Two Guns, east of Flagstaff, and delivered to the development by truck. Under this alternative, normal water-conserving fixtures would be used, and all lodging units would incorporate conventional tub-shower combinations.

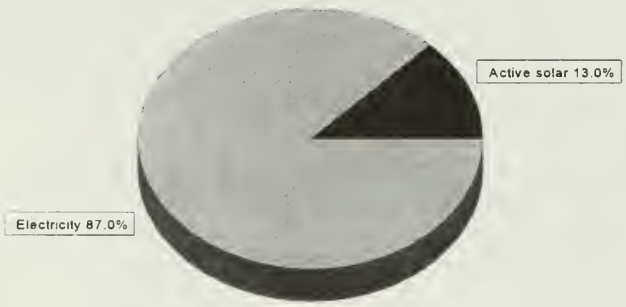
Energy

Under this alternative, most energy needs would be met using traditional systems, emphasizing energy efficiency through manufactured applications, equipment, and appliances. Proportions of total energy requirements provided by these sources are depicted in Figure 2.17.

Conventional electric sources would be the main energy source, with active solar applications contributing 13% of the total energy supply. Electricity would be supplied by Arizona Public Service (APS).

Figure 2.17 Proposed Energy Uses

percentage of total use



Waste Management

Solid waste would be hauled by a private contractor to the City of Flagstaff landfill, unless a regional solid waste facility is established closer to Tusayan in the future. Solid waste would be reduced through collection and marketing of all recyclable materials.

A conventional wastewater treatment plant would be constructed under this alternative. The sludge by-product generated by this system would be disposed of in a designated site approved for this use or in a composting system that would be developed somewhere between Tusayan and Williams (land and approvals for this use have not been secured).

Resource Conservation

Electric energy systems would be supplemented by active solar systems. Construction and related materials would include particle board, veneers, woods, and light-weight frames instead of timber, stone, and masonry.

Project Implementation

Governance

Governance would be the same as that described for Alternative B (see Tables 2.10 and 2.11).

Project Cost

This alternative would be funded through private investments. Construction cost for this alternative is estimated to be $363,758,000.00.

Implementation Schedule

The implementation of this alternative revolves around the need to build visitor services and facilities that generate income to build the subsidized aspects of the alternative (housing, community facilities, transportation staging area). The implementation schedule begins following the exchange of lands, approval of zoning, securing of permits and licenses, and construction of support infrastructure.

Visitor Segment

Sixty percent of the lodging and all of the retail facilities would be constructed within four years. Limited-service lodging would be phased in over the minimum 12-year development period, based on expected market demand. A projected implementation schedule for the visitor segment is provided in Table 2.15.

Community Segment

Apartments, dormitories, and single-family homes would be phased in over the minimum 12-year development period, with a large proportion of the units being constructed within seven years to accommodate housing demands from an increased employment base. Other community facilities, including the proposed parks, community center, and library, would be constructed in the first year. Lots for a shared house of worship, a day-care center, a post office, and medical facilities would be made available for sale or lease in the first year. A schoo site with infrastructure would be developed and donated to the school district in the first year. Table 2.16 provide an implementation schedule for the community segment the proposed development.

Transportation Segment

The transportation staging area, transit station, and orientation center would be constructed within the first year.

Table 2.15 Projected Implementation Schedule for Visitor Segment Facilities

Units/Area Per Year	1	2	3	4	5	6	7	8	9	10	11	12	*Total*
Lodging (units)													
Limited service	300	200	150	150	200		150		150		150	100	*1550*
Full service	200					150							*350*
Bed and Breakfast	40	40	20										*100*
Campground	250												*250*
Subtotal	***790***	***240***	***170***	***150***	***200***	***150***	***150***		***150***		***150***	***100***	***2250***
Cumulative % of max. buildout	*35*	*46*	*53*	*60*	*69*	*76*	*82*		*89*		*96*	*100*	
Retail (1000 sq. ft., improvements only)													
Visitor	120	40	20										*180*
Community	100	20	4										*124*
Subtotal	***220***	***60***	***24***										***304***
Cumulative % of max. buildout	*72*	*92*	*100*										
Orientation/Interpretation (1000 sq. ft.)													
Pavilions	35	20	15		15								*85*
Museums	20												*20*
Theaters	10	5											*15*
Restaurants	6												*6*
Retail	10												*10*
Reception	4												*4*
Subtotal	***85***	***25***	***15***		***15***								***140***
Cumulative % of max. buildout	*61*	*79*	*89*		*100*								

Table 2.16 Projected Implementation Schedule for Community Segment Facilities

Units/Area Per Year	1	2	3	4	5	6	7	8	9	10	11	12	*Total*	
Housing														
CFVAP														
Single family	31	27	8	3	5	3	2		2		2	2	*85*	
Apartments	277	147	40	12	28	20	7		7		7	5	*550*	
Dormitories	216	119	48	20	41	41	15		15		15	10	*540*	
Subtotal	***524***	***293***	***96***	***35***	***74***	***64***	***23***		***23***		***23***	***16***	***1175***	
Cumulative % of max. buildout	*45*	*70*	*78*	*81*	*87*	*93*	*95*		*97*		*99*	*100*		
GCNP														
Single family		21		21		21		21		21			*105*	
Apartments		35		35		35		35		35			*175*	
Dormitories		24		24		24		24		24			*120*	
Subtotal		***80***		***80***		***80***		***80***		***80***			***400***	
Cumulative % of max. buildout		*20*		*40*		*60*		*80*		*100*				
Tusayan Area														
Single family		16		16		16		16		16			*80*	
Apartments		44		44		44		44		44			*220*	
Dormitories		40		40		40		40		40			*200*	
Subtotal		***100***		***100***		***100***		***100***		***100***			***500***	
Cumulative % of max. buildout		*20*		*40*		*60*		*80*		*100*				
Total Single Family	***31***	***64***	***8***	***40***	***5***	***40***	***2***	***37***	***2***	***37***	***2***	***2***	***270***	
Cumulative % of max. buildout	***12***	***36***	***39***	***54***	***56***	***71***	***71***	***85***	***85***	***99***	***99.6***	***100***		
Total Apartments	***277***	***226***	***40***	***91***	***28***	***99***	***7***	***79***	***7***	***79***	***7***	***5***	***945***	
Cumulative % of max. buildout	***29***	***53***	***57***	***67***	***70***	***80***	***81***	***90***	***90***	***99***	***99***	***100***		
Total Dormitories	***216***	***183***	***48***	***84***	***41***	***105***	***15***	***64***	***15***	***64***	***15***	***10***	***860***	
Cumulative % of max. buildout	***25***	***46***	***52***	***62***	***67***	***77***	***80***	***88***	***90***	***97***	***99***	***100***		
Total all housing	***524***	***473***	***96***	***215***	***74***	***244***	***23***	***180***	***23***	***180***	***23***	***16***		***2,075***
Cumulative % of max. buildout	***25***	***48***	***53***	***63***	***67***	***77***	***80***	***88***	***89***	***98***	***99***	***100***		
Community														
Parks (1000 sq. ft.)	3,000													*0.07*
Community Center (1000 sq. ft.)	w/in village core (area undetermined)													NA
School Site	10*													*10*
Houses of worship	1*													1
Library	w/in village core (area undetermined)													NA
Day-Care	(location and area undetermined)													NA
Post Office	w/in village core (area undetermined)													NA
Police/Fire	1*													1
Medical Services	w/in village core (area undetermined)													NA

*acres

Alternative D: Townsite Act/special Use Permit

Introduction

This alternative is proposed by the GCIA, a group of Tusayan land and business owners. The GCIA is presently working on plans to redevelop Tusayan to provide a better mix of visitor services, residential housing, and community services on private and NFS lands. The area of this proposal is shown in Figure 2.18. Development of **private** land in Tusayan is not dependent upon the outcome of this EIS, but on approvals by Coconino County for rezoning portions of the existing private land. Development of NFS land is dependent on the provisions of the Townsite Act which allows the purchase of Federal lands for residential housing and community services. Commercial use of NFS land acquired under the Townsite Act is not permitted.

Figure 2.19 Proposed Uses of NFS Land

based on percent of total land area



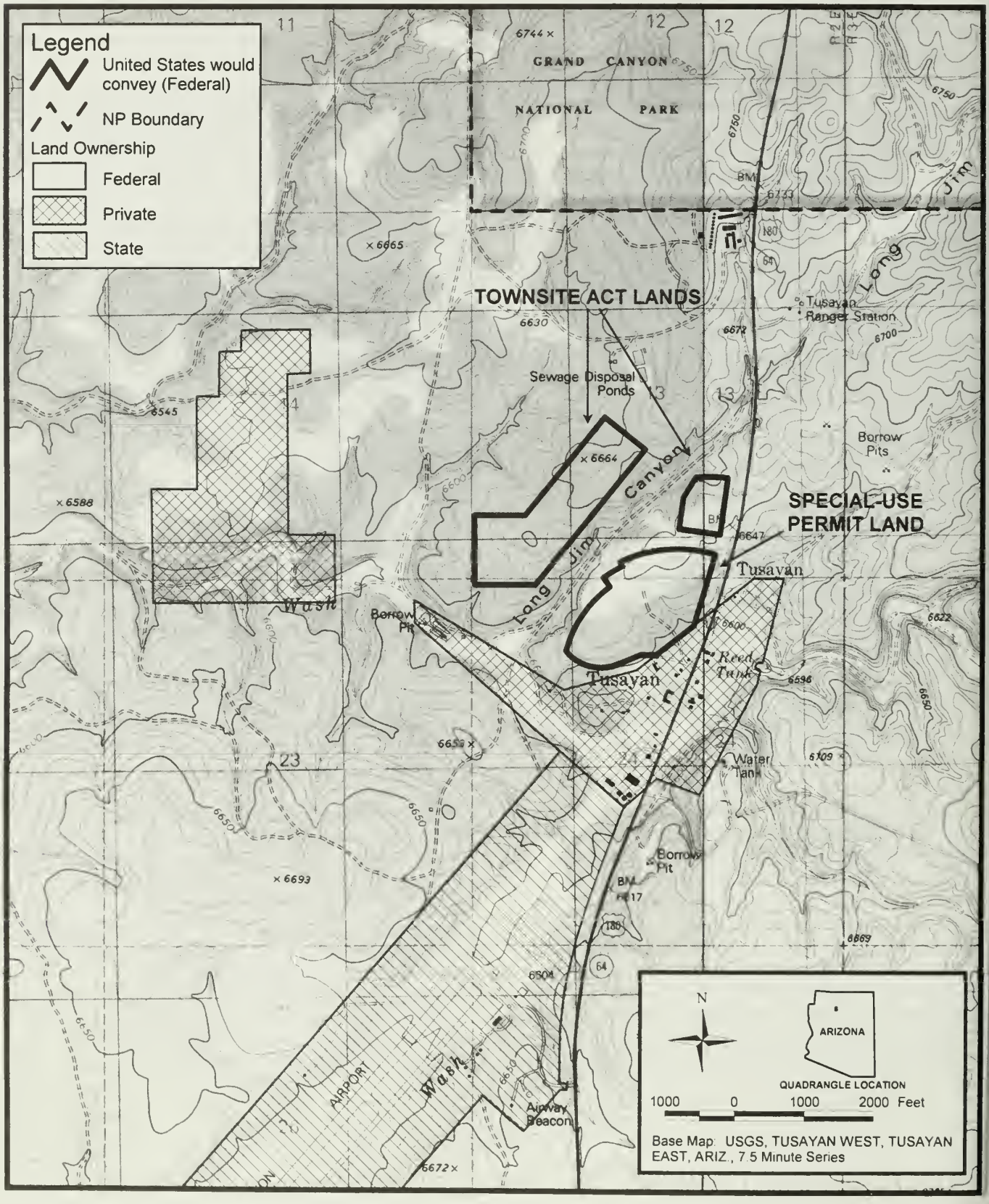
In this alternative, a qualifying municipal or county entity would be created to purchase approximately 65 acres of NFS land near Tusayan under the provisions of the Townsite Act. The land would be purchased at fair market value and would be used for housing, a community center, a school, a fire station, and parks. In addition, this alternative proposes that a transportation staging area and visitor orientation center be developed on 52 acres of NFS land under a special use permit administered by the KNF. Recognizing that there would be competitive interest in such a development, the permit must be issued through the bidding process. Together, the land purchased under the Townsite Act and the requested land under the special use permit total approximately 117 acres. The uses of NFS lands proposed under this alternative are depicted in Figure 2.19.

Development in the Tusayan area under this alternative would involve three primary components: (1) redevelopment of the existing private lands in Tusayan (primarily aimed at enhancing and increasing the commercial visitor segment); (2) development of a centralized residential housing/community area on Federal land purchased under the Townsite Act; and (3) development of a transportation staging area and information/orientation center on Federal land under a special use permit. A fourth component, design features, describes the development principles of the alternative.

The visitor segment includes 710 lodging units and 220,200 square feet of retail and food service facilities, to be constructed through the redevelopment of Tusayan. These figures do not include potential expansion of Moqui Lodge and/or GCNP or development of the Domes property, that collectively could provide another 651 rooms. The residential housing/community segment includes housing for area employees. The community segment also includes making land available for a school, fire house, and community center. The transportation segment would consist of a transportation staging area and transit center that would serve both the visitor and community segments.

Design features of this alternative focus on using energy and water conservation measures and natural construction materials, following the guidelines presented in Coconino County's Design Review Overlay Zone for Tusayan. Figure 2.20 provides an illustration of the land uses for this alternative, and Figure 2.21 provides a concept plan illustrating the location and spatial relationships of the redevelopment of Tusayan, the residential housing/community area, and the transportation staging and information orientation area. A projected implementation schedule for these development components is provided in Table 2.21.

Figure 2.18 Footprint of NFS Land Involved in Alternative D



Visitor Segment

Lodging

Under this alternative, limited-service and full-service lodging and facilities would be provided for visitors on the existing private land in Tusayan. Redevelopment of Tusayan to accommodate additional lodging is not dependent on the outcome of this EIS process, although it is affected by it. The primary difference between limited-service and full-service is the addition of a dining establishment to the full-service lodging facility. Table 2.17 and Figure 2.22 outline the percentage of the total visitor accommodations each lodging type comprises.

Figure 2.22 Existing and Proposed Visitor Accomodations

based on a percentage of 1,641 units

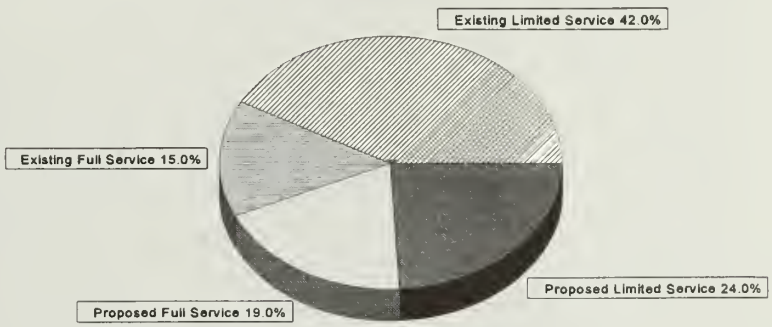


Table 2.17 Proposed Lodging Types in Tusayan

Accommodation type	Number of units	Percentage of total visitor accommodations
Limited Service	390	28
Full Service*	320	23
Total	*710*	*51*

* Ownership of the lease on the Camper Village Campground which includes proposed development of 320 units of full-service lodging, is under litigation.

Visitor Retail

Under this alternative, 220,200 square feet of additional retail and food service facilities targeted to visitors would be constructed in the tourist market core of the existing private land base in Tusayan, on the east side of State Highway 64. Food and beverage services would account for 40% or about 88,000 square feet and visitor retail would comprise the remaining 132,200 square feet. Like the lodging segment, redevelopment of Tusayan to include this additional retail space is not dependent on the outcome of this EIS process. Specific plans for these establishments have not been developed, but the types of facilities expected to be established include gift shops, restaurants, a gas station, and themed retail establishments. Table 2.18 lists the amounts of retail space that are proposed at each site. Figure 2.21 shows the location of each site.

Community Segment

Community components proposed under Alternative D would be constructed on NFS land acquired under the Townsite Act. A County Improvement District would be formed to serve as the qualifying governmental entity to purchase the approximately 65 acres of NFS lands at fair market value based on appraisal of the lands. Currently, a County Improvement District does not have the authority to purchase lands; a change in the State statutes would be required to achieve the goals of this alternative. The process of forming a County Improvement District entails the completion of more than 18 steps. Some of these steps are: submitting a petition for the proposed improvement; holding public hearings; determining scope of work and cost (including construction; legal fees; posting, publishing, and mailing notices; administration; design; construction inspection; bond marketing; and capitalized interest); appointing a district engineer, attorney, and financial consultant; obtaining bids; and sale of bonds to fund the improvement project. As proposed, the County Improvement District would enter into agreements with and sell land to local governmental entities (e.g., Public Housing Authority, School District, and Fire District) to implement the individual components of the community plan. The local governmental entities would be responsible for raising the funds necessary to finance the improvements. Commercial use of NFS land acquired under the Townsite Act is not permitted.

Figure 2.20 Proposed Land Uses for Alternative D

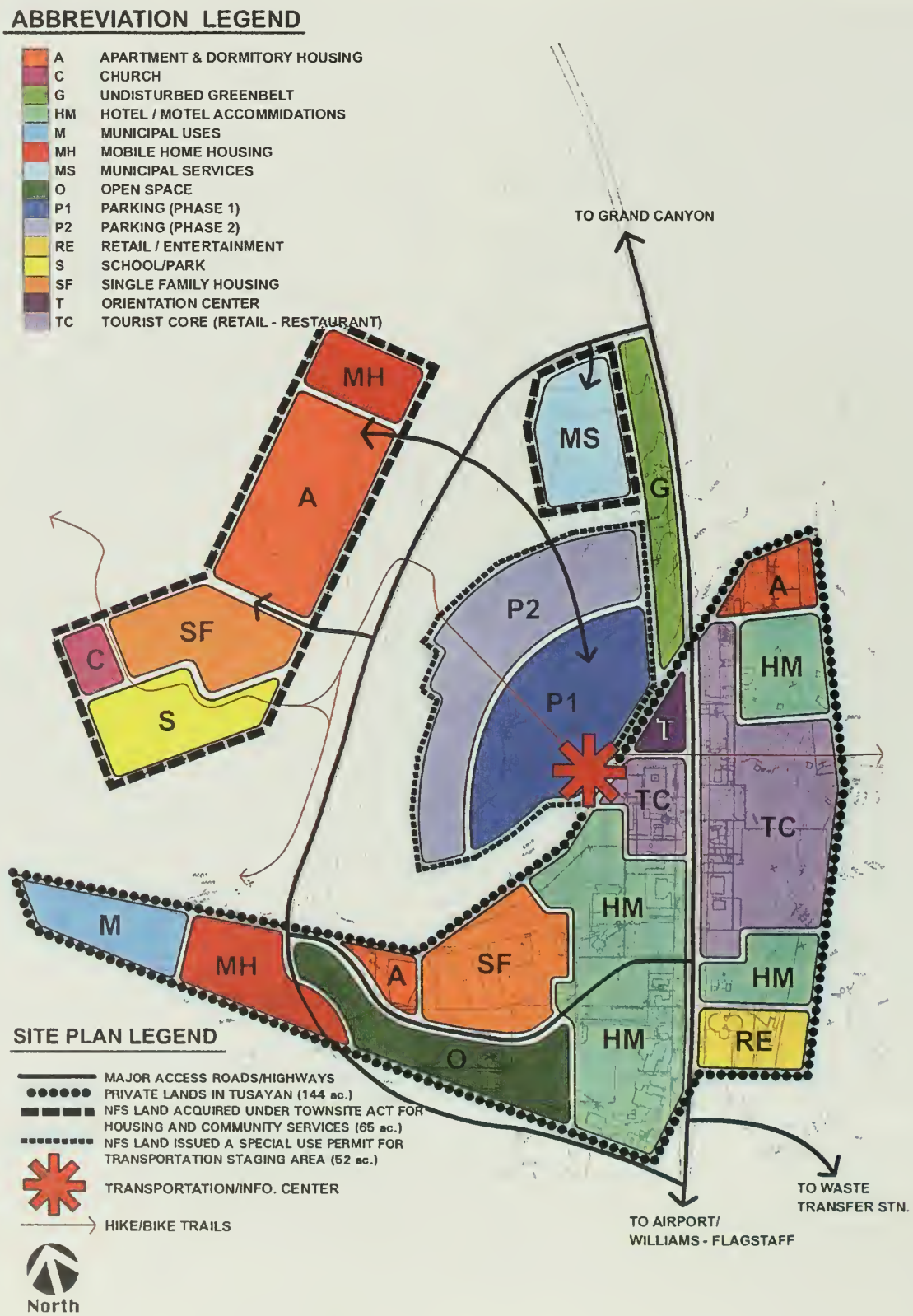


Figure 2.21 Concept Plan for Tusayan Development Plan



TUSAYAN COMMUNITY DEVELOPMENT SITE PLAN

Grand Canyon Improvement Association, LLC — Tusayan, Arizona

THORP ASSOCIATES P.C., ARCHITECTS and PLANNERS — ESTES PARK, COLORADO

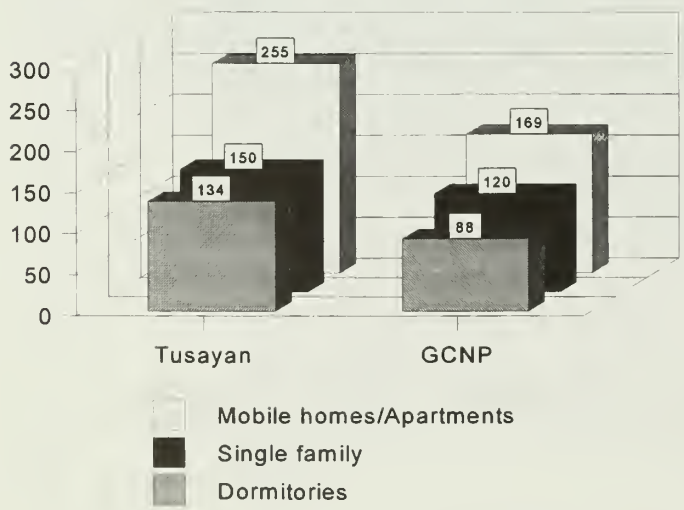
Table 2.18 Proposed Visitor Retail within Tusayan

Location and Type of Retail	Amount of Retail (Square Feet)
The Grand (retired Kenai Site)	
Gift Shop	3,200
Dinner Theater	6,000
The New Hotel Site east of State Highway 64 and behind Babbitts (existing Campground Site)	
Retail, Restaurants, and Cafes	105,000
The Tourist Market Core, Retail Core, and Retail/Visitor Service (North Site)	
Themed Retail and Restaurants	60,000
Retired Papillon Highway Site	
Retail and Restaurants	40,000
Total	***220,200***

Residential Housing

The proposed development would include housing for area residents constructed on NFS land acquired under the Townsite Act. The housing component would be managed by a Public Housing Authority (PHA) which would be formed to provide for low-income housing. The term PHA applies to any state, county, municipality, or other governmental entity or public body which is authorized to engage in or assist in the development or operation of low-income housing. A PHA must be approved by HUD as an eligible PHA before participating in the public housing program by demonstrating that it has the required legal authority and has entered into a Cooperation Agreement with the local governing body to provide the cooperation required by HUD. The PHA must also submit organization documents for approval by the Area Office which then reviews and determines the eligibility of the PHA to participate in the public housing program. Any housing built under a PHA must be available to any employee in the county.

Figure 2.23 Housing Type by Number of Unit



The GCIA has estimated the need for 539 units for Tusayan businesses and 377 units for GCNP employees. Housing types available would include single-family units, apartments, and dormitories. Under a public housing authority, housing would be constructed and made available to area residents (Figure 2.23 and in Table 2.19).

Community Infrastructure

The proposed development would include a number of community features on NFS land acquired under the Townsite Act for permanent residents and employees of Tusayan and GCNP. The governmental entity that purchases the land would contract with other local governmental entities to provide the community facilities. As part of this alternative, land would be sold to these entities to provide a community center, fire station, school, and park. The community center would be available for worship services, and office space would be available for law enforcement.

Community Retail

The existing Babbitt's store provides a grocery store and gift shop in an 8,500 square foot center. Additional community-type retail has not been identified in the proposal.

Transportation Segment

Transportation Staging Area

A transportation staging area and transit center would be located just north of Tusayan, adjacent to the IMAX theater, to provide parking and access to a mass transit system for GCNP. Construction and operation of the transportation staging area would be authorized under a Forest Service special use permit through a competitive bidding process. Abutting the transit center would be an orientation center and campus designed and operated in cooperation by Destination Cinema and possibly the National Geographic Society. Parking facilities would be developed for a capacity of up to 4,500 automobiles. If additional parking is needed, a new proposal would be submitted to the Forest Service for use of additional NFS land to the north or west of the proposed transportation staging area. The 20,000 square foot transit center would house the transit system provider; a terminal for the National Park transportation permittee; offices for park and Forest Service personnel; information kiosks for the KNF, GCNP, Coconino County, northern Arizona communities, and American Indian tribes; and a few retail shops and food service establishments.

Visitor and Resident Shuttle Systems

To link visitors from the transit center to other commercial uses on the east side of State Highway 64, a pedestrian bridge would be constructed over State Highway 64 at the IMAX theater, and at-grade pedestrian crossings would be established in the vicinity of the transit center and Babbitts intersection, the Red Feather Lodge and McDonalds intersection, and the Holiday Inn Express and Grand Hotel intersection.

Widening of State Highway 64 is proposed to allow a four-foot-wide bike path. As planning evolves for this alternative, areas to park bikes adjacent to the transit center and on the fringes of public areas would be provided. Off of State Highway 64, for example on Long Jim Canyon Road, bikes and cars would share the street. A shared bike and pedestrian path may evolve to provide general circulation and link the local community and commercial areas of Tusayan.

The backbone of the internal shuttle system would be Long Jim Canyon Road. The shuttles would use State Highway 64 as necessary to access the major areas of employment. A specific circulation plan would be developed once key components of the development are approved, including the necessary amenities, such as shelters and pull-outs.

Table 2.19 Percent Composition by Housing Type

Housing type	Estimated number of units	Percentage of total housing
Mobile Homes/Apartments		
Tusayan Area	255	27
GCNP	169	18
Dormitories		
Tusayan Area	134	16
GCNP	88	10
Single Family		
Tusayan Area	150	16
GCNP	120	13
Total	***916***	***100***

Roadway Improvements

Two main intersections along State Highway 64 are expected to facilitate the majority of turning movements into and out of the transportation staging area: the IMAX intersection and the access point to the transit center parking lot. Some roadway improvements would be completed at these intersections to ensure traffic safety and efficient flow, including two left-turn lanes. Single left-turn lanes are proposed at all other intersections.

Another roadway improvement is the proposed completion of Long Jim Canyon Road. The southern end of this route is not currently open to traffic. As proposed under this alternative, this section of the road would be opened to facilitate local traffic movement to the expanded residential housing/community area and existing residential housing area. Figure 2.24 shows the proposed transportation circulation for cars and buses through Tusayan and the transit center.

Orientation and Interpretation

Under this alternative, an orientation/interpretive center would be constructed on private and NFS lands adjacent to the transit center. While Destination Cinema will possibly participate in the design of the orientation/interpretive center with the National Geographic Society, final approval of the concept and incorporation of the concept within a development prospectus would be the responsibility of the Forest Service and the NPS. The orientation/interpretive center would be an estimated 20,000 square feet in size and would be integrated into the transit center and the redesigned IMAX theater which currently is visited by one million people annually.

Design Features

This alternative is based on efficiency of use, water conservation, and native vegetation. Specific design features proposed under this alternative are described as follows.

Site Planning and Design

Architectural and Landscape Design

Design of the development under this alternative would conform to guidelines set forth by Coconino County's Design Review Overlay Zone for Tusayan and other guidelines to maintain the inherent character of the area. GCIA is working with ADOT on plans to landscape State Highway 64 ROW in Tusayan. Landscaping would include: a clear delineation of vehicle and pedestrian ways to prevent congestion and conflicts; parking lots designed to include landscaping within the periphery and interior to break up surface coverage; landscaping that consists of low-water-use indigenous plants; preservation of existing trees and vegetation; utilization of reclaimed water for irrigation; and signs that complies with Coconino County requirements.

Open space

Under this alternative, GCIA proposes 200-300 foot setbacks or undisturbed "greenbelts" for all development north of the existing community of Tusayan. Open space has been designated in the Tusayan Community Development Plan between visitor accommodations west of State Highway 64 and existing mobile home housing. Under this alternative, open space accounts for about 10-15 acres of private land comprising 7% to 10% of the existing private land base in Tusayan.

Infrastructure

Water

Currently there are two privately owned water systems in Tusayan, one owned by the Anasazi Water Co. and the other by Hydro-Resources. Existing storage capacities of the two systems are 300,000-350,000 gallons and 3,650,000 gallons, respectively. Water for Tusayan businesses comes from two deep wells in Tusayan and purchased water from Williams and GCNP. Table 2.20 shows what these sources contribute based on current consumption rates.

Table 2.20 Tusayan Water Sources and Percent Contribution

Water Source	Percent contribution of consumption	Consumption in 1995 (mgy)	Predicted Consumption in 2000* (mgy)
Tusayan Wells	47	25.5	41.6
Hauling	30	16.3	26.6
GCNP	23	12.5	20.3
Total	*100*	*54.3*	*88.5*

*excluding Moqui Lodge and any development on private inholdings

With the completion of redevelopment of existing private lands in Tusayan in the year 2000, water consumption is expected to be an estimated 88.5 mgy (excluding Moqui Lodge and any inholding development). This total does not include water needs for GCNP housing and the transportation staging area, which would be provided by the GCNP system, requiring a pipeline to be constructed from the park to the transportation staging area (about 5 miles). This pipeline would be constructed within or adjacent to the highway ROW. Under this alternative, another deep well would be drilled in Tusayan, and a water tank farm would be constructed adjacent to the existing water storage area to increase capacity by an additional 5 million gallons. Water would be pumped from wells during the winter months (and, if possible, purchased from Williams and GCNP) and stored at the water tank farm for use during the summer months.

Water conservation measures mandated by the Tusayan Area Plan would be implemented under this alternative, including irrigation with non-potable water only, xeriscaping, and dual plumbing of residences and lodging facilities for use of reclaimed water.

Energy

Tusayan electric service is currently provided by Arizona Public Service (APS). The substation located in Tusayan is near capacity and would require upgrading to support future development.

Waste Management

Solid waste would be hauled to a county-operated transfer station approximately 3 miles southeast of Tusayan. From there, the County hauls the waste to a landfill northeast of Flagstaff. Solid waste would be reduced through initiation of a community recycling program that is scheduled to begin in 1997.

The South Grand Canyon Sanitary District owns and operates the wastewater treatment plant in Tusayan. This plant has a capacity of 750,000 gallons per day and can accommodate additional wastewater generated by redevelopment of Tusayan into the foreseeable future. Part of the recent plant expansion included the construction of a reclaimed water facility, which will become operational in 1997. Beginning with the Grand Canyon Squire Inn constructed in the 1970s, all hotels have been double-plumbed to take advantage of reclaimed water.

Resource Conservation

In addition to using reclaimed water and developing a community-wide recycling program, most existing and all future hotels and other commercial operations must use "timed" faucets and low-volume toilets and shower heads to help conserve water. Outdoor lighting would conform to the provisions of the Coconino County Lighting Ordinance and the Tusayan Area Plan.

Project Implementation

Governance

Development on private land in Tusayan would be subject to the goals and policies incorporated in the Tusayan Area Plan and the Design Review Overlay Zone. As with all local regulatory codes, provisions may change at the discretion of the County Board of Supervisors unless development is subject to a development agreement between the landowner and the County.

Governance for the transportation staging area and visitor orientation center would be provided through the terms and conditions of a special use permit and the permit renewal process. Governance for the community section developed pursuant to the Townsite Act would be achieved through the terms and conditions of the Townsite Act as overseen by the County Improvement District, and through agreements executed between the County Improvement District and the local governmental entities implementing the individual components of the community development plan.

Project Cost

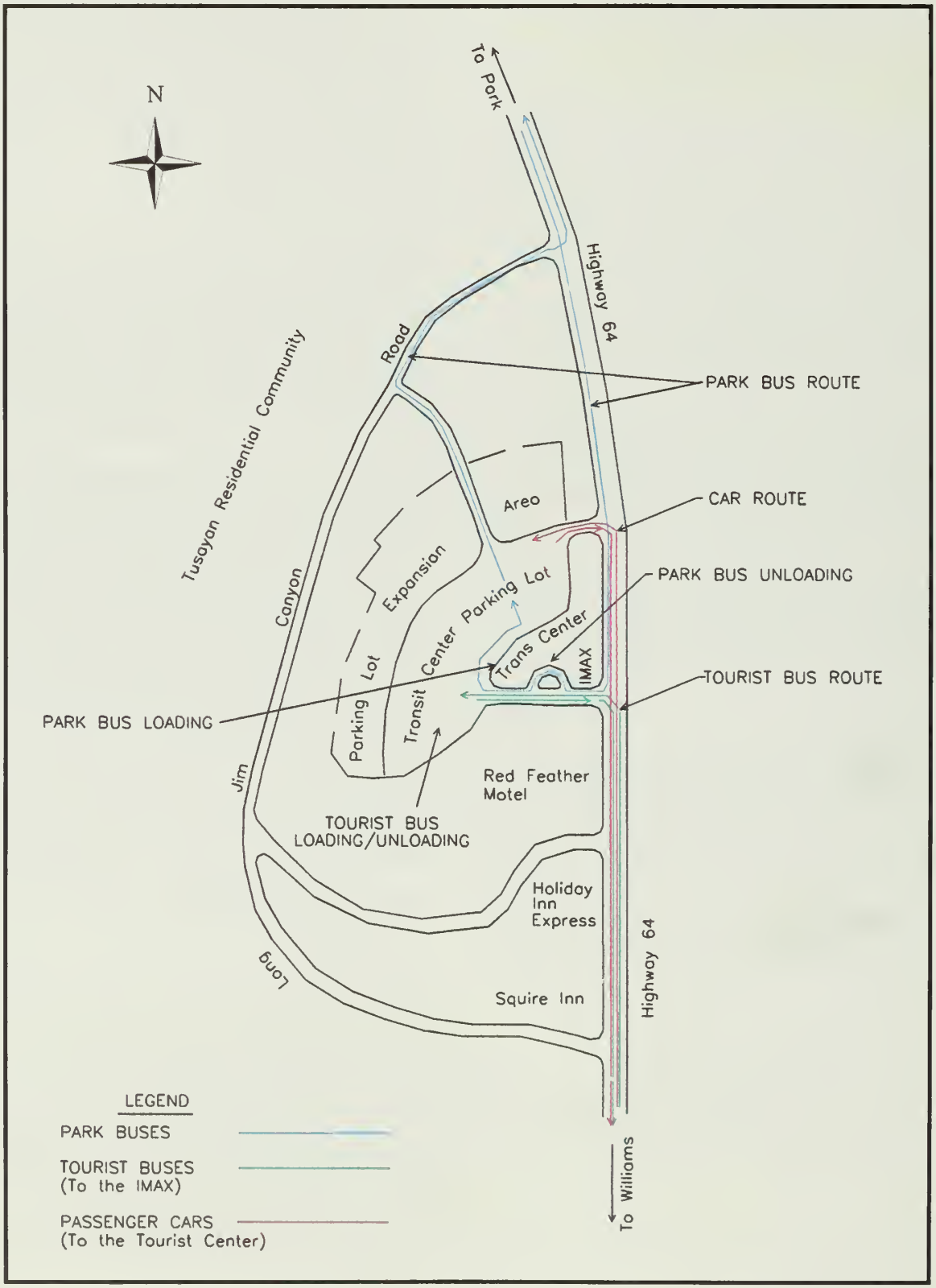
The costs of implementing this alternative and the estimates for construction of the housing or community aspects of the alternative have not been disclosed.

Implementation Schedule

Visitor Segment

Under this alternative, GCIA is proposing to continue to improve the development of the existing private land in Tusayan to absorb current and future commercial market demands created by visitors to GCNP. The redevelopment is not intended to be a rigid, "phased" proposal, but to be more market-driven. In the visitor segment, the majority of the lodging and retail facilities would be constructed within the next three years, with the majority of the redevelopment completed by the year 2002. A projected implementation schedule for the visitor segment is provided in Table 2.21.

Figure 2.24 Traffic Circulation Pattern for Alternative D



Community Segment

No phasing has been specified for development of community services and facilities. GCIA intends to continue its redevelopment efforts on private property that, at the landowner's discretion, may include certain community facilities. County planning mandates would require provisions for employee housing. The GCIA would provide housing on available private land in Tusayan and in Valle, until approval is obtained for consolidation of housing in a new residential community on NFS lands. If approval is secured for the purchase of Federal land under the Townsite Act, these lands would serve as the primary land base for development of community services and facilities.

Transportation Segment

The transportation staging area, transit station, and orientation center would be constructed within the first year.

Table 2.21 Projected Implementation Schedule For Additional (or new) Visitor Segment Facilities

Units/Area Per Year	1	2	3	4	5	*Total*
Lodging (units)						
Limited service			250	140		*390*
Full service	160	160				*320*
Subtotal	***160***	***160***	***250***	***0***	***140***	***710***
Cumulative % of max. buildout	*23*	*45*	*80*	*80*	*100*	
Retail (1000 sq. ft., improvements only)						
Visitor	50.2	50	50	35	35	*220.2*
Community						0
Cumulative % of max. buildout	*23*	*45*	*68*	*84*	*100*	

Alternative E: Transportation Staging Area and NPS Housing

Introduction

This alternative was developed by the Interdisciplinary Team to address transportation and Federal housing needs identified in the GCNP GMP. Under this alternative, a total of 120 acres of NFS land would be dedicated to the construction and operation of a transportation staging area and orientation center and to the provision of housing for NPS employees. The transportation staging area and orientation center would be constructed and operated by a private concessionaire under a special use permit from the KNF. Housing would be federally funded, built and maintained by a private developer and leased back to the park or its employees, or a combination of both. NFS land that would be used to implement this alternative is located directly north of Tusayan and west of State Highway 64 (Figure 2.25). This alternative would not involve transfer of jurisdiction between the two Federal agencies or transfer of ownership between the Federal government and private parties. Instead, the Department of Agriculture and Department of the Interior would execute an interagency agreement to furnish government housing.

Included in the description of this alternative are three primary elements: 1) a visitor segment, 2) a residential segment, and 3) a transportation segment. All visitor services and facilities offered in this alternative would be associated with the proposed transportation staging area. Components of the visitor segment include information and interpretive facilities and limited retail. No visitor lodging facilities would be included. The residential segment consists of housing for NPS employees and a large meeting facility for residents of the housing facility. No other community facilities would be constructed under this alternative. The transportation component includes a transportation staging area and orientation center; a large parking area for private vehicles; and access to 1) a transit system carrying visitors to the park, 2) shuttle systems serving NPS employees, and 3) a trail system for bicyclists and pedestrians. As described in other alternatives, design features constitute a fourth component and define the development principles of this alternative. The proportion of land area that would be dedicated to the various uses is shown in Figure 2.26. Figure 2.27 provides a concept plan. Acreage for each of the components are listed in Table 2.22.

Figure 2.26 Proposed Uses of NFS Land
based on percent of total land area

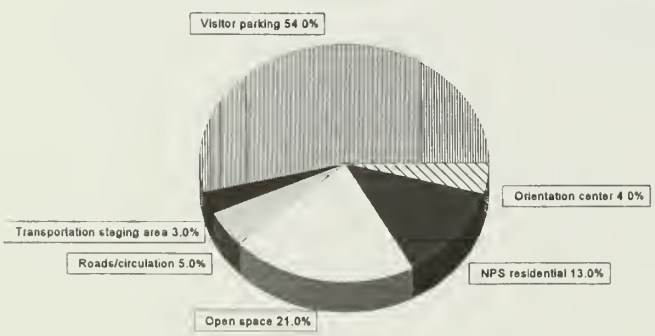
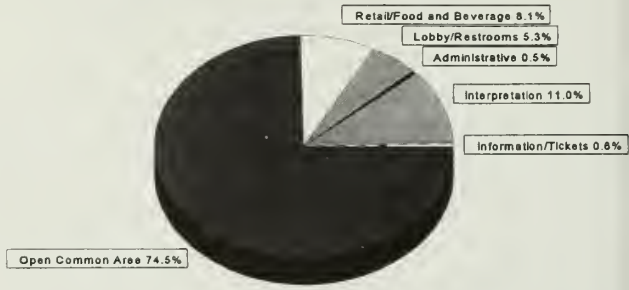


Figure 2.28 Visitor Uses
based on proportion of total orientation center area



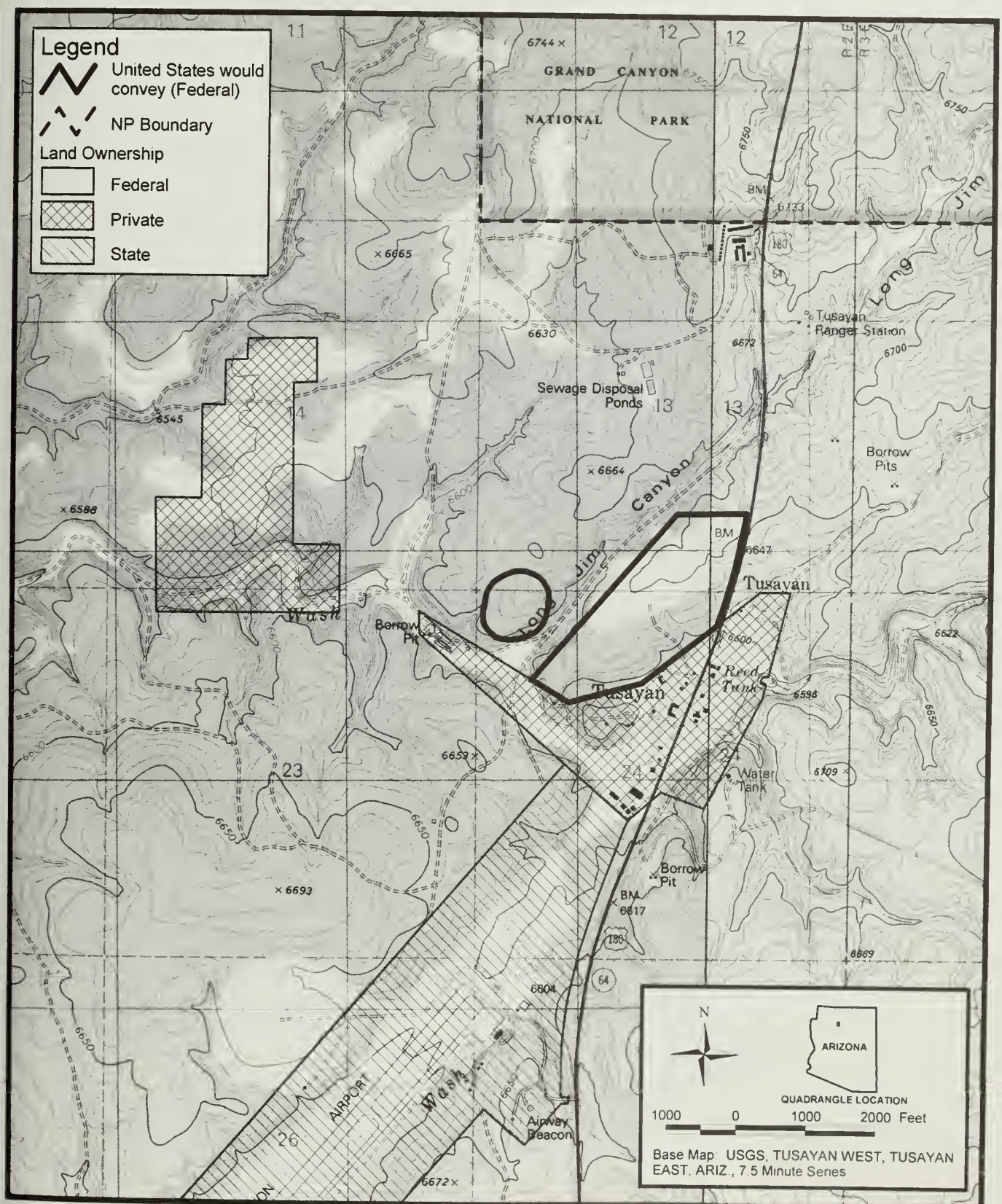
Visitor Segment

Visitor facilities would be incorporated into the transportation staging area and orientation center. These facilities, consisting of three separate pavilions and an open-air plaza, would provide limited retail and food operations, information/ interpretive services, and quarters for administrative and support functions.

Visitor Retail

Visitor retail would include park entrance ticket sales, a bicycle rental shop, and a series of food and gift shops and carts. Ticket sales and bicycle rental would be located together in the first pavilion of the orientation center. The other retail facilities—a gift shop, food/vending operations, and a bookstore—would be located in the second pavilion, with restrooms provided in the lobby. Administrative and support facilities would be located in a third pavilion and would include offices and storage and receiving areas. A kennel for pets would be constructed at the periphery of the parking area. The proportion of area allocated to the various uses and square footage associated with each component of the orientation center is depicted in Figure 2.28 and summarized in Table 2.23.

Figure 2.25 Footprint of NFS land Involved in Alternative E



Kaibab National Forest

Figure 2.29 Concept Plan for Development of Alternative E

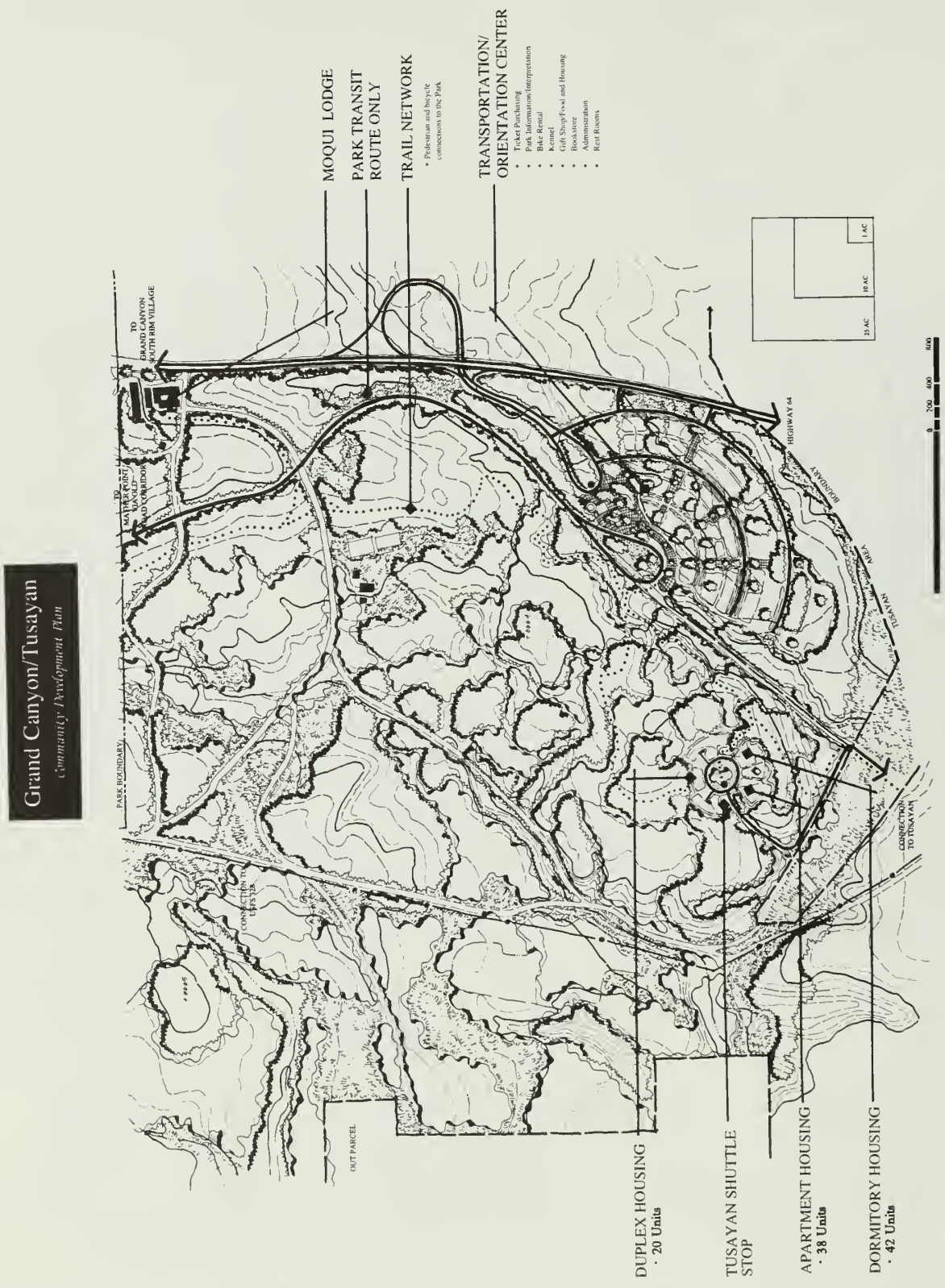


Table 2.22 Proposed Uses of NFS Land by Acre Under Alternative E

Use	Acres	Percentage of Total Acres
Visitor Segment		
Orientation center	5	4
Residential/community Segment		
NPS residential	16	13
Transportation segment		
Transportation staging area	3	3
Visitor parking	65	54
Roads/circulation	6	5
Design features		
Open space	25	21
Total	***120***	***100***

Orientation/Interpretation

Orientation and interpretation would be provided by information booths and interpretive exhibits. Three information booths would be established in the pavilion where park entrance tickets are sold and bicycles are rented. These booths would provide assistance to visitors in using the transportation system and provide general information about services in the Tusayan and Grand Canyon areas, including local businesses, attractions, and events. Interpretive elements would be limited to exhibits established in the lobby of the main retail pavilion and interpretive panels, exhibits, and monitors placed in the bus loading area. Additional interpretive panels would be established inside the transit vehicles to benefit visitors en route to the park.

Residential Segment

Under this alternative, housing and a large meeting room would be constructed and maintained for NPS employees residing within the housing complex. Housing units proposed are multifamily duplexes, apartments, and dormitories. If housing is privately developed, rental rates would be subject to market forces. Current market rates are estimated at $650.00 for a two-bedroom apartment and $450.00 for a one-bedroom apartment. If housing is federally funded, rents would be determined using an established government formula, as it currently exists in the park. The number of units of each housing type to be built under this alternative is depicted in Figure 2.29 and listed in Table 2.24.

Figure 2.29 Housing Type by Number of Units

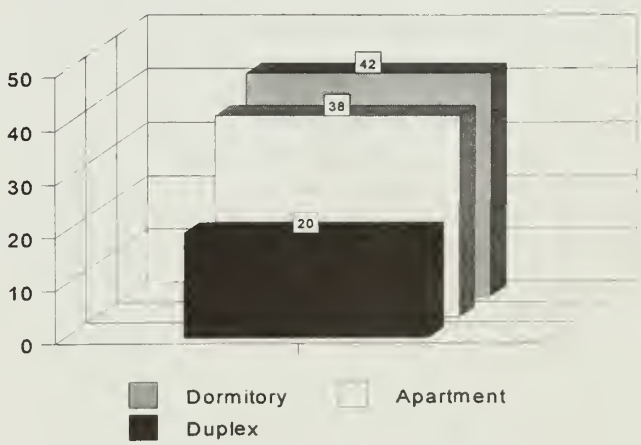


Table 2.23 Orientation Center and Plaza Land Use, Services, and Facilities

Facility/service	Square feet	Percentage of total visitor facilities
Information/Ticket Sales	420	0.6
Retail/Food and Beverage	5,420	8.1
Administrative Support	360	0.5
Lobby and Restrooms	3,500	5.3
Interpretation	7,298	11.0
Open Common Area	49,580	74.5
Total	*66,578*	*100.0*

Table 2.24 Number of Units and Percent Composition by Housing Type

Housing type	Estimated number of units	Percentage of total housing
Duplex	20	20
Apartments	38	38
Dormitories	42	42
Total	*100*	*100*

The multipurpose meeting room would include a large hall for meetings and worship services, a full-service kitchen, a day-care facility, a crafts room, a resource center, administrative offices, and other support facilities. This facility would be available only to residents of the housing complex.

Transportation Segment

Transportation Staging Area

Under this alternative, a transportation staging area and orientation center would be constructed and operated just north of the Tusayan townsite and west of State Highway 64 on 94 acres of NFS land. In addition to the visitor retail, orientation, and interpretive facilities described earlier, the transportation staging area and orientation center would provide parking for approximately 4,500 vehicles and would serve as the transfer point from private vehicles to the mass transit system into the park.

Trails and Bike Paths

A trail system would be established and maintained to provide pedestrian and bicycle connections between the residential areas, the transportation staging area and orientation center, and GCNP. Bike paths and pedestrian/hiking trails would provide alternative ways to enter the park.

Roadway Improvements

Under this alternative, an underpass would be constructed at the State Highway 64 crossing of Long Jim Canyon to accommodate access lanes to and from the transportation staging area and orientation center (Figure 2.27). This underpass would connect directly to the visitor parking facilities. Existing gravel and dirt roads would be paved and used for visitor and residential shuttle circulation. An alignment associated with a former access road into GCNP from this area would be paved and used as a transportation corridor between the transportation staging area and orientation center and the park.

Design Features

Features that define the character, structure, and function of this alternative include site planning and design, infrastructure, and resource conservation measures. The intent of this alternative is to provide an environmentally sustainable design that allows for proposed human uses while maintaining the natural and cultural character of the area.

Site Planning and Design

Architectural and Landscape Design
Architectural design of visitor, housing, and transportation facilities would follow the GCNP Architectural Character Guidelines and would take into account both landform and existing vegetation. Building materials would consist primarily of wood, with native stone used to the extent possible. Colors for buildings and facilities would be compatible with the existing natural surroundings. Clumps of ponderosa pine and other native vegetation would be retained within the visitor parking area and surrounding facilities to maintain a natural setting.

Open space
Open areas or natural buffer zones would be maintained around the transportation staging area and between proposed roadways. Approximately 25 acres or about 21% of the NFS land used in this alternative would remain as open space.

Infrastructure

Water
Potable water for the proposed development (6.9 mgy) would be drawn from the GCNP's water supply, which originates within Grand Canyon at Roaring Springs. Water would be piped to the development via an 8-inch diameter pipeline installed adjacent to the proposed transit corridor between the transportation staging area and the park. The proposed pipeline would be approximately 4.5 to 5 miles in length. An on-site water storage facility would be established as part of the transportation staging area and orientation center. Under this alternative, approximately 19,000 gallons of potable water and 59,000 gallons of nonpotable water would be required per day (totaling approximately 28.5 mgy). Nonpotable water (21.6 mgy) would be obtained from the South Grand Canyon Sanitary District.

Energy
The primary energy source for the development proposed under this alternative would be electricity, originating from an APS transmission line that crosses the site. If the transit system is electrically powered, a substation would have to be established on or near the site. Electrical lines would be placed underground to eliminate or reduce visual impacts. An active solar system would be used to heat water, and passive solar elements would be incorporated into architectural design. Propane would be used as a supplemental energy source. If natural gas becomes available in the region, it would be considered as an alternative energy source.

Waste management
Solid waste would be hauled to a Coconino County–operated transfer station southeast of Tusayan and subsequently to a City landfill northeast of Flagstaff. An estimated 70,000 gallons per day of wastewater would be generated by the proposed transportation/orientation center and residential facilities. Wastewater would be transferred to the South Grand Canyon Sanitary District via 6- to 10-inch diameter pipes. It is estimated that between 0.5 and 1 mile of pipeline would have to be installed.

Resource Conservation
Conservation of materials would be achieved through participation in a community-wide recycling program to be initiated in the Tusayan area in 1997. Water conservation would be achieved through the use of efficient fixtures for flush toilets, urinals, and lavatories in the employee housing units and in the transportation staging area and orientation center. Efficient showerheads and faucets would also be installed in employee housing units. As noted above, reclaimed water would be used as appropriate, and high-efficiency fixtures would be installed in visitor facilities and housing units to reduce total water consumption.

Energy conservation would be achieved by site and building design and materials selection. Conservation strategies would include building placement and design to maximize passive solar heating and cooling, the use of thermal walls and chimney ventilation, and the use of supplemental active solar systems. Buildings would be designed to rely on natural daylight for interior lighting during daytime hours. The type and extent of night-time lighting has not yet been determined but would conform to the provisions of the Coconino County Lighting Ordinance and the Tusayan Area Plan.

Project Implementation

Governance
Governance for the transportation staging area and orientation center would be achieved through the administration of the terms and conditions of the special use permit. Governance for the residential segment would be achieved through administration of the terms and conditions of the Memorandum of Agreement or other instruments executed between the Forest Service and the NPS.

Project Cost

This alternative would cost an estimated $21,425,976.00. Under this alternative, construction and/or operating costs of the proposed facilities would not be completely offset by income received from the monthly housing rental fees and the retail concessionaire. Estimated construction costs, net annual income from rent and retail, required return for project feasibility (taking into account a 12% margin), and expected deficits are in Table 2.25.

This projected deficit would have to be subsidized from other sources. Possibilities include a Federal appropriation, increased monthly rent charged to NPS employees for housing, fees for parking private vehicles at the transportation staging area and orientation center, reallocation of GCNP entrance fees, or a substantial increase in the square footage devoted to retail at the transit center. Table 2.26 depicts how much revenue would have to come from each of these sources to cover the deficit. Figures are provided for three scenarios: (1) the residential segment alone, (2) the transportation segment with associated retail alone, and (3) both segments (residential and transportation) built as provided for in this alternative.

For example, NPS employees living in the housing developed under this alternative would have to pay an additional $842 per month to cover the costs of their housing if a transportation staging area is not built. To cover the costs of both the housing and transportation staging area, the employees would have to pay an additional $2,110 per unit per month in rent.

Implementation schedule

No implementation schedule has been developed for this alternative.

Table 2.25 Estimated Costs, Revenues, and Deficits

Element	Construction Costs	Net Annual Income	Required Annual Return	Deficit
Residential Complex	$10,400,498	$ 281,940	$1,292,682	$1,010,742
Transportation and retail	$11,025,478	($198,488*)	$1,323,057	$1,521,545
Total	$22,797,832	$ 83,452	$2,615,739	$2,532,287

Source: EDAW 1997

*Annual loss of $198,488 results from projected annual operating costs of $415,288 exceeding projected annual revenue of $216,800 from retail sales.

Table 2.26 Alternative Revenue Sources to Offset Projected Deficits

Revenue Source	Residential Only	Transportation Staging Area Only	Residential & Transportation Staging Area
Federal appropriation	$8,420,000.00	$12,680,000.00	$21,100,000.00
Additional monthly rent per unit housing	$842.00	--------.--	$2,110.00
Parking fee per vehicle	-------.--	$1.60	$2.67
Additional entrance fee per park visitor	$0.16	$0.24	$0.40
Additional square feet of retail	-------.--	116,683 sq. ft.	194,194 sq. ft.

Source: EDAW 1997

Mitigation Measures

The following mitigation measures generally apply to all of the action alternatives, B through E (exceptions are noted under individual measures). The mitigation measures will be more clearly defined in the Final EIS.

Surface Water and Groundwater

The developer(s) will prepare, fund and implement a groundwater monitoring plan, in conjunction with the NPS, ADWR, USGS, Havasupai Tribe and Navajo Tribe, to validate assumptions in the EIS and to assess the impacts of well development on water discharge at springs in Grand Canyon. The monitoring plan will collect and assess water withdrawal data from existing wells in the Redwall-Muav aquifer and collect water discharge data from Havasu, Indian Garden, Hermit and Blue springs in Grand Canyon. The groundwater model used in the EIS will be recalibrated based on information obtained from monitoring. Information gained from this monitoring plan will be maintained by the NPS and used for future groundwater analyses. (This mitigation measure does not apply to Alternative E.)

All development will comply with Sections 401, 402 and 404 of the Clean Water Act.

Water pipelines and other utilities will use existing utility and transportation corridors, to the extent practicable, to reduce and minimize vegetation clearing and the disturbance of new ground.

Socioeconomic Resources

The developer(s) will prepare, fund and implement a monitoring plan, in conjunction with the FS, NPS, Coconino County, and Northern Arizona Council of Governments, to validate the socioeconomic impact analysis in the EIS. The monitoring plan will consider the level of visitation at GCNP and performance in the lodging and retail markets in the outlying communities and in Tusayan. Information gained from this monitoring plan will be maintained by Coconino County and used for future planning. (This mitigation measure does not apply to Alternative E.)

The developers(s) will prepare, fund and implement a comprehensive employment plan that addresses employment practices related to 1) encouraging the hiring of new employees from the northern Arizona employment base, including local American Indian Tribes, and 2) use of northern Arizona-based contractors.

Visitor Experience in and Around Grand Canyon

The developer(s) will design, fund and implement a visitor survey, in conjunction with the NPS and FS, that will be conducted every three years through the year 2010 to examine visitor satisfaction at GCNP, KNF and Tusayan.

The developer(s) will provide visitor orientation information at the transit center and on the mass transit systems used at the transportation staging area.

Air Quality

Water or other stabilizers will be applied to unpaved road sections and disturbed ground during construction to minimize dust.

Primary transportation corridors into GCNP and developed areas will be hard-surfaced.

Burning of slash and other debris created from construction will be prohibited. Vegetation debris created from construction activities will be chipped and used for mulch, or hauled off-site and disposed of in approved land-fills.

All land areas disturbed by construction activities will be re-vegetated as quickly as possible to reduce the potential for blowing dust.

Installation and use of wood-burning stoves in residential and visitor facilities will be prohibited.

Transportation

The developer(s) will prepare a transportation impact analysis to determine needed roadway improvements for the internal transportation system, and for access off State Highway 64.

The developer(s) will prepare a detailed transportation plan prior to conveyance and use of NFS lands. The plan will consider all traffic circulation needs, including foot and bike paths in developed areas and routes linking developed areas with GCNP and attractions on NFS lands.

Development Plan Assurances

The transfer of NFS land into private ownership will be conditioned upon escrow instructions specifying that the conveyance will not be completed until the following are recorded in the Coconino County land records:

1) development agreements containing the covenants, conditions and restrictions or conservation easements ensuring that commitments in the EIS are a binding condition of the land title and apply to all future landowners. Commitments include the construction phasing schedule and proposed uses of NFS land, e.g., housing, designated open space, school site, fire station, parks, etc.

2) development agreements containing the covenants, conditions and restrictions or conservation easements creating a mechanism to ensure that the proposed development will generate funding necessary to fulfill commitments in the EIS in perpetuity.

(This mitigation measure does not apply to Alternative E.)

Cultural Resources

Cultural resource sites on NFS land will be mitigated through the design and implementation of a treatment plan for data recovery. The effectiveness of this mitigation will be ensured through compliance with Section 106 of the National Historic Preservation Act and consultation with the State Historic Preservation Office.

Threatened, Endangered and Sensitive Species

Mitigation for the Tusayan flame flower will include minimizing ground disturbance in plant population areas by incorporating these areas into green belts, buffer zones and natural areas; fencing of plant populations to prevent encroachment during construction activities, and; active monitoring of plant populations during and following construction activities by a qualified botanist.

Special Land Uses

Use and conveyance of NFS lands will be subject to the continuation of existing easements and special use permits.

Fire Management Programs

The developer(s) will design, fund and implement, in conjunction with the FS and NPS, a fuel treatment program for wildland/urban interface areas.

Comparison of Alternatives

Components of Purpose and Need	Alternatives				
	Alternative A: No Action	*Alternative B: Land Exchange Option 1 Proponent: CFV*	*Alternative C: Land Exchange Option 2 Proponent: CFV*	*Alternative D: Townsite Act/Special Use Permit Proponent: GCIA*	*Alternative E: Transportation/ Federal Housing*
Land Ownership Management	•NFS land would remain in Federal ownership •Private inholdings would remain in private ownership	•672 acres of NFS land located directly north of Tusayan would be exchanged into private ownership •12 private inholdings totaling 2,184 acres within the Tusayan Ranger District would be acquired by the KNF •The land exchange is completed on the basis of equal value of lands exchanged. The Forest Service is completing an appraisal to determine land value. Additional private land may be secured by CFV, or adjustments may be made in the size of the NFS land, to equalize the value of lands being exchanged based on the results of the appraisal.	•380 acres of NFS land located directly north of Tusayan would be exchanged into private ownership •12 private inholdings totaling 2,184 acres within the Tusayan Ranger District would be acquired by the KNF •The land exchange is completed on the basis of equal value of lands exchanged The Forest Service is completing an appraisal to determine land value. Additional private land may be secured by CFV, or adjustments may be made in the size of the NFS land, to equalize the value of lands being exchanged based on the results of the appraisal.	•County Improvement District formed to purchase 65 acres of NFS land under the Townsite Act for public housing and community services and facilities •52 acres of NFS land designated for use as a transportation staging area authorized by special use permit •Private inholdings remain in private ownership	•NFS land would remain in Federal ownership •16 acres of NFS land used to build Federal employee housing under a Memorandum of Understanding between USDA and USDI •80 acres of NFS land designated for use as a transportation staging area authorized by special use permit •Private inholdings remain in private ownership
Transportation System	•No designated transportation staging area would be built near Tusayan on NFS land •Possible construction of Grand Canyon Railway Spurline that could transport a maximum of 1 million visitors per year from Grand Canyon Airport to Maswik Transportation Center at GCNP •Possible use of spurline parking and depot facilities for additional mass transit systems (i.e. buses) offering access to GCNP	•A transportation staging area would be constructed on NFS land acquired through exchange in the southern part of the proposed development to implement a mass transit system for GCNP •The parking facility would be built in phases to reach a designed capacity of 8,000 to 10,000 vehicles •Two internal shuttle systems, a resident and visitor shuttle, would operate in the CFV development •Trail system for hiking/ biking would be constructed between the CFV development and GCNP	•A transportation staging area would be constructed on NFS land acquired through exchange in the northern part of the proposed development to implement a mass transit system for GCNP •The parking facility would be built in phases to reach a designed capacity of 6,000 to 8,000 vehicles •Two internal shuttle systems, a resident and visitor shuttle, would operate in the CFV development •Trail system for hiking/ biking would be constructed between the CFV development and GCNP	•A transportation staging area would be constructed north and adjacent to IMAX theater on NFS land under a special use permit from KNF •The parking facility would accommodate 4,500 vehicles. Should additional parking be needed in the future, it would be pursued under a separate action •An internal shuttle system would operate between Tusayan and the residential area to shuttle employees to and from work	•A transportation staging area would be constructed directly north of Tusayan on NFS land under a special use permit from KNF •The parking facility would accommodate 4,500 vehicles. Should additional parking be needed in the future, it would be pursued under a separate action •Trail system for hiking/ biking would be constructed between the transportation staging area and GCNP

Components of Purpose and Need	Alternatives				
	Alternative A: No Action	*Alternative B: Land Exchange Option 1 Proponent: CFV*	*Alternative C: Land Exchange Option 2 Proponent: CFV*	*Alternative D: Townsite Act/Special Use Permit Proponent: GCIA*	*Alternative E: Transportation/ Federal Housing*
Employee Housing	•No housing is proposed on NFS land, or using Federal funds on other land •Housing for park employees could be provided by the private sector on the private inholdings or in the outlying communities of Valle, Williams, and Flagstaff •As required by the Tusayan Area Plan, employers must provide housing for new employees generated by redevelopment of Tusayan, or potential development of the private inholdings	•Housing includes 310 single-family, 1,045 apartment, and 1,220 dormitory units •Housing is designated for: CFV (1,680 units), GCNP (400 units), Tusayan (495 units) employees •Housing cost: Single-family would sell for $60,000 to $110,000, apartments would rent for $640/month, and dormitories would rent for $455/month •Canyon Forest Village Council formed to establish rental rates and resident eligibility to ensure housing is affordable and available	•Housing includes 270 single-family, 945 apartment and 860 dormitory units •Housing is designated for: CFV (1,075 units), GCNP (400 units), Tusayan (475 units) •Housing cost. Single-family would sell for $65,000, apartments would rent for $640/month, and dormitories would rent for $455/month •Canyon Forest Village Council formed to establish rental rates and resident eligibility to ensure housing is affordable and available	•Housing would be constructed on land acquired under the Townsite Act •County Improvement District would sell land to Public Housing Authority to build housing •Housing includes 270 single family, 424 mobile homes/ apartment, and 122 dormitory units •Housing available to all area residents but earmarked for: GCNP (377 units), Tusayan (539 units) •Housing cost: Single-family would rent for $375/month, apartments would rent for $223/month, and dormitories would rent for $180/month. Subsidy structure for public housing has not been developed. •Public Housing authority formed to establish rental rates and resident eligibility to ensure housing is affordable and available	•Housing would be constructed on NFS land through execution of a Memorandum of Understanding between the USDA and USDI •Housing includes 20 duplex, 38 apartment, and 42 dormitory units •Housing would be available for Federal employees only •No private sector housing proposed on NFS land •Rental rates for Federal housing complex would be established using a government formula if construction is funded by the Federal government; rental rates would be based on market conditions if construction is funded by a private developer.

Components of Purpose and Need	Alternatives				
	Alternative A: No Action	*Alternative B: Land Exchange Option 1 Proponent: CFV*	*Alternative C: Land Exchange Option 2 Proponent: CFV*	*Alternative D: Townsite Act/Special Use Permit Proponent: GCIA*	*Alternative E: Transportation/ Federal Housing*
Community Infrastructure	•Community services and facilities in GCNP would continue to serve resident population of Tusayan and GCNP. No expansion of these services or facilities is planned for in GCNP GMP •The construction of additional community facilities and services in Tusayan, or potentially on the private inholdings would be at the landowner's discretion	•CFV would design, finance, and build parks, a community center, library, fire station, sheriff's office, post office, and day care facility •CFV would provide a one million dollar school grant and would donate land for a school site, with infrastructure •CFV would construct infrastructure and make sites available for primary health care provider, and houses of worship •120,000 sq. ft. of community retail, including laundromat, car wash, video rental, salon, hardware, etc., plus 55,000 sq ft of improved pads for other community retail	•CFV would design, finance, and build parks, a community center, library, fire station, sheriff's office, post office, and day care facility •CFV would donate land for school site, with infrastructure •CFV would construct infrastructure and make sites available for primary health care provider, and a shared house of worship •80,000 sq. ft. of community retail, including laundromat, car wash, video rental, salon, hardware, etc., plus 44,000 sq. ft. of improved pads for other community retail	•County Improvement District would make land available for purchase by other governmental entities to build community services and facilities (e.g., school district, fire district) •Governmental entity would raise funds to build facilities •Proposed facilities include school site, fire station, and community center •Community center to house medical center, sheriff's office, chamber of commerce, American Legion and other service organizations •No specified community retail is proposed; however, some area residents may use visitor retail associated with redevelopment of Tusayan	• A multipurpose room would be built and include a large hall for meeting and worship services, full-service kitchen, day care facility, crafts room, resource center, administrative offices, and other support facilities for residents of Federal housing complex only

Components of Purpose and Need	Alternatives				
	Alternative A: No Action	*Alternative B: Land Exchange Option 1 Proponent: CFV*	*Alternative C: Land Exchange Option 2 Proponent: CFV*	*Alternative D: Townsite Act/Special Use Permit Proponent: GCIA*	*Alternative E: Transportation/ Federal Housing*
Visitor Services and Facilities	•Development of private land in Grand Canyon/Tusayan area is contingent on zoning approvals from Coconino County •Visitor services and facilities provided with redevelopment of Tusayan, and potentially with development of private inholdings controlled by CFV, and other surrounding communities, tribal land, state trust land •Potential development of two orientation/interpretive centers; one with redevelopment of Tusayan, and one with potential development of private inholdings controlled by CFV	•3,650 guest lodging units, 250 campground/RV sites •250,000 sq ft of retail including restaurants, shops, and services •Development of INSIGHT in conjunction with MNA	•2,000 guest lodging units, 250 campground/RV sites •180,000 sq ft. of retail including restaurants, shops, and services •Development of INSIGHT in conjunction with MNA	•710 additional guest lodging units on private land in Tusayan through redevelopment •220,200 sq. ft. of additional retail including restaurants, gift shops, and a dinner theater •Development of orientation/ interpretive center adjacent to IMAX site, potentially with the National Geographic Society	•5,420 sq. ft. of retail including vending, limited food and beverage, and gift shops associated with transit center •Basic visitor orientation and information provided at transit center

Summary of Environmental Consequences

Resource Issue *sub-issue*	Alternatives				
	Alternative A: ***No Action***	***Alternative B:*** ***Land Exchange Option 1***	***Alternative C:*** ***Land Exchange Option 2***	***Alternative D:*** ***Townsite Act/Special Use Permit***	***Alternative E:*** ***Transportation/Federal Housing***
Surface and Groundwater *Water Supply*	•Water needs will likely increase as visitation increases to GCNP and development seeks to accommodate visitor demand. Additional development is expected in Tusayan, on some of the private inholdings, on state trust land, on tribal land, and in outlying communities. •Total water demand could range between 88.5 mgy and 235 mgy (or more), depending on the level and type of development •Per capita water consumption rates are unknown.	•147 mgy of water needed to supply development at full buildout •Water supplied by five new wells drilled in Valle. •Water conservation techniques used, such as water harvesting, use of maximum water conserving appliances, use of reclaimed wastewater, and xeriscaping. •Water consumption equates to about 41.3 to 46.3 gallons per person per day.	•140 mgy of water needed to supply development at full buildout •Water supplied by five new wells drilled in Valle. •Water conservation techniques used, such as use of reclaimed wastewater, and xeriscaping •Water consumption equates to about 55.9 to 80 gallons per person per day.	•34.2 mgy of additional water needed to supply redevelopment at full buildout. Total water supply needs would be 88.5 mgy (54.3 mgy + 34.2 mgy) for Tusayan. •Water supplied from two existing wells in Tusayan and one new well drilled in Tusayan (47% or 41.6 mgy), water bauled from Williams (30% or 26.6 mgy), and water bauled from GCNP (23% or 20.3 mgy). •Water conservation techniques used, such as use of reclaimed wastewater, and xeriscaping. •Per capita water consumption rates are unknown.	•28.5 mgy of water needed to supply development at full buildout. •Water supplied/sold by GCNP (6.9 mgy), and reclaimed water supplied by Sanitary District (21.6 mgy). •Water conservation techniques used, such as use of reclaimed wastewater, and xeriscaping. •Water consumption equates to about 50 gallons of potable water and 35 gallons of nonpotable water per person per day for the residential area, and 0.25 gallons of potable and 2 gallons of nonpotable water per visitor per day for the transportation staging area.

