

Former Bennett Freeze Area *Draft* Integrated Resource Management Plan

May 2020

“A rehabilitated Former Bennett Freeze Area (FBFA) with well-managed natural resources and environmental conditions, improved economic conditions and quality of life, with preserved Diné culture and traditions.” Navajo Nation

Prepared by:

The Navajo Nation
Division of Natural Resources
and the United States Department of the Interior
Bureau of Indian Affairs, Navajo Region



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List of Abbreviations and Acronyms

°F	degrees Fahrenheit
AIARMA	American Indian Agricultural Resources Management Act
AIRFA	American Indian Religious Freedom Act
ALUP	Agricultural Land Use Permits
AML	Abandoned Mine Lands
AQS	Air Quality System
ARPA	Archaeological Resources Protection Act
AUM	abandoned uranium mines
AZ	Arizona
BE	biological evaluation
BIA	Bureau of Indian Affairs
CAA	Clean Air Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLUP	Chapter Land Use Plans
CRCS	Cultural Resource Compliance Section
CRM	cultural resource management
DGC	District Grazing Committee
EIS	Environmental Impact Statement
FBF	Former Bennett Freeze
FBFA	Former Bennett Freeze Area
FEMA	Federal Emergency Management Agency
GIS	geographic information system
IRMP	Integrated Resource Management Plan

IWMP	Integrated Weed Management Plan
LMD	Land Management District
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAQCP	Navajo Air Quality Control Program
NEPA	National Environmental Policy Act
NESL	Navajo Endangered Species Listing
NHLC	Navajo Hopi Land Commission
NHPA	National Historic Preservation Act
NNC	Navajo Nation Code
NNDA	Navajo Nation Department of Agriculture
NNDFW	Navajo Nation Department Fish and Wildlife
NNDWR	Navajo Nation Department of Water Resources
NNEPA	Navajo Nation Environmental Protection Agency
NNHHPD	Navajo Nation Heritage and Historic Preservation Department
NNHP	Navajo Natural Heritage Program
NNOBR	Navajo Nation Open Burn Regulations
NNSDWA	Navajo Nation Safe Drinking Water Act
NO ₂	nitrogen dioxide
NPL	Navajo Partitioned Lands
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NRO	Navajo Regional Office
O ₃	ozone
PEA	Programmatic Environmental Assessment
PL	Public Law
PM _{2.5}	airborne particles 2.5 microns in diameter and smaller
SHPO	State Historic Preservation Officer
SO ₂	sulfur dioxide
SOP	Standard Operating Procedures
SUYL	Sheep Units Year Long
SWEMP	Southwest Exotic Mapping Program

TCP	traditional cultural places
THPO	Tribal Historic Preservation Officer
tpy	tons per year
UMTRA	Uranium Mill Tailings Remedial Action
US	United States
USC	United States Code
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compounds

1. Introduction

In accordance with the American Indian Agricultural Resources Management Act (AIARMA) (107 Stat. 2011, 25 United States Code [USC] 3701 et seq.), this Integrated Resource Management Plan (IRMP) is a strategic, long-range management plan based on the Navajo Nation's vision, interests, needs, and concerns for their natural and cultural resources. This IRMP is the result of cooperative intergovernmental planning and intends to serve as a strategic planning document for the redevelopment of the Former Bennett Freeze Area (FBFA).

The AIARMA defines an IRMP as a “plan developed pursuant to the process used by tribal governments to assess available resources and to provide identified holistic management objectives that include quality of life, production goals, and landscape descriptions of all designated resources that may include (but not be limited to) water, fish, wildlife, forestry, agriculture, minerals, and recreation, as well as community and municipal resources, and may include any previously adopted tribal codes and plans related to such resources.” (25 USC § 3703(11)). The goal of this IRMP is to create balanced natural resource management actions that reflect the social, cultural, economic, and natural resource values of FBFA residents.

On November 21, 2015, the Navajo Nation and Bureau of Indian Affairs (BIA) signed a Memorandum of Understanding (MOU), electing to finalize the development of the FBFA IRMP in partnership with the BIA and in accordance with AIARMA (Appendix A). The IRMP was undertaken as a method for updating the Former Bennett Freeze Area Recovery Plan, which was prepared for Navajo Nation by WHPacific in 2008. Data collection and development of the IRMP has been an ongoing process since 2017 and the final draft IRMP was completed in August of 2019.

This plan supports community and departmental goals and promotes the sustainable development of FBFA resources by encouraging integrated resource management decision-making. An advanced collaborative approach and planning methodology among resource managers, coordinating agencies, and local Chapters will spread awareness of interdisciplinary opportunities and issues. Although there have been many instances of successful cooperation between resource managers, departments, and the public, there are still many instances of reactive resources management in response to ongoing pressures and demands. The incorporation of integrated resource management will facilitate more proactive resource management that considers long-term resource needs from a more holistic point-of-view.

1.1 Background

In 1934, the federal government sought to add about 234,000 acres to the Western Navajo Agency of the Navajo Indian Reservation (also known as Navajo Nation), which was established in 1968 by the United States (US) Government. The 1934 action proved to be contentious, as the Hopi Tribe claimed ownership of the land in question, citing that it was part of 2.5 million acres of land set aside for the Hopi people in an 1882 Executive Order signed by US President Chester A. Arthur.

Over three decades passed without resolution of the land-ownership dispute. In 1966, the commissioner of Indian Affairs, Robert Bennett, halted development on 1.6 million acres of Navajo Nation land in

northeastern Arizona that was claimed by both the Navajo Nation and the Hopi Tribe. Commissioner Bennett imposed the ban to stop both Tribes from taking advantage of the other while they negotiated ownership. The ban became known as the Bennett Freeze.

The Bennett Freeze stopped development of new homes, businesses, roads, schools, or utility infrastructure and no structural maintenance could occur. Two exceptions to the ban were allowed. One allowed for the placement/development of water wells, which were to be approved by both Tribes, and the second was the inclusion of administrative safe zones where development could occur. These administrative safe zones were in Tuba City and Moenkopi, Arizona.

The land dispute lasted for 40 years and paralyzed the residents in a state of poverty. Many homes and ranches were deserted after falling into states of disrepair. The Tribes settled their differences in November of 2006, through the Navajo-Hopi Intergovernmental Compact, and most of the land went to the Navajo Nation (Appendix B). In May 2009, US President Obama cleared the way for federal funding to help rehabilitate the area.

1.2 Previous Work

Previous studies performed in the FBFA area include a 2008 Former Bennett Freeze Recovery (FBFA) Plan prepared by WHPacific for the Navajo Nation, a draft FBFA IRMP in 2016, and the 2018 Former Bennett Freeze Area Economic and Market Feasibility Study prepared by Indigenous Design Studio + Architecture for the Navajo Hopi Land Commission (NHLC).

The 2008 FBFA Recovery Plan report presented full natural resource and socioeconomic evaluations for the area. This report contained a high level of detail and served as the base study document to begin the recovery process for many communities. It also evaluated the feasibility of future developments and capital improvements. However, while some progress was made, recovery from the freeze was in the infancy stage and did not mature before the study became antiquated.

In 2018, NHLC completed the Former Bennett Freeze Area Economic and Market Feasibility Study. This study modernized the socioeconomic and economic feasibility portions of the 2008 FBFA Recovery Plan report. The report included detailed information on current land use areas, areas withdrawn by Chapters for development that are not being utilized, and capital improvement projects that may facilitate the economic recovery of the Former Bennett Freeze Chapters. The economic and feasibility study is provided in Appendix C.

1.3 Location and Setting

The FBFA encompasses over 1.6 million acres in the northeast corner of Arizona and forms the westernmost portion of the Navajo Nation (Figure 1-1). Nine Chapters are included within the FBFA boundary: (1) Bodaway-Gap, (2) Cameron, (3) Coalmine Canyon, (4) Coppermine, (5) Kaibeto, (6) Leupp, (7) Tolani Lake, (8) Tonalea, and (9) Tuba City. Two US Highways (US 89 and US 160) and two Arizona (AZ) State Highways (AZ 64 and AZ 264) traverse through the FBFA. The FBFA is bordered by the Kaibeto Plateau to the north, the Colorado River and Coconino Plateau to the west, the Painted Desert

to the south, and the Moenkopi Plateau to the east. The Little Colorado River traverses through the FBFA starting in the south and meandering west and eventually meeting up with the Colorado River at the confluence along the western border of the FBFA (Map 1-1). The FBFA boundary definitions and litigations are detailed in the 2008 recovery plan (2008 FBFA Recovery Plan pages 31-34).