Resource Issue *sub-issue*	Alternatives				
	Alternative A: No Action	***Alternative B: Land Exchange Option 1***	***Alternative C: Land Exchange Option 2***	***Alternative D: Townsite Act/Special Use Permit***	***Alternative E: Transportation/Federal Housing***
Surface and Groundwater *Grand Canyon Water Resources*	•Additional demands for groundwater in Havasu Springs sub-basin of Redwall-Muav aquifer from development in the region •The two existing wells in Tusayan are expected to decrease the discharge of springs and seeps in Grand Canyon by about the amount of water pumped. •From the two existing wells in Tusayan, the rate of discharge from Grand Canyon springs would decrease by: Havasu 0.1% (29 gpm) Indian Garden 2.5% (7.5 gpm) Hermit 1.4% (4.2 gpm) •Additional groundwater pumped from the Havasu Springs groundwater sub-basin from new development, including the potential development of the private inholdings, would further decrease discharge from Grand Canyon springs. •A well drilled at Lower Basin would affect the Blue Springs groundwater sub-basin and most likely intercept water that would discharge from Blue Springs.	•Additional demands for groundwater in the Havasu Springs sub-basin from the CFV development. •From the CFV development, the rate of discharge from Grand Canyon springs would decrease by: Havasu 0.8% (232 gpm) Indian Garden 2.0% (6 gpm) Hermit 1.3% (3.9 gpm) •Reclaimed water may be reinjected into the aquifer, if allowed by ADEQ, which would reduce impacts to Grand Canyon springs. •Collectively, from all potential development in area, the rate of discharge from Grand Canyon springs would decrease by a maximum of: Havasu 1.0% (278.4 gpm) Indian Garden 6.0% (18 gpm) Hermit 3.9% (11.7 gpm)	•Additional demands for groundwater in the Havasu Springs sub-basin from the CFV development. •From the CFV development, the rate of discharge from Grand Canyon springs would decrease by: Havasu 0.8% (232 gpm) Indian Garden 1.9% (5.7 gpm) Hermit 1.2% (3.6 gpm) •Reclaimed water may be reinjected into the aquifer, if allowed by ADEQ, which would reduce impacts to Grand Canyon springs. •Collectively, from all potential development in area, the rate of discharge from Grand Canyon springs would decrease by a maximum of: Havasu 1.0% (278.4 gpm) Indian Garden 5.9% (17.7 gpm) Hermit 3.8% (11.4 gpm)	•Additional demands for groundwater in the Havasu Springs sub-basin from redevelopment of Tusayan, and construction of housing, community facilities, and a transportation staging area. •From the redevelopment in Tusayan, the rate of discharge from Grand Canyon springs would decrease by: Havasu 0.2% (46.4 gpm) Indian Garden 4.0% (12 gpm) Hermit 2.6% (7.8 gpm) •Water needed from GCNP (Roaring Springs Pipeline) would total 20.3 mgy. Greater use of the overflow would reduce overflow spills into Garden and Pipe creeks, returning them to a more natural state. •Collectively, from all potential development in area, the rate of discharge from Grand Canyon springs would decrease by a maximum of: Havasu 1.0% (278.4 gpm) Indian Garden 6.0% (18 gpm) Hermit 3.9% (11.7 gpm). •A well drilled at Lower Basin would affect the Blue Springs groundwater sub-basin and most likely intercept water that would discharge from Blue Springs.	•No additional demands for groundwater in the Havasu Springs sub-basin would be required for this alternative. •Water needed from GCNP (Roaring Springs Pipeline) would total 6.9 mgy. Greater use of the overflow would reduce overflow spills into Garden and Pipe creeks, returning them to a more natural state. •Collectively, from all potential development in area, impacts on Grand Canyon springs would be similar to the direct and indirect impacts discussed under Alternative A. •A well drilled at Lower Basin would affect the Blue Springs groundwater sub-basin and most likely intercept water that would discharge from Blue Springs.

Resource Issue *sub-issue*	Alternatives				
	Alternative A: ***No Action***	***Alternative B:*** ***Land Exchange Option 1***	***Alternative C:*** ***Land Exchange Option 2***	***Alternative D:*** ***Townsite Act/Special Use Permit***	***Alternative E:*** ***Transportation/Federal Housing***
Surface and Groundwater *Water Transportation*	•Existing water hauled from Williams and GCNP totals 28.8 mgy (1995 data). This requires approximately 4,800 water tanker trucks (round trip) per year. •Redevelopment in Tusayan may require more water to be hauled from outlying areas such as Williams and GCNP, thus increasing the number of tanker trucks on State Highway 64 and roads in the park. •Depending on the source of water used, development of the private inholdings may require water to be hauled from outlying areas, increasing the number of tanker trucks on State Highway 64 and potentially U.S. Highway 89 (if Lower Basin is developed).	•Water supplied by the Valle well field would be transported to the development by a pipeline in State Highway 64 right-of-way. •During emergencies, water supplied from Two Guns would be trucked to the development, increasing tanker truck traffic on State Highway 64.	•Same as Alternative B.	•Redevelopment in Tusayan, and construction of employee housing, community facilities, and a transportation staging area would require an estimated 18.13 mgy of additional water to be hauled. This would require an additional 3,021 hauling trips (1,311 from GCNP and 1,710 from Williams), requiring an additional five tanker trucks from Williams and four tanker trucks from GCNP per day on area highways. Water hauling would account for about 0.4% of the total traffic on State Highway 64. •Depending on the source of water used, development of the private inholdings may require water to be hauled from outlying areas, increasing the number of tanker trucks on State Highway 64 and potentially U.S. Highway 89 (if Lower Basin is developed).	•Water supplied by GCNP (6.9 mgy) for employee housing and the transportation staging area would be transported to the development by a pipeline in the transit system corridor. •Redevelopment in Tusayan may require more water to be hauled from outlying areas such as Williams and GCNP, thus increasing the number of tanker trucks currently on State Highway 64 and roads in the park. •Depending on the source of water used, development of the private inholdings may require water to be hauled from outlying areas, increasing the number of tanker trucks currently on State Highway 64 and potentially U.S. Highway 89 (if Lower Basin is developed).

Resource Issue *sub-issue*	Alternatives				
	Alternative A: No Action	***Alternative B: Land Exchange Option 1***	***Alternative C: Land Exchange Option 2***	***Alternative D: Townsite Act/Special Use Permit***	***Alternative E: Transportation/Federal Housing***
Socioeconomics *Tusayan/Grand Canyon area*	•Based on the moderate visitation growth scenario, a 30% penetration rate, and a 70% occupancy level, the economic model estimates that 1,835 lodging units and up to 190,000 sq. ft. of additional retail and food service could be added to the Grand Canyon/Tusayan area through the year 2010 with limited impacts on the existing businesses in the Grand Canyon/Tusayan area. Additional rooms or retail and food service added beyond what the model estimates as supportable may increase competition, which could reduce pricing, increase service, or could result in failure of less competitive or undercapitalized businesses •The level of additions in any individual year would be influenced by the individual landowner, rather than a specified development schedule. •As proposed, up to 1,371 additional lodging units and 220,000 sq. ft. of retail and food service may be added to the Grand Canyon/ Tusayan area through independent redevelopment projects, subject to approval by Coconino County. •Development could also occur on three of the private inholdings (Lower Basin, TenX, and Kotzin), which could provide some percentage of additional visitor services and facilities as proposed under Alternative B, subject to approval by Coconino County.	•As proposed, up to 3,650 lodging units and 425,000 sq. ft. of retail and food service may be added to the Grand Canyon/ Tusayan area over a minimum 12-year period, this is 1,815 lodging units and 235,000 sq. ft. of retail and food service above what the model estimates as supportable through the year 2010. •The level of additions in any individual year would be influenced by a specified development schedule (Table 2.10) •Additional lodging units or retail added beyond what the model estimates as supportable may increase competition, which could reduce pricing, increase service, or result in failure of less competitive or undercapitalized businesses •Redevelopment in the Grand Canyon/Tusayan area is expected to occur by the various entities and could add another 1,371 lodging units and 220,000 sq. ft. of retail and food service to the area, subject to approval by Coconino County, bringing the potential collective number of lodging units in the Grand Canyon/Tusayan area to 5,021, and the collective amount of retail and food service to 645,000 sq. ft.	•As proposed, up to 2,000 lodging units and 304,000 sq. ft. of retail and food service may be added to the Grand Canyon/ Tusayan area over a minimum 12-year period; this is 165 lodging units and 114,000 sq. ft. of retail and food service above what the model estimates as supportable through the year 2010. •The level of additions in any individual year would be influenced by a specified development schedule (Table 2.16) •Additional rooms or retail added beyond what the model estimates as supportable may increase competition, which could reduce pricing, increase service, or result in the failure of less competitive or undercapitalized businesses. •Redevelopment in the Grand Canyon/Tusayan area is expected to occur by the various entities and could add another 1,371 lodging units and 220,000 sq. ft. of retail and food service to the area, subject to approval by Coconino County, bringing the potential collective number of lodging units in the Grand Canyon/Tusayan area to 3,371, and the collective amount of retail and food service to 524,000 sq. ft.	•As proposed, up to 710 lodging units and 220,000 sq. ft. of retail and food service may be added in Tusayan in the next five years. •The level of additions in any individual year would be influenced by the individual landowner, rather than a specified development schedule. •Additional rooms or retail added beyond what the model estimates as supportable may increase competition, which could reduce pricing, increase service, or result in the failure of less competitive and/or undercapitalized businesses. •Additional development in the Grand Canyon/Tusayan area, independent of the Tusayan redevelopment, could add another 661 lodging units and an undetermined amount of retail and food service to the area. •Development could also occur on three of the private inholdings (Lower Basin, TenX, and Kotzin), which could provide some percentage of additional visitor services and facilities as proposed under Alternative B, subject to approval by Coconino County.	•No additional lodging units are proposed under this alternative. Limited retail and food service, about 5,400 sq. ft. would be built in association with the transportation staging area. •Up to 1,371 additional lodging units and 220,000 sq. ft of retail and food service may be added to the Grand Canyon/Tusayan area by various entities through redevelopment projects. •Development could also occur on three of the private inholdings (Lower Basin, TenX, and Kotzin), which could provide some percentage of additional visitor services and facilities as proposed under Alternative B, subject to approval by Coconino County •Additional rooms or retail added beyond what the model estimates as supportable may increase competition, which could reduce pricing, increase service, or result in failure of less competitive or undercapitalized businesses.

Resource Issue *sub-issue*	Alternatives				
	Alternative A: ***No Action***	***Alternative B:*** ***Land Exchange Option 1***	***Alternative C:*** ***Land Exchange Option 2***	***Alternative D:*** ***Townsite Act/Special Use Permit***	***Alternative E:*** ***Transportation/Federal Housing***
Socioeconomics *Other Outlying Communities*	•The economic model estimates that 3,982 rooms can be added to northern Arizona, outside of the Grand Canyon/Tusayan area, through the year 2010 to support Grand Canyon visitor-related demand and maintain existing supply-demand relationships. •As proposed, up to 1,371 additional lodging units may be added to the Grand Canyon/ Tusayan area by various entities through redevelopment projects, subject to approval by Coconino County. •Development could also occur on three of the private inholdings (Lower Basin, TenX, and Kotzin), which could provide some percentage of additional visitor services and facilities as proposed under Alternative B, subject to approval by Coconino County. •Depending on the collective amount of development in the Grand Canyon/Tusayan area, northern Arizona communities could experience reduced potential of 297 to 1,447 lodging units through the year 2010 •Northern Arizona communities could add between 2,535 and 3,685 new lodging units through the year 2010 •Depending on the collective amount of development in the Grand Canyon/Tusayan area, northern Arizona communities could experience a total reduced potential in visitor spending of $10.7 to $51.8 million through the year 2010 •Visitors are expected to generate total potential spending between about $90.7 and $131.8 million by the year 2010	•The CFV development and redevelopment project could result in the collective total of 5,021 additional lodging units in the Grand Canyon/Tusayan area by the year 2010. At this level of development, northern Arizona communities could experience reduced potential of 1,447 lodging units through the year 2010. Northern Arizona communities could add 2,535 new lodging units through the year 2010 •Based on the collective amount of development in the Grand Canyon/Tusayan area, northern Arizona communities could experience a total reduced potential in visitor spending of $51.8 million through the year 2010. Visitors are expected to generate total potential spending of about $90.7 million through the year 2010	•The CFV development and redevelopment project could result in the collective total of 3,371 additional lodging units in the Grand Canyon/Tusayan area by the year 2010. At this level of development, northern Arizona communities could experience reduced potential of 754 lodging units through the year 2010. Northern Arizona communities could add 3,228 new lodging units through the year 2010. •Based on the collective amount of development in the Grand Canyon/Tusayan area, northern Arizona communities could experience a total reduced potential in visitor spending of $26.9 million through the year 2010. Visitors are expected to generate total potential spending of about $115.5 million through the year 2010.	•Same as Alternative A.	•Same as Alternative A.

Resource Issue *sub-issue*	Alternatives				
	Alternative A: No Action	***Alternative B: Land Exchange Option 1***	***Alternative C: Land Exchange Option 2***	***Alternative D: Townsite Act/Special Use Permit***	***Alternative E: Transportation/Federal Housing***
Socioeconomics *Housing*	•No housing is proposed on NFS land, or using Federal funds on other land •Housing for park employees could be provided by the private sector on the private inholdings or in the outlying communities of Valle, Williams, and Flagstaff •As required by the Tusayan Area Plan, employers must provide housing for new employees generated by redevelopment of Tusayan, or potential development of the private inholdings.	•Housing includes 310 single-family, 1,045 apartment, and 1,220 dormitory units •Housing is designated for: CFV (1,680 units), GCNP (400 units), Tusayan (495 units) employees •Housing cost: Single-family would sell for $60,000 to $110,000, apartments would rent for $640/month, and dormitories would rent for $455/month •Canyon Forest Village Council formed to establish and enforce housing restrictions, rental rates, and determine resident eligibility to ensure housing is affordable and available.	•Housing includes 270 single-family, 945 apartment and 860 dormitory units. •Housing is designated for: CFV (1,075 units), GCNP (400 units), Tusayan (475 units). •Housing cost: Single-family would sell for $65,000, apartments would rent for $640/month, and dormitories would rent for $455/month •Canyon Forest Village Council formed to establish and enforce housing restrictions, rental rates, and determine resident eligibility to ensure housing is affordable and available	•Housing would be constructed on land acquired under the Townsite Act. •County Improvement District would sell land to Public Housing Authority to build housing •Housing includes 270 single family, 424 mobile homes/ apartment, and 122 dormitory units •Housing available to all area residents but earmarked for GCNP (377 units), Tusayan (539 units). •Housing cost. Single-family would rent for $375/month, apartments would rent for $233/month, and dormitories would rent for $180/month Subsidy structure for public housing has not been developed. •Public Housing authority formed to establish and enforce housing restrictions, rental rates, and resident eligibility to ensure housing is affordable and available.	•Housing would be constructed on NFS land through execution of a Memorandum of Understanding between the USDA and USDI. •Housing includes 20 duplex, 38 apartment, and 42 dormitory units. •Housing would be available for Federal employees only •No private sector housing proposed on NFS land. •Rental rates for Federal housing complex would be established using a government formula if construction is funded by the Federal government; rental rates would be based on market conditions if construction is funded by a private developer.
Socioeconomics *Employment Opportunities*	•Employment opportunities are expected to be generated through redevelopment in the Grand Canyon/Tusayan area and potential development of the private inholdings	• This alternative would be expected to generate 3,334 new jobs ranging from laborers, construction managers and chefs, to retail and hotel managers •Some additional jobs may be created in outlying communities to serve the CFV development.	• This alternative would be expected to generate 2,115 new jobs ranging from laborers, construction managers and chefs, to retail and hotel managers •Some additional jobs may be created in outlying communities to serve the CFV development.	•This alternative would be expected to generate 1,078 new jobs ranging from laborers, construction managers and chefs, to retail and hotel managers •A number of secondary jobs would be created in Tusayan to service the new development and employment base, in addition to a small number of jobs in the outlying communities	•This alternative would be expected to generate 28 new jobs ranging from laborers, construction managers and maintenance workers, to administrative and transit managers •Few, if any, secondary jobs would be generated
Socioeconomics *Crime Rates*	•Existing law enforcement services would continue. Coconino County would provide 3 deputies, NPS would patrol the park, and KNF would patrol NFS land •Continued development in the area could hinder available law enforcement from development scattered in several areas.	•A county sheriff's substation would be built and equipped by CFV •Opportunities for criminal activity would increase because of increased development and population growth in the area •Law enforcement responsibilities for the county, NPS, and KNF would remain unchanged.	•Same as Alternative B	•As proposed, office space would be available in the community center for a sheriff's office •Opportunities for criminal activity would increase because of increased development and population growth in the area •Law enforcement responsibilities for the county, NPS, and KNF would remain unchanged	•Same as Alternative A

Resource Issue *sub-issue*	**Alternatives**				
	Alternative A: No Action	***Alternative B: Land Exchange Option 1***	***Alternative C: Land Exchange Option 2***	***Alternative D: Townsite Act/Special Use Permit***	***Alternative E: Transportation/Federal Housing***
Socioeconomics *Community Infrastructure*	•The Tusayan fire district is planning to build a temporary fire station to serve the community of Tusayan. •No additional community infrastructure is proposed. •Any community infrastructure that is built would be at the land owner's discretion or as may be required through zoning with Coconino County. •Tax revenue for Federal, state, and county governments would increase with new development and employment in the area.	•The developer would make land available and build, at their expense, parks, police/sheriff station, fire station, community center, library, and post office. •An improved school site would be donated to the School District along with a $1 million grant to help build a new school. •Land would be available for houses of worship. •Office space would be available to a primary health care provider. •Approximately 322,000 gallons of sewage would be generated per day. Sewage would be treated using Solar Aquatic System. Reclaimed water would be used for landscape irrigation, toilet flushing, discharged to natural or man-made ponds, or reinjected into the aquifer •Solid waste would be hauled to the Flagstaff landfill, which would shorten the lifespan of this landfill somewhat. •Development would generate a substantial amount of tax revenue for Federal, state, and county government.	•The developer would make land available and build, at their expense, parks, police/sheriff station, fire station, community center, library, and post office. •An improved school site would be donated to the School District. •Land would be available for a non-denominational house of worship. •Office space would be available to a primary health care provider. •Approximately 309,000 gallons of sewage would be generated per day. Sewage would be treated using a conventional wastewater treatment plant. Reclaimed water would be used for landscape irrigation, toilet flushing, discharged to natural or man-made ponds, or reinjected into the aquifer •Solid waste would be hauled to the Flagstaff landfill, which would shorten the lifespan of this landfill somewhat. •Development would generate a substantial amount of tax revenue for Federal, state, and county government.	•County Improvement District would make land available for purchase by governmental entities to build community services and facilities. •Governmental entities would raise funds to build facilities. •Proposed facilities include school site, fire station, and community center. •Community center to house medical center, sheriff's office, chamber of commerce, American Legion and other service organizations, etc. •The existing medical facility in the park would continue to provide emergency care in the area. During the summer months, it operates near capacity. Office space may be made available in the community center for a health care provider. •Approximately 70,000 gallons of sewage would be generated per day. Sewage would be treated by the existing facility operated by the South Grand Canyon Sanitary District Reclaimed water would then be used for landscape irrigation and toilet flushing. •Solid waste would be hauled to the County transfer station, then to the Flagstaff landfill which would shorten the lifespan of the landfill somewhat The county would have to haul trash from the transfer station more frequently •Development would generate a substantial amount of tax revenue for Federal, state, and county government.	•Similar to Alternative A

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Visitor Experience *Grand Canyon Experience*	•Additional visitor facilities potentially built in several locations spread throughout the region, such as Tusayan, Valle, private inholdings, and other communities. Redevelopment in Tusayan and potential development of private inholdings would satisfy to some degree the unmet demand for lodging near the park. •Development in several areas in the region would disperse visitation •If Grand Canyon Railway spurline is built, it would function as one of several different modes of transportation that could potentially be implemented to reduce traffic congestion in the park. •Visitors would continue to rely heavily on their private vehicles to access the park resulting in increased traffic and parking congestion, and negatively affecting visitor experience. •Development of Lower Basin inholding would change visitor patterns, increasing use of facilities at Desert View, and increasing traffic on East Rim Drive. •NPS would place restrictions on visitation.	•Visitors would park their cars at the transportation staging area north of Tusayan and proceed to a center where they would purchase parking/transportation/park entry tickets, obtain orientation information, and proceed to the park. Visitors would have access to a substantial amount of facilities around the transportation staging area within walking distance. •INSIGHT, the proposed educational facility, developed in partnership with the Museum of Northern Arizona, would offer visitors an opportunity to learn about the natural and cultural resources of the area. Development would be concentrated in one area around the existing community of Tusayan. •Average length of visitor stay to area may increase. •Visitors may travel to and from the park using mass transit more than once per day. Hiking/biking trails would also be available for access to the park. •A substantial amount of new lodging would satisfy the demand for lodging near the park	•Similar to Alternative B, except that fewer lodging, retail, and food service choices would be available to visitors, and the development would be of a slightly lower quality, which may have an unquantifiable effect on the visitors experience.	•Visitors would park their cars at the transportation staging area north of Tusayan and proceed to a center where they would purchase parking/transportation/park entry tickets, obtain orientation information, and proceed to the park. •Redevelopment of the commercial property in Tusayan would offer visitor facilities to the south of the transportation staging area, but for some visitors these facilities may be too distant for walking. Because visitor facilities would not be directly adjacent to the staging area, the visitor would experience or perceive less commercial development. •A new orientation/interpretive center would be built adjacent to IMAX. This new facility would be potentially developed in conjunction with the National Geographic Society and would offer educational and interpretive information. •The amount of new lodging would partially satisfy the demand for lodging near the park. •Average length of visitor stay to area may increase. •Development of Lower Basin could change visitor patterns, increasing use of facilities at Desert View, and increasing traffic on East Rim Drive.	•Essentially the same as described under Alternative D. This alternative would entail the construction and operation of a transportation staging area, where little commercial development would take place. A small amount of retail and food service would be associated with the transportation staging area. •Development in several areas in the region would disperse visitation. •Average length of visitor stay to area may increase. •Development of Lower Basin could change visitor patterns, increasing use of facilities at Desert View, and increasing traffic on East Rim Drive.

Resource Issue *sub-issue*	Alternatives				
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Visitor Experience *Visual Quality*	•The NFS land involved in this analysis would not he developed, but redevelopment of Tusayan or development of the private inholdings would alter the visual character of adjacent NFS land. •Private inholdings would remain in private ownership and available for potential development. Development could be dispersed in the region over several areas. •The development of the TenX inholding (194 acres) would negatively affect visual quality of the landscape viewed from Forest Road 302 •The development of the Lower Basin inholding (320 acres) would negatively affect visual quality of the landscape from State Highway 64.	•Approximately 672 acres of NFS land adjacent to Tusayan would be developed. The private inholdings would be acquired hy KNF through a land exchange and precluded from future development. •The project would use the concepts of sustainable design which include architectural styles and construction materials that minimize impacts to landform, vegetation, and other natural systems. •Dedicated open space accounts for 17% of the total acreage allocated to this alternative, and additional open areas, trails, and natural landscaping are integrated into all areas of the development to make it appear less urban. •The conversion of land from undeveloped to community development would result in extending the existing viewed development of Tusayan to Moqui Lodge. Measures to buffer the development and highway setbacks would be used to maintain the visual integrity of State Highway 64 corridor.	•Approximately 380 acres of NFS land adjacent to Tusayan would be developed. The private inholdings would be acquired hy KNF through a land exchange and precluded from future development. •The development would use design guidelines that place more emphasis on the functional use of the land and less on aesthetic values. The development would appear more urban with limitations on the ability to preserve the natural terrain and vegetation of the site. •Dedicated open space accounts for 3% of the total acreage allocated to this alternative •The conversion of land from undeveloped to community development would result in extending the existing viewed development of Tusayan to Moqui Lodge. Measures to buffer the development and highway setbacks would be used to maintain the visual integrity of State Highway 64 corridor.	•Approximately 116 acres of NFS land would be developed adjacent to Tusayan for community needs and a transportation staging area, and portions of private land in Tusayan would be redeveloped to provide additional visitor facilities. •Design guidelines to address visual concerns would he hased on provisions in the Tusayan Area Plan. Additional measures to minimize visual quality impacts could be implemented on the NFS land used for employee housing, community services, and the transportation staging area. •The existing visual character of Tusayan would not likely be diminished. GCIA is working with ADOT to landscape State Highway 64 corridor as it passes through Tusayan to improve visual quality along the highway. •Little difference would be noticed between this alternative and Alternatives B and C as viewed from State Highway 64. •Potential development of the private inholdings, particularly TenX and Lower Basin, would alter the visual character of adjacent NFS land, and would negatively affect visual quality of the landscape viewed from Forest Road 302 and State Highway 64	•Approximately 120 acres of NFS land would be developed The project would employ the concept of sustainable design, similar to that explained under Alternative B, to minimize impacts to the visual resource. •The existing visual character of Tusayan would not likely be diminished. •The transportation staging area would likely be the only development noticeable from the highway. This would extend the existing urhan views of Tusayan by less than ¼ mile, undeveloped NFS land would then be viewed for ahout two-thirds mile, until passing Moqui Lodge. Measures to huffer the development and highway setbacks would be used to maintain the visual integrity of State Highway 64 corridor. •Potential development of the private inholdings, particularly TenX and Lower Basin, would alter the visual character of adjacent NFS land, and would negatively affect visual quality of the landscape viewed from Forest Road 302 and State Highway 64

Resource Issue *sub-issue*	Alternatives				
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Visitor Experience *Air Quality*	•Any development that occurs would be required to comply with the standards of a Class I airshed in addition to National Ambient Air Quality Standards established by the EPA •Short-term construction related impacts would be expected from new development, such as dust and vehicle exhaust •Impacts could result from installing wood burning stoves in residences and continued reliance on private vehicles by residents and visitors.	•Any development that occurs would be required to comply with the standards of a Class I airshed in addition to National Ambient Air Quality Standards established by the EPA •Short-term construction related impacts would be expected from new development, such as dust and vehicle exhaust •Although visitation to the park should increase substantially, current air quality conditions in the park should not deteriorate because of measures taken to limit use of private vehicles in the park and development of a transportation staging area and mass transit system •Vehicle emissions at the transportation staging area would increase. These impacts would be localized and temporary •If secondary transportation staging areas are developed in outlying communities, as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus reduce vehicle emissions on a regional basis.	•Same as Alternative B	•Any development that occurs would be required to comply with the standards of a Class I airshed in addition to National Ambient Air Quality Standards established by the EPA. •Federal agencies involved in the project require air quality mitigation measures similar to those already in place in the park for development of housing, community facilities, and development of the transportation staging area. •Short-term construction related impacts would be expected from new development, such as dust and vehicle exhaust •Although visitation to the park should increase substantially, current air quality conditions in the park should not deteriorate because of measures taken to limit use of private vehicles in the park and development of a transportation staging area and mass transit system •Vehicle emissions at the transportation staging area would increase. These impacts would be localized and temporary. •If secondary transportation staging areas are developed in outlying communities as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus reduce vehicle emissions on a regional basis •Impacts could result from installing wood burning stoves in residences constructed on private land in the area, including the private inholdings	•Same as Alternative D, except that no community facilities are planned to be built.

Resource Issue *sub-issue*	Alternatives				
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Visitor Experience *Light Pollution*	•Redevelopment near Tusayan plus development of the private inholdings would disperse light pollution over a broad area, increasing the impact to GCNP viewpoints over a greater area. •Development near Tusayan and at Lower Basin, could increase background ambient night-sky levels by up to 25% at Mather Point, and by up to 4% at Desert View.	•Development would be concentrated in one area around Tusayan, which would concentrate light pollution in one area . •Outdoor lighting would only be installed as is necessary to meet provisions of Zone III of the Coconino County Lighting Code •Ambient night-sky levels at the North Rim would increase 3.0% over existing conditions. •Impacts of greater than 20% would be noticeable with a naked eye up to 7 6 miles from the CFV development, including Mather Point which would observe a 37% increase over existing night-sky glow levels •Collectively, development in the Tusayan area could increase background ambient night-sky levels by more than 20% up to 13.3 miles from Tusayan, including most overlooks on the South Rim	•Development would be concentrated in one area around Tusayan, which would concentrate light pollution in one area •Outdoor lighting would only be installed as is necessary to meet provisions of Zone III of the Coconino County Lighting Code. •Ambient night-sky levels at the North Rim would increase 1.6% over existing conditions. •Impacts of greater than 20% would be noticeable with a naked eye up to 6 0 miles from the CFV development •Collectively, development in the Tusayan area could increase background ambient night-sky levels by more than 20% up to 10 7 miles from Tusayan, including several overlooks on the South Rim.	•Outdoor lighting would be installed to comply with Zone I of the Coconino County Lighting Code. •Ambient night-sky levels at the North Rim, would increase 0.6% over existing conditions •Impacts of greater than 20% would be noticeable with a naked eye up to 3.9 miles from the Tusayan area. •Redevelopment in Tusayan, plus development of the private inholdings would disperse light pollution over a broad area, increasing the impact to GCNP viewpoints over a greater area •Impacts from potential collective development in the Grand Canyon/Tusayan area could be the same as those described in Alternative A	•Ambient night sky light levels would not noticeably increase at GCNP overlooks. •Redevelopment in Tusayan, plus development of the private inholdings would disperse light pollution over a broad area, increasing the impact to GCNP viewpoints over a greater area •Impacts from potential collective development in the Grand Canyon/Tusayan area could be the same as those described in Alternative A

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Visitor Experience *Noise*	•Approximately 42 acres of existing private land in Tusayan would receive noise from the airport above 65 decibels (dBa) by the year 2010 (planning horizon for implementation of the Grand Canyon Airport Master Plan) Redevelopment is not currently proposed for this 42 acre area. •If constructed, the Grand Canyon Railway spurline would alleviate some private vehicle noise in the park, but with increased visitation and continued reliance on the use of private vehicles, this reduction would be quickly absorbed Operation of the trains may increase noise in the Tusayan area during their approach into and out of depot, and to residents living along the train corridor between Grand Canyon Airport and Maswik. •Use of private vehicles would continue and would affect visitors who seek solitude in the park	•The development would fall outside the 65 dBa contour for airport noise levels. •Noise levels in the park would be reduced from restricting use of private vehicles and developing a mass transit system. •Short-term impacts from construction activities associated with development would be expected in the Tusayan area These would continue through the 12-year buildout. •Planned development in Tusayan could accelerate the addition of a third runway at Grand Canyon Airport, increasing air traffic and related aircraft noise in Tusayan	•Same as Alternative B.	•Similar to Alternatives B and C, except that development could occur on the Lower Basin inholding resulting in increased use of private vehicles in the eastern portion of the park, increasing vehicle noise. •Other portions of the South Rim would be closed to private vehicle use, reducing noise levels in these areas. •Collective development in the Grand Canyon/Tusayan area may accelerate the addition of a third runway at Grand Canyon Airport, increasing air traffic and related aircraft noise in Tusayan	•Similar to Alternative D

Resource Issue *sub-issue*	Alternatives				
	Alternative A: ***No Action***	***Alternative B:*** ***Land Exchange Option 1***	***Alternative C:*** ***Land Exchange Option 2***	***Alternative D:*** ***Townsite Act/Special Use Permit***	***Alternative E:*** ***Transportation/Federal Housing***
Visitor Experience *GCNP Management*	•Additional lodging units are provided by redevelopment in Tusayan, and potential development of the private inholdings, and other developable land in the region. •If built, Grand Canyon Railway spurline could handle up to 1 million visitors per year. By the year 2010, this would leave 6 8 million visitors still unable to access mass transit, having to use private vehicles or tour buses to visit the park. The NPS would have to institute some limited visitation restrictions •No plans or assurances that adequate and affordable housing would be built for NPS or park concessionaire employees. •Development of community facilities would be at landowner's discretion.	•3,650 additional lodging units are provided by CFV development, satisfying the demand for lodging near the park, but outside park boundaries. •Construction of 100- acre INSIGHT facility (an educational/experiential center developed in partnership with the Museum of Northern Arizona). Visitors would pay to use this facility. • Transportation staging area is built north of Tusayan with parking capacity of 6,000 to 8,000 vehicles with ability to expand •175 single-family, 105 apartment units, and 120 dormitory units are proposed to be built and available for NPS and park concessionaire employees. Housing would be subsidized through recapture fees and assessments to commercial property owners to keep housing rates affordable for local employees. •A full mix of community facilities would be provided.	•Similar to Alternative B, except that 2,000 additional lodging units are provided. INSIGHT would be built on 25 acres, only manufactured, single-family homes would be built, and community infrastructure would be available in a slightly different manner (See Community Infrastructure above)	•710 additional lodging units are provided by redevelopment in Tusayan, partially satisfying the demand for lodging near the park, but outside park boundaries.. •IMAX theater would be redesigned and an orientation center would be constructed by Destination Cinema and National Geographic (pending agreements) adjacent to IMAX. Visitors would pay to use this facility. •Transportation staging area would be built adjacent to IMAX theater with parking capacity of 4,500 vehicles. •916 units in a mixture of single-family, mobile home/apartment, and dormitory units are available for residents of the area including NPS and park concessionaire. Employee housing cannot be designated to a particular employer. Subsidy structure for public housing authority has not been developed, but proposed rental rates imply a subsidy of some sort. •A full mix of community facilities would be provided.	•Additional lodging units are provided by redevelopment in Tusayan, and potential development of the private inholdings, and other developable land in the region. •Transportation staging area is built directly north of Tusayan with parking capacity of 4,500 vehicles. •100 housing units in mix of duplex, apartment, and dormitory units is proposed for Federal employees. Housing would be built on NFS land under a Memorandum of Agreement between the USDA and USDI. •Development of community facilities would be at landowner's discretion.

Resource Issue *sub-issue*	Alternatives				
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Visitor Experience *GCNP Visitation*	•Redevelopment in Tusayan, and development of the private inholdings, other private land in the area, and other communities would relieve some of the pressures on GCNP to provide visitor facilities inside the park. While these visitors may choose to stay longer in the Grand Canyon/Tusayan area, they would not be expected to lengthen their stay in the park, or make multiple trips to the park •If built, Grand Canyon Railway spurline could handle up to 1 million visitors per year, but the majority of visitors would continue to access the park in private vehicles •The NPS would institute limited restrictions on park visitation.	•Development under this alternative would provide a full range of visitor services and facilities for the increasing number of people expected to visit the park. The length of visitor stay in the area would likely increase. •A transportation staging area is proposed that could accommodate even the most aggressive visitation projections. Visitors may be more likely to make multiple trips into the park, depending on the frequency, ease of use, and cost of the mass transit system. Visitors may be more evenly distributed throughout the day, relieving pressures on facilities and management in the park •With the large portion of visitor services and educational amenities located outside the park, visitors would be less likely to overuse the services inside the park	•Same as Alternative B, although Alternative C proposes a smaller development.	•Development under this alternative would provide a full range of visitor services and facilities for the increasing number of people expected to visit the park. The length of visitor stay in the area would likely increase. •A transportation staging area is proposed that could accommodate most visitation projections. Visitors may be more likely to make multiple trips into the park, depending on the frequency, ease of use, and cost of the mass transit system. Visitors may be more evenly distributed throughout the day, relieving pressures on facilities and management in the park. •With the large portion of visitor services and educational amenities located outside the park, visitors would be less likely to overuse the services inside the park.	•Redevelopment in Tusayan, and development of the private inholdings, other private land in the area, and other communities would relieve some of the pressures on GCNP to provide visitor facilities inside the park. While these visitors may choose to stay in the area longer, they would not be expected to lengthen their stay in the park. Some visitors may make multiple trips to the park depending on the frequency and cost of the mass transit system. •The transportation staging area proposed could accommodate most visitation projections.

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Transportation	•No designated transportation staging area would be built outside of Tusayan; however, the Grand Canyon Railway spurline, if constructed, could accommodate up to 1 million visitors per year (about 14% of the expected visitation to the South Rim by the year 2010). •During the summer months the Grand Canyon Village roads would operate at a level-of-service classification of "E" or possibly "F" (poorest rating). As visitation increases, longer lines would be expected at the South Entrance. The existing shuttle system would become increasingly delayed in congested traffic. Parking areas and vista points along the South Rim would be unable to handle the large numbers of private vehicles. Measures would need to be implemented by the NPS to restrict visitation. •To maintain the level-of-service classification of State Highway 64, Coconino County or ADOT may require improvement to the highway as part of the project planning for development proposals in Tusayan, and potentially, the private inholdings. •If secondary transportation staging areas are developed in outlying communities as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus decrease vehicle emissions on a regional basis. •If Lower Basin is developed, increased traffic would be expected on U.S. Highway 89 and State Highway 64 between Desert View and Tusayan.	•Transportation staging area would be built directly north of Tusayan. •By restricting use of private vehicles in the park, Grand Canyon Village roads would operate at a level-of-service classification of "B" or possibly "A" (highest rating). Park shuttles would experience minimal delays and should run on dependable and regular schedules. •Improvements to State Highway 64 are proposed, including an enhanced intersection that may have a traffic signal at some point. Highest use of the intersection would occur most likely in the morning (10 am - 2 pm) and late afternoon (4-6 pm). During these hours, the level of service on State Highway 64 may deteriorate. •If secondary transportation staging areas are developed in outlying communities as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus decrease vehicle emissions on a regional basis.	•Same as Alternative B.	•Transportation staging area built adjacent to IMAX theater. •By restricting use of private vehicles in the park, Grand Canyon Village roads would operate at a level-of-service classification of "B" or possibly "A" (highest rating). Park shuttles would experience minimal delays and should run on dependable and regular schedules. •Improvements to State Highway 64 are proposed, including an installing two left-turn lanes at the two intersections that access the transportation staging area. All other intersections would have a single left-turn lane. Highest use of the intersection would occur most likely in the morning (10 am - 2 pm) and late afternoon (4-6 pm). During these hours, the level of service on State Highway 64 may deteriorate. •Development of Lower Basin may attract more people to the East Entrance. These visitors would access the park with their private vehicles. The vista points and parking areas in the eastern portion of the park may become overused. Traffic on State Highway 64 between Desert View and Tusayan would increase. Tourists staying at Lower Basin would drive from Desert View to the transportation staging area in Tusayan and use the mass transit system to visit Grand Canyon Village. •If secondary transportation staging areas are developed in outlying communities as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus decrease vehicle emissions on a regional basis.	•Transportation staging area built directly north of Tusayan. •By restricting use of private vehicles in the park, Grand Canyon Village roads would operate at a level-of-service classification of "B" or possibly "A" (highest rating). Park shuttles would experience minimal delays and should run on dependable and regular schedules. •Improvements to State Highway 64 are proposed, including constructing an underpass at the State Highway 64 crossing of Long Jim Canyon to accommodate access lanes to and from the transportation staging area. This is the most efficient means of routing vehicles off the highway, and minimal changes in traffic flow on the highway should occur. •Development of Lower Basin may attract more people to the East Entrance. These visitors would access the park with their private vehicles. The vista points and parking areas in the eastern portion of the park may become overused. Traffic on State Highway 64 between Desert View and Tusayan would increase. Tourists staying at Lower Basin would drive from Desert View to the transportation staging area in Tusayan and use the mass transit system to visit Grand Canyon Village. •If secondary transportation staging areas are developed in outlying communities as proposed in the Regional Transportation Plan, they would further reduce reliance on private vehicles to reach GCNP and thus decrease vehicle emissions on a regional basis.

Resource Issue *sub-issue*	Alternatives				
	Alternative A: No Action	***Alternative B: Land Exchange Option 1***	***Alternative C: Land Exchange Option 2***	***Alternative D: Townsite Act/Special Use Permit***	***Alternative E: Transportation/Federal Housing***
Development Plan Assurances	•Development in Tusayan and on the private inholdings would continue to follow market forces at the discretion of the landowner and local land use and development policies. •Coconino County would be responsible for ensuring compliance with the Tusayan Area Plan. The primary criteria for evaluating projects would be the zoning code.	•A comprehensive and enforceable package of mechanisms and long-term financing provisions are proposed that provide assurances that the commitments related to housing, informational and educational facilities, community services and facilities, transportation staging area, conservation, open space, sustainable design, and phasing of the development would be implemented during the life of the project. •These commitments would be embodied with Coconino County, so that they would not be subject to reconsideration through the local zoning process •Deed restrictions would run with title to the property, binding these commitments to future landowners. •Commitments would be further ensured through the creation of Canyon Forest Village Council and Environmental Preservation Trust Entity. The Canyon Forest Village Council would have representatives from local and Federal agencies and environmental organizations on the board of directors.	•Same as Alternative B.	•Activities occurring on NFS land acquired through the Townsite Act would be subject to statutory requirements limiting the use of these lands to community and noncommercial purposes. •The County Improvement District, when formed, would purchase the NFS land under the Townsite Act, and would be responsible for monitoring and enforcing the provisions of the Townsite Act. •The County Improvement District would make land available for other governmental entities (Public Housing Authority, School District, Fire District) to purchase land for use to build public housing and communities services and facilities. •No mechanism exists to ensure that the community facilities would be developed according to the proposed manner and schedule. •The transportation staging area would be constructed and operated under a special use permit and subject to the monitoring and enforcement mechanisms incorporated into the USFS special use permit.	•The transportation staging area would be constructed and operated under a special use permit and subject to the monitoring and enforcement mechanisms incorporated into the USFS special use permit •Federal housing would be constructed on NFS land under a Memorandum of Agreement between the USDA and USDI. Commitments related to the development of housing would be assured through the terms and conditions of this Agreement or other agreements between the KNF and GCNP.

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Cultural Resources	•No immediate impact to the four archaeological sites on the NFS land involved in this analysis would occur. These four sites are eligible for nomination to the National Register of Historic Places. •Future development of the private inholdings could result in disturbance or destruction of archaeological sites on those lands. The three private inholdings with the greatest development potential contain 20 sites (TenX = 4 sites, Lower Basin = 16 sites, Kotzin = no sites). •Traditional Cultural Properties (TCPs) initially identified to date on the Ten X, Lower Basin, and Kotzin inholdings include 8 Hopi and Zuni sites (with Puebloan or Puebloan/Cohonina affiliation), and two Navajo sites (with three sweat lodges) •The nine remaining inholdings contain 82 sites, 47 of which have been initially identified as TCPs. Although these inholdings are more remote and less likely to be developed, these cultural resources would be afforded little protection under private ownership and management.	•Three of the four eligible sites would be located on the INSIGHT campus and could be protected from disturbance. •The fourth eligible site would be located near the transportation staging and parking area, and could not be avoided •Sites susceptible to disturbance would require a data recovery plan, developed in consultation with KNF, SHPO, ACHP, and the tribes to ensure that data and information contained in the site is retrieved. •The KNF would acquire 102 archaeological sites on 12 private inholdings, 57 of which have been initially identified as TCPs. These sites would be afforded greater protection under Federal ownership and management.	•Three of the four eligible sites would be located on proposed lodging facilities. These sites could not be avoided •The fourth site would be located near the proposed village core, and also could not be avoided. •All four sites would require a data recovery plan, developed in consultation with KNF, SHPO, ACHP, and the tribes to ensure that data and information contained in the site is retrieved. •The KNF would acquire 102 archaeological sites on 12 private inholdings, 57 of which have been initially identified as TCPs. These sites would be afforded greater protection under Federal ownership and management.	•Three of the four eligible sites would be in the residential area. These sites could not be avoided. •The fourth site would be located near the community services, and may possibly be avoided during further site planning. •Sites susceptible to disturbance would require a data recovery plan, developed in consultation with KNF, SHPO, ACHP, and the tribes to ensure that data and information contained in the site is retrieved. •Future development of the private inholdings could result in disturbance or destruction of archaeological sites on those lands. The three private inholdings with the greatest development potential contain 20 sites (TenX = 4 sites, Lower Basin = 16 sites, Kotzin = no sites). •TCPs initially identified to date on the Ten X, Lower Basin, and Kotzin inholdings include 8 Hopi and Zuni sites (with Puebloan or Puebloan/Cohonina affiliation), and two Navajo sites (with three sweat lodges) •The nine remaining inholdings contain 82 sites, 47 of which have been initially identified as TCPs. Although these inholdings are more remote and less likely to be developed, these cultural resources would be afforded little protection under private ownership and management.	•Three of the four eligible sites would be unaffected by development. •The fourth site would be located near the transportation staging area, and may possibly be avoided during further site planning. •Sites susceptible to disturbance would require a data recovery plan, developed in consultation with KNF, SHPO, ACHP, and the tribes to ensure that data and information contained in the site is retrieved. •Future development of the private inholdings could result in disturbance or destruction of archaeological sites on those lands. The three private inholdings with the greatest development potential contain 20 sites (TenX = 4 sites, Lower Basin = 16 sites, Kotzin = no sites). •TCPs initially identified to date on the Ten X, Lower Basin, and Kotzin inholdings include 8 Hopi and Zuni sites (with Puebloan or Puebloan/Cohonina affiliation), and two Navajo sites (with three sweat lodges). •The nine remaining inholdings contain 82 sites, 47 of which have been initially identified as TCPs. Although these inholdings are more remote and less likely to be developed, these cultural resources would be afforded little protection under private ownership and management.

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Biological Resources *Vegetation*	•Existing vegetation on NFS lands would remain under KNF management. •Private inholdings would remain in private ownership and subject to future development •Up to 674 acres of vegetation (±0.2% of that occurring on District) may be modified on three private inholdings that have the greatest development potential (TenX, Kotzin, and Lower Basin).	•On NFS land proposed for development, 672 acres of vegetation (±0.2% of that occurring on District) may be modified. 112 acres retained as open space (±17% of NFS land proposed for development). •Net gain of ± 2,184 acres of vegetation/habitat to the KNF (±0.7% increase in these vegetation types on District) from Federal acquisition of private inholdings.	•On NFS land proposed for development, 380 acres of vegetation (±0.1% of that occurring on District) may be modified. 10 acres retained as open space (±3% of NFS land proposed for development). •Net gain of ± 2,184 acres of vegetation/habitat to the KNF (±0.7% increase in these vegetation types on District) from Federal acquisition of private inholdings.	•On NFS land proposed for development, 117 acres of vegetation (±0.04% of that occurring on the District) may be modified. Little area within the proposed development is allocated for open space. •Private inholdings would remain in private ownership and subject to future development. •Up to 674 acres of vegetation (±0.2% of that occurring on District) may be modified on three private inholdings that have the greatest development potential (TenX, Kotzin, and Lower Basin).	•On NFS land proposed for development, 120 acres of vegetation (±0.02-0.03% of that occurring on the District) may be modified. 22.50 acres retained as open space (±29% of NFS land proposed for development). •Private inholdings would remain in private ownership and subject to future development. •Up to 674 acres of vegetation (±0.2% of that occurring on District) may be modified on three private inholdings that have the greatest development potential (TenX, Kotzin, and Lower Basin).
Biological Resources *Wildlife*	•No change in net acres of wildlife habitat under KNF management. •Private inholdings would remain in private ownership and subject to future development •Development of the inholdings would cause partial displacement and disturbance of local wildlife populations. Development in separate locations would result in a greater total zone of influence to wildlife than development concentrated in one area •Wildlife use of up to six ephemeral stock tanks could be eliminated if TenX and Lower Basin inholdings are developed	•672 acres of wildlife habitat on NFS lands would be modified with zone of wildlife disturbance around development. •Net gain of ± 2,184 acres of wildlife habitat would come under Federal ownership and management through the acquisition of private inholdings, including 17 ephemeral stock tanks that provide seasonal water for wildlife (±12% of total number on District).	•380 acres of wildlife habitat on NFS lands would be modified with zone of wildlife disturbance around development •Net acres of habitat gained comparable to Alternative B.	•117 acres of wildlife habitat on NFS lands would be modified with zone of wildlife disturbance around development. •Private inholdings would remain in private ownership and subject to future development. •Development of the inholdings would cause partial displacement and disturbance of local wildlife populations. Development in separate locations would result in a greater total zone of influence to wildlife than development concentrated in one area •Wildlife use of up to six ephemeral stock tanks could be eliminated if TenX and Lower Basin inholdings are developed.	•95 acres of wildlife habitat on NFS lands would be modified with zone of wildlife disturbance around development. •Private inholdings would remain in private ownership and subject to future development. •Development of the inholdings would cause partial displacement and disturbance of local wildlife populations. Development in separate locations would result in a greater total zone of influence to wildlife than development concentrated in one area. •Wildlife use of up to six ephemeral stock tanks could be eliminated if TenX and Lower Basin inholdings are developed

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Biological Resources *Special Interest Species*	•Known habitat for Tusayan flameflower and possible habitat for northern goshawk, flammulated owl, and Navajo Mountain Mexican vole on NFS land involved in analysis would remain under Federal ownership and management. •40 Arizona leatherflower plants (13% of known population on the District), 470 Tusayan flameflower plants (<3% of known population on the District), and possible habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat could be impacted or destroyed by development of private inholdings.	•152 Tusayan flameflower plants (1% of the known population on the District) and possible habitat for northern goshawk, flammulated owl, and Navajo Mountain Mexican vole could be impacted or destroyed by development of the NFS land. •40 Arizona leatherflower plants (13% of known population on the District), 470 Tusayan flameflower plants (<3% of known population on the District), and possible habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat on the private inholdings would come under Federal ownership and management.	•Similar to Alternative B, except 135 Tusayan flameflower plants (<1% of the known population on the District) could be impacted or destroyed by development of the NFS land.	•No FS sensitive plants affected. Possible habitat for northern goshawk, flammulated owl, and Navajo Mountain Mexican vole could be impacted or destroyed by development of the NFS land. •40 Arizona leatherflower plants (13% of known population on the District), 470 Tusayan flameflower plants (<3% of known population on the District), and possible habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat could be impacted or destroyed by development of private inholdings.	•100 Tusayan flameflower plants (<1% of the known population on the District) and possible habitat for northern goshawk, flammulated owl, and Navajo Mountain Mexican vole could be impacted or destroyed by development of the NFS land •40 Arizona leatherflower plants (13% of known population on the District), 470 Tusayan flameflower plants (<3% of known population on the District), and possible habitat for northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat could be impacted or destroyed by development of private inholdings.

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KNF Management *Management Objectives*	•Potential loss of six stock tanks on the TenX and Lower Basin inholdings, if developed. •KNF continues to manage watershed conditions on NFS lands. Watershed conditions on the private inholdings continue to be affected by existing uses •Existing special uses unaffected Continued demand for additional special use permits and encumbrances for utilities, services, and facilities on NFS land surrounding Tusayan and the private inholdings. •Continue current boundary management practices and procedures. Value of private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development.	•Loss of 672 acres of NFS land from the Rain Tank allotment, although no change in permitted number of livestock on this or other allotments would occur. Federal acquisition of 17 stock tanks associated with private inholdings. Net gain of roughly 2,184 acres of rangeland on the Tusayan Ranger District •No increase in peak flow or sediment concentrations in regional waters from development of NFS land •KNF management of soil and vegetation on acquired private inholdings could improve watershed conditions. •Existing utility corridor rights-of-way reserved in exchange. CFV development may increase use of Moqui Lodge and Apache Stables from increased visitors to area, but would not influence continued operations of these facilities under special use permits. CFV development near Moqui Lodge would create opportunity for sharing infrastructure, particularly wastewater treatment facilities. •About 4 miles of new boundary and up to 10 new property corners associated with development of NFS lands. Net decrease of 34 miles of boundary and 121 property corners on the Tusayan Ranger District with Federal acquisition of private inholdings.	•Similar to Alternative B, except loss of 380 acres from the Rain Tank Allotment, and about 3 miles of new boundary and up to 8 new property corners associated with development of NFS lands Net decrease of 35 miles of boundary and 123 property corners on District with Federal acquisition of the private inholdings.	•Loss of 117 acres of NFS land from the Rain Tank Allotment, but no change in the permitted number of livestock on this allotment would occur. Potential loss of six stock tanks on the TenX and Lower Basin inholdings, if developed •KNF continues to manage watershed conditions on NFS lands Watershed conditions on the private inholdings continue to be affected by existing uses. •Existing special uses unaffected. Continued demand for additional special use permits and encumbrances for utilities, services, and facilities on NFS land surrounding Tusayan and the private inholdings. •Continue current boundary management practices and procedures. Value of private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development •Net increase of about 2 miles of new boundary and 11 property corners on the Tusayan Ranger District	•Loss of 120 acres of NFS land from the Rain Tank Allotment, but no change in the permitted number of livestock on this allotment would occur. •KNF continues to manage watershed conditions on NFS lands. Watershed conditions on the private inholdings continue to be affected by existing uses. •Existing special uses unaffected. Continued demand for additional special use permits and encumbrances for utilities, services, and facilities on NFS land surrounding Federal housing, transportation staging area, Tusayan, and the private inholdings. •Continue current boundary management practices and procedures. Value of private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development. •Net increase of about 1 mile of new boundary and 3 property corners on the Tusayan Ranger District.

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KNF Management *Public Recreation Opportunities*	•Current recreational use of NFS land would continue. •Dispersed recreational use could be eliminated or restricted on the private inholdings, particularly those with the greatest development potential. •Camper Village RV park and campground (250 sites) would be closed and land developed into mixed-use commercial facilities. •Expansion of TenX Campground by another 150 camp sites could occur as proposed by the KNF. This would absorb some of the demand created from closing of Camper Village RV park and campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area. •Two orientation/interpretive centers may be built on private land, INSIGHT (by CFV and the Museum of Northern Arizona) and the orientation/interpretative center developed by Destination Cinema (potentially in conjunction with the National Geographic Society). Visitors would pay to use both facilities. •No change in the total acres of various Recreation Opportunity Spectrum (ROS) classifications on NFS land would occur.	•Opportunities for dispersed recreation eliminated on 672 acres of NFS land. •Dispersed recreational use could continue on 2,184 acres of the private inholdings acquired through exchange. •Development of 250 site RV/campground in CFV development. •KNF may pursue expansion of TenX Campground, by an additional 150 units as proposed. •INSIGHT built in CFV development. Visitors would pay to use this facility. •Net increase of 160 acres of Semi-Primitive Motorized ROS area and 2,024 acres of Roaded Natural ROS area on the Tusayan Ranger District. •Development of another orientation/interpretive center could occur with redevelopment of Tusayan.	•Similar to Alternative B, except opportunities for dispersed recreation eliminated on 380 acres of NFS land.	•Opportunities for dispersed recreation eliminated on 117 acres of NFS land. •Camper Village RV park and campground (250 sites) would be closed and land developed into mixed-use commercial facilities. •Orientation/interpretive center built adjacent to redesigned IMAX theater. Visitors would pay to use this facility. •Expansion of TenX Campground by another 150 camp sites could occur as proposed by the KNF. This would absorb some of the demand created from closing of Camper Village RV park and campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area. •Decrease of 117 acres of Roaded Natural ROS area on the Tusayan Ranger District. •Development of INSIGHT could occur on one of the private inholdings.	•Opportunities for dispersed recreation eliminated on 120 acres of NFS land. •Dispersed recreational use could be eliminated or restricted on the private inholdings, particularly those with the greatest development potential. •Camper Village RV park and campground (250 sites) would be closed and land developed into mixed-use commercial facilities. •Expansion of TenX Campground by another 150 camp sites could occur as proposed by the KNF. This would absorb some of the demand created from closing of Camper Village RV park and campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area. •Two orientation/interpretive centers may be built on private land, INSIGHT (by CFV and the Museum of Northern Arizona) and the orientation/interpretation center developed by Destination Cinema (potentially in conjunction with the National Geographic Society). Visitors would pay to use both facilities. •Decrease in 120 acres of ROS area on the Tusayan Ranger District designated as Roaded Natural.

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KNF Management *Fire Management Programs*	•Potential development of private inholdings would result in increased wildland/urban interface and increased fire risk from new development in areas previously undeveloped. Scattered development could affect fire response time and emergency services.	•Increase wildland/urban interface in the Tusayan area from the development of 672 acres of NFS land. Development concentrated in one area would allow fire management programs to be more efficient. •CFV would build and equip a permanent fire station for Tusayan.	•Same as Alternative B, except size of CFV development is 360 acres.	•Increase wildland/urban interface in the Tusayan area from the development of 117 acres of NFS land. •Potential development of private inholdings would result in increased wildland/urban interface and increased fire risk from new development in areas previously undeveloped Scattered development could affect fire response time and emergency services. •Land would be available for sale to Tusayan Fire District on Townsite land to build a permanent fire station.	•Increase wildland/urban interface in the Tusayan area from the development of 120 acres of NFS land. •Potential development of private inholdings would result in increased wildland/urban interface and increased fire risk from new development in areas previously undeveloped. Scattered development could affect fire response time and emergency services.

Chapter 3: Affected Environment

This chapter provides background information on the lands involved in the alternatives and on the regional area that may be affected by growth in and around Tusayan. Such information offers a baseline that can be used to evaluate potential environmental impacts of the alternatives. Topics covered include descriptions of the area and issues raised during public scoping.

Environmental Setting

This section describes physical and biological attributes, providing information on the location and biogeography, climate, geology, soils, and topography of the region. This information is included to provide an environmental frame of reference for the project area and is not directly issue-related.

Location and Biogeography

The alternatives described and analyzed in this EIS involve the use and development of private and Federal lands in the vicinity of GCNP and the unincorporated community of Tusayan, Coconino County, Arizona. Tusayan is on State Highway 64, directly south of GCNP. Private and NFS land involved in this analysis are within the Tusayan Ranger District of the Kaibab National Forest, Coconino County, Arizona (Figure 3.1).

The vegetation of the project area is predominantly transitional between Great Basin conifer woodland and Rocky Mountain montane conifer woodland (Brown 1982). Vegetation types include pinyon-juniper woodland, grassland, sagebrush flats, relatively homogenous stands of ponderosa pine, and different mixtures of these and other plant species (KNF 1987).

Climate

The climate in the region of the project area is generally arid to semiarid. Average annual precipitation is approximately 14.5 inches at the watershed's northern border at Grand Canyon Village (GCNP 1995) and 21.17 inches at the southern border at Williams (Owenby and Ezell 1992). Winter precipitation occurs predominantly as snow, and late summer rains result from both convection over Grand Canyon and monsoon events (GCNP 1995). Average air temperature ranges from 25° to 30° Fahrenheit (F) in January, and from 65° to 70°F in July (Hecht and Reeves 1981).

Geology

Grand Canyon lies in the physiographic region known as the Colorado Plateau or Plateau Province of northern Arizona. The region is characterized by a thick sequence of flat to gently dipping sedimentary rocks that, when eroded, form plateaus and mesas separated by deep canyons. The project area is on the Coconino Plateau, a segment of the Colorado Plateau that slopes to the south, away from the South Rim of Grand Canyon.

The Coconino Plateau surface is composed primarily of Kaibab Formation limestone. The Toroweap Formation, also composed of limestone, directly underlies the Kaibab Formation and is exposed in some of the drainages and canyons in the area. The Kaibab and Toroweap formations rest on the Coconino Sandstone and Hermit Shale formations (Beus and Morales 1990). The underlying Redwall, Temple Butte, and Muav limestone formations contain the primary aquifer in this area. The aquifer is about 800 feet thick, approximately 2,500 feet below ground level near Tusayan (Errol L. Montgomery and Associates 1993). Figure 3.2 provides a cross section of the regional geology.

Soils and Topography

Soils in the area are derived primarily from surface strata, including the Kaibab and Toroweap limestone and Coconino Sandstone. Soil development is influenced by climate, vegetation, topography, and other factors (KNF 1987). These soils generally have fair to good potential for wildlife habitat and range forage production. Slow permeability, depth to bedrock, high shrink-swell properties, and low bearing strength are factors that in some areas limit the potential for homesite, community, and recreational development (Hendricks 1985).

Topography in the area is dominated by plateau ridgetops, shallow drainages, and deeper limestone- and sandstone-walled canyons. The terrain generally slopes gently to the southwest, and surface drainage is away from Grand Canyon. Major topographic features in the area include Red Butte, the Coconino Rim, Coconino Wash, Rain Tank Wash, and Long Jim Canyon. Although the washes and canyons are not noticeable from great distances, they represent major drainages in the area.

Existing Conditions Related to Issues and Concerns

Resources that raised public concern or for which potentially significant impacts were possible are addressed in this section. Concerns include water resources, socio- economics, visitor experience, transportation, cultural and biological resources, and Forest Service management of the resources. This section describes the existing

Figure 3.1 Regional Map of Project Area

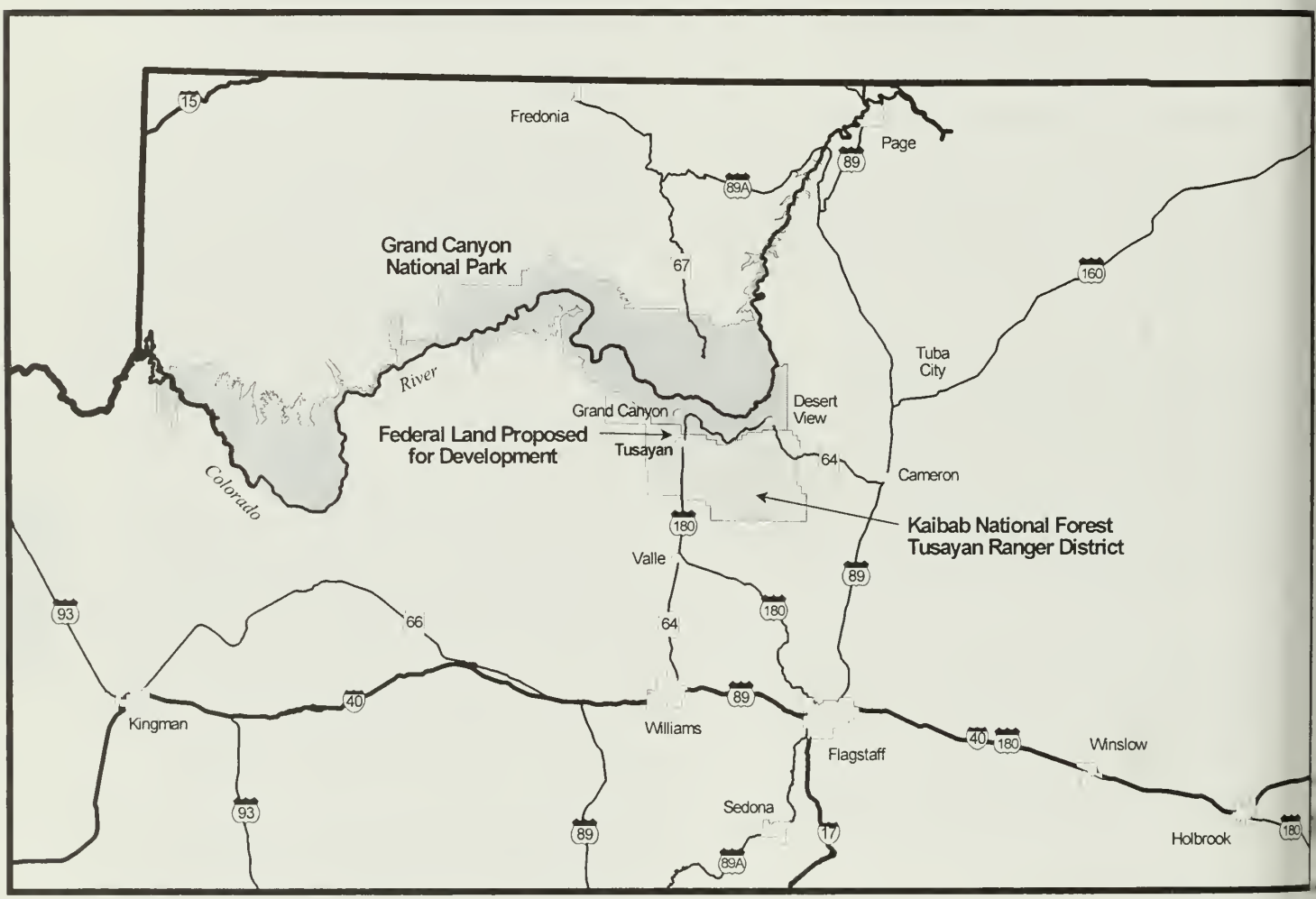
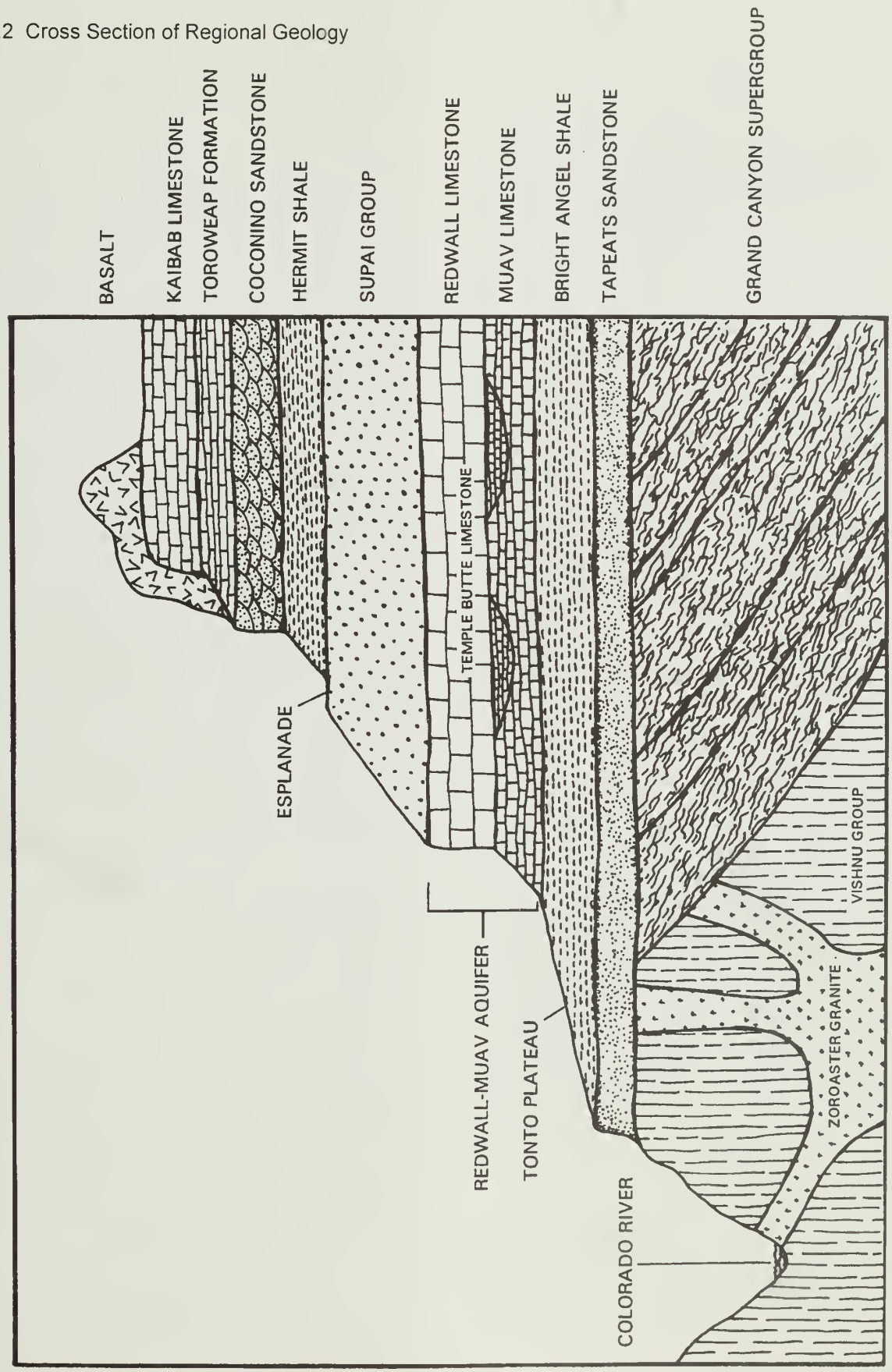


Figure 3.2 Cross Section of Regional Geology



conditions in the study area, including, in some instances, a much larger area (e.g., northern Arizona) than the immediate NFS or private lands involved in the analysis.

Surface and Groundwater

As water availability is limited in the Tusayan area, much public concern was expressed about this resource. Issues researched include water supply, Grand Canyon water resources, and water transportation.

Water Supply

Two privately owned water storage systems, Anasazi Water Company and Hydro-Resources, supply potable water to Tusayan. Anasazi Water Company's system was built in the mid to late 1960s and has a storage capacity of 300,000-350,000 gallons. The Hydro-Resources system was established in 1978 and has a storage capacity of 3,650,000 gallons. Water for these systems is supplied by two wells in Tusayan and purchased from GCNP and Williams, Arizona. GCNP obtains water from a gravity-fed pipeline from Roaring Springs on the north side of the Colorado River; Williams obtains water primarily from surface reservoirs. Percentage contribution for each source of water in Tusayan is as follows:

Water Source	Percent Contribution
GCNP	23%
Williams	30%
Tusayan wells	47%

Groundwater in the area comes from the Redwall-Muav aquifer. Two wells in Tusayan, one well at the Canyon Mine site near Tusayan (primarily used for groundwater quality monitoring), and two wells in the vicinity of Valle, Arizona, all pump from this aquifer. These wells combined pump an estimated 290 gallons per minute (gpm) from the aquifer. Two additional wells are being drilled to pump water from the aquifer: one at Hilltop, near Supai, and one at Williams. An additional 20 to 30 gpm will be drawn from this aquifer when the new well near Supai is completed, and an unknown amount will be pumped from the new well in Williams.

The two Tusayan wells, constructed in 1994 by the Canyon Squire Inn, supply water to Tusayan. These two wells produce an estimated 80 gpm (Errol L. Montgomery & Associates 1996).

The two Valle wells, one at Grand Canyon Valle Airport and the other at Days Inn, were drilled in 1994. Reported water use for the Valle wells is public supply. The well owners and Arizona Department of Water Resources (ADWR) records provided little data regarding quantity of groundwater discharged, specific capacity, or results of pumping tests (Errol L. Montgomery & Associates 1996).

The Canyon Mine site well, about six miles south-southeast of Tusayan, was drilled in 1986 as a monitor/supply well. This well is primarily for monitoring purposes, as required in the modified plan of operations and the Canyon Mine EIS. The mining operation would require very little potable water from this well—mostly for washing and toilets. The well pumps infrequently, at an estimated rate of about 5 gpm (KNF 1985); pumping may continue if the mine becomes operational. Errol L. Montgomery & Associates (1996) report the results of pumping tests for the Canyon Mine; the chemical quality of groundwater from this well is good.

The well at Hilltop is being constructed under the direction of the U.S. Geological Service (USGS), the U.S. Bureau of Reclamation, and the U.S. Bureau of Indian Affairs. The well will supply water for community services being moved from the remote canyon area of Supai. The well was drilled to a total depth of 3,100 feet below land surface. The top of the Redwall Limestone was encountered at about 2,500 feet below land surface; groundwater level measured in the well was about 2,360 feet below land surface. Based on results of a USGS investigation, the well is estimated to be capable of producing groundwater at a rate of 20 to 30 gpm. Because the water quality is below Federal standards, it will be treated before use. This well will be in use in one to two years (Don Bills, USGS Flagstaff office, personal communication 19 April 1997).

Grand Canyon Water Resources

Regional Watershed

The Redwall-Muav aquifer is divided into several sub-basins; two (the Havasu Springs and the Blue Springs sub-basin) are affected by this analysis.

The watershed for the Havasu Springs sub-basin encompasses nearly 5,000 square miles of Coconino County, with the southern tip at Ash Fork in Yavapai County. The watershed's northern border is the South Rim of Grand Canyon. The southern border, roughly 60 miles south of the park, includes Ash Fork and Williams and is bounded by a groundwater divide. The western border, approximately 50 miles west of Valle, is formed by the Toroweap and Aubrey faults that make up the Aubrey cliffs. The eastern border is approximately 15 miles east of Valle and is bounded by a groundwater divide; the northeastern edge is formed by the

Grandview-Phantom fault (Montgomery & Associates 1996).
The Blue Springs sub-basin is adjacent to and northeast of the Havasu Springs sub-basin. This sub-basin would be affected by the alternative actions only if groundwater was pumped on the Lower Basin private inholding.

The elevation of the watershed boundary ranges from approximately 5,000 to 7,400 feet. The lowest area is approximately 10 miles east southeast of Valle, above the Markham Dam Fracture Zone. This is the largest zone of transmissivity (area where water is able to move through soil or rock layers) in the region and connects to Havasu Springs through Havasu Downwarp. Havasu Springs is a major discharge point (approximately 29,000 gpm) (Errol L. Montgomery & Associates 1996).

The most noticeable hydrologic characteristic of the plateaus in the vicinity of the South Rim of GCNP is the lack of perennial streams (Brown and Moran 1979) caused by the relatively low annual precipitation and the rapid absorption into the soil of the rain and melted snow (GCNP 1994). The fraction of precipitation reaching groundwater systems of the Grand Canyon area is difficult to compute because in many places the boundary of their recharge areas is uncertain. Huntoon (1974, 1982) has computed recharge between a low of about 1% for the Hualapai Plateau system up to about 20% for the Upper Bright Angel system.

In the Grand Canyon area, groundwater moves down hydraulic gradients primarily along interconnected rock fractures. Major fractures along faults govern locations of the larger springs. Most often, large springs arise from the impermeable Muav Limestone or underlying Bright Angel Shale. Bright Angel Shale, in both fractured and unfractured form, is a barrier to virtually all downward groundwater movement from overlying rocks.

The length of time that water remains in a groundwater system, known as residence time, depends on properties such as recharge rate, surface recharge area, hydraulic gradient, and ability of rock to transmit water. For some systems, such as Havasu Springs that form Havasu Creek, these properties are such that spring flow is not readily affected by seasonal or even yearly variations in precipitation. In contrast, flow from other springs with well-formed networks of underground passageways may increase rapidly in response to precipitation or rapid snowmelt (Huntoon 1974, 1977).

Regional Aquifers

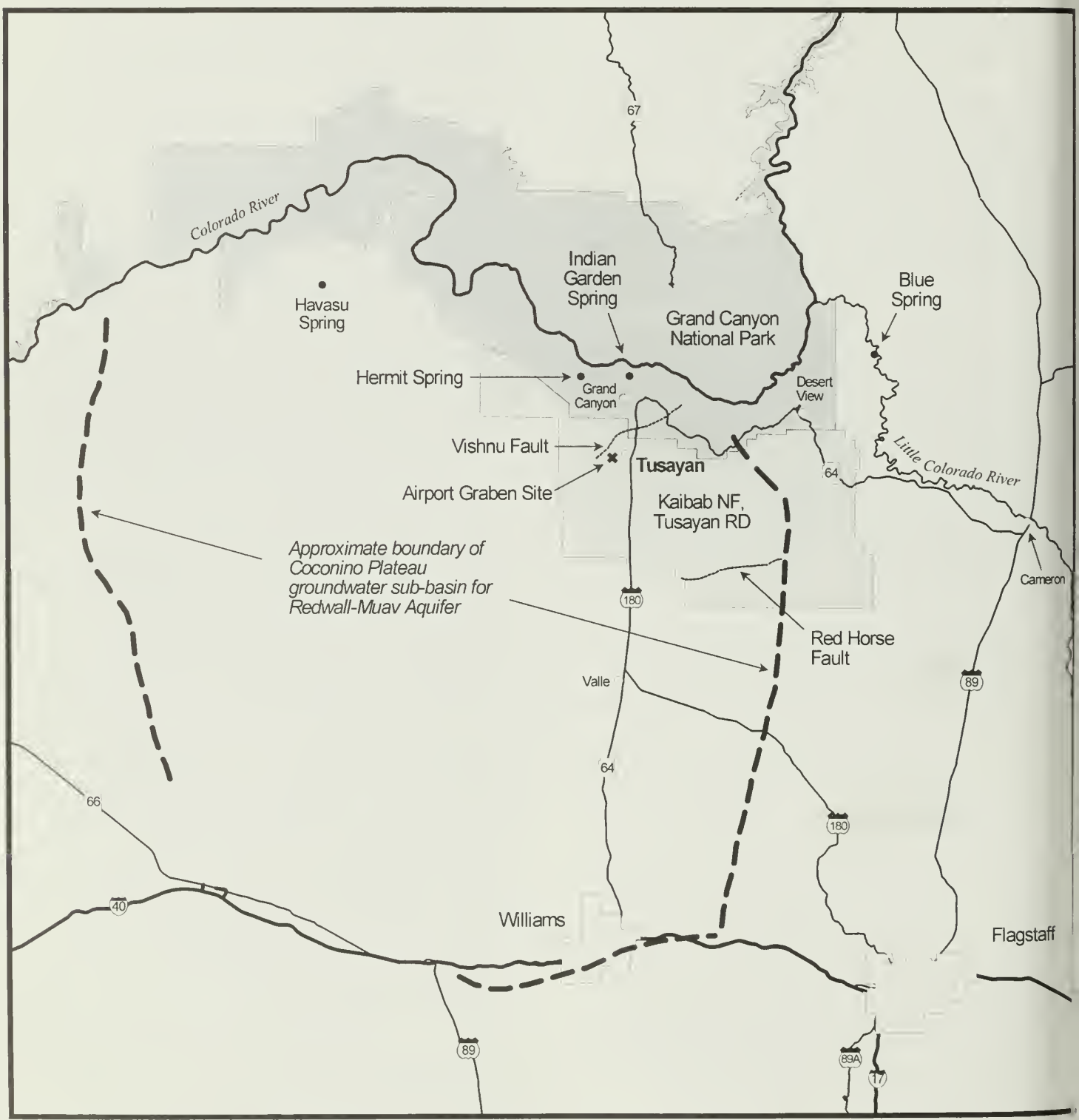
The Redwall-Muav aquifer (Figure 3.3) is the only aquifer of regional extent and regional importance in the Tusayan area (Errol L. Montgomery & Associates 1992). Overlying the Redwall-Muav aquifer is a thick sequence of geologic strata that at some locations contains thin and discontinuous perched aquifers (see below) (Errol L. Montgomery & Associates 1985). Depth to groundwater level in the Redwall-Muav aquifer near Tusayan is about 2,500 feet below surface level. The aquifer consists of three geologic formations; in descending order they are the Redwall, Temple Butte, and Muav limestones (Montgomery et al. 1988). Thickness of the aquifer in the area is about 800 feet. Underlying the Redwall-Muav aquifer is the Bright Angel Shale, a thick sequence of clay, silt, and sandstone strata that forms an effective barrier to downward movement of groundwater.

The groundwater flow system in the Redwall-Muav aquifer in the Tusayan area is believed to be in dynamic equilibrium (average rate of groundwater discharge at the springs is equal to average rate of recharge to the aquifer). Recharge to the Redwall-Muav aquifer around Tusayan is from absorption of precipitation and intermittent streamflow (Metzger 1961). The largest amounts of recharge reach the aquifer by downward movement, chiefly through fracture systems. The fracture systems are usually related to the occurrence of prominent faults and folds which are commonly shown on geologic maps (Huntoon et al. 1986, and Errol L. Montgomery & Associates 1996). Smaller amounts of recharge may reach the aquifer in some locations by downward percolation through overlying strata.

Discharge from the Havasu Springs sub-basin occurs principally at three springs located where the south wall of Grand Canyon intersects prominent faults. The largest discharge from the aquifer, about 29,000 gpm, is at Havasu Springs (Johnson and Sanderson 1968). Measurements of discharge for Havasu Springs over a 70-year period indicate the rate of flow is remarkably constant. Smaller but important amounts of groundwater discharge occur along faults and related fracture systems at Hermit Springs and Indian Garden Springs; base rate of discharge at each of these springs is about 300 gpm (Metzger 1962 and Goings 1985).

Other springs that discharge from the Havasu Springs sub-basin along the south wall of Grand Canyon include Miner's, O'Neill, Cottonwood, Grapevine, Pipe, Burro, Horn, Boucher Creek, Elves Main, Elves Joint, and Matkatamiba springs. Discharge from these springs accounts for less than 1% of the reported discharge in the

Figure 3.3 Groundwater Drainage, Springs, Subbasin Divides, and Hydrogeological Faults in the Area



sub-basin and is believed to result chiefly from infiltration of precipitation in local drainage basins along the rim of Grand Canyon. The sources of these springs are believed to be poorly connected or unconnected to the regional Redwall-Muav aquifer system.

Several other springs with substantial discharge, most notably Warm, Diamond, Upper Diamond, and East Diamond springs, discharge from the Redwall-Muav aquifer along the south wall of Grand Canyon. However, these springs are outside of the Havasu Springs sub-basin and are not believed to be influenced by groundwater movement in the sub-basin (Errol L. Montgomery & Associates 1996).

The Blue Springs sub-basin is east of Tusayan. Its primary discharge is Blue Springs, in the Little Colorado River approximately 12 miles upstream from its confluence with the Colorado River. Blue Springs provides the base flow of the Little Colorado River by discharging an estimated 100,000 gpm (KNF 1986).

Perched Aquifers

In areas where fractures are sparse, groundwater may be perched above confining layers. In the project area, these conditions occur most commonly in the Toroweap Formation, where groundwater is perched in sandstone units above fine-grained confining strata, and at the base of the Coconino Sandstone, where groundwater may be perched on fine-grained strata of the Hermit Formation. At these locations, the perched aquifers may yield small quantities of groundwater for domestic and stock use. These perched reservoirs are commonly small, thin, and discontinuous. If the stored groundwater is not replenished annually by rainfall and snowmelt, wells and springs that discharge from the perched aquifers may dry up.

Several springs discharge from fractures or sandstone strata in perched aquifers in the Toroweap Formation, the Coconino Sandstone, and the Supai Group along the south wall of Grand Canyon and its southern tributary canyons. The Hydrology Report in the appendix provides records for these springs (Table 1 in Errol L. Montgomery & Associates 1996) indicating that the groundwater discharge is small and the chemical quality of the groundwater ranges widely.

Water Transportation

Just over half of Tusayan's water supply is transported by truck from other regional sources. In 1995, water use in Tusayan totaled 54.3 million gallons: 30% (16.3 million gallons) was hauled from Williams, and 23% (12.5 million gallons) was hauled from GCNP, for an estimated 4,800 truckloads (GCNP 1995).

Socioeconomic Environment

For the 13 communities and four American Indian tribes surrounding Grand Canyon, the parameters that contribute to the socioeconomic environment of the area (e.g., proximity to the park, population, unemployment rate, economic base, and visitor services) are summarized below. The housing situation, crime rate, and community infrastructure of the Grand Canyon/Tusayan area are also discussed.

Grand Canyon/Tusayan Area

Being tourist-oriented, perhaps one of the best socioeconomic indicators of the area is growth in visitor lodging; the area offers over 1,000 lodging units, not including those that are within GCNP (Table 3.1).

Table 3.1 Lodging Accommodations in Grand Canyon/Tusayan Area (Not Including GCNP)

Lodging Establishment	Number of Units
Best Western Squire Inn	250
Quality Inn	232
Red Feather Lodge (plus addition)	230
Holiday Inn Express	166
Seven Mile Lodge	20
Grand Canyon Suites	33
Moqui Lodge*	136
Total	*1,067*

*Between Tusayan and GCNP

Over the past decade, 485 rooms have been added to the area in 1992, 1995, and 1996 (Table 3.2). Other economic factors of the area are presented below.

Table 3.2 New Room Additions for the Grand Canyon/Tusayan Area

Year	# New Rooms
1987	0
1988	0
1989	0
1990	0
1991	0
1992	100
1993	0
1994	0
1995	296
1996	89
1997	0
Total	*485*

Population
The 1990 census reports the population of Tusayan at 555. However, Tusayan's population nearly doubles in the summer because of seasonal employees.

Unemployment Rate
Unemployment is not easily calculated for Tusayan because of seasonal employment and the consequent transient nature of Tusayan's population. Because Tusayan is not incorporated, the Arizona Department of Commerce does not publish a profile on this community, and the Arizona Department of Economic Security does not publish unemployment statistics.

Tusayan

Proximity to GCNP
Tusayan, one mile south of GCNP along State Highway 64, is the immediate gateway community to the South Rim of GCNP.

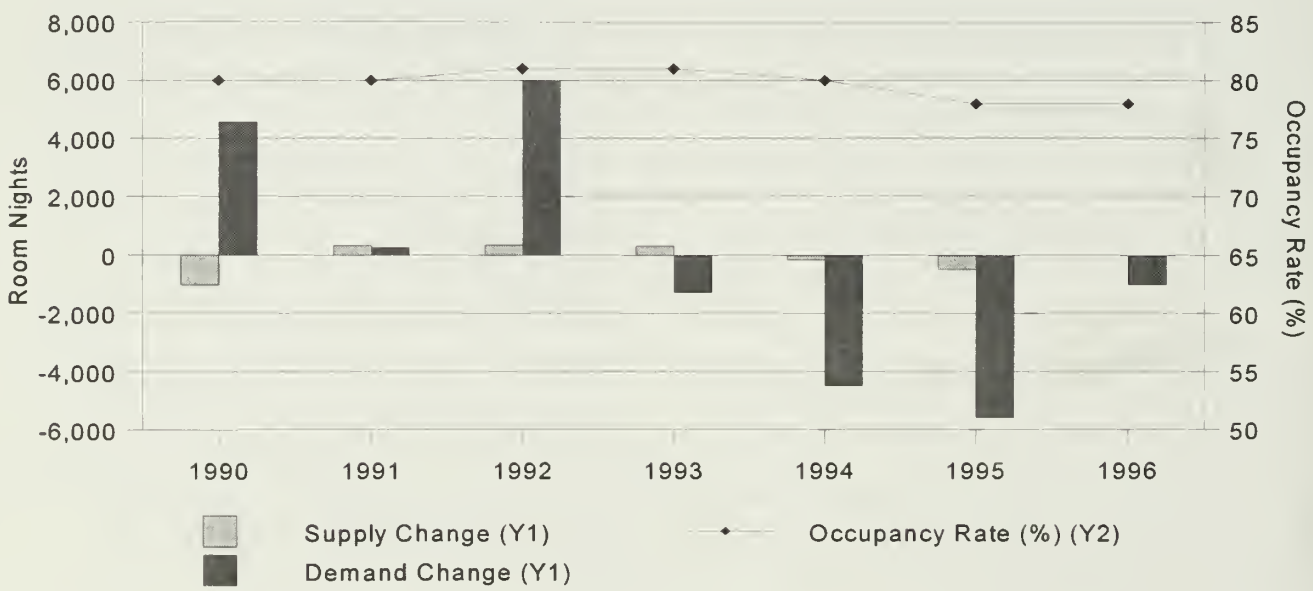


Figure 3.4 Historical Performance of GCNP Lodging Market; Annual Change in Available vs. Occupied Room Nights

Economic Base
Tusayan relies almost entirely on tourism for its economic base. Visitation data for GCNP show that over 99% of visitors to the South Rim of Grand Canyon travel through the Tusayan area.

Visitor Services
Tusayan provides lodging, food services, air tours, and other facilities. Lodging accommodations are divided between six establishments, as shown in Table 3.1.

Growth in number of lodging rooms between 1987 and 1996 was 108%. Retail establishments account for approximately 35,000 square feet and restaurants for approximately 25,000 square feet.

Grand Canyon Village

Proximity to GCNP
Grand Canyon Village is within GCNP on the South Rim.

Population
The 1990 population of the village was reported at 1,499. Estimated mid-summer, peak-season population is 2,100.

Unemployment Rate
As the village exists to provide housing for NPS or concessionaire employees and their families, the unemployment rate for the village is very low. In 1993 the average rate for the year was 2.7%.

Economic Base
The village's economy is geared toward serving visitors. Goods and services not tourist-oriented are very limited.

Visitor Services
The village has 1,033 rooms owned and operated by Grand Canyon National Park Lodges. The number of lodging rooms did not increase between 1987 and 1996. Historical performance of the village's lodging market is shown in Figure 3.4. Over the past seven years, the park lodges maintained occupancies at 78% to 81%, despite declines in park visitation (approximately 5%) in 1990 and 1994. Supply varied slightly because of opening and closing dates of some facilities, with demand being slightly higher in 1990 through 1992, while slightly lower in 1993 through 1996. Travel trailer and camping spaces are also available, as are other concession services. The village also has 58,872 square feet of retail establishments and 63,121 square feet of food and beverage establishments as well as a school, a bank, a non-denominational house of worship, and a post office.

Other Surrounding Communities

Many of the communities in northern Arizona depend to a large extent on tourist revenues created by visitation to GCNP. In general (with two notable exceptions—Las Vegas and Phoenix), the farther communities are from the park, the less they depend on these revenues. A performance analysis comparing the lodging industry in northern Arizona to U.S. norms revealed that properties in northern Arizona substantially outperformed U.S. average occupancies during the early 1990s. More recently, however, the variance has moderated, with both averages in the mid-60% range (Figure 3.5).

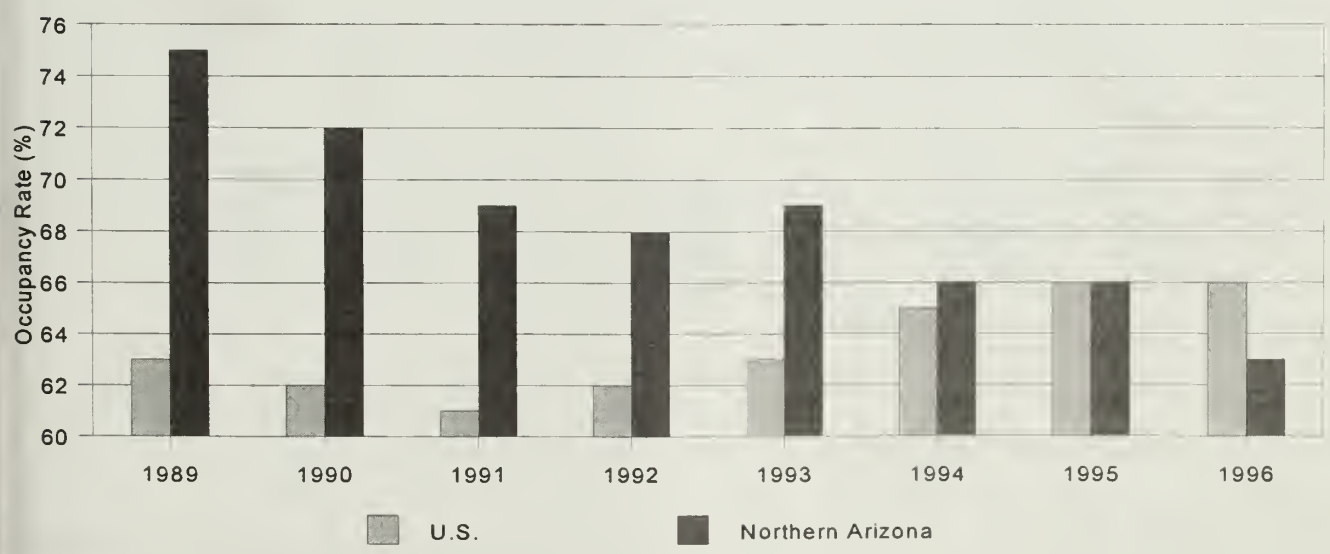


Figure 3.5 Occupancy Rates of Lodging Units for Northern Arizona compared to U.S. Average

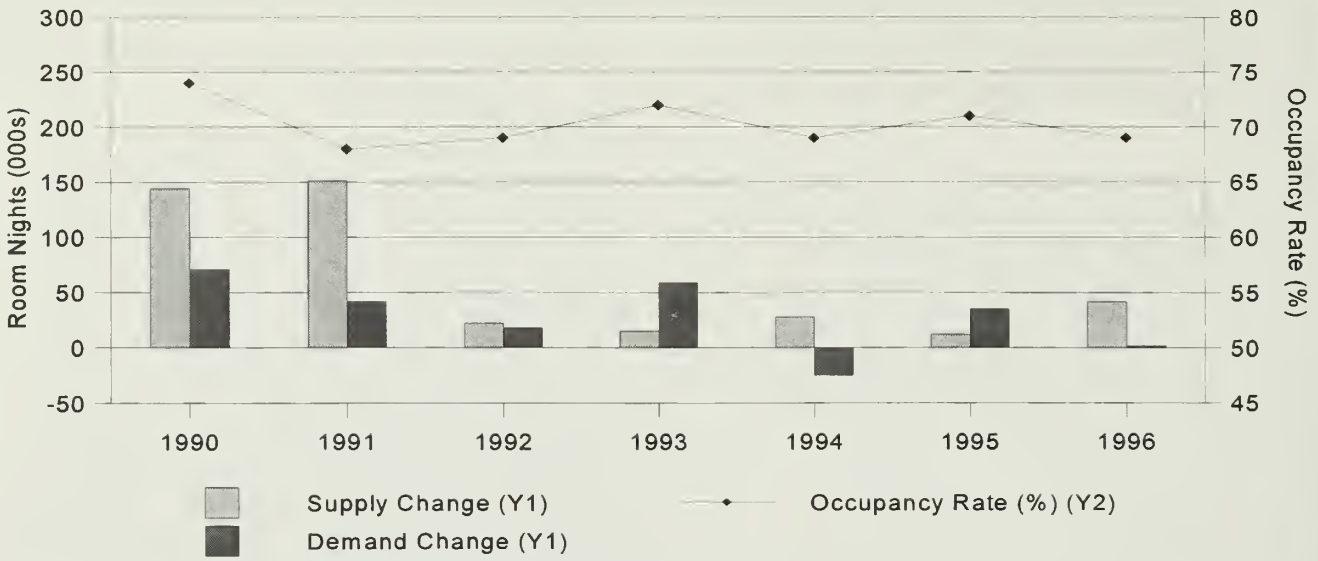


Figure 3.6 Historical Performance of Northern Arizona Lodging Market; Annual Change in Available vs. Occupied Room Nights

New lodging units were added every year over the past decade in northern Arizona for a total of 4,772 new units since 1987 (Table 3.3). Historical performance for the approximately 13,000 hotel rooms in northern Arizona is shown in Figure 3.6. The figure reflects the amount of room nights in northern Arizona. One new lodging unit can potentially accommodate 365 room nights.

Table 3.3 New Room Additions for Northern Arizona (Outside Grand Canyon/Tusayan Area)

Year	# New Rooms
1987	227
1988	160
1989	362
1990	853
1991	416
1992	394
1993	238
1994	247
1995	660
1996	537
1997	678
Total	*4,772*

The new supply of rooms and associated room nights has exceeded new demand every year since 1990. This "excess" supply of new rooms led to a large drop in occupancy rates, from 72% in 1990 to 63% in 1996. Approximately 1,400 rooms were added in 1990 and 1991 alone. Between 1992 and 1994, new supply continued to be added, but at a much more moderate rate. As a consequence, occupancy again improved, leading to further accelerated supply growth in 1995 and 1996.

This analysis considered the northern Arizona region, including such communities as Flagstaff, Williams, Page, Sedona, Winslow, Holbrook, Fredonia, and Kingman. Although the analysis does not include every community in northern Arizona, it is representative of the northern Arizona lodging market.

The economic environment of eleven communities surrounding GCNP has been reviewed. Economic aspects of these communities that are influenced by visitation at GCNP are summarized below.

Valle

Proximity to GCNP

Valle is at the junction of State Highway 64 and U.S. Highway 180, about 30 miles south of the south entrance to GCNP.

Population

The 1990 census reported that Valle, an unincorporated community, had 123 full-time residents.

Unemployment Rate
As Valle is an unincorporated area, the unemployment rate is not available from the Arizona Department of Economic Security.

Economic Base
Valle relies almost entirely on tourism for its economic base. Until recently, lack of economically available water limited development in Valle. Now that two wells have been drilled in the community, future development of visitor and residential services is anticipated.

Visitor Services
Valle provides some visitor services, including a small amusement park, an aircraft museum, a motel, overnight camping facilities, gift shops, and a gas station/ convenience store. The Days Inn Grand Canyon has 73 units for visitor use, and a private airport is being developed in Valle that would allow visitors to fly into Valle and take a proposed shuttle bus service to the park.

Flagstaff

Proximity to GCNP
Flagstaff is about 80 miles from the South Rim of GCNP. Visitors typically access the park by traveling through Flagstaff along U.S. Highway 180 to Valle, then continuing north on State Highway 64, but they can also enter through the east entrance at Desert View by taking U.S. Highway 89 to Cameron and then traveling west on State Highway 64. Flagstaff's location, at the junction of two major interstates (I-40 and I-17), makes it a transportation hub for tourists visiting several attractions in the region.

Population
Flagstaff is the largest community in northern Arizona, with a 1995 population estimate of 52,745 residents.

Unemployment Rate
The 1995 unemployment rate for Flagstaff was 6.1%.

Economic Base
Tourism plays an important role in Flagstaff's economy, although government, university, light industry, and regional trade and distribution activities also account for a significant portion. Flagstaff also serves as the regional center for retail goods and services for residents of northern Arizona.

Visitor Services
Flagstaff offers the largest concentration of lodging accommodations in northern Arizona, with approximately 4,500 rooms in the city. Growth in number of lodging units between 1987 and 1996 was 64%; almost 2,000 new rooms were added during this time (see Table 3.4).

Historical performance of Flagstaff's lodging market is shown in Figure 3.7. The overall occupancy performance of the Flagstaff market has fluctuated over the past several years, mainly due to increased supply. Through the late 1980s, Flagstaff generally achieved the highest occupancy performance of any market in Arizona, but

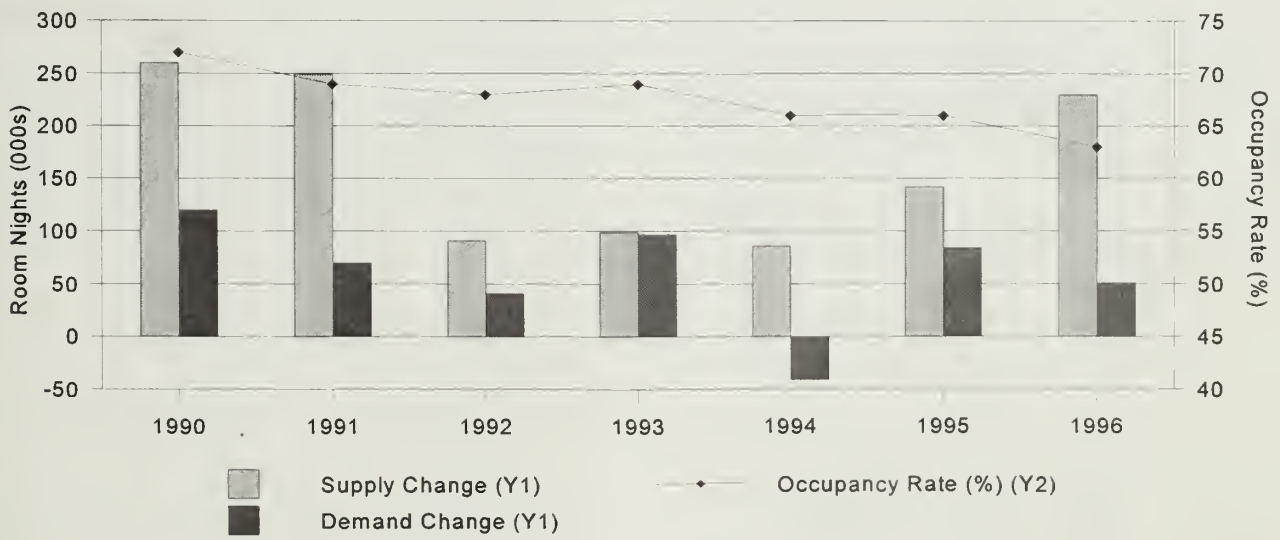


Figure 3.7 Historical Performance of Flagstaff Lodging Market; Annual Change in Available vs. Occupied Room Nights

lodging new supply has impacted occupancy rates in recent years. From a rate of 77% in 1989, occupancy has decreased to between 68% and 72% since 1991. Generally, Flagstaff's supply consists of limited-service properties, both chain affiliated and independently owned and operated. Additionally, Flagstaff provides visitors with several convenience stores/gas stations, restaurants, an airport, railway and bus depots, gift shops, and organized tours to various destinations.

Table 3.4 New Room Additions in Flagstaff

Year	# New Rooms
1987	227
1988	102
1989	108
1990	674
1991	170
1992	88
1993	118
1994	0
1995	50
1996	202
1997	208
Total	*1,947*

Williams

Proximity to GCNP

Williams is about 60 miles from the South Rim of GCNP at the junction of Interstate 40 and State Highway 64.

Population

Williams is an incorporated community with over 2,690 residents (1995 data). Population increase during the tourist season is slight.

Unemployment Rate

The 1995 unemployment rate for Williams was 3.6%.

Economic Base

Tourism forms the economic base of Williams. Known as "the Gateway to Grand Canyon," the town attracts not only visitors to GCNP but also travelers on I-40, a major coast-to-coast interstate. The Forest Service, agriculture, ranching, and rock quarrying also contribute to employment in Williams.

Visitor Services

Williams is the origination for the Grand Canyon Railway, a daily, round-trip, steam-powered (diesel during winter months) passenger train service from Williams to Grand Canyon Village. Since reinstituting service in 1989, the number of railway passengers has steadily increased by 11% annually and brings over 100,000 visitors to Williams each year. The railway was responsible for creating a significant amount of lodging demand, and

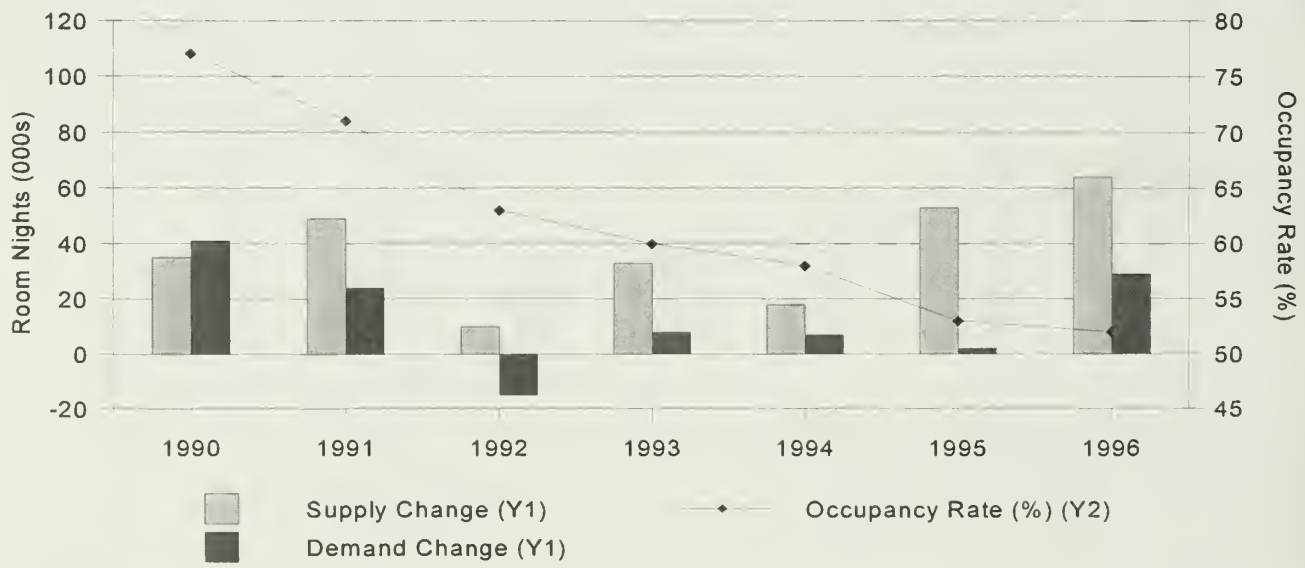


Figure 3.8 Historical Performance of Williams Lodging Market; Annual Change in Available vs. Occupied Room Nights

hotel development has thus increased dramatically since 1990, with over half of the current supply (approximately 1,350 rooms) developed since then (see Table 3.5); the number of lodging rooms grew by approximately 165% between 1987 and 1996. Historical performance of the lodging market in Williams is shown in Figure 3.8. New supply exceeded new demand in every year but 1990, and lodging occupancy rates have dropped steadily from 77% in 1990 to 52% in 1996. In addition to visitor lodging, Williams provides visitors with gift shops, restaurants, convenience stores/gas stations, and a small winter ski resort.

Table 3.5 New Room Additions in Williams

Year	# New Rooms
1987	0
1988	73
1989	73
1990	61
1991	91
1992	72
1993	78
1994	86
1995	88
1996	215
1997	0
Total	*837*

Sedona

Proximity to GCNP

Sedona is about 30 miles south of Flagstaff on U.S. Highway 89A. Visitors traveling from Sedona to GCNP would most likely pass through Flagstaff, then travel the remaining 80 miles on U.S. Highway 180 and State Highway 64.

Population

The 1995 population of Sedona was recorded as 8,910.

Unemployment Rate

The 1995 unemployment rate for Sedona was 2.4%.

Economic Base

Sedona relies on tourism for its economic base. Sedona and the surrounding area receive about 3.5 million visitors each year.

Visitor Services

As a major tourist destination, Sedona is home to resorts, small motels, and inns, totaling 1,907 rooms. Growth in number of lodging rooms between 1987 and 1996 was 55%; almost 700 new rooms were added during this time (Table 3.6). There are also restaurants, shops, art galleries, golf courses, tennis courts, jeep tours, and horseback riding. More rustic accommodations, camping, fishing, and other outdoor activities are nearby in Oak Creek Canyon.

Table 3.6 New Room Additions in Sedona

Year	# New Rooms
1987	0
1988	-15
1989	-15
1990	51
1991	46
1992	-20
1993	1
1994	8
1995	340
1996	120
1997	162
Total	*678*

Page

Proximity to GCNP

Page is roughly 110 miles north of the east entrance to GCNP. Visitors approaching the park from Page travel south on U.S. Highway 89 to Cameron, then roughly 30 miles west on State Highway 64 to Desert View.

Population

Page is an incorporated community of over 7,950 residents (1995 data).

Unemployment Rate

The 1995 unemployment rate for Page was 6.1%.

Economic Base

Page was established during the construction of Glen Canyon Dam, which created Lake Powell. The popularity of Lake Powell as a summertime recreation area has made Page a resort community, filled with many recreational homes. Recreational properties and public utilities are the predominant employers, followed by retail trade, service sectors, and government.

Visitor Services
Page has approximately 1,350 guest lodging units, several RV parks and campgrounds, and a variety of specialty shops, gift shops, grocery stores, and restaurants. Growth in number of lodging rooms between 1987 and 1996 was 47.6%; just over 600 new rooms were added during this time (see Table 3.7)

Table 3.7 New Room Additions in Page

Year	# New Rooms
1987	0
1988	0
1989	0
1990	39
1991	0
1992	132
1993	0
1994	153
1995	108
1996	0
1997	175
Total	*607*

Cameron

Proximity to GCNP
Cameron is about 30 miles east of GCNP, near the junction of U.S. Highway 89 and State Highway 64. It is the closest community to the east entrance of the park.

Population
Cameron is an unincorporated community on the Navajo Reservation. The 1990 census reported 493 residents.

Unemployment Rate
The 1995 unemployment rate for Cameron was 19.8%.

Economic Base
Tourism represents a major portion of Cameron's economy. The community profits primarily from the sale of American Indian arts and crafts, although livestock grazing and services also provide revenue.

Visitor Services
Visitor services in Cameron include a motel, campground, trading post, grocery store, and convenience stores/gas stations. Cameron Trading Post provides 45 rooms. Cameron plans to expand the Cameron Cultural Center, adding a tourism information kiosk offering pamphlets on activities available to tourists in Cameron, Grand Canyon, and other scenic locations in the area. The possibility of making reservations to visit Grand Canyon from the Cultural Center is also being explored. Various plans for an additional campground/RV park in Cameron have been proposed in recent years, but none have been completed.

Kingman

Proximity to GCNP
Kingman, near the western border of Arizona, is at the junction of I-40, U.S. Highway 93, and State Highways 68 and 66. The town is about 110 miles west of Williams and 170 miles southwest of GCNP. Visitors traveling to GCNP from Kingman would most likely go through Williams.

Population
Kingman is an incorporated community with an estimated 16,775 residents (1995 data). Population increase during the tourist season is slight.

Unemployment Rate
The 1995 unemployment rate for Kingman was 6.4%.

Economic Base
Kingman is a regional trade center for northwestern Arizona. Other sectors of Kingman's economy include tourism, manufacturing, heavy industry, and service and distribution.

Visitor Services
Kingman has approximately 800 guest lodging units and four RV parks with 340 spaces, as well as a variety of specialty shops, gift shops, grocery stores, and restaurants. Growth in number of lodging rooms between 1987 and 1996 was 14%; over 200 new rooms have been added during this time (see Table 3.8)

.Table 3.8 New Room Additions in Kingman

Year	# New Rooms
1987	0
1988	0
1989	121
1990	28
1991	0
1992	0
1993	0
1994	0
1995	10
1996	0
1997	68
Total	*227*

Fredonia

Proximity to GCNP

Fredonia is north of GCNP, immediately south of the Utah-Arizona state line on U.S. Highway 89A. Most visitors entering the park from Fredonia would access the North Rim area. Driving distance from Fredonia to the North Rim is about 75 miles, and to the South Rim about 180 miles.

Population

Fredonia is an incorporated community of over 1,250 (1995 data).

Unemployment Rate

The 1995 unemployment rate for Fredonia was 7.1%.

Economic Base

Tourism, agriculture, and service industries are the largest economic sectors in Fredonia. Because of its close proximity to the Colorado River, Fredonia is a warehousing point for river trips. Timber cutting and processing were a large part of Fredonia's economy until Kaibab Forest Industries closed its mill in 1995.

Visitor Services

Fredonia is used by several river rafting companies as a warehouse location. Picnicking, rock hunting, camping, and hunting are available in close proximity to the town. Fredonia is often considered the gateway to the North Rim of GCNP. A few restaurants, backcountry jeep tours, and air tours over the region and the park are available to visitors, as well as 50 lodging units and two RV parks. The amount of lodging increased by 16 rooms between 1987 and 1996 (see Table 3.9).

Table 3.9 New Room Additions in Fredonia

Year	# New Rooms
1987	0
1988	0
1989	0
1990	0
1991	0
1992	2
1993	0
1994	14
1995	0
1996	0
1997	0
Total	*16*

Source: Fredonia Welcome Center 1997

Winslow

Proximity to GCNP

Winslow is about 60 miles east of Flagstaff on I-40. Visitors traveling from Winslow to GCNP would most likely pass through Flagstaff.

Population

Winslow is an incorporated community of over 10,780 residents (1995 data).

Unemployment Rate

The 1995 unemployment rate for Winslow was 7.2%.

Economic Base

Transportation, tourism, manufacturing, trade, and retail form the basis of Winslow's economy.

Visitor Services

Winslow has approximately 740 guest lodging units, as well as a variety of shops, grocery stores, and restaurants. Growth in number of lodging rooms between 1987 and 1996 was 19.2%; almost 200 new rooms were added during this time (see Table 3.10).

Table 3.10 New Room Additions in Winslow

Year	# New Rooms
1987	0
1988	0
1989	0
1990	0
1991	55
1992	0
1993	0
1994	0
1995	64
1996	0
1997	65
Total	*184*

Holbrook

Proximity to GCNP

Holbrook is about 90 miles east of Flagstaff on I-40. Visitors traveling from Holbrook to GCNP would most likely pass through Flagstaff.

Population
Holbrook is an incorporated community of over 5,070 residents (1995 data).

Unemployment Rate
The 1995 unemployment rate for Holbrook was 6.6%.

Economic Base
Holbrook is a regional trade center for northeastern Arizona and is also the seat of Navajo County. A major employer in Holbrook is the nearby Cholla Power Plant, operated by Arizona Public Service Company.

Visitor Services
Holbrook has 1,088 rooms in 24 motels, 152 RV spaces, and two public campgrounds, as well as a variety of specialty shops, gift shops, grocery stores, and restaurants. Growth in the number of lodging units between 1987 and 1996 was 36.7%; almost 300 new rooms were added during this time (see Table 3.11).

Table 3.11 New Room Additions in Holbrook

Year	# New Rooms
1987	0
1988	0
1989	75
1990	0
1991	54
1992	122
1993	41
1994	0
1995	0
1996	0
1997	0
Total	*292*

Tuba City

Proximity to GCNP
Tuba City is about 10 miles east of the junction of U.S. Highways 89 and 160 and about 25 miles northeast of Cameron. Visitors traveling from Tuba City to GCNP would most likely pass through Cameron and enter the park at Desert View.

Population
Tuba City is a community on the Navajo Reservation with a 1995 census of 8,163 residents.

Unemployment Rate
The 1995 unemployment rate for Tuba City was 19.8%.

Economic Base
Residents in Tuba City are employed principally by government agencies, local schools, and retail businesses. Other sectors include public administration, services, and American Indian arts and crafts.

Visitor Services
Three overnight camping areas with hookups for campers are near Tuba City. Additional visitor services include restaurants, trade centers, and convenience stores/gas stations. Tuba City has one hotel with 80 units. The number of lodging units has not increased over the past decade.

Surrounding American Indian Tribes

Four American Indian tribes have reservation lands near the South Rim of Grand Canyon. Social and economic components of these tribes are discussed below, and their lands are shown in Figure 3.9.

Hualapai

Proximity to GCNP
The Hualapai reservation, totaling 992,463 acres, adjoins a portion of the park's southwestern boundary.

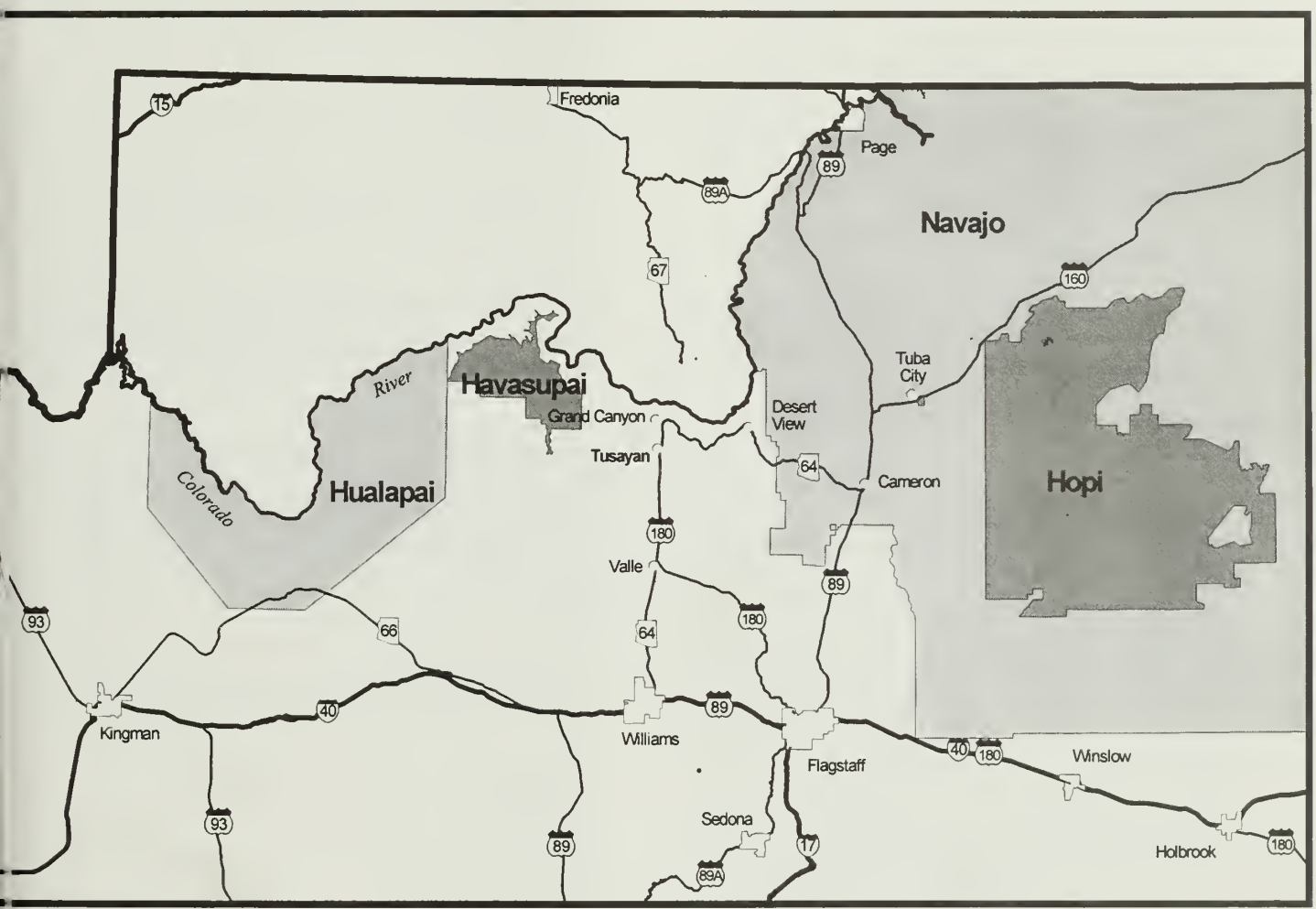
Population
In 1995 the tribe had 1,979 members.

Unemployment Rate
Unemployment rate for the Hualapai reservation was 33.8% in 1995.

Economic Base
The Hualapai economy is mostly based on tourism, river rafting, cattle ranching, guided hunting expeditions, timber cutting, and selling of arts and crafts.

Visitor Services
Grand Canyon West, a Hualapai commercial enterprise, accommodates more than 3,000 guests each month and is planning an expansion to increase visitor services. A food service facility will be constructed at Guano Point to replace the existing facility which currently serves a limited lunch menu to visitors on five different commercial tours that serve the Grand Canyon West area. The new facility would occupy approximately 5,500 square feet and provide seating for approximately 150 guests. This structure would also provide space for food preparation and storage.

Figure 3.9 American Indian Tribal Land near the South Rim of GCNP



A motel/restaurant/arts and crafts center is proposed for downtown Peach Springs on the Hualapai reservation. The building would include guest rooms, an office, and a laundry facility. The proposed restaurant would provide breakfast, lunch, and dinner menus to motel guests, visitors, and members of the tribe. The arts and crafts center would provide tourist information and sell a variety of Hualapai handmade arts and crafts, curio, and/or other specialty items. The Hualapai tribe also operates the only American Indian–owned river rafting company offering guided tours on the Colorado River.

Havasupai

Proximity to GCNP

The Havasupai reservation, totaling 188,077 acres, borders a portion of the southern boundary of GCNP, west of Grand Canyon Village.

Population

In 1995 the tribe had 658 members.

Unemployment Rate

Unemployment rate for the Havasupai reservation was 51% in 1995.

Economic Base

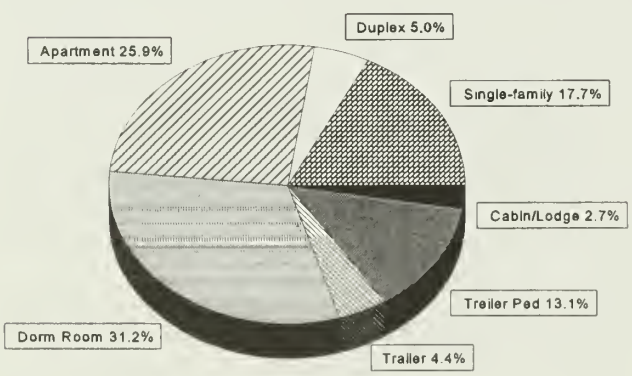
Tourism is the basis of the tribe's economy. More than 12,000 people a year hike or ride horses into the Canyon and stay at the lodge or campground near Havasu Springs.

Visitor Services

A campground and small lodge with 24 units accommodate visitors who stay overnight in the Canyon. The Havasupai also operate a cafe, grocery store, museum and cultural center, and art and silk screen studio.

Figure 3.10 Housing types in GCNP

(based on a percentage of 1,000 existing units)



Hopi

Proximity to GCNP

Hopi land totals 1,561,213 acres. The western border is about 40 miles east of GCNP.

Population

In 1995 the tribe had 9,137 members.

Unemployment Rate

Unemployment rate for Hopi was 21% in 1995.

Economic Base

Federally funded programs represent almost half of the employment opportunities. Other sectors of the economy include service stations, motels, restaurants, arts and crafts shops, and other service businesses.

Visitor Services

Limited visitor services exist, with no significant inventory of guest lodging rooms available to visitors. The Hopi cultural center provides restaurant facilities, limited lodging facilities, and retail outlets for crafts.

Navajo

Proximity to GCNP

The Navajo Nation, totaling 16,224,896 acres, borders GCNP on the east.

Population

In 1995 the tribe had 157,716 members.

Unemployment Rate

Unemployment rate for the Navajo Nation was 27.9% in 1995.

Economic Base

Mining is one of the largest contributors to the Navajo economy. Other sectors include forestry, tourism, government, manufacturing, and agriculture/livestock.

Visitor Services

Within or directly adjoining the Navajo Reservation, including Cameron and Tuba City, 768 lodging units are available for visitors. Other visitor services are limited.

Housing

Presently about 1,679 employees who work at the South

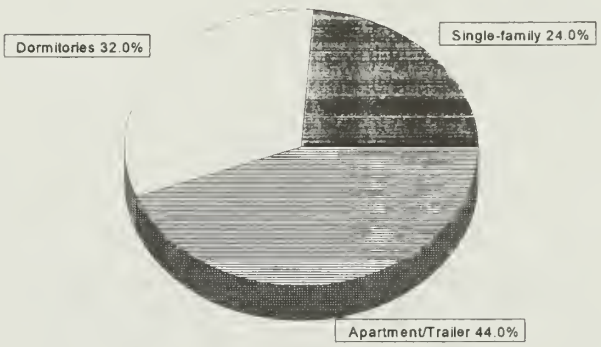
Rim of GCNP during peak season live in employer-provided housing. Employee housing for GCNP staff and the park concessionaire is in three areas on the South Rim: Grand Canyon Village, Desert View, and Hermits Rest. Housing types are in seven categories: single-family, duplex, apartment, dormitory unit, trailer, trailer pad, and cabin/ lodge (Figure 3.10). The General Management Plan (GMP) for the park reports that some housing needs to be replaced because of substandard conditions and that additional housing is needed for projected new employees and to relieve current crowded conditions. The number of existing adequate housing units and projected needs for additional housing is presented in Table 3.12.

The park's GMP has also identified a need for up to 500 housing units to be located outside of the park, adjacent to Tusayan for NPS and park concessionaire employees.

Approximately 940 employees presently work in Tusayan during the peak season, with most living in employer-provided housing. This number decreases by roughly 50% during the winter months. Future development in Tusayan will increase employment needs and subsequently the need for additional employee housing. Area businesses predict about 1,078 new employees will be needed during the peak season by the year 2000 with a resultant need for up to 539 new housing units. Businesses in Tusayan currently manage 346 housing units, consisting of 152 apartments/trailers, 111 dormitory units, and 83 single-family houses (Figure 3.11).

Roughly 200 housing units are available in Valle, both privately owned homes and employer-provided housing for Tusayan employees.

Figure 3.11 Housing types in Tusayan
(based on a percentage of 346 existing units)



Crime Rates

For the Grand Canyon area, 233 criminal cases were reported in 1991; 373 in 1992; 371 in 1993; 358 in 1994; and 533 in 1995. Of these cases 52% to 58% occurred in Tusayan from 1991 through 1994. In 1995, the Tusayan crime rate dropped to 11%. The significance of this decrease is unknown, as local law enforcement officers have been unable to predict crime trends for Tusayan.

Tusayan relies on the Coconino County Sheriff's Office for law enforcement services and protection. Three officers based out of Williams patrol the Tusayan area.

According to the County's 1992 Activity Analysis, Tusayan accounts for 87% of the law enforcement activity in the immediate area, with Grand Canyon accounting for 11% and other areas 2%. Theft is the most frequent criminal activity followed by traffic accidents, property crimes, driving under the influence of alcohol or drugs (DUI), and domestic violence.

Law enforcement is also provided by three other agencies in the area. The Arizona Department of Public Safety (DPS) has one officer in Tusayan, who is responsible primarily for maintaining the flow of traffic and dealing with accidents on State Highway 64. This officer also assists the Park Service and the County Sheriff's Department with investigations and tactical and air rescue operations. The NPS provides law enforcement through an Intergovernmental Agreement (IGA) with the County Sheriff's Department. The primary role of NPS personnel is law enforcement in the park, but they also respond to a small number of calls in Tusayan. The KNF is the third agency providing law enforcement in the Grand Canyon/Tusayan area, mostly on NFS land.

Community Infrastructure

Community Services and Facilities

As few community services are provided in Tusayan, area residents rely on the limited community services and facilities in GCNP. These include a bank, post office, parcel package center, grocery store, employee laundry facility, medical/dental clinic and pharmacy, community library, day care center, and an elementary, middle, and high school complex with baseball, soccer, and football fields, a playground, a tennis court, and a track. These buildings are also used for adult education courses offered by Coconino County Community College. The community recreation center burned in 1994 and has not been replaced.

Table 3.12 Existing and Needed Housing for NPS and Concessionaire Employees by 2010

Housing Location	Existing Adequate Units	(Substandard Units)	Projected Needed Units NPS	Projected Needed Units Concessionaire
Grand Canyon Village	958	(113)	44	454
Desert View	40	(11)	22	48
Hermits Rest	2	(1)	0	0
Tusayan	—	—	98	389
Total	*1,000*	*(125)*	*164*	*891*

County and State Facilities and Services

Flagstaff is the seat of Coconino County and provides the majority of county services for the region, including employment/unemployment services. Direct county services in Tusayan are currently limited to the three Coconino County Sheriff's deputies mentioned above, a solid waste transfer facility, and maintenance of three miles of Forest Road (FR) 302 that leads to the transfer facility. State facilities and services in the Tusayan area are limited to operation of Grand Canyon Airport and maintenance of State Highway 64 by the Arizona Department of Transportation (ADOT).

Medical Facilities

Existing medical facilities in the Grand Canyon/Tusayan area are limited to a full-service clinic in GCNP that currently operates near capacity, two Park Service ambulances, and an air evacuation helicopter. The clinic offers 24-hour primary care, emergency care, and outpatient services. It is staffed by two physicians, four registered nurses, and clerical personnel. Current volume of patients per year is approximately 10,000. The patients are divided roughly equally between local residents and visitors. Use of the ambulances and the air evacuation helicopter is primarily in GCNP.

Tusayan lacks an official emergency medical responder. The Eddingfield Ambulance Service in Williams provides transport to the Flagstaff Medical Center (FMC), but first response to emergency medical situations is typically made by the NPS with an ambulance equipped with basic life support apparatus. The park also has a helicopter for transporting patients to FMC. The Grand Canyon Clinic provides primary care for the area, treating minor cases and stabilizing more serious cases for transport to another center. The NPS is very concerned about the lack of a Mutual Aid Agreement for service outside the park.

Firefighting Services

Tusayan recently formed a fire district and acquired some fire fighting equipment and plans to build a temporary fire station in the community of Tusayan. In the past, the residents of Tusayan relied solely on outside agencies, including the NPS, Grand Canyon Airport, the Forest Service, and GCNP Lodges (Fred Harvey). All fire response in Tusayan is on a cooperative basis in the interest of protecting life and property, as there are no formal arrangements such as an Intergovernmental Agreement or Mutual Aid Agreement.

Sewage and Wastewater

Tusayan, GCNP, and Moqui Lodge all have their own sewage and wastewater treatment facilities. Treatment of sewage and wastewater for Tusayan is currently handled by the wastewater facility operated by the South Grand Canyon Sanitary District. This facility was recently expanded and can now accommodate up to 750,000 gallons per day. Current volumes range between 150,000 and 250,000 gallons per day.

The wastewater treatment plant for the South Rim of GCNP has a capacity of 750,000 gallons per day. This facility treats all wastewater generated by the South Rim portion of the park. Maximum wastewater flow in 1995 was approximately 600,000 gallons per day. An additional 150,000 gallons per day could be accommodated by this facility before it reaches total capacity.

The Moqui Lodge treatment facility treats wastewater from the Tusayan Ranger District administrative site as well as the lodge's wastewater. At present, this facility is operating at capacity. A proposal to expand the facility is on hold until a decision is made on this EIS because of the potential opportunity to share infrastructure with development on NFS land.

Solid Waste

Coconino County operates a transfer facility at Tusayan that services the Tusayan area as well as private residences and the concessionaire in GCNP. The transfer facility consists of a 5-cubic-yard compactor box and two 40-cubic-yard open boxes and accepts waste from 70-cubic-yard trailers. This facility serves the Tusayan area, private individuals, and the concessionaire at GCNP. Compacted waste, approximately 1,400 tons in 1996, is hauled to the Flagstaff landfill. The landfill currently comprises approximately 175 acres and can handle up to 500 tons per day or 150,000 tons per year. Planned expansion, to 355 acres, will almost double landfill capacity and is expected to extend the lifespan of the landfill approximately 50 years, or up to 80 years if further recycling is implemented. The NPS currently operates its own landfill within GCNP; this landfill is expected to reach capacity in the next three to five years.

Visitor Experience in and Around Grand Canyon

This section explores various factors that a visitor to the region is exposed to. These factors include GCNP, visual quality, air quality, light pollution, noise pollution, and other components of GCNP.

Grand Canyon Experience

The majority of the nearly 5 million tourists that visit GCNP each year enter the park at the South Rim. During the summer months average daily visitation is approximately 17,600. Day users spend an average of 4 hours in the park, whereas overnight users stay an average of 1.2 days.

Visitation on the South Rim is primarily oriented toward use of private vehicles to access park facilities. People travel from one scenic area to another, ultimately ending up at Grand Canyon Village. During the summer season, roads are heavily congested, parking is inadequate, and the shuttle system is crowded. The visitor centers and interpretive facilities are too small for the number of visitors using them in the summer, and the exhibits are outdated and limited in their interpretation of the park's attributes. Food service is inadequate, requiring long waits for restaurant service. The combined result has been a gradual degradation of the visitor experience and the recognized values of GCNP at the South Rim, including global or universal appeal; scenic beauty; solitude and spiritual/inspirational qualities; recreational opportunities; natural resources, ecosystems, and research opportunities; and cultural resources. The park's GMP has identified a need to ensure an enjoyable experience as visitors enter the park and get their first glimpse over the edge of the Canyon wall, as well as maintaining the opportunity for wilderness experiences along the many miles of corridor trails.

Visitor centers and interpretive facilities on the South Rim are poorly designed and located. All of the visitor centers are often very crowded, information is inadequate for introducing visitors to the park, and no basic orientation is provided to allow visitors to plan their park visit in an informed manner. From the south entrance, Mather Point is the first area encountered by visitors (Figure 3.12). Mather Point offers a view of the Canyon and two chemical toilets. Yavapai Observation Station is the first park facility encountered upon entering from the south entrance. An information desk, retail area, restrooms, and water are available in the buildings as well as views of the Canyon. South Rim Visitor Center was intended to be the primary center for visitor contact, orientation, and interpretation, but because its design is outdated and it is distant from the park entrance, only a small percentage of visitors use the center. During the busy season, parking is insufficient to handle even the 10% of the visitors who do stop at the center. The center hosts an information desk, bookstore, history exhibits, and an audiovisual program and is a trailhead to the rim trail. No exhibits introduce visitors to all of the park's primary themes or advise visitors where they may obtain more information.

The IMAX theater, located in Tusayan, is visited by an estimated one million visitors each year and features a film of Grand Canyon. For many visitors, this film serves as an introduction to the Canyon, providing visual experiences and information that people do not normally obtain during their visit to GCNP.

Visual Quality

Regional Overview

With few exceptions, human development within the Tusayan Ranger District does not dominate the visual experience. State Highway 64 is the only major paved roadway that loops into and back out of GCNP. With the exception of Red Butte and Grandview lookouts, road alignments and occasional small clearings afford the few distant landscape views of the area. Tusayan is the only developed community within the Tusayan Ranger District. A network of forest roads within the Tusayan Ranger District provides access to more remote areas. The Coconino Rim Road (FR 310) and FR 302 receive the majority of four-season recreational use. The TenX campground, just south of Tusayan on State Highway 64, is the only Forest Service campground on the Tusayan Ranger District and contains 70 camping sites.

Figure 3.12 Map of South Rim of GCNP



Figure 3.13 Highly Sensitive Viewpoints in the Tusayan/G

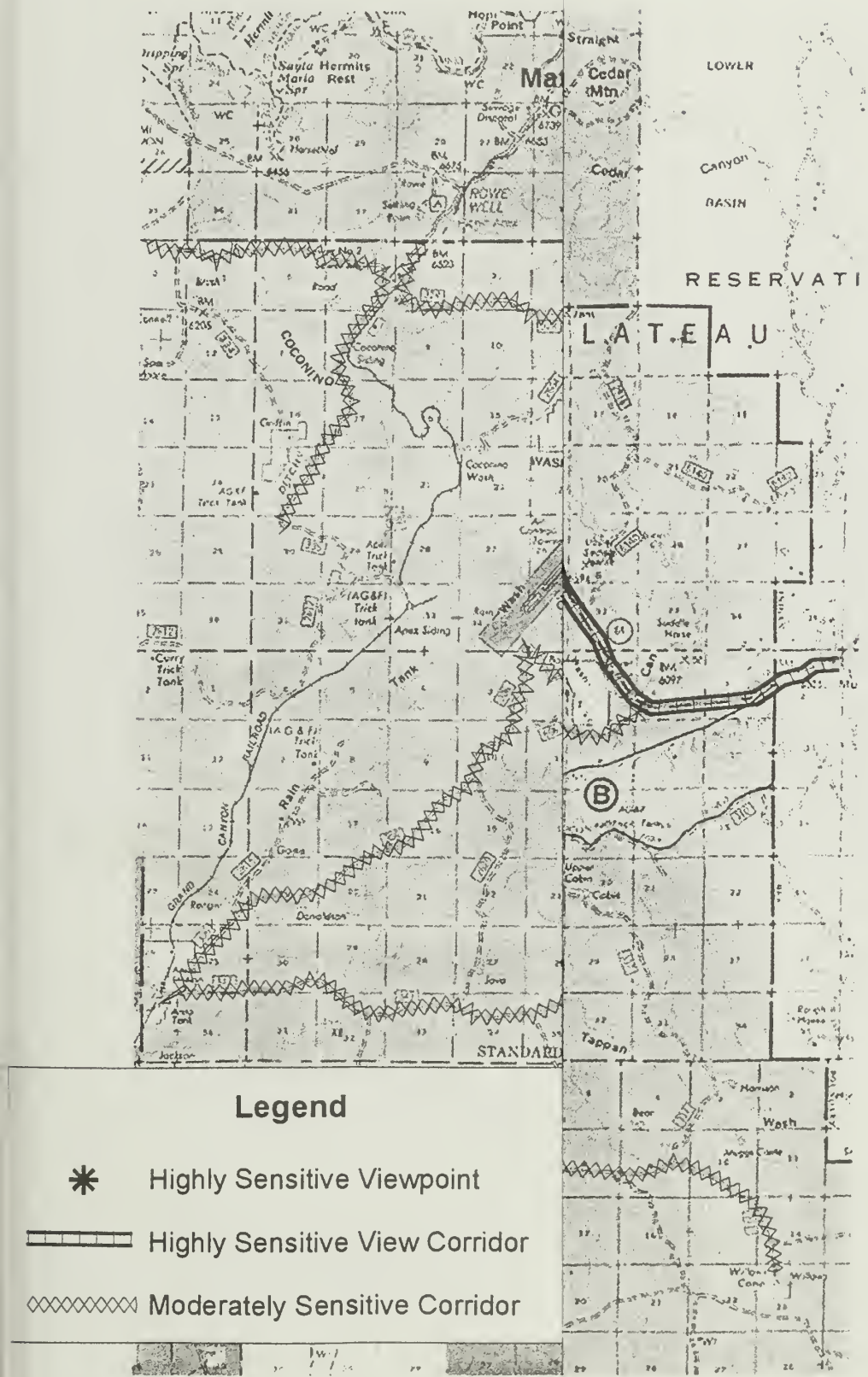
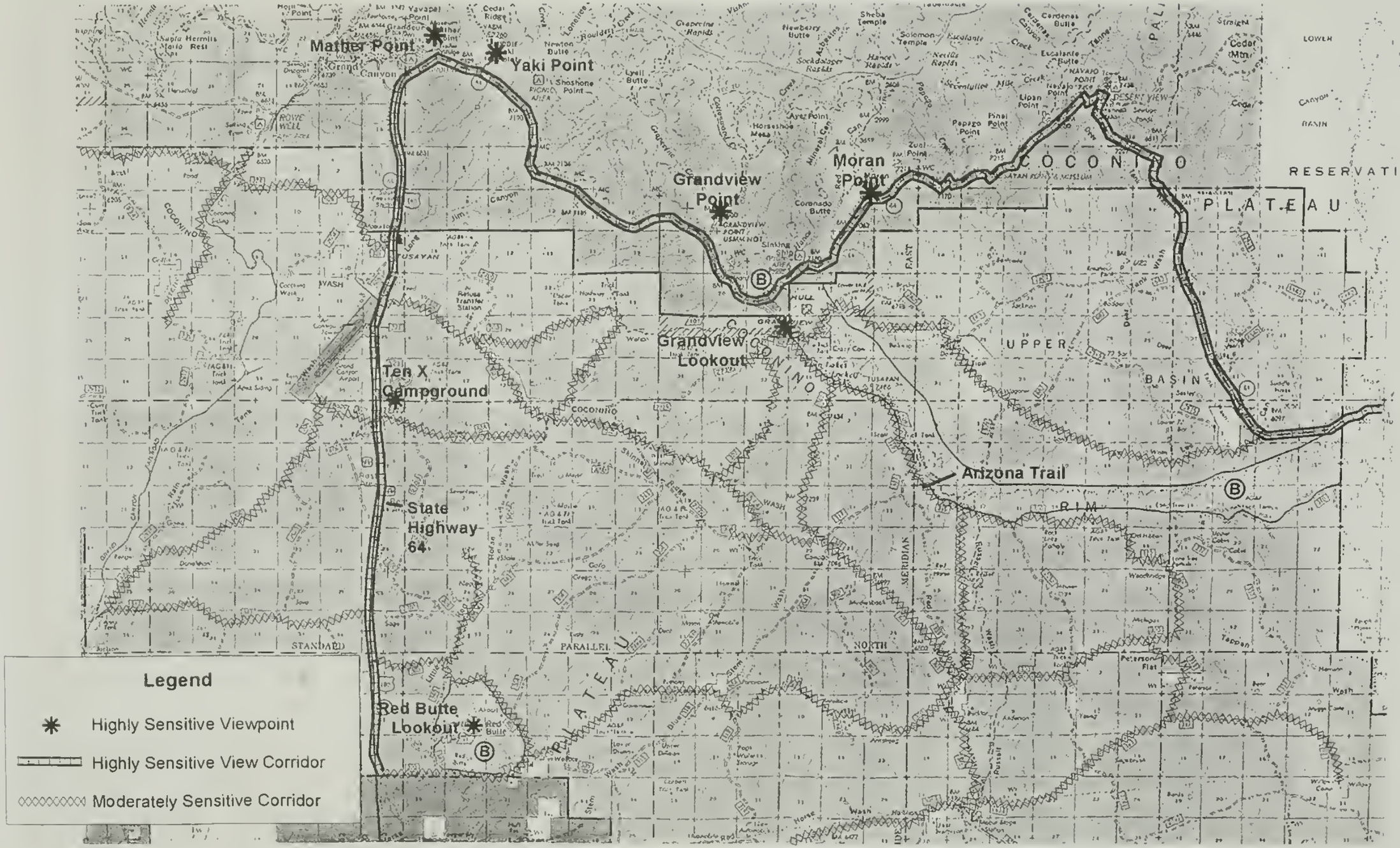


Figure 3.13 Highly Sensitive Viewpoints in the Tusayan/GCNP Area



Highly Sensitive Viewpoints

The following viewpoints were identified as highly sensitive. They are mapped in Figure 3.13.

State Highway 64

This highway is the sole access to the South Rim of GCNP from both the east and the south and is the main travel route through Tusayan. Views from the highway are typically of the foreground. Occasional middle ground and background views are available at clearings in the forest cover or breaks in topography.

Grandview Lookout

The Grandview Lookout is on the Coconino Rim Road less than one-half mile from the south boundary of GCNP. It is accessible by FR 310 from State Highway 64 in GCNP and Tusayan. The lookout has extensive views of the upper basin and upper elevational forests of the Colorado Plateau.

Red Butte Lookout

The Red Butte Lookout is on top of Red Butte, within three miles of State Highway 64. The lookout offers comprehensive views of the Coconino Plateau up to the Coconino Rim of the Colorado Plateau. Although the lookout is not as accessible or as frequently used as Grandview Lookout, it provides the largest viewshed of any viewpoint on the Tusayan Ranger District.

Grand Canyon National Park Observation Points

Numerous overlooks are adjacent to State Highway 64 in GCNP. They include, among others, Mather Point, Yaki Point, Moran Point, and Grand View Point. None of the observation points have views of the NFS or private lands involved in this analysis.

Scenic Aerial Tours

Regular small airplane and helicopter scenic tours originate at Grand Canyon Airport taking various flight paths over the plateau to Grand Canyon and back to the airport. Flights are short in duration and intended to provide a visual experience of Grand Canyon. The sensitivity of this viewing perspective is tempered by the travel speed and the nature of viewing quality from within an aircraft.

TenX Campground

As the only designated campground in the Tusayan Ranger District, TenX is used by visitors to both GCNP and the KNF. Limited views are available from the campground.

Moderately Sensitive Viewpoints

The Arizona Trail and some local Forest Service roads in the area were identified as moderately sensitive viewpoints. They are mapped in Figure 3.13.

Arizona Trail

The Arizona Trail roughly parallels the crest of the Coconino Rim. Trail uses include hiking, mountain biking, horseback riding, and cross-country skiing. Use of the trail is not a part of the usual experience of visitors to GCNP and is relatively lower in frequency than at the high-sensitivity viewpoints.

Improved Forest Service Roads

Improved gravel and dirt Forest Roads provide access to many areas within the Tusayan Ranger District. The roads serve multiple purposes, including recreation and resource management. Although some routes, such as FR 310 and 302, provide limited access to GCNP, most Forest Roads are for local use.

Landscape Character of Affected Lands

The NFS land involved in this analysis and three of the private inholdings (Kotzin, TenX, and Lower Basin) were inventoried separately to determine their landscape character. The three private inholdings were chosen for visual quality analysis because of their development potential within the next 15 years. The other private inholdings are thought to be sufficiently remote that development is not likely in the near future.

NFS Land North of IMAX and South of Moqui Lodge

The landform of the site is generally flat to rolling, climbing gradually from south to north, with a few small drainage providing 50 to 100 feet of topographic relief across the site. The site is visually dominated by moderately dense to sparse ponderosa pine forest. In general, the large trees and density of vegetation preclude views across the site or off-site. Vegetation is mostly sparse in the southwestern portion of the site near State Highway 64.

State Highway 64 runs through the center of Tusayan just before approaching the site from the south. This is the most common route for visitors traveling from Flagstaff or Williams to GCNP. The alignment is straight and bisects the existing development. Views are enclosed by the forest when approaching Tusayan. The view opens onto urban development upon entering Tusayan, and becomes enclosed again after leaving Tusayan.

The existing structures in Tusayan immediately south of the site lack a unified architectural style. Motels, fast-food restaurants, a grocery store, the IMAX theater, and the domes are the main structures seen by travelers driving through Tusayan. The style of these buildings is not indigenous to the area and is similar to commercial structures in Flagstaff or Phoenix. The landscaping does not screen development, nor does it enhance pedestrian or vehicular circulation.

Foreground portions of the site along the State Highway 64 corridor are visible from the road. No other obvious views are available across the site. With the exception of aerial views, this site cannot be seen from the other sensitive viewpoints.

With appropriate vegetation preservation and architectural control measures, much of this site has a high capacity to visually absorb change resulting from development. Several factors support this assumption: the adjacent high-density commercial land use and development in Tusayan to the south and southeast; the rolling terrain of the site; the existing forested nature of the landscape on both sides of the highway; and the limited existing viewsheds from State Highway 64 and Tusayan.

TenX Inholding

Much of the TenX site, approximately two miles southeast of Tusayan, is in a small drainage bordered on both sides by a low ridge. The vegetation pattern differs from the surrounding area in that most of the site has been cleared for livestock grazing and is now dominated by sagebrush and grass communities. The periphery of the site is bordered by woodland. Adjacent NFS land is sparsely forested.

FR 302, an improved gravel road, is the main corridor adjacent to TenX. The property is visible from this road corridor. TenX has a few older ranch buildings with a corral that occupy a very small portion of the site. There are very limited views into TenX from off-site and none of the high-sensitivity viewpoints overlook the site. Because of the lack of development immediately adjacent to the site and the lack of screening provided by vegetation, any development of the west end of TenX near FR 302 would contrast significantly with the surrounding environment.

Lower Basin Inholding

The Lower Basin landform is a broad, open basin surrounded to the north, west, and south by steeper slopes that gradually connect to the Coconino Rim to the south and the rest of the Upper Basin to the north and west. The vast majority of the Lower Basin site is covered by a sagebrush grassland. The site is bordered by pinyon-juniper woodland, with occasional ponderosa pines.

FR 307 runs along the south side of this inholding. There are a few structures on the site associated with ranching activity, but they are not a dominant visual element of the site. State Highway 64, also called East Rim Drive within GCNP, parallels the east side of the Lower Basin site and is the second most popular approach to the South Rim of GCNP. The lack of vegetation makes the Lower Basin inholding highly visible from this highway over a long distance.

The flat topography and lack of vegetation make Lower Basin highly susceptible to visual impacts. The visibility of Lower Basin for long periods of time from State Highway 64 and the level of traffic along this highway corridor make Lower Basin quite susceptible to visual impacts. If developed, the Lower Basin site could also be visible from the Grandview Lookout.

Kotzin Inholding

The landform of the Kotzin site is similar to the surrounding NFS land. The Kotzin site is predominantly open shrub/grass vegetation with moderately dense to sparse ponderosa pine forest on the eastern half of the property.

Kotzin is accessible only by an unimproved forest road and is not visible from any of the identified sensitive viewpoints. There are a few accessory ranch structures on the site. Kotzin has a high capacity to absorb change. The vegetation on and adjacent to the property could provide good screening of visual impacts from adjacent NFS land.

Air Quality

GCNP has been designated a Class I airshed, the cleanest standard under the Clean Air Act and is subject to stringent standards for airborne pollutants. Air quality is generally good at GCNP, but it is influenced seasonally by weather patterns, temperature inversions, and pollutants carried from the Navajo Generating Station near Page and major metropolitan areas such as Phoenix, Las Vegas, and Los Angeles (Bureau of Reclamation 1994). Locally, air quality is affected by emissions from private vehicles, buses, trains, and stationary sources such as wood-burning stoves.

Visitors to the park notice the haze created by wind-blown air pollution, particularly in the summertime when average visibility drops from 158 miles to about 100 miles (Bowman 1991). Prevailing winds across the region are generally from the south and west, picking up pollutants

from such urbanized areas as Phoenix and Los Angeles. During the winter months, cold fronts from the north bring clean air. However, pollutants settle in Grand Canyon and can be trapped by inversions until the next storm front from the north arrives.

Light Pollution

GCNP is a relatively remote area and is considered important for its solitude and wilderness values. Night views at GCNP are spectacular because of the lack of light-generating sources in the area.

Noise

The Grand Canyon Airport, just south of Tusayan, is the main contributor of noise in the area. For this reason, the source of noise information cited here is the environmental assessment (EA) for the Master Plan for Grand Canyon Airport (1993). Figure 3.14 shows the projected noise levels for all proposed improvements to the airport through the year 2010.

Noise contours in Figure 3.14 were generated from the Day-Night Average Sound Level (Ldn), a method approved by the Federal Aviation Administration (FAA), Environmental Protection Agency (EPA), and Department of Housing and Urban Development (HUD). Ldn contours represent typical conditions for planning purposes and have been used to highlight existing or potential aircraft noise problems, assess relative exposure levels of various noise abatement alternatives, assist in land use plans, and provide guidance in the development of land use control devices. As these contours represent annual average conditions, they understate noise levels during peak periods and overstate noise during periods of lower activity.

Guidelines for land use compatibility at differing noise levels have been developed by HUD, FAA, and others based on the finding that people are not as likely to be disturbed by aircraft noise when they are driving, working, or shopping as when they are at home. These compatibility guidelines from the Federal Aviation Regulation (FAR) Part 150, show that lands used for residential areas, mobile home parks, commercial lodging, and schools are incompatible with sound levels from 65 to 70 decibels. For lands that fall below the 65-decibel Ldn noise contour, there are no recommended restrictions on land use and related structures.