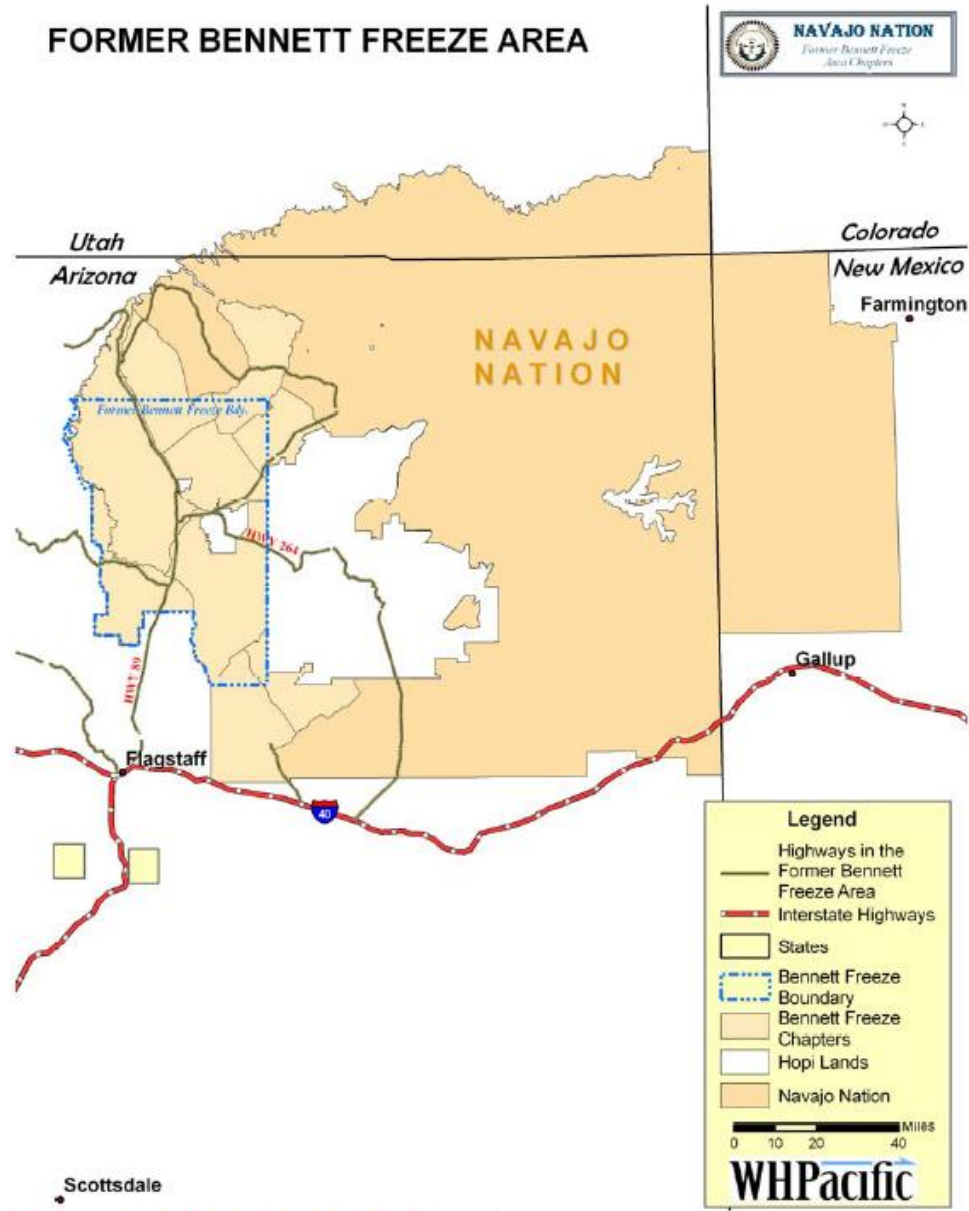
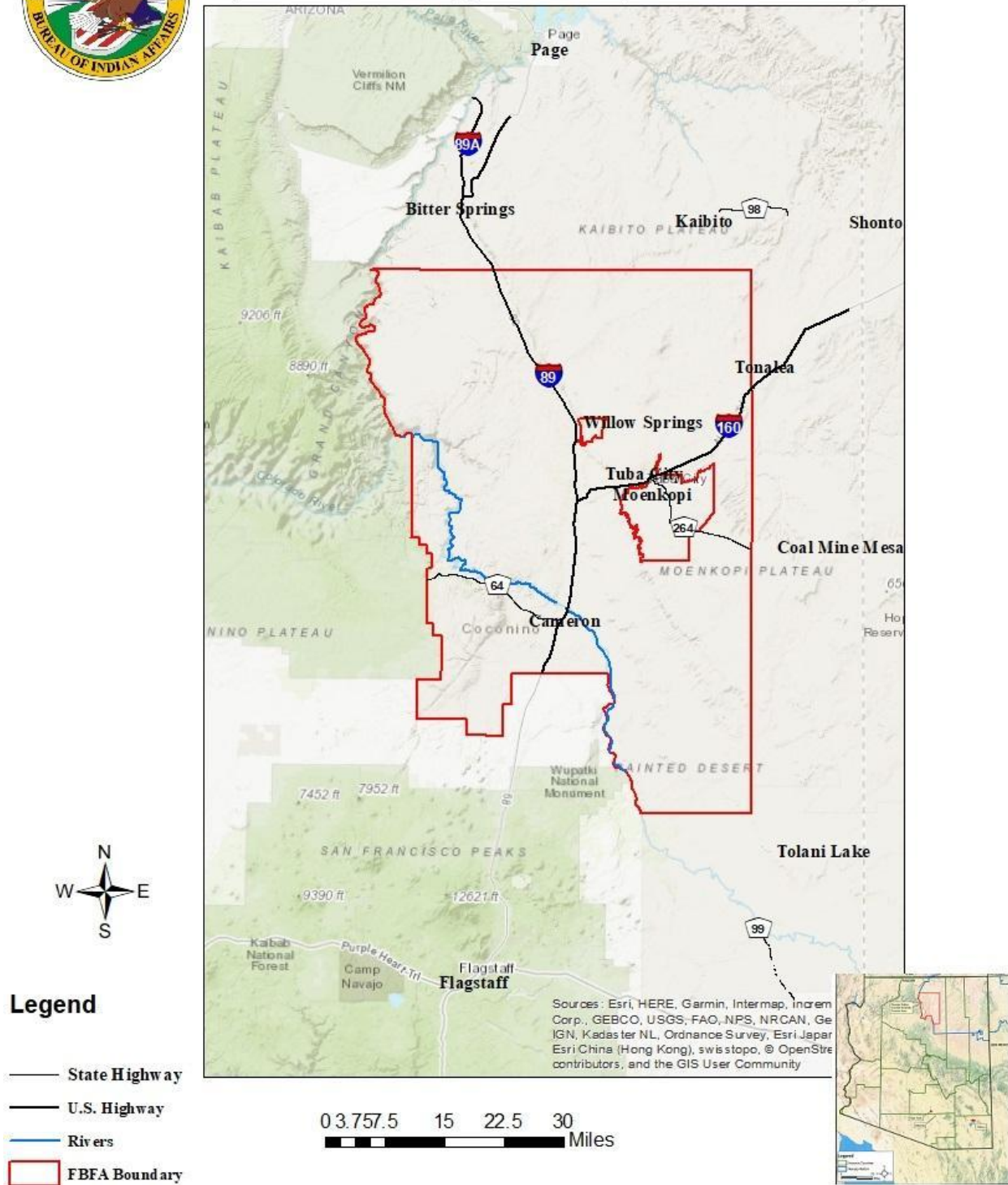


Figure 11: Former Bennett Freeze Area Location

Figure 1-1. Former Bennett Freeze Area Location



IRMP Planning Area Map for the FBFA



Map 1-1. Integrated Resource Management Planning Area for the Former Bennett Freeze Area

1.4 Purpose and Need

Since the congressional repeal of the Bennett Freeze in 2009, the Navajo Nation believes that preserving the environment on its lands can be successfully balanced with the need for housing and infrastructure development, economic development projects, and other land use developments. A comprehensive IRMP is essential to the planning process and for balancing environmental protection and development on the FBFA. Currently, no IRMP or agricultural resource management plan for the FBFA has been finalized by the Navajo Nation or the BIA.

The purpose of this IRMP is to provide a strategic management plan based on the Navajo Nation's vision for its resources that will allow for integrated natural resource management within the FBFA. The IRMP identifies the resources available, specifies the goals and objectives of the Navajo Nation and BIA, and provides a foundation to guide the management of these resources. The IRMP creates a unified approach for managing the FBFA from a multi-resource benefit perspective by addressing opportunities for increased collaboration. In addition, as a foundational document, subsequent resource specific implementation plans such as an Agricultural Resource Management Plan would be consistent with the IRMP or conform to the IRMP, meaning that the Agricultural Resource Management Plan builds upon the goals, objectives, and management actions identified in the IRMP.

The need for the action is the BIA's responsibilities for the management of Indian agricultural lands under the AIARMA. AIARMA requires, in part, that the Secretary of the Interior conduct all land management activities on Indian agricultural land in accordance with goals and objectives set forth in an integrated resource management plan. Management of Indian agricultural lands in accordance with integrated resource management plans further the objectives of producing increased economic returns, enhancing Indian self-determination, promoting employment opportunities, and improving the social and economic well-being of Indian and surrounding communities.

1.5 Resource Management Tribal Codes and Federal Laws

AIARMA obligates the Secretary to "conduct all land management activities on Indian agricultural land in accordance with goals and objectives set forth in the approved agricultural resource management plan, in an integrated resource management plan, and in accordance with all tribal laws and ordinances." (25 U.S.C. at § 3712(a)). Therefore, this IRMP was prepared in accordance with AIARMA and its implementing regulations (25 Code of Federal Regulations [CFR] Section 166.311, Navajo Nation Code [NNC] Title 3) that require cooperation between the BIA and/or tribal governments to manage Indian agricultural and rangelands.

Title 2 of the NNC Section 501 (b) (7), authorizes the Resources and Development Committee of the Navajo Nation Council to report studies of natural resources for the protection and efficient utilization, management, administration, and enhancement of the Navajo Nation's resources. The Resources and Development Committee is the approval body for the IRMP. This law specifies that an integrated approach to resource management is necessary. The BIA consulted with the Resources and Development Committee to ensure the IRMP accurately reflects the Navajo Nation's policy and vision for the FBFA.

Title 26 of the NNC authorizes the Navajo Nation Chapters under the Local Governance Act to develop community-based land use plans using the standard guidelines to receive funding and address all community needs. Using these standards and guidelines, WHPacific assisted in updating all nine affected Chapter's Community Land Use Plans in 2008.

The NHLHC was codified by NNC Title 2 and Office of Navajo and Hopi Indian Relocation was established by Public Law (PL) 93-531, as amended. In 1972, the NHLHC office and Navajo Nation Land Commission (consisting of Navajo Nation Council Delegates under the Legislative Branch) were established. A plan of operation defines the roles and responsibilities of the offices and is updated periodically for both NHLHC and Land Commission.

Numerous federal laws and Navajo Nation laws apply to the implementation of the IRMP. Federal regulatory requirements are imposed on resource managers which direct management actions and standards associated with implementation of the IRMP. Implementation of the IRMP shall be consistent with the following laws and implementing regulations, and policies:

- Agricultural Risk Protection Act of 2000 (PL 106-224)
- American Indian Agricultural Resource Management Act (PL 103-177; 25 USC Chapter 39)
- American Indian Religious Freedom Act (PL 95-341; Stat. 469 42 USC 1996)
- Archaeological Resources Protection Act (PL 96-95; 16 USC Section 470aa et seq.)
- Biological Resource Land Use Clearance Policies and Procedures (RCS-44-08)
- Carlson-Foley Act (PL 90-583)
- Clean Air Act (CAA) (PL 88-206; 42 USC 7401)
- Clean Water Act (Federal Water Pollution Control Act) (PL 92-500; 33 USC 1251-1151)
- Comprehensive Environmental Response, Compensation, and Liability Act (PL 96-510; 42 USC 9601)
- Emergency Planning and Community Right-to-Know Act (PL 99-499; 42 USC 11001 et seq.)
- Endangered Species Act (PL 93-205; 16 USC 1531-1544)
- Federal Insecticide, Fungicide, and Rodenticide Act (PL 61-152; 7 USC 136 et seq.)
- Federal Land Policy and Management Act (PL 94-579; 43 USC Chapter 35)
- Federal Noxious Weed Act of 1974 (PL 93-629; 7 USC Chapter 61)
- Food, Conservation, and Energy Act (PL 110-234; 7 USC 1926)
- Golden and Bald Eagle Nest Protection Regulations (RCS-42-08)
- Indian Affairs Manuals
- Indian Self-determination and Education Assistance Act, as amended (PL 93-638; 25 CFR Part 900), as amended
- National Environmental Policy Act (NEPA), (PL 91-190; 43 USC Section 4321 et. seq.) as amended and the implementing regulations issued by Council on Environmental Quality (40 CFR Parts 1500-1508)
- National Historic Preservation Act (PL 89-665; 16 USC 470(f) et seq.)
- National Indian Forest Resources Management Act (PL 101-630; 25 CFR Section 163]

- Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001)
- Navajo Nation Air Pollution Prevention and Control Act (4 NNC 11)
- Navajo Nation Conservation and Wildlife Regulations (23 NNC)
- Navajo Nation Cultural Resources Protection Act (19 NNC Section 1001 et seq.)
- Navajo Nation Environmental Policy Act (4 NNC 9)
- Navajo Nation Fish and Wildlife Regulations (17 NNC 21)
- Navajo Nation Pesticide Act (4 NNC 3)
- Navajo Nation Policy to Protect Traditional Cultural Properties (2010)
- Navajo Nation Safe Drinking Water Act (22 NNC Section 1115)
- Navajo Nation Water Code (22 NNC Section 1101)
- Noxious Weed Control and Eradication Act (PL 108-412; 7 USC 7781)
- Noxious Weed Coordination and Plant Protection Act (PL 106-224; 7 USC 7701)
- Plant Protection Act (PL 106-224; 7 USC 7701 et seq.)
- Resource Conservation and Recovery Act (PL 94-580; 42 USC 6901 et seq.)
- Safe Drinking Water Act (PL 93-523; 42 USC 300)
- Toxic Substances Control Act (PL 94-469; 15 USC Chapter 53)

2. Planning Process and Public Involvement

2.1 Planning Process

The BIA developed this IRMP in close consultation with the Navajo Nation. Figure 2-1 outlines the steps in the IRMP planning and approval process. The early planning process involved discussions within the Navajo Nation, which identified their expectations, concerns, and recommendations for the planning effort. Through this process it was decided that the IRMP would function as an update to the 2008 FBFA Recovery Plan. The FBFA Recovery Plan was developed as a planning tool to help Chapters and the Navajo Nation make decisions about potential capital projects within the FBFA (2008 FBFA Recovery Plan).

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
Gather Resource Data, Background information, Management Plans, Community	Identify Current Resource Management Concerns	Community Outreach	Identified Resource Targeted Goals and Objectives	Development of Integrated Resource Management Alternatives	Finalize IRMP and submit for publication	Initiate National Environmental Policy Act Compliance Process	Adopt and implement the IRMP	10-15 year Revision of the IRMP

ty Land Use Plans								
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Figure 2-1. Integrated Resource Management Planning Process

In the planning process, the Navajo Nation and the BIA entered an MOU for the purpose of developing this IRMP. The MOU established the core and interdisciplinary teams, comprised of Navajo Nation and BIA personnel. In addition to defining the teams for the IRMP, the MOU also defined the roles and responsibilities of the team members. The MOU was finalized and signed on November 21, 2015.

Through the MOU, the BIA and the Navajo Nation agreed to develop the planning effort for the IRMP and prepare and implement appropriate action plans following completion of the IRMP document (i.e., additional NEPA actions, conservation plans, annual work plans, etc.).

In 2016, a draft IRMP was submitted to BIA. In 2018, the Navajo Nation and BIA elected to update the draft IRMP with the most current and relevant information available. Through collaboration with Navajo Nation departments, the interdisciplinary team updated the resource assessments and identified natural resource management plans, goals, and objectives.

2.1.1 Concurrence and Approval Process

The Navajo Nation Resources and Development Committee is the approval body for this IRMP. Following finalization of the draft IRMP, the BIA will prepare a Programmatic Environmental Assessment (PEA) to evaluate potential environmental impacts of implementing the proposed IRMP within the FBFA. The PEA will be prepared in accordance with the requirements of NEPA, Council on Environmental Quality implementing regulations, Department of the Interior implementing regulations, and the Indian Affairs NEPA Guidebook (59 IAM 3-H). A PEA is a concise document that focuses on issues identified in scoping and the potentially significant effects of the proposed action; explains the environmental effects of the proposed action; identifies mitigation necessary to avoid significant impact; and provides information to decision makers.

The Final PEA will be issued with any revisions to the IRMP after public comment on the Draft PEA and the associated IRMP. The Navajo Nation Resource and Development Committee will select the preferred management alternative through Tribal resolution and recommend to the BIA Regional Director for approval and implementation of the IRMP. The BIA Regional Director will then issue a decision based on the Navajo Nation Resources and Development Committee recommendation, upon which the IRMP will be approved and adopted. In the event that the PEA concludes with a determination to proceed to preparation of an environmental impact statement (EIS) rather than a finding of no significant impact, the BIA will proceed with preparation of an EIS for the IRMP.

The PEA will (1) provide the basis for selecting the appropriate integrated resource management strategy, (2) assess the potential programmatic impacts of the IRMP, and (3) provide a document for tiering of site-specific NEPA documents. It will be provided by request to all interested individuals, groups, coordinating agencies, tribal and BIA decision makers.

The need for the PEA is to provide a framework for greater and more efficient agency coordination when tackling important management issues on the FBFA. This agency coordination will reduce duplication of effort by:

- Providing more consistent directives to agency staff;
- Requiring more transparency between agencies, tribal members, and the general public;
- Enhancing values-driven resource management decisions based on public input;
- Focusing management on priority issues; and
- Improving communication.

The PEA will not evaluate project-level issues such as a specific development, project footprint, or design details—instead it will examine the interaction among proposed projects or plans. After the PEA is final, it would be followed by those project-level environmental reviews that can use the information in the PEA. The PEA provides information and analyses necessary for decision makers to make informed decisions.

2.1.2 Plan Implementation

A critical outcome of the FBFA IRMP planning process is that it results in a framework for managing the multitude of resources available within the FBFA. When approved, the framework developed through this process would be utilized by Navajo Nation and BIA resource managers to develop lower-level resource management plans such as an Agricultural Resource Management Plan (ARMP), Range Management Plans (RMP), and/or Cropland Management Plan (Figure 2-2). While development of an Agricultural Resource Management Plan consistent with the requirements of AIARMA has not begun, funding for a proposed a Navajo Nation ARMP has been secured, and the development of a RMP and CMP for Land Management District (LMD) 3 is under way. These plans are being developed in conjunction with this IRMP to address some of the immediate and urgent needs identified from the 2008 FBFA Recovery Plan. Implementation of this IRMP and the selected preferred management alternative would be pursued through multiple avenues. Following approval of the IRMP, the Navajo Nation and BIA will prepare and implement appropriate management alternatives and actions consistent with this IRMP (e.g., range management plans, additional NEPA actions, conservation plans, annual work plans, etc.).

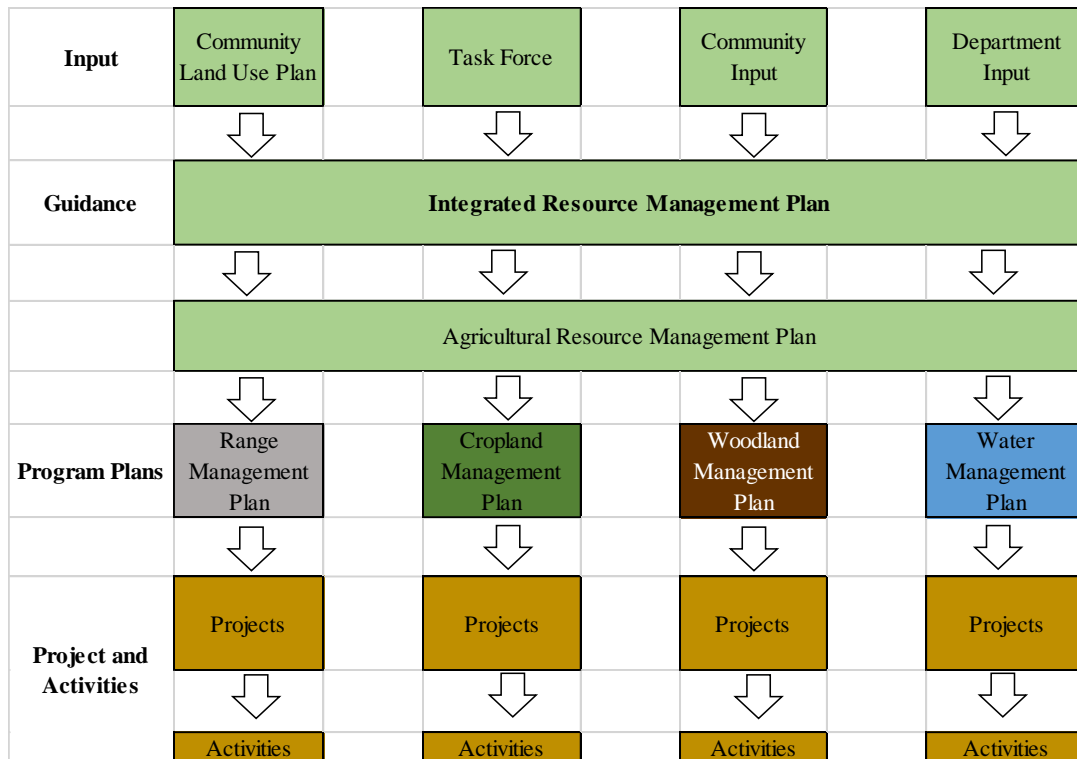


Figure 2-2. Integrated Resource Management Plan Development and Application

The central theme of these integrated resource management approaches is to improve communication. Therefore, an initial step should be to establish an IRMP action committee, comprised of representatives from each resource management department (or an extension of the existing core and interdisciplinary teams). This committee will pilot the IRMP directives by first organizing a team-building IRMP workshop among all the divisions and departments responsible for managing the resources. Workshop deliverables will include the following:

1. A “social contract” that validates the intent to incorporate the IRMP and the preferred management alternative, and to pursue a mutual approach and to improve inter-departmental communication.
2. An Action Plan for developing improvements to information storage and sharing (e.g., GIS capabilities).
3. A proposed agenda and date for a separate session to develop an interdisciplinary planning process.

Initiation of these next steps requires a commitment among all departments to share information, participate in workshops, and generally work in unity to obtain the shared vision. The IRMP action committee will need to ensure ongoing coordination and project evaluation between resource managers and departments. A project evaluation methodology should be developed that would document interdepartmental review and incorporate recommendations to the resource manager. As mentioned before, monitoring and evaluation of results is the crucial to long-term success.