The review of potential incompatible land uses at Grand Canyon Airport was based on the FAA guidelines and the projected noise contours illustrated in Figure 3.14. All areas subjected to a 70-Ldn noise contour or higher fall within airport property. The 65-Ldn noise contour generated for the year 2010 would affect approximately 100 acres of non-airport property, approximately 42 acres of which are within Tusayan. Some existing residential areas are within the projected 65-Ldn noise contour. The 1978 South Grand Canyon Specific Area Study by Coconino County recommends resort commercial, general commercial, and recreational vehicle camping uses within this area to ensure that land uses are generally compatible with the anticipated noise levels.

All NFS and private lands proposed for development and/or exchange in all of the alternatives fall outside of the 65-Ldn noise contour.

Grand Canyon National Park General Management Plan

Grand Canyon National Park's GMP addresses park issues in the context of the park's legislation and the Organic Act for the NPS. The purpose of the plan is to protect park resources from harmful activities and provide for a meaningful visitor experience. A secondary purpose is to encourage compatible activities on adjacent lands to minimize adverse effects on the park.

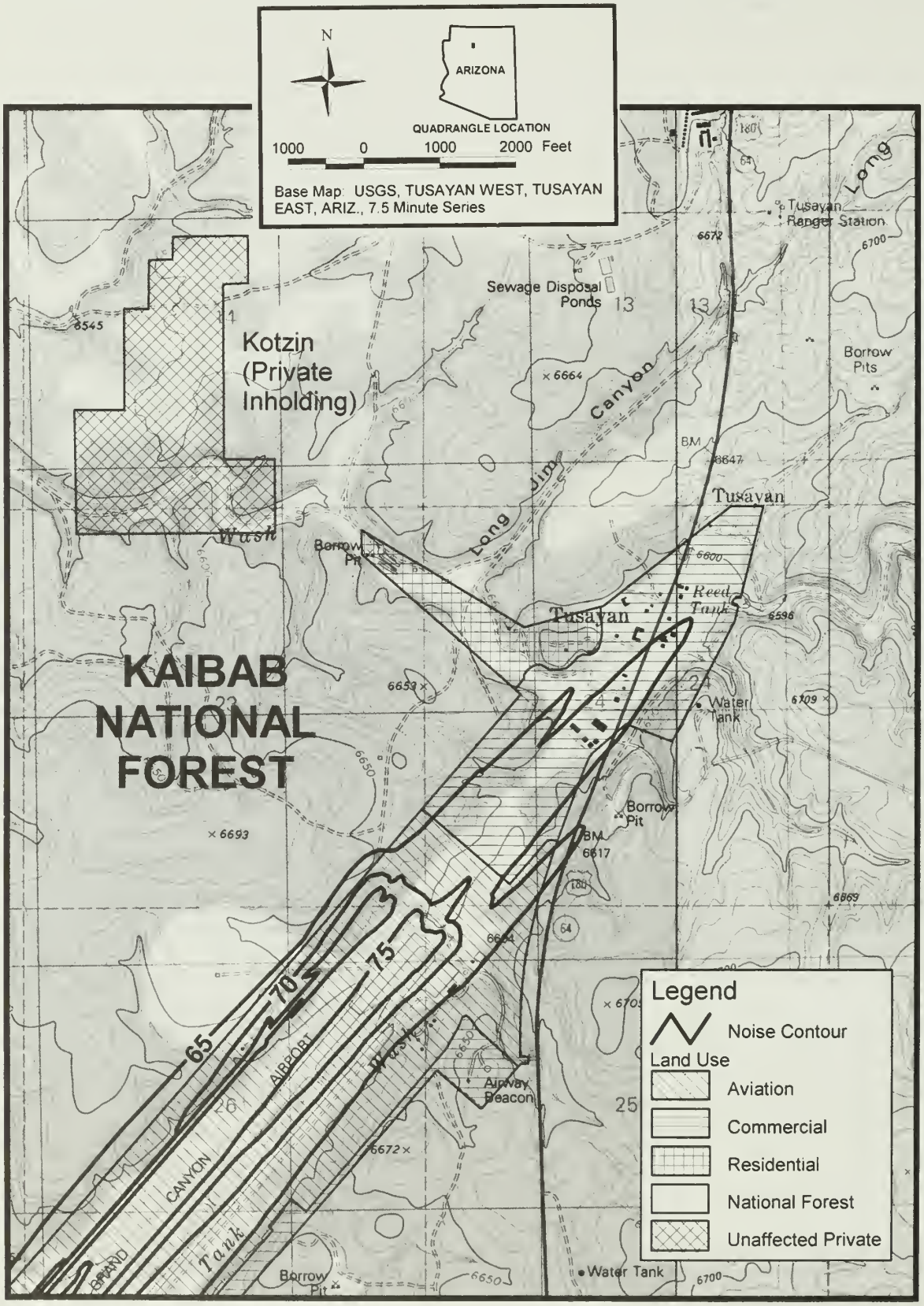
The purpose of GCNP, and the goal of the GMP, is based on the legislation establishing the park and the legislation governing the NPS. As a place of national and global importance, GCNP is managed:

- to preserve and protect its natural and cultural resources and ecological processes, as well as its scenic, aesthetic, and scientific values, and
- to provide opportunities for visitors to experience and understand the environmental interrelationships, resources, and values of Grand Canyon without impairing the resources.

The GCNP envisions that the South Rim would remain the focus for most park visitors, with diverse opportunities to view the Canyon. Access should be provided to areas that allow people to have solitary experiences. The West Rim and East Rim drives should be meandering, rural roads that lead to overlooks where visitors can get away from the more urbanized areas. The South Rim should provide parkwide orientation and introduce visitors to all the park's educational themes. Alternative means of transportation—walking, biking, or using convenient public transit—should be encouraged.

The proposed action of the GMP states, "The regional context of Grand Canyon National Park would be emphasized, and proposals for resource preservation and visitor use would take into account environmental effects

Figure 3.14 Projected Noise Contours (in decibels) from Activity at Grand Canyon Airport through 2010



Source: Adapted from Master Plan for Grand Canyon Airport (1993)

on the park as well as the region. Planning outside the park would be done cooperatively, with an emphasis on disseminating information, preserving regional and park resources, and providing a quality visitor experience."

The park would work with the community of Tusayan, KNF, and all other affected entities near the park in providing for many park needs outside of the park and to encourage compatible, aesthetic, and well-planned development and recreational opportunities. Consideration of the regional context, the use of sustainable design, and the need to preserve resources while providing for a quality visitor experience are guiding factors in the GMP.

New facilities would be constructed on previously disturbed areas in the park and existing structures would be renovated. The number of visitors to certain areas would be limited in the future, to assure a quality visitor experience. Also, a monitoring system would keep track of resource impacts, facility use, visitor satisfaction, and levels of visitor use in each developed area of the park.

Grand Canyon Visitation

Current annual visitation to GCNP is approximately 5 million people. Although park visitation fluctuates from year to year, visitation has shown an overall increase since the inception of the park. A large proportion of the visitors come during the peak summer season, creating overcrowded conditions and high demand on overnight accommodations and food services (GCNP 1995).

According to data collected, visitation to GCNP has grown rapidly, particularly during the past decade. As shown in Figure 3.15 and Table 3.13, visitation typically averaged between 2.5 and 3.0 million visitors from the early 1970s to the mid 1980s. During the second half of the 1980s, visitation increased significantly. By the early 1990s, visitation had approached 4 million and increased further to nearly 5 million people by 1993.

While the source of this visitation growth is not precisely known, a variety of factors are often cited as likely generators. The growth and expansion of Las Vegas and its increasing role as a family destination has spurred activity at the park, as has the growth of Phoenix and the Southwest in general. Increased foreign tourism, influenced by periods of weakness of the U.S. dollar, has also affected park visitation and recent press attention of GCNP has increased general public recognition of the park and its attributes.

The increasing visitation trends of recent years have led to a general perception that consistent Grand Canyon visitation growth is the norm. However, this increase has not been constant as seen in Table 3.13. While the overall trend is increasing, visitation has dropped in some years, by more than 23% in 1973 and 1979.

Historical trends show that from 1971 to 1996, visitation has grown an average of 3% annually. Growth rates from 1985 to the present are far greater than for earlier periods, with an annual average of 6.2%. Based on these data, the NPS has estimated that visitation to the park will reach 6.86 million persons by the year 2010, an annual

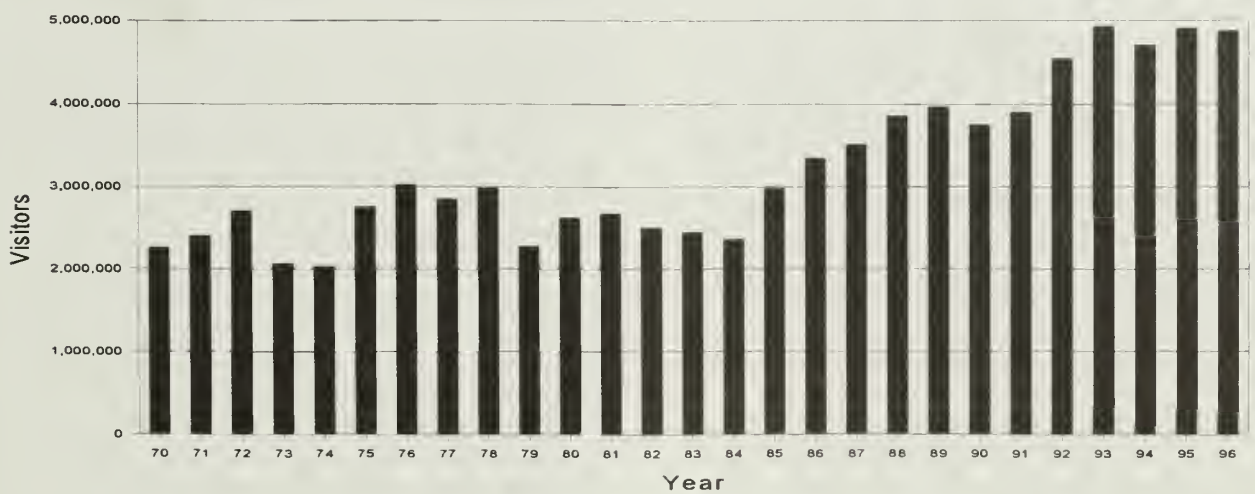


Figure 3.15 Annual Visitation for Grand Canyon National Park

compounded growth rate of 2.5% from 1996 to 2010 (GCNP 1994).

Transportation

The main mode of transportation into the South Rim of the park is by private vehicle through the south entrance. For the south entrance, 1996 data show that 71% of all visitors arrived by private vehicle, 16% by tour bus, 9% by airport shuttle bus, and 4% by train. In addition to visitors using the south entrance to enter the park, many visitors entering through the east entrance leave through the south entrance.

Area Highways

The two primary highways to the South Rim are U.S. Highway 180 and State Highway 64. U.S. Highway 180 connects Flagstaff to Valle, where it joins State Highway 64 heading north from Williams. From Valle to Tusayan, the highway is jointly named U.S. Highway 180/State Highway 64. State Highway 64 continues into the park where it is also known as East Rim Drive. This road then turns east along the South Rim to Desert View and continues for roughly 30 miles until it intersects U.S. Highway 89 near Cameron. U.S. Highway 89 connects Flagstaff to Page, and Interstate 40 extends east and west across northern Arizona, passing through both Flagstaff and Williams. These highways are depicted in Figure 3.9.

Table 3.14 shows the level of traffic and number of accidents on the area highways and the main traffic arteries leading to these highways.

Tusayan Road System

The road system in Tusayan is quite limited. One main artery, State Highway 64 (maintained by ADOT), runs north and south through the Tusayan business district. Other public roads are scarce in Tusayan; Coconino County maintains FR 302 to the county compactor facility through a cooperative agreement, and the Forest Service provides maintenance on other roads under FS jurisdiction. Grand Canyon Airport maintains all roads on airport property, and Canyon Pines Road in the residential area of Tusayan is privately owned and maintained.

Rail Transportation

Amtrak serves Flagstaff, Los Angeles, and Las Vegas, providing regional access to the park. The Grand Canyon Railway operates a vintage steam-powered train between Williams and the South Rim. In 1996, more than 118,000 visitors accessed the park via this train. The Grand Canyon Railway has proposed a spurline to provide service from Tusayan and the airport to the Maswik Transportation Center in Grand Canyon Village. This proposal was analyzed and approved in an EIS in 1993; however, the decision is currently under appeal. This line would provide up to eight trains per day to the park and potentially could carry up to 1,000,000 visitors to the park per year.

Air Transportation

Regionally, commercial air service is available to Tucson, Phoenix, Flagstaff, Kingman, Los Angeles, and Las Vegas. Grand Canyon Airport, operated by ADOT, has a 9,000-foot paved runway that can accommodate commercial passenger activity, including jet aircraft, and is served by approximately 30 commuter airlines. The airport also handles the operations of six air tour companies, representing roughly 20% of the airport's total operations. Grand Canyon Airport currently handles approximately 186,000 aircraft annually, ranging from small private craft to DC-9s. Airport capacity, estimated at 175,000 craft per year, is often exceeded during the peak summer season. In 1996, almost 287,000 people flew into the Grand Canyon Airport to visit the park. A private airport in Valle is also open to the public.

Bus Transportation

Over 70 tour companies provide bus tours to the park, originating in metropolitan areas within and outside of Arizona. In 1996, buses transported over 795,000 visitors to the park. A shuttle service operates between Grand Canyon Airport and Grand Canyon Village, with several stops in Tusayan. Nearly all who arrive at the Grand Canyon Airport use this shuttle; roughly 287,000 passengers rode the shuttle in 1996.

NPS Transportation Systems

Roads

West Rim Drive, Grand Canyon Village roads, East Rim Drive, and Desert View roads are the major routes for vehicular travel on the South Rim. Each of these is described below and is shown in Figure 3.12.

West Rim Drive follows the rim of the Canyon for nearly eight miles between Hermits Rest and the west end of Grand Canyon Village. This scenic drive, the only vehicle route west of the village, is a narrow, two-lane paved road in poor condition. It is closed to private vehicles from April through October to relieve traffic congestion. A free shuttle service travels along the road during this time. East Rim Drive is also State Highway 64, a two-lane paved road that connects the south entrance road to the east entrance near Desert View, a distance of 25 miles. This road follows the rim of the Canyon, with several parking areas at overlooks.

Table 3.13 Annual Visitation for Grand Canyon National Park

Year	Visitors	Percent Change
1970	2,258,195	3.0
1971	2,402,058	6.4
1972	2,707,516	12.7
1973	2,064,300	-23.8
1974	2,028,194	-1.7
1975	2,754,791	35.8
1976	3,026,235	9.9
1977	2,848,419	-5.9
1978	2,984,138	4.8
1979	2,275,712	-23.7
1980	2,618,713	15.1
1981	2,674,117	2.1
1982	2,499,799	-6.5
1983	2,448,545	-2.1
1984	2,360,767	-3.6
1985	2,983,436	26.4
1986	3,347,872	12.2
1987	3,513,084	4.9
1988	3,858,708	9.8
1989	3,968,605	2.8
1990	3,752,901	-5.4
1991	3,905,989	4.1
1992	4,547,027	16.4
1993	4,928,509	8.4
1994	4,702,989	-4.6
1995	4,908,073	4.4
1996	4,877,210	-0.6

The Grand Canyon Village roads are the major vehicle circulation routes in the village. The major access route into the South Rim is the South Entrance Road. Beginning just north of Tusayan at the park's southern boundary, this two-lane paved road extends north into the park for 6.4 miles, providing access to the visitor center and the business center of the village. Village Loop Road, the main circulation artery in the village, becomes a one-way street along the northern half of the loop between Maswik Lodge and the concessionaire's general office. Access to most facilities in the village—lodges, restaurants, the railroad station, and historic portions of the village—is by this loop road, as is access to many of the local village roads leading to employee housing and community facilities. Center Road intersects the Village Loop Road near the NPS operations office at the south entrance. This road is the principal access route to the residential area and other facilities.

Desert View Road intersects with East Rim Drive (State Highway 64). The limited paved roads in the area offer access from the east entrance to an information center, campground, store, housing area, and gas station.

The operation and effectiveness of NPS roads outside of Grand Canyon Village are, for the most part, good. The roads within the Village are very poor because of limited designated parking. When the 2,730 parking spaces within the Village are full, visitors often park along the roadsides, creating traffic congestion.

The proposed action of the GMP encourages alternative modes of travel into the park to relieve traffic congestion. Alternatives include the Grand Canyon Railway from Williams, bus service from outlying communities, and various shuttles from Tusayan and the airport. The proposed spurline of the Grand Canyon Railway from Tusayan into the park would be capable of transporting

Table 3.14 1994 Traffic Statistics of Area Highways to the South Rim of GCNP (JHK 1996)

Roadway	Linking	Traffic Volume (vehicles per day)	No. Accidents (per year)
I-40	Williams and Flagstaff	13,000	360
US Hwy 180	Flagstaff and Valle	1,600	135
State Hwy 64	Williams and Valle	2,450	65
US Hwy 180/State Hwy 64	Valle and Tusayan	4,200	144
State Hwy 64	Inside Grand Canyon	6,000	12
State Hwy 64	Desert View and Cameron	2,150	24
US Hwy 89	Cameron and Flagstaff	5,800	256

approximately 20% of the annual visitors (a maximum of one million) to the South Rim. The GMP also calls for the development of a transportation staging area and transit center north of Tusayan and south of the park boundary. Visitors would park their vehicles at the transportation staging area and board a mass transit system into the park. Transportation staging areas developed in the outlying communities, as proposed in NACOG's regional transportation plan, would also help alleviate the traffic problems in the park.

Development Assurances

As the community of Tusayan is unincorporated, Coconino County is responsible for land use planning and development review of this area. Development on private land in Tusayan is subject to the goals and policies of the Tusayan Area Plan, part of the Coconino County Comprehensive Plan. Other instruments of governance, such as development agreements, are optional.

For future development in the area, the Tusayan Area Plan serves as the official guide. The Plan emphasizes the importance of the needs of the community's residents and states, "The provision of decent, affordable housing for all employees as close as is feasible to the employment centers is the most basic community and resident need. New commercial projects shall provide housing for their employees as they are developed. Existing housing shall be continuously upgraded to improve the overall sense of community."

The Plan also hopes to improve the aesthetic quality of Tusayan through appropriate architectural designs, landscaping, and restricted use of signs to provide a positive visitor experience. A Design Review Overlay Zone has been adopted which contains guidelines to achieve the very high aesthetic quality identified as desirable in the Tusayan Plan. Architectural style, materials and color, and site design including landscaping, signs, and lighting are addressed.

Development on private land in Tusayan is also subject to the provisions of the Coconino County zoning and building codes. All lands in Coconino County that are not within American Indian reservations have a designated zoning classification. Developed areas typically have a variety of zones, including agricultural, residential, commercial, and industrial. Most of the undeveloped remote private lands in the County, including all of the inholdings, are in the general zone, an agricultural-residential zone with a 10-acre minimum parcel size. Most NFS lands, including those around Tusayan, are in the open space zone.

Most development projects, especially in undeveloped areas, require a change of zone and may require other approvals such as subdivision, conditional-use permit, or design review. Zone changes can be approved by the Board of Supervisors only after a public hearing and after having received a recommendation from the Planning and Zoning Commission at an initial hearing. In order to approve a zone change, the Commission and the Board must make certain determinations or findings that are spelled out in the Zoning Ordinance:

- conformance with the County Comprehensive Plan and any special area plans,
- conformance with the zoning ordinance,
- no detrimental impact on public health, safety, and welfare, and
- no unduly negative impact on surrounding properties.

Zone changes may be conditioned on the site plan and specified land uses and on a schedule of development. Certain special purpose zones, such as Planned Community or Planned Residential, may have a large number of other conditions addressing specific requirements of the development.

As with all local regulatory codes, provisions change at the discretion of the County Board of Supervisors unless development is subject to a development agreement between the landowner and Coconino County. A development agreement provides long-term assurances to the developer that the land-use requirements of the agreement will apply during construction and over the life of the project. Conversely, the County, or other governing agency, is provided long-term assurance that the development will be constructed and managed as planned. Presently no existing or proposed development in Tusayan is subject to a development agreement between the landowner and Coconino County.

Cultural Resources

Cultural resources are broadly defined as evidence of human behavior or activities and include prehistoric and historic archaeological sites and traditional cultural properties and resources. Both historic and prehistoric resources reflect cultural traditions beginning with Archaic groups (*ca.* 4000 BC), continuing through the Puebloan and Cohonina peoples (*ca.* AD 500-1200) and the Cerebat tradition (*ca* AD 1300-1700) to present day use by some tribes in the region. Apachean people entered the area sometime after 1600, and historic Anglo-American use of the area began after the 1880s with ranch sites and railroad activities.

Archaeological Sites

Archaeological surveys were conducted on the NFS land and private inholdings involved in this analysis. Four archaeological sites were found on NFS land: a rock shelter, a lithic quarry, a site comprising two masonry alignments, and a lithic scatter/rock shelter. All have been determined eligible for the National Register of Historic Places. On the private inholdings, 102 sites were found. Of these sites, 19 were determined to be historic and 75 prehistoric; eight were thought to have both historic and prehistoric components. Additionally, over 100 isolated occurrences were identified on the NFS land and private inholdings.

American Indian Traditional Cultural Properties and Resources

Although archaeological sites and historic references provide some insight into use by American Indians, only through consultation with appropriate members from each tribe with ancestral claims to the area can both their historic and present day traditional uses of the area be determined. Identification of sacred sites and consultation is governed and/or mandated by the National Historic Preservation Act, as amended in 1992, (16 U.S.C. 470 et seq.), the American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996), and the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.) and Executive Order 13007 of 1996.

The following American Indian tribes are known to have ancestral claims in the area:

- Havasupai
- Hopi
- Hualapai
- Navajo
- Zuni

Havasupai

The Havasupai are one of 14 bands of Yuman-speaking Pai Indians, and one of two tribes still living within Grand Canyon. They share common ancestry and a similar language with the other local Pai tribes, the Hualapai and Yavapai (USDI 1994). Their home in Havasu Canyon lies within their reservation, which includes land on the Coconino Plateau, and to the east and west of Havasu Canyon. According to their creation story, this region is the place where they began, and has always been home to their ancestors (Arizona State Teachers College 1940).

Historically, the Havasupai occupied a territory from the Aubrey Cliffs on the west to the Little Colorado River on the east, and from the Colorado River on the north to the vicinity of Bill Williams Mountain on the south (Spier 1928). As one Havasupai tribal member expressed it, "As you drive on U.S. Highway 180, near the town of Valle, all the mountains you see surround Havasupai territory."

Within these boundaries, the Havasupai traditionally subsisted by hunting, gathering, and farming. Much of the native flora and fauna of the Canyon and the adjacent Coconino Plateau have traditionally been important to the Havasupai for both economic and religious purposes (USDI 1994, Wray 1990).

In the late summer, pinyon nuts were collected. Groups of Havasupai, and sometimes Hopi, Navajo, and Paiute, would gather in the same area to collect the nuts. One favorite Havasupai pinyon camp was located between Moqui Tank and Big Tank. Havasupai camps were also located at cave sites along Coconino Wash and near the present-day locations of Moqui Lodge, Hull Tank, Cecil Dodd Tank, and Homestead Tank. (Cleeland et al. 1992). Since resources on the Plateau were limited during the winter, the Havasupai organized into family, extended family, or band units, returning to areas known to belong to these groups (Wray 1990). Hunting continued through the winter all over the Coconino Plateau, while in the spring, mescal was collected on the benches of the

Canyon (Wray 1990). Other locations of seasonal activities on the Plateau included Rain Tank, Pasture Wash, Drift Fence, and the Little Colorado River.

The Havasupai accessed the Plateau through a series of trails that were constructed long before Anglos first visited the area (Casanova 1967, Wray 1990). Bright Angel Trail, Mystic Springs Trail, and Hermit Basin Trail were originally Havasupai trails, rebuilt by Anglos in the 1890s. The Moqui Trail was a trade route between the Hopi Mesas and Havasu Canyon; it had been almost completely abandoned, however, by 1910 (Wray 1990). One of the trails crosses through the Anita inholding.

Many of the trails that ascended to the Plateau ran to water sources. Rain Tank, now part of Grand Canyon Airport, was a natural perennial water source used by generations of Havasupai for both subsistence camps and as a water stop during long-distance travel. Another route east from Rain Tank passes through Long Jim Canyon near present-day Tusayan, where a traditional Havasupai story tells of an old woman who lived in one of the caves along the limestone walls. Smoke-blackened overhangs suggest that these caves also provided shelter for travelers (Cleeland et al. 1992).

The NFS land and private inholdings contain a variety of medicinal, ceremonial and subsistence plants that have been and continue to be of importance to tribal members. The Curley Wallace inholding is near Red Butte which has traditional and spiritual significance to the Havasupai and is considered by them to be a sacred place. Natural water sources are also sacred places to the Havasupai, as water is the key element in traditional and spiritual life.

Hopi

The Hopi are a northern Uto-Aztecan-speaking people, residing in 11 villages on three mesas along the southern border of the larger Black Mesa in northeastern Arizona. Traditional Hopi homelands are extensive and include all the ancestral lands of the many clans that do and have comprised the tribe. These clans trace their histories from Mexico to the Great Basin country of Utah, and from the Great Plains to the California coast (Northern Arizona University [NAU] and SWCA 1996).

Hopi origin myth begins with the emergence of the people into the Fourth World from *Sipapu*, a travertine cone near Grand Canyon. According to oral traditions, after their emergence, the Hopi people migrated around the Southwest, with the clans eventually coming back together at the center of their universe, the Hopi mesas. During this migration, several of the clans resided at Grand Canyon; Pueblo occupation is documented in the archaeological record (Balsom et al. 1991). Of the 475 cultural resource sites identified by the NPS during its survey of the Canyon bottom, 180 were left by a prehistoric Puebloan people. Hopi oral history holds that these sites were produced by the ancestors (*Hisatsinom* in the Hopi language) of the present-day Hopi people (USDI 1994).

Archaeological evidence shows that the use of Grand Canyon by Pueblo people began around AD 700-800. As their population steadily increased, they began to use all portions of the northern and eastern canyon bottom, as well as both the North and South Rims. By AD 1200, certain groups had migrated from Grand Canyon, moving closer to the Hopi Mesas. Ties to Grand Canyon were not severed, and ritual pilgrimages to the Canyon for salt, minerals, and other resources, as well as visits to shrines, have continued into the present (USDI 1994).

These pilgrimages and other trips to the Grand Canyon region were made via a trail system from the Hopi villages. These trails were well traveled because the Hopi had a long trade relationship with the Havasupai. According to Colton (1964), there were two principal trails from Hopi country to the Havasupai. One originated near Hotevilla, went down the Little Colorado River, and headed up Coconino Basin to Supai. A shorter trail to Supai went down the Denebito Valley to within a few miles of the Little Colorado, headed west crossing the present route of U. S. Highway 89, then continued northwesterly past Moqui Tanks to a point above a spring that feeds Cataract Creek. The trail then continued down the canyon to Supai.

Grand Canyon continues to play a significant role in Hopi culture. Although the Hopi people do not live in Grand Canyon, they continue to use the Canyon's resources and trails to the area for ceremonial purposes. They believe their ancestors all visited Grand Canyon and that their spirits still occupy this area. Various locations in the Canyon are held sacred by the Hopi people and provide "a vast spiritual and physical link between the past, the present, and the future. Given these circumstances, the Hopi continue to be greatly concerned about the physical and spiritual well-being of Grand Canyon and [believe] that disrespectful attitudes and activities there can cause serious spiritual damage" (USDI 1994).

The Hopi consider all archaeological sites of Puebloan origin to be sacred places, and through their traditional teachings, the Hopi have been instructed that it is the Hopi's role is to take care of all such places and lands. The Hopi claim cultural affiliation with Grand Canyon and its surrounding parts. Oral history has documented

Grand Canyon as the "place of emergence" for the Hopi. It is noted that upon this emergence, they were sent on different migratory paths depending upon their instructions. Oral history concludes that the following Hopi clans are known to have migrated through this region: Bow, Greasewood, Fire, Deer, Water, Rabbit, Sand, Rattlesnake, Lizard, Flute, Reed, Spider, and Katcina. In addition to this claim, the Hopi Tribe claims affiliation to the following prehistoric cultures and phases of human habitation: Hisatsinom (Anasazi), Fremont, Mogollon, Sinaguan, Salado, Mimbres, Hohokam, Cohonino, Basketmaker, Archaic, and Paleo-Indian. Evidence for these claims are not only documented in oral history, but are found in the form of petroglyphs, artifacts, and ruins found throughout the region. No Puebloan sites were found on the NFS lands. On the private inholdings, 52 sites with Puebloan cultural affiliation were identified.

Hualapai

The Hualapai people also have a long tradition in the Grand Canyon region. Their creation story centers on the Colorado River region of Grand Canyon, and archaeological evidence indicates that Pai people have occupied portions of northwestern Arizona for over a millennium (Dobyns and Euler 1979). Physical remains of the Cerbat, considered ancestors of the Pai people, date back to at least AD 1300 in the Grand Canyon area. Evidence of earlier use of the region has been documented near Hoover Dam at Willow Beach, where dates of sites may extend back as far as AD 600 and sites with associated ceramics date from AD 700-1890. Hualapai family and tribal records, traditions, and legends, which are held orally and passed from generation to generation, also support this long-term use and occupation (USDI 1994).

Historically, Hualapai traditional homelands include the Colorado River on the north and west, the San Francisco Peaks on the east, and the Bill Williams and Santa Maria rivers on the south. Within this region, the Hualapai lived in groups composed of 14 bands, each band consisting of nuclear and extended families who utilized this vast range for their livelihood (USDI 1994). These 14 bands were divided among three subtribes. The Middle Mountain subtribe included the Red Rock and Cerbat Mountain bands; the Plateau People subtribe included the Clay Springs, Grass Springs, Hackberry, Milkweed Springs, Peach Springs, Pine Springs, and Cataract Canyon (Havasupai) bands; and the Yavapai Fighter subtribe included the Hualapai Mountain, Big Sandy River, Mahone Mountain, and Juniper Mountain bands (Dobyns and Euler 1970, Gilpin 1996). No single band owned the territory, and the people lived in harmony as a group and with nature (USDI 1994).

The Colorado River continues to be important to the Hualapai people both spiritually and physically. They believe the river is the backbone known as "*Ha'yitad.*" The river, Grand Canyon, and the surrounding plateaus also offer the necessary plant and animal resources for the Hualapai to survive and prosper in the region.

Navajo

The Navajo Reservation encompasses a vast area of land, from southern Utah to approximately the latitude of Flagstaff in northeastern Arizona and from northwestern New Mexico to the borders of KNF and GCNP. Ethnographic studies within the Kaibab, Coconino, and Apache-Sitgreaves National Forests include information from Navajo tribal members that the Colorado River, the confluence of the Colorado and the Little Colorado rivers, and Grand Canyon are sacred places to the Navajo. Archaeological surveys of Grand Canyon have revealed historic Navajo sites within the Canyon (NAU and SWCA 1996, Sorrell et al. 1994).

The boundary of the traditional Navajo homeland is defined by four sacred mountains, which are of primary religious and sacred significance and are associated with supernatural beings and the Navajo Holy People. *Dibe Nitsaa* (Hesperus Peak) is located to the north in Colorado's San Juan Range; *Sis Naajinii* (Blanca Peak) is to the east near Alamosa, Colorado; *Tsoo Dsil* (Mount Taylor) is to the east near Grants, New Mexico; and *Dook'o'ooosliid* (San Francisco Peaks) is to the west near Flagstaff (USDI 1994). Today the Navajo Reservation is composed of 52 local governmental units known as chapters that operate much like counties. The two chapters that have been involved in consultation on this project are Cameron and Tuba City.

The Navajo origin stories describe how the first people originated from three earlier underworlds, emerging into this, the fourth world, through a series of events. Water is important in many Navajo ceremonies and oral traditions and is the basis for the origins of many Navajo clans. The Colorado River is a sacred female being to the Navajo and forms a protective boundary on the western border of their lands. Navajo oral traditions and physical places connect Grand Canyon to its tributaries and the land around it. The Little Colorado River is considered by the Navajo to be a sacred male being. The Navajo believe both these rivers provide protection to their people by providing water to them for ceremonies and through the protection their canyons offered the people throughout history. In addition to their water, the canyons contain many other resources that have been traditionally used by the Navajo for ceremonial, medicinal, and utilitarian purposes (USDI 1994).

Archaeological and linguistic evidence suggest that Apachean groups (Athapaskan-speaking ancestors of the modern Navajo and Apache) entered the North American Southwest sometime between AD 1000 and the 1400s. During this time, the Apacheans traded and intermarried with neighboring Puebloan and other groups. Traditional Navajo culture of today is the result of these interactions (USDI 1994).

By sometime in the mid 1800s, Navajos were fully utilizing resources in and around Grand Canyon for farming, livestock operations, plant gathering, hunting, and religious purposes. They also used the area as a refuge from Mexican slave raiders and non-Navajo tribes. During the incarceration of the Navajo at Fort Sumner in the 1860s, many Navajo families took refuge in the Canyon, residing there for several years. The Navajo also found refuge in the Canyon for themselves and their livestock herds during the federal livestock reduction program in the 1940s (USDI 1994).

Traditional Navajo people from neighboring communities continue to use Grand Canyon and surrounding forests in traditional manners as well as for grazing and firewood gathering. Because of the offerings, prayers, and ceremonies which take place in sweatlodges and hogans, the Navajo consider them be sacred places, even if little remains of the original structure. No sites with Navajo cultural affiliation were identified on the NFS lands. On the private inholdings, three sweat lodges were identifed.

Zuni

The Zuni reservation is in western New Mexico and eastern Arizona, with the population and cultural center at Zuni Pueblo approximately 45 miles south of Gallup, New Mexico. The traditional homeland of the Zuni, however, encompasses an area that is bordered by the Sandia Mountains near Albuquerque, New Mexico, on the east; the Abajo Mountains in Utah and Colorado on the north; Grand Canyon and San Francisco Peaks in Arizona on the north and northwest; and the Mogollon, Gallo, and Tularosa mountains in New Mexico on the south (NAU and SWCA 1996).

Zuni oral history relates how the Zuni people were created in the "fourth world" or "womb" and were led by immortal gods through a succession of wombs before emerging onto the surface of Mother Earth into the light of this world (NAU and SWCA 1996). This emergence is said to have occurred at the bottom of Grand Canyon and from the moment that the Zunis arrived on the surface of the earth, Grand Canyon and the Colorado River have been sacred. After emergence, the Zunis began their search for the center of the world, the Middle Place. They moved up the Colorado River and the Little Colorado River, stopping and settling for a time at locations along the rivers; their petroglyph symbols and abandoned pueblos along their migration route are still evident to the Zuni today. After a long search, the Zunis located the Middle Place and settled there at the present-day Zuni (NAU and SWCA 1996, USDI 1994).

The Zuni consider their homeland to be all the places their ancestors have lived. Various locations in the Grand Canyon area are important to Zuni traditional and cultural values, providing important spiritual linkages to what they consider their place of emergence (USDI 1994). The Zunis traditionally have gathered various materials from Grand Canyon, and Zuni prayers mention over thirty springs between the place of emergence and Zuni Pueblo. Important trade relationships also existed with the Hualapai and Havasupai Indians, and these relationships were maintained through a series of trails that went out of Zuni like the hub of a wheel. Two of theses trails led to the Hopi villages and then to Grand Canyon, continuing farther down the Colorado River to the lands of the Havasupai and other tribes (Ferguson and Hart 1985). Trails used by the Zunis also hold religious importance and are cared for through blessings and prayers. Such a blessing is permanent and the Zuni people are, therefore, concerned about an ancient trail that leads from Zuni Pueblo to the bottom of Grand Canyon (USDI 1994).

Biological Resources

The plant and animal species occurring in the project area are discussed below, including threatened, endangered, and sensitive species.

Vegetation

Plant communities in northern Arizona reflect influences of climate, topography, soil, and elevation (Carothers and Brown 1991). The affected areas on the Tusayan Ranger District consist predominantly of pinyon-juniper woodland, ponderosa pine forest, and interspersed grassland and sagebrush habitat. The vegetation types found on the Tusayan Ranger District are shown in Figure 3.16 and are described below (KNF 1988).

Pinyon-juniper Woodland

Pinyon-juniper woodland comprises about 180,000 acres on the Tusayan Ranger District and is characterized by Utah and one-seed juniper; pinyon pine; and interspersed grass and shrub species. This habitat type occurs on most of the private inholdings, including Kotzin, Apex, Babbitt Tank, Willows Camp, East Harbison, Trash Dam, Lower Basin, and Anita Station.

Figure 3.16 Vegetation Types on the Tusayan Ranger Distr

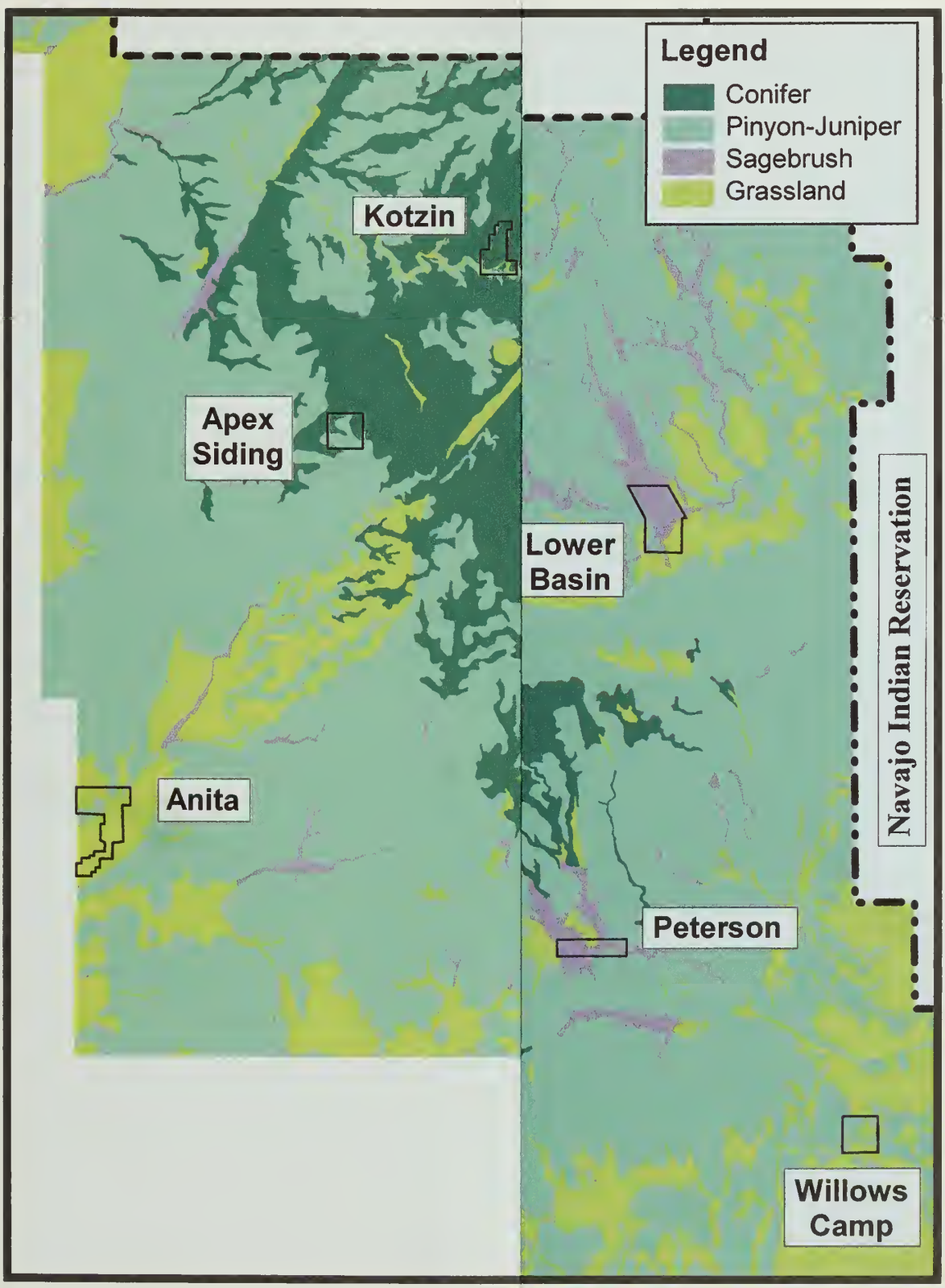
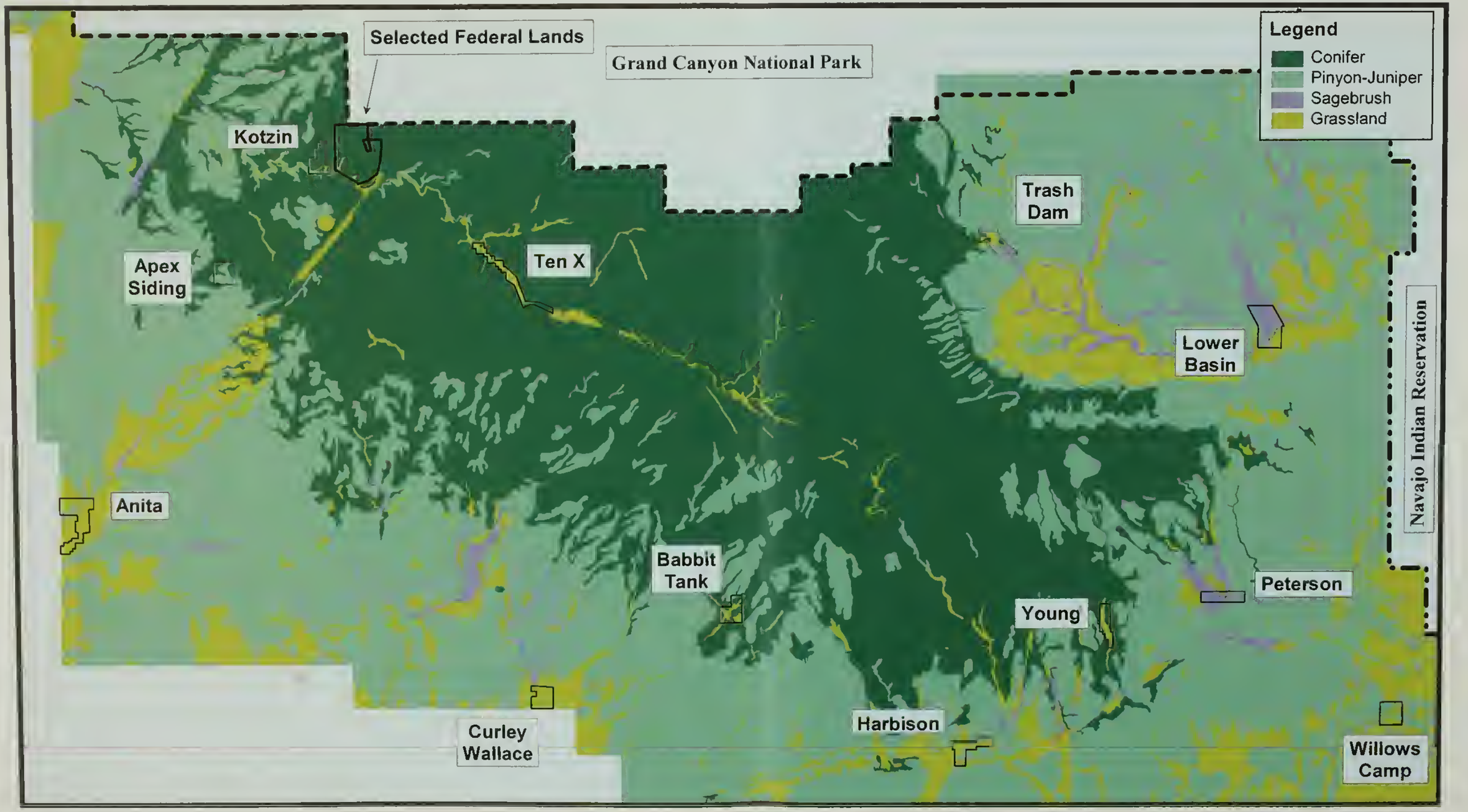


Figure 3.16 Vegetation Types on the Tusayan Ranger District



Ponderosa Pine Forest

Ponderosa pine forest covers about 102,000 acres on the Tusayan Ranger District. Ponderosa pine is the dominant tree species with Gambel's oak typically comprising less than 10% of the canopy cover. Ponderosa pine habitat occurs primarily on the NFS land and the Kotzin and TenX private inholdings. Scattered ponderosa pines also occur on the Apex, Babbitt Tank, Trash Dam, and Young private inholdings, but they do not comprise the dominant woody species there.

Grassland

Grassland comprises about 43,000 acres on the Tusayan Ranger District and includes mutton bluegrass, western wheatgrass, squirreltail, and blue grama. The Young private inholding is composed primarily of grassland habitat. Grasses also occur in open areas in pinyon-juniper woodland, ponderosa pine, and sagebrush habitats and are therefore found to some degree throughout the NFS land and on all of the private inholdings.

Sagebrush

About 7,000 acres on the Tusayan Ranger District are dominated by sagebrush and rabbitbrush with interspersed grasses and forbs. This vegetation type is predominant on the Lower Basin, Trash Dam, and Peterson inholdings, but also occurs in washes and floodplain areas on most of the other private inholdings and the NFS land.

Wildlife

The Tusayan Ranger District lies within the Arizona Game and Fish Department's (AGFD) Game Management Unit 9. Habitat within this unit has a lower carrying capacity compared to other management units in northern Arizona because of low availability of permanent surface water. The only perennial water source on the Tusayan Ranger District is Lockett Lake, approximately three miles southwest of the Trash Dam private inholding. Russell Tank, although not truly perennial, is a mostly reliable source of water approximately five miles south of the Trash Dam inholding. Other water sources for wildlife on the Tusayan Ranger District include 28 trick tanks (tanks provided by AGFD) and 136 ephemeral stock tanks, seventeen of them on the private inholdings involved in the land exchange alternatives (Table 3.15). The NFS land involved in all of the alternatives has neither ephemeral stock tanks nor permanent surface water.

Table 3.15 Ephemeral Stock Tanks on the Private Inholdings

Private Inholding	Number of stock tanks
Anita Station	2
Apex	0
Babbitt	1
Curley Wallace	1
East Harbison	2
Kotzin	0
Lower Basin	4
Peterson	1
TenX	2
Trash Dam	2
Young	1
Willows	1
Total	*17*

No special wildlife use areas, such as movement corridors or areas important for breeding, have been identified in the vicinity of the NFS land. Elk and antelope calving areas have been identified on the southern portion of the TenX inholding, and a deer fawning area has been identified adjacent to TenX. Wildlife found on the Tusayan Ranger District can generally be tied to vegetation type, although a number of species use more than one habitat type. Figures 3.17- 3.19 illustrate habitat for elk, deer, antelope, and turkey.

Pinyon-juniper woodland provides year-round habitat for the gray fox, coyote, porcupine, rock squirrel, black-tailed jackrabbit, pinyon mouse, woodrat, great horned owl, plain titmouse, bushtit, and hairy woodpecker. In winter, pinyon-juniper habitats are used by antelope, mule deer, elk, and birds, including the American robin, western bluebird, pinyon jay, and Townsend's solitaire. Common breeding birds include the black-throated gray warbler and the gray flycatcher.

Ponderosa pine forest is important summer habitat for deer, elk, and turkey. It also provides year-round habitat for other mammals, including the Abert's squirrel, chipmunk, skunk, porcupine, and birds such as the acorn woodpecker, white-breasted and pygmy nuthatch, and mountain chickadee. Common breeding birds include the solitary vireo, black-headed grosbeak, and Grace's warbler.

Grasslands provide important habitat for antelope, coyote, and several smaller rodents and insectivorous mammals. Common resident birds include the western meadowlark, horned lark, vesper sparrow, and common raven. Open grassland areas within forest or woodland habitats provide important foraging areas for elk and, to some extent, deer.

Sagebrush habitats are used by coyotes, mule deer, black-tailed jackrabbits, various small mammals, and breeding birds such as chipping and Brewer's sparrows and common poorwills.

Threatened, Endangered, and Sensitive Species

Federally Listed Species

Two Federally listed species are known to occur on the Tusayan Ranger District. The endangered bald eagle occurs locally and sporadically in winter months, most often along major roadways where it feeds on roadkill. Bald eagles are not known to breed on the Tusayan Ranger District, and no winter roost sites have been found on the involved private or NFS lands. Peregrine falcons nest in Grand Canyon and are occasionally seen foraging in forest and woodland habitats near the Canyon rim. No nest sites have been found, and no suitable nesting habitat occurs on either the NFS land or the private inholdings.

Federal Candidate Species

One Federal Candidate plant species, the Arizona leatherflower, occurs on the Tusayan Ranger District. This plant typically grows in small colonies on soils derived from Kaibab Limestone, at an elevation of 6,700 to 6,800 feet. This species has been recorded regionally in only three widely separated areas in Coconino County: from Flagstaff south to Lower Lake Mary, in the Volunteer Canyon area, and east of Tusayan. East of Tusayan, on the Tusayan Ranger District, Arizona leatherflower is known from two locations: on NFS land near the TenX private inholding and along FR 302 (which runs adjacent to and partially within the TenX private inholding). The first location—on NFS land near the TenX inholding— has two populations, totaling about 300 plants. At the second location—along FR 302—two small populations of 23 plants and 16 plants occur on or near the TenX private inholding, and a third population of three plants occurs just west of FR 302 on NFS land (A. M. Phillips, Ph.D., personal communication 1997) .

Forest Service Sensitive Species

Two KNF Sensitive plant species (Tusayan flameflower and disturbed rabbitbrush) are known to occur on the Tusayan Ranger District. One Sensitive wildlife species (northern goshawk) is also known to occur, and two others (flammulated owl and Navajo Mountain Mexican vole) may occur at least seasonally or occasionally.

The Tusayan flameflower grows in gravelly, shallow soils in shallow depressions in open ponderosa pine forest and pinyon-juniper habitats, typically at an elevation between 5,600 and 6,500 feet. This species has been recorded in four widely separated areas in Yavapai and Coconino counties, one of which is in the Tusayan Ranger District. Surveys conducted from 1990 to 1992 and in 1995 have found about 130 populations, totaling over 15,000 plants, on the Tusayan Ranger District. Populations of various sizes exist north and west of Tusayan. Three populations of Tusayan flameflower, totaling about 100 individual plants, are known to occur on the TenX private inholding. Ten populations of Tusayan flameflower, totaling about 370 individuals, are known to occur on the Kotzin private inholding. The NFS land involved in this analysis has nine populations, totaling about 152 plants.

Disturbed rabbitbrush occurs between 5,900 and 6,900 feet in elevation, in pinyon-juniper woodland and associated grass/shrubland with calcareous deposits, and frequently in alluvial drainage systems. Populations of this plant are known to occur on the Curley Wallace private inholding, but the number of individuals is not known. One plant was also found south of Grand Canyon Airport, but the northern extent of this species' distribution generally occurs in the southern part of the Tusayan Ranger District (A. M. Phillips, Ph.D., personal communication 1997).

The northern goshawk occurs locally in coniferous forests of the mountains and high mesas in the northeastern half of Arizona (AGFD 1988) and nests primarily in mixed-conifer and ponderosa pine forest. Northern goshawks also have been known to nest in areas transitional to pinyon-juniper woodland at lower elevations. No goshawks were recorded on the involved NFS land during surveys conducted in 1995. One goshawk was documented near the TenX private inholding during the 1995 surveys. Goshawks have also been sighted south of Grand Canyon Airport and near the Curley Wallace private inholding; no nesting habitat exists on the Curley Wallace inholding.

The flammulated owl is a small, migratory owl that nests in snags in forest habitats throughout western North America. It occurs primarily in mature ponderosa pine forest but also nests in habitats transitional to pinyon-juniper woodland at lower elevations and in mixed-conifer forest at higher elevations. Possible habitat for this species occurs on the NFS land and on the Kotzin and

Figure 3.17 Elk Calving and Antelope Fawning Areas

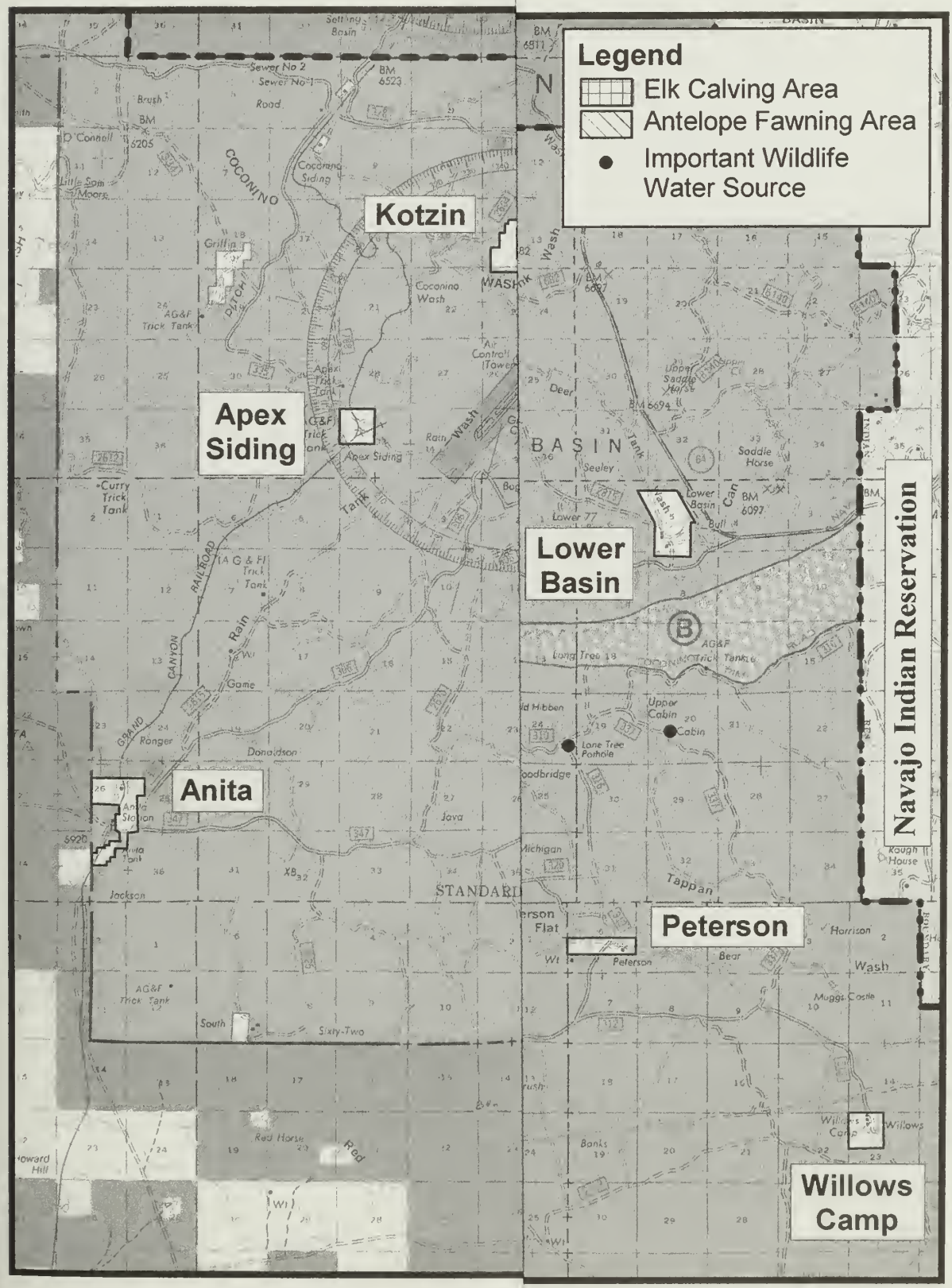


Figure 3.17 Elk Calving and Antelope Fawning Areas

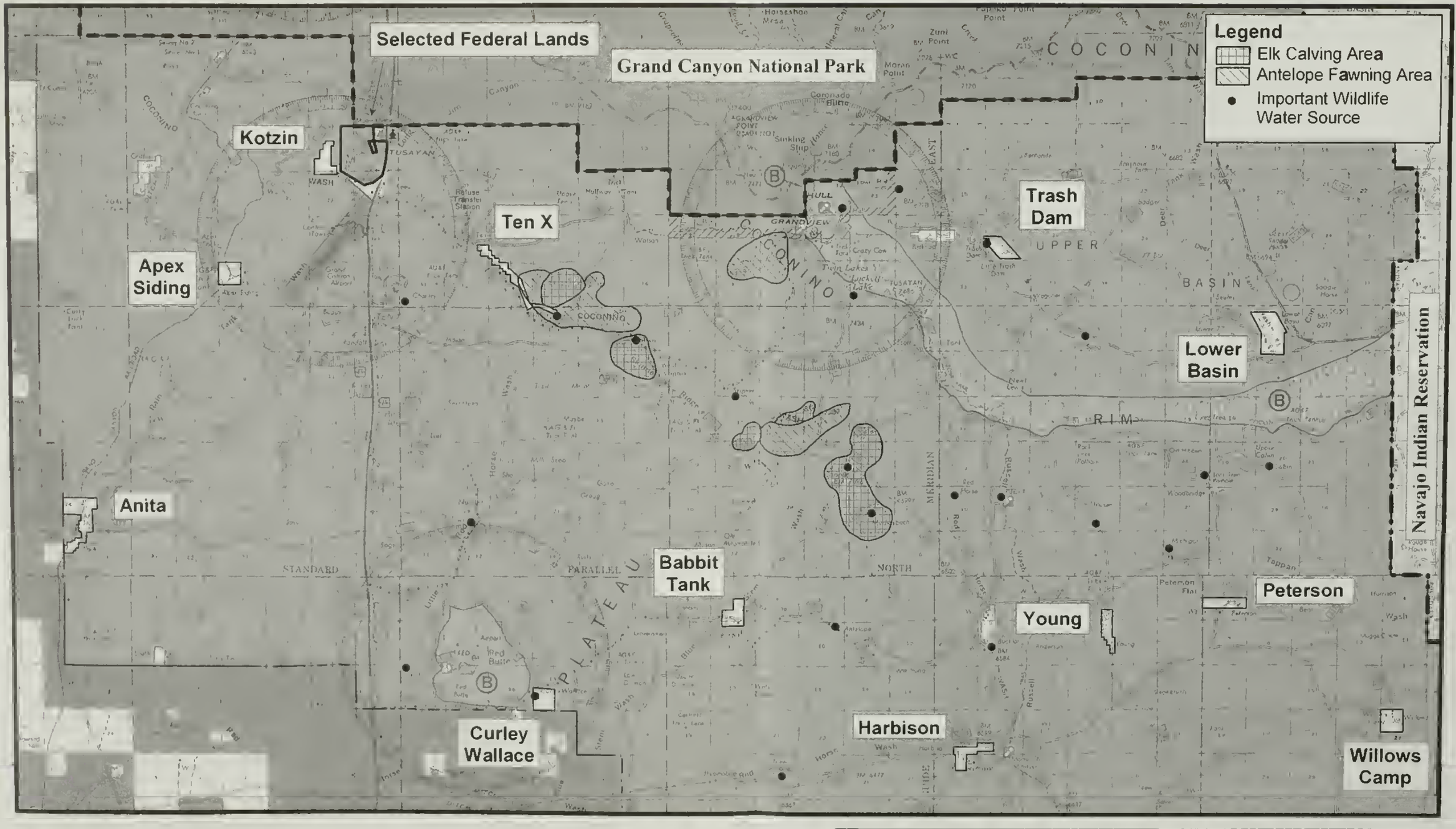


Figure 3.18 Deer Fawning Areas

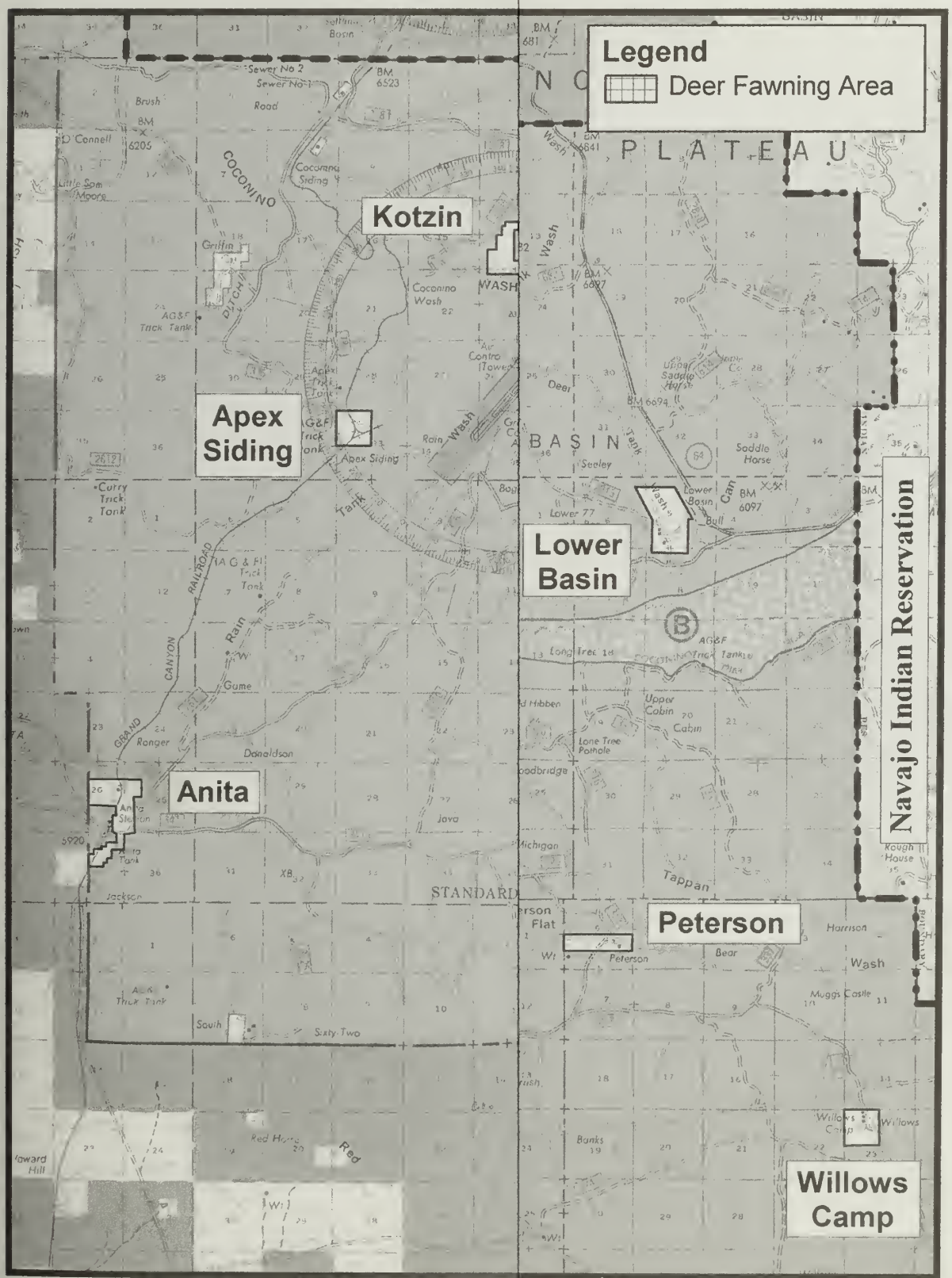


Figure 3.18 Deer Fawning Areas

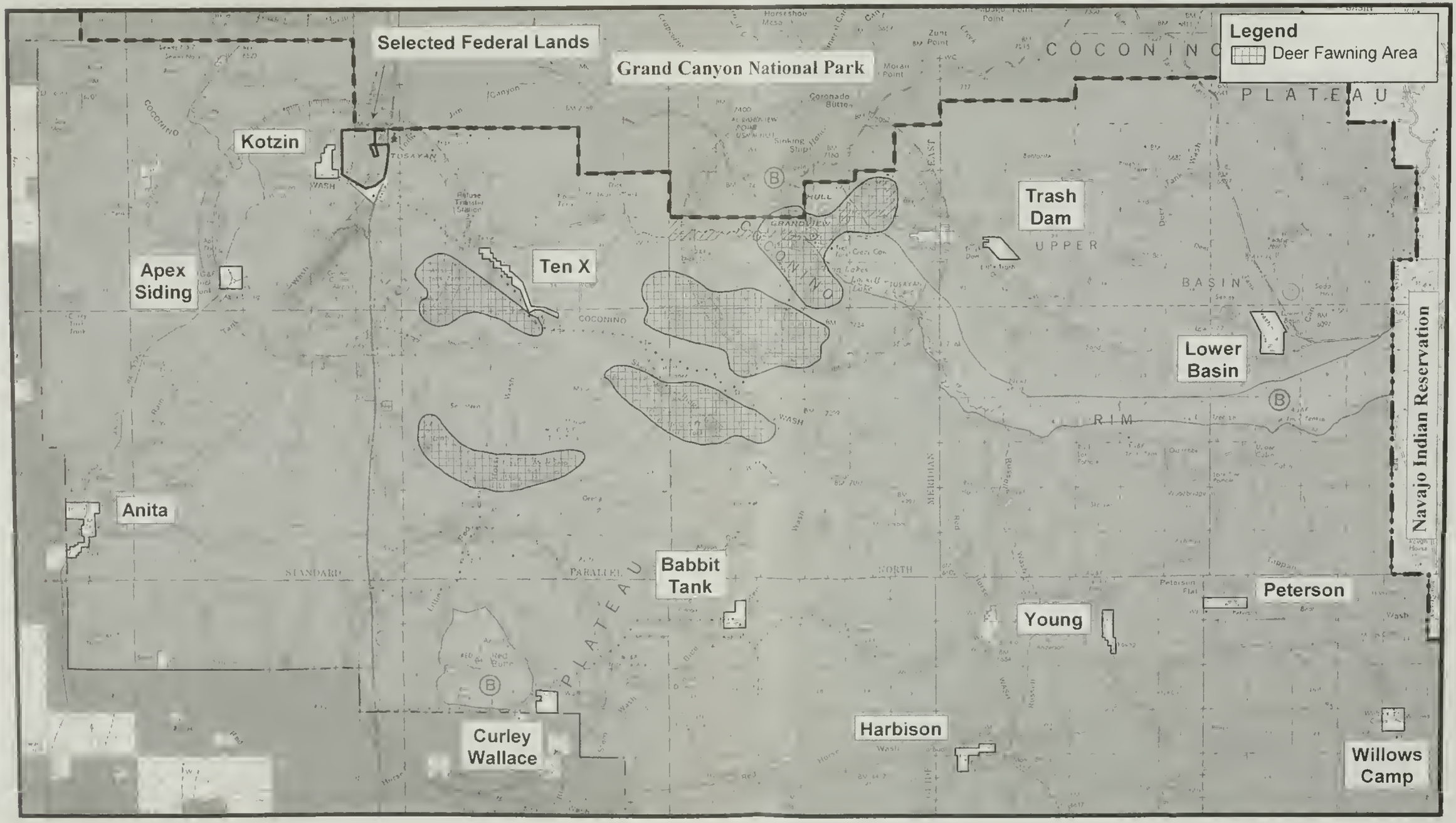


Figure 3.19 Turkey Habitat

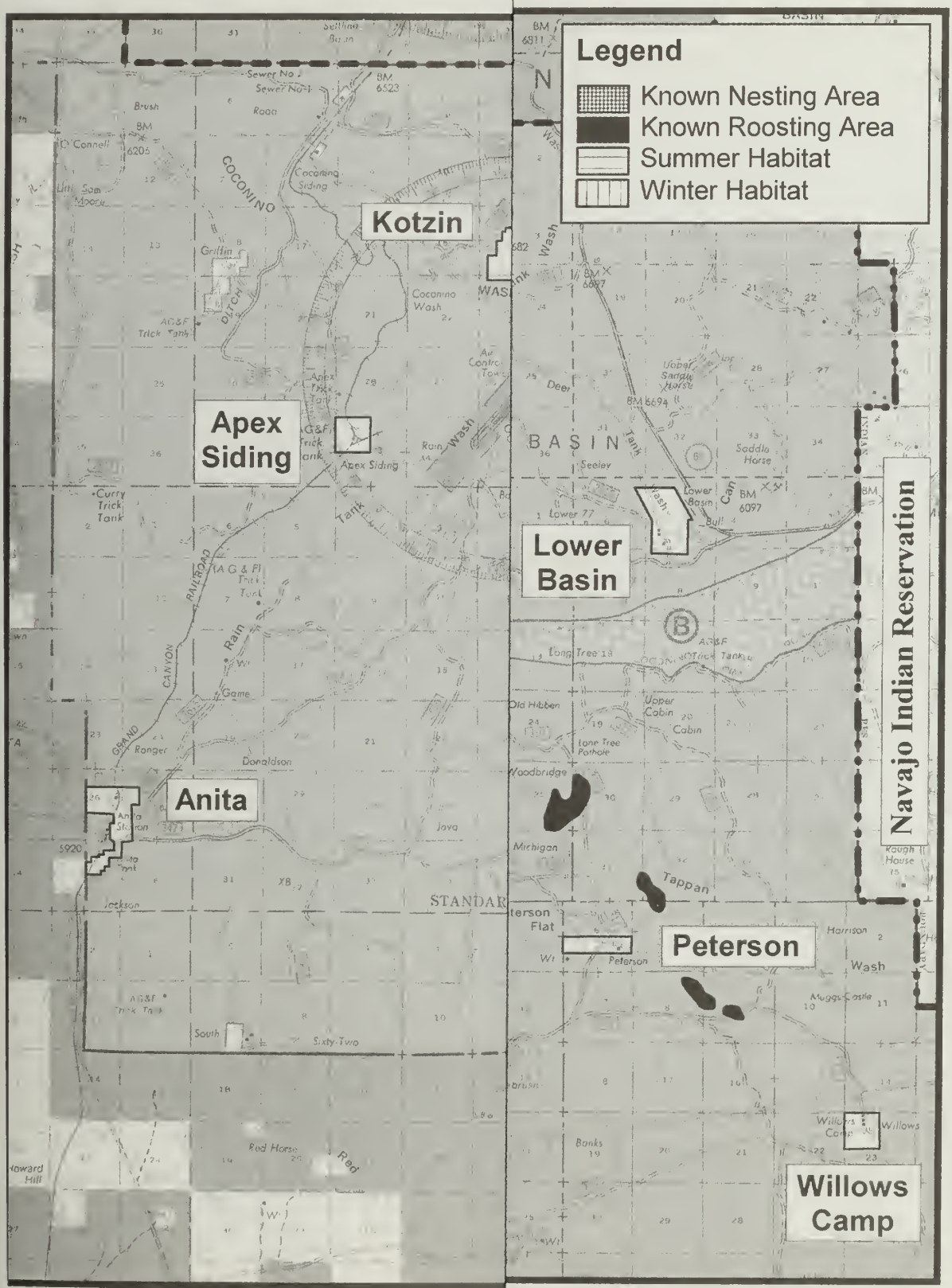
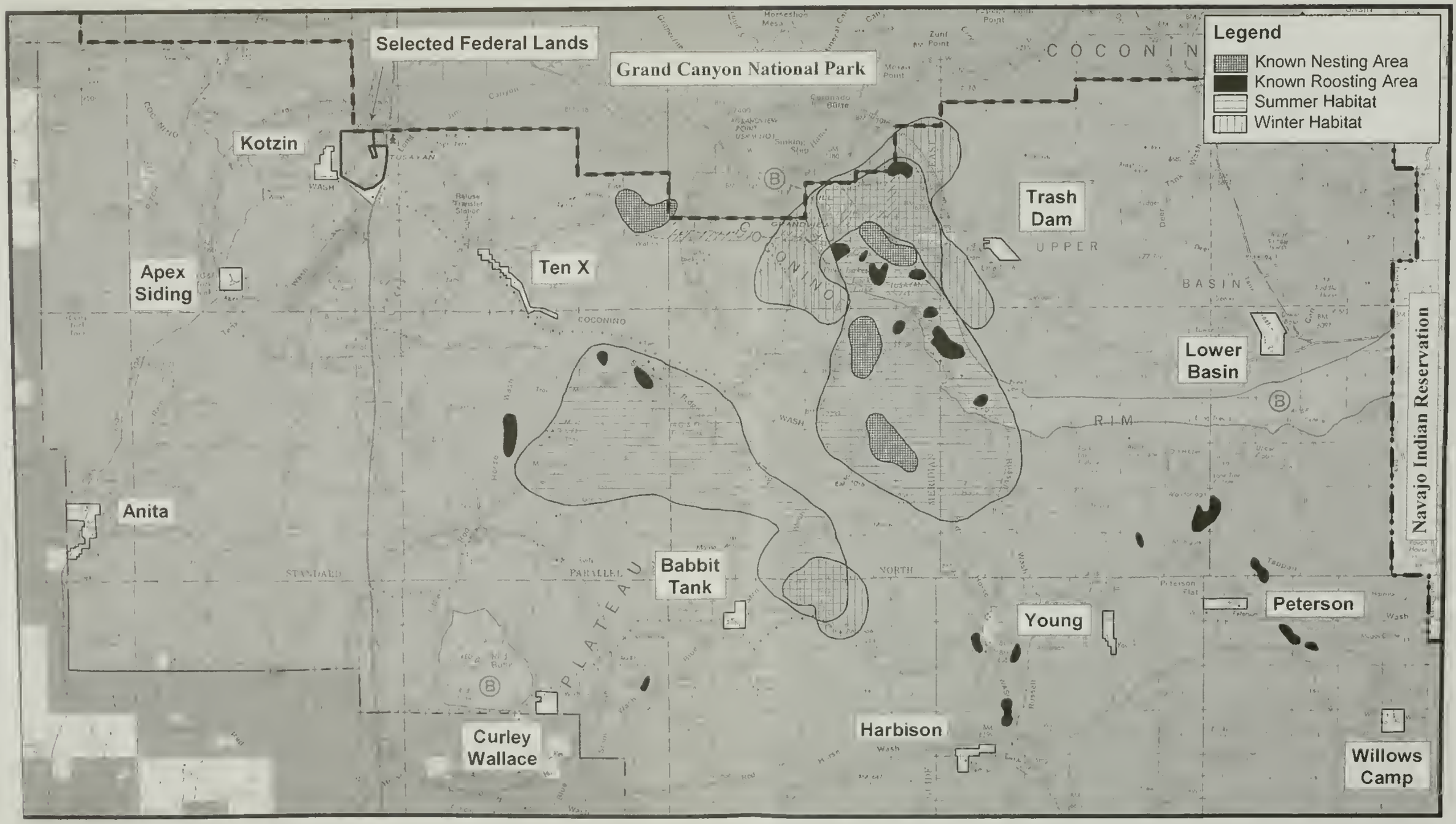


Figure 3.19 Turkey Habitat



TenX private inholdings, although there have been no documented sightings or records of flammulated owls at these locations.