Successful implementation of the IRMP has the potential to create a shift in philosophy within the organizations that starts with buy-in to this IRMP and a commitment to cooperation and collaboration between departments.

2.2 Tribal Membership Participation

2.2.1 Community Input Received during the Planning Process

Community input was received, compiled and considered from multiple sources.

1. Chapter Land Use Plans (CLUPs) from all nine affected Chapters
 - a) Overview of IRMP on November 13, 2014, Tuba City Chapter, Tuba City Arizona;
 - b) Coalmine Canyon Chapter House Meeting March 9, 2016, Coalmine Canyon, Arizona;
 - c) Workshop on March 16, 2016 in Tuba City to inform Chapter members on the IRMP and the IRMP process, Tuba City, Arizona.
2. 2008 Former Bennett Freeze Recovery Plan
 - a) Community members, youth, Chapter officials and administration staff participated in two community workshops to develop the 2008 FBFA Recovery Plan occurred from May 28 to June 22, 2008;
 - b) Community members, youth, tribal officials and Chapter administration staff participated in two community workshops to update each CLUP.
3. 2018 Former Bennett Freeze Area Economic and Market Feasibility Study

CLUPs are prepared by a community appointed committee and reflect the vision and goals of community members with concern for the development and protection of Chapter lands. These plans serve as a strategic guide for Chapter administrators when considering development within their respective Chapter service areas. For the purposes of this IRMP, these CLUPs were considered the most comprehensive collection of community identified goals available and were extensively utilized in the planning process.

In 2015 the IRMP core and interdisciplinary teams were created jointly by the Navajo Nation and BIA under an MOU. During the creation of this IRMP, the core team and interdisciplinary team members have changed; however, the primary roles and goals of both teams have remained consistent throughout the process as follows:

1. The purpose and need for the IRMP and the steps in the IRMP process.
2. Resource data collection and recognizing data gaps.
3. Identification of priority resource goals and objectives.
4. Identification of resource programs past, present, and foreseeable future activities and projects.
5. Development of the draft IRMP by reviewing previous versions of the IRMP.

Excerpts from the approved CLUPs developed between 2006 and 2008 by the nine Chapters in the FBFA are provided in Appendix D. Each of these CLUPs is currently being revised by the Chapters.

2.2.2 Issues and Concerns

Several critical issues have been identified by the core team members and residents within the FBFA including water rights, recovery from the halted development within the FBFA, and the restriction on development within Navajo Nation cultural and religious areas.

1. Water Resources

The Navajo Nation has severe water infrastructure deficiencies that impact the health, economy, and welfare of the Navajo Nation. The lack of adequate domestic and municipal water is the greatest water resource problem facing the Navajo Nation.

2. Recovery from the halted development

Housing, transportation, utilities, and business have all been impacted by the ban on development within the FBFA.

3. Restriction on Development within Navajo Nation Religious Zones

Protection of Navajo Nation cultural practices and areas is critical when considering development within the FBFA. The Navajo-Hopi Intergovernmental Compact recognizes the spiritual heritage of both Tribes and ensures that religious traditions can continue while ensuring the conservation of eagle nesting areas under federal law. Article 4.1 of the Navajo-Hopi Intergovernmental Compact states that no development will occur within any areas listed under Exhibit C of the Compact.

2.3 Community Vision and Goals

2.3.1 Vision Statement

“A rehabilitated Former Bennett Freeze Area (FBFA) with well-managed natural resources and environmental conditions, improved economic conditions and quality of life, with preserved Diné culture and traditions.” by Navajo Nation Navajo-Hopi Land Commission, FBFA Chapters and LGSC staff, May 15, 2014.

2.3.2 Community Goals

This plan functions as a planning tool to aid in FBFA recovery while effectively managing natural resources in a holistic manner. The freeze has had a lasting impact for all Chapters within the FBFA and has even affected neighboring Chapters. Each community affected by the freeze has unique goals and objectives for their communities. The following is a summarized list of goals for recovery, voiced by the community members in the FBFA, based on the 2008 Recovery Plan (2008 FBFA Recovery Plan) and the nine CLUPs (Appendix D):

- quality housing with dependable power and reliable potable water in both developed (urban centers) and rural areas within the FBFA;
- the ability to foster safe communities with strong growth potential in the direction that each community sees fit;

- ability to provide gainful employment opportunities within the community for community members;
- provide lifelong educational opportunities to community members;
- economic opportunity that fosters education, training and provides jobs which support community desire to be self-sustaining and independent;
- easy access to health, medical, and social services;
- respect and honor for traditional values such as livestock grazing and agriculture while balancing the needs for growth and development within the community;
- protection of natural and cultural resources, historic properties, sacred sites, and sacred species.

3. Integrated Resource Management Planning Alternatives

Incorporating community comments and expertise of the resource professionals of the Navajo Nation and BIA, the project core and interdisciplinary teams developed four potential IRMP Alternatives for the FBFA.

These alternatives could be used to guide coordinated management of the FBFA in the future. Each management alternative represents a distinct management philosophy that prioritizes different goals and objectives. These management alternatives will be further developed and presented to the Navajo Nation and interdisciplinary team for a final review and modification before being brought to the community for their review and feedback during the NEPA process.

A preferred management alternative will be developed with public input and selected during the NEPA process. The three potential IRMP Alternatives for the FBFA are listed below:

1. **No Action Alternative**—continuance of current management practices without the increased levels in planning, coordination, and integration identified during the IRMP development process.
2. **Balanced Growth Emphasis Alternative**—this alternative supports environmentally and culturally responsible growth and economic development. The Balanced Growth Emphasis Alternative would consider current Navajo Nation protection zones and restrictions on development as well as require the more robust integrated management techniques identified in the IRMP. Development on FBFA land would be in line with the goals and objectives of the IRMP. This alternative focuses on balancing growth and economic development with minimal impact on environmental and cultural resources.
3. **Growth and Economic Emphasis Alternative**—this alternative would focus on greater growth and economic development while minimizing costs to Navajo Nation programs. This alternative would require a reduction to current restrictions on development and environmental protections within the FBFA to allow for a simplified process under which capital improvement, economic development, and community development projects could be completed.

4. Resource Descriptions

This section describes the natural resources that are managed in the IRMP.

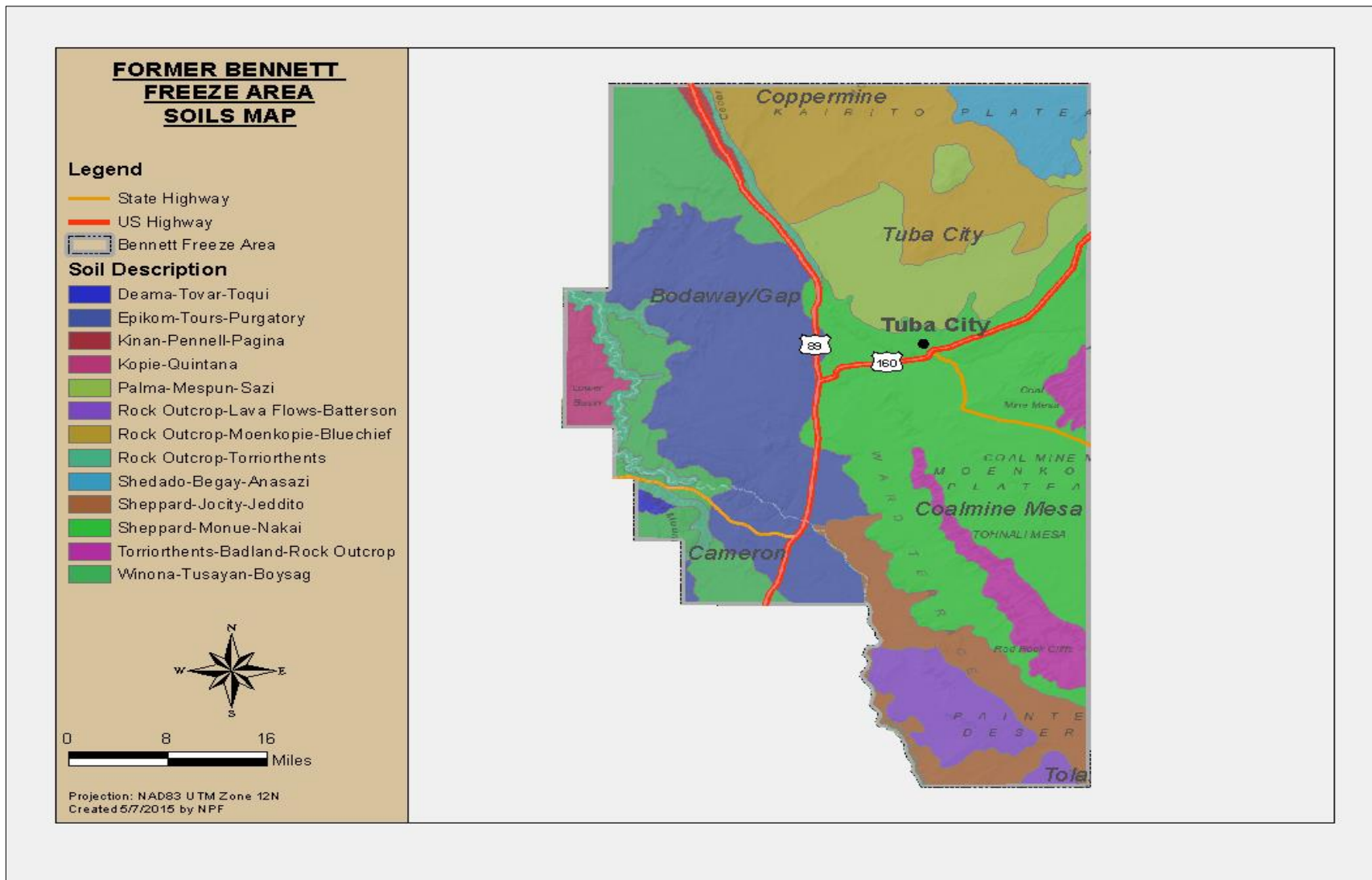
4.1 Soils, Water, Air Quality, and Climate

4.1.1 Soils

Soil management for FBFA utilizes the Natural Resource Conservation Service (NRCS) Soil Surveys and Ecological Site Descriptions as resources to provide guidance and management decisions. Ecological Site Descriptions embody site characteristics that include physiographic, climate, soil and water features; these descriptions are provided in Appendix E.