The Navajo Mountain Mexican vole occurs in dry, grassy habitats associated with ponderosa pine but has also been found in grassy areas near juniper, sagebrush, and spruce-fir habitats. A number of records of this species exist within GCNP, including Long Jim Canyon and Pasture Wash, where it was found in sagebrush habitats. Potential habitat for this species occurs on the NFS land and on all of private inholdings, but there have been no documented sightings or records of this species in these areas.

Forest Service Management

Forest Service Management Objectives

The KNF has a stated mission to "manage NFS land and resources using the best methods available to meet the needs and desires of present and future generations, while protecting and enhancing the environment and efficiently administering Forest programs" (KNF 1988). The goals and objectives of the KNF are to manage the available resources on a multiple-use and sustainable-yield basis, while protecting nonrenewable resources and the environment. Land management objectives on the Tusayan Ranger District relate primarily to livestock use, wildlife resources, soil and water resources, and special land uses.

Livestock

The KNF manages livestock grazing to produce the maximum amount of forage, consistent with other resource values, for use by wildlife and livestock on a sustained-yield basis. The Forest Service seeks to cooperate with owners of private inholdings within the Tusayan Ranger District to develop coordinated range management systems for livestock grazing where lands of other ownership are intermingled or adjacent to NFS land.

The Tusayan Ranger District is divided into four livestock grazing allotments: Rain Tank, Anita, Cameron, and Moqui (Figure 3.20). Most of the twelve private inholdings involved in this analysis are used for livestock grazing, and associated structures such as corrals and water tanks are found on these inholdings.

The Cameron allotment, on the east side of the Tusayan Ranger District, is the largest of the four allotments, permitting 1,200 yearlings. Four private inholdings are within the boundaries of this allotment: Trash Dam, Lower Basin, Babbitt Tank, and Willows.

The Anita allotment, on the west side of the Tusayan Ranger District, is the next largest, permitting 666 yearlings. Three private inholdings are within the boundaries of this allotment: Anita, TenX, and Curley Wallace.

The Moqui allotment follows the Anita in size, permitting 570 yearlings. This allotment is on the east side of the Tusayan Ranger District, and three private inholdings are within its boundaries: Peterson, Young, and East Harbison.

The Rain Tank allotment is permitted 470 adults. This allotment includes the NFS land considered in this analysis and two private inholdings, Kotzin and Apex Siding.

Wildlife

The KNF has developed a set of management goals for wildlife that center around improving wildlife habitat (including that of threatened, endangered, and sensitive species). Steps to accomplish these goals include increasing knowledge of species requirements, cooperating with AGFD to achieve shared management responsibilities, identifying areas that contain threatened or endangered species so that these areas can be protected, and expanding agency, conservationist, and public understanding of the importance of wildlife management. The types of wildlife species and their habitats found on the Tusayan Ranger District were discussed previously.

Soil and Water

Management goals in the KNF Plan for soil and water include maintaining soil productivity and watershed conditions, rehabilitating nonproductive land on a planned basis to eliminate unsatisfactory watershed conditions by the year 2020, maintaining a high-quality sustained water yield for Forest users and others, and identifying wetlands and floodplains for protection.

Special Land Uses

Special use permits are issued to individuals, organizations, or companies under established laws and regulations for occupancy or use of NFS land for private and commercial purposes. Special use permits in the Tusayan area include those for Moqui Lodge, Apache Stables, and utility lines and associated rights-of-way. The Moqui Lodge is located on 80 acres of NFS land and is under a 40-year special use permit, which comes up for renewal in five years. A listing of special use permits related to utility corridors that have been granted for NFS land involved in this analysis is provided in Table 3.16.

Table 3.16 Utility Corridor Special Use Permits on NFS Land Involved in this Analysis

Permittee	Facility	Legal Location
Arizona Public Service	40-foot powerline right-of-way	N½ of N½ of Section 13, E½ of Section 14, E½ of NE¼ of Section 23, N½ of Section 24 (T30N, R2E).
Mountain States Telephone and Telegraph	40-foot telephone right-of-way	N½ of N½ of Section 13, E½ of Section 14, NE½ of NE¼ of Section 23, N½ of Section 24 (T30N, R2E).
Fred Harvey	12-inch water transmission line	N½ of Section 13 (T30N, R2E).
Indevideo	water tank and overhead and underground cable lines	NE¼ of NW¼ of NW¼ of Section 13, N½ of Section 24 (T30N, R2E).
South Grand Canyon Hospitality Corporation	sewer and water lines	NW¼ of Section 24 (T30N, R2E).

Property Boundary Management

The KNF conducts boundary surveys to determine the location of land lines and property boundaries, and maintains monuments, accessories, boundary lines, and survey records. Table 3.17 summarizes the approximate number of miles and property corners associated with the private inholdings.

Table 3.17 Number of Miles of Land Line and Property Corners on the Private Inholdings

Private Inholding	Approx. miles of land line	Number of Property Corners
TenX	6	35
Lower Basin	3	6
Curley Wallace	4	2
Trash Dam	2.5	6
Willows	2	4
Babbitt	2.5	6
Kotzin	3	14
Anita	5	28
East Harbison	3	10
Young	3	12
Peterson	1.5	4
Apex Siding	2	4
Total	*37.5*	*131*

Public Recreational Opportunities

Recreational use on the Tusayan Ranger District is rated moderate. Dispersed recreational activities involve hunting, camping, and sightseeing and are concentrated in close proximity to State Highway 64 (KNF 1987). Other recreational activities include hiking, cross-country skiing, horseback riding, mountain biking, and off-road vehicle use.

Developed recreational sites on the Tusayan Ranger District are limited to the TenX Campground and Moqui Lodge. The TenX Campground is operated by the KNF and has 70 sites. Use of this site in 1995 totaled 90,000 recreation visitor days. For the past nine years, the campground has operated at an average campsite capacity of roughly 89%. Moqui Lodge is privately operated under a special use permit issued by the KNF and has a capacity of 480 rooms. A blended average of the occupancy rate for Grand Canyon Lodges, including Moqui Lodge, is 78%. In addition to the developed sites listed above, the KNF maintains limited picnic facilities along State Highway 64.

Figure 3.20 Grazing Allotments of the Tusayan Ranger District

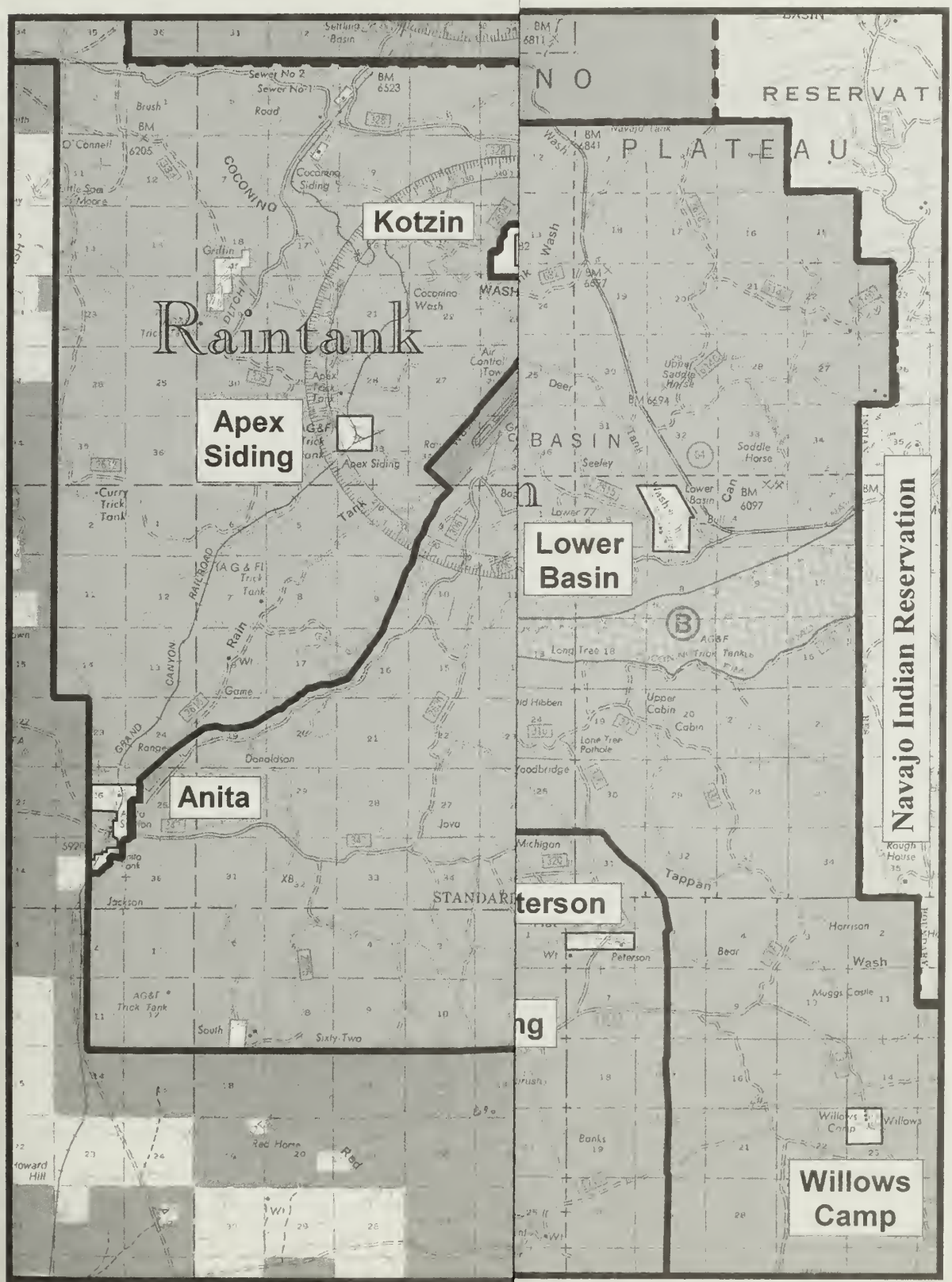
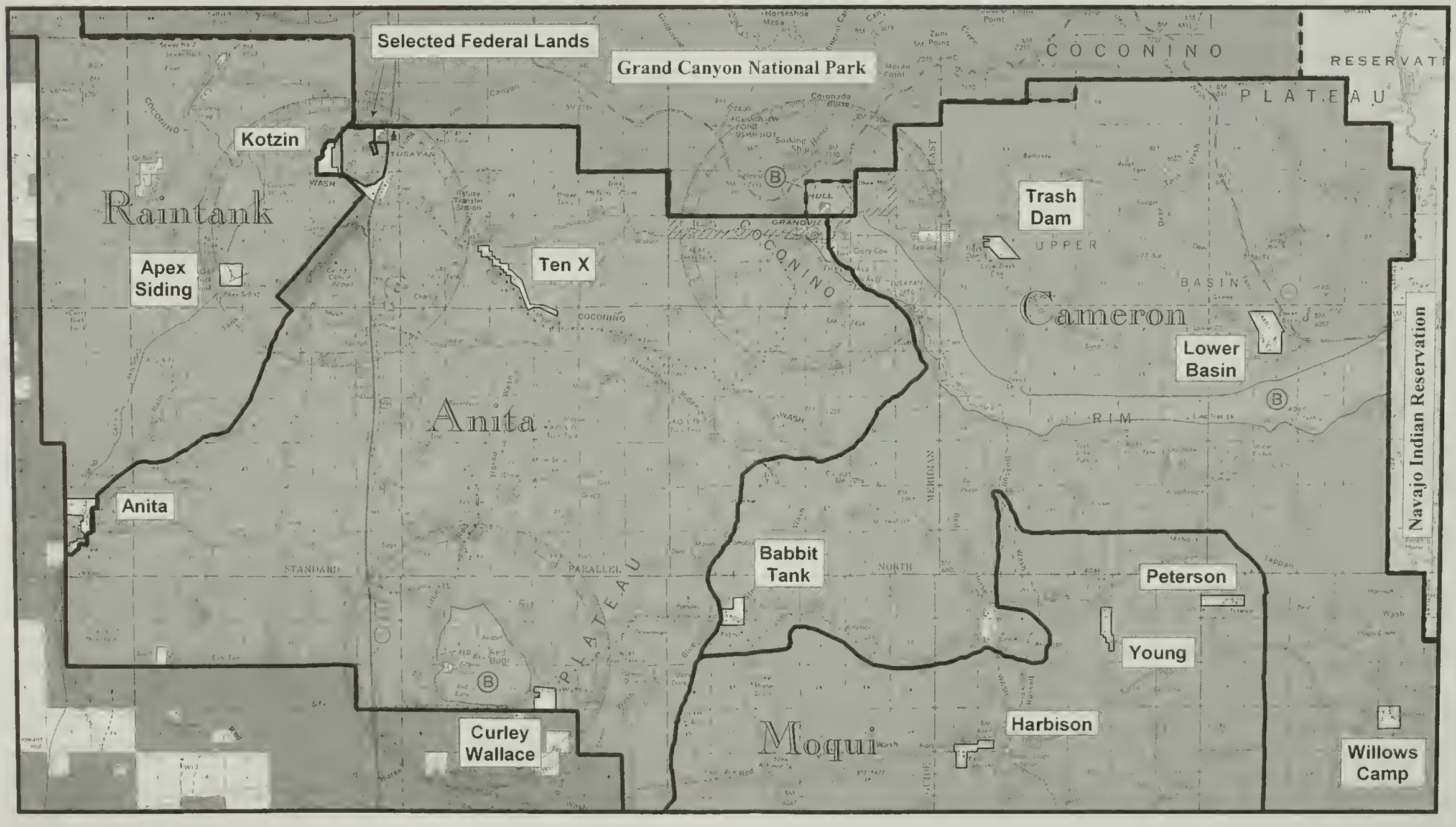


Figure 3.20 Grazing Allotments of the Tusayan Ranger District



The predominant recreational opportunity spectrum (ROS) classification for these areas is roaded natural area (RNA) and semi-primitive motorized (SPM), as seen in Table 3.18. RNA is characterized by a predominantly natural environment with evidence of moderate permanent resource use. Evidence of sights and sounds of people is moderate but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from people. SPM is characterized by moderately dominant alterations by people, with strong evidence of primitive roads and/or trails.

Table 3.18 ROS Designations of NFS Lands Involved in this Analysis and of NFS Land Surrounding Private Inholdings

Parcel Name	ROS Classification*
TenX	RNA
Lower Basin	RNA
Curley Wallace	RNA
Trash Dam	RNA
Willows	SPM
Babbitt	RNA
Kotzin	RNA
Anita	RNA
East Harbison	RNA
Young	RNA
Peterson	RNA
Apex Siding	RNA
NFS Land Proposed for Development	RNA

*current designation of NFS lands surrounding the private inholding

Fire Management Programs

Fire management objectives on the Tusayan Ranger District emphasize cost-effective fire suppression techniques and limiting fuel treatment, such as controlled burning to maintain firebreaks, to areas with wildland/urban interfaces (KNF 1988). Providing fire protection to restrict wildfire size to 200 acres is a management goal in the Forest Plan. The Tusayan Ranger District has proposed two prescribed burn programs near Tusayan (Figure 3.21). The first prescribed burn program includes over 50 square miles, mostly south and west of Grand Canyon Airport. A small portion of the program is northwest of the airport. Two private inholdings are included in this prescribed burn program, Anita and Apex Siding. The second prescribed burn program includes about 12 square miles and is located east of State Highway 64 and the Tusayan Ranger District office. The TenX private inholding is just south of this prescribed burn program, and the Kotzin private inholding is about 1 mile to the west.

The Tusayan Ranger District conducts various fire management activities in wildland/urban interfaces in the Tusayan area and along the park and the KNF boundary. Activities include thinning, piling, and burning in a 660-foot to 990-foot buffer. Estimated cost for this activity is approximately $150 per acre. Funding and personnel are limiting factors in the amount of wildland/urban interfaces that are treated.

Figure 3.21 Proposed Prescribed Burns on the Tusayan Ranger District near Tusayan

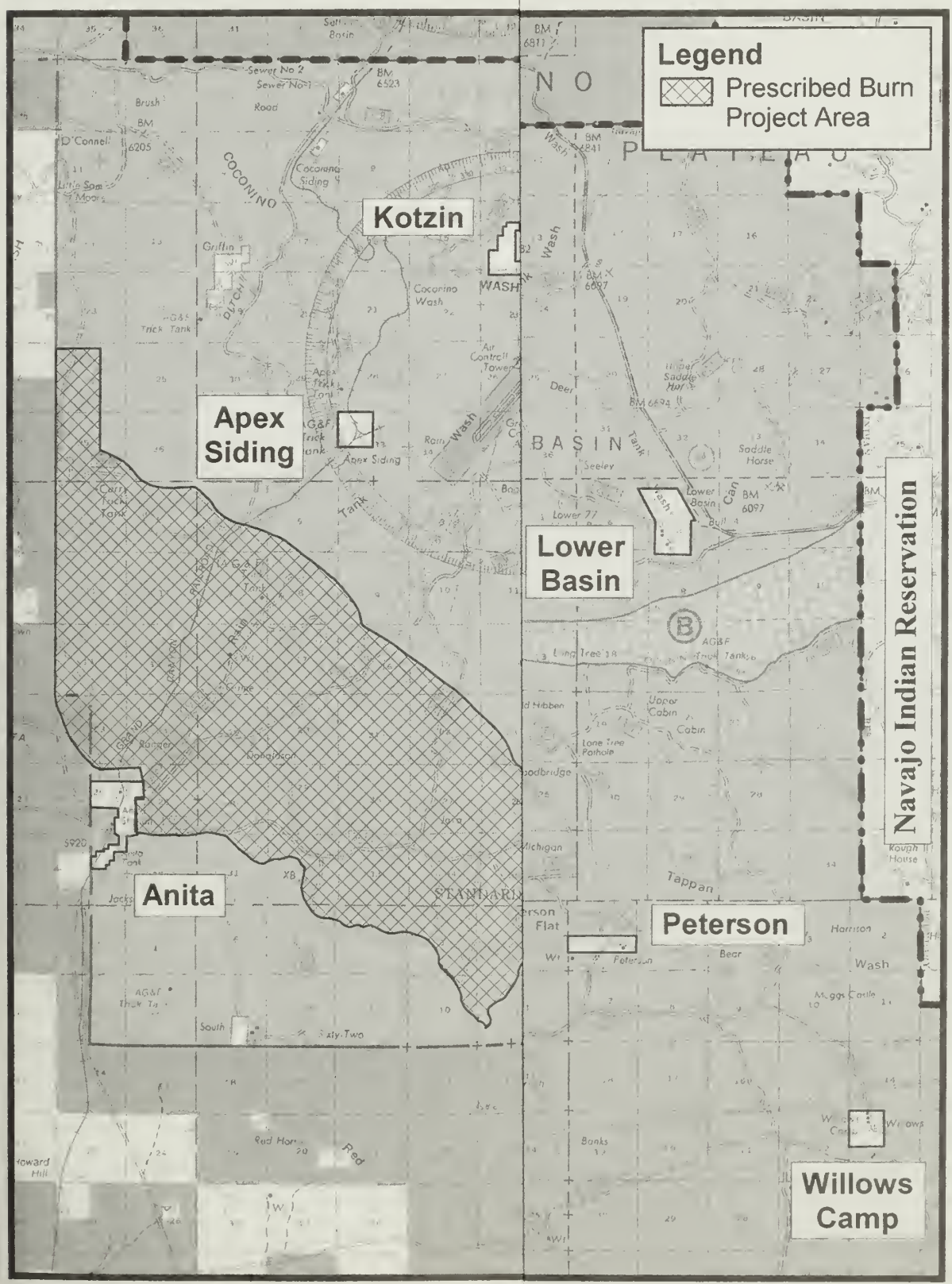
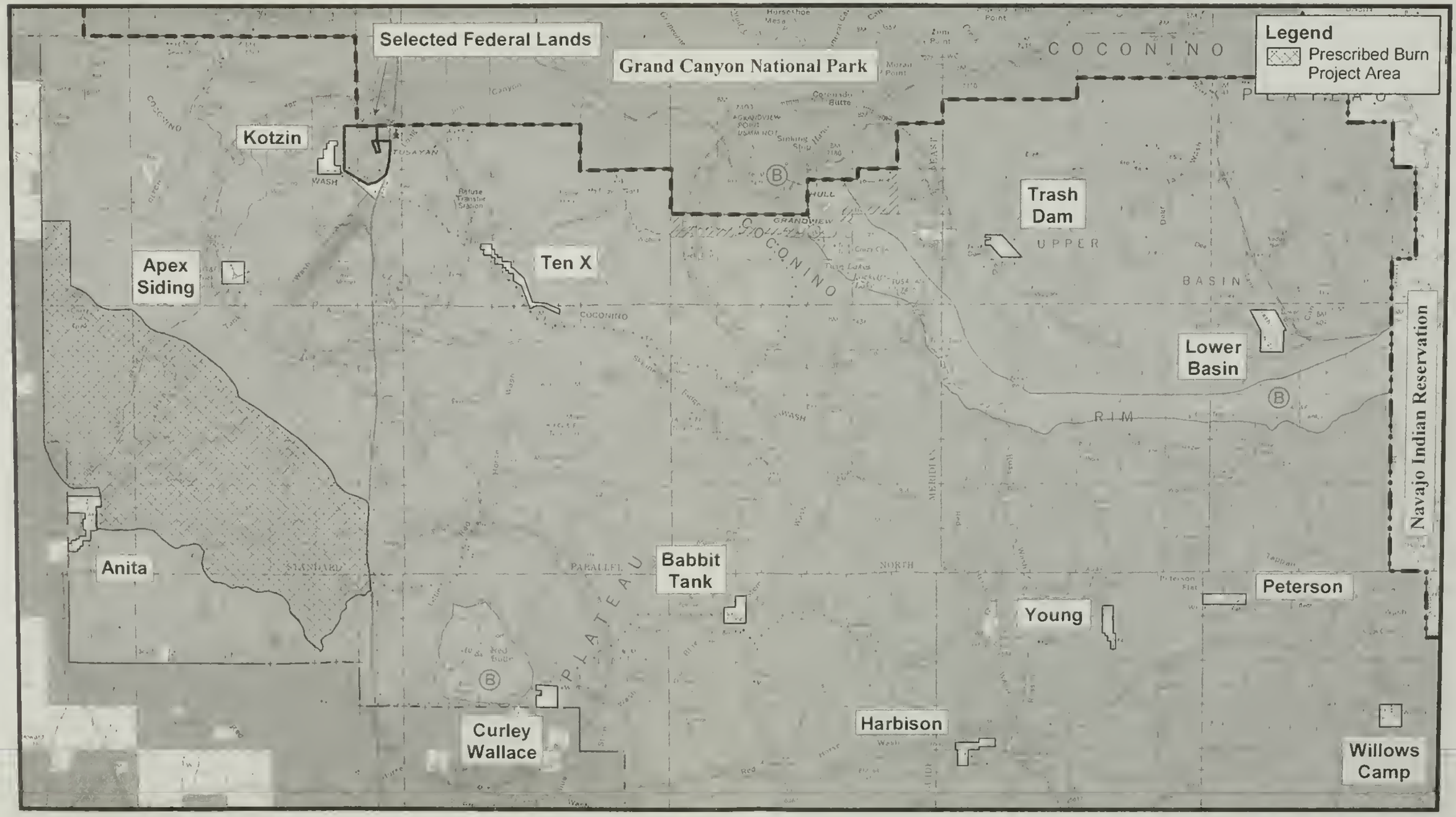


Figure 3.21 Proposed Prescribed Burns on the Tusayan Ranger District near Tusayan



Chapter 4: Environmental Consequences

This chapter describes the direct, indirect, and cumulative environmental consequences of the alternatives. It is organized by resources, with environmental consequences discussed under each alternative. Environmental consequences are the effects and impacts on the physical, biological, social, and economic environment that may be caused by implementing an alternative. Environmental consequences result from the level and type of development that either is proposed or may be expected from each alternative.

Direct effects are defined as those that occur at the same time and place as the action. For example, a direct impact of construction activities in forested land would be the removal of trees and other vegetation.

Indirect effects are those that are spatially removed from the activity or occur later in time but are considered likely in the foreseeable future. For example, implementation of any of the alternatives may indirectly change visitor use patterns at Grand Canyon National Park (GCNP).

Cumulative effects are the incremental impacts of the direct and indirect effects of the action added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these additional actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects for this analysis differ by alternative, as follows:

Alternative A (No Action Alternative): No action refers to no Federal action. This alternative, however, allows for many actions, including redevelopment of Tusayan, potential development of the private inholdings, development on tribal land, purchase of and subsequent development of state trust land, and development in other northern Arizona communities. Under this alternative, these actions do not result in cumulative impacts because all of their effects are considered to be directly or indirectly the result of no Federal action being taken.

Alternatives B and C (Land Exchange Options): Actions contributing to cumulative effects include the redevelopment of Tusayan, development of tribal land, purchase of and subsequent development of state trust land, and development in other northern Arizona communities.

Alternative D (Townsite Act/Special Use Permit): Actions contributing to cumulative effects include potential development of the private inholdings, development on tribal land, purchase of and subsequent development of state trust land, and development in other northern Arizona communities.

Alternative E (Transportation/Federal Housing): Actions contributing to cumulative effects include the redevelopment of Tusayan, potential development of the private inholdings, development of tribal land, purchase of and subsequent development of state trust land, and development in other northern Arizona communities.

Surface and Groundwater

Environmental consequences associated with these resources are discussed under three issue headings related to surface and groundwater resources: water supply, Grand Canyon water resources, and water transportation. The issue of water supply deals with the amount of water needed and the proposed source of water for each of the proposed alternatives. For alternatives that propose use of groundwater the impacts of groundwater withdrawal on the springs in Grand Canyon are discussed under the issue of Grand Canyon water resources. Under the third issue, water transportation, proposed water transportation and systems effects are analyzed.

Water Supply

Issue: Development of private or NFS land near Tusayan would increase the demand for water.

Methods for Analyzing Impacts

A primary factor in determining potential impacts to water supply is current and future water demand associated with development of private or NFS lands. Analysis involves estimating the potential increase in demand for water from new development and identifying the potential sources of supply for that water. The location, capacity, and long-term and regional effects on availability of any new proposed sources of water are also considered. The effectiveness of water conservation and reuse is evaluated as measured by per capita use, as well as cumulative effects of development on regional water supply. For alternatives that require the use of groundwater, the potential impacts of harvesting groundwater are analyzed under Grand Canyon water resources. For alternatives that purchase or obtain water from outlying areas, the potential impacts of water transportation are analyzed under water transportation. For purposes of this discussion, the Moqui Lodge is not included in the discussion of the Tusayan water system. They use approximately 7 million gallons of water per year from

supplies provided entirely through purchase from Belmont, Valle, Williams, Hydro-Resources (in Tusayan), and GCNP (when they have excess water).

Alternative A: No Action

Direct and Indirect Impacts

Water needs will likely increase as visitor numbers rise and existing private land in Tusayan and the private inholdings are developed for visitor services and employee housing. Total water demand could range between 88.5 mgy to 235 mgy (or more) in the next 12 years, depending on the level and type of development. Water supplies of adjacent communities, such as Valle, Flagstaff, and Williams, could be impacted if they are relied on to support new development in the Tusayan area. For example, if a greater proportion of new water demand in Tusayan is met by water purchased from Williams than by the construction of new on-site groundwater wells, the Williams water supply would be more heavily impacted.

Planned and proposed future redevelopment in Tusayan on existing private land would require additional water and could reach the amount required under Alternative D (88.5 mgy) by the year 2000. Redevelopment of Tusayan is dependent on individual project approval by the Coconino County Board of Supervisors. Tusayan businesses are expected to drill another well in Tusayan, bringing the number of groundwater wells in Tusayan to three, that pump groundwater from the Redwall-Muav aquifer. Other possible means of acquiring water to support redevelopment include purchasing and hauling water from Williams or other outlying communities willing to sell excess water supplies, and requesting and purchasing additional water from GCNP.

Three private inholdings are believed to have development potential: Lower Basin, Kotzin, and TenX (see Table 2.1). Additional water supplies would be needed to support such development. The proposed construction of a 94-acre golf course on the TenX inholding would increase demand on local water resources; however, the golf course could use treated effluent from the Tusayan wastewater plant, thus reducing the demand for potable water. Because of the uncertainty surrounding the extent and location of future growth on the private inholdings, it is difficult to estimate how much water may be needed. However, development of the private inholdings could require as much water as is needed to support the level of development planned in Alternative B (147 mgy) or more. Should some of this development occur on the Lower Basin inholding, new water sources would be needed in that area, as none currently exist. If groundwater wells were drilled to meet at least part of the water supply needed at Lower Basin, springs that discharge from the Blue Springs groundwater sub-basin of the Redwall-Muav aquifer could be impacted, an issue that is analyzed further in Grand Canyon water resources.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, 147 mgy (279.7 gallons per minute [gpm] of continuously pumped water) of potable would be needed to support the proposed level of development. Potable water would be supplied by five wells drilled in Valle to meet potable water demand for all elements of the proposed development, including water for the NPS housing and transportation staging area. An associated pipeline would be placed adjacent to the State Highway 64 right-of-way (ROW) to carry the water to the development. Potable water from wells at Two Guns, Arizona, east of Flagstaff, would be trucked to the development in emergency situations. Water storage facilities would be constructed at the CFV development in Tusayan to store potable water. Table 4.1 presents the sources for potable water and estimated quantity of water supplied by each source.

To minimize the use of potable water, state-of-the-art water conservation techniques would be implemented. These techniques would include xeriscaping, irrigating with reclaimed water, dual-plumbing residences and lodgings for reclaimed-water use, rainfall harvesting, installing maximum water conservation fixtures (low-flow shower heads, toilets, and faucets) in all structures, and installing only showers in dormitories and a minimum of 25% of the lodging guest rooms.

Sewage effluent generated by the development, approximately 322,000 gallons per day, would be treated by a Solar Aquatics System. Reclaimed wastewater may be discharged to natural or man-made ponds; injected back into the aquifer at a site approved by the regulating agencies, reducing net withdrawals from the aquifer; reused to flush toilets in dual-plumbed facilities; or used to irrigate landscaping. Landscape irrigation with reclaimed effluent is a proven technique and is currently used in communities such as Flagstaff. Aquifer reinjection has not been undertaken in Arizona. The location of reinjection is an important consideration, as it must be at a safe distance from locations where groundwater is withdrawn to ensure that contamination does not occur. If reinjection of reclaimed water back into the aquifer is allowed, up to 50% of the water consumed under this alternative could be reintroduced into the aquifer, greatly reducing the potential long-term

Table 4.1 Estimated Potable Water Needs (in mgy) under Alternative B

Source	Water Quantity (mgy)	Percentage of Total Water Supply
Groundwater		
Existing Wells	0	0
New Wells	147	100
Water Supplied/Purchased from GCNP	0	0
Water Purchased from other Communities	0	0
Total	**147**	**100**

impacts of this alternative on the groundwater aquifer. Reinjection would require approval by ADEQ and ADWR. Wastewater discharge or reuse would require a National Pollution Discharge Elimination System (NPDES) Permit and an Aquifer Protection Permit from the ADEQ.

The Valle well field could deliver the necessary water supply for this alternative without affecting the water supplies in Flagstaff or Williams, as neither of these communities currently depend on the aquifer that would be tapped by the Valle wells. Groundwater withdrawal from the aquifer may have impacts on Grand Canyon water resources, an issue that is explored further in the next section.

This alternative uses maximum water conservation techniques to minimize the water supply requirements for servicing the visitor and resident population of the development. These techniques exceed those that are required under the Tusayan Area Plan. Water consumption under this alternative includes approximately 46.3 gallons per person per day in single family homes, 42.3 gallons per person per day in apartments, and 41.3 gallons per person per day for lodging guests (Wright Water Engineers 1995).

Cumulative Impacts

Cumulative impacts under this alternative are similar to those described under the other action alternatives, as growth is expected to occur on the existing private lands in Tusayan (as described under Alternative D), on tribal land, on state trust land, and also in outlying communities. The cumulative impacts on water supply center around the ability of the region to provide sufficient water for its residents and visitors. Cumulatively, it can be expected that substantial water development would occur in northern Arizona, both in Tusayan and in the outlying communities.

Each community generally has its own developed water source or sources to supply water to the municipalities and, through sales, water to outlying rural subdivisions. Water demands in one community rarely substantially impact water supplies in neighboring communities within the Havasu Springs groundwater sub-basin.

An exception is Tusayan, which supplements its water supply with purchases from Williams and GCNP. Drilling a third well in Tusayan may reduce Tusayan's dependence on water purchased from outlying areas, particularly Williams, potentially making more water available in Williams to accommodate growth in that community.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under this alternative, 140 mgy (266.4 gpm of continuously pumped water) of potable would be needed to support the proposed level of development. Potable water would be supplied as described under Alternative B (five wells drilled in Valle). Table 4.2 presents the sources for potable water and estimated quantity of water supplied by each source.

Water conservation measures would also be implemented under this alternative, but to reduce cost they would deviate from Alternative B as follows:

- Rainfall would not be harvested
- Normal water-conserving fixtures would be used instead of maximum-conservation appliances and fixtures
- Lodging guest rooms would use conventional tub-shower combinations

This alternative would also seek to reclaim wastewater generated by the development as described under Alternative B.

Table 4.2 Estimated Potable Water Needs (in mgy) under Alternative C

Source	Water Quantity (mgy)	Percentage of Total Water Supply
Groundwater		
Existing Wells	0	0
New Wells	140	100
Water Supplied/Purchased from GCNP	0	0
Water Purchased from other Communities	0	0
Total	**140**	**100**

Impacts of implementing these three components to supply water to the development would be similar to those described under Alternative B, with an important exception. The reduction in water conservation measures in Alternative C would result in higher water consumption per capita than under Alternative B. For instance, under Alternative C, the total number of lodging units (2,250) and housing units (2,075) proposed is approximately 57% and 80%, respectively, of that proposed under Alternative B, yet total water needs for Alternative C are 95% of that required for Alternative B. The estimated 140 mgy includes approximately 80.0 gallons per person per day in single family homes, 59.9 gallons per person per day in apartments, and 55.9 gallons per person per day for lodging guests (Wright Water Engineers 1995).

Cumulative Impacts

Cumulative impacts under this alternative are similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

This alternative would require 88.5 mgy of potable water to meet projected needs for the proposed level of development, including current water use in Tusayan (54.3 mgy). To supply water for the redevelopment of Tusayan, GCNP would supply/sell from the Roaring Springs system 20.3 mgy, or 23%, of the water required under this alternative, for NPS employee housing and the transportation staging area. This water would be piped from GCNP to the water tank farm southeast of Tusayan. Impacts associated with the water pipeline are discussed under water transportation. The two existing Tusayan wells and one additional new well proposed for Tusayan would provide 41.6 mgy of water (or 79.2 gpm of continuously pumped water), or 47%, of the additional water supply needed under this alternative. Drilling a third well in Tusayan would require a permit from the ADWR. Impacts to springs in Grand Canyon from operation of a third well are further explored in Grand Canyon water resources. Finally, water trucked from Williams would supply 30% (26.6 mgy) of the water required. Table 4.3 presents the sources for potable water and estimated quantity of water supplied by each source.

Table 4.3 Estimated Potable Water Needs (in mgy) under Alternative D

Source	Water Quantity (mgy) Total Water Supply	Percentage of
Groundwater		
Existing Wells	24.8	28
New Wells	16.8	19
Water Supplied/Purchased from GCNP	20.3	23
Water Purchased from other Communities	26.6	30
Total	**88.5**	**100**

The Tusayan wastewater treatment plant and reclaimed water facility would reclaim wastewater generated under this alternative. Hotel facilities would be constructed with dual-plumbing fixtures to accommodate reclaimed water systems, and all landscape irrigation would use reclaimed water.

GCNP has said that the park would supply/sell water from the Roaring Springs system to Tusayan for GCNP employees housed outside the park, in addition to meeting water needs for the transportation staging area. Additional water is available in the GCNP system, which is currently operating at 70% of capacity (the pumps run only 118 hours per week to save power costs). Therefore, the capacity exists in the Roaring Springs system to meet the park's commitment to supply water for GCNP employees housed outside of the park and water for the transportation staging area.

Purchasing additional water from Williams would require modifications to agreements between the Grand Canyon Improvement Association (GCIA) and the City of Williams to increase the city's commitment to supplying water to Tusayan. Impacts associated with additional water transport are discussed under water transportation.

The Tusayan wastewater treatment plant produces reclaimed water and makes this nonpotable water available for a variety of applications in Tusayan. Dual plumbing of lodging, a component of the Tusayan Area Plan that is currently practiced at all the hotels, is estimated to save up to 25 gallons of water per person per day (Wright Water Engineers 1995). Any new developments in Tusayan may be required to use reclaimed water for nonpotable use, install water conserving plumbing fixtures, and implement xeriscaping.

No data were provided on estimated daily per capita water consumption rates under this alternative.

Cumulative Impacts

Under Alternative D, cumulative impacts would result from additional water being supplied from a number of sources, including water purchased from GCNP, water from a new well in Tusayan, water purchases from Williams, and water development to serve potential visitor and residential facilities on the private inholdings currently controlled by CFV, if developed. The collective impacts from this alternative are therefore similar to the direct and indirect impacts described under Alternative A.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

This alternative would require 28.5 mgy of water to meet the needs of the project. GCNP would supply/sell 6.9 mgy of potable water from the Roaring Springs system and transport it by a pipeline to the transportation staging area and housing development on NFS land. The Tusayan wastewater treatment plant would reclaim wastewater generated under this alternative and supply 21.6 mgy of reclaimed water to the housing complex and transportation staging area developed on NFS land. Table 4.4 presents the sources for potable water and estimated quantity of water supplied by each source.

As described under Alternative D, GCNP could supply the necessary water for this alternative without affecting the park's other water obligations. The transportation staging area and housing development should generate enough wastewater for the treatment facility to supply reclaimed water. Should additional water be needed, it would be supplied by GCNP.

Table 4.4 Estimated Potable Water Needs (in mgy) under Alternative E

Source	Water Quantity (mgy)	Percentage of Total Water Supply
Groundwater		
Existing Wells	0	0
New Wells	0	0
Water Supplied/Purchased from GCNP	6.9	100
Water Purchased from other Communities	0	0
Total	**28.5**	**100**

The amount of water consumed under this alternative includes 50 gallons of potable water and 35 gallons of nonpotable water per person per day for the residential area and 0.25 gallons of potable water and 2 gallons of nonpotable water per visitor per day for the transportation staging area.

Cumulative Impacts

Cumulative impacts under this alternative are similar to those described under the other alternatives. Development of additional visitor facilities to accommodate increasing Grand Canyon visitation is expected on the existing private lands in Tusayan, potentially on three of the inholdings controlled by CFV, and in the outlying communities. As a result, demand for potable water is expected to increase throughout the region.

Grand Canyon Water Resources

Methods for Analyzing Impacts

The factors considered in analyzing impacts to Grand Canyon water resources include effects on Grand Canyon springs, primarily Havasu, Hermit, and Indian Garden springs, and on Blue Springs outside the canyon, as a result of groundwater pumping in the project area. A computerized groundwater flow model was developed by Errol L. Montgomery & Associates, Inc., (Montgomery & Associates) to assess the potential impacts of withdrawal from wells in the Tusayan and Valle areas on the Redwall-Muav aquifer (Montgomery & Associates 1996). This model estimates the effects of a given pumping rate on the discharge of the major springs in Grand Canyon that discharge from the Redwall-Muav aquifer. Estimates for this analysis are based on interpolation of Figure 9 of the Hydrology Report, included in the appendix of this EIS.

Issue: Additional groundwater pumping from the Redwall-Muav aquifer for new development could affect aquifer flow dynamics and potentially could affect spring flow and other water-related uses and values in GCNP and on tribal land. If a well is drilled on the Lower Basin private inholding, which is in the Blue Springs sub-basin, discharge from Blue Springs may be affected.

The modeling study sought to depict the current condition of the Redwall-Muav aquifer and to simulate potential impacts to discharge points (springs) from that aquifer from operation of groundwater wells. Four important points from that analysis are:

(1) Any amount of groundwater pumped from the area directly affects the Redwall-Muav aquifer; however, the location from which it is pumped could affect either of two sub-basins in the study area: the Havasu Springs or the Blue Springs sub-basins. According to Errol L. Montgomery & Associates (1996), groundwater withdrawal from pumping in the Tusayan/Valle area would impact the Havasu Springs sub-basin and reduce discharge from Havasu Springs (which discharges 29,000 gpm), Hermit Springs (which discharges 300 gpm), and Indian Garden Springs (which discharges 300 gpm). Groundwater withdrawal at or near Lower Basin would likely affect the Blue Springs sub-basin and could reduce discharge from Blue Springs, which discharges about 100,000 gpm (Errol L. Montgomery & Associates 1997).

(2) The Redwall-Muav aquifer is assumed to be in a state of dynamic equilibrium. This means that recharge and discharge are moving toward a state of balance. Therefore, increasing groundwater pumping from wells would decrease discharge from springs or other discharge points. For example, if a well pumps 300 gpm, there must eventually (perhaps tens or hundreds of years later) be a corresponding decrease in discharge of 300 gpm elsewhere in the system. Drilling of wells into the Redwall-Muav aquifer over the past several years has changed the equilibrium of the system, but effects on discharge of springs and seeps may not be noticeable yet because of the generally low transmissivity (ease of movement) of groundwater within the strata composing the Redwall-Muav aquifer.

(3) Groundwater movement within the Redwall-Muav aquifer is slow, and it may take tens or hundreds of years for dynamic equilibrium to be re-established. However, the model results indicate that dynamic equilibrium is substantially re-established about 50 years after a new well is operational, assuming no additional changes occur in the groundwater sub-basin.

(4) The location of a well within a sub-basin has an important bearing on the amount of impact to specific springs and seeps. For example, if a well is close to Indian Gardens but far from Havasu Springs, then the impact would be larger at Indian Gardens than at Havasu.

Another factor that warrants explanation is that drilling and operation of the two existing wells in Tusayan (and the wells in Valle) did not require an analysis of potential impacts to springs in Grand Canyon because no Federal compliance action was required. Under Arizona statutes, a private landowner/developer is required only to obtain a permit from the ADWR to drill a well. The modeling analysis conducted for this EIS can be used to estimate the decrease in springflow from the operation of the two existing wells in Tusayan, as well as the potential impacts from operation of additional wells drawing from the Redwall-Muav aquifer. Groundwater pumping and well production data are not available for the two existing wells in Valle.

A more detailed discussion of these principals and the entire modeling effort can be found in the Hydrology Appendix report.

Alternative A: No Action

Direct and Indirect Impacts

It is impossible to accurately predict the amount of groundwater necessary under this alternative, but it is likely that it would be in the range of the other alternatives described in this section.

Under Alternative A, additional development is expected on the existing private land in Tusayan and potentially on three of the private inholdings controlled by CFV, increasing the demand for water. To meet this demand, it is likely that additional groundwater wells would be drilled, in Tusayan, in Valle (and then piped up to Tusayan), and/or on the inholdings. Using the model developed by Montgomery & Associates, the impacts of these additional wells on the springs in Grand Canyon can be estimated.

As described earlier, the entire aquifer system reaches a state of substantial dynamic equilibrium after about 50 years, with the total decrease in spring discharge approximately equaling the amount of water pumped and the overall rate of discharge in equilibrium with recharge. Table 4.5 shows the decrease in discharge anticipated at each of the springs as a result of pumping from the two existing wells in Tusayan if pumping rates remain unchanged, as well as the adjusted discharge after a dynamic equilibrium is re-established. Assuming a continuous, steady pumping rate out of the two existing wells in Tusayan, in 50 years, the rate of discharge from Havasu Springs would decrease by 0.1%, Indian Garden Springs would decrease by 2.5%, and Hermit Springs would decrease by 1.4%.

Should additional wells be drilled in Tusayan (or in Valle or on the inholdings controlled by CFV) drawing from the Redwall-Muav aquifer in the Havasu Springs groundwater sub-basin, additional impacts to these springs (Havasu, Indian Gardens, and Hermit) would be likely. Discharge from Blue Springs could also be affected if groundwater wells were drilled and pumped on the Lower Basin inholding. Long-term pumping of water at Lower Basin would progressively intercept groundwater that, in the absence of pumping, would have discharged at Blue Springs. Eventually a new condition of dynamic equilibrium would be established for the Blue Springs groundwater sub-basin, with a lower rate of discharge from Blue Springs.

Table 4.5 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal From the Two Existing Wells in Tusayan under Alternative A.

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	Decrease in Discharge percentage	Adjusted Discharge Rate gpm
Havasu Springs	29,000.0	29.0	0.1	28,971.0
Indian Garden Springs	300.0	7.5	2.5	292.5
Hermit Springs	300.0	4.2	1.4	295.8

A new well planned for the Village of Supai would also contribute to effects on Grand Canyon water resources. The collective amount of water pumped from new wells drawing from the Redwall-Muav aquifer in the Havasu Springs groundwater sub-basin would decrease discharge at the springs in Grand Canyon by a corresponding amount. New water demands from growth in the outlying community of Flagstaff is not expected to affect water discharge at springs in Grand Canyon, as Flagstaff is in a different groundwater sub-basin. The primary municipal water source for Williams is a series of surface reservoirs; therefore, the city does not rely on groundwater from the Havasu Springs groundwater sub-basin for water supply. However, a new well east of Williams is currently being developed that is intended to intercept the Redwall-Muav aquifer. When completed, this well could serve as an additional municipal water source for Williams and outlying rural areas. The boundary of the Havasu Springs sub-basin lies close to Williams, and it is possible that a groundwater well drilled near Williams would draw from the Havasu Springs sub-basin.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

After buildout, the proposed CFV development would pump 147 mgy (279.7 gpm) from five proposed wells in the Valle area. According to the groundwater study (Errol L. Montgomery & Associates 1996), the Valle wells would affect the amount of discharge from Havasu Springs more than discharges from Hermit and Indian Garden springs because Havasu Springs are closer to the wells. However, because of the large volume of water discharged from Havasu Springs, (29,000 gpm, compared to 300 gpm each from Hermit and Indian Garden springs), any reductions in flow from Havasu Springs would be a smaller fraction of the entire discharge of that spring. Table 4.6 shows the decrease in discharge anticipated at each of the springs under this alternative. Continuous pumping at about 300 gpm from the five Valle wells over 50 years would decrease the rate of discharge from Havasu Springs by 0.8%, from Indian Garden Springs by 2.0%, and from Hermit Springs by 1.3%.If allowed, the aquifer could be recharged by reinjection of treated effluent. After dynamic equilibrium is re-established, the discharge from springs would be greater than the adjusted discharge rates in Table 4.6, assuming no other changes in aquifer discharge occur from additional groundwater withdrawal in the Havasu Springs groundwater sub-basin. The exact amount of the increase would be a function of how much water is reinjected and the location of the reinjection wells.

Cumulative Impacts

Under this alternative, Tusayan would continue to pump water from the two existing Tusayan wells for a portion of the community's water needs. If redevelopment of Tusayan occurs as proposed, the discharge from Havasu, Indian Garden, and Hermit springs may be further reduced if either a third well is drilled or pumping from the two existing wells in Tusayan is increased. Table 4.7 shows the cumulative decrease in discharge anticipated at each of the springs from the proposed Valle wells (the CFV plan) plus the two existing wells in Tusayan, and the proposed Valle wells plus three wells in Tusayan. The cumulative impact of both CFV and Tusayan groundwater pumping (from the two existing wells) over 50 years would reduce the discharge from Havasu Springs by 0.9%, from Indian Garden Springs by 4.5%, and from Hermit Springs by 2.7%. These numbers do not reflect reinjection of the aquifer with reclaimed water, the amount of water drawn from the existing wells in Valle, or the possibility of additional withdrawal and use of groundwater in the aquifer by other communities in the sub-basin, by private landowners, and by mining communities.

Table 4.6 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal under Alternative B

Spring	Current Discharge Rate	Decrease in Discharge		Adjusted Discharge Rate
	gpm	gpm	percentage	gpm
Havasu Springs	29,000.0	232.0	0.8	28,768.0
Indian Garden Springs	300.0	6.0	2.0	294.0
Hermit Springs	300.0	3.9	1.3	296.1

Table 4.7 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal under Alternative B

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	Decrease in Discharge percentage	Adjusted Discharge Rate gpm
CFV Plus Two Existing Wells in Tusayan				
Havasu Springs	29,000.0	261.0	0.9	28,739.0
Indian Garden Springs	300.0	13.5	4.5	286.5
Hermit Springs	300.0	8.1	2.7	291.9
CFV Plus Three Wells in Tusayan				
Havasu Springs	29,000.0	278.4	1.0	28,721.6
Indian Garden Springs	300.0	18.0	6.0	282.0
Hermit Springs	300.0	11.7	3.9	288.3

If a third well is drilled in Tusayan to supply water for redevelopment, the collective impact of both the CFV and Tusayan groundwater pumping over 50 years would reduce the discharge from Havasu Springs by 1.0%, from Indian Garden Springs by 6.0%, and from Hermit Springs by 3.9%. These numbers do not reflect reinjection of the aquifer with reclaimed water.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

The impacts on water resources from this proposal would be similar to but slightly lower than those discussed under Alternative B because the total water needs for Alternative C are slightly less. This alternative would also draw water from five proposed wells in the Valle area. After buildout, the proposed CFVAP development would pump 140 mgy (266.4 gpm) from five wells in the Valle area. Table 4.8 shows the resulting decrease in discharge anticipated at each of the springs under Alternative C. With continuous pumping at this rate and upon reaching dynamic equilibrium, the rate of discharge from Havasu Springs would decrease by 0.8%, from Indian Garden Springs by 1.9%, and from Hermit Springs by 1.2%. As under Alternative B, reinjection of treated effluent into the aquifer, if allowed, would offset decreases in spring flow by the amount of water reinjected.

Cumulative Impacts

Under this alternative, the community of Tusayan would continue to pump water from the Tusayan wells. If redevelopment of Tusayan occurs as proposed and additional water demands are partially met from additional groundwater withdrawals from the Redwall-Muav aquifer, the discharge from Havasu, Indian Garden, and Hermit springs would be further reduced. Table 4.9 shows the cumulative decrease in discharge anticipated at each of the springs from five proposed Valle wells with two Tusayan wells and with three Tusayan wells. The cumulative impact of both CFVAP and Tusayan pumping from the two existing wells over 50 years would decrease the discharge from Havasu Springs by 0.9%, from Indian Garden Springs by 4.4%, and from Hermit Springs by 2.6%. These numbers do not reflect reinjection of the aquifer with reclaimed water, the amount of water drawn from the existing wells in Valle, or possible additional use of groundwater in the aquifer by other communities in the sub-basin, by private landowners, and by mining communities.

Table 4.8 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal under Alternative C

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	Decrease in Discharge percentage	Adjusted Discharge Rate gpm
Havasu Springs	29,000.0	232.0	0.8	28,768.0
Indian Garden Springs	300.0	5.7	1.9	294.3
Hermit Springs	300.0	3.6	1.2	296.4

Table 4.9 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal under Alternative C

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	percentage	Adjusted Discharge Rate gpm
CFVAP Plus Two Existing Wells in Tusayan				
Havasu Springs	29,000.0	261.0	0.9	28,739.0
Indian Garden Springs	300.0	13.2	4.4	286.8
Hermit Springs	300.0	7.8	2.6	292.2
CFVAP Plus Three Wells in Tusayan				
Havasu Springs	29,000.0	278.4	1.0	28,721.6
Indian Garden Springs	300.0	17.7	5.9	282.3
Hermit Springs	300.0	11.4	3.8	288.6

If a third well is drilled in Tusayan to supply water for redevelopment, the collective impact of both the CFVAP and Tusayan groundwater pumping over 50 years would reduce the discharge from Havasu Springs by 1.0%, from Indian Garden Springs by 5.9%, from Hermit Springs by 3.8%. These numbers do not reflect reinjecting the aquifer with reclaimed water.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, in addition to the water provided by the two existing wells in the community, Tusayan would pump an additional 16.1 mgy (30.6 gpm) from a proposed third well by the year 2000, further reducing discharge from Grand Canyon springs. After establishment of dynamic equilibrium following addition of the third well, the rate of discharge at Havasu Springs would be reduced by 0.2%, Indian Garden Springs would be reduced by 4.0%, and Hermit Springs would be reduced by 2.6%.

Table 4.10 shows the combined effects on discharge at the springs from the two existing wells in Tusayan in addition to a third well

Under Alternative D, Tusayan proposes to receive an additional 7.87 mgy from GCNP. The GCNP pipeline is gravity fed from Roaring Springs to the Indian Gardens pumping station and has a capacity of approximately 700 gpm. When the pumps at Indian Gardens are not running, the excess water overflows into Garden and Pipe creeks. Garden and Pipe creeks are perennial without the Roaring Springs overflow; therefore, the riparian ecosystem and associated fauna in these systems would continue to exist even if the overflow was used completely. The frequent artificial surges of water caused by sudden shutdowns of the pumps at Indian Gardens result in negative impacts to aquatic invertebrates in the Garden and Pipe creek systems. A greater use of the overflow from Roaring Springs would more closely approximate the natural state of the Garden and Pipe creek systems, and could have a positive impact on these systems (Usher et al. 1984).

Table 4.10 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Groundwater Withdrawal From Three Wells in Tusayan under Alternative D

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	percentage	Adjusted Discharge Rate gpm
Havasu Springs	29,000.0	46.4	0.2	28,953.6
Indian Garden Springs	300.0	12.0	4.0	288.0
Hermit Springs	300.0	7.8	2.6	292.2

Cumulative Impacts

Some development may occur on three of the private inholdings (Kotzin, TenX, and Lower Basin), on tribal land, on state trust land, or in outlying communities, increasing the demand for water. It is likely that water for development of the private inholdings would be supplied by groundwater wells either on these inholdings or in the proposed well field in Valle, as described under Alternatives B and C. In either case, increased use of groundwater from the Redwall-Muav aquifer would have the cumulative effect of further decreasing discharges from Havasu, Indian Gardens and Hermit springs (see Table 4.11). Development of the Lower Basin inholding would require new water sources in that area. If groundwater wells are drilled to meet at least part of the water supply needed for development at Lower Basin, the discharge from Blue Springs would be affected. Long-term pumping of water at Lower Basin would progressively intercept groundwater that, in the absence of pumping, would have discharged at Blue Springs. Eventually a new condition of dynamic equilibrium would be established for Blue Springs, at a lower rate of discharge.

Table 4.11 Adjusted Discharge at Havasu, Indian Garden, and Hermit Springs as a Result of Cumulative Groundwater Withdrawal under Alternative D

Spring	Current Discharge Rate gpm	Decrease in Discharge gpm	Decrease in Discharge percentage	Adjusted Discharge Rate gpm
Three Tusayan Wells Plus 25% Water Consumption of CFV Development under Alternative B				
Havasu Springs	29,000.0	104.4	0.4	28,895.6
Indian Garden Springs	300.0	13.5	4.5	286.5
Hermit Springs	300.0	8.8	2.9	291.2
Three Tusayan Wells Plus 50% Water Consumption of CFV Development under Alternative B				
Havasu Springs	29,000.0	162.4	0.6	28,837.6
Indian Garden Springs	300.0	15.0	5.0	285.0
Hermit Springs	300.0	9.8	3.3	290.2
Three Tusayan Wells Plus 75% Water Consumption of CFV Development under Alternative B				
Havasu Springs	29,000.0	220.4	0.8	28,779.6
Indian Garden Springs	300.0	16.5	5.5	283.5
Hermit Springs	300.0	10.8	3.6	289.2
Three Tusayan Wells Plus 100% Water Consumption of CFV Development under Alternative B				
Havasu Springs	29,000.0	278.4	1.0	28,721.6
Indian Garden Springs	300.0	18.0	6.0	282.0
Hermit Springs	300.0	11.7	3.9	288.3

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Pumping of groundwater would not increase under this alternative. Rather, the proposed development would receive 6.9 mgy of potable water from GCNP and 21.6 mgy of nonpotable water from Tusayan wastewater facilities. The additional 6.9 mgy of potable water needed under Alternative E would be supplied form the Roaring Springs system. As discussed under Alternative D, without Roaring Springs overflow, Garden and Pipe Creeks are perennial, and returning the Garden and Pipe creek systems to a condition that more closely resemble their natural state could reverse impacts from artificial water surges in the creek systems (Usher et al. 1984).

The amount of sewage generated under this alternative is expected to more than adequately supply the 21.6 mgy of

reclaimed water required. In the unlikely event that 21.6 mgy of reclaimed water should not be available, additional potable water would be supplied by GCNP.

Cumulative Impacts

The cumulative effects of Alternative E on Grand Canyon springs are similar to the direct and indirect impacts discussed under Alternative A because the redevelopment of the existing private land in Tusayan is likely, along with development of several of the private inholdings controlled by CFV and development on other private, state trust, or tribal lands.

As proposed in the redevelopment plan for Tusayan, additional water may be needed from the Roaring Springs system. A greater use of overflow from Roaring Springs would more closely approximate the natural state of the Garden and Pipe creek systems (Usher el al. 1984).

Water Transportation

Issue: Increased hauling of water from surrounding areas could increase vehicle emissions and resultant air pollution and could decrease public safety on roadways. Construction of pipelines to transport water from distant sources could affect natural and cultural resources.

Methods for Analyzing Impacts

Factors considered in determining impacts from transporting water include current and future water demands associated with development of private or NFS lands. In addition, factors associated with proposed new sources of water are also considered, including location of the water source, amount of water, and number of tanker trucks required. Pipeline systems proposed for various alternatives are also considered.

Impacts to natural and cultural resources from transportation of water could be caused by water-hauling trucks on roadways and additional pipeline construction to bring water to the project area. Analyses include the change in the number of trucks required to transport water under the different alternatives proposed, the percentage of traffic consisting of water-hauling trucks, and the length of pipeline construction required to transport water to the project area.

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, redevelopment of the existing private land in Tusayan and development of three of the inholdings controlled by CFV may occur, in addition to development of tribal land, state trust land, and land in outlying communities. Redevelopment of Tusayan would be expected to be similar to that described under Alternative D, and the extent of development on the three inholdings controlled by CFV is speculative but could collectively be equal to the level of development proposed under Alternative B. In any event, it is likely that a substantial increase in the amount of water would be required to service developments on the existing private lands in Tusayan and on the private inholdings. Water for these developments would either be trucked in from existing sources such as Grand Canyon or Williams, or be

provided from existing or new wells and then trucked or piped to areas where it would be used.

In 1995, 28.8 million gallons of water were hauled by an estimated 4,800 truck loads to Tusayan from Williams and GCNP (round-trip). This number of truck loads is about 0.3% of the average daily vehicle traffic generated on State Highway 64 between Valle and Tusayan.

Based on estimates for the other alternatives, it is very likely that new demand for water would exceed the current amount of water used in Tusayan; however, the source of this water is unknown, and the future volume of water hauling cannot be estimated. Nevertheless, the amount of tanker-truck traffic can be expected to increase if water pipelines are not constructed to each of the developments. If the number of water trucks increases,

corresponding impacts to air quality, road conditions, traffic, and highway safety would be expected.

If any of the CFV-controlled private inholdings are developed and the source of water for those developments is off-site, impacts would occur from the construction of water pipelines or from additional water hauling truck traffic. Either of these methods may have direct and indirect impacts to natural and cultural resources. Construction of new water pipelines would require further analysis under NEPA should Federal land or ADOT right-of-way be used.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, 147 mgy from five new wells in the Valle area would be transported by a pipeline to the proposed development. The pipeline would be roughly 25.4 miles in length and located within or adjacent to the right-of-way for State Highway 64. Should this pipeline route be pursued, additional NEPA analysis and permitting work would be required by the Forest Service. Construction of the proposed pipeline would have short-term impacts and would necessitate vegetation clearing and ground disturbance in the pipeline corridor.

Two wells near Two Guns, Arizona, east of Flagstaff, would be used only in case of emergency water demand. Water from the Two Guns area would be hauled by tanker truck, with corresponding increase in truck traffic and impacts to air quality, traffic safety and road conditions. These impacts are expected to be infrequent and of short duration.

Cumulative Impacts

Cumulative impacts under implementation of Alternative B would arise from the combination of the development of CFV, along with the expected continued development of the existing private land in Tusayan. Businesses in Tusayan would continue to haul water by truck and harvest groundwater. Additional development would require expansion of these water delivery systems, which may mean increased hauling and/or additional pipeline construction.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts would essentially be the same as those described under Alternative B.

Cumulative Impacts

Impacts would essentially be the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Impacts from water transportation would be expected to increase from increased water needs under this alternative. Water to meet increased demand would be supplied from the existing sources in the Tusayan area and from the addition of one new well in Tusayan. The amount of water to be obtained from the proposed new well is currently undetermined. If all additional water was supplied in the same manner as in the past, 53%, or 18.13 mgy, of the additional water would be hauled by trucks, requiring an additional 3,021 water-truck trips annually. If the proportions provided by Williams and Grand Canyon remain constant, an estimated 1,311 of these trips would come from GCNP, and 1,710 would come from Williams. Approximately five additional vehicle trips would be generated per day from Williams to Tusayan and about four additional vehicle trips from GCNP to Tusayan. Water-hauling trucks would account for about 0.4% of the total traffic on State Highway 64.

Cumulative Impacts

Under Alternative D, three of the private inholdings controlled by CFV could be developed. While the potential level of development of these inholdings is unknown, it is likely that additional demand for water would be required. Therefore, cumulative impacts under Alternative D would be expected to be similar to those described under Alternative A.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under this alternative, new development would use potable water sources in GCNP and reclaimed water sources in Tusayan. The additional water would be delivered to the proposed development by a five-mile pipeline, constructed from GCNP to the transportation staging area within the right-of-way designated for the transportation corridor. Construction of a pipeline system has the potential to impact natural and cultural resources. The extent of these impacts has yet to be determined by survey analysis, and would likely require further analysis

under NEPA. However, existing transportation or utility corridors probably could be used for the water pipeline to reduce impacts to natural and cultural resources.

Cumulative Impacts

Under this alternative, the potential exists for redevelopment of the existing private land in Tusayan and development of three of the CFV-controlled private inholdings. This level of development would result in cumulative impacts similar to the direct and indirect impacts described under Alternative A.

Socioeconomic Resources

Environmental consequences associated with this resource are divided into six categories. These include Tusayan and the Grand Canyon area; other northern Arizona communities; housing; employment opportunities; crime rates; and community services and facilities.

As outlined in the Economic Analysis Appendix report, GCNP visitation has increased significantly since the mid 1980s. While growth patterns have varied from year to year, GCNP has averaged approximately 210,000 additional visitors each year since 1985, with almost 5 million visitors in 1996. Partially in response to this increase in GCNP visitation, many northern Arizona communities have substantially expanded their supply of lodging and restaurant facilities. For instance, in the eleven-year period from 1987 to 1997, over 5,200 rooms were added to northern Arizona hotel inventories.

A variety of surveys and studies (e.g., 1994/95 Grand Canyon Visitor Survey, 1992 Kaibab Visitor Survey, and GCNP General Management Plan) have noted visitor concerns over the range of visitor services in the Grand Canyon/Tusayan area, as well as visitor service quality and pricing. As visitation continues to grow, pertinent questions arise: "What impact would additional development have on existing businesses and communities in northern Arizona, and how should visitor services be expanded in the Grand Canyon/Tusayan area?"

To address these questions, an economic model was developed capable of considering a wide variety of existing relationships between visitation and current facilities. The model was used to estimate the level of visitor-oriented facilities that necessary to meet visitor *needs* and *desires* under a variety of different visitation growth scenarios. It should be recognized that providing for visitor needs (e.g., more parking, food outlets, bathrooms) may have greater importance than responding to visitor desires (e.g., more and/or different lodging, additional and/or more varied retail).

The model operates from five basic premises:

(1) Visitation to GCNP will continue to grow through 2010, and as visitation to the park increases, the need/desire for additional visitor facilities will also increase.

(2) Development is likely to continue in Tusayan, as well as on private inholdings in the area. Development could also occur in numerous other locations, including tribal land, state trust land, and land in outlying communities, in response to demand pressures.

(3) This study does not attempt to accurately predict future visitation, nor does it seek to quantify the specific level of facilities that will likely be developed in various areas to accommodate the resulting demand. Rather, the model is a tool to identify key variables, the relationships among them and the effect of changes in those variables.

(4) While the model can be used to predict how various areas will perform under a given set of assumptions, actual consumer behavior will be significantly influenced by the choices individual businesses make relative to the pricing and quality of products/services.

(5) The model is based on **average** annual visitation increases. **Actual** annual visitation will vary from the average, and the variation may be material. Accordingly, the impacts in any given year may be greater or less than those indicated by the model.

Table 4.12 outlines a list of key assumptions related to the model and the model process is shown in Figure 4.1. The Economic Report provided as an appendix to this EIS provides details on how the key assumptions were derived.

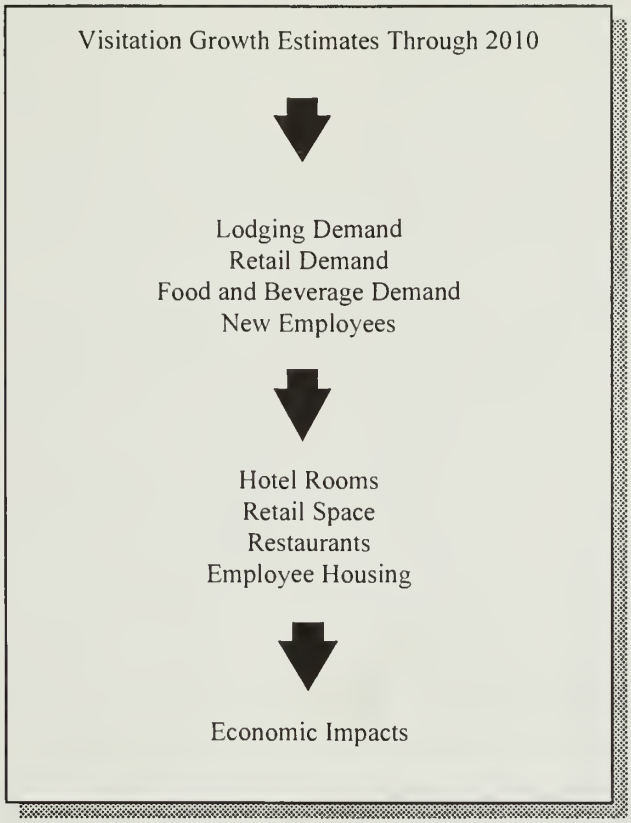


Figure 4.1 Land Use Demand Model Analysis Process

Table 4.12 Key Economic Model Inputs (Assumptions and Variables)

1. Grand Canyon visitation growth scenarios - High, Moderate, GCNP GMP, Low
2. Hotel occupancy rates - 65%, 70%, 75%, 78%
3. Market penetration rates - 25%, 30%, 35%
4. Average length of overnight stay - 1.2 days
5. Average party size - 2.75 persons
6. Average hotel densities - 35 units per acre
7. Average hotel employees per room - .425
8. Average annual GCNP/Tusayan retail sales per capita - $3,000
9. Average trip retail spending per visitor - $10
10. Average annual retail sales as a function of area per square foot - $300
11. Average retail employees as a function of area per square foot - 1 per 500 sq. ft.
12. Average trip food & beverage spending per visitor - $6
13. Average annual food & beverage sales as a function of area per square foot - $300
14. Average food & beverage employees as a function of area per square foot - 1 per 125 sq. ft.
15. Average employee-to-resident ratio - 1.3
16. Average household size - 1.6
17. Average housing density - 23 units per acre

A key input in the model is growth in visitation through the year 2010. To understand the impact of various levels of potential visitation, four possible growth levels were evaluated. These visitation scenarios are summarized in Table 4.13 and are compared to visitation figures for the period from 1985 to 1996.

While all four visitation growth rate scenarios were analyzed in the Economic Report, the EIS uses the moderate visitation growth rate scenario to estimate and compare impacts. Under the moderate visitation growth rate scenario, visitation is expected to grow at an average annual rate of 4.0% (or approximately 252,000 visitors annually), with an expected visitation level of about 8,400,000 visitors by 2010. In addition to historic similarities, the moderate visitation growth rate scenario is believed to reflect: (1) continued population growth in Arizona and the Southwest; and (2) continued growth in tourism in Southwest. The purpose of the modeling effort is not to precisely quantify impacts at a given visitation level, but to display the relationships between supply and demand and the key variables.

To calculate the level of additional visitor facilities that would be necessary to accommodate a moderate level of visitation growth rate, other assumptions were made:

- Market Occupancy. Market occupancy is a function of the number of room nights of demand in a given market for a given period of time, divided by the number of the available room nights of supply for that same period, expressed as a percent. For example, if an area contained 1,000 hotel rooms, there would be 365,000 available room nights each year (365 days × 1,000 available rooms). If that same area had 255,500 room nights of *demand* annually, market occupancy would be 70% (255,500 ÷ 365,000). When demand (the numerator) increases faster than supply (the denominator), the occupancy rate increases. The inverse is also true: when supply increases faster than demand, the occupancy rate decreases. The methodology employed in the model required an assumed level of market occupancy for hotels in each area under study to show how many additional hotel rooms could be supported without raising or lowering market occupancy from the assumed level. The assumed occupancy level selected, 70%, is believed to be above the threshold necessary to sustain a reasonable profit, given that over the past 10 years, the average occupancy for U.S. hotels has ranged from a low of 61% in 1991 to a high of 66% in 1996 (source: Smith Travel Research). At the 1996 occupancy level of 66%, hotel industry profitability was the highest ever recorded (sources: Coopers & Lybrand; STR Host Report). While it might be argued that what would be considered an appropriate level of occupancy nationwide would not be appropriate for Tusayan hotels because of their higher operating costs, it is also true that the current average rates at Tusayan hotels are well above the rates charged for comparable hotels in other rural Arizona locations.

- Market Penetration Rate. Market penetration rate is the percent of visitors accommodated in a given area. Currently, on average, hotels in the Grand Canyon/Tusayan area accommodate an estimated 29% of South Rim visitors, (i.e., they achieve a market penetration rate of 29%). Based on an analysis of monthly penetration rates and visitor surveys from the 1994/95 Grand Canyon Visitor Survey discussed in the Economic Analysis Appendix report, it appears that close to 35% of South Rim visitors would like to stay in the Grand Canyon/Tusayan area if lodging were available. However, due to capacity constraints (i.e., insufficient available lodging units), many visitors are turned away and must find lodging in another community. If most visitors who desired to stay in the Grand Canyon/Tusayan area were accommodated (thus requiring a substantial increase in the number of lodging units in Tusayan), the penetration rate would need to increase from 29% to roughly 35%.

Table 4.13 GCNP Visitation Growth Scenarios 1997 - 2010

Scenario	Average Annual % Increase	Average Annual Increase in Visitors	Total Estimated Number of Visitors in 2010
Historic GCNP Increase 1985-1996	6.2%	209,703	NA
(1) High Growth	6.2%	460,342	11,322,000
(2) Moderate Growth	4.0%	251,914	8,404,000
(3) GCNP GMP	2.5%	141,556	6,859,000
(4) Low Growth	1.5%	80,771	6,008,000

It should be recognized that under any of the alternatives, the actual level of development could vary from that presented in current conceptual plans. Whether in Tusayan, in GCNP, in Valle, on the private inholdings, or elsewhere in the area, development of visitor services through the year 2010 would be influenced by market conditions that could modify any individual developer's/landowners current conceptual plan. Under any of the alternatives, visitation growth may not occur in concert with the level of supply, and new supply may not be phased according to demand.

The Grand Canyon/Tusayan Area

Issue: Increased competition from additional commercial development in the Grand Canyon/Tusayan area could affect revenues of existing businesses in the Grand Canyon/Tusayan area.

Methods for Analyzing Impacts

With the moderate visitation growth scenario, a 30% penetration rate, and a 70% occupancy level (the level estimated as reasonable to provide acceptable profitability), the model predicted that 239 lodging units could be added to the Grand Canyon/Tusayan area immediately to accommodate (support) current visitation levels. In addition, 114 lodging units could be added to the Grand Canyon/Tusayan area each year to support new visitation growth. In total, 1,835 lodging units could thus be added to the Grand Canyon/Tusayan area through the year 2010 with little economic impact on the existing businesses in Tusayan, other than an initial reduction in the occupancy of Grand Canyon/Tusayan hotels from their current estimated level of 75% to the 70% level that is assumed to provide a reasonable profit.

To illustrate how the estimated demand is influenced by assumptions about GCNP visitation, assuming the same penetration and occupancy rates used above, under the high visitation growth scenario (scenario 1) the total number of lodging units required through the year 2010 would increase from 1,835 to 3,151. Under the GCNP GMP visitation growth rate scenario (scenario 3), 1,135 lodging units would be needed through the year 2010, and under the low visitation growth rate scenario (scenario 4), 743 additional lodging units would be needed in the Grand Canyon/Tusayan area.

Based on the level of new lodging facilities under the moderate visitation growth rate scenario (1,835 units), the model also estimated new retail square footage, new food and beverage square footage and the number of associated employees and housing units required to support these new facilities. The results are presented in Table 4.14.

These estimates are based on historical relationships between visitation and demand for retail and food and beverage facilities in the Grand Canyon/Tusayan area. If facilities are developed at these levels and visitation approximates the moderate visitation growth scenario, the existing competitive relationship among the businesses in Tusayan would remain intact, and little change in product pricing or services would be expected. The level of potential facilities and services supported through the year 2010 under the moderate visitation growth rate scenario, as summarized in Table 4.14, serves as a benchmark that can be used to evaluate the alternatives.

Alternative A: No Action

Direct and Indirect Impacts

As stated in Chapter 2, "no action" for this EIS means no use of Federal land for community expansion. However, new visitor facilities are being developed on private land in the area, and this is expected to continue. Land and business owners in Tusayan and elsewhere are expected to continue to develop new hotels, retail services, food and beverage outlets, and housing to meet increasing visitor demand. Up to 1,371 additional lodging units could be provided through the redevelopment of Tusayan and GCNP, increasing the total number of lodging units to approximately 3,300 in the Grand Canyon/Tusayan area. This figure does not include potential development on the private inholdings currently controlled by CFV, in Valle, or at other prospective locations. Three of the CFV inholdings (Kotzin, TenX, and Lower Basin) are considered to hold the greatest development potential, although rezoning by Coconino County would be required under several of the development options for these inholdings described in Chapter 2. It is impossible to accurately estimate the level of development that would actually occur on these private inholdings under Alternative A. For instance, zoning conditions could change several times over a long-term planning horizon as a result of economic necessities and changes in elected officials. The level of desire to develop the private inholdings will be a product of such factors as market demand and the availability and cost of capital. However, several options for development of these inholdings were presented in Chapter 2, and some do not require any zoning changes.

Table 4.14 Potential Additional Visitor Facilities in Grand Canyon/Tusayan Area Supported Through the Year 2010

Product Type	Unit Measure	Amount
Lodging	Rooms	1,835
Retail	Square Feet	128,000
Food & Beverage	Square Feet	62,000
Lodging Employees	Persons	780
Retail Employees	Persons	256
Food & Beverage Employees	Persons	497
Housing	Housing Units	1,245

The economic model estimates that 1,835 new lodging units could be supported in the Grand Canyon/Tusayan area through the year 2010, with limited economic impact on existing area businesses. As noted, 1,371 lodging units could potentially be built on existing private land in Tusayan and within GCNP. If this number of lodging units is constructed in Grand Canyon/ Tusayan and development of lodging units elsewhere (on CFV inholdings, in Valle, etc.) exceeds 464 lodging units (1,835 - 1,371) through the year 2010, economic impact to the existing businesses in Grand Canyon/Tusayan would be expected.

While the number of potential new lodging units on these other lands is uncertain and impossible to accurately predict, it is possible that the developers of CFV, who control numerous private inholdings in the area, would strive to develop several of their inholdings, possibly meeting or exceeding the level of development proposed in Alternative B. Because the ability to achieve specific levels of development on the private inholdings is unclear, a range of development scenarios (100%, 75%, 50%, and 25%) of the level of development proposed under Alternative B have been considered for the private inholdings. It should be noted that under typical commercial zoning for lodging in the Tusayan area, 3,650 units requires less than 100 acres; there is thus ample land area on the private inholdings to accommodate far more commercial development than is proposed under Alternative B.

If a significant percentage of targeted development was actually achieved in Tusayan and on the private inholdings controlled by CFV, economic impacts outside of the Grand Canyon/Tusayan area (a subject discussed further in other surrounding communities) and a substantial increase in competition between businesses in the Grand Canyon/Tusayan area would result. The timing of construction and the numbers of tourists are also important factors in determining impacts. Under Alternative A, the level of additions in any individual year would be determined by individual landowners rather than a specific phasing schedule.

In addition to hotel room development, Tusayan's planned expansion of retail and food and beverage facilities could add about 220,000 square feet to existing inventories. The cumulative amount of retail and food and beverage facilities could be much greater if CFV achieves some, or all, of the planned retail and food and beverage development on the private inholdings. These new facilities would substantially expand the range of options in the area, providing both residents and visitors a larger selection of goods. Increased competition would likely lead to decreased prices and increased service, but could also result in the failure of less competitive and/or undercapitalized operations.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Development on the NFS land under this alternative would include 3,650 lodging units and 425,000 square feet of community and visitor retail and food and beverage facilities. According to the economic model, this amount of development is approximately twice that estimated to maintain existing supply-demand relationships during this time period in the Grand Canyon/Tusayan area under the moderate visitation growth rate scenario. This level of growth would likely result in increased competition among Grand Canyon/Tusayan area businesses to provide better services at lower prices. Should visitation increase at a level faster than that assumed under the moderate visitation growth scenario, fewer impacts to existing Grand Canyon/Tusayan area hotels would result. However, should visitation increase at a level slower than the moderate visitation growth rate scenario, greater impacts to Grand Canyon/Tusayan area hotels would result. The 425,000 square feet of retail and food services

proposed by CFV would also be more than double the amount estimated by the model to maintain existing relationships. This level of development would lead to a more competitive environment, perhaps with some retail operations closing, and would likely result in increased competition among Grand Canyon/Tusayan area businesses to provide better services at lower prices.

Cumulative Impacts

As described under Alternative A, lodging units proposed under this alternative would be in addition to those that might be constructed on existing private land in Tusayan or GCNP, bringing the total potential number of lodging units to 5,021 (3,650 from the CFV development, plus 1,371 from the redevelopment in the Grand Canyon/ Tusayan area). It is reasonable to expect some level of redevelopment in Tusayan and GCNP, potentially reaching a total of 1,371 new lodging units and 220,000 square feet of retail and food and beverage facilities. Therefore, the collective economic impacts to the Grand Canyon/Tusayan area businesses could be similar to those described under Alternative A. However under Alternative A, the quantity of lodging units that would be constructed is entirely speculative, while Alternative B is based on a definite plan to construct 3,650 new lodging units in a phased manner over a minimum of a 12-year period. It is reasonable to expect that such an increase in supply (an increase that is substantially above that estimated to be necessary to maintain the current supply and demand relationships) would result in increased competition, not only in the Grand Canyon/Tusayan area but in surrounding communities as well. The potential impacts to surrounding communities from this level of development are presented in the next issue section.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under Alternative C, CFV would construct 2,000 lodging units on acquired NFS land in a phased manner over a minimum of a 12-year period. This number by itself is roughly equivalent to levels estimated by the economic model to be necessary in the Grand Canyon/Tusayan area to maintain current visitor service supply/demand relationships under the moderate visitation growth rate scenario. New community and visitor facilities would add 304,000 square feet of retail and food and beverage space. As this level is above the approximately 190,000 square feet estimated by the model, competition would increase, which in turn could lower product pricing, increase levels of service, or provide a broader range of products and services. Some marginally profitable or under capitalized businesses could fail.

Cumulative Impacts

As under Alternative B, a certain level of redevelopment is expected in Tusayan, as well as a small amount of development in GCNP, potentially adding 1,371 lodging units in the Grand Canyon/Tusayan area. Therefore, under this alternative, new hotel construction could potentially reach an estimated 3,371 lodging units in the Grand Canyon/Tusayan area (2,000 from the CFV development, plus 1,371 from the redevelopment of Tusayan and GCNP), approximately 175% of the level estimated by the model to be supportable under the moderate visitation growth rate scenario. Cumulatively, this level of development would further increase competition or result in failure of marginally profitable or under capitalized businesses.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, the existing hoteliers in the Grand Canyon/Tusayan area could construct up to 1,371 lodging units and 220,000 square feet of retail and food and beverage facilities. Addition of 1,371 lodging units over an eight-year period would not be expected to substantially affect existing Tusayan businesses if visitation grows to a level similar to or slightly below the moderate visitation growth rate.

Cumulative Impacts

As there is no land exchange, some commercial development of the private inholdings controlled by CFV could occur. Again, the amount and type of development would be determined by market factors (availability of debt and equity capital) and by Coconino County through its zoning process. If development occurs on some of the private inholdings, the potential economic impact to Grand Canyon/Tusayan businesses would be a result of increased supply leading to increased competition in the lodging, retail, and food and beverage industries. Such competition could decrease prices and increase levels of service, but also could result in one or more hotels and/or retail outlets going out of business. In addition, planned hotels or other retail businesses may not be constructed because of deteriorating market conditions. Collectively, these impacts could be similar to those described under the direct and indirect impacts under Alternative A.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, the land exchange does not occur and no NFS land is made available to existing business owners and landowners in Tusayan. The additional population in the area associated with the proposed 100 units of new Federal housing would create some increased demand for retail and food and beverage services. Most likely, this demand would be met by the existing businesses in Tusayan. The transportation staging area proposed under this alternative includes limited retail and food and beverage services for customer convenience, which are not expected to significantly compete with the existing businesses in Tusayan.

Cumulative Impacts

Under this alternative, development would be expected on existing private lands in Tusayan and on selected inholdings controlled by CFV, as well as on outlying private or tribal lands. Therefore, the potential cumulative economic impacts to the Grand Canyon/Tusayan area are similar to those described under Alternatives A and D.

Other Outlying Communities

Issue: Development in the Tusayan area could affect the economy of a number of communities by diverting Grand Canyon tourist revenue.

Methods for Analyzing Impacts

The economic model developed for this EIS also analyzed the potential economic impact of additional development in the Grand Canyon/ Tusayan area on other communities that accommodate Grand Canyon visitors, particularly those in northern Arizona. The analysis considers the level of new lodging that could potentially be developed under the alternatives in comparison with the level of estimated demand necessary to support visitation growth at market penetration and occupancy rates approximating current levels (30% and 75%, respectively). The difference between facilities developed and facilities supported provides an estimate of the level of demand that would be "displaced" from other areas by new development in the Grand Canyon/Tusayan area. Displaced demand is demand that would be relocated from another area to Grand Canyon/Tusayan if supply in Grand Canyon/Tusayan exceeds levels supportable by visitation growth (assuming occupancy and market penetration rates remain unchanged). Since the current penetration rate for the Grand Canyon/Tusayan area is

Table 4.15 Locations Outside of the Grand Canyon/Tusayan Area where Visitors Stayed the Night before and after Visiting GCNP (1994-1995 Visitor Survey)

Location	Percentage of Visitor Room Nights within Northern Arizona	Percentage of Room Nights Total GCNP Visitors
Northern Arizona		42%
Flagstaff	39%	*(16%)*
Williams	15%	*(6%)*
Sedona	15%	*(6%)*
Page	8%	*(4%)*
Other	23%	*(10%)*
Las Vegas		29%
Phoenix		10%
Other		19%
Total		100%

29% and the visitor survey indicated that approximately 35% of the respondents would potentially stay in the Grand Canyon/Tusayan area if lodging were available, some displacement from areas outside the Grand Canyon/Tusayan area is expected as a result of new development. If market penetration rates increase in one area, they must necessarily decrease in another area, as long as visitation, length of stay, and occupancy rates remain unchanged. However, with growth in visitation, most communities would still be able to build new lodging facilities even if a portion of demand is displaced to the Grand Canyon/Tusayan area.

Findings from the 1994/95 Grand Canyon Visitor Survey indicating where visitors were staying the night before and the night after visiting the park were used to estimate where "displacement" would occur. As outlined in Table 4.15, the visitor survey indicated that Las Vegas was the most frequently selected location, attracting 29% of visitor room nights the night before and night after visiting GCNP. The northern Arizona region attracted 42% of visitor room nights; Flagstaff attracted 39% of the northern Arizona visitors and 16% of all visitors. In addition to estimating "displaced" demand, the model also estimated the level of new development needed in communities outside the Grand Canyon/Tusayan area to support increased GCNP visitor-related demand. Findings from the 1994/95 Grand Canyon Visitor Survey used to develop this estimate are outlined in Table 4.16.

Using these factors, the economic model estimated that through the year 2010, the northern Arizona area outside of GCNP and Tusayan (Phoenix and Las Vegas are not included in this estimate) would need to add 3,982 lodging units to support the increase in GCNP visitor-related demand projected under the moderate visitation growth rate scenario and to maintain existing supply-demand relationships. This estimate of demand (3,982 lodging units) includes the number of room nights needed to bring northern Arizona communities outside of the Grand Canyon/Tusayan area to a stabilized 70% occupancy level from their current level of 63%.

In Table 4.17, the estimated number of supportable new lodging units in the Grand Canyon/Tusayan area is subtracted from the potential cumulative level of new hotel development in the Grand Canyon/Tusayan area under the alternatives (assuming a 30% penetration level and 75% occupancy under the moderate growth scenario). The resulting figure is an estimate of the number of lodging units that would be displaced from areas outside the Grand Canyon/Tusayan area through the year 2010. This figure is then multiplied by the share of room nights currently being captured by northern Arizona communities (percentages from Table 4.15) to estimate the reduction in potential new lodging units in northern Arizona caused by displaced demand through the year 2010. As shown in Table 4.17, although development in the Grand Canyon/Tusayan area could pull or displace demand from other northern Arizona communities, additional development would still be necessary in these communities to support estimated increases in GCNP visitor-related demand. The number of new lodging units needed is estimated by subtracting the reduction in new lodging units in northern Arizona caused by displaced demand from the total estimated new lodging units that could be built in northern Arizona to support GCNP visitor-related demand. Table 4.17 indicates a range of new lodging units that could potentially be built in northern Arizona of 2,535 to 3,685 under the various alternatives.

Figure 4.2 presents a graphic representation of new room demand under the alternatives shown in Table 4.17. The shaded portion of the bar represents the number of new lodging units which the model estimates for northern Arizona through the year 2010 to maintain existing relationships under the moderate visitation growth rate scenario. The white portion of the bar represents the number of new lodging units that would be added in the Grand Canyon/Tusayan area in lieu of being built in other northern Arizona communities in the alternatives. For example, under Alternative B, the Grand Canyon/Tusayan area would increase their capture of visitor room nights leading to a decrease in the capture of visitor room nights

Table 4.16 Key Inputs in Estimating Room Demand in Communities outside Grand Canyon/Tusayan Area

Percent Staying In Hotels Night Before/Night After	63.2/60.4
Average Party Size	2.75
Average Nights Stayed Before/After	1.73/1.83
Average Occupancy Level	70%
Percent Staying in Northern Arizona	42%

Table 4.17 Northern Arizona Room Development Requirements for 1997 to 2010

Alternative	GRAND CANYON/TUSAYAN DISPLACED DEMAND: Proposed and Potential Lodging Units in Grand Canyon/ Tusayan Area (1)		Estimated Supportable Lodging Units in Grand Canyon/ Tusayan Area (2)		Lodging Units Displaced from Areas Outside the Grand Canyon/ Tusayan area (3)		Northern Arizona Share of GCNP Visitor Demand (4)		Reduction in Potential New Lodging Units in Nortbern Arizona Caused by Displaced Demand	REGIONAL IMPLICATIONS: Total Estimated New (4,5) Lodging Units tbat Could be Built in Nortbern Arizona to Support GCNP Visitation Growth		Reduction in Potential New Lodging Units in Nortbern Arizona Caused by Displaced Demand		Net New Lodging Units that Could be Built in Northern Arizona outside the GC/Tusayan area
Alternatives A/D/E														
100%*	5,021	-	1,576	=	3,445	x	42%	=	1,447	3,982	-	1,447	=	2,535
75%*	4,109	-	1,576	=	2,533	x	42%	=	1,064	3,982	-	1,064	=	2,918
50%*	3,196	-	1,576	=	1,620	x	42%	=	680	3,982	-	680	=	3,302
25%*	2,284	-	1,576	=	708	x	42%	=	297	3,982	-	297	=	3,685
Alternative B	5,021	-	1,576	=	3,445	x	42%	=	1,447	3,982	-	1,447	=	2,535
Alternative C	3,371	-	1,576	=	1,795	x	42%	=	754	3,982	-	754	=	3,228

(1) Includes lodging units proposed in alternative and other potential development in the Grand Canyon/Tusayan area

(2) From model, estimated number of lodging units needed in Grand Canyon/Tusayan area based on 30% penetration, 75% occupancy, and moderate growth rate A 75% occupancy rate is used because it more closely resembles industry performance in this area

(3) Number of lodging units above what is estimated from the model to be supportable in the Grand Canyon/Tusayan area These units would be built in the Grand Canyon/Tusayan area instead of other areas.

(4) Based on 1994/95 Grand Canyon Visitor Survey

(5) Assumes Northern Arizona lodging market operates at an average occupancy level of 70%

* Possible levels of development as a percentage of development under Alternative B

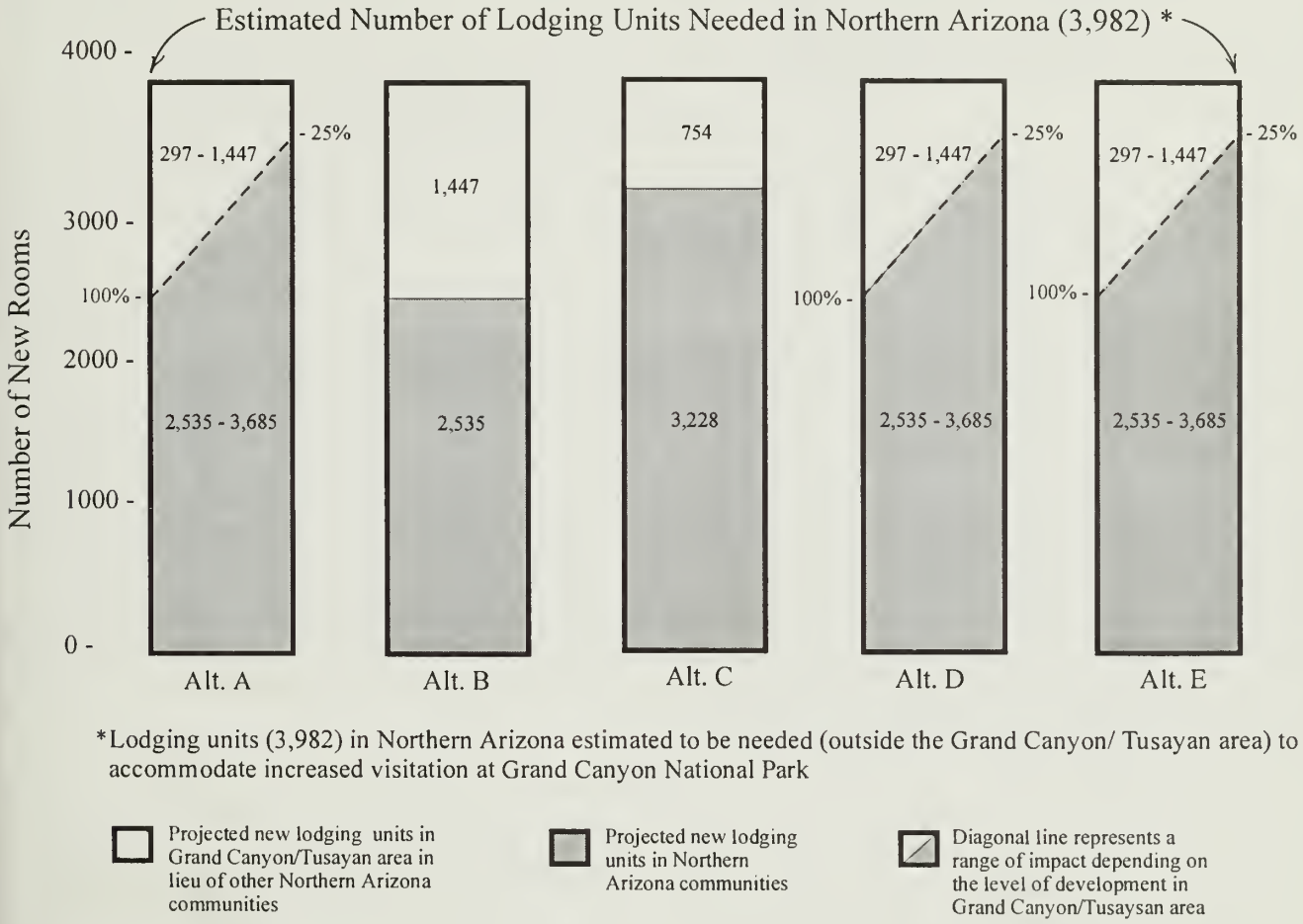


Figure 4.2. Cumulative Impact on Potential Future Room Demand in Northern Arizona (1997-2010).

in other northern Arizona communities. This adjustment in the capture of visitor room nights would reduce the number of potential new lodging units that could be built in northern Arizona by 1,447 units (the white portion of the bar). These communities could still potentially add up to 2,535 new lodging units through the year 2010 (the shaded portion of the bar). The GCNP visitor-related supply/demand relationships for Alternatives A, D, and E are represented by a diagonal line across the bar. This represents a range of development that could occur in the Grand Canyon/Tusayan area collectively on the existing private land in Tusayan, in GCNP, on state and tribal lands, and on the private inholdings. As the collective level of development increases in the Grand Canyon/Tusayan area, the potential level of development decreases in other communities outside the Grand Canyon/ Tusayan area.

Alternative A: No Action

Direct and Indirect Impacts

Increased visitor demand would likely spur development both in the community of Tusayan and potentially on several of the private inholdings controlled by CFV. The levels of development that would actually occur on these lands is unclear, but collectively could meet or exceed the levels described under Alternative B. To evaluate a range of potential impacts, four levels of development are analyzed: 25%, 50%, 75%, and 100% of the amount of development proposed in Alternative B.

It should be recognized that, depending on the phasing of development in Tusayan and on the private inholdings, there could be individual years when new development could exceed supportable levels, thereby potentially impacting the performance of existing hotels. Under Alternative A, zoning and general market forces are the only measures available to control the phasing of development.

As outlined in Table 4.17, a total of 3,982 new lodging units would likely be required in northern Arizona (outside the Grand Canyon/Tusayan area) through the year 2010 (a 14-year period) to support increased visitation at GCNP (by way of comparison, 4,800 units were actually added to the region since 1987) to maintain existing supply-demand relationships. If, under the moderate visitation growth rate scenario, 100% of the development levels planned in Alternative B were achieved (3,650 units) on developable land in the area, and all Grand Canyon/Tusayan lodging properties were redeveloped as planned (1,371 units), northern Arizona communities would experience a potential reduction in the growth of the lodging industry of an estimated 1,447 lodging units because of displaced demand. The impacts of development under this scenario would thus mean that through the year 2010, northern Arizona communities would experience a reduction in the level of new lodging units needed to support increased visitation, from 3,982 lodging units to 2,535 lodging units (3,982 - 1,447).

Table 4.17 also shows the impact on northern Arizona communities if 75%, 50%, and 25% of the levels of development planned in Alternative B are actually developed on the private inholdings controlled by CFV, or other developable land in the region. Under any of these levels of development, northern Arizona communities would experience a reduction (from 3,982) in the number of supportable new lodging units. Table 4.17 also shows that northern Arizona communities would still be able to expand their inventories by more than 2,500 lodging units under any of the development levels.

Table 4.18 provides more detail on where demand for new lodging units in individual northern Arizona communities would potentially occur, based on findings from the 1994/95 Grand Canyon Visitor Survey and the modeling results.

Each room that is occupied represents a certain number of overnight visitors; accordingly, a level of visitor spending is associated with each room. Estimated visitor party spending is $140 per occupied room-night, the composition of which is described more fully in the Appendix. Table 4.19 outlines both the likely expenditures that could be anticipated within northern Arizona communities, and the impacts of displaced demand from the Grand Canyon/Tusayan area capturing a portion of the current share attributed to northern Arizona communities. The impacts through the year 2010 would generally consist of a reduction in future growth rather than a reduction in current spending levels.
The results of a similar analysis evaluating impacts to other areas (Phoenix, Las Vegas, etc.) are presented in the Appendix. The same general relationships exist, with Alternative A resulting in a potential reduction in future growth needs in the outlying communities.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

This proposal is based on a definite plan by CFV to construct 3,650 new lodging units in a phased manner over a minimum of a 12- year period. As previously discussed, this amount of development would likely result in demand being displaced to the Grand Canyon/Tusayan area and a corresponding decrease for outlying communities. New lodging units would be required in other northern Arizona communities, but at a reduced rate. Tables 4.17 - 4.19 quantify the anticipated impacts of this alternative on these outlying communities.

Cumulative Impacts

Tusayan and GCNP could add another 1,371 new lodging units, increasing the collective lodging additions under Alternative B to 5,021 units. The process for deriving estimates and considering impacts is the same as for the 100% level of Alternative A (Table 4.17). With this level of displaced demand, the model estimates that northern Arizona communities outside the Grand Canyon/Tusayan area could potentially add up to 2,535 new lodging units through the year 2010. As noted in the discussion of Alternative A, the economic model estimates are based on annual average increases in visitation; proposed new development (supply) could exceed visitation growth (demand) in individual years, potentially impacting the performance of existing hotels.

It should be noted that changes in the marketplace, such as substantial increases in competition, may preclude the construction of all 5,021 potential lodging units in the Grand Canyon/Tusayan area. If significant additions do occur, prices would be expected to come down, and some hotels would try to attract business by offering improved service. More marginal properties might go out of business, either because they would be less desirable to the traveling public or because their profit margin would not permit them to offer competitive prices.

Table 4.18 Community Net New Rooms Required Over a 12 year period

Alternative	COMMUNITY IMPLICATIONS: 1997 - 2010 Total Estimated New Lodging Units that Could be Built in Northern Arizona to Support GCNP Visitation Growth		Reduction in Potential New Lodging Units in Northern Arizona Caused by Displaced Demand		Net New Lodging Units that Could be Built
FLAGSTAFF - 39% of total demand captured by northern Arizona communities					
A/D/E					
100%	1,553	-	564	=	989
75%	1,553	-	415	=	1,138
50%	1,553	-	265	=	1,288
25%	1,553	-	116	=	1,437
B	1,553	-	564	=	989
C	1,553	-	294	=	1,259
WILLIAMS - 15% of total demand captured by northern Arizona communities					
A/D/E					
100%	597	-	217	=	380
75%	597	-	160	=	438
50%	597	-	102	=	495
25%	597	-	45	=	553
B	597	-	217	=	380
C	597	-	113	=	484
SEDONA - 15% of total demand captured by northern Arizona communities					
A/D/E					
100%	597	-	217	=	380
75%	597	-	160	=	438
50%	597	-	102	=	495
25%	597	-	45	=	553
B	597	-	217	=	380
C	597	-	113	=	484
PAGE - 8% of total demand captured by northern Arizona communities					
A/D/E					
100%	319	-	116	=	203
75%	319	-	85	=	233
50%	319	-	54	=	264
25%	319	-	24	=	295
B	319	-	116	=	203
C	319	-	60	=	258
OTHER - 23% of total demand captured by northern Arizona communities					
A/D/E					
100%	916	-	333	=	583
75%	916	-	245	=	671
50%	916	-	156	=	759
25%	916	-	68	=	847
B	916	-	333	=	583
C	916	-	173	=	742
TOTAL NORTHERN ARIZONA					
A/D/E					
100%	3,982	-	1,447	=	2,535
75%	3,982	-	1,064	=	2,918
50%	3,982	-	680	=	3,302
25%	3,982	-	297	=	3,685
B	3,982	-	1,447	=	2,535
C	3,982	-	754	=	3,228

Table 4.19 Community Net New Spending Attributed Over a 12 year period

	COMMUNITY IMPLICATIONS: 1997 - 2010				
Alternative	Total Estimated New Spending in Northern Arizona Communities to Support GCNP Visitation Growth		Reduction in Potential Spending Caused by Displaced Demand		Net New Spending in Community
FLAGSTAFF - 39% of total demand captured by northern Arizona communities					
A/D/E					
100%	$55,550,810	-	$20,174,280	=	$35,376,530
75%	$55,550,810	-	$14,844,550	=	$40,706,260
50%	$55,550,810	-	$9,479,050	=	$46,071,760
25%	$55,550,810	-	$4,149,320	=	$51,401,490
B	$55,550,810	-	$20,174,280	=	$35,376,530
C	$55,550,810	-	$10,516,380	=	$45,034,430
WILLIAMS -15% of total demand captured by northern Arizona communities					
A/D/E					
100%	$21,354,690	-	$7,762,090	=	$13,592,600
75%	$21,354,690	-	$5,723,200	=	$15,631,490
50%	$21,354,690	-	$3,648,540	=	$17,706,150
25%	$21,354,690	-	$1,609,650	=	$19,745,040
B	$21,354,690	-	$7,762,090	=	$13,592,600
C	$21,354,690	-	$4,042,010	=	$17,312,680
SEDONA - 15% of total demand captured by northern Arizona communities					
A/D/E					
100%	$21,354,690	-	$7,762,090	=	$13,592,600
75%	$21,354,690	-	$5,723,200	=	$15,631,490
50%	$21,354,690	-	$3,648,540	=	$17,706,150
25%	$21,354,690	-	$1,609,650	=	$19,745,040
B	$21,354,690	-	$7,762,090	=	$13,592,600
C	$21,354,690	-	$4,042,010	=	$17,312,680
PAGE - 8% of total demand captured by northern Arizona communities					
A/D/E					
100%	$11,410,630	-	$4,149,320	=	$7,261,310
75%	$11,410,630	-	$3,040,450	=	$8,370,180
50%	$11,410,630	-	$1,931,580	=	$9,479,050
25%	$11,410,630	-	$858,480	=	$10,552,150
B	$11,410,630	-	$4,149,320	=	$7,261,310
C	$11,410,630	-	$2,146,200	=	$9,264,430
OTHER - 23% of total demand captured by northern Arizona communities					
A/D/E					
100%	$32,765,320	-	$11,911,410	=	$20,853,910
75%	$32,765,320	-	$8,763,650	=	$24,001,670
50%	$32,765,320	-	$5,580,120	=	$27,185,200
25%	$32,765,320	-	$2,432,360	=	$30,332,960
B	$32,765,320	-	$11,911,410	=	$20,853,910
C	$32,765,320	-	$6,188,210	=	$26,577,110
TOTAL NORTHERN ARIZONA					
A/D/E					
100%	$142,436,140	-	$51,759,190	=	$90,676,950
75%	$142,436,140	-	$38,095,050	=	$104,341,090
50%	$142,436,140	-	$24,287,830	=	$118,148,310
25%	$142,436,140	-	$10,659,460	=	$131,776,680
B	$142,436,140	-	$51,759,190	=	$90,676,950
C	$142,436,140	-	$26,934,810	=	$115,501,330

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under this alternative, CFV plans to build 2,000 new lodging units. Economic impacts would be a reduction in future growth and increased competition in outlying communities (see Tables 4.12 - 4.14).

Cumulative Impacts

Under Alternative C, Tusayan and GCNP could again increase the number of new lodging units, potentially up to 3,371 units (2,000 + 1,371). As outlined in Table 4.17, these cumulative additions could reduce the number of potential new lodging units in northern Arizona outside the Grand Canyon/Tusayan area from 3,982 to 3,228 (a reduction of 754 lodging units), similar to the 50% development level of Alternatives A, D, and E and approximately 700 units more than under Alternative B. As shown in Table 4.17, the amount of development in the Grand Canyon/Tusayan area under Alternative C would be less than the maximum amount of what could potentially occur under any of the other alternatives, including the No Action Alternative.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

A total of 1,371 units could potentially be added under Alternative D from redevelopment in the Grand Canyon/Tusayan area. This figure is lower than the estimated number of lodging units (1,576) that could be supported in the Grand Canyon/Tusayan area with little impact to other northern Arizona communities.

Cumulative Impacts

Cumulative impacts to northern Arizona communities under Alternative D would be similar to those impacts described under Alternative A, as development of some of the private inholdings controlled by CFV could potentially occur, as well as development of other private, state, and tribal land in the Grand Canyon/Tusayan area.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

This alternative would have the same impacts as described under Alternative D.

Cumulative Impacts

Cumulative impacts to northern Arizona communities under Alternative E would be similar to the direct and indirect impacts discussed under Alternative A.

Housing

Issue: There is a need for additional housing for both Federal and concessionaire employees within GCNP and for employees of Tusayan businesses. Issues include who would build the housing, who would pay for the housing to be built, how many housing units are needed, what types of housing are needed, and the distribution of housing types and affordability offered.

Methods for Analyzing Impacts

The GCNP GMP has identified a need for up to 500 additional housing units for NPS and park concessionaire employees. The GMP stipulates that these additional units should be located outside of park boundaries. The questions of who would build the housing and pay for the construction, and how this housing would be made affordable and available for the employees, are very important. Finally, the type of housing is also of concern, as there is a wide variety of needs, including a segment of the population that would like to achieve home ownership.

Grand Canyon/Tusayan area businesses predict that over 1,000 new employees will be needed during the peak season by the year 2000, requiring up to 539 new housing units to house these new employees. The alternatives can be compared in terms of whether and how they would provide housing for existing and new employees.

Alternative A: No Action

Direct and Indirect Impacts

Under this alternative, no construction of housing for GCNP or park concessionaire employees is proposed. Housing for Grand Canyon/Tusayan area employees, including NPS employees, could be provided in Tusayan, on the private inholdings, or in the outlying communities of Valle, Williams, and Flagstaff. Open market housing has not been built on private land in Tusayan to date because profits from housing would be minimal at best and construction costs are high. For new commercial development in Tusayan or commercial development on

the private inholdings, it is likely that Coconino County would continue to require that developers/employers provide employee housing. Recently, some employers have developed housing outside of Tusayan, for instance in Valle, and transport their employees to and from Tusayan by bus.

It is possible under Alternative A that private land may be subdivided and sold, apartment complexes built and rented, or other housing provided. These possibilities would be considered more likely if a developer could profit from the venture. Private inholdings such as Kotzin and TenX are considered suitable for such development. Should this occur, it is likely that these housing units could be made available for purchase or rent to park and concessionaire employees, as well as to other employees in the Tusayan area. Such housing could also be made available for purchase or rent to persons wishing a second home or recreational lot near Grand Canyon. Further development would likely result in more housing in various areas in Tusayan, on the private inholdings, in Valle, or in other surrounding communities. Such piecemeal development would continue to preclude the development of a centralized community of residents and community services.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Development of NFS land for visitor and community services and facilities as proposed under Alternative B would require housing for an estimated 3,334 new employees. Employment figures for this alternative include secondary (or induced) employment for community services and facilities at the development. Additional housing may be required in outlying communities for a small number of employees in jobs generated offsite to support the CFV development. Sufficient housing should be available in these communities to accommodate this demand. Alternative B calls for the development of 2,575 units of various housing types. Apartments and dormitories would be leased at an average estimated monthly rate of $575 and $455 per unit, respectively, while a variety of manufactured and custom single family homes would be available for purchase at prices ranging from $65,000 to $110,000.

Rents paid by employees would be subsidized by the commercial aspects of development. Canyon Forest Village Council would be created to ensure that rents remain within the affordable range for employees and that the housing is made available only to Grand Canyon/Tusayan area employees. The governing body described in Chapter 2 and is further discussed under the governance issue. Housing is designated for employees of the development, the NPS, the park concessionaire, the Forest Service, and Tusayan businesses, as shown in Table 4.20.

The number of housing units proposed for GCNP employees under this alternative may not entirely satisfy the need for GCNP housing outside the park, estimated at up to 500 units (100 units for Federal employees and up to 400 units for park concessionaire employees). If needed, NPS employees could request housing from the governing council to make up the difference. Up to 495 housing units would be available for employees of Tusayan businesses, which may also be less than the number needed. These employees would be able to request housing from the Canyon Forest Village Council, or Tusayan businesses or other area employers could acquire building sites from CFV to construct apartments for their employees under the rules and conditions of the Canyon Forest Village Council.

Cumulative Impacts

Redevelopment of Tusayan is expected to occur to a certain degree simultaneously with implementation of Alternative B. Coconino County requires that developers provide housing for their employees; thus

Table 4.20 Proposed Number of Employee Housing Types to be Built under Alternative B

Groups	Number of Units of Each Type			*Total*
	Dormitories	Apartments	Single Family	
GCNP and Concessionaire Employees*	120	175	105	***400***
CFV Employees	900	650	130	***1,680***
Other Area Employees	200	220	75	***495***
Total	**1,220**	**1,045**	**310**	**2,575**

*Or other Federal employees

additional development within the existing Tusayan townsite would necessitate additional housing for employees associated with these developments. This housing might be constructed in the existing Tusayan townsite, in Valle, or in the CFV development through cooperative agreement with CFV, as housing units have been dedicated for existing employers.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under Alternative C, housing issues and needs are generally satisfied as they are under Alternative B. The two primary differences between Alternatives B and C are the amount of housing proposed and the amount of the subsidy offered to keep rents affordable.

Alternative C calls for the development of 2,075 units of housing in a wide variety of types. Apartments and dormitories would be leased at an average of $650 and $455 per unit per month, while manufactured single family homes would be available for purchase at a price of $65,000. Housing is designated for employees of the development, the NPS, the park concessionaire, the Forest Service, and Tusayan businesses, as shown in Table 4.21.

Housing units proposed for GCNP employees may not entirely satisfy the need for GCNP housing outside the park, estimated at up to 500 units. Under this alternative up to 500 housing units would also be available for other area employees. These employees could request housing from the Canyon Forest Village Council, or Tusayan businesses or area employers could acquire building sites from CFV to construct housing for their employees under the rules and conditions of the Canyon Forest Village Council.

Cumulative Impacts

Cumulative impacts under Alternative C would be expected to be similar as those under Alternative B, as redevelopment in Tusayan would be expected concurrent with the CFV development.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, the proposal for satisfaction of housing issues and needs is different than under the previous two alternatives. Housing would be developed on about 54 acres of land acquired through the Townsite Act. Housing is defined as an appropriate use of land acquired under the Townsite Act, as long as a governmental entity is the housing owner. Under this alternative, a County Improvement District would be formed to purchase the NFS land to be used for housing and community services. The land proposed for housing would then be made available for purchase by a public housing authority. The housing authority could raise funds through property taxes, to cover the cost of the land and construction of housing units. The public housing authority would have control over rents to ensure that they remain affordable.

Alternative D calls for the development of 916 units of housing in a variety of types (Table 4.22). Apartments, mobile homes, dormitories, and single-family homes would be leased. No single-family homes would be available for purchase under this alternative.

Unlike Alternatives B and C, this alternative cannot set aside housing specifically for NPS, park concessionaire,

Table 4.21 Proposed Number of Employee Housing Types to be Built under Alternative C

Groups	Number of Units of Each Type			*Total*
	Dormitories	Apartments	Single Family	
GCNP and Concessionaire Employees*	120	175	105	*400*
CFV Employees	540	550	85	*1,175*
Other Area Employees	200	220	80	*500*
Total	**860**	**945**	**270**	**2,075**

* Or other Federal employees

Table 4.22 Proposed Number of Employee Housing Types to be Built under Alternative D

Groups	Number of Units of Each Type*			*Total*
	Dormitories	Apartments/Mobile homes	Single Family	
GCNP	88	169	120	*377*
Tusayan Area Employees	134	255	150	*539*
Total	**222**	**424**	**270**	**916**

*This is the proposed housing distribution: however, under the Townsite Act, this housing must be made available to all residents in the area.

or other employees. However, it is anticipated that the majority of people wishing to live in Tusayan would also work in Tusayan or GCNP. Housing proposed for GCNP employees may not entirely satisfy the need for GCNP housing outside the park, estimated at up to 500 units. While the number of units proposed is certainly adequate for employee housing needs in the short term, no guarantees of housing supply can be given to any particular employer

Cumulative Impacts

Cumulatively, implementation of Alternative D does not preclude the commercial development of the inholdings controlled by CFV, and cumulative impacts on housing under implementation of Alternative D would therefore be expected to be similar to those described for Alternative A. However, new housing for Tusayan area employees would be in one location rather than in different locations, providing a greater sense of community for residents.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Implementation of Alternative E includes a housing component solely for NPS employees. Under this alternative, the USDA and USDI would execute an interagency agreement for government-furnished employee housing. This alternative calls for the construction of 100 units of housing for NPS employees and their families. Construction of these units would be by a contractor selected by the NPS through competitive bidding, who may or may not be the same as the contractor selected to construct and operate the transportation staging area and mass-transit system. Rental rates for the Federal housing complex would be established using a government formula if construction is funded by the Federal government; rental rates would be based on market conditions if construction is funded by a private developer. Employees of the park concessionaire, who need an estimated 400 lodging units, would have to find housing opportunities elsewhere along with other Tusayan area employees.

Cumulative Impacts

Under Alternative E, no private-sector housing would be available on NFS land. Therefore, the housing situation for existing and new businesses in the Tusayan/Grand Canyon area would be expected to be similar to the conditions under Alternative A.

Employment Opportunities

Issue: Development near Tusayan may provide additional employment opportunities.

Methods for Analyzing Impacts

Development is anticipated under all the alternatives, requiring additional employees in the Grand Canyon/Tusayan area. Proponents of each alternative were asked to estimate the number of new employees needed under each alternative. Methods for analysis of employment opportunities evaluate the number of new employees required and the types of jobs created from implementation of each alternative.

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, employment opportunities are expected to be generated by the redevelopment of Tusayan and potentially the development of several of the private inholdings controlled by CFV. Such development would create a multitude of employment categories, including laborers, construction managers, chefs, and retail and hotel managers. The redevelopment of Tusayan could potentially create employment opportunities for 1,078 employees. The breakdown of these employment opportunities is discussed under Alternative D.

No specific plans for development of other private, state, or tribal lands in the Grand Canyon/Tusayan area, including the private inholdings controlled by CFV are proposed under this alternative. Thus, the amount of employment generated collectively under this alternative is considered to be within the range identified under the other four alternatives.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Development proposed under Alternative B would create an estimated 3,334 jobs at full buildout (Table 4.23).

Table 4.23 Employment Opportunities Created by Full Buildout of CFV Development

Type of Work	Number of Employees
Lodging	1,568
Retail/Food & Beverage	1,455
Educational	100
Community	43
Transportation Center	60
Village Administration	51
Apartments	35
Dormitories	22
Total	3,334

Employment estimates under this alternative include many of the additional jobs that would be generated to serve the needs of this new population, referred to as secondary employment (or induced employment). A small amount of induced employment (not included in total employment figures) would also be expected in the outlying communities from additional jobs generated to support the new CFV development.

Cumulative Impacts

Implementation of Alternative B would not preclude the redevelopment of Tusayan, which would also create additional employment opportunities in Tusayan. This amount of employment would be expected to be equal to or less than that described under Alternative D. Cumulatively, a substantial increase in employment is expected in Tusayan under Alternative B. Employment in the visitor service industry is expected to grow considerably throughout Coconino County and northern Arizona as businesses expand to meet increasing visitation demands at Grand Canyon.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Alternative C would create additional employment opportunities but not as many as under Alternative B because of the reduced amount of development. The additional 2,115 jobs are summarized in Table 4.24. A small amount of induced employment could also occur in the outlying communities to support this new population created by the CFVAP development.

Table 4.24 Employment Opportunities Created by Full Buildout of CFVAP

Type of Work	Number of Employees
Lodging	745
Retail/Food & Beverage	1,060
Educational	99
Community	43
Transportation Center	60
Village Administration	51
Apartments	35
Dormitories	22
Total	2,115

Cumulative Impacts

Cumulative impacts under Alternative C would be similar to those under Alternative B, except that the employment under Alternative C is less than that shown for Alternative B because of the smaller size of the development.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Implementation of Alternative D would result in employment opportunities from redevelopment in Tusayan. Jobs would primarily be in the construction and service sectors. A breakdown of the 1,078 jobs generated under this alternative is presented in Table 4.25.

Table 4.25 Employment Opportunities Created by Redevelopment of Tusayan

Type of Work	Number of Employees
Lodging	490
Retail/Food & Beverage	462
Educational	53
Transportation Center	73
Total	1,078

Employment estimates for this alternative do not include additional jobs that would be created to service the additional population and businesses created through redevelopment of Tusayan. A number of such jobs would be expected in Tusayan, in addition to a small number of jobs in the outlying communities.

Cumulative Impacts

Implementation of this alternative would not preclude development of the private inholdings controlled by CFV, and additional employment opportunities in construction and service sectors could therefore occur, depending upon the level of development on the inholdings. It is possible that the inholdings could be developed at a level equal to or greater than that proposed under Alternative B, and collective potential employment opportunities could therefore approximate those under any of the three alternatives previously discussed.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Employment opportunities under Alternative E are expected to be limited because of the limited amount of development proposed. Table 4.26 presents the employment opportunities expected to be generated under Alternative E.

The limited level of development proposed in this alternative would also limit the amount of induced employment. Few, if any, secondary jobs would be created under this alternative.

Cumulative Impacts

Under Alternative E, new commercial and residential development would be expected through continued redevelopment of Tusayan and through potential development on several of the private inholdings controlled by CFV, on tribal land, and on state trust land. Cumulative impacts associated with this alternative are considered to be similar to those discussed under the other alternatives.

Crime Rates

Issue: Additional population growth and visitation resulting from development of the private or NFS lands near Tusayan could increase crime rates in the Grand Canyon/Tusayan area.

Methods for Analyzing Impacts

Past and present criminal cases in the Grand Canyon/Tusayan area are tabulated by the Coconino County Sheriff's Department. The criminal cases considered here are actual cases reported to the Sheriff's Department, the Arizona Department of Public Safety (DPS), and the NPS. Types of crime include theft, traffic accidents, property crimes, DUIs, and domestic violence.

The Coconino County Sheriff's Department does not have a model for projecting future crime rates based on population increase. The Sheriff's Department stated that law enforcement activity is different in Tusayan than in other small communities because the large number of people in the area (visitors and employees), particularly in the summer, creates opportunities for crime. It is not that the rise in population causes an increase in crime, but rather that the increased population creates additional opportunities for criminal activities (Sergeant Forman, Coconino County Sheriff's Department, personal communication 1997). Reported criminal cases are also thought to be tied to social activities; for example, watching a TV program on domestic violence may result in an increase in the number of domestic violence cases reported to the Sheriff's Department.

Table 4.26 Employment Opportunities Created by Implementing Alternative E

Type of Work	Number of Employees
Retail/Food & Beverage	10
Transportation Staging Area	18
Total	28

Methods for analyzing impacts to crime rates include a description of how each alternative proposes to provide law enforcement services and facilities and an assessment of the potential increase in opportunity for criminal activity. Estimated visitation rates would not change under any of the alternatives, but proposed community size would vary under each alternative, which may affect crime rates.

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, no additional law enforcement facilities or services are proposed for the Grand Canyon/Tusayan area. Coconino County would continue to provide three Sheriff's deputies based out of the substation in Williams, DPS would continue to station one officer in Tusayan, the KNF would continue to provide one law enforcement officer to patrol NFS land on the Tusayan Ranger District, and the NPS would provide rangers for law enforcement inside GCNP. As there is no formula for estimating increase or decrease in crime rates related to projected population increase, any such estimates would be speculative. It is anticipated that continued development in the Grand Canyon/Tusayan area under this alternative would hinder law enforcement because development would be scattered throughout the region instead of concentrated in one area. This situation would continue until such time as Tusayan incorporates and can provide municipal police service or the County determines a need to station deputies in Tusayan.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, CFV would construct and equip a Coconino County Sheriff's Department substation in the CFV development, reducing response times to criminal occurrences in Tusayan. The substation would be manned by county personnel and equipped with vehicles already assigned to the Tusayan area. The DPS officer stationed in Tusayan would continue to be responsible for State Highway 64, the KNF would continue to provide a law enforcement officer for NFS land, and the NPS would continue to provide rangers for law enforcement inside GCNP. As under Alternative A, any estimates of increase or decrease in crime rates related to projected population increase would be speculative.

Opportunities for criminal activities may increase under this alternative because of the additional development of visitor and community services and facilities. The impact of having a Sheriff's substation on-site cannot be determined, but such a law enforcement presence may reduce the likelihood of unlawful activity.

Cumulative Impacts

Implementation of Alternative B would not preclude the redevelopment of Tusayan, which could also create additional criminal opportunities in Tusayan. Some additional law enforcement officers may be required to patrol this new development, but they would be dispatched from the substation built by CFV.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under this alternative, CFV would build and equip a Coconino County Sheriff's Department substation in the CFV development, reducing response times to criminal occurrences in Tusayan. Although the development proposed under Alternative C is smaller than that proposed under Alternative B, crime rates would be expected to be similar to those under Alternative B.

Cumulative Impacts

Cumulative impacts under Alternative C would be the same as under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Impacts on crime rates would be similar to those described under Alternatives B and C, except that no funding is identified under Alternative D to pay for a Sheriff's Department substation. Under this alternative, plans for the community center identify office space for police/sheriff. DPS would continue to station an officer in Tusayan, the KNF would provide a law enforcement officer to patrol NFS land, and NPS rangers would continue to provide law enforcement in GCNP. Again, any attempt to estimate increase or decrease in crime rates related to projected population increase would be speculative.

Cumulative Impacts

Cumulatively, implementation of this alternative would not preclude development of some of the inholdings controlled by CFV. Additional development would be scattered throughout the region, requiring existing law enforcement to patrol areas that were previously undeveloped and response times could be increased.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Impacts to crime rates would be similar to those under Alternative A. No additional law enforcement facilities or services are proposed under this alternative.

Cumulative Impacts

Cumulative impacts under Alternative E would be the same as the direct and indirect impacts discussed under Alternative A.

Community Infrastructure

Issue: As visitation to the park continues to increase, the need to expand existing facilities or provide new facilities for schools, police and fire protection, medical services, and other community services will increase.

Methods for Analyzing Impacts

The existence and condition of community facilities in the Grand Canyon/Tusayan area was inventoried for this analysis. Additionally, new facilities desired by residents of Grand Canyon and Tusayan were analyzed from input gathered during the public scoping process and information in the GCNP GMP. Two of the primary community services desired are the expansion of Grand Canyon School outside GCNP and construction of houses of worship. The types, locations, and capacities of community services differ for each alternative. Methods for analyzing impacts to community infrastructure include a description of how each alternative proposes to use existing community services and facilities, how each alternative proposes to incorporate new community facilities into development design, and how these services satisfy community needs. Also discussed are the funding mechanism involved in implementing the development, the proponent's ability to cover the costs associated with existing and future services and facilities, and a qualitative discussion of the tax revenues.

Commercial businesses (lodging, retail, and food and beverage) pay income taxes to the state and Federal government as well as business property taxes (taxes on business equipment such as computers) to Coconino County. Employees of these businesses pay individual Federal and state income taxes. Visitors and residents pay sales taxes on purchases, monies which go to the State of Arizona and Coconino County, and pay additional sales taxes on purchases of gasoline. Finally, property owners pay county property taxes on their land.

The Forest Service makes payments to counties with respect to Federal lands under two statutes known as the Twenty-Five Percent (25%) Fund and the Payment in Lieu of Taxes (PILT) Act. The 25% Fund of May 23, 1908, provides for counties to receive 25% of the gross receipts and revenues from timber sales and other income-generating activities on Federal lands. The PILT Act of 1976 authorizes payments to counties based on the number of acres of "entitlement lands" within the county. For purposes of this discussion, entitlement lands are NFS land.

Alternative A: No Action

Direct and Indirect Impacts

Community Services and Facilities

Under this alternative, no additional community services or facilities are proposed. Any future community services and facilities associated with development in Tusayan, on the private inholdings, or on other private lands would be at the landowner's discretion. Redevelopment of Tusayan would be guided by the Tusayan Area Plan. The potential for future development and the type of development created on the private inholdings or other private land in Coconino County would be influenced by existing Coconino County plans and zoning ordinances and by limitations such as remoteness and access. No direct Federal authority over development of the private inholdings exists, other than that contained in current Federal statutes and regulations.

Redevelopment in Tusayan and potential development of the private inholdings, tribal land, or state trust land may increase the number of students attending Grand Canyon school. This school is currently operating at capacity, and any increase in the student population may require the transfer of children to other school districts. Children currently bused to GCNP from Valle could be transferred to the Williams Unified School District. The Lower Basin

private inholding is on the boundary line between the Grand Canyon School District and Flagstaff Unified School District, and school children associated with residential development there would most likely be bused to Flagstaff.

The Tusayan Fire District is planning to build a temporary fire station to serve the Tusayan community. The district may need to find another location on private land in the area for a permanent facility. The Tusayan Fire District does not include any of the private inholdings. If these areas were to be developed, fire protection services would be provided by the KNF or NPS (as currently exists), or the Tusayan Fire District boundaries could be annexed to include the private inholdings.

County and State Services and Facilities

Existing public infrastructure would remain the same. County services in Tusayan would continue to be limited to three Coconino County Sheriff's deputies and a solid waste compaction facility. State facilities and services would include operation of Grand Canyon Airport and maintenance of State Highway 64 by ADOT.

The private inholdings, if developed, may include land set aside for county and state facilities and services (Table 2.2 shows the acreage proposed to be developed for such facilities and services). Development of the private land may require the expansion of existing facilities or the construction of new facilities to handle additional sewage, solid waste, and hazardous materials generated by the development(s).

The GCNP GMP assures the willingness of the NPS to cooperate with other agencies and private entities to guide future development in the Tusayan area. As Tusayan grows, the need to expand or provide new facilities for police and fire protection, medical services, and other community facilities will increase. The adopted Tusayan Area Plan (provided in Appendix) provides some goals and policies for future development, but there is no land-use or financing plan for Tusayan that assures the provision of community facilities.

Medical facility

Existing medical facilities in the area consist of a full-service clinic in GCNP, two Park Service ambulances, and an air-evacuation helicopter. While the capacity of existing facilities has not been exceeded, increased visitation to the park would likely increase demand for medical facilities and services.

Sewage

The South Grand Canyon Sanitary District would continue to operate a sewage treatment facility for local residents and businesses. GCNP's South Rim facility would treat all wastewater generated on the South Rim of the park. The Tusayan facility can accommodate an additional 500,000 gallons of wastewater per day before reaching capacity, and the South Rim GCNP facility can handle an additional 150,000 gallons per day before reaching capacity. Both of these facilities can accommodate planned development in GCNP and in the community of Tusayan. The Moqui Lodge, which is currently operating their wastewater treatment facility at capacity would continue to pursue expansion of their wastewater treatment system with the KNF. Development of the private inholdings controlled by CFV would require the construction of new sewage treatment facilities or expansion of the Tusayan or Moqui Lodge facilities.

Solid waste

Coconino County would continue to operate a compactor station and haul solid waste to the City of Flagstaff landfill. Capacity at the Flagstaff landfill is currently sufficient to accommodate all solid waste originating from Tusayan. Redevelopment of Tusayan and development of some of the private inholdings would shorten the lifespan of the landfill.

Tax Revenue

Continued development in the Tusayan area would provide additional tax revenue for Coconino County, the State of Arizona, and the Federal government under a variety of taxation programs.

Under this alternative, tax revenue from Tusayan and the surrounding areas would be expected to increase substantially with new development of visitor service facilities and new employment created to staff these facilities. While it is impossible to estimate tax revenue under Alternative A because of the uncertainties inherent in this alternative, tax revenue generated would be expected to be within the range of any of the other alternatives. Should any land in Tusayan or on the private inholdings be rezoned for a higher density commercial use (such as commercial lodging), property taxes would increase substantially, bringing greater revenue to Coconino County. Sales tax revenues would also increase. Finally, additional business growth in the area would bring in more tax revenue to the county, state, and Federal governments, both from the businesses and from the employees who work in those businesses.

On the NFS land, PILT and 25% Fund payments would continue to be made.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Community Services and Facilities

Table 4.27 shows the community services and facilities that are proposed under this alternative and how they would be funded. CFV would build 120,000 square feet of community-related retail space plus 55,000 square feet of improved pads for other commercial retail. A list of these proposed establishments is provided in the description of alternatives in Chapter 2.

Under Alternative B, CFV would design, finance, and build parks, a community center, a library, a sheriff's office, a fire station, and a post office. CFV would provide a one million dollar school grant and donate land with infrastructure to the Grand Canyon School District to build a school site. Improved land would be sold to religious groups to build individual houses of worship, and space in the Village Core would be leased or sold to a primary health care provider.

County and State Services and Facilities

A Coconino County Sheriff's Department substation

would be constructed and equipped at CFV's expense, as well as a fire station to serve the Tusayan area. The substation would be manned by county personnel and equipped with vehicles already assigned to the Tusayan area. ADOT would continue operation of Grand Canyon Airport and maintenance of State Highway 64.

Medical Facility

The existing medical facility in the park would remain open for use by park visitors and employees. Office space in CFV would be made available for lease to a primary health care provider for operation of a health clinic and an emergency air evacuation system and dental practitioners and other specialized care providers. Medical facilities provided in Tusayan would help to ensure that the medical services and facilities in Grand Canyon would not be used beyond capacity.

Sewage

Alternative B would produce approximately 322,000 gallons of wastewater per day along with the pollutants normally associated with that wastewater. A new wastewater treatment and disposal facility would be constructed using the Solar Aquatics System (SAS). This system consists of greenhouses with solar ponds and vegetation beds that treat effluent for subsequent discharge to composting reed beds and infiltration basins. Reclaimed wastewater produced by the SAS may be (1) discharged to natural or man-made ponds, (2) discharged to groundwater and used for aquifer recharge, (3) used for irrigation of local landscape or stock tanks, or (4) used for toilet flushing in dual-plumbed facilities. Reuse of reclaimed wastewater would require review and approval by ADEN and ADWR. Building a new facility would have no impact on existing wastewater treatment facilities.

Table 4.27 Disposition of Community Services and Facilities under Alternative B

Community Service or Facility	Land Area		Improvements	
	Contributed	Sold To User	Contributed	Paid For By User
School	✔		✔*	
Parks	✔		✔	
Police Station	✔		✔	
Fire Station	✔		✔	
House(s) of Worship		✔		✔
Community Center	✔		✔	
Medical Clinic		✔		✔
Library	✔		✔	
Post Office	✔		✔	

* A one million dollar grant would be provided to the school district for funding.

Solid Waste

Solid waste would be hauled to the city landfill northeast of Flagstaff, unless a regional solid waste facility is established closer to Tusayan in the future. Solid waste would be reduced through the collection and marketing of all recyclable materials.

Construction materials make up a significant portion of landfill volume (20-30%). Making use of opportunities to recycle waste generated during construction could reduce the amount of waste by as much as 75%. Possibilities include recovering wood and stone for reuse at another site, recycling metals to generate other materials, crushing glass for use in paving material and other applications, crushing concrete for use as an aggregate in new concrete, and grinding up gypsum wall product for use as an agricultural soil amendment.

Tax Revenue

Development of CFV would generate a substantial amount of sales tax revenue for the State of Arizona, which assesses 5%, and for Coconino County, which assess sales tax is 0.5%. The development would also generate personal and corporate income taxes and business property taxes. Substantial property tax revenues would accrue to the Grand Canyon School District, the Tusayan Fire District, Coconino County, and the Community College. Property tax revenues would far exceed what is currently collected on all of the private inholdings.

Cumulative Impacts

Redevelopment of Tusayan would create additional solid waste that would be hauled to the county transfer station, then to the Flagstaff city landfill. Potential cumulative impacts to the landfill could occur if other municipalities in Coconino County decide to transport their solid waste to Flagstaff as well. The need for funding to further expand the landfill may require raising tipping fees and costs charged to residents of Flagstaff and Coconino County. Cumulatively, tax revenues are expected to increase with implementation of Alternative B and continued growth and redevelopment in Tusayan, Valle, and much of northern Arizona as visitation to GCNP continues to grow.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Community Services and Facilities

Table 4.28 shows the community services and facilities that are proposed under this alternative and how they would be funded. CFV would build 80,000 square feet of community-related retail space plus 44,000 square feet of improved pads for other community-related commercial retail. A list of these proposed establishments is provided in the description of alternatives in Chapter 2.

Table 4.28 Disposition of Community Services and Facilities under Alternative C

Community Service or Facility	Land Area		Improvements	
	Contributed	Sold To User	Contributed	Paid For By User
School	✔		✔	
Parks	✔	✔		
Police Station	✔	✔		
Fire Station	✔	✔		
House(s) of Worship		✔		✔
Community Center	✔		✔	
Medical Clinic		✔		✔
Library	✔		✔	
Post Office	✔		✔	

Under Alternative C, CFV would design, finance, and build parks, a community center, a library, a sheriff's office, a fire station, and a post office. CFV would donate land with infrastructure to the Grand Canyon School District for a school site. Improved land would be sold to build a shared house of worship and facilities for a primary health care provider.

County and State Services and Facilities
Impacts would be the same as under Alternative B.

Medical Facility
Impacts would be the same as under Alternative B.

Sewage
A new conventional wastewater treatment plant would be constructed under this alternative. The sludge by-product generated by this system would be disposed of in a designated site approved for this use or in a composting system that would be developed somewhere between Tusayan and Williams (land and approval for this use have not been secured). Size and location of the system would be depend on whether the Forest Service or Moqui Lodge (which currently operates a separate system), would be interested in participating in the construction of a new system. If either or both chooses to participate, all parties would decide on location, and an appropriate-sized facility would be constructed. Ultraviolet multi-media filters and disinfectants would process wastewater prior to removal of filtered nutrients (nitrates and phosphates). Reclaimed water would be held in storage tanks for fire suppression or used to flush toilets in dual-plumbed facilities or for other reclaimed-water uses. A portion of the reclaimed water could also be used to develop riparian habitat for wildlife in the area.

Solid Waste
Impacts would be the same as under Alternative B.

Tax Revenue
Although Alternative C proposes a smaller level of development than Alternative B, it would still generate a substantial amount of tax revenue for the State of Arizona and Coconino County, as described under Alternative B.

Cumulative Impacts
Impacts would be the same as under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts
Community Services and Facilities
Under Alternative D, the County Improvement District would serve as the qualifying entity under the Townsite Act to purchase NFS land for community uses. Presumably, the County Improvement District would then enter into agreements with other local governmental entities (e.g., fire district, school district, and public housing authority) to implement the individual components of the community plan. The local governmental entities would be responsible for raising the funds necessary to finance the improvements. Facilities that have been proposed and may be built if funding becomes available include a school, a fire station, and a community hall. The community hall could be used by various service organizations, a Chamber of Commerce, a Sheriff's Department, a library, a shared worship, or other desired community facilities. Table 4.29 shows the community services and facilities that are proposed under this alternative and how they would be funded.

Table 4.29 Disposition of Community Services and Facilities Under Alternative D

Community Service or Facility	Land Area		Improvements	
	Contributed	Sold or Leased To User	Contributed	Paid For By User
School		✔		✔
Parks	✔		✔	
Police Station		✔		✔
Fire Station		✔		✔
House(s) of Worship		✔		✔
Community Center		✔		✔
Medical Clinic		✔		✔
Library		✔		✔
Post Office		✔		✔

County and State Services and Facilities
Land would be made available for purchase by the Fire District to build a fire station, and office space in the community hall for law enforcement services could be made available. Other impacts to county and state facilities and services would be similar to those described under Alternative A.

Medical Facility
Plans for the community center identify office space available for lease to a health care provider.

Sewage
The South Grand Canyon Sanitary District owns and operates the wastewater treatment plant in Tusayan. This plant has a capacity of 750,000 gallons per day and can accommodate additional wastewater generated from redevelopment of Tusayan for the foreseeable future. Part of the recent plant expansion included the construction of a reclaimed-water facility, which will become operational in 1997. Beginning with construction of the Canyon Squire Inn in the 1970s, all hotels have been double-plumbed to use reclaimed water from the wastewater treatment plant for toilet flushing.

Solid Waste
Solid waste would be hauled to a county-operated transfer station approximately three miles southeast of Tusayan. From there, the county hauls the waste to the City of Flagstaff landfill. The amount of waste generated and deposited at the transfer facility from the community and commercial development proposed under Alternative D may require Coconino County to make multiple trips per day to haul waste from the transfer station to the landfill. Solid waste may be reduced if businesses and residents implement plans for a community-wide recycling program scheduled to begin in 1997.

Tax Revenue
Redevelopment of Tusayan under this alternative would also generate a substantial amount of tax revenue for the state and Coconino County, but less than under the previous two alternatives. Redevelopment would also generate sales, business property, and substantial property tax revenues, as some property in Tusayan would be rezoned and redeveloped as commercial, putting the property in a higher assessed value classification.

On the NFS land (the transportation staging area constructed under a special use permit), PILT and 25% payments would continue to be made.

Cumulative Impacts
The cumulative impact of growth in Tusayan and potential development of the private inholdings controlled by CFV would result in a greater demand to expand or provide new facilities for police and fire protection, medical services, and other community services. The Tusayan Area Plan provides some provisions for future development; however, there is no land-use or financing plan for Tusayan that assures the provision of community services.

Solid waste generated as a result of development of the Kotzin and TenX private inholdings would most likely be hauled to the county transfer station and then to the Flagstaff landfill. No transfer stations are located near the Lower Basin private inholding, so solid waste generated from development there would be taken directly to the Flagstaff landfill. Potential cumulative impacts could result if the transfer station is continually inundated with waste, requiring the county to make many trips per day to haul waste from the Tusayan transfer station to the landfill. Cumulative impacts to the landfill could occur if other municipalities in Coconino County also decide to haul solid waste to the landfill. Additionally, the need for funding to further expand the landfill may require raising tipping fees and costs charged to Flagstaff and Coconino County residents.

Redevelopment of Tusayan would not preclude the development of some of the private inholdings controlled by CFV. Should any of these inholdings be developed for commercial purposes, they would have to be rezoned (thus resulting in higher property tax revenues), new business opportunities would be created (resulting in business and employment taxes), and sales tax revenues would be generated. While the amount of development on the inholdings is difficult to predict, it could potentially be as high as that described under Alternative B.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Community Services and Facilities
A meeting room would be constructed in association with the Federal housing complex, but this facility would only be available for residents of this housing complex. No additional community facilities are proposed under this alternative.

County and State Services and Facilities
Existing infrastructure would remain the same; the impacts, therefore, are the same as under Alternative A.

Medical Facility
Impacts would be the same as under Alternative A.

Sewage
The South Grand Canyon Sanitary District would continue to operate a sewage treatment facility for local residents and businesses. An estimated 70,000 gallons per day of wastewater would be generated by the proposed transportation/orientation center and residential facilities. Wastewater would be transferred to the sanitary district through six-inch to ten-inch diameter pipes, requiring installation of an estimated one-half to one mile of pipeline. This facility was recently expanded and could accommodate the additional volume produced by the proposed development before reaching capacity.

Solid Waste
Solid waste would be hauled to a county-operated transfer station approximately three miles southeast of Tusayan. From there, the county hauls the waste to the City of Flagstaff landfill. The amount of waste deposited at the transfer facility may require Coconino County to make multiple trips per day to haul waste from the transfer station to the landfill.

Tax Revenue
Development under this alternative would be expected to generate a minimum amount of taxes, as the property that would be developed would remain in Federal ownership. Tax revenue sources would include operation of the transportation staging area (sales taxes, business property, and income taxes) and employment taxes. Depending on how this alternative is funded, implementation may require a taxpayer subsidy, resulting in a net tax loss (see Table 2.26 and related text for more information on the amount and type of subsidy being considered).

On the NFS land, PILT and 25% payments would continue to be made.

Cumulative Impacts
Cumulative impacts would be the same as under Alternative D.

Visitor Experience in and Around Grand Canyon

Environmental consequences associated with this resource are divided into seven categories: Grand Canyon experience, visual quality, air quality, light pollution, noise pollution, GCNP management, and GCNP visitation.

Grand Canyon Experience

Issue: Development of private or NFS land near Tusayan could affect some of the values of GCNP and the surrounding KNF through increased visitation and impaired or degraded quality of the visitor experience resulting from further urbanization near the park boundary.

Methods for Analyzing Impacts

To understand the composition and orientation of visitors to GCNP, a number of existing studies were examined and a new research effort was undertaken. The following existing studies were evaluated for their potential use in addressing issues relevant to visitor experience.

- Grand Canyon National Park - General Management Plan EIS, July 1995
- Winter Sports Visitors to Flagstaff: Visitor Profile and Analysis of Economic Impact, July 1993
- Grand Canyon Railway, Inc., Passenger Rail Service - Grand Canyon Airport to Maswik Transportation Area, Grand Canyon Village EIS, August 1993
- National Park Service Statistical Abstract, 1993
- Kaibab National Forest Visitor Study, 1992 (Northern Arizona University [NAU] 1992)
- Grand Canyon National Park Housing Report, November 1993
- The Northern Arizona and Southern Utah Visitor Information and Interpretation Assessment, April 1992
- A Study of the Perceptions, Expectations, and Satisfaction Levels of Visitors to GCNP (Albrecht 1992)
- Arizona Visitor Profile, 1990-1991 (NAU 1991)

In an effort to better understand GCNP visitor trip orientation, traveling party characteristics, and satisfaction levels, a primary research effort was undertaken through a series of visitor surveys conducted during 1994 and 1995. The surveys addressed where visitors stayed (1) prior to

arriving at GCNP, (2) upon arriving at GCNP, and (3) after leaving GCNP, and the reasons for their choices. Visitor satisfaction levels with a variety of Grand Canyon related facilities/amenities were also explored, along with visitors' thoughts about the need to expand these facilities. Questions relating to transportation access within the park, the use of mass transportation facilities, and the cost and length of traveling time associated with mass transit were also part of the survey. Detailed analysis of the survey results can be found in the Socioeconomic Appendix report.

Results of the survey were used in estimating future demand for visitor facilities in the Grand Canyon/Tusayan area, as well as the potential impacts of new development on surrounding communities. These impacts are described in the socioeconomic section.

The survey used a combination of on-site interviews and mail-back questionnaires, a format initially used for the Kaibab National Forest Visitor Study in 1992 conducted by NAU. Using a similar design and format permitted comparisons of the results of the two surveys. The survey methods and questionnaire were developed in conjunction with the Interdisciplinary Team.

Three separate surveys were undertaken, from fall 1994 through the summer of 1995, to take account of differences in park visitation experience during the summer and in the spring and fall shoulder seasons. As the park experiences the lowest level of visitation during the winter months, and the availability of facilities at this time is at or above that during the spring and fall, a separate survey was not undertaken for the winter period.

The key findings of the survey were:

- The percentage of first-time visitors at Grand Canyon is high
  GCNP is often only a part of a more extensive travel itinerary
  The duration of stay at Grand Canyon/Tusayan typically is short
- One-third of visitors who attempted to make reservations at Grand Canyon National Park Lodges during the summer months were unsuccessful
- One-third of visitors who attempted to make reservations in Tusayan during the summer months were also unsuccessful
- One-quarter to one-third of the survey respondents who did not stay overnight expressed a desire to stay in Tusayan if hotels were available or were lower priced
- The geographic distribution of visitors the night before and the night after visiting GCNP is wide
- Visitors to GCNP who stay in Phoenix or Las Vegas tend to stay longer than those who stay in Flagstaff or Williams
- Availability and cost of lodging units are the most important factors in a visitor's choice of where to stay in the Grand Canyon/Tusayan area
- Parking, hotels, and restaurants are the additional facilities most desired in the Grand Canyon/Tusayan area
- Survey respondents criticized the current pricing of hotels and restaurants
- Generally, visitors are satisfied with their overall experience at GCNP

The way in which each alternative addresses the desires expressed by the survey respondents is evaluated below.

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, the visitor experience at Grand Canyon would change as a result of additional visitor facilities developed on private land as well as through the operation of the transportation services previously approved under the Grand Canyon Railway Spurline EIS, should that project be developed. The railway spurline is not intended to function as the primary mass transit system for park visitors, but as one of many different modes of mass transportation that could be implemented to help reduce traffic congestion in the park.

The current visitor experience is dependent to some degree on the method used to arrive at the park. Visitors arriving by automobile during the busy times of the year (March - October) spend a substantial amount of time looking for a place to park. Those who want to stay overnight in the Grand Canyon/Tusayan area must make reservations far in advance, and the survey results indicate that availability and cost are primary factors in selecting where to stay. Under the No Action alternative, a substantial increase in the quantity of visitor facilities in the Grand Canyon/Tusayan area is expected from redevelopment of the commercial properties in Tusayan,

and from potential development of several private inholdings controlled by CFV, particularly the Lower Basin inholding near the Desert View Entrance Station. Such an increase in visitor facilities would affect availability and cost and therefore help to satisfy (to some degree) the unmet demand for lodging near the park.

Should the railway spurline depot and parking area be developed at Grand Canyon Airport, visitors arriving by automobile would have the option of parking at the airport and taking the railway spurline to the park. This option would help alleviate part of the parking problem at the park, but the transportation services as described in the railway spurline EIS could accommodate a maximum of 1,000,000 visitors annually, approximately 20% of the projected South Rim visitation by the year 2010. Thus traffic congestion would continue and intensify as visitation to the park increases. Long lines at the entrance gates and parking areas would negatively impact the visitor experience, especially during the peak summer season.

Under the No Action Alternative, a substantial increase in available parking (for the railway spurline), lodging, retail services, and restaurants could occur, thus satisfying many of the concerns expressed by the respondents in the visitor survey. However, these facilities could be developed in several locations. For example, additional lodging would be developed on the existing private lands in Tusayan and possibly on the TenX, Kotzin, and Lower Basin inholdings. Development on the Lower Basin would provide a second location outside the Tusayan area for providing visitor facilities in close proximity to the park boundary. Development in these areas could also provide retail establishments, including restaurants, gift shops, and other facilities oriented toward visitors. The availability of these types of services in a variety of locations would result in some changes to the visitor experience. For example, visitors staying at lodging facilities on the Lower Basin would likely increase visitation to Desert View and perhaps increase the number of trips on State Highway 64 between the South Rim Village and Lower Basin. Increased visitation at Desert View could result in visitor use far exceeding the capacity of the services and facilities at this location, which are designed, sized, and staffed for relatively few visitors. Should lodging facilities be developed on the TenX inholding, and possibly the Kotzin inholding, visitor traffic patterns around Tusayan would change as well.

Development of additional visitor facilities at these other locations may also affect visitors who arrive in organized groups, such as on bus tours. In these cases, the tour company makes the arrangements and plans the itinerary, and additional visitor facilities may offer more choices and potentially lower prices as a result of increased competition.

The length of visitor stay in GCNP might change as competition for parking and use of visitor services inside the park increase. Currently, average day-use visitation length in the park is 4 hours. Development outside the park, especially of educational facilities, may keep visitors in the area longer.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Development of CFV on the NFS land would have a substantial impact on the visitor experience, particularly for visitors who arrive at the park by automobile. Instead of driving up to the park and looking for a parking space at the South Rim Village, visitors would enter into a large parking lot just north of Tusayan and leave their vehicles. Visitors would then proceed to the transit center, where they would be able to obtain information about overnight accommodations (including backcountry information), things to do in the region, and the park transit system. Park entrance tickets would also be sold there. Should they choose not to go immediately into the park by the transportation provided, visitors would have access to a substantial amount of development within walking distance of the transportation staging area. INSIGHT, the proposed educational facility, would offer visitors an opportunity to learn about the natural and cultural resources of the area.

INSIGHT is perceived by the Museum of Northern Arizona as a communication center. The role of INSIGHT, through its exhibitions, educational programs, and outreach activities, is to present a comprehensive and balanced view of the natural resources of Grand Canyon and its environs. The exhibition program would provide varied interpretations of the history, science, past, and future of the region, by scientists, historians, resource management agencies, Native Americans, and special interest groups. INSIGHT would provide visitors with informational and educational opportunities that would encompass natural and social history, current issues, regional tourism, and services available in all the towns adjacent to GCNP.

Visitors ready to go into GCNP would board the transit system at the transportation staging area for the ride to the park. Within the park they would use the expanded shuttle system or hiking/biking trails to move from one area to another. When they decide to leave the park, the visitors would take the transit system back to CFV, where they would either go to their vehicles and leave the area or make use of the CFV facilities. Visitors choosing to stay in CFV lodging accommodations may travel to and from the park more than once in one day. It is also likely that some visitors may extend their stay in the area because of the facilities and educational opportunities available within CFV.

Under Alternative B, the substantial amount of new lodging accommodations proposed, if developed fully, would be expected to satisfy the demand for lodging near the park. Competition caused by this increase in lodging units could lead to lower prices and increased levels of service. The transportation staging area would provide adequate parking for visitors staying overnight at CFV as well as for day use.