The US Department of Agriculture (USDA) NRCS Soil Survey delineated 13 soil associations occurring in the FBFA (Map 4-1). Each soil unit identified has characteristics that can be used to determine the development potential of the region. While several soil unit maps have been created as part of the inventory, they are incomplete, and the data is subject to revision. The soils that have been identified are as follows:

1. Deama-Tovar-Toqui association
2. Epikom-Tours-Purgatory association
3. Kinan-Pennell-Pagina association
4. Kopie-Quintana association
5. Palma-Mespun-Sazi association
6. Rock Outcrop-Lava Flows-Batterson association
7. Rock Outcrop-Moenkopie-Bluechief association
8. Rock Outcrop-Torriorthents association
9. Shedado-Begay-Anasazi association
10. Sheppard-Jocity-Jeddito association
11. Sheppard-Monue-Nakai association
12. Torriorthents-Badland-Rock Outcrop association
13. Winoa-Tusayan-Boysag association



Map 4-1. Soil associations delineated by the Natural Resource Conservation Service in the Former Bennett Freeze Area

Statements made in this report are intended to help land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations. Enlargement of maps could cause misunderstanding of the detail of mapping. Maps do not show the small areas of contrasting soils that could be shown at a larger scale.

Deama-Tovar-Toqui Association

Soils are mapped above the Coconino Rim. The map unit is characterized by nearly level to gently sloping plateaus and mesas, and strongly sloping to very steep hillsides. Slope is 0 to 60 percent. Elevation is 5,200 to 6,800 feet. Average annual precipitation is about 13 to 17 inches. Average annual air temperature is 49 to 54 degrees Fahrenheit (°F), and the average frost-free season is 120 to 170 days.

Deama soils are on hillsides. The soils are very shallow to shallow and are well-drained. They formed in residuum and slope alluvium derived from limestone and calcareous sandstone. About 15 to 30 percent of the surface is covered with gravel and stones. Deama soils are very cobbly and loamy and are underlain by limestone at a depth of 6 to 20 inches. Vegetation on the Deama soils is juniper, New Mexico feathergrass, black grama, sideoats grama, and turbinella oak.

Tovar soils are on hillsides. The soils are moderately deep and well-drained. They formed in residuum, and slope alluvium derived dominantly from sandstone. From 0 to 30 percent of the surface is covered with stones. Tovar soils are loamy to unweathered sandstone at a depth of 20 to 40 inches. Vegetation on Tovar soils is juniper, western wheatgrass, blue grama, and black grama.

Toqui soils are on plateaus and mesas. These soils are very shallow to shallow and are well-drained. They formed in residuum, and eolian deposits derived from limestone and calcareous sandstone. Toqui soils are loamy to limestone at a depth of 8 to 20 inches. Vegetation on Toqui soils is piñon, juniper, blue grama, and big sagebrush.

Epikom-Tours-Purgatory Association

Soils are mapped northwest of Cameron to the edge of Blue Moon Bench, and southeast of Cameron to Black Point. The map unit is mainly on plateaus and mesas, and alluvial fans intermingled with buttes and escarpments. Slope is 0 to 15 percent. Elevation is 4,300 to 5,600 feet. The average annual precipitation is about 6 to 10 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 to 175 days.

Epikom soils are on plateaus and mesas. These soils are shallow and well-drained. They formed in residuum and slope alluvium derived dominantly from sandstone and sandy shale. Epikom soils are loamy and are underlain by sandstone at a depth of 10 to 20 inches. Vegetation on Epikom soils is mainly black grama, blue grama, galleta, four-wing saltbush

Tours soils are on alluvial fans and streambeds. These soils are deep and well-drained. They formed in mixed alluvium. Tours soils are loamy and silty extending to a depth of 60 inches or more. Vegetation on Tours soils is mainly alkali sacaton, galleta, blue grama, and Indian ricegrass.

Purgatory soils are on plateaus and mesas. These soils are moderately deep, and well-drained. They formed in slope alluvium, and eolian deposits derived dominantly from gypsiferous sandy shale.

Purgatory soils are highly gypsiferous, loamy, and underlain by weathered shale at a depth of 20 to 40 inches. Vegetation on Purgatory soils is mainly gyp dropseed, galleta, alkali sacaton, and Mormon tea.

Kinan-Pennell-Pagina Association

Soils are mapped in Cornfield Valley north of Cedar Ridge. The map unit is mainly on plateaus and mesas. Slope ranges from 0 to 70 percent. Elevation is 5,400 to 6,000 feet. Precipitation is 11 to 14 inches. The average annual air temperature is 50 to 54°F, and the average frost-free season is 120 to 170 days.

Kinan soils are on undulating plateaus and fan terraces. The soils are very deep and well-drained. They formed in eolian deposits and/or mixed alluvium from various sources. Kinan soils are loamy to a depth of over 60 inches. Vegetation is galleta, blue grama, black grama, Indian ricegrass, Cutler Mormon tea, and needle and thread.

Pennell soils are mesas and benches. The soils are shallow and well-drained. They formed in residuum, or residuum with colluvium or eolian deposits. Pennell soils are loamy and underlain with limestone or calcareous sandstone bedrock between 10 to 20 inches depth. Vegetation is blackbrush, broom snakeweed, Mormon-tea, shadscale saltbush, and galleta.

Pagina soils are on rolling plateaus and low hills of structural benches. The soils are moderately deep, and well-drained. They formed in residuum, or eolian sands over residuum. Pagina soils are loamy and underlain with limestone or calcareous sandstone. Vegetation is mainly blackbrush, Mormon tea, broom snakeweed, Indian ricegrass, and yucca.

Kopie-Quintana Association

Soils are mapped in Lower Basin, west of the Colorado River near Cedar Mountain. The map unit is on plateaus and mesas. Slope ranges from 0 to 30 percent. Elevation is 5,300 to 6,100 feet. Precipitation is 8 to 13 inches, the average annual temperature is 49 to 54°F, and average annual frost-free days are 120 to 170 days.

Kopie soils are on plateaus and mesas. The soils are shallow and well-drained. They formed in residuum and slope alluvium or eolian deposits. The soils are loamy and underlain with calcareous sandstone or mudstone. Vegetation is galleta, black grama, needle and thread and juniper.

Quintana soils are on mesas and foothills. The soils are deep or very deep and well-drained. They formed in alluvial or eolian deposits. Quintana soils are loamy to a depth of 40 inches or more. Vegetation is juniper, piñon, fourwing saltbush, blue grama, black grama, sideoats grams, and sand dropseed.

Palma-Mespun-Sazi Association

Soils are mapped east of the Colorado River from Big Canyon to the Little Colorado River. The map unit is on plains, terraces, dunes, and mesas. Slope ranges from 0 to 15 percent. Elevation is 4,400 to 5,700 feet. Precipitation is 7 to 11 inches, the average annual temperature is 51 to 56°F, and the average annual frost-free days are 150 to 175 days.

Palma soils are on undulating plains, dunes, fan terraces and fan piedmonts. The soils are very deep and well-drained, or somewhat excessively drained. They formed in alluvium, or alluvium and eolian deposits derived from sandstone. Surfaces and subsoils are loamy to over 60 inches depth. Vegetation is blue grama, sand dropseed, sand sage, and yucca.

Mespuen soils are on alluvial fans, fan remnants, and fan piedmonts. Soils are very deep and excessively drained. They formed in alluvium. Soil surfaces and subsoils are sandy. Vegetation is sand sagebrush, Mormon tea, snakeweed, piñon, and juniper.

Sazi soils are on mesas, structural benches, and cuestras. The soils are moderately deep and well-drained. They formed in eolian deposits derived from sandstone. Sazi soils are loamy and underlain with sandstone at 20 to 40 inches depth. Vegetation is four-wing saltbush, winterfat, galleta, and blue grama.

Rock Outcrop-Lava Flows-Batterson Association

Soils are mapped east of the Little Colorado River, and east of Wupatki National Monument, including Baah Lokaa Ridge. The map unit is on plateaus and mesas. Slope ranges from 0 to 40 percent. Elevation is 4,300 to 5,000 feet. The average annual precipitation is about 6 to 9 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 to 175 days.

Rock outcrop and Lava Flows are miscellaneous areas intended to represent areas where little or no soil may be present, or where enough exists to restrict soil management to that level.

Batterson soils are on gently sloping upland hills and ridges. The soils are shallow and excessively drained. They form in residuum dominantly derived from sandstone. Batterson soils are sandy and underlain by sandstone at less than 20 inches depth. Vegetation is alkali sacaton, galleta, black grama, mound saltbush, fourwing saltbush, and sixweeks fescue.

Rock Outcrop-Moenkopic-Bluechief Association

Soils are mapped in the area of the Kaibito Plateau surrounding Preston Mesa, including Mormon Ridges. The map unit is on plateaus and mesas. Slope ranges from 0 to 30 percent. Elevation is 5,300 to 6,300 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 51 to 55°F, and the average frost-free season is 150 to 175 days.

Rock outcrop is miscellaneous areas intended to represent areas where little or no soil may be present, or where enough exists to restrict soil management to that level.

Moenkopic soils are on plateaus and mesas. The soils are shallow and well-drained. They formed in residuum derived from calcareous sandstone. Moenkopic soils are loamy and underlain by sandstone or mudstone at less than 20 inches depth. Vegetation is alkali sacaton, shadscale saltbush, fourwing saltbush, and prickly pear.

Bluechief soils are on fan terraces. The soils are moderately deep and well-drained. They form in alluvium and local dunes deposits derived sandstone. Bluechief soils are loamy and underlain by sandstone between 20 and 40 inches deep. Vegetation is ephedra, alkali sacaton, galleta, and prickly pear.

Rock Outcrop-Torriorthents Association

Soils are mapped along cliff faces of the Echo Cliffs north from Hidden Springs. This map unit is on escarpments and cliff faces. Slope ranges from 0 to 60 percent. Elevation is 4,900 to 6,800 feet. The average annual precipitation is about 7 to 13 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 to 175 days.

Rock outcrop is miscellaneous areas intended to represent areas where little or no soil may be present, or where enough exists to restrict soil management to that level.

Torriorthents soils are at the bottoms of cliff faces. Soils are shallow or deep and well-drained. They form in colluvium and slope alluvium derived from sandstone. Soils are rocky. Vegetation is Wyoming big sagebrush, fourwing saltbush, blue grama, and juniper.

Shedado-Begay-Anasazi Association

Soils are mapped east of Preston Mesa at White Mesa of the Kaibito Plateau. The map unit is on mesas and dunes. Slope ranges from 0 to 60 percent. Elevation is 5,400 to 6,800 feet. Precipitation is 9 to 13 inches, the average annual temperature is 48 to 54°F, and the average annual frost-free days are 120 to 170 days.

Shedado soils are on mesas, and plateaus. The soils are moderately deep and well-drained. They formed eolian dune deposits derived from sandstone. Shedado soils are sandy and underlain by sandstone at a depth of 20 to 40 inches. Vegetation is sand sage, juniper, Indian ricegrass, needle and thread, and Mormon tea.

Begay soils are fan terraces and fan remnants. The soils are very deep and well-drained. They formed in eolian deposits and alluvium derived from sandstone. Begay soils are loamy to a depth of more than 60 inches. Vegetation is needle and thread, big sagebrush, blue grama, and Indian ricegrass.

Anasazi soils are on dissected pediments and hills. The soils are moderately deep and well-drained. They formed in eolian material weathered from sandstone. Anasazi soils are loamy and underlain by sandstone at a depth of 20 to 40 inches. Vegetation is piñon, juniper, blackbrush, Mormon tea, and Indian ricegrass.

Sheppard-Jocity-Jeddito Association

Soils are mapped southeast of Cameron below Ward Terrace to Tolani Lake. The map unit is on plateaus, mesas, benches, and terraces. Slope ranges from 0 to 15 percent. Elevation is 4,500 to 5,600 feet. The average annual precipitation is about 6 to 10 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 to 175 days.

Sheppard soils are on terraces and dunes. The soils are very deep and somewhat excessively drained. They formed in local dunes or alluvial terraces derived from sandstone. Sheppard soils are sandy to depths of more than 60 inches. Vegetation is Mormon tea, sandsage, Indian ricegrass, galleta, and Russian thistle.

Jocity soils are very deep and well-drained. They formed in flood plains, and alluvial fans derived from mixed sandstone and shale. Jocity soils are loamy to more than 60 inches depth. Vegetation is galleta, alkali sacaton, blue grama, black grama, and juniper.

Jeddito soils are very deep, and somewhat excessively drained. They formed in stream terraces derived from sandstone. Jeddito soils are sandy to a depth of more than 60 inches. Vegetation is Indian ricegrass, galleta, blue grama, fourwing saltbush, and winterfat.

Sheppard-Monue-Nakai Association

Soils are mapped on the Moenkopi Plateau from Tuba City above Ward Terrace to Garces Mesas, and from Tuba City to Kletthla Valley. The map unit is on plateaus and mesas. Map unit slopes range from 0 to 40 percent. Elevation ranges from 4,600 to 5,800 feet. The average annual precipitation is about 7 to 12 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 days.

Sheppard soils are very deep and somewhat excessively drained. They formed in local dunes or alluvial terraces derived from sandstone. Sheppard soils are sandy to a depth of more than 60 inches. Vegetation is Indian ricegrass, needle and thread, black grama, blue grama, bottlebrush squirreltail, and sand dropseed.

Monue soils are very deep and well-drained. They formed in stream terraces and fan terraces derived from sandstone. Monue soils are loamy to a depth of more than 60 inches. Vegetation is Indian ricegrass, black grama, blue grama, and Mormon tea.

Nakai soils are very deep and well-drained. They formed in terrace deposits of mixed alluvium and eolian deposits derived from sandstone and shale. Nakai soils are sandy to a depth of more than 60 inches. Vegetation is Indian ricegrass, galleta, sand dropseed, snakeweed, and Mormon tea.

Torriorthents-Badland-Rock Outcrop Association

Soils are mapped on cliff faces at Ward Terrace and in Coal Mine Canyon. The map unit is on cliff faces, escarpments, and talus slopes. Map unit slopes ranges from 5 to 70 percent. Elevation ranges from 4,600 to 5,600 feet. The average annual precipitation is about 6 to 10 inches, the average annual air temperature is 52 to 55°F, and the average frost-free season is 150 to 175 days.

Torriorthents soils are at the bottoms of cliff faces. Soils are shallow or deep and well-drained. They formed in colluvium and slope alluvium dominantly derived from sandstone. Soils are rocky. Vegetation is Wyoming big sagebrush, fourwing saltbush, blue grama, and juniper.

Rock outcrop and Badland miscellaneous areas represent areas where little or no soil may be present or where soil is absent enough to restrict management to that level.

Winona-Tusayan-Boysag Association

Soils are mapped in the area of Gray Mountain and east along the Colorado River. The map unit is on plateaus and mesas. The map unit slope ranges from 0 to 50 percent. Elevation is 5,000 to 6,200 feet. The average annual precipitation is 10 to 17 inches, the average annual temperature is 49 to 54°F, and the average frost-free season is 120 to 175 days.

Winona soils are very shallow and shallow and well-drained. They formed in residuum derived dominantly from limestone and calcareous sandstone. In some areas, about 10 to 50 percent of the surface is covered with stones. Winona soils are limy gravelly loam and are underlain by limestone at a depth of 6 to 20 inches. Vegetation is mainly blue grama, galleta, and four-wing saltbush.

Tusayan soils are in concave areas of plateaus and mesas. The soils are moderately deep and well-drained. They formed in slope alluvium or eolian deposits over residuum derived from dominantly limestone. Tusayan soils are limy gravelly loam, or very gravelly loam, and are underlain by limestone at a depth of 20 to 40 inches. Vegetation is blue grama, galleta, and more frequently four-wing saltbush than Winona soils.

Boysag soils are shallow and well-drained. They formed in residuum and slope alluvium derived from limestone and sandstone. Boysag soils are loamy and underlain with limestone at a depth of less than 20 inches. Vegetation is blue grama, winterfat, galleta, and needle and thread.

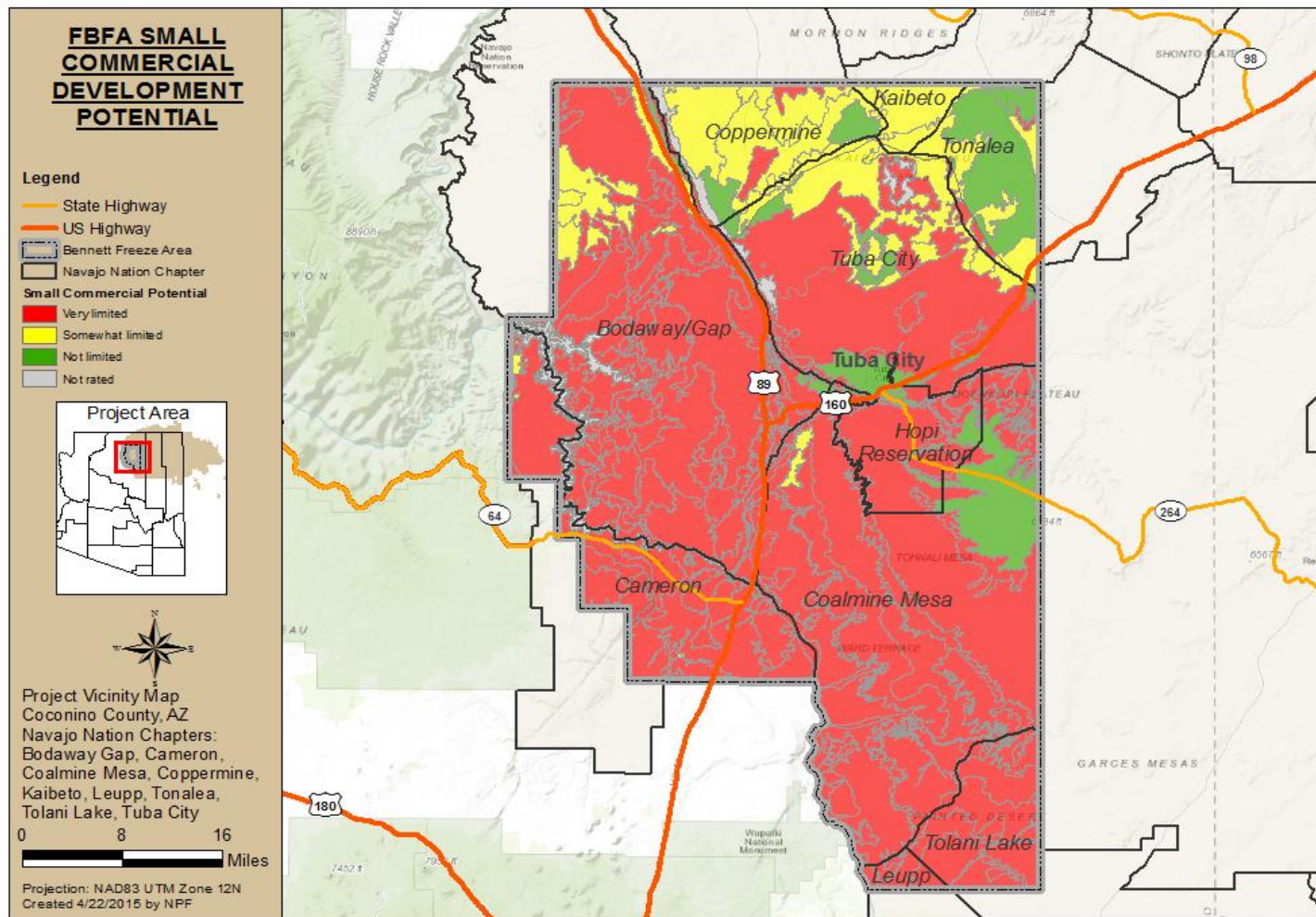
4.1.1.1 Commercial Development Potential

Soil properties influence the development of building sites, the selection of sites, the design of the structure, construction, maintenance, and performance after construction. Evaluating the potential for commercial development in the FBFA based on soil type and soil properties reveals areas that may have greater potential for commercial development than other areas. The USDA NRCS Soil Mapping Tool was used to evaluate the potential for small commercial development within the FBFA. Small commercial development refers to the construction of structures that are less than three stories high and do not have basements. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and properties that affect excavation and construction costs.

Soil properties that affect the load-supporting capacity include; depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified Classification of the soil). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments (USDA NRCS 2016).

The rating class terms indicate the extent to which the soils are limited by the soil properties that affect the specified use. In Map 4-2, green areas are classified as “Not Limited,” which indicates that the soil has properties that are favorable for small commercial buildings. Yellow regions are classified as “Somewhat Limited,” which indicates that the soils have properties that are moderately favorable for small commercial buildings. Regions colored red are classified as “Very Limited,” which indicates that the soil has one or more properties that are unfavorable for small commercial building development. The soil limitations, which determine these classifications generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures.

Within the FBFA the majority of the region is rated as very limited potential for small commercial development; however, there are some areas within the Bodaway-Gap, Coppermine, Kaibeto, Tonalea, Tuba City, and Coalmine Canyon Chapters, which contain soils with features that would support small commercial building development (Map 4-2).