Cumulative Impacts

Redevelopment of commercial properties in Tusayan would also serve to increase the amount and variety of visitor services and facilities in the area. Tusayan redevelopment, together with the development of CFV, would increase the average length of stay for visitors to the area.

As other opportunities are developed at GCNP that keep people in the area longer, visitors may elect to make northern Arizona a trip destination in itself rather than a stopover on a more extensive trip itinerary. Additional educational and recreational opportunities in the Tusayan/Grand Canyon area may also affect the rate of visitation to the area, particularly for in-state and northern Arizona residents, who may choose to visit Grand Canyon more frequently.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts to the visitor experience under this alternative are similar to those under Alternative B. As this alternative proposes a lower level of development, the number of new lodging units and retail and food and beverage services is less than under Alternative B, and therefore the range of choices available to visitors would be less. The quality of the development as described by the proponent is lower than under Alternative B, which may have some unquantifiable effect on visitor experience at CFV. For most visitors, the experience would comprise parking their vehicles at the transportation staging area, using the facilities at the development, and using mass transit to enter, exit, and travel around in the park.

Cumulative Impacts

Cumulative impacts would be the same as those discussed under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Alternative D provides many of the visitor facility components proposed under Alternatives B and C through the redevelopment of the existing townsite and development of the NFS land for transportation uses, but at a smaller scale. Under this alternative, a transportation staging area would be constructed just north of the existing IMAX Theater in Tusayan, and most of Grand Canyon Village would be closed to vehicular traffic. Therefore, the basic changes to the visitor experience would be similar to those described for the previous two alternatives, in that visitors would park their cars, proceed to a transit center where they would purchase parking/transportation/park entry tickets, and proceed to the park. The IMAX theater and orientation center would be adjacent to the transportation staging area and within walking distance for most visitors. Under this alternative, redevelopment of the commercial property in Tusayan would offer a wide variety of additional visitor facilities to the south of the transportation staging area, but some visitors would not consider these facilities to be within walking distance.

The orientation center would include a redesigned IMAX theater, an information center and a transportation facility to access GCNP. Redesign of the IMAX theater would include creating a more southwestern appearance that would transition into the information and transportation developments. Although no agreements have been signed, Destination Cinema and the National Geographic Society plan to design and operate the orientation center.

Because the new or improved visitor facilities would not be directly adjacent to the transportation staging area, the visitor would experience or perceive less commercial development at the staging area than under Alternatives B or C. The actual use of the transportation staging area and the transportation system would be essentially the same as under Alternatives B and C. Visitors staying in Tusayan may potentially use the mass transit system multiple times in one day for access into the park.

This alternative also includes development of visitor facilities such as lodging, retail, and food and beverage services at levels substantially below those proposed under Alternatives B or C. While the proposed increase in these facilities would help alleviate some of the concerns expressed by survey respondents, the amount of

development is less than that which would be necessary under the moderate visitation growth rate scenario to force an increase in competition pricing and levels of service.

Cumulative Impacts

Development of the private inholdings would serve to increase the amount and variety of visitor services and facilities in the area, but development would not be concentrated around Tusayan but could include the Lower Basin private inholding near Desert View. While dispersed facilities could allow the visitor exposure to a variety of landscape settings, the visitors would be required to travel more distance. As under Alternatives B and C, development of the inholdings together with redevelopment of Tusayan would increase the average length of stay for visitors to the area.

As other opportunities are developed at GCNP to keep people in the area longer, visitors may elect to make northern Arizona a trip destination in itself, rather than a stopover on a more extensive vacation. Additional educational and recreational opportunities in the Tusayan/Grand Canyon area may also affect the rate of visitation to the area, particularly for in-state and northern Arizona residents, who may choose to visit Grand Canyon more frequently.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, impacts to the visitor experience would be essentially equivalent to those described under Alternative D. This alternative would entail the construction and operation of a transportation staging area just north of Tusayan, where little commercial development would take place. For visitors to the park, the means of transportation would change from personal vehicle to mass transit, to enter, exit, and travel around in the park.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative D.

Visual Quality

Issue: The level of proposed development in the Tusayan area along State Highway 64 may increase, altering visual conditions along the highway. The development of the private inholdings represents a change in the landscape that may be visible to KNF and GCNP visitors.

Methods for Analyzing Impacts

The method for evaluating the visual resources employs two steps. First, the visual attributes of the affected lands are characterized, then the environmental consequences of each alternative are evaluated. Three resources were used for guiding the evaluation process: the U.S. Forest Service's Visual Management System (USFS 1993); *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute 1995); and "Managing Regional Scenic Quality in the Lake Tahoe Basin" (Iverson et al. 1993).

Two criteria were developed to evaluate the visual impacts with particular emphasis on changes in visual quality and characteristics along State Highway 64.

(1) An alternative will create an impact to visual resources if it results in the development of a site(s) that has(have) a medium to high vulnerability to visual impact and/or if it does not use best design and management practices.

(2) An alternative will create a minimal impact to visual resources if it results in development of a site(s) that has(have) a low to medium vulnerability to visual impact and uses best design and management practices (BDMP).

Vulnerability to Visual Impacts

Vulnerability to visual impacts is a function of a site's visibility and capacity to absorb change and is expressed in relative terms. The matrix in Table 4.30 illustrates the relationship between the capacity of a site to absorb visual change and the visibility of the site. The higher the vulnerability, the greater the visual impact to viewers of the site. For example, a site with low visual absorption capacity and high visibility would be highly vulnerable to visual impacts. A community development project on such a site would be expected to have the highest degree of impact on the viewer, and the impact would be very

Table 4.30 Vulnerability to Visual Impacts

Visual Absorption Capacity	Visibility		
	Highly Visible	**Moderately Visible**	**Seldom Visible**
Low Capacity	High vulnerability	Medium-high vulnerability	Low-medium vulnerability
High Capacity	Medium vulnerability	Low-medium vulnerability	Low vulnerability

difficult to mitigate because of the low visual absorption capacity of the site. The visual vulnerability matrix provides one measure of the magnitude of visual impacts and was used to evaluate the alternatives.

Development Impact

Development impact is the extent to which a site is visually altered by development activities. It is a function of the size of the development and how well the development employs BDMP's. Evaluation of the degree of impact for each alternative was based on these two criteria.

Size and Concentration of Development

To evaluate the potential visual impacts from the size and concentration of a development, relative sizes of proposed

development and the degree of dispersement were evaluated for each alternative. Large developments generally have a greater zone of influence than small developments, and more vegetation must be cleared, making the site visible from greater distances, particularly from the air. Viewed across a region, dispersed developments, give an impression of greater extent of development than if concentrated in one location. Development dispersed over several discrete parcels has a greater effect on regional visual character than development concentrated in one area.

Implementation of Best Design and Management Practices for Minimizing Visual Impacts

Guidelines from the Tusayan Area Plan for architectural style, lighting, landscaping, roadway signs, open space, circulation, integrating development with existing landscape, vegetation preservation, and other best design and management practices were used to compare development impact factors for each alternative. These guidelines reflect what residents of Tusayan have determined to be the most desirable qualities to incorporate into their community. BDMP include incorporation of the Tusayan Area Plan guidelines and application of the GCNP Architectural Character Guidelines. Proposed developments that could voluntarily employ, or be required to implement, the BDMP were assumed to be most likely to keep visual impacts below significance levels.

Visual Impacts Common to All Alternatives

Potential visual impacts to viewers at identified high and moderately sensitive viewpoints (see Figure 3.11) likely to result from the development of any of the alternatives:

- Dust would be generated during construction, creating localized haze and possibly impairing visibility and degrading scenic quality.
- NFS land would be used for community development, resulting in increased visual contrast with surrounding undeveloped NFS land. Visual quality of the NFS and adjacent lands would be changed over the long term.
- Visitors to GCNP and the Tusayan Ranger District would experience short-term visual impacts from increased construction and related movement of equipment, materials, and people.

Alternative A: No Action

Direct and Indirect Impacts

Under this alternative, the NFS land involved in this EIS would not be developed for community or visitor services, and additional uses for utility and access may be needed on NFS land to support redevelopment of Tusayan or development of the private inholdings. Private inholdings would remain in private ownership and available for development. The TenX, Lower Basin, and Kotzin inholdings are most likely to be developed over the next 15 years. Although development of these inholdings

would require approvals, permits, and licenses from Coconino County and potentially other governmental agencies, there is minimal regulatory means to ensure that BDMP's would be applied to such development. The Tusayan Area Plan would apply to TenX and Kotzin. The Lower Basin inholding is outside the boundaries of the Tusayan Area Plan. Development on Lower Basin would be governed by the regulations of the Coconino County Comprehensive Plan and General Plan and Zoning Code. Approximately 194 acres could be developed on the TenX inholding, which would negatively affect visual quality of the landscape viewed from FR 302 without employment of BDMP. On Lower Basin, approximately 320 acres could be developed, including about ½ mile adjacent to State Highway 64. Visitors to GCNP using the east entrance would have extensive views of the development on the Lower Basin inholding from a 3-mile segment of State Highway 64, and possibly from East Rim Drive within GCNP. Approximately 160 acres could be developed on the Kotzin inholding. Although this development would change the visual quality of adjacent NFS land, it would not be visible from the identified sensitive viewpoints, with the exception of air tours. Overall, development in the region would be dispersed over several areas.

The nine remaining inholdings could experience some degree of development that could affect visual quality from sensitive viewpoints and on NFS land, although, they are less likely to be developed in the next 15 years than TenX, Lower Basin, and Kotzin. Development of the Curley Wallace inholding, next to Red Butte (a highly sensitive viewpoint), would negatively affect the visual quality of Red Butte. Other inholdings (Willows, Peterson, East Harbison, and Young) are more removed from highly sensitive viewpoints, and development in these areas would have minimal impacts on visual quality of the identified highly sensitive or moderately sensitive points.

Tusayan would continue to develop within the limits of existing private land in the community.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, CFV would follow the concepts of sustainable design, incorporating aesthetics as an important design consideration. The design concept for this alternative uses architectural styles and construction materials that minimize impacts to landforms, vegetation, and other natural systems. Dedicated open space accounts for 17% of the total acreage allocated to this alternative, and additional open areas, trails, and natural landscaping are integrated into all areas of the development to make the development appear less urban. Figure 4.3 illustrates the entry to CFV from State Highway 64. Screening and buffering using existing or planted native vegetation would be incorporated as appropriate into highway frontage to mitigate visual impacts and maintain the visual integrity of State Highway 64.

Highway 64 is the only identified sensitive viewpoint from which the proposed development would be visible. The conversion of land from undeveloped to community development would result in extending the existing viewed development of Tusayan to Moqui Lodge.

Cumulative Impacts

In addition to development of CFV, redevelopment is expected to occur in portions of Tusayan. Overall, the scenic character of Tusayan would not likely be diminished, and development would be concentrated in one location instead of dispersed throughout the region. Measures to buffer development and use of setbacks from highway frontage would be used to maintain the visual integrity of State Highway 64. As part of redevelopment, GCIA is working with ADOT to landscape the State Highway 64 right-of-way as it passes through Tusayan.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under Alternative C, CFV would use BDMP; however, greater emphasis would be placed on the functional use of the land and less on aesthetic values. The development would have a more urban appearance and potential to preserve the natural terrain and vegetation of the site would be limited. The developer would use fewer natural materials (stones, timber, etc.) in construction than under Alternative B; less area would be dedicated as open space (3% of the total land area); and architectural screenwalls would be used instead of natural open spaces and greenbelts to define community boundaries. The entry to CFV from State Highway 64 would be similar in appearance to the design for Alternative B, depicted in Figure 4.3. Screening and buffering using existing or planted native vegetation would be incorporated as appropriate into highway frontage to mitigate visual impacts and maintain the visual integrity of State Highway 64.

Figure 4.3 Artist's Rendering of Entry to CFV as Viewed from State Highway 64 under Alternatives B and C



State Highway 64 is the only identified sensitive viewpoint from which the proposed development would be seen. Although development is concentrated on about one-half the area proposed for Alternative B, the conversion of land from undeveloped to community development would still result in extending the existing viewed development of Tusayan to Moqui Lodge, with little noticeable difference in the view from State Highway 64 between the two land exchange alternatives. Measures to buffer the development and highway setbacks would be used to maintain the visual integrity of State Highway 64.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, the proponent would likely employ BDMP to minimize impacts to visual resources. Measures beyond those in the Tusayan Area Plan would not be enforceable on the private lands, but additional measures to minimize visual quality impacts could be implemented on the NFS land used for employee housing, community services, and the transportation staging area. Figure 4.4 depicts some of the changes that might take place along State Highway 64 from redevelopment in Tusayan. A pedestrian walkway over State Highway 64 could affect viewer experience. Overall, however, the visual character of Tusayan would not likely be diminished. GCIA is working with ADOT to landscape the State Highway 64 right-of-way as it passes through Tusayan to improve visual quality along the highway.

State Highway 64 is the only identified sensitive viewpoint from which the proposed development could be viewed. Although development is concentrated in a smaller area than under either Alternatives B or Alternative C, little difference would be noticed between the alternatives from State Highway 64. Measures to buffer the development and highway setbacks would be used to mitigate visual quality impacts and to maintain the visual integrity of State Highway 64.

Cumulative Impacts

Development in the region would be dispersed over several areas. Instead of concentrating development outside the south entrance to the park, development of a second "gateway community" could occur at the east entrance. The TenX, Lower Basin, and Kotzin inholdings could be developed to some extent in the next 15 years. Although development of these inholdings would require approvals, permits, and licenses from Coconino County, there are minimal regulatory means to ensure that BDMP's would be applied to the development of the inholdings. The Tusayan Area Plan would apply to TenX and Kotzin, while the Coconino County Comprehensive Plan would govern development of the Lower Basin inholding. Approximately 194 acres could be developed on the TenX inholding, which would negatively affect visual quality of the landscape viewed from FR 302 if BDMP's are not employed. Approximately 320 acres could be developed, including about one-half mile adjacent to State Highway 64, on the Lower Basin inholding. Visitors to GCNP using the east entrance would have extensive views of the development on Lower Basin from a three-mile segment of State Highway 64 and from portions of East Rim Drive within GCNP. Approximately 160 acres could be developed on the Kotzin inholding. Although development of this area would change the visual quality of adjacent NFS land, it would not be visible from the identified sensitive viewpoints, with the exception of air tours.

The nine remaining inholdings could experience some degree of development that could affect visual quality from sensitive viewpoints and on NFS land, although they are less likely to be developed in the next 15 years than TenX, Lower Basin, and Kotzin. The development of the Curley Wallace inholding, next to Red Butte (a highly sensitive viewpoint), would negatively affect the visual quality of Red Butte. Other inholdings (Willows, Peterson, East Harbison, and Young) are more removed from highly sensitive viewpoints, and development in these areas would create minimal impacts to visual quality of the identified highly or moderately sensitive points.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, approximately 120 acres of NFS land would be developed. The project as currently conceived would employ the concept of sustainable design, as explained under Alternative B, to minimize impacts to the visual resources. Overall, the visual character of Tusayan would not likely be diminished. Figure 4.5 illustrates the entry to the site from State Highway 64.

Figure 4.4 Artist's Rendering of the View along State Highway 64 through Tusayan under Alternative D



Figure 4.5 Artist's Rendering of Entry Under Alternative E.



State Highway 64 is the only identified sensitive viewpoint from which the proposed development could be viewed. The transportation staging area would likely be the only development noticeable from the highway. This facility would extend the existing urban views of Tusayan by less than one-fourth mile, undeveloped NFS land would then be viewed for about two-thirds mile, to Moqui Lodge. Measures to buffer the development and highway setbacks would be used to mitigate visual quality impacts and maintain the visual integrity of State Highway 64.

Cumulative Impacts

Cumulative impacts would be the similar to those described under Alternative D, including redevelopment of portions of Tusayan and potential development of several private inholdings controlled by CFV.

Air Quality

Issue: Additional development of private or NFS lands near Tusayan could result in a change in vehicle-emitted air pollution and overall visibility in Grand Canyon.

Methods for Analyzing Impacts

Construction and use of the proposed developments could cause air quality impacts under each alternative. Construction impacts relate primarily to fugitive dust (particulate matter) and construction/demolition equipment emissions. Use of the development could result in air quality impacts from vehicle exhaust, heating/cooling equipment, wastewater treatment plants, and other facilities. Staging people outside the park to use mass transit to access the park would reduce vehicle emissions in the park.

Potential impacts to air quality were assessed by evaluating the contribution of local sources of air pollution on air quality in GCNP (taking into account weather conditions) under each alternative; the changes in levels of pollution generated under each alternative; and the measures incorporated into the design plans for each alternative to reduce the effects of local sources of air pollution.

Alternative A: No Action

Direct and Indirect Impacts

Under the moderate visitation growth rate scenario, an estimated 8.7 million people could be visiting GCNP annually by the year 2010. Under this alternative, development would occur not only in Tusayan but potentially on the private inholdings (Kotzin, TenX, and Lower Basin), state trust land, tribal land, and land in other communities. Any development in the Grand Canyon/Tusayan area would be required to comply with the stringent standards of a Class I airshed under the Clean Air Act in addition to National Ambient Air Quality Standards established by the EPA. The EPA, under the Class I airshed regulations, has placed stringent emissions standards on sulfur dioxide, nitrogen dioxide, and particulate matter to protect air quality and visibility in Grand Canyon. Measures such as restricting the use of wood burning stoves are already in place inside the park to protect air quality, but imposing these types of measures on development of private land would be more difficult and would require cooperation from the County to impose such measures before building permits were issued. Decreases in air quality from dust and vehicle exhaust would be expected during construction activities associated with any development, whether in Tusayan or on the private inholdings controlled by CFV. These impacts, however, would be localized and temporary.

Long-term impacts may be associated with installation of wood-burning stoves in housing units and continued reliance on private vehicles by residents and visitors in the area. Even with the potential development of the Grand Canyon Railway spurline at Grand Canyon Airport, the majority of visitors would continue to use their private vehicles while visiting the park. As visitation increases, so would emissions of sulfur dioxide, carbon monoxide, and nitrogen dioxide.

Continued population growth in the area would generate additional air pollution sources. These additional pollution sources could be expected to intensify the severity of air pollution during temperature inversions, impacting visibility in the canyon. Increased population growth would result in additional recreational use of adjacent NFS land. Additional traffic would increase dust from unpaved roads, decreasing air quality.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, most development would occur around Tusayan. Decreases in air quality from dust and vehicle exhaust would be expected during construction activities associated with development. Vehicle emissions would be expected to increase at the transportation staging area but not beyond National Ambient Air Quality Standards. These impacts would be localized and temporary.

Although visitation to the park is expected to increase substantially over the planning period for this EIS, regional air quality should improve. Limiting the number of private vehicles in the park and requiring the mass transit system to use alternative fuels would reduce emissions from vehicle exhaust. The philosophy and design of this alternative encourage visitors to leave their vehicles in the transportation staging area. Visitor services and facilities would be in close proximity to the parking area so that visitors could easily walk or take a shuttle bus. Residents could also use a shuttle system, and community services and facilities would be in close proximity to residential areas to reduce residential dependence on private vehicles as well.

Cumulative Impacts

Visitors using the redeveloped commercial properties in Tusayan could park their vehicles at the transportation staging area and use the internal shuttle system offered by CFV, reducing the overall use of private vehicles in the Tusayan area. If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would further reduce reliance on private vehicles to reach GCNP, and thus reduce vehicle emissions on a regional basis.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Air quality impacts under Alternative C would be the same as those described for Alternative B.

Cumulative Impacts

Cumulative impacts are expected to be similar to those under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under this alternative, development on the existing private land in Tusayan and on the NFS land developed for community and transportation purposes would be required to comply with the stringent standards of a Class 1 airshed under the Clean Air Act in addition to the National Ambient Air Quality Standards established by the EPA. Decreases in air quality from dust and vehicle exhaust would be expected during construction activities associated with development. These impacts, however, would be localized and temporary. The Federal and local agencies involved in the project would be able to require mitigation measures similar to those already in place in the park for development of housing and community facilities on NFS land purchased under the Townsite Act and on NFS land developed for the transportation staging area under special use permit.

By limiting the number of private vehicles in the park and requiring mass transit providers to use alternative fuels, emissions generated from vehicle exhaust would be reduced, improving long-term air quality in the park.

Cumulative Impacts

Development of the private inholdings would change local vehicle traffic in the Tusayan area, as increased numbers of vehicles would be traveling between the private inholdings and the transportation staging area. If Lower Basin is developed, additional traffic between Desert View and Tusayan would result, slightly increasing vehicle emissions in the park. If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would reduce reliance on private vehicles traveling to GCNP, resulting in fewer vehicle emissions on a regional basis from visitation associated with GCNP.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Impacts to air quality associated with Alternative E would be the same as those described under Alternative D.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative D.

Light Pollution

Issue: Commercial and community growth in the Tusayan area may create additional light pollution for visitors looking across Grand Canyon from the North Rim and for backcountry users in GCNP. Such growth could also diminish night-sky visibility for visitors and residents in GCNP, KNF, and Tusayan.

Methods for Analyzing Impacts

The International Dark Sky Association's method for estimating the level of sky glow from cities was used to evaluate each alternative in terms of which sensitive viewpoints would be affected by night-time lighting emanating from the proposed developments. Sky glow was estimated using "Walkers Law," a formula developed through the measurement of sky glow at different distances from numerous cities in California. This formula assumes that the average number of lumens generated per person, under typical lighting regimes and clear-sky atmospheric conditions, is between 500 and 1000. The formula for estimating the increase in night-time sky glow is:

$I = .01 (P/r^{2.5})$

I = increase in sky glow level above the natural background expressed as a percentage
P = population
r = distance in kilometers from the center of development

Population estimates for each alternative were based on expected visitor numbers and proposed residential units. An increase in lighting to at least 20% above natural background light would affect the night-sky viewing with the naked eye. An increase of 10% above background would affect the viewing of stars with a powerful telescope (International Dark Sky Association, 1997).

Population numbers are important in calculating the effect of development on the night sky. The population estimates included overnight visitors and permanent residents. Estimates of population under average peak season conditions for the alternatives were based on the assumptions listed in Table 4.31

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, it as assumed that a certain amount of development would occur in Tusayan, on some of the private inholdings (TenX, Kotzin, and Lower Basin), on tribal land, state trust land, and in other outlying communities.

Table 4.32 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Grand Canyon Village from additional development in the Tusayan area and development of Lower Basin.

Table 4.31 Population Estimate Assumptions to Compute Walker's Law

(1)	Visitor facilities will be 70% occupied
(2)	Residential facilities will be 80% occupied
(3)	Visitor accommodations will have an average of 2 occupants per unit
(4)	Apartments will have an average of 2 occupants per unit
(5)	Dormitories will have an average of 1 occupant per unit
(6)	Single-family residences will have an average of 3 occupants per unit
(7)	Duplexes will have an average of 4 occupants per unit

Table 4.32 Increase in Night-Time Sky Glow above Existing Conditions under Alternative A

Location	Increase in Sky Glow (%)
*Development near Tusayan**	
North Rim	1.1 - 2.4
Mather Point	11.6 - 25.0
Desert View	1.0 - 2.5
Development at Lower Basin	
North Rim	0.1 - 0.4
Mather Point	0.1 - 0.5
Desert View	1.0 - 4.0

*Includes Redevelopment of Tusayan and development of Kotzin and TenX private inholdings.

Development of all three private inholdings, plus proposed redevelopment in Tusayan would disperse light pollution over a broad area. Increased ambient night-sky glow levels at the North Rim would increase between 1.1 and 2.4% over existing conditions, but may be more noticeable because the North Rim is about 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable at Mather Point with a naked eye from development around Tusayan.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, minimum outdoor lighting would be installed to comply with the provisions of Zone III of the Coconino County Lighting Code. The code allows lighting levels to maintain enough illumination for safety but low enough that night-sky glow would be minimized. Table 4.33 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Grand Canyon Village from the CFV development in Tusayan. Increased ambient night-sky glow levels at the North Rim would increase 3.0% over existing conditions, but may be more noticeable because the North Rim is about 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable with the naked eye up to 7.6 miles from the development, including Mather Point which would observe a 36.6% increase over existing night-sky glow levels.

Table 4.33 Increase in Night-Time Sky Glow above Existing Conditions under Alternative B

Location	Increase in Sky Glow (%)
North Rim	3.0
Mather Point	36.6
Grand Canyon Village	2.3

Cumulative Impacts

Redevelopment of portions of Tusayan would increase night lighting in the Tusayan area, possibly increasing background ambient night sky light levels by more than 20% up to 13.3 miles from Tusayan, including most overlooks on the South Rim.

The planned development may accelerate the need for an additional runway at Grand Canyon Airport. This would result in additional outdoor lighting associated with the additional runway and facilities.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under this alternative, minimum outdoor lighting would be installed to comply with the provisions of Zone 3 of the Coconino County Lighting Code. Because of the smaller size of the development, the zone of lighting impact would not extend as far as under Alternative B. Table 4.34 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Grand Canyon Village from the CFV development under Alternative C. Increased ambient night-sky glow levels at the North Rim would increase 1.6% over existing conditions, but may be more noticeable because the North Rim is about 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable with the naked eye up to 6.0 miles from the development.

Table 4.34 Increase in Night-Time Sky Glow above Existing Conditions under Alternative C

Location	Increase in Sky Glow (%)
North Rim	1.6
Mather Point	19.8
Grand Canyon Village	1.2

Cumulative Impacts

Redevelopment of portions of Tusayan would increase night lighting in the Tusayan area, possibly increasing background ambient night sky light levels by more than 20% up to 10.7 miles from Tusayan, including several overlooks on the South Rim.

The planned development may accelerate the need for an additional runway at Grand Canyon Airport. This would result in additional outdoor lighting associated with the additional runway and facilities.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under this alternative, outdoor lighting would be installed to comply with the provisions of the Coconino County Lighting Code. Table 4.35 shows the percentage increase in night-time sky glow above the existing background at the North Rim, Mather Point, and Grand Canyon Village from redevelopment in Tusayan and the development of NFS land for housing, community facilities, and a transportation staging area. Increased ambient night-sky glow levels at the North Rim would increase 0.6% over existing conditions, but may be more noticeable because the North Rim is about 1,000 feet higher in elevation than the South Rim. Impacts of greater than 20% would be noticeable with a naked eye up to 3.9 miles from the development.

Table 4.35 Increase in Night-Time Sky Glow above Existing Conditions under Alternative D

Location	Increase in Sky Glow (%)
North Rim	0.6
Mather Point	7.1
Grand Canyon Village	0.5

Cumulative Impacts

Development of additional private inholdings could result in light pollution increases above ambient conditions at GCNP viewpoints. Development of the three private inholdings, plus existing development within Tusayan, would disperse light pollution over a broad area, increasing the impact to GCNP viewpoints. Redevelopment in Tusayan could lead to a decision by Grand Canyon Airport to pursue an additional runway, leading to increased outdoor lighting associated with these facilities.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Alternative E would not noticeably increase background ambient night sky light levels at GCNP overlooks.

Cumulative Impacts

Cumulative impacts would be the same as the direct and indirect impacts described under Alternative A.

Noise

Issue: Additional development of private or NFS land near Tusayan may increase noise associated with residential use, local traffic, mass transit, and air traffic in the Tusayan and Grand Canyon village areas.

Methods for Analyzing Impacts

Grand Canyon Airport, just south of the community of Tusayan, is the main contributor of noise in the area; hence, the source of most of the information on noise for this EIS is the environmental assessment (EA) of the Master Plan for Grand Canyon Airport (Coffman & Associates 1993). The projected noise levels for all proposed improvements to the airport through the year 2010 were presented in chapter 3 (see Figure 3.13).

Guidelines for land-use compatibility at differing noise levels have been developed by the Department of Housing and Urban Development (HUD), the Federal Aviation Administration (FAA), and others based on the finding that people are not as likely to be disturbed by aircraft noise when they are driving, working, or shopping as when they are at home. These compatibility guidelines from the Federal Aviation Regulations (FAR), Part 150, show that lands used for residential areas, mobile home parks, guest lodgings, and schools are incompatible with sound levels above 65 to 70 decibels (dBa). Below 65 decibels, there are no recommended restrictions on land use and related structures.

Alternative A: No Action

Direct and Indirect Impacts

Under this alternative, the proposed Grand Canyon Railway's spurline from the Grand Canyon Airport to Maswik Transportation area could be developed, as well as the improvement proposed in the Grand Canyon Airport Master Plan. If implemented, both of these actions would contribute to the noise levels in the area.

Approximately 42 acres within Tusayan would receive noise levels above 65 dBa from the airport by the year 2010. If the railway spurline is built, noise would increase from the Apex Siding site into the park, as the number of trains would increase to up to twenty trains per day (10 round trips) from the existing four trains daily (two round trips). Furthermore, trains would follow a loop from just southeast of the airport and just west of State Highway 64 to the proposed airport and highway depots. These trains would generate noise in the area particularly for residents living along the existing train track corridor, but it is not anticipated that sound levels generated by railway spurline activity would exceed 65 dBa within Tusayan, since the new tracks would be roughly two miles south of the town.

The operation of the railway spurline could handle a maximum of 1,000,000 visitors per year, or 22% of the existing visitation to the park. Some private vehicle noise within the park would be replaced with train noise, but with increased visitation, this reduction would be quickly absorbed. Continued high levels of private vehicle operations on the Rim would continue to indirectly affect visitor experience, especially for those visitors who seek solitude in the park. Increased visitation and continued use of private vehicles by visitors would be expected to degrade visitor experience over time from increased noise levels, and from air quality and visual impacts.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under Alternative B, it is unlikely that the railway spurline would be built because of competition from the proposed mass transit system at the transportation staging area. Creation of a transportation staging area would reduce noise levels from those anticipated under Alternative A. CFV would cooperate with the NPS in adapting the design of the staging area and transit center to accommodate the selected mode of mass transit for the park, expected to be either a light-rail system or alternative-fuel buses. Either system would contribute very little to the existing ambient noise levels. Alternative B would also create a central shuttle system for both residents and tourists for use in the CFV development and in Tusayan. Visitors would be encouraged to leave their vehicles at the transportation staging area and ride a shuttle into the park or to other destinations within the area, reducing the amount of vehicular traffic and resulting noise in Tusayan and the park.

Short-term impacts from construction activities associated with development of CFV would be expected. These impacts would recur over the 12-year phasing schedule for construction but would not be continuous, as they would occur during daylight hours on a project-by-project basis.

Cumulative Impacts

Continued population growth in Tusayan from redevelopment would increase urban noise associated with increased visitor use and increased resident population. Approximately 42 acres of private land in Tusayan would receive noise level s above 65 dBa from the airport, as described under Alternative A.

The planned development by CFV would likely accelerate the addition of a third runway at Grand Canyon Airport. This would allow for greater air traffic in the Tusayan area and would increase aircraft noise in the area. The Master Plan for Grand Canyon Airport and accompanying EA evaluated the impacts associated with aircraft noise. Airport operations would remain as outlined in Alternative A, and all new development would likely be outside the 65-dBa contour.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts would be the same as those under Alternative B.

Cumulative Impacts

Cumulative impacts would be the same as those under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, it is unlikely that the railway spurline would be built because of competition from the

proposed mass transit system at the transportation staging area. As this alternative calls for a transportation staging area similar to that proposed under Alternatives B and C, the impact to park noise levels would be the same as described under these alternatives. No plans for a shuttle system from the staging area to various lodging facilities in Tusayan are proposed, thus visitors would be more dependent on private vehicles for local travel, slightly increasing the ambient noise levels in Tusayan as visitation in the area increases. Airport operations would remain as outlined in Alternative A. No new development is planned within the 65-dBa contour.

Cumulative Impacts

Development could potentially occur on the private inholdings, including the Lower Basin inholding, which could become a gateway development for the east entrance to the park. As no mass transit or staging area is proposed for this area, visitors would rely on private vehicles for transportation into the eastern portion of the park, with a likely increase in visitor traffic at Desert View, and hence an increase in noise, from the development at Lower Basin. Other portions of the South Rim would be closed to private vehicle use, reducing noise levels in these areas. Visitors from the Lower Basin development wishing to access other portions of the park would need to drive from Desert View to Tusayan and use the mass transit system.

Development of the TenX and Kotzin inholdings would increase local traffic resulting in increased noise levels in the Tusayan area.

The redevelopment in Tusayan may accelerate the addition of a third runway at Grand Canyon Airport. This would allow for greater air traffic in the Tusayan area and would increase aircraft noise in the area. The Master Plan for Grand Canyon Airport and accompanying EA evaluated the impacts associated with aircraft noise. Airport operations would remain as outlined in Alternative A, and all new development would likely be outside the 65-dBa contour

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Impacts would be the same as those described under Alternative D.

Cumulative Impacts

Impacts would be the similar to those described under Alternative D, with one exception. The lack of planned development of visitor services and facilities would be less likely to promote the addition of a third runway at Grand Canyon Airport.

Grand Canyon National Park Management

> Issue: Development of private or NFS land near Tusayan could affect management of GCNP. Management of park visitation may improve with additional visitor-related facilities and services constructed outside the park.

Methods for Analyzing Impacts

Factors used in determining impacts to GCNP management included evaluating how the design plans of the alternatives complement the GCNP GMP and how well each alternative addresses primary issues in the GMP, including traffic congestion, overcrowded visitor facilities, and housing and community service needs. Each alternative was also evaluated to determine the degree to which it ensured protection of the values for which GCNP was created.

Alternative A: No Action

Direct and Indirect Impacts

Visitor Facilities

Under all alternatives, 240 additional lodging guest rooms would be created through the conversion of existing dormitories in the park, along with one additional food service establishment as provided for in the GCNP GMP. Under Alternative A, additional visitor needs would be met through the redevelopment of Tusayan, the potential development of the private inholdings, and development of state and tribal land, and in other surrounding communities. Based on the moderate visitation growth rate scenario, an estimated 8.7 million tourists would be visiting GCNP each year by the year 2010. If current trends continue and 90% of these visitors go to the South Rim, 7.8 million tourists would be visiting this area each year by the year 2010. Without additional visitor facilities, the park may have difficulty handling this

amount of visitation. A larger percentage of visitors could access the park from the east entrance above current rates depending on the amount and type of development at the Lower Basin inholding, and how well it is marketed to attract visitors. This level of visitation may overcrowd visitor facilities at Desert View.

Traffic

Under Alternative A, the Grand Canyon Railway spurline and the associated depot and parking area could be constructed at Grand Canyon Airport in accordance with the Grand Canyon Railway Spurline EIS. The spurline would provide a maximum of eight round trip train trips per day to the Maswik Transportation Center in GCNP, transporting a maximum of 1 million visitors into and out of the park each year. Based on the moderate visitation growth rate scenario, an estimated 7.8 million visitors would visit the South Rim each year by the year 2010, leaving 6.8 million visitors still unable to access mass transit and therefore using their private vehicles or tour buses to enter the park.

A mass transit staging area is not proposed for the east entrance. Visitors entering the park from the east would continue to access the park in private vehicles. During the summer months, this level of visitation would probably strain facilities at Desert View beyond capacity. Parking areas would be even more overcrowded than they are now, and roadside parking would aggravate impacts to adjacent resources. The NPS would need to institute some limited visitation restrictions.

Housing and Community Facilities

The park's GMP identifies a need for up to 500 housing units to be built outside the park. Under Alternative A, housing might be developed in Tusayan, in Valle, or on the private inholdings, but there are no assurances or plans that indicate that adequate and affordable housing would be constructed by the private sector.

Although additional community facilities could be developed on private lands outside the park, such development would be at the landowner's discretion. Very few community facilities have been built to date in Tusayan or on other private land in the Tusayan area, and there is little economic incentive to build public facilities that do not generate revenue. The school in the park currently accepts students from Valle if their parents are employed in the Grand Canyon/Tusayan area. Under this alternative, these students would be bused to Williams when Grand Canyon School enrollment reaches capacity.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Visitor Facilities

This alternative would meet the intent of the park's GMP by accommodating visitor facility needs outside the park and KNF in a consolidated area in Tusayan, and by providing the visitor with orientation facilities at the transit center and educational and interpretive opportunities at INSIGHT. In addition to a large amount and mix of lodging, retail, and food and beverage development, this alternative provides for the development of a 100+ acre INSIGHT facility, envisioned as a multipurpose, multi-audience experiential/ educational center that would not only serve visitors to GCNP but would also reflect and expand on the Museum of Northern Arizona's programs and activities, encouraging Grand Canyon visitors to visit Flagstaff for further educational and recreational opportunities.

Traffic

Under this alternative, a single transportation staging area would be constructed between Tusayan and the south entrance to the park. The transportation staging area could accommodate between 6,000 and 8,000 cars, with a potential to add parking for another 2,000 vehicles in the future. This plan is consistent with the direction of the park's GMP. This alternative would also preclude development of the Lower Basin inholding because Lower Basin would be exchanged into Federal ownership and managed by the KNF. Under this alternative, current visitor patterns would be expected to remain unchanged, with 90% of all South Rim visitors accessing the park through Tusayan and 10% through Desert View.

Housing and Community Facilities

The park's GMP identifies a need for up to 500 housing units to be built outside the park. This alternative meets that intent by providing subsidized housing for park and concessionaire employees and expanding community services outside the park. Under this alternative, 175 single-family housing units, 105 apartment units, and 120 dormitory units would be available for NPS and park concessionaire employees of the park. An additional 2,175 housing units would be designated for CFV and Tusayan employees, but could also be used by park and other Federal employees, if needed. Single-family housing units would be available for purchase between $65,000.00 and $110,000.00. Apartments and dormitories would be leased for an estimated $575 and $455 per month, respectively. A full mix of community

services would be provided, including parks with sports and recreational facilities, a community center, a library, a post office, and a day-care facility. A school site with infrastructure would be donated to the public school system with a $1 million grant to help fund the school. Additionally, a sheriff's substation would be constructed and space made available for the construction one or more houses of worship. Office space would be made available for lease to a primary health care provider. This alternative fulfills many of the goals in the park's GMP through public and private partnerships.

Cumulative Impacts

Redevelopment of Tusayan would increase the amount and mix of facilities available for GCNP visitors outside park boundaries, which is consistent with the intent of the GCNP GMP.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Visitor Facilities

This alternative would have the same effects on GCNP management as those described under Alternative B.

Traffic

This alternative would have the same effects on GCNP management as those described under Alternative B.

Housing and Community Facilities

This alternative would essentially have the same effects as those described under Alternative B, except that single-family housing would consist only of manufactured homes and be made available for purchase at $65,000.00. A mix of housing would be available for NPS and park concessionaire employees. An additional 1,675 housing units of mixed type would be available for CFV and Tusayan employees that could also be used by park and other Federal employees. The same type of community services and facilities would be provided as described under Alternative B.

Cumulative Impacts

This alternative would have the same cumulative effects as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Visitor Facilities

This alternative would meet the intent of the park's GMP by accommodating visitor facility needs outside the park in a consolidated area in Tusayan and by providing the visitor with interpretive and orientation information near the transportation staging area. This alternative provides for the development of an orientation/interpretation center by Destination Cinema and potentially with the National Geographic Society to provide the visitor with information on the GCNP, KNF, Tusayan, area attractions, and visitor accommodations.

Traffic

Under this alternative, a transportation staging area would be constructed adjacent to the IMAX theater. The transportation staging area could accommodate up to 4,500 vehicles, which is consistent with the direction of the park's GMP.

Housing and Community Facilities

The park's GMP identifies a need for up to 500 housing units to be built outside of the park. Under this alternative, a County Improvement District would be created to purchase land from the KNF under the Townsite Act. This land could only be used for public purposes (e.g., to build employee housing and community facilities) and a public housing authority would be formed to build and administer the housing project. Housing that would be built would be available to any resident of Coconino County; however, it is anticipated that the majority of interested tenants would be persons who work in either Tusayan or GCNP. The GCIA has proposed a total of 916 units in a mixture of single-family, dormitory, and mobile home/apartment styles. It is proposed that housing be made available to tenants at $375 per month for single-family housing, $223 per month for apartments, and $180 per month for dormitories. The subsidy structure of the housing authority has not been developed, but these rates imply a subsidy of some sort.

The County Improvement District would also make land available for purchase to the School District for a new school, to the American Legion or a governmental entity to build the community hall, and to the Fire District to build a fire station. Funding for these facilities has not been determined but would most likely include approving a district bond and/or property tax.

Cumulative Impacts

The development of the Lower Basin private inholding could create changes in visitor use and traffic patterns that are not consistent with the management direction in the

park's GMP. Increased visitation at the east entrance would tax the facilities at Desert View.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Visitor Facilities

This alternative would have the same effects as those described under Alternative D.

Traffic

This alternative would have the same effects as those described under Alternative D.

Housing and Community Facilities

Under this alternative, the KNF would dedicate land for housing of NPS employees. Park concessionaire employees would not obtain housing on NFS land under this alternative. Like other employees of Tusayan, they would look for housing opportunities in Tusayan, in Valle, on the private inholdings, or in other nearby communities. GCNP has proposed a total of 100 units in a mixture of duplex, dormitory, and apartment styles. If housing is privately developed, rental rates would be subject to market pricing. Current rates range from $650/month for a two-bedroom apartment to $450/month for a one-bedroom apartment. If housing is Federally funded, rents would be determined using a government-established formula, as they currently are for park employees. Effects to community facilities would be the same as those described under Alternative A.

Cumulative Impacts

Cumulative impacts of this alternative would be similar to those described under Alternative A.

Grand Canyon National Park Visitation

Issue: Development of visitor facilities near Tusayan could alleviate excess demand for lodging and food services in GCNP. However, average visitor length of stay may increase, affecting park facilities, services, and resources.

Methods for Analyzing Impacts

Factors used in evaluating impacts to park visitation included determining the existing and projected annual visitation rates at GCNP; projecting the change in visitation rates to the park from the development of private or NFS lands; and projecting the change in the average length of visitor stay and its effects on park facilities, services, and resources.

Historic and existing visitation were examined to develop four growth scenarios for future park visitation. Data on historic visitation are presented in Chapter 3 of this EIS (Table 3.4), and the four scenarios are depicted in Figure 3.14 and described in the text. The scenarios project a range in annual visitation between 6 million and 13.7 million by the year 2010. For purposes of this analysis, a moderate visitation growth rate scenario was used.

Design components were then examined under each of the alternatives to determine if visitation rates to the park would change as a result of the development (e.g., would people be likely to stay at the park or in the area longer, or take multiple trips into the park?) and, if so, how this change would affect park facilities, services, and resources.

Alternative A: No Action

Direct and Indirect Impacts

Redevelopment of Tusayan, potential development of private inholdings, and development in surrounding communities would all provide additional visitor services for the increasing numbers of visitors to the park, relieving some of the pressures on GCNP to provide additional visitor facilities inside the park. Although the proposed Grand Canyon Railway Spurline is not designated as the transportation staging area and mass transit system for GCNP, construction of the spurline would provide transit for up to 1 million visitors to the park each year. This service would provide a maximum of sixteen trains per day (eight round trips) from Grand Canyon Airport and would not likely be economical or convenient enough for people to want to use it to make multiple trips into the park during their stay. The majority of people would still access the park in private vehicles, continuing to overtax the park's facilities, services, and resources. The NPS would institue limited restrictions on park visitation.

Redevelopment of Tusayan may attract visitors to stay in Tusayan during their visit to the park, and possibly to stay longer in the Tusayan area. In the absence of a convenient and economical mass transit system, visitors to the park would not be expected to lengthen their stay or increase the number of trips they make into the park.

If developed, construction of INSIGHT and other visitor facilities on the Lower Basin inholding would be expected to draw a number of visitors from the south entrance to the east entrance area, changing visitation patterns on the South Rim. These visitors would continue to access the east portion of the park in their private vehicles, leading to overcrowding at parking areas and vista points along East Rim Drive, further degrading park resources. Tourists wishing to visit other areas of the park, including Grand Canyon Village, would drive from Desert View to Grand Canyon Village where they would compete for parking. While these visitors may choose to stay longer at Lower Basin if that area were to be developed, they would not necessarily be expected to stay longer in the park, nor would they be expected to make multiple trips into the park.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, the CFV development would offer a full range of visitor services and facilities for the increasing numbers of people expected to visit the park. A transportation staging area would be constructed within CFV that could accommodate even the most extreme GCNP visitation growth forecasts. The length of visitor stay in the area would likely increase, and visitors may be more likely to make multiple trips into the park, depending on the frequency and cost of the mass transit system. It is also possible that visitation would be more evenly distributed over the course of the day, also relieving pressures on park facilities. Limiting the use of private vehicles in GCNP would lessen visitor impacts on park resources and allow for more efficient and effective management of those resources.

Cumulative Impacts

Redevelopment of Tusayan would be expected under this alternative, which would provide additional visitor services and facilities outside the park. Under this alternative, the park would be able to accommodate the level of visitation forecast for the early part of the next century and ensure that the bulk of the facilities needed by visitors would be provided outside park boundaries.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts to visitation would be similar to those described under Alternative B, although the size of the CFV development is smaller.

Cumulative Impacts

Cumulative impacts to visitation would be similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under this alternative, Tusayan would be redeveloped to offer a wide range of visitor services and facilities for the increasing numbers of people expected to visit GCNP. A transportation staging area with an orientation/interpretive center would be constructed adjacent to IMAX. The length of visitor stay in the area would likely increase because of the availability of additional activities in the Tusayan area (shopping, education/orientation). Visitors may also be more likely to make multiple trips into the park, depending on the frequency and cost of the mass transit system. Visitation may be more evenly distributed over the course of the day, also relieving pressures on park facilities.

Cumulative Impacts

Cumulative impacts associated with Alternative D would be similar to the direct and indirect impacts of Alternative A.

Development of the private inholdings could change the visitation patterns at the South Rim, particularly development of the Lower Basin inholding. Development of visitor facilities on Lower Basin would be expected to increase the number of visitors entering and exiting the park at the east entrance station. Tourists entering the park at the east entrance station would have to drive from Desert View to the transporation staging area in Tusayan, and use the mass transit system to visit other areas of the park, including Grand Canyon Village.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under this alternative, no visitor guest lodging and only limited retail and food and beverage services would be constructed in association with the transportation staging area. The length of visitor stay would not be expected to change as a direct result of this alternative. Some visitors may use the mass transit system for multiple trips in the same day depending on the frequency and cost of the mass transit system.

Cumulative Impacts

Redevelopment of Tusayan would be expected, along with the potential development of the Kotzin and TenX inholdings, which would offer additional visitor services and facilities. If the amount of development in Tusayan and on the private inholdings does not meet visitor demand for food and beverage facilities, retail establishments, or visitor lodging, park services and facilities may continue to be overused during the peak season, and visitor pressure to build additional services inside the park may continue.

Development of INSIGHT and other visitor facilities on the Lower Basin inholding would be expected to draw a number of visitors from the south entrance to the east entrance area, changing visitation patterns on the South Rim. These visitors would continue to access the park in their private vehicles which could lead to overcrowding at parking areas and vista points along East Rim Drive, further degrading park resources. Tourists wishing to visit other areas of the park, including Grand Canyon Village, would drive from Desert View to the transportation staging area in Tusayan, and use the mass transit system. While these visitors may choose to stay longer at Lower Basin if this area were to be developed, they would not necessarily be expected to stay longer in the park, nor would they be expected to make multiple trips into the park.

Transportation

Issue: A transportation staging area near Tusayan could relieve traffic congestion in GCNP by providing a staging area for alternative transportation modes into the park. As park visitation continues to increase, traffic congestion in the Tusayan area and on State Highway 64 could increase as well.

Further development in the Tusayan area could result in greater use of Grand Canyon Airport runway and its facilities. Expansion of the community in the general vicinity of the airport may increase land-use conflicts and affect public safety.

Methods for Analyzing Impacts

Transportation issues relate primarily to potential increases in area traffic, that is, impacts to levels of service on roads in the Grand Canyon/Tusayan area, particularly on State Highway 64. Also considered are effects on the level of service of State Highway 64 caused by construction of the transportation staging areas proposed under each alternative, including modifications proposed to the highway to provide vehicle access to the transportation staging area.

Level of service is a concept measured by a number of factors: speed and travel time; traffic interruptions; freedom to maneuver; safety; driving comfort and convenience; and operating costs. Levels of service range from A through F, with A being best and F being worst. The "E" classification denotes conditions that either are approaching or are at maximum capacity. Most of the roads in GCNP have a level-of-service classification of "E" during the summer months and are expected to exceed capacity as visitation increases if a mass transit system is not implemented (GCNP 1997). State Highway 64 has a current level-of-service classification of "B".

Additional development in the Tusayan area could also affect Grand Canyon Airport. Visitation to GCNP may increase air traffic at the airport to such an extent that another runway would be needed as provided for in the Grand Canyon Airport Master Plan. Assessment of potential effects was based on the extent to which each alternative would remain compatible with existing and proposed airport use, including safety considerations.

Alternative A: No Action

Direct and Indirect Impacts

Although no designated transportation staging areas are proposed under this alternative, secondary transportation staging areas could be developed in the outlying communities, and the Grand Canyon Railway Spurline facility could be built adjacent to Grand Canyon Airport. Use of these staging areas by visitors to GCNP would reduce overall reliance on private vehicles to access the park.

The Grand Canyon Railway Spurline could accommodate about 14% of the visitation expected at GCNP by the year 2010— leaving about 86% of the visitors to use their private vehicles. Another system, such as a bus line, could potentially use the parking facilities developed for the spurline to accommodate some of these visitors.

During the summer months, the village transportation system would continue to operate at a level-of-service classification of "E" or possibly "F". As visitation increases at the park, longer waiting lines would be expected at the south entrance. The existing shuttle system would become increasingly delayed by congested traffic. Parking areas and vista points along the South Rim would be unable to handle the large numbers of vehicles. Measures would need to be implemented by the NPS to restrict visitation.

Alternative A would make no changes to State Highway 64, and ADOT would continue to be responsible for maintenance and any highway improvements. However, as visitation to the park increases, additional traffic would be expected on the highway, which could lower level-of-service classifications. ADOT has concluded that the principal highways serving the park, namely U.S. Highway 180 and State Highway 64, are able to accommodate both the present and projected volumes of traffic that would use these roads.

Under this alternative, it is anticipated that Tusayan businesses would redevelop Tusayan and that some of the private inholdings could be developed, contingent on Coconino County approvals. Development in any of these areas would increase traffic in the Tusayan area. To maintain current conditions on State Highway 64, Coconino County or ADOT may require improvements to the highway as part of the project planning.

Development of Lower Basin could change current traffic patterns. Construction of visitor services and facilities, including an INSIGHT campus, would be expected to increase the number of visitors that enter and exit the park by the east entrance. An increase in vehicle traffic would be expected on U.S. Highway 89 and on State Highway 64 between Tusayan and Desert View. Access improvements would be necessary at the intersection of Lower Basin and State Highway 64.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, a transportation staging area would be built in phases between Tusayan and the south entrance to the park that could accommodate 6,000 to 8,000 vehicles, with the potential to add parking for another 2,000 vehicles. Visitors would park their vehicles and either take a mass transit system into the park or hike or bike into the park along designated trails. Over the long term, this system would alleviate much of the congestion and parking problems in Grand Canyon Village currently faced by park managers. Restricting use of private vehicles in the park would allow roads in the park to operate below capacity at a level-of-service classification of "B" or better. Park shuttles would therefore be more reliable.

A visitor and residential shuttle system in the newly developed area would allow people to park their vehicles at the transportation staging area until they leave. The visitor loop would connect the transit area with all of the lodging, commercial, and cultural facilities associated with the CFV development. Existing businesses in Tusayan could also use this system, linking the CFV development with the existing community. The residential loop of the system would connect all community areas with the transportation staging area. From there, employees would be within walking distance of work in Tusayan or could connect to the mass transit system to commute to employment in the park. With a shuttle system connecting CFV and Tusayan, it is anticipated that many of the visitors would choose to use the shuttle system instead of their personal vehicles, thereby reducing the severity of impacts ot roads in the Tusayan area. The intent of the transportation system in this alternative is to remove the dependence of the public on the use of private vehicles;however, individuals would have to make the commitment to use mass transit instead

of personal vehicles to travel around or between the CFV development and Tusayan.

Alternative B would include improvements to State Highway 64. An enhanced at-grade intersection would be constructed at the highway and the main entrance to CFV. The intersection would include a left-turn lane for northbound traffic and a right-turn deceleration lane for southbound traffic, as well as left-turn and right-turn acceleration lanes, respectively. At some point, the intersection may be signalized. Highest use of the intersection would likely occur when day-users arrive in the morning (10 am-2 pm) and leave in the late afternoon (4-6 pm). During these hours, the level of service on Statc Highway 64 would likely deteriorate.

Cumulative Impacts

Tusayan businesses would be expected to redevelop Tusayan to a certain degree, contingent on approval by Coconino County. Redevelopment would lead to higher visitor use of the area and more traffic on the roads in Tusayan, which could lead ADOT to make some improvements to State Highway 64, such as signals at various points in Tusayan, to allow traffic to operate more efficiently. Traffic in the park would not be expected to change from the collective impact of the redevelopment of Tusayan.

If secondary transportation staging areas are developed in the outlying communities as proposed in the Regional Transportation Plan coordinated by NACOG, these staging areas would further reduce reliance on private vehicles to enter the park.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts to transportation would be similar to those described under Alternative B.

Cumulative Impacts

Cumulative impacts to transportation would be similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under this alternative, a transportation staging area accommodating up to 4,500 vehicles would be built adjacent to the IMAX theater on NFS land under special use permit. Should additional space be needed in the future, additional permitting and action from the Forest Service would be required. Visitors would leave their vehicles at the staging area and take the mass transit system into the park. Over the long term, this plan would alleviate many of the traffic congestion and parking problems currently facing managers in Grand Canyon Village. Restricting use of private vehicles in the park would allow roads to operate below capacity at a level-of-service classification of "B" or better. Park shuttles would therefore be more reliable.

A visitor and residential circulation plan in Tusayan would link visitors from the transportation staging area with other commercial uses in Tusayan and shuttle residents from housing areas to their places of employment. A pedestrian bridge would be constructed over State Highway 64 so that visitors could access facilities on the east side of the highway. At-grade pedestrian crossings would be established in the vicinity of the transportation staging area/Babbitt intersection, the Red Feather/McDonalds intersection, and the Holiday Inn Express/Grand Hotel intersection. Visitor services are located on both sides of State Highway 64, and these crossings would allow visitors to safely walk to their destinations on either side of highway.

The residential loop of the system would connect all community areas with places of employment. As under Alternative B, residents would have to make a commitment to use the shuttle system instead of their cars to maintain or improve current levels of operation of roads in Tusayan.

The widening of State Highway 64 to accommodate a four-foot bicycle path is also proposed under this alternative. This would require approval, and probably funding, from ADOT. Off of the highway, bicycles and cars would share the roads of Tusayan, mainly Long Jim Canyon Road.

Improvements would be made to Tusayan roads under Alternative D to accommodate the additional traffic demands. Two main intersections are expected to facilitate the flow of traffic accessing the transportation staging area: the IMAX theater intersection with State Highway 64 and the access road north of IMAX where most of the private vehicles would enter the transportation staging area. Two left-turn lanes would be constructed at the transportation staging area intersection to ensure

traffic safety and efficient flow. A single left-turn lane is proposed at all other intersections. Long Jim Canyon Road would be completed and improved to facilitate local traffic movement to the existing and proposed residential areas. Highest use of the intersection to the transportation staging area would likely occur when day users arrive in the morning (10 am-2 pm) and leave in the late afternoon (4-6 pm). During these hours, the level of service on State Highway 64 would likely deteriorate.

Cumulative Impacts

Because the inholdings would be left in private ownership, they could potentially be developed. Continued increase in the numbers of residents and visitors in the area would add to the traffic in Tusayan, as well as increase traffic on Forest roads accessing development on the inholdings, such as Kotzin and TenX.

Development of Lower Basin could occur under this alternative, creating a change in current traffic patterns. Construction of visitor services and facilities, including an INSIGHT campus, would be expected to increase the number of visitors that enter and exit the park by the east entrance. An increase in vehicle traffic would be expected on U.S. Highway 89 and on State Highway 64 , between Tusayan and Desert View. Tourists staying at Lower Basin would drive from Desert View to the transportation staging area in Tusayan, and would use the mass transit system to visit other areas of the park, including Grand Canyon Village. Access improvements would be necessary at the intersection of Lower Basin and State Highway 64.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under this alternative, a transportation staging area would be built on NFS land under special use permit between Tusayan and the south entrance to the park that could accommodate up to 4,500 vehicles. Should additional space be needed in the future, additional permitting and action from the Forest Service would be required. Visitors would leave their vehicles at the staging area and take a mass transit system into the park, as they would in the other three action alternatives. This plan would alleviate much of the traffic congestion and parking problems in Grand Canyon Village currently faced by park managers. Restricting use of private vehicles in the park would allow roads to operate below capacity at a level-of-service classification of "B" or better. Park shuttles would therefore be more reliable.

An underpass would be constructed at the State Highway 64 crossing of Long Jim Canyon to accommodate vehicle access to and from the transportation staging area. This underpass would improve safety for vehicles exiting and entering the highway at this point and would connect directly to the parking facility. An alignment associated with former access into GCNP from this area would be improved and used as the main transportation corridor for the mass transit system into the park. Highest use of the underpass would likely occur when day users arrive in the morning (10 am-2 pm) and leave in the late afternoon (4-6 pm); however, this would be the most efficient means of routing vehicles off of the highway should result in minimal changes in traffic flow on the highway.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative D.

Development Plan Assurances

Issue: Development of private or NFS land near Tusayan would require a specific plan that includes assurances that what is proposed and analyzed for development would actually be built and that development and mitigation commitments would be carried out during implementation.

Methods for Analyzing Impacts

Each alternative is evaluated based on the extent to which the alternative proposes non-discretionary mechanisms to assure that the following conditions are fulfilled:

Permanence

Commitments made in the alternative carry forward to future developers or landowners.

Commercial Development

The amount of commercial development proposed in the alternative is the same amount of commercial development that would be proposed for Coconino County development approval.

Financial Feasibility
A non-discretionary plan exists for funding the proposed noncommercial facilities. The proposed facilities and activities are financially feasible. Mechanisms exist to ensure that commitments to fund non-commercial activities and mitigation measures are permanent.

Land Control and Ownership
The proponent has ownership interests or agreements providing effective control over the lands that are proposed for development.

Housing
Proposed housing would serve employees and residents and would remain available at specified pricing for employees and residents. Housing would be built as proposed and as necessary for commercial development.

Information and Education Facilities
Information and educational facilities would be developed, funded, and operated according to the proposed phasing plan.

Community Services and Facilities
Community services and facilities would be developed, funded, and operated according to the proposed phasing plan.

Transportation
Transportation components of the proposal would be developed, funded, and operated according to the proposed phasing plan.

Water and Energy Conservation
Commitments to long-term water and energy conservation measures would be implemented.

Open Space Management
Open-space commitments would be carried out, and dedicated open space would be managed in a manner that promotes open space values.

Architectural and Design Control
Commitments to architectural and design review and control would be implemented.

Alternative A: No Action

Direct and Indirect Impacts
Development in Tusayan and potentially on the private inholdings would continue to follow market forces at the discretion of landowners and local land use and development zoning/policies. The Tusayan Area Plan provides goals and policies for future development in Tusayan and Coconino County is responsible for ensuring its implementation. Development would also be subject to Coconino County zoning and building codes, including the Design Review Overlay Zone. The County, particularly the Board of Supervisors, has the authority to decide whether to waive any or all requirements of the Tusayan Area Plan and Design Review Overlay Zone requested by the developers. Under Alternative A, it is reasonable to expect that current interpretation of county policies would continue and that the primary criteria for evaluating projects would be the Tusayan Area Plan, or the Coconino County Comprehensive Plan for development outside the area defined in the Tusayan Area Plan.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts
This alternative incorporates a comprehensive and enforceable package of mechanisms and long-term financing provisions that provide assurances that the commitments proposed by CFV related to commercial development, housing, information and education facilities, community services and facilities, transportation, conservation, open space, design, and phasing of the development would be carried out during the implementation and the life of the project. This alternative would embody these commitments in a development agreement with Coconino County, ensuring that the commitments are not subject to future reconsideration through the local zoning process. The alternative also proposes to base these commitments in future deed restrictions that bind all landowners and provide a supplement to local governmental enforcement of the commitments. The alternative also proposes the creation of a non-profit Canyon Forest Village Council and Environmental Preservation Trust Entity. As proposed, the Canyon Forest Village council would have representatives of local and Federal agencies and environmental organizations on the board of directors responsible for ensuring that commitments are adhered to

by affected parties. The alternative also incorporates a permanent revenue source that would provide the funds necessary to ensure compliance with these commitments.

Cumulative Impacts

Redevelopment of the existing private lands in Tusayan is likely, with the focus on construction of new commercial properties (lodging, retail, and food and beverage) and redesign of the highway frontage landscape. This redevelopment would result in an increased employment base that would in turn create demand for housing and additional community services and facilities. The CFV development could accommodate this demand, and the governance structure provided for under Alternative B would assure compliance with the commitments related to housing and community infrastructure.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Assurances under this alternative are the same as those described under Alternative B.

Cumulative Impacts

Cumulative impacts under this alternative are the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Activities on the 57 acres acquired through the Townsite Act would be subject to statutory requirements limiting the use of these lands to community and noncommercial purposes. However, the Townsite Act does not provide any mechanism to assure that the community facilities proposed by the GCIA would be developed. The County Improvement District, serving as the qualifying entity under the Townsite Act to purchase the NFS land, would be responsible for monitoring and enforcement of the limitations set forth in the Townsite Act. Presumably, the County Improvement District would then enter into agreements with other local governmental entities (e.g., public housing authority, fire district, or school district) to implement the individual components of the community plan. The local governmental entities would be responsible for raising the funds necessary to finance the improvements. The housing component would require the formation of a public housing authority to provide and manage the planned housing units. To meet the policies of the public housing authority, the housing must be available to all county residents and not a specific segment of the population, preventing employers from constructing housing only for their own employees on the lands acquired under the Townsite Act.

The transportation center and visitor orientation center would be developed on NFS land under a special use permit. These uses would be subject to the monitoring and enforcement mechanisms incorporated into the USFS special use permit and the renewal process for special use permits.

This alternative provides no mechanism or financing commitments other than existing taxing authorities to ensure that desired community would be provided as proposed. With respect to the dynamic nature of local land use policies, this alternative incorporates no assurances that commitments associated with future development would be made.

In addition, several tracts of land on the east side of State Highway 64 in Tusayan (17 acres on the north end and 6.5 acres on the south end) that are owned by members of the GCIA have leaseholds held by others for terms ranging from 14 to 35 years. These tracts are included in the GCIA's plans for redevelopment of Tusayan but may not be available for redevelopment until the leases expire.

Cumulative Impacts

Commercial and residential development could potentially occur on the private inholdings within the KNF. Development on private land would continue to follow market forces, at the discretion of the landowner. Local land use and development policies do not provide any assurances that housing and community services and facilities would be developed on the private inholdings.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

The transportation staging area and visitor orientation center would be developed on NFS land pursuant to the terms of a special use permit. These uses would be subject to the monitoring and enforcement mechanisms incorporated in the USFS special use permit and the renewal process for special use permits. Commitments

related to development of housing would be assured through the terms and conditions of the Memorandum of Agreement or other agreement between KNF and GCNP.

Cumulative Impacts

Commercial and housing development would continue on existing private land within Tusayan and potentially on the private inholdings. Development on private land would continue to follow market forces, at the discretion of the landowner and in accordance with local land use and development policies, with no assurances that housing and community services and facilities would be developed in Tusayan or on the private inholdings.

Cultural Resources

Issue: Development of private or NFS land near Tusayan could impact archaeological sites, traditional cultural properties of local and regional American Indian groups, and historic resources associated with railroad, logging, and livestock operations.

Methods for Analyzing Impacts

Intensive cultural resource surveys were conducted on the NFS land and the private inholdings. Archaeological sites and isolated artifacts were documented on site forms, and all sites were plotted on USGS 7.5 minute series maps. Four sites found on the NFS land were determined to be eligible for the National Register of Historic Places. No determinations of eligibility for the National Register of Historic Places were made for the sites found on the private inholdings. Cultural resources on the private inholdings included prehistoric and historic sites, and traditional cultural properties.

Many sites have sacred or cultural importance for American Indian tribes. These areas are described as Traditional Cultural Properties (TCPs) and can include shrines (prayer-offering sites), outcroppings of stone material, mineral deposits, plant-gathering areas, springs, and landforms. Tribal consultations have been initiated with the Hualapai, Havasupai, Hopi, Navajo, and Zuni tribes to determine if TCPs in the Grand Canyon/Tusayan area are affected by the alternatives described in this EIS. Table 4.36 lists the archaeological sites and TCPs found on the private inholdings. National Register eligibility determinations have not been made for the identified TCPs

Development concept plans for each alternative were compared with locations of known archaeological sites or TCPs on the NFS land. If an alternative proposes development on a site or portion of a site, or if such development is possible under the alternative, the degree to which the site would be impacted was determined. If an archaeological site cannot be avoided by specific alternative design, further actions would be necessary in consultation with the KNF, the State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation (ACHP), and the tribes.

Alternative A: No Action

Direct and Indirect Impacts

No immediate impacts to the four identified archaeological sites on NFS land would result under Alternative A. Future development of the private inholdings could result in disturbance or destruction of archaeological sites found on those lands.

If the private inholdings are developed, it is likely that some sites would be lost along with their associated information and tribal significance. Archaeological sites and American Indian TCPs found on the private inholdings would remain in private ownership and subject to private management actions insofar as state and Federal cultural resource laws pertain to such activities on private lands. Cultural resource regulations typically do not apply to private lands unless other Federal actions are involved or burials are located on them.

The three inholdings considered to have the greatest potential for development (Kotzin, TenX, and Lower Basin) contain a total of 20 archaeological sites, consisting of prehistoric sherd and lithic scatters, rock alignments, sweat lodges, masonry structures, and a field house; and a historic trash dump, railroad grade, and homestead. TCPs found on these private inholdings include eight Hopi and Zuni TCPs (sites with Puebloan or Puebloan/Cohonina cultural affiliation) and two Navajo TCPs (consisting of three sweat lodges). TCPs for the Hualapai have yet to be determined.

The remaining 82 archaeological sites are on more remote inholdings and changes in land use are less likely. Of these 82 archaeological sites, 47 have been initially identified as TCPs by the consulting tribes.

Table 4.36 Archaeological Sites and Identified Traditional Cultural Properties Found on the 12 Private Inholdings Controlled by CFV

Private Inholding	Number of Sites	Number of Identified TCPs
TenX	4	0
Lower Basin	16	10
Kotzin	0	0
Curley Wallace	5	11
Trash Dam	14	12
Willows	9	6
Babbit Tank	10	5
Anita	12	7
East Harbison	19	3
Young	5	1
Peterson	3	0
Apex Siding	5	2
Total	**102**	**57**

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under Alternative B, three of the four sites found on NFS land (the masonry structures, a rock shelter, and a lithic scatter/rock shelter) would be on the proposed campus of INSIGHT and could be incorporated into the design of this facility as interpretive areas. The fourth site, a lithic procurement area, would be near the transportation staging area and may not be as easily avoided. Any archaeological sites that cannot be avoided would be subject to a testing and data recovery plan to ensure that data and information contained in those sites are not lost. This procedure would be developed in consultation with the KNF, the SHPO, the ACHP, and the tribes.

Under this alternative, KNF would acquire 102 archaeological sites, 57 sites of which have been initially identified as a TCP, that would then be subject to Federal cultural resource laws and afforded greater protection under Federal ownership and management.

Visitation to NFS land surrounding the development or in the vicinity of Tusayan may increase as visitors seek additional recreational opportunities outside of GCNP. Such visitation could affect cultural resources that have not yet been identified.

Cumulative Impacts

Development on the other private land, state land, and tribal land in the Grand Canyon/Tusayan area could increase the likelihood of disturbance of archaeological sites and TCP's on those lands.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under Alternative C, three of the four sites found on NFS land, would be on the area where proposed lodging facilities would be constructed (the masonry structures, a rock shelter, and a lithic procurement area). It is unlikely that these sites could be avoided. The fourth site, a lithic scatter and rock shelter, would be near the proposed CFV development, and also probably could not be avoided. A testing and data recovery plan would be implemented on these sites to ensure that data and information they contain are not lost. This procedure would be developed in consultation with the KNF, SHPO, ACHP, and the tribes.

Visitation to NFS land surrounding the development or in the vicinity of Tusayan may increase as visitors seek additional recreational opportunities outside of GCNP. Such visitation could affect cultural resources that have not yet been identified.

As under Alternative B, NFS would acquire 102 archaeological sites, 57 sites of which have been initially identified as TCPs, that would then be subject to Federal cultural resource laws and afforded greater protection under Federal ownership and management.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, three of the four sites found on NFS land (the masonry structures, a rock shelter, and a lithic scatter/rock shelter) would be in the proposed mobile home, apartment and dormitory, and single-family housing areas. It is unlikely that these sites could be avoided. The fourth site, a lithic procurement area, would be near the proposed municipal services area and may be more easily avoided during detailed site planning. The three archaeological sites that cannot be avoided would be subject to a testing and data recovery plan to ensure that data and information contained in those sites are not lost. This procedure would be developed in consultation with the KNF, the SHPO, the ACHP, and the tribes.

Visitation to NFS land surrounding the new residential area and Tusayan may increase under this alternative. Such visitation could affect cultural resources that have not yet been identified.

Cumulative Impacts

Archaeological sites found on the private inholdings would remain in private ownership and subject to private management actions insofar as state and Federal cultural resource laws pertain to such activities on private lands. Cultural resource regulations typically do not apply to private lands unless other Federal actions are involved or burials are located on them. If the private inholdings are developed, it is likely that some sites would be lost along with their associated information and tribal significance.

The three inholdings considered to have the greatest potential for development (Kotzin, TenX, and Lower Basin) contain a total of 20 archaeological sites, consisting of sherd and lithic scatters, rock alignments, sweat lodges, masonry structures, a field house, and a historic trash dump, railroad grade, and homestead. TCPs identified to date on these private inholdings include eight Hopi and Zuni TCPs (sites with Puebloan cultural affiliation) and two Navajo TCPs (consisting of three sweat lodges). TCPs for the Hualapai Tribe have yet to be determined.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, three of the four sites found on NFS land (the masonry structures, a rock shelter, and a lithic scatter/rock shelter) would be unaffected by development of employee housing or the transportation staging area. The fourth site, a lithic procurement area, would be near the proposed transportation staging area and may be avoided during more detailed site planning. Any archaeological sites that cannot be avoided would be subject to a testing and data recovery plan to ensure that data and information contained in those sites are not lost. This procedure would be developed in consultation with the KNF, the SHPO, the ACHP, and the tribes.

Visitation to NFS land surrounding the employee housing area may increase under this alternative. Such visitation could affect cultural resources that have not yet been identified.

Cumulative Impacts

Cumulative impacts are the same as those described under Alternative D.

Biological Resources

Environmental consequences associated with these resources are divided into three categories: vegetation; wildlife; and threatened, endangered, and sensitive species.

Vegetation

Issue: Development of private or NFS land near Tusayan could affect the types and acreage of vegetation available on the Forest. A portion of the NFS land is suitable for commercial timber production, and development may result in a decrease in the timber supply available from the Forest.

Methods for Analyzing Impacts

Effects on vegetation include direct removal as a result of development of the NFS land and potential removal as a result of future development of the private inholdings.

Alternative A: No Action

Direct and Indirect Impacts

Under No Action, vegetation on the NFS land would remain unaltered. Existing ponderosa pine forest and associated understory vegetation would be affected only by natural processes, such as fire, succession, and pest outbreaks, and by KNF management activities. No vegetation treatments are proposed for the area where the NFS land is located. The NFS land involved in this analysis is excluded from management for commercial timber production in the Forest Plan.

Vegetation on some of the private inholdings may be removed if these lands are developed in the future. Because they are relatively close to GCNP and State Highway 64, the Kotzin, TenX, and Lower Basin private inholdings have the greatest development potential. Development of all three inholdings could result in the removal of up to 674 acres of vegetation, primarily ponderosa pine forest, pinyon-juniper woodland, and sagebrush flats, which comprise about 0.2% of the combined total acreage of these vegetation types on the Tusayan Ranger District. Other inholdings are remote and not likely to be developed.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Development of the NFS land involved in this alternative would result in the modification of 560 acres of vegetation, predominantly ponderosa pine forest and to a lesser extent pinyon-juniper woodland and sagebrush flats, to accommodate planned development. About 112 acres of the total 672 acres of NFS land would remain as open space within the proposed development, which would retain native vegetation. Vegetation removed as part of this alternative would represent about 0.2% of the total acreage of ponderosa pine, pinyon-juniper, and sagebrush vegetation on the Tusayan Ranger District. Native vegetation would be planted in disturbed areas following construction.

A total of 2,184 acres of ponderosa pine forest, pinyon-juniper woodland, sagebrush, and grassland habitat associated with the private inholdings would come under Federal ownership and management, representing about a 7% increase in these vegetation types on the Tusayan Ranger District.

Cumulative Impacts

Foreseeable future actions that would contribute to additional removal of vegetation in the Tusayan area include ongoing and planned development in Tusayan and planned expansion of Grand Canyon Airport. Development in these areas would not include a substantial amount of clearing of native vegetation.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Alternative C would result in the modification of 370 acres of ponderosa pine, pinyon-juniper, and sagebrush vegetation to accommodate planned development. A total of 10 acres of the total 380 acres of NFS land would remain as open space within the proposed development, which would retain native vegetation. Vegetation removed under this alternative would represent about 0.1% of these vegetation types on the Tusayan Ranger District. Native vegetation would also be used in this alternative to revegetate cleared areas following construction.

A total of 2,184 acres of ponderosa pine forest, pinyon-juniper woodland, sagebrush, and grassland habitat associated with the private parcels would come under Federal ownership and management, representing about a 7% increase in these vegetation types on the Tusayan Ranger District.

Cumulative Impacts

Cumulative impacts are the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under this alternative, a total of 117 acres of ponderosa pine, pinyon-juniper, sagebrush, and grassland habitat would be removed to accommodate planned development, representing about 0.04% of the total number of acres of these vegetation types on the Tusayan Ranger District. Although some native landscaping would likely be incorporated, vegetation would be removed from most of this area.