Map 4-2. Small Commercial Development Potential in the Former Bennett Freeze Area

4.1.1.2 Roadway Development Potential

Soil properties influence the development of roadways. Analysis of roadway potential is a crucial step in the planning process. The USDA NRCS Soil Mapping Tool was used to evaluate the potential for road development within the FBFA. Evaluating the potential for road development in the FBFA based on soil type and soil properties reveals some areas within the region that may have greater potential for roads than other areas.

Local roads and streets are defined as streets that have an all-weather surface and carry automobile and light truck traffic all year. These roads have a subgrade of cut or fill soil material that might include; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder (USDA NRCS 2016).

The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength, subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding (USDA NRCS 2016).

Rating class terms indicate the extent to which the soils are limited by the soil properties that affect road development. In Map 4-3, green areas are classified as “Not Limited,” which indicates that the soil has properties that are very favorable for road development. In green areas, good performance and very low maintenance can be expected (USDA NRCS 2016).

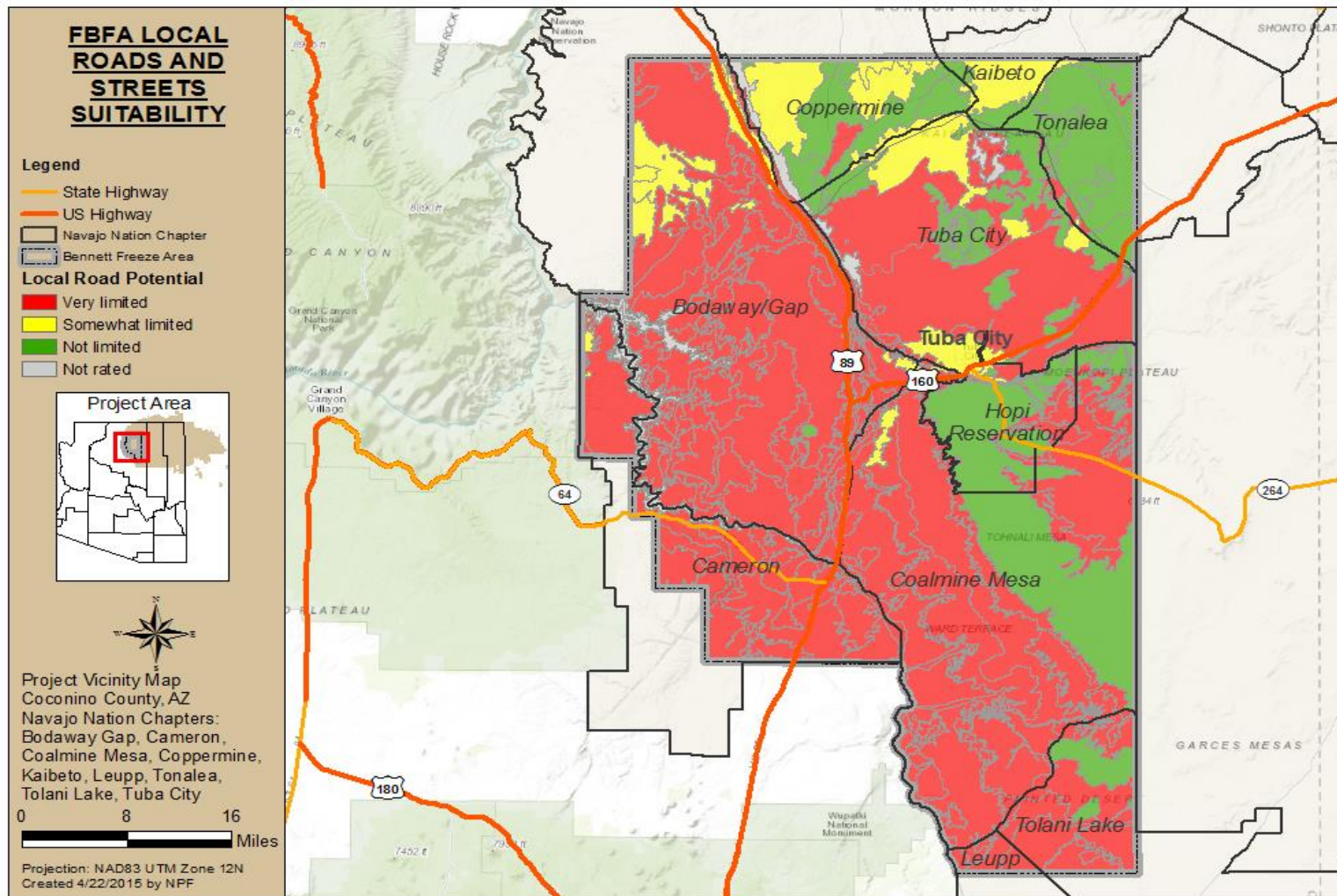
Yellow areas are classified as “Somewhat Limited,” which indicates that the soil has properties that are moderately favorable for road development. Limitations in these areas can be overcome or minimized by special planning, design, or installation. Within these regions of the FBFA, fair performance and moderate maintenance of roads can be expected (USDA NRCS 2016).

Red areas shown in Map 4-3 are classified as “Very Limited,” which indicates that the soil has one or more properties that are unfavorable for road development. The limitations in these areas typically cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected of roads developed in these areas. Many of the Chapters within the FBFA have soils that are not suitable for traditional roadway (asphalt or concrete) development. The most restricted Chapters in terms of road development potential are Bodaway-Gap, Cameron, Coalmine Canyon, Tolani Lake, and Leupp.

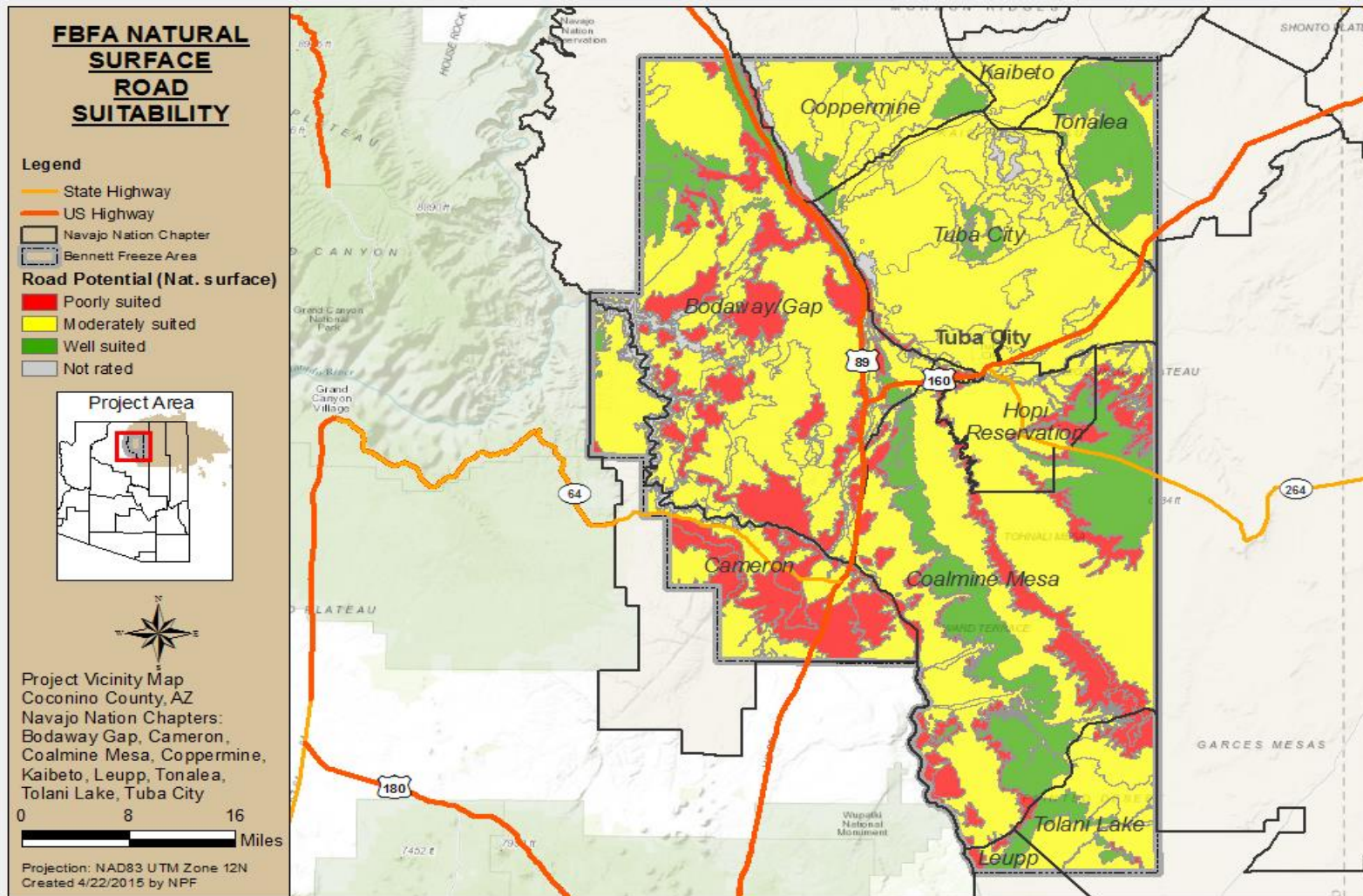
An alternative to traditional road development is the development of road systems with a natural surface (not asphalt or concrete). Evaluating the potential for natural surface road development in the FBFA based on soil type and soil properties reveals areas within the region that may have greater potential for natural surface roads than other areas. The USDA NRCS Soil Mapping Tool was used to evaluate the potential for natural surface road development within the FBFA. Natural surface roads and streets use the natural surface of the soil for roads.

The ratings are based on slope, rock fragments on the surface, plasticity index, content of sand, depth to a water table, ponding, flooding, and the hazard of soil slippage (USDA NRCS 2016). Map 4-4 shows natural road development potential within the FBFA. Green areas are classified as “Well Suited,” which indicates that the soil has properties that are favorable for natural surface road development and has no limitations (USDA NRCS 2016). Good performance can be expected of natural surface roads in these areas with little maintenance required. Yellow areas are classified as “Moderately Suited,” which indicates that the soil has properties that are moderately favorable for natural surface road development. This classification indicates that one or more soil properties are less than desirable, and fair performance can be expected. It is likely that natural surface roads in these regions will require some maintenance (USDA NRCS 2016). Red areas in Map 4-4 indicate areas that have been classified as “Poorly Suited,” which indicates that the soils have one or more properties that are unfavorable for natural surface road development. Typically, overcoming the unfavorable properties in these regions requires special design, extra maintenance, and costly alteration (USDA NRCS 2016).