Cumulative Impacts

If the Kotzin, TenX, and Lower Basin parcels are eventually developed, up to an additional 674 acres of ponderosa pine forest, pinyon-juniper woodland, and sagebrush flats could be removed. Together, this would correspond to approximately 0.22-0.23% of the total acres of these vegetation types on the Tusayan Ranger District.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, up to 95 acres of predominantly ponderosa pine and pinyon-juniper vegetation would be removed to accommodate the planned development. An estimated 25 acres of the total 120 acres of NFS land would remain as open space with native vegetation. Vegetation removed or modified would represent about 0.04% of these types on the Tusayan Ranger District.

Cumulative Impacts

Cumulative impacts are the same as those described under Alternative D.

Wildlife

Issue: Development of private or NFS land near Tusayan could affect known deer-fawning, elk-calving, and turkey-roosting habitat, as well as other game management areas in the vicinity of the NFS land. It could also affect nearby wildlife movement corridors and would likely increase human disturbance of these and other wildlife populations near the NFS land.

Methods for Analyzing Impacts

Impacts to wildlife habitat closely correlate with changes in vegetation. Best available information was used to determine the existing habitat conditions on the NFS land and private inholdings involved in the analysis. Effects on wildlife are also influenced by the level and proximity of existing human development and the presence of important features for wildlife survival such as ephemeral water sources.

Alternative A: No Action

Direct and Indirect Impacts

Under the Alternative A, net acres of habitat under KNF management would not change. Wildlife populations on the NFS land may be indirectly affected by additional development in the Tusayan area.

Habitat on the Kotzin, TenX, and Lower Basin private inholdings would be subject to modification if developed, causing the partial displacement and disturbance of local wildlife populations in three distinct and separate locations on the Tusayan Ranger District. Development in three separate locations would result in a greater total zone of influence than that created by development in one location. Effects of development on wildlife in surrounding areas would vary by species. Some species, such as deer and elk, may not be affected; other species, such as antelope and some birds, could be negatively affected; and some species, such as skunks, coyotes, and some passerine birds, would likely benefit. Wildlife use on the Kotzin inholding is currently affected by proximity to Moqui Lodge, Tusayan, and State Highway 64. Wildlife use on the Lower Basin inholding may be somewhat affected by proximity to State Highway 64. Up to six ephemeral stock tanks, representing about 4% of the total number on the Tusayan Ranger District, could be eliminated from use by wildlife on the TenX and Lower Basin private inholdings if they are developed.

Ongoing and planned development in the Tusayan area, in addition to potential development of the Kotzin and TenX private parcels, could affect wildlife by increasing the degree of habitat fragmentation in the Tusayan area. Zones of influence would extend around the Kotzin and TenX parcels, in addition to existing zones of influence around Tusayan and Grand Canyon Airport.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under this alternative, development of the NFS land would result in the modification of 672 acres of wildlife habitat, with a potential to displace local wildlife populations and disturb wildlife in a zone of influence surrounding the development.

A total of 2,184 acres of wildlife habitat would come under Federal ownership and management. The KNF would acquire private lands composed primarily of bottomlands with generally high forage production and containing a total of 17 ephemeral stock tanks

(approximately 12% of the stock tanks on the Tusayan Ranger District) that provide water for wildlife on at least a seasonal basis.

Cumulative Impacts

Existing and planned development in the Tusayan area would contribute to wildlife displacement and disturbance effects around the NFS land. Effects on wildlife would be concentrated in the Tusayan area, with zones of influence extending outward from the community, Grand Canyon Airport, and CFV development on NFS land.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Effects on wildlife under this alternative would be similar to those described under Alternative B, except that 380 acres of habitat would be directly affected and the zone of influence would be correspondingly smaller.

A total of 2,184 acres of wildlife habitat would come under Federal ownership and management. The KNF would acquire private lands composed primarily of bottomlands with generally high forage production and containing a total of 17 ephemeral stock tanks (approximately 12% of the stock tanks on the Tusayan Ranger District) that provide water for wildlife on at least a seasonal basis.

Cumulative Impacts

Cumulative effects of this alternative on wildlife would be similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, a total of 117 acres of habitat for wildlife would be altered or removed to accommodate a transportation staging area, and housing and community facilities for Tusayan businesses and NPS employees. A zone of influence would extend around the NFS land.

Cumulative Impacts

Private inholdings on the KNF would remain private, and potential development of the Kotzin, TenX, and Lower Basin inholdings could result in modification of habitat on up to 674 acres of wildlife habitat, creating habitat fragmentation and collectively more, although individually smaller, zones of influence. Up to a total of six ephemeral stock tanks on the TenX and Lower Basin inholdings, representing about 4% of the total number on the Tusayan Ranger District, could be eliminated from wildlife use if these inholdings were developed.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Effects on wildlife under this alternative would be similar to those under Alternative D, except that 95 acres of wildlife habitat would be affected.

Cumulative Impacts

Cumulative impacts are similar to those described under Alternative D.

Threatened, Endangered, and Sensitive Species

Issue: Development of private or NFS lands near Tusayan could affect populations of TES plants and/or animals. Additional TES species habitat may be gained by Federal acquisition of the private inholdings.

Methods for Analyzing Impacts

The KNF, the U.S. Fish and Wildlife Service (USFWS), and the Arizona Game and Fish Department (AGFD) were consulted about special interest species (threatened, endangered, proposed, candidate, and sensitive species) that may be potentially affected by this undertaking. After receiving lists of special interest species from the agencies, existing literature and records of previous surveys were reviewed to determine the occurrence of these species on the NFS land and the private inholdings involved in this analysis. Table 4.37 provides a list of the species either known to occur or for which possible habitat exists on the Tusayan Ranger District and their designated status.

Previous surveys for the Tusayan flameflower had been completed by KNF botanists on portions of the NFS land involved in this analysis and on NFS land surrounding Tusayan. Additional surveys for the Tusayan flameflower were completed by SWCA biologists in 1995 on the NFS land not previously surveyed and on the TenX

and Kotzin private inholdings. Existing KNF records of Tusayan flameflower populations were reviewed prior to completing surveys in 1995. Surveyors walked transects approximately 75'-150' apart searching

for suitable habitat (rocky soils and/or rock outcrops). Once suitable habitat was located, surveyors searched the area thoroughly before continuing the transects. Populations of Tusayan flameflower that were detected were plotted on field maps and later transferred to final project maps. Results from surveys previously conducted by KNF botanists were reviewed to determine locations of the Arizona leatherflower and disturbed rabbitbrush.

The KNF and AGFD were consulted for records of Forest Service Sensitive northern goshawk occurrence in the project area. Existing KNF data on known nest sites were reviewed, and the KNF wildlife biologist was interviewed for information on previous goshawk sightings and known nest sites. Forest Service protocol was used while conducting species-specific surveys on the NFS land involved in the analysis and on the Kotzin and TenX private inholdings during the nesting period in June and early July 1995.

In July 1995 the NFS land involved in this analysis and the Kotzin and TenX private inholdings were evaluated for habitat for other Federally listed, proposed, candidate species, Forest Service sensitive species, and state listed species identified by the agencies.

Existing literature was reviewed for descriptions of habitat and known occurrences.

Table 4.37 Special Status Species and Designated Status

Common Name	Scientific Name	Status
American peregrine falcon	*Falco peregrinus anatum*	Fed-End, AZ-Can, FS-Sen
Bald eagle	*Haliaeetus leucocephalus*	Fed-End, AZ-End, FS-Sen
Arizona leatherflower	*Clematis hirsutissima* var. *arizonica*	Fed-Cand, AZ-HS, FS-Sen
Navajo Mountain Mexican vole	*Microtus mexicanus navaho*	AZ-Thr, FS-Sen
Tusayan flameflower	*Talinum validulum*	AZ-SR, FS-Sen
Northern goshawk	*Accipiter gentilis*	AZ-Can, FS-Sen
Disturbed rabbitbrush	*Chrysothamnus molestus*	FS-Sen
Flammulated owl	*Otus flammeolus*	FS-Sen
Occult little brown bat	*Myotis lucifugus occultus*	FS-Sen

FEDERAL (FED)
End - Listed Endangered by the USFWS under the Endangered Species Act (ESA).
Thr - Listed Threatened by the USFWS under the ESA.
Cand - Those species with strong scientific evidence indicating they are likely to be in need of listing as endangered or threatened under the ESA.
FOREST SERVICE (FS)
Sen - Classified as Sensitive when occurring on lands managed by the U.S. Forest Service.
ARIZONA (AZ)
End - State Endangered on the AGFD's listing of Wildlife of Special Concern in Arizona (WSCA). Species extirpated from Arizona since the mid-1800's or for which extirpation is highly probable without conservation efforts.
Thr - State Threatened on the AGFD's WSCA list. Species that have identified, serious threats and have populations lower than they were historically and/or are extremely localized with small populations.
Can - State Candidate species on AGFD's WSCA list. Species with known or suspected threats, but for which substantial population declines from historical levels have not been recorded.
HS - Highly Safeguarded as defined by Arizona Native Plant Law (ADA 1993).
SR - Salvage Restricted as defined by Arizona Native Plant Law (ADA 1993).

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, habitat for the Tusayan flameflower and possible habitat for the northern goshawk, the flammulated owl, and the Navajo Mountain Mexican vole (all Forest Service Sensitive species), on the NFS land involved in this analysis would remain under Federal ownership and management. Habitat for these species would continue to be affected by natural processes such as succession, fire, and competition, and by KNF management activities such as livestock grazing.

Potential development of the Kotzin, TenX, and Lower Basin private inholdings could affect the Arizona leatherflower (a Federal Candidate species) and the Tusayan flameflower, northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat (Forest Service Sensitive species). Two small populations of Arizona leatherflower, totaling about 40 plants, are known to occur on the TenX private inholding. If TenX is developed, up to 13% of the known number of Arizona leatherflower plants on the Tusayan Ranger District could be impacted or destroyed. Three populations of Tusayan flameflower, totaling about 100 individuals, are known to occur on the TenX inholding, and 10 populations, totaling at least 370, plants are known to occur on the Kotzin inholding. These populations account for about 3% of the known number of Tusayan flameflower plants on the Tusayan Ranger District.

Possible habitat for the flammulated owl, northern goshawk, and Navajo Mountain Mexican vole occurs on the Kotzin and TenX private inholdings and possible habitat for the occult little brown bat occurs on TenX. It is unlikely that the population viability of these species would be affected by the development of these inholdings.

Known and possible habitat for Forest Service Sensitive species on the other nine private inholdings would remain in private ownership. Because of the lower likelihood of their development, these lands would be subject to their current use, which is primarily livestock grazing. Known habitat for disturbed rabbitbrush on the Curley Wallace inholding and possible habitat for the Navajo Mountain Mexican vole on the other private inholdings would remain in private ownership.

As visitors seek additional recreational opportunities outside of GCNP, visitation to NFS land surrounding Tusayan or the private inholdings may increase with development. Such visitation may affect special interest species or their habitat. The Tusayan flameflower, the northern goshawk, and the flammulated owl would be most likely impacted. Populations of the Tusayan flameflower were recorded by the KNF in 1994 to the south and east of Grand Canyon Airport, and a northern goshawk has been sighted south of the airport. Possible habitat for the flammulated owl occurs throughout the Tusayan Ranger District in ponderosa pine forest habitats.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under Alternative B, development of the NFS land would affect habitat for the Tusayan flameflower and possible habitat for the northern goshawk, flammulated owl, and the Navajo Mountain Mexican vole. During surveys conducted by the KNF from 1990 to 1992, nine populations of the Tusayan flameflower, totaling about 152 plants, were recorded on the NFS land proposed for development. Development of the NFS land could result in the removal of about 1% of the known population of Tusayan flameflower on the Tusayan Ranger District. This would not be expected to impact the population viability of this species. About 672 acres of possible habitat for the northern goshawk, flammulated owl, and Navajo Mountain Mexican vole may also be directly affected by development activities, and a larger zone of influence may also be created. It is unlikely that the population viability of these species would not be affected.

This alternative would increase the amount of special interest species habitat managed by the Forest Service through acquisition of the private inholdings controlled by CFV. On the private land acquired through the land exchange, known habitat occurs for the Arizona leatherflower, Tusayan flameflower, disturbed rabbitbrush, and possible habitat occurs for the northern goshawk, flammulated owl, Navajo Mountain Mexican vole, and occult little brown bat. The KNF Plan requires consideration of potential effects of management activities such as timber management, livestock grazing, and recreational use on TES species. On the TenX inholding, three populations of Tusayan flameflower, totaling about 100 individuals, and two populations of Arizona leatherflower, totaling about 40 plants, would come under Federal ownership and management. On the Kotzin inholding, 10 populations, totaling at least 370 Tusayan flameflower plants would come under Federal ownership and management. These plants would correspond to

about 3% and about 13% of the known number of Tusayan flameflower and Arizona leatherflower individuals on the Tusayan Ranger District, respectively. Known habitat for disturbed rabbitbrush on the Curley Wallace inholding would also come under Federal ownership and management. Possible habitat for the northern goshawk, flammulated owl, and Navajo Mountain Mexican vole on the TenX and Kotzin inholdings, and possible habitat for the occult little brown bat on the TenX inholding would also be managed by the KNF.

Cumulative Impacts

Redevelopment of the existing private land in Tusayan would not impact TES species or their habitat.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Under Alternative C, development could directly affect seven populations of Tusayan flameflower, totaling about 135 plants and representing less than 1% of the known number of individuals on the Tusayan Ranger District. This is not expected to impact population viability of this species. About 380 acres of possible habitat for the northern goshawk and flammulated owl would be directly affected by development activities. A larger zone of influence around the development would produce unknown effects on these species, but would not be expected to affect population viability.

Federal acquisition of private inholdings would place known habitat of the Arizona leatherflower, Tusayan flameflower, and disturbed rabbitbrush, and possible habitat for the northern goshawk, flammulated owl, occult little brown bat, and Navajo Mountain Mexican vole under Federal ownership and management.

Cumulative Impacts

Cumulative impacts are expected to be similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, no known populations of Tusayan flameflower would be affected on the NFS land. About 117 acres of possible habitat for the northern goshawk and the flammulated owl would be directly affected. A larger zone of influence around the community development and transportation staging area would produce unknown effects on these species, but it is not expected to affect population viability by this development.

Cumulative Impacts

Potential cumulative effects of this alternative on special interest species individuals or habitat on private inholdings would be similar to those described under Alternative A. Known habitat of the Arizona leatherflower, Tusayan flameflower, and disturbed rabbitbrush, and possible habitat for the northern goshawk, flammulated owl, occult little brown bat, and Navajo Mountain Mexican vole on the Kotzin and TenX private inholdings could be subject to disturbance from potential future development. Known habitat for disturbed rabbitbrush on the Curley Wallace inholding and possible habitat for the Navajo Mountain Mexican vole on the other private inholdings would remain in private ownership and subject to disturbance from potential future development. Potential development of the TenX inholding could affect up to 40 Arizona leatherflower plants and up to 100 Tusayan flameflower plants. Potential development of the Kotzin inholding could affect 10 known populations, totaling at least 370 plants. Up to 355 acres of possible habitat for the northern goshawk and flammulated owl could be directly affected by development of the TenX and Kotzin private inholdings.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, two populations of Tusayan flameflower on the NFS land, totaling about 100 plants and representing less than 1% of the known number of individuals on the Tusayan Ranger District, would be potentially affected. This is not expected to affect the population viability of this species. About 120 acres of possible habitat for the northern goshawk and flammulated owl would be directly affected by development, and a larger zone of influence around the housing complex and transportation staging area would produce unknown effects on these species. It is unlikely that population viability of these species would be impacted by this development.

Cumulative Impacts

Cumulative impacts are similar to those described under Alternative D.

Forest Service Management

Environmental consequences associated with this resource are divided into three categories: Forest Service management objectives, public recreational opportunities, and fire management programs.

Forest Service Management Objectives

Issue: Using NFS land for development of visitor facilities and community services could affect the KNF's ability to effectively manage these resources in the areas adjacent to development.

Methods for Analyzing Impacts

Effects of each alternative on Forest Service Management objectives, including the management of livestock, soil and water, special land uses, and property boundaries, are summarized below.

Alternative A: No Action

Direct and Indirect Impacts

Livestock Grazing

Under Alternative A, development of some of the private inholdings may affect the availability of surface water for livestock. Of the private inholdings with the greatest development potential, Lower Basin has four stock tanks and TenX has two. Development of these inholdings would affect livestock access to these stock tanks. Because of the relatively minor contribution of the private inholdings to the total available forage on the allotment, a reduction in the permitted number of livestock in the Cameron, Anita, or Rain Tank allotments would not occur. Other inholdings would remain in private ownership and would continue to be used for livestock grazing.

Soil and Water

Under Alternative A, the KNF would continue to manage watershed conditions on the NFS land. Objectives in the KNF Plan call for a reduction of soil erosion and sedimentation due to overgrazing and a reduction in the number of poorly located and constructed roads through active management. Watershed conditions on the private inholdings, totaling 2,184 acres, would continue to be affected by existing uses, primarily livestock grazing, and would be excluded from soil and water improvement activities by the KNF.

Special Land Uses

Under Alternative A, there would be no effect on existing special use permits in the Tusayan area. Special use permits for Moqui Lodge and Apache Stables would likely be renewed within 5 years. Development of the Kotzin, TenX, and Lower Basin parcels would result in more encumbrances on the Tusayan Ranger District and additional requests for special use permits for utilities, services, and facilities on NFS land surrounding the private inholdings. Continued demand for visitor and community services and facilities in the Tusayan area would likely result in additional requests for special use permits for NFS land adjacent to Tusayan.

Property Boundary Management

Under Alternative A, KNF would continue current boundary management practices and procedures. A large portion of the Tusayan Ranger District has been acquired by the Forest Service through the land exchange program. Under Alternative A, simplification and enhancement of NFS administration through acquisition of the private inholdings would not occur. The exchange of 12 private inholdings would not occur, leaving them in private ownership. The value of the private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Livestock Grazing

Under Alternative B, livestock grazing on the NFS land would be discontinued because of change in ownership and subsequent development. No stock tanks are on the NFS land involved in this analysis. A total of 672 acres would be eliminated from the Rain Tank Allotment. Although the effective size of the Rain Tank Allotment would be reduced, no change in the permitted number of livestock on this allotment would result from exchange of the NFS land. Since there is no anticipated significant change in the grazing permit as a result of this alternative, this alternative is consistent with Section 402(g) of FLPMA, and the two-year notification period is not required. An environmental assessment currently being prepared by the KNF may result in adjustments in the potential number of livestock on the Rain Tank Allotment,

independent of this proposed exchange alternative (Don Cosby, Tusayan Ranger District, personal communication 1997). Acquiring the private inholdings would add 2,184 acres of rangeland under KNF management to the Tusayan Ranger District, although allotment sizes would not increase appreciably. Inholdings that would be acquired by the KNF contain some productive bottomlands and a total of 17 stock tanks that provide seasonal water for livestock.

Soil and Water

Under Alternative B, impervious surface area on the NFS land would increase because of the construction of roads, parking lots, rooftops, and other surfaces. According to Federal law, development of the NFS land cannot result in adverse impacts to downstream portions of the watershed. Development more than 5 acres in extent requires a National Pollutant Discharge and Elimination System permit and an associated Storm Water Pollution Prevention Plan. Under the conditions of this permit, developers cannot increase peak flow or sediment concentrations in regional waters.

Soils associated with bottomlands on the private inholdings are prone to compaction, puddling, displacement, and gullying during heavy rains and therefore can impact watershed conditions. Acquisition of the private inholdings would allow active management of soil and vegetation on the inholdings and would facilitate the overall management goal of improving watershed conditions.

Special Land Uses

Under this alternative, existing special use permits in the Tusayan area would be unaffected. Rights associated with special use permits for utility lines crossing the NFS land would be preserved and continued with the change of ownership. Development of the NFS land would not influence the continued operations of Moqui Lodge and Apache Stables. Horseback riding routes through the NFS land would have to be relocated. Development of the NFS land up to Moqui Lodge may benefit special use permittees by attracting more visitors to Moqui Lodge and Apache Stables (Ken Olsen, Tusayan Ranger District, personal communication 1997). Development adjacent to Moqui Lodge would create opportunities for sharing infrastructure, particularly wastewater treatment facilities. The existing wastewater treatment system at Moqui Lodge is operating at capacity and would have to be upgraded as part of the proposed expansion at Moqui Lodge. Development of the NFS land in this alternative would likely result in additional special uses on the Tusayan Ranger District for utility corridors.

Property Boundary Management

Exchange of NFS land under this alternative would result in about 4 miles of new boundary and up to 10 new corners. Acquisition of the private inholdings would result in a net **decrease** of about 34 miles of boundary and 121 property corners.

Cumulative Impacts

Additional requests for special land uses for NFS land adjacent to Tusayan are likely from the redevelopment of the commercial properties in Tusayan.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Livestock Grazing

A total of 380 acres would be eliminated from the Rain Tank Allotment under Alternative C. No change in the number of permitted livestock within allotments on the Tusayan Ranger District would result. About 2,184 acres of rangeland would be acquired would come under direct management by the KNF. Private inholdings that would be acquired include some productive bottomlands and a total of 17 stock tanks.

Soil and Water

Under Alternative A, development and the associated creation of impervious surfaces would occur on a total of 380 acres. No increase in peak flow or runoff volume could occur under existing Federal law. KNF management of vegetation and soils on the private inholdings would facilitate improvement of watershed conditions on the Tusayan Ranger District through active management.

Special Land Uses

Under Alternative A, existing special use permits in the Tusayan area would be unaffected, including those for Moqui Lodge and Apache Stables. Development adjacent to Moqui Lodge would create opportunities for shared infrastructure, particularly wastewater treatment facilities, as described under Alternative B. Alternative C would likely result in additional special uses on the Tusayan Ranger District for utility corridors.

Property Boundary Management

Exchange of NFS land under Alternative C would result in about 3 miles of new boundary and 8 new corners.

Acquisition of the private inholdings would result in a net **decrease** of about 35 miles of boundary and 123 property corners.

Cumulative Impacts

Cumulative impacts are expected to be similar to those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Livestock Grazing

Under Alternative D, a total of 117 acres of NFS land would be eliminated from the Rain Tank Allotment. No change in the permitted number of livestock would occur as a result of this alternative.

Soil and Water

Development and the associated creation of impervious surfaces would occur on a total of 96 acres. No appreciable changes in peak flow or volume would occur.

Special Land Uses

Under Alternative D, existing special use permits in the Tusayan area would not be affected, including those for Moqui Lodge and Apache Stables. Moqui Lodge and Apache Stables would likely benefit from the development of the transportation staging area between the IMAX theater and Moqui Lodge. Additional special use permits and easements for utility corridors and access roads are likely for the development of community services and facilities on the Townsite Act lands. The transportation staging area would require the issuance of a special use permit through the competitive bidding process.

Property Boundary Management

This alternative would result in a net **increase** of about 2 miles of new boundary and 11 property corners on the Tusayan Ranger District.

Cumulative Impacts

Livestock Grazing

Seventeen stock tanks associated with the private inholdings would remain in private ownership. No change in the respective allotment sizes would be expected. Potential development of the Kotzin, Lower Basin, and TenX private inholdings could result in the modification of some rangeland and potential loss of access to six stock tanks used by livestock. The other private inholdings would likely continue to be used for livestock grazing.

Soil and Water

Private inholdings would remain in private ownership, and soil and vegetation resources on these inholdings would not come under KNF management.

Special Land Uses

Development of the private inholdings would result in more encumbrances on the Tusayan Ranger District and additional requests for special use permits for utilities, services, and facilities on NFS land surrounding the private inholdings.

Property Boundary Management.

KNF would continue current boundary management practices and procedures. The exchange of 12 private inholdings would not occur, leaving them in private ownership. The value of the private inholdings may increase over time and an opportunity to acquire them may be lost because of increased value or possible development.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Livestock Grazing

A total of 120 acres of rangeland would be eliminated from the Rain Tank Allotment under Alternative E. This would not result in a reduction of the number of permitted livestock on this allotment.

Soil and Water

Development and the associated creation of impervious surfaces would occur on a total of 77 acres. No changes in peak flow or volume would occur.

Special Land Uses

Under Alternative E, existing special use permits would not be affected including those for Moqui Lodge and Apache Stables. The transportation staging area would require the issuance of a special use permit through the competitive bidding process.

Property Boundary Management

Alternative E would result in a net increase of about 1 mile of new boundary and 3 property corners on the Tusayan Ranger District.

Cumulative Impacts
Cumulative impacts under Alternative E are similar to those described under Alternative D.

Public Recreational Opportunities

Issue: Development of private or NFS lands near Tusayan may affect recreational opportunities in the area. Development of the NFS land may affect the proposed expansion of TenX Campground.

Methods for Analyzing Impacts
An inventory of existing recreational opportunities was completed for the NFS land involved in this analysis. Each alternative was evaluated against this inventory to determine if these recreational opportunities would be affected. Each alternative was also evaluated to determine how the development would affect the proposed expansion of TenX Campground. Finally, the Recreational Opportunities Spectrum (ROS) map for the forest was examined to determine the change in acreage of the various ROS classifications on the Tusayan Ranger District.

Alternative A: No Action

Direct and Indirect Impacts
Current recreational uses of the NFS land, such as dispersed camping, hiking, and horseback riding, would continue under Alternative A. Dispersed recreational uses on some of the more remote inholdings would likely continue, although future restrictions could be imposed by the private landowners. Dispersed recreational use of the Kotzin, TenX, and Lower Basin parcels could eventually be eliminated by private development of these inholdings.

Developed recreational sites in the Tusayan area include the Camper Village Campground/RV park in Tusayan and the TenX Campground in the KNF south of Tusayan. With proposed redevelopment of Tusayan, the Camper Village Campground/RV park would be closed and that property would be developed into mixed-use commercial services. Expansion of the TenX Campground by an additional 150 camp sites could occur as proposed by the KNF. The proposed expansion of TenX would help to absorb the demand created by the closure of CamperVillage Campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area.

Under this alternative, two visitor orientation/interpretive centers may be developed. INSIGHT may be developed on one of the private inholdings (Lower Basin or Kotzin), as proposed by CFV and the Museum of Northern Arizona. Destination Cinema, potentially in conjunction with the National Geographic Society, may construct an orientation/interpretive center on the private land in Tusayan. Both of these facilities would be for-profit ventures that visitors would pay to use.

There would be no change in the total acres of the various ROS classification on the Tusayan Ranger District under Alternative A.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts
Opportunities for dispersed camping, hiking, and horseback riding would be eliminated on 672 acres of NFS land. Dispersed recreational uses on the private inholdings would be allowed to continue under Federal ownership. A developed network of hiking/biking trails would be constructed to connect GCNP with the CFV development, proposed under Alternative B.

A 250-site campground/RV park would be constructed in the CFV development, absorbing the demand available from the closure of Camper Village Campground/RV park. The KNF may pursue the expansion of TenX Campground by an additional 150 camp sites as proposed.

Under Alternative B, INSIGHT would be developed on the NFS land acquired through exchange, as proposed by CFV and the Museum of Northern Arizona. This facility would be a for-profit venture that visitors would pay to use. INSIGHT would provide additional recreational and educational opportunities for visitors to GCNP.

One inholding on the Tusayan Ranger District (the Willows inholding) is in an area classified as Semi-Primitive Motorized. Therefore, there would be a **net increase** of 160 acres of Semi-Primitive Motorized Lands on the Tusayan Ranger District through the Federal acquisition of private inholdings under Alternative B. This ROS classification currently makes up about 20% of the land area on the Tusayan Ranger District. There would also be a **net increase** of 1,352 acres of Roaded Natural area on the Tusayan Ranger District through the Federal acquisition of private inholdings under

Alternative B. This ROS classification currently makes up about 66% of the land area on the Tusayan Ranger District.

Cumulative Impacts

If Tusayan is redeveloped as proposed, the Camper Village Campground/RV Park would be closed and that property would be redeveloped into mixed-use commercial services. Destination Cinema, potentially in conjunction with the National Geographic Society, may pursue building an orientation/interpretation center on private land in coordination with the redesign of IMAX. This for-profit venture would provide additional recreational and education opportunities for visitors to GCNP.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts to recreational opportunities would be the same as those described under Alternative B, except that dispersed camping, hiking, and horseback riding would be eliminated on 380 acres rather than 672 acres of NFS land.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, recreational opportunities such as dispersed camping, hiking, and horseback riding would be eliminated on 117 acres of NFS land.

With proposed redevelopment in Tusayan, the Camper Village Campground/RV park would be closed and that property would be developed into mixed-use commercial services. Expansion of the TenX Campground by an additional 150 camp sites could occur as proposed by the KNF. The proposed expansion of TenX would help to absorb the demand created by the closure of Camper Village Campground, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area.

Under Alternative D, Destination Cinema, potentially in conjunction with the National Geographic Society, would construct an orientation/interpretive center on the private land in Tusayan. This facility would be a for-profit venture that visitors would pay to use. This facility would provide additional recreational and education opportunities for visitors to GCNP.

There would also be a **decrease** of 117 acres of Roaded Natural area on the Tusayan Ranger District through private acquisition and use of NFS land under Alternative D. This ROS classification currently makes up about 66% of the land area on the Tusayan Ranger District.

Cumulative Impacts

Dispersed recreational uses on some of the more remote inholdings would likely continue, but future restrictions could be imposed by the private landowners. Dispersed recreational use of the Kotzin, TenX, and Lower Basin parcels could be eliminated by private development of these inholdings.

Under this alternative, INSIGHT may be developed on one of the private inholdings (Lower Basin or Kotzin), as proposed by CFV. This would be the second such orientation/interpretive facilities built in the area. This for-profit venture would provide additional recreational and educational opportunities for visitors to GCNP.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Effects of Alternative E on recreation would be similar to those under Alternative D. Opportunities for dispersed recreation would be eliminated from 120 acres of NFS land. A network of hiking/biking trails would be developed between the transportation staging area and GCNP. Expansion of the TenX campground by an additional 150 camp site could occur as proposed by the KNF, but may not entirely satisfy total demand for camping in the Grand Canyon/Tusayan area. There would be a **decrease** of 120 acres of Roaded Natural area on the Tusayan Ranger District through the use of NFS land under Alternative E.

Cumulative Impacts

Cumulative impacts under Alternative E would be similar to those described under Alternative D.

Fire Management Programs

Issue: Development of private or NFS lands near Tusayan may affect the amount of wildland/urban interface and increase fire risk, affecting fire suppression efficiency.

Methods for Analyzing Impacts

The Tusayan Ranger District land boundary map was examined to determine the amount of shared boundary between the wildland and urban settings. Each alternative was then evaluated to determine how the proposed and potential development would impact fire risk and fire suppression efficiency.

Alternative A: No Action

Direct and Indirect Impacts

Under Alternative A, potential development of the private inholdings would result in a greater area of wildland/urban interface and increased fire risk from new populations in areas previously undeveloped. If developed, the scattered nature of the private inholdings could affect fire response time and emergency services.

The Tusayan Fire District has proposed establishing a temporary fire station to service existing private land in Tusayan, but they would not have responsibilities for fire suppression on the private inholdings. Fire protection services of the private inholdings would be provider either by the developer or through an agreement with the Forest Service or Park Service.

Alternative B: Land Exchange Option 1

Direct and Indirect Impacts

Under Alternative B, fire risk would increase because the wildland/urban interface would be greater than what currently exists from the development of 672 acres of NFS land. Since development would be concentrated in one area, fire management programs would be more efficient as management efforts could be concentrated in one area. CFV would build and equip a permanent fire station for Tusayan.

Cumulative Impacts

A temporary fire station would be built by the Tusayan Fire District, but this station would be expected to move to the permanent facilities on the CFV development when they are completed.

Alternative C: Land Exchange Option 2

Direct and Indirect Impacts

Impacts to fire management would be the similar to those described under Alternative B.

Cumulative Impacts

Cumulative impacts would be the same as those described under Alternative B.

Alternative D: Townsite Act/Special Use Permit

Direct and Indirect Impacts

Under Alternative D, fire risk would increase because the wildland/urban interface would be greater than what currently exists from the development of 117 acres of NFS land. Since development would be concentrated in one area, fire management programs would be more efficient.

Townsite Act land purchased by a qualifying entity (the County Improvement District) could be sold to the Tusayan Fire District to build a permanent fire station. A temporary fire station would be built by the Tusayan Fire District to service private land in Tusayan until money could be raised for the permanent facility.

Cumulative Impacts

Cumulative impacts to fire management would be the same as the direct and indirect impacts described under Alternative A.

Alternative E: Transportation/Federal Housing

Direct and Indirect Impacts

Under Alternative E, fire risk would increase because the wildland/urban interface would be greater than what currently exists from the development of 120 acres of NFS land. Since development would be concentrated in one area, fire management programs would be more efficient.

Cumulative Impacts

Cumulative impacts to fire management would be the same as the direct and indirect impacts described under Alternative A.

Environmental Consequences or Factors Not Identified as Major Issues or Concerns

Effects on Consumers, Civil Rights Legislation, Minority Groups, and Women

Various civil rights, affirmative action, and equal employment opportunity acts and regulations require that any Federal action must carry out hiring, supervisory, and contracting practices that meet established regional and national goals for civil rights. If an action alternative is selected, the proponent or permittee and the contractors would be required to maintain these practices.

An analysis of impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including American Indians, was undertaken. A review of Chapter 4, including the analysis of socioeconomic resources, surface water and groundwater quality, air quality, hazardous materials, and other elements of the human environment, indicates that American Indians and other minority and/or low-income groups are not disproportionately affected by the alternatives.

Effects on Prime Farmland and Range Land

There are no prime farm, range, or forest lands, or roadless, wilderness, natural, or study areas on the Federal lands proposed for exchange or acquisition under the Townsite Act. Range land is present on the private inholdings, and the Federal acquisition of the private inholdings would provide a net increase of range land for the Forest Service.

Effects on Wetlands and Flood Plains

The NFS land and private inholdings involved in this analysis were surveyed for floodplains and wetlands. No jurisdictional wetlands were found on either the NFS or private lands. Floodplains of less than 30 feet were found on the Young, Curley Wallace, Apex Siding, and East Harbison inholdings, totaling less than one acre; five acres of floodplains were found on the Kotzin inholding; and about 35 acres of floodplains were found on the NFS land (within Long Jim Canyon). Any drainages or water catchments such as stock tanks that were found during surveys lacked the vegetative components required to qualify as jurisdictional wetlands. Soils and underlying bedrock are too permeable to allow the prolonged surface saturation required for the development of hydric soil characteristics and the growth of hydrophytic (water-loving) vegetation. None of the alternatives conflict with Executive Order 11988 regarding floodplain management or Executive Order 11990 regarding wetland management.

Effects on Minerals, Geothermal Resources, Oil, and Gas

A Mineral Report, assessing the mineral potential of NFS and private inholdings, was prepared. The BLM has concurred that there is low potential for locatable minerals on most of the private inholdings and the NFS land involved in this analysis. There is moderate potential for locatable minerals on the Babbit Tank private inholding. There is low to moderate potential for mineral materials and low potential for leasable minerals on the private inholdings and NFS land involved in this analysis.

Within the private and NFS lands involved in this analysis, there is no potential for coal, oil, gas, or solid minerals. There is low to moderate potential for common-variety minerals. Copper and uranium have historically been mined in the area, although no evidence of prospecting or mining for these minerals was found. There are no active mining claims on or within the immediate vicinity of the NFS land. There are no Forest Service or BLM mineral leases or permits on or within the proximity of the NFS land. Borrow pits for rock and dirt were identified. These materials are abundant in the area.

The Babbit Tank private inholding has moderate potential for locatable minerals from its proximity to a mineralized, collapsed breccia pipe on an adjacent 40-acre tract of private land that is excluded from the proposed exchange.

Effects on Hazardous Materials

A field review and records check of both the private and NFS lands for the presence of hazardous substances was completed as required by 40 CFR 273.3(a). The lands involved in this analysis have been examined in accordance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act (26 U.S.C. 4611-4682, and as amended by 42 U.S.C. 9601-9657). Western Technologies, Inc., prepared the

Phase I Environmental Site Assessment for GCIA on roughly 96 acres of NFS land directly north of Tusayan. Geotechnical and Environmental Consultants, Inc., prepared the Transaction Screens for CFV on the 12 private inholdings and 672 acres of NFS land.

Western Technologies reported, "No evidence exists to suggest the presence of environmental concerns from facilities identified during our database research." They concluded that this assessment revealed no evidence of recognized environmental conditions in connection with the NFS land and recommended no further assessment.

Geotechnical and Environmental Consultants prepared preliminary data to aid in evaluating the 12 private inholdings and 672 acres of NFS land proposed for exchange for the presence of significant quantities of disposed hazardous and petroleum substances resulting from past or present uses. Several sites require additional studies to provide a more detailed evaluation: TenX, Lower Basin, Babbit Tank, Kotzin, Anita Station, East Harbison, and Apex Siding.

Based on this information, a Phase I/Phase II Environmental Site Assessment is recommended for the NFS land and the TenX, Lower Basin, Kotzin, Willows, Babbit Tank, Anita Station, East Harbison, and Apex Siding inholdings. No further work is recommended for the Curley Wallace, Trash Dam, or Peterson inholdings.

Effects on Cave Resources

The Cave Resources Protection Act of 1988 (Public Law 100-691 [16 U.S.C. 4301 et seq.;102 Stat. 4546]) establishes requirements for the management and protection of caves and their resources on Federal lands. One cave was found on the NFS land involved in this analysis, approximately midway between the Kotzin inholding and State Highway 64. SWCA, Inc., evaluated the cave found in Section 13, Township 30 North, Range 2 East on the USGS 7.5 minute topographic map for Tusayan West, Arizona. The cave is an outcrop of Kaibab limestone in a wooded area. Two entrances lead to a roughly oval area approximately measuring 289 feet by 66 feet, with a dome 12 feet in height. Six specific criteria are used for the evaluation of caves to determine the cave's significance. These criteria and the findings are listed in Table 4.38.

Because of the natural characteristics of the cave and recent human disturbance, the resources offered by this cave are limited. None of the alternatives involved in this EIS conflict with the Cave Resources Protection Act.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitment of resources refers to nonrenewable resources, such as cultural resources, or to those factors that are renewable only over long periods of time, such as soil productivity. Irretrievable commitment applies to losses of production, harvest or use of renewable natural resources. For example, timber production and grazing capabilities are irretrievably lost while the area is used for visitor and community services and facilities. The production lost is irretrievable, but the action is not irreversible.

Development of the NFS land represents an essentially permanent commitment of the area. This development is not a completely irreversible or irretrievable commitment of resources, but from a practical standpoint, it can be considered as such. Should the time come that development is no longer desired, the various facilities could be dismantled and removed and the area revegetated or allowed to return to a natural state.

Irreversible commitments include construction of new roads and parking areas, because of the earthwork required. Other aspects of development, including utility easements and landscaping could be reversed and natural resources restored over time. Vegetation removed for development is an irretrieveable impact for at least the life of the project. Some loss of wildlife habitat is also irretrievable for the life of the project. Increased human disturbance may cause some species to permanently avoid the area, thus indirectly impacting the carrying capacity of their habitat in the vicinity.

Table 4.38 NFS Criteria for Evaluation of Caves and Findings for the Cave Found on NFS Land Proposed for Exchange under Alternatives B and C

NFS CRITERIA	FINDINGS
Biota	No evidence was found of flora or fauna native to caves or restricted to caves, or of any species that are on sensitive, threatened, or endangered species lists.
Cultural	Due to recent human presence, it is unlikely that any historic or archeological resources are intact and in situ in this cave. It is likely that the cave was used in prehistory, as artifacts have been found in the immediate vicinity. The Forest Service has no record of excavation.
Geologic/Mineralogic/Paleontologic	The cave is in Kaibab limestone with patches of calcite with no highly-developed crystalline structures. No bones were visible.
Hydrologic	The cave contains no permanent water but appears to receive some drainage and/or runoff from the surface and may be flooded on an irregular seasonal basis. The cave is on a ridge above a wash (Long Jim Canyon) that is below the lowest depth of the cave. Therefore, the cave is probably not a direct aquifer recharge feature.
Recreational	The cave shows evidence of recent use for non-organized recreational activity.
Educational or Scientific	As the cave shows evidence of contemporary human disturbance and is not in a pristine state, it offers very limited opportunities for educational or scientific use.

Chapter 5: Consultation, Coordination, and EIS Preparation

Introduction

During the preparation of this EIS, the KNF consulted with and received input from Federal, state, and local agencies, elected representatives, non-governmental organizations, and private individuals. This chapter summarizes these efforts of consultation and coordination, presents a distribution list for the Draft EIS, provides a bibliographic citation for all referenced material, and lists the persons responsible for preparing this document.

Coordination with Federal, State, and County Agencies

The KNF has coordinated with the following list of agencies, elected officials, and groups (Table 5.1) to discuss the EIS and to gather their comments on the proposed project.

Consultation

Several individuals contributed information for the EIS. Listed in Table 5.2 are these individuals, their titles, and the subject matter they contributed.

Table 5.1 Federal, State, and County Agencies Consulted with for Project Concerns and Issues

FEDERAL	STATE	COUNTY
Army Corps of Engineers	Department of Environmental Quality	Coconino County
Fish and Wildlife Service	Air Quality	Planning and Zoning
	Solid Waste	
	Water Quality	
	Department of Transportation	
	Grand Canyon Airport	
	Transportation Planning Division	
	Department of Water Resources	
	Game and Fish Department	
	State Historic Preservation Office	

AMERICAN INDIAN GROUPS	ELECTED REPRESENTATIVES	NON-GOVERNMENTAL
Havasupai	Representative J.D. Hayworth	GCIA
Hopi	Representative Bob Stump	Grand Canyon Trust
Hualapai	Senator Jon Kyl	
Navajo	Senator John McCain	
Zuni	Congressman John Shadegg	

Table 5.2 Contributing Individuals

Contact	Position	Contribution
Lieutenant Augenstein	Law Enforcement Officer	Crime rates
Chris Becker	Facility Manager	Medical facility (Samaritan Health Center and Pharmacy) at Grand Canyon
Don Bills	USGS Hydrologist	Supai Well
Don Cosby	Tusayan Ranger District Staff	Livestock Grazing
Mike Covalt	Airport Manager	Grand Canyon Airport and Master Plan
Ben Fisk	Sanitation Superintendent	Flagstaff Landfill
Sergeant Forman	Law Enforcement Officer	Crime Rates
Dick Johnson	Quality Control Superintendent	Transportation
John Munderloh	ADWR Staff	Water Rights
Arthur Phillips, Ph.D.	Botanist	Special Status plant species
Gordon Taylor	Moqui Lodge Manager	Moqui Lodge Facility Information

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Landscape Architect	Kevin Percival	B.A. Landscape Architecture M.A. Landscape Architecture	14 years
Landscape Architect	Jeff Rapson	B.A. Landscape Architecture	3 years
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Water Resources	Bill Victor	B.S. Geology M.S. Hydrology	20 years
Water Resources	John Lindquist	B.S. Geology M.S. Geosciences	10 years

EIS Distribution List

The following list includes the agencies, congressional delegation, city councilman, tribal representatives, organizations, and individuals who are on the mailing list for distribution of information about this project, including the environmental impact statement.

Federal Agencies

Bureau of Land Management - State Director, Phoenix
Bureau of Reclamation - Flagstaff
Coconino National Forest - Forest Supervisor
Grand Canyon National Park - Superintendent, I-Team Manager
House Committee on Government Operations - Subcommittee on Environment, Energy, and Natural Resources
Soil Conservation Service
U.S. Army Corps of Engineers - Phoenix
U.S. Army Corps of Engineers - Los Angeles
U.S. Attorney's Office - Phoenix
U.S. Environmental Protection Agency - San Francisco
U.S. Fish and Wildlife Service - Phoenix
U.S. Forest Service - Southwestern Region
U.S. Forest Servcie - Arizona Zone Office
U.S. Forest Service - Environmental Coordiantor, Washington DC
U.S. Forest Service - Land Management Planning Staff, Washington DC
U.S. Postal Service - Flagstaff
U.S. Postal Service - Grand Canyon

Elected Officials

Honorable Russel W. Bowers
Honorable Jack A. Brown
State Legislature - Joe Hart
State Legislature - John Verkamp
State Legislature - John Wettaw
Congressman Gallegly
Arizona Governor - Fife Symington
Senator John Kyl
Senator John McCain
Senator John Raidt (Leg. Assistant)
State Representative - Jack Jackson

State Agencies

Arizona Department of Commerce
ADEQ - Air Quality
ADEQ - Director
ADEQ - Flagstaff President
ADEQ - Drinking Water Section/PDOU
ADEQ - Non-point Source Unit
ADEQ - Solid Waste
ADEQ - Water Quality
Arizona Department of Transportation (ADOT)-Chairman, Phoenix
ADOT - Environmental Planning, Phoenix
ADOT - Flagstaff Branch
ADOT - Traffic Engineer, Prescott
ADOT - Grand Canyon Airport Manager
Arizona Department of Water Resources - Director
Arizona Game and Fish Department- Mesa
Arizona Game and Fish Department- Flagstaff
Arizona Game and Fish Department- Phoenix
Arizona Office of Tourism
Arizona State Land Department - Commissioner
Arizona State Land Deparment - Deputy Commissioner

County Agencies

Coconino County - Planning and Zoning
Coconino County - County Attorney
Coconino County Board of Supervisors - Matt Ryan
Coconino County Board of Supervisors - Liz Archuleta
Coconino County Board of Supervisors - Louise Yellowman
Coconino County Board of Supervisors - Tom Chabin
Coconino County Board of Supervisors - Paul Babbitt
Coconino County Sheriff's Department - Tusayan
Coconino County Sheriff's Department - Flagstaff
Coconino County Library Board - Chariman
Yavapai County Board of Supervisors

City Government and Councilmen

City of Flagstaff - Councilmen Rick Swanson
City of Flagstaff - Councilmen Zach Markham
City of Flagstaff - Councilmen Norm Wallen
City of Flagstaff - Councilmen Rita Johnson
City of Flagstaff - Councilmen John Covolo
City of Flagstaff - Councilmen Rick Lopez
City of Flagstaff - Mayor Chris Bavasi
City of Flagstaff - Chamber of Commerce
City of Flagstaff - Economic Development Chairman
City of Flagstaff - Fire Chief
City of Flagstaff - Housing Authority
City of Flagstaff - Planing and Zoning Commission
City of Flagstaff - Police Chief
City of Flagstaff - Flagstaff Public Schools
City of Flagstaff - Traffic Commission Chairman

City of Flagstaff - Urban Design Planner
City of Fredonia - Chamber of Commerce
City of Holbrook - Mayor
City of Holbrook - Chamber of Commerce
City of Page - Mayor
City of Sedona - Mayor and City Council
City of Seligman - Chamber of Commerce
City of Show Low - Mayor
City of Williams - Mayor
City of Wiliams (and Grand Canyon) - Chamber of Commerce
City of Williams - Unified School District #2
City of Winslow - Mayor
Grand Canyon - Chamber of Commerce
Grand Canyon - School District #4
Grand Canyon - South Grand Canyon Sanitary District
Town of Clarkdale - Vice Mayor
Town of Fredonia - Mayor
Town of Jerome - Vice Mayor
Valle Area - Chamber of Commerce

Tribal Representatives

Havasupai Tribe
Hopi Tribe
Hualapai Tribe
Kaiabab Piute Tribe
Navajo Nation - Cameron Chapter
Navajo Nation - Tuba City Chapter
Navajo Nation - Window Rock
San Juan Southern Paiut Tribe
Yavapai Apache Tribal Council
Zuni Tribe

Organizations

ASA4WDC
Air Nevada
Airstar Helicopters
American Caner Society
American Legion - Flagstaff
American Legion - Chino Valley
Applied Ecosystems Management
Airzona Daily Sun
Arizona Education Association
Arizona Engineering Company
Arizona KOA Owners
Arizona Mining Association
Arizona Mountian Inn
Arizona Prospectors and Small Mine Operators
Arizona Public Service (APS)
Arizona Republic
Arizona Wilderness Coalition
Arizona Wildlife Federation
Ask Fork Development Association
Babbitt Brothers Trading Company
Bank One
Bar U Bar Ranch Inc.
Beck Industries
Bedrock Development Inc.
Best Western Grand Canyon Squire Inn
Bikeway Committee
Bits and PC's
Boy Scouts of America - Roosevelt Council
Briar Patch Inn
Budget Rent-a-Car
Buffalo Park Coalition
Butler Motel
Camper Village
Center for Environmental Studies
Center for Urban Affairs and Policy Regulation
Cheers
Circle Pines KOA
Citizens Utilties
Coconino Estates Pool Association
Coconino Park Association
Coconino Sportsmen
Cocopai RC&D
Coldwell Bankers
Colorado River Inn
Communication Station
COPEC Alliance
Cosmic Cycles
GCNP Lodges - Director of Transportation
Dallas Real Estate
Danian S. Willaims Association
Dollar Rent-a-Car
Elks Lodge BPOE No. 499
Elks Lodge BPOE No. 1184
FHC
Fin and Feathers
Flagstaff Alpine Ski Team- FAST
Forest Guardians
Friends of the Coconino
Friends of the River
Glen Canyon Environmental Studies
Grand Canyon Air Tourism Associaiton
Grand Canyon Airlines
Grand Canyon Association
Grand Canyon Food Mart
Grand Canyon IMAX Theater
Grand Canyon Management
GCNP Science Center
Grand Canyon - McDonald's

Grand Canyon News
Grand Canyon Railway
Grand Canyon Ranch
Grand Canyon Trading Post
Grand Canyon Trust
Great Basin Environmental Education Center
Greater Gila Biodiversity Project
Holiday Inn Express - Williams
Holiday Inn Express - Tusayan
Hozho Center
KAFF Radio
KASM Radio
KMGN Radio
KNAZ Radio
KSGC - FM Radio
KWBF - TV
Kaibab Forest Products
Kenia Helicopers
La Quinta Inn Suites
Main Street Foundation - Flagstaff
Merry Maids
Mesa Four Wheelers
Moqui Lodge
Museum of Northern Arizona
Museum Club
NACOG
NARRC
NAU
National Parks and Conservation Association
Native and Nature
Native American for Community Action
Nature Conservancy - Flagstaff
Northern Arizona Audubon Society
Northern Arizona Board of Realtors
Northern Arizona Environmental Newsletter
Northern Arizona Loggers Association
NAU - Library
OK RV Park
ORV Task Force
Office of the Center Township Assessor
Phoenix Gazette
Papillon Airways
Papillon Grand Canyon Helicopers
Pulliam Airport
Quality Inn - Grand Canyon
Red Feather Lodge
Red Feather Properties LP/ Fain Properties LP
Red Rock News
Resource Center for Environmenal Education
Rocky Mountain Elk Foundation
Safaris Destination Services
Salt River Project - Environmental Coordinator
Salt River Recreation
Santa Fe Railway
Scottsdale Communtiy College
Senic Airlines
Seven Mile Lodge
Shallow Water School
Sierra Club - Phoenix
Sierra Club - Flagstaff
Sierra Club Legal Defense Fund
Snell and Wilmer
Society for Range Management
Sonoran Institute
Southwest Center for Biological Diversity
Sports Advantages Corp.
Stone Forest Industries
Sun City Sportmans Club
Sunshine Rescue Mission
SWOCC
Teamsters Local Union No. 104 - Flagstaff
The Awareness Journal
The Brook Group
The Business Journal
The Guide
The Inn at 410
The Journal
Thorp Associates
Tusayan Grand Canyon Shuttle
United 4-wheel
University of Arizona - School of Natural Resources
Valle Airport
Verde Independent Newspaper
Verde Valley Horsemens Council
Vetrans of Foreign Wars
We Cook Pizza Etc.
Western Wood Products Association
White Flag Laundry
Wilderness Society
Wildlife Legislative Council
Williams News
Windrock Aviation Inc.
Woody Mountain Campground
77, 77 Bar, Inc.

Individuals

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Merrill Abeshaus
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Christine Adams
James Adams
Patricia Adams
Kathryn Agrell

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Walt Aldinger
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Carl Allizon
Garry Alsvig
W.J. Ambrose
Edward Anable
Chester Anderson
Greg Anderson
Frank Antal
Steve Andrews
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Linda Argumelo
Paul Arizona
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Reola Avery
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Travis Bard
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Tina Bier
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Benny Bishop
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Emely Blackford
Lari Blackwell
Daniel Blakley
Bob Bliss
Peter Bloomer
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Murrell Booth
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Dayne Boyden
Thomas Brackman
Roger Brackney
John Bradford
Josh Brady
Katherine Bralliar
Bob Brawdy
Don Braman
William Breed
Donald Bremner
Richard Brennan
Lynn Brenner
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Judith Britt
Terry Brown
Shawn Browning
David Bruner
Jeffrey Buchella
John Buchner
Barbara Buckholz
Harriet Burgess
Anthony Busalacchi
Leonard Bustillos
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Geraldine Calley
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J.W. Campbell
Karyn Campbell
Jackson and K. Campros
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Ray Cancino
Beth Caplan
R.G. Cardella
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Susannah Carney
Dylan Carpenter
Sherra Carter
Kevin Chadwick
Calder Chapman
Baudilio Chavez
Sharon Churchhill
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Dean Clark
Roger Clark
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James Claypool
Jack Cluff

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Butch Cochran
Ethel Cole
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C. Crossland
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Doug Darnell
Ann P. Davies
Chuch Davis
Lee Davis
Martha Davis
Mike Davis
John Davison
Lauro de Barros
David DeGraff
Matthew and Bonnie Delaney
Manuel Demiguel
Jim and Peggy DeVeau
Pat Devinger
Jane Dick
Sal Digiovanni
Brad Dimock
David Dodgen
Frank Douglas
Donna Drumm
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Christopher Dungan
James Dungan Jr.
Bill Dunlap
Marsha East
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Antoinette Edwards
Curtis Efsertic
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Lindsley Ellsworth
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Darrell English
Debbie Evans
Peter Evans
Richard Evans
Bert Fingerhut
Susan Finley
Mike Finney
James Fischbach
Barbara Fischer
Richard Flinn
Jim Florence
Robert Foreman
Don and Nadene Forester
Rex Foster
Fast Fred
Mike French
D.W. Frerichs
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David and Irene Frisch
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Nicholas Gabriel
John Gallagher
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Dan Gasky
Arline Gavinski
Robert Gaylord
Danial Gee
Dan Gentile
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Judy Gofolin
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Luis Gonzalez
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Lonny Greene
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June and George Huston
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Wayne Iverson
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M. Jenkins
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Wayne Johnson
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Elvira Juarez
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Don Keil
Jackson Keim
Pat Kelley
Charles Kemp
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Johnny McCulloch
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Owen Martin
Ralph Martin
Sonia Martin
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Bill Mihailou
Elson Miles
Mark Miles
Britta Miller
Duane Miller
Jeff Miller
Kenneth Miller
Michael Miller
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Russ Moker
Gary Molzahn
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Gilbert Montoya
Manuel Montoya
Raymond Montoya
Richard Montoya
Robert Montoya
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Matthew Mordan
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Grand Morris
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Alfred Munoz
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Jennifer Myka
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Chris Thurston
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Blake Whitten
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Edward Williams
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Ed Wojciak
Harold Wolfinger
Alfred Wong
Judge Woo
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Patty Wooster
Howard Wren
Robert Wright
Benny Yanni
Mike and Karen Yarnell
Al Zalfini
Ron Zheng
Kim Zukosky

GLOSSARY

A

Affected Environment. Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action. Also, the chapter in an environmental impact statement that describes the current environmental conditions.

Air Quality. Measure of health related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific air borne matter.

Allotment. A land area where one or more operators graze their livestock. The allotment generally consists of public land but may include parcels of private and state-owned lands. The number of livestock and season of use are stipulated for each allotment by the landowner.

Alternative. One of several policies, plans, or projects proposed for decision making.

Appraisal. Act of placing an estimated value on an asset or assets.

Aquifer. An area of porous sand, gravel, or fractured rock in which fractures and pores between material have filled with water. The water in these materials moves very slowly and can remain in an aquifer for hundreds of years.

Archaic. In American archaeology, a cultural stage following the earliest known human occupation in the New World (about 5500 BC to AD 100). It was characterized by a hunting and gathering lifestyle and seasonal movement to take advantage of a variety of resources.

Artifact. Any object showing human workmanship or modification especially from a prehistoric or historic culture.

Average Daily Rate (ADR). The average room revenue generated for each occupied room. ADR is calculated by dividing the total room revenue achieved, by a specific hotel or market during a given period, by the corresponding total number of occupied room nights in the period.

B

Background. The distant part of a landscape; surroundings, especially those behind something, and providing harmony and contrast; area located from three to five miles to infinity from the observer.

Band Unit. A subgroup within a tribe composed of families sharing common cultural traits, such as territory, oral history, or function within a tribe.

Best Design and Management Practices. A practice or combination of practices that are the most effective and practical means of achieving resource protection objectives.

Biogeography. The geographical distribution of living things

Built Environment. Modifications to the environment by man — buildings, roads, cities, etc., as compared to the natural environment.

C

Canopy Cover. The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Carrying Capacity. The maximum level at which animals can use (forage, live, etc.) an area without damage to the vegetation or related uses.

Class I Airshed. Any area that is designated under the Clean Air Act for the most stringent degree of protection from future degradation of air quality. All National Parks greater than 6,000 acres are designated as Class I areas.

Colorado Plateau Region or Plateau Province. Geologists have carved the United States into about a dozen geologic provinces, each based on an area's generalized similarities. The Colorado Plateau Province (encompassing about 130,00 square miles) is centered roughly at the Four Corners, a region shared by Utah, Colorado, New Mexico, and Arizona. This province was so named because much of the region is drained by the Colorado River and its main tributaries. It is outlined by volcanoes and lava flows along its southern boundary in Arizona and New Mexico, by the Rockies on it eastern boundary in Colorado, and by the fault-lined deserts on

its western boundary in Utah. Essentially, the province is covered by relatively flat-lying sedimentary rock, ranging from 50 to 500 million years old.

Composting Reed Bed. A wastewater treatment process with an artificially constructed wetland where final polishing and purification of waste water is accomplished.

Conditional Use Permit. A permit granted by the County Planning and Zoning Commission for certain designated land uses that have unusual characteristics and require special consideration to determine conformance to plans, ordinances, and effects on surrounding properties.

Convection. Upward or downward movement of part of the atmosphere.

Cooperating Agency. An agency, other than the lead agency, that has legal jurisdiction or special expertise to comment on the proposed actions of a lead agency.

Cultural Resources. Remains of human activity, occupation or endeavor, reflected in sites, structures, buildings, objects, artifacts, ruins, works of art, architecture and natural features that were of importance in past human events. These resources consist of: (1) physical remains, (2) areas where human events occurred, even though evidence of the event no longer remains, and (3) the environment immediately surrounding the actual resource.

Cumulative Impact. The impact on the environment that results from incremental impact of the action when added to other past, present, and reasonably foreseeable future actions: cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

D

Design Review Overlay Zone. An area designated by the County Board of Supervisors for which special design criteria have been established and within which all multi-family, commercial, and industrial uses must be approved by the County Planning and Zoning Commission to ensure that the development meets these criteria. Features often include architectural standards, site planning (considering environmental protection), landscaping, lighting, and special sign requirements.

Desired Condition. A description of the desired human dimensions, production, and physical/biological characteristics to be achieved on an ecosystem management area.

Developed Recreation. Recreation that requires facilities that in turn result in concentrated use of an area. Examples of recreation areas are campgrounds and ski areas; facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings.

Development Plan Assurances. A specific set of commitments, mitigation measures, deed restrictions, conservation easements, etc. that will assure that what is analyzed and proposed for development will actually be built.

Direct Impact. Effects caused by the action and occur at the same time and place.

Dispersed Recreation. A general term referring to recreation use outside of developed recreation sites; this includes activities such as scenic driving, hunting, backpacking, and recreation in primitive environments.

Displaced Demand. Demand, in this instance for visitor services and facilities, that is pulled, taken, or removed from one region and used by another.

Dual Plumbing. Plumbing a structure to take advantage of reclaimed water for toilet flushing. These structures use both potable water for faucets, showers/tubs, and laundry, and nonpotable (or reclaimed water) for toilet flushing and possibly watering landscaping.

Dynamic Equilibrium. Condition achieved when the average amount of water discharged or withdrawn from an aquifer is in balance with the amount of water that is recharged or added to the aquifer.

E

Effect. A result. The words effect, impact, and consequence are used in this document synonymously. Effects may include those actions which may either beneficial or detrimental.

Endangered, Threatened, or Sensitive Species. A species or subspecies whose survival may be in danger of extinction throughout all or a significant portion of its

range. Management programs are established for these species to help protect them from extinction.

Environmental Impact Statement. A detailed statement required by the National Environmental Policy Act when an agency proposes a major federal action significantly affecting the quality of the human environment. There is usually a Draft EIS followed by a Final EIS and associated Record of Decision.

Ephemeral Drainages. A stream of portion of a stream which flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources.

Equal Monetary Value. The dollar value of exchanged lands must be within 25% of each other.

Extended Family. The nuclear family (parents and offspring) plus grandparents, aunts and uncles, nieces and nephews, often forming a viable economic unit.

F

Fire Suppression. Action to limit the spread of and/or prevent damage by wildfire.

Forage. All browse and nonwoody plants available to livestock or wildlife for grazing.

Foreground. A term used in visual management to describe the portion of a view from the observer to one-quarter to one-half mile from the observer.

Fracture Zones. Areas of cracks, fissures and/or caverns in otherwise impermeable rock layers that allow water to flow through, either vertically or laterally. Also called "fracture systems," these function as channels or conduits for groundwater flow and typically occur along major faults and/or folds in the rock layers.

Fuel Cells. An energy storage system similar to a battery. Storage cells rely on controlled chemical reactions for the production of electrical energy.

Fuel Treatment. The rearrangement or disposal of natural or activity fuels (generated by management activity, such as slash left from logging) to reduce fire hazard. Fuels are defined as both living and dead vegetative materials consumable by fire.

Fugitive Dust. Particulates, usually soil, suspended in the air, that were not released through a stack, vent, or chimney. Examples include wind erosion of exposed ground and particulates generated from traffic on unpaved roads.

G

Game Management Unit. A unit or bounded area specified by the Arizona Game and Fish Department for hunting purposes.

General Management Plan. A plan that sets forth the basic management philosophy for the park; it is a comprehensive tool for future park management and provides the strategies for addressing issues and achieving identified management objectives for a 10- to 15-year period.

Greenbelt. Commonly used in urban and regional planning, and the process of creating a natural environmental corridor.

H

Historic Archaeological Sites. An archaeological site dating within the time period when historical records have been kept; in the Southwest, this refers to generally after the first European presence in the region, about AD 1540.

Hydraulic Conductivities. The ability of rock/soil to transport water.

Hydraulic Gradients. The direction of water movement within an aquifer, moving from area of recharge to area of discharge.

I

Impact. A modification in the status of the environment brought about by the action.

Indirect Impact. Effects caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable; indirect effects may include growth inducing effects and other effects related to

induced changes in the pattern of land use, populationn density, or growth rate and related effects on air and water and other natural systems, including ecosystems.

Induced Employment. Employment, aside from what is created for the proposed action, that is created as a result of implementing an action. Increasing the permanent residential base in an area would induce employment for additional community services such as banks, postal service, utilities service, entertainment services, laundromats, or governmental employees, etc.

Infiltration Basin. A natural area, usually low lying, where water drains and is absorbed into the ground, and eventually into the groundwater system.

Interdisciplinary Team. A group of agency resource specialists with various backgrounds who are responsible of preparation and review of the NEPA document.

L

Land Exchange. The conveyance of non-Federal land or interests to the United States in exchange for National Forest System land or interests in land.

Landform. An area that is defined by its particular combination of bedrock and soils, erosion processes, and climatic influences.

Lead Agency. The agency that has taken the primary responsibility for preparing the environmental impact statement.

Level of Service (LOS) Classification. A concept measured by a number of factors: speed and travel time; traffic interruptions; freedom to maneuver; safety; driving comfort and convenience; and operating costs. LOS classifications range from "A" (being best) to "F" (being worst).

LOS "A". Represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger or pedestrian is excellent.

LOS "B". Represents a stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A because the presence of others in the traffic stream begins to affect individual behavior.

LOS "C". Represents a stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

LOS "D". Represents high density, but stable flow. Speed and freedom to maneuver are severely restricted and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

LOS "E". Represents operating conditions at or near the capacity level. All speed are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable because small increases in flow or minor disturbances within the traffic stream will cause break downs.

LOS "F". Represents a forced breakdown in flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Lines form behind such locations. Operations within the queue are characterized by stop-and-go waves and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion (stop and go).

Light Pollution. The level of sky glow from cities that is emanated at night, which may affect observatories, or persons seeking isolation from urban-type characteristics.

Lithic Procurement Area. A locale where raw material for stone tools are abundant or available (e.g., stream bed, volcanic field, exposed and eroding geologic formations).

Lithic Tool. Stone tool such as an arrow point, spear point, metate, or mano.

M

Market Penetration Rate. The percent of visitors accommodated by a hotel, community, or region.

Market Occupancy Rate. A percentage which indicates the number of available rooms which have actually been occupied. This percentage is calculated by dividing the number of occupied room nights in a given hotel or market by the corresponding number of available room nights.

Masonry Structure. A building constructed of stone, with or without mortar.

Mescal. A type of agave plant, used as an important food source for some American Indian groups.

Middle Ground. That part of a scene or landscape that extends from the foreground zone to 3 to 5 miles from the observer.

Mitigate, Mitigation. Mitigation includes: (1) avoiding the impact altogether by not taking a certain action or parts of an action, (2) minimizing impacts by limiting the degree or magnitude of the action and its implementation, (3) rectifying the action and its implementation by repairing, rehabilitating, or restoring the affected environment, (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, or (5) compensating for the impact by replacing or providing substitute resource or environments.

Multiple Use. The management of all various renewable surface resources of the NFS so that they are used in the combination that will best meet the needs of the American people; making the most reasonable use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give greatest dollar return or the greatest unit output.

N

National Ambient Air Quality Standards. The basis for defining air quality and the criteria for specifying concentrations of various pollutants not to be exceeded in the air. These standards are established by the Environmental Protection Agency under the regulations of the Clean Air Act.

National Environmental Policy Act (NEPA). Legislative act passed in 1969 as the national charter for analysis of impacts of federal actions upon the quality of the human environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 CFR 1500-1508 implement the Act.

National Forest System (NFS) Land. Federal lands that have been designated by the Executive Order or statute as National Forest, National Grassland, or Purchase Units and other lands under the administration of the Forest Service, including Experimental Areas and Title III lands.

National Register of Historic Places. A list, kept by the Secretary of Interior, of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

Noise Contour. Noise levels. Since noise decreases at a consistent rate in all directions from a source, points of equal noise levels can be indicated by drawing contour lines around the noise generator. Noise contours can be used for: (1) highlighting existing or potential incompatibilities between a noise generator and any surrounding development, (2) assessing relative exposure levels, (3) assisting in preparation of land use plans, and (4) providing guidance in developing land use control devices, such as zoning ordinances, subdivision regulations and building codes.

Nonpotable Water. Water that is not suitable for human consumption. Often times nonpotable water is used for

landscape irrigation, flushing toilets, and/or filling stock tanks, or is discharged to natural or man-made ponds, or used for aquifer recharge.

Nonrenewable. Not able to replenish or reuse.

O

Occupancy Permit. A permit to occupy a structure.

Oral History. History of a tribe or group of people handed down from one generation to the next by word of mouth.

P

Passive Solar. Effective absorption and radiation of solar (sun) heat with little or no auxiliary heating or cooling. In passive solar systems, absorptive and radiating qualities are based primarily on natural heat collection and storage systems with high thermal mass (e.g., south facing windows and slate floors).

Perched Aquifer. An area of permeable rock that holds groundwater because of sparse or limited fractures in the impermeable layers beneath. These are usually limited in size and not connected to a larger aquifer (such as the Redwall-Muav aquifer). Discharge from perched aquifers is generally small in size and susceptible to drying up during periods of drought.

Perennial Stream. A stream that flows year round.

Photovoltaic Cells. Also known as solar cells. An electronic devise that directly converts the energy in light to electrical energy. Unlike batteries and fuel cells, photovoltaic cells do not use chemical reactions to produce electrical power and energy is not stored in these cells.

Physiographic. A region having a particular pattern of relief features or land forms that differs significantly from that of adjacent regions.

Potable Water. Water that is suitable for domestic use, and is drinkable by humans.

Precipitation Harvesting. The process of capturing rainwater from building roofs. This water, considered nonpotable, can be used for irrigation or toilet flushing.

Prehistoric Archaeological Sites. An archaeological site dating prior to the time period when historical records have been kept; in the Southwest, this refers to generally before the first European presence in the region, about AD 1540.

Prescribed Burn. Fire burning under conditions specified in an approved plan to dispose of fuels, control unwanted vegetation, stimulate growth of desired vegetation, and change successional stages to meet range, wildlife, recreation, wilderness, watershed, or timber management objectives.

Private Inholdings. Parcels of private land that are surrounded by National Forest System lands.

Public Scoping. A process of obtaining public input on planning documents. Required as a major input into an environmental impact statement.

R

Reclaimed Water. Treated wastewater that may be reused for nonconsumptive uses (e.g., irrigation, toilet flushing).

Record of Decision. A public document that reflects an agency's final decision on a proposed project, rationale behind that decision, and commitments to monitoring and mitigation.

Recreation Visitor Day. Twelve visitor hours which may be combined by one or more persons in single or multiple visits.

Recreation Opportunity Spectrum (ROS). Land classification system which categorizes land into six classes, each being defined by its setting and by the probable recreation experiences and activities it affords. The six management areas are: urban, rural, roaded-natural, semi-primitive motorized, semi-primitive nonmotorized and primitive.

Revenue Per Available Room (RevPAR). Represents the average room revenue achieved for each available room. RevPAR is calculated by dividing total room revenue achieved, by a specific hotel or market during a given period of time, by the corresponding total number

of available rooms or room nights.

Right-of-Way (ROW). A legal right to use, occupy, or access land or water areas for specified purposes.

Roaded Natural (ROS). A classification of the recreation opportunity spectrum that characterizes a predominately natural environment with evidence of moderate permanent resources alternation and utilization. Evidence of the sights and sounds of man is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of man.

Rock Shelter. A cave or rock overhand providing protected site for a dwelling, campsite, food storage, or material storage, etc.

Room Night. One hotel room for a period of one night. This term would apply to both available rooms and occupied rooms. An available room represents a hotel room which is available for nightly rental. An occupied room represents a hotel room which has actually been rented (occupied). To calculate available room nights, a 100-room hotel would create 36,500 available room nights annually (100 X 365). To calculate occupied room nights, add the number of rooms occupied each day for each day in the period.

S

Semi-Primitive Motorized (ROS). A classification of the recreation opportunity spectrum characterized by a predominately unmodified natural environment in a location that provides good to moderate isolation from sights and sounds of man except for facilities/travel routes sufficient to support motorized recreational travel opportunities which present at least a moderate challenge, risk and a high degree of skill testing.

Snag. A nonliving standing tree. The interior of the snag may be sound or rotted.

Socioeconomic Environment. Pertaining to, or signifying the combination or interaction of social and economic factors. As used in this analysis, socioeconomics refer to local and regional businesses and residents, in addition to the local and regional economy.

Solar Ponds. Artificially constructed ponds partitioned to provide slow moving streams to replicate a natural environment. A central component in solar aquatics methodology for bioremediation (treating without chemicals) of waste water.

Solution-Enhanced Conduit. Cave-like channels in the aquifer that are formed by water dissolving some of the rock in the aquifer. These channels transmit large quantities of groundwater laterally between areas of aquifer recharge and spring discharge. Also called "solution-enhanced permeability features" or "solution features," they primarily develop parallel to the direction of the hydraulic gradient.

Special Use Permit. A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest System land for a special purpose.

Strata. Layers or beds of rocks.

Sustainable Design. The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Sustainable-Yield. The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of various renewable resources of the National Forest without impairment of the productivity of the land.

T

Thermal Mass. The amount of potential heat storage capacity available in a given assembly or system.

Townsite Act. A legislative act passed by Congress in 1906 that allows a government entity to purchase Federal land at not less than fair market value, and to use this land for public purposes (e.g. public housing, community facilities).

Traditional Cultural Property. A site or resource that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs of a living community.

Transition Zone. Equivalent to the pine forest , and specifically to ponderosa pine forest, in Arizona.

Transmissivity. The ability of water to pass through layers of soil or rock, usually through fracture zones.

Transportation Staging Area. A centralized area for parking private vehicles, accessing a mass transit system, and obtaining regional information.

Travertine Cone. Hotspring deposits composed largely of calcite.

Trick Tanks. A man-made structure or catchment that functions to collect and store water for wildlife.

Tusayan Area Plan. A plan adopted by the Coconino County Board of Supervisors that outlines policy and direction for future development in the Tusayan Area. This plan primarily addresses future land uses, aesthetics, employee housing, and environmental protection, and requires design review for such issues as architectural styles, building materials, and lighting.

V

Vegetation Beds. The second stage in a Solar Aquatic Systems to treat waste water. Waste water flows into a greenhouse. Plants on the surface of the solar tanks and solar ponds with their root masses reaching down into the water column, take nitrogen and phosphorus from the waste stream to promote leaf and flower production. The extensive surface area of the root systems filters solids from the waste water and provides extensive microsites for microbial attachment.

Viewshed. That area seen from major travel routes, or high use locations.

Visitor Experience. The broad range of opportunities and experiences available to visitors of public lands. Generally, the things that allow visitors to better connect with the natural resources, preservation ethic, history, and stories of the area.

Visual Quality Objective. A desired level of excellence based on the physical and sociological characteristics of an area; refers to degree of acceptable alteration of the characteristic landscape. Five classifications of visual quality exist: preservation, retention, partial retention, modification, and maximum modification.

W

Walker's Law. A formula developed through the measurement of sky glow at different distances from numerous cities in California. $I = 0.1(P/r^{2.5})$. I = increase in sky glow level above the natural background expressed as a percentage. P = population. r = distance in kilometers from the center of development.

Water Quality. The interaction between various parameters that determine the useability or nonuseability of water for onsite or downstream uses. Major parameters that affect water quality include: temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, and discharge and fecal coliform.

Water Rights. The rights to divert and use water or to use it in place.

Watershed. The geographic region from which water drains into a particular stream, river, aquifer, or body of water. Watershed boundaries are defined by the ridges or divides separating them.

Wildland/Urban Interface. The line, area, or zone where structure and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

X

Xeriscaping. The act of landscaping with plant species that require or are adapted to low soil moisture levels.

Y

Yearling. An animal in its second year of life.

Z

Zone of Influence. The geographic area surrounding a particular activity within which that activity has indirect effects on specific resources.

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