Comparing road development potential between the more traditional style road systems (asphalt or concrete) and natural surface road systems (Map 4-3), there are far more areas within the FBFA that are suitable for natural surface road systems than there are for traditional road systems. Natural surface roads are likely challenging during monsoonal activity and spring thaw due to mud but are less costly than traditional style roadway systems. Within the FBFA, regions classified as having very limited potential for traditional road development (Map 4-4), but do have more favorable ratings for natural surface road development (Map 4-4) might benefit from advancements in soil technology and evaluate the potential for chemically treated (lithified) natural surface roads which offer the stability and durability of a more traditional style road system, but might not be as restrictive in terms of development similar to that of a natural surface road system. Hybrid roads have been tested in other areas of the Navajo Nation including Whiteclay Road, Arizona.



Map 4-3. Local Road Development Potential in the Former Bennett Freeze Area



Map 4-4. Natural Road Surface Development Potential in the Former Bennett Freeze Area

4.1.2 Water

All water resources on the Navajo Nation are subject to the Navajo Nation Water Code (22 N.N.C. §§ 1101 et seq.) and managed by the Navajo Nation Department of Water Resources (NNDWR). The Navajo Nation has enacted the Navajo Nation Clean Water Act and Water Quality Standards. The US Environmental Protection Agency (USEPA) manages and the National Pollutant Discharge Elimination System (40 USC 122) on tribal lands to protect the quality of water resources on the reservation.

4.1.2.1 Surface Water

Surface water resources within the FBFA consist of perennial streams, ephemeral streams, springs, and wetlands (Figure 4-1). The major surface water features within the FBFA are the Colorado River and the Little Colorado River. Utilizing these resources is complicated by many factors including legal, environmental, flow variability, and quality (total dissolved solids concentrations). However, ongoing litigation may change the feasibility of developing these resources.

Watersheds within the FBFA boundaries include the Lower Colorado-Marble Canyon, Moenkopi Wash, Lower Little Colorado, and the Dinnebito Wash. The Moenkopi Wash watershed encompasses approximately 686,099 acres in the northeast quadrant and has a total drainage area of approximately 1,629 square miles. The watershed drains a large portion the western part of Black Mesa where flow is facilitated by Moenkopi Wash and its tributaries. A stream gauge is present near the Village of Moenkopi and the period of record indicates continuous flow except in summer months when the wash is dry and monsoonal rains from July to September (Mason 2018).

Dinnebito Wash watershed has a total drainage area of 473 square miles and covers approximately 73 square miles of the southeast corner of the FBFA. It drains the middle portion of the Black Mesa area. The major feature of the watershed is Dinnebito Wash, which is an intermittent stream with small sections that have year-round flow. A gauging station located near Sand Springs, Arizona indicates monsoonal rains from July to September (Mason 2018).

The Lower Little Colorado watershed is a subwatershed of the Little Colorado Watershed, and the largest watershed in the FBFA. It encompasses approximately 1,231 square miles in the southwest quadrant. The major feature of the watershed is the Little Colorado River and the watershed drains approximately 2,399 square miles. A stream gauge on the Little Colorado near Cameron, Arizona shows a mean annual flow of 219.28 cubic feet per seconds (cfs) and indicates monsoonal rains occur from July to September. Another stream gauge near Desert View, Arizona gives a mean annual flow of 310 cfs and shows monsoonal influences occurring from July to September (Arizona Department of Environmental Quality 2006). Refer to Figure 4-1 for annual median flow at select sites on the Little Colorado River.

The Lower Colorado-Marble Canyon watershed is in the northwestern corner of the FBFA and covers an area of approximately 234 square miles. The watershed has a total area of approximately 1,468 square miles. The primary feature of the watershed is the Colorado River. No stream gauges exist along the river within the FBFA boundaries; however, nearby at Lee's Ferry, Arizona a gauging station gives an annual mean discharge of 14,670 cfs with a maximum peak flow of 127,000 cfs (<https://waterdata.usgs.gov/az/nwis/sw>).

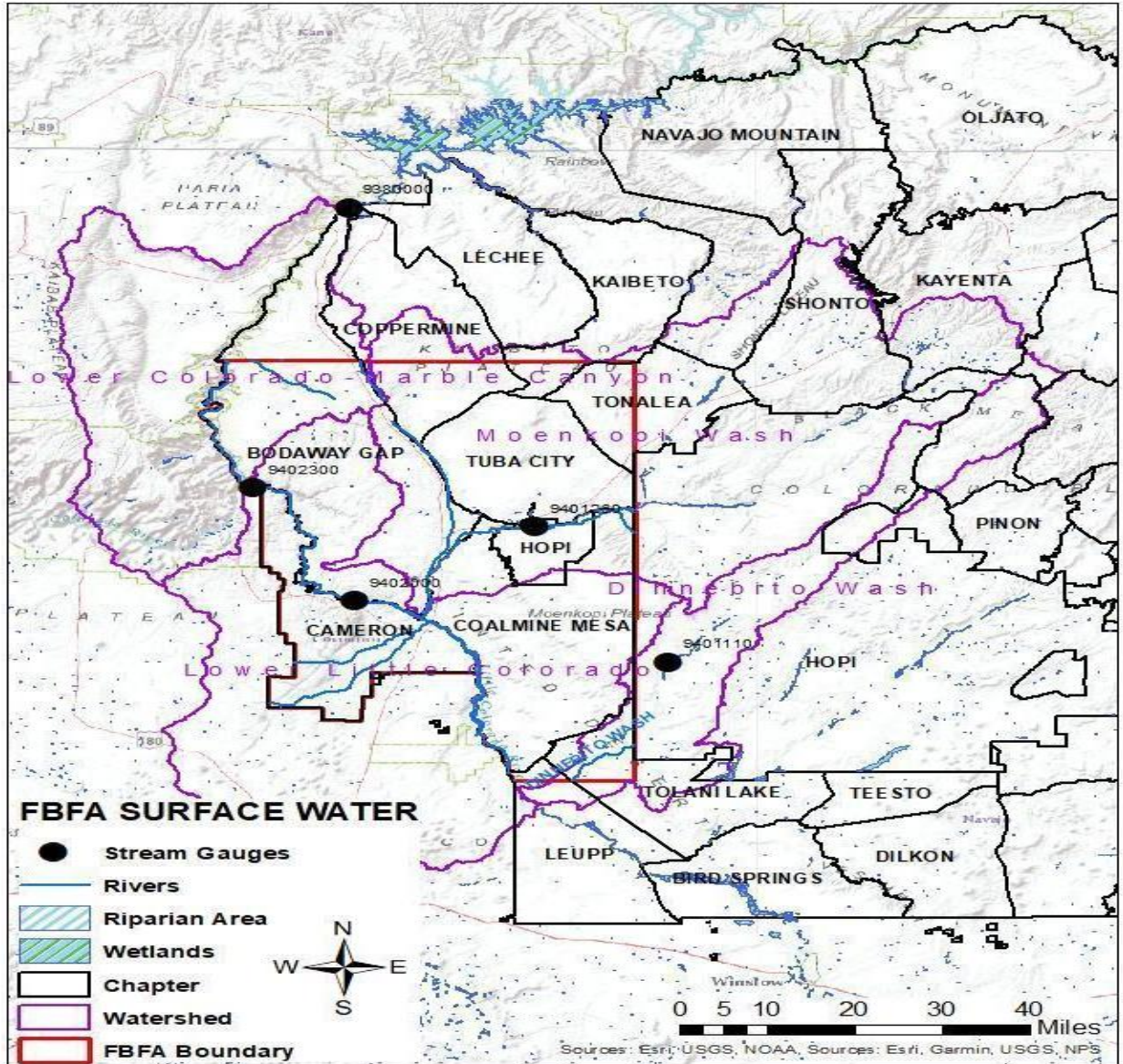


Figure 4-1. Surface Water Resources in the Former Bennett Freeze Area

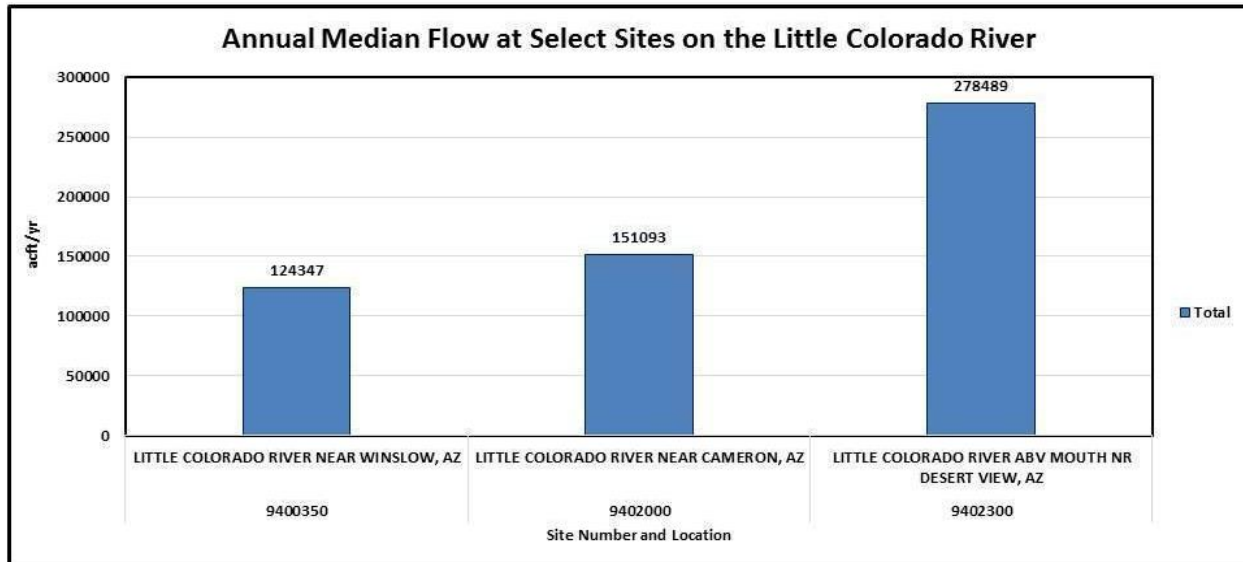


Figure 4-2. Annual Median Flow Little Colorado River

In 2017, seeps and springs within the FBFA were inventoried to assess condition. Table 4-1 lists the number of springs and their condition at the time of the inventory (Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area, BIA, June 2017).

Table 4-1. Number of Springs and Condition in the Former Bennett Freeze Area

Condition	Number of Springs
Good	40
Fair	24
Poor	23
Non-existent	24
Total	111

Source: Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area, BIA June 2017..

Other smaller sources of surface water in the FBFA are wholly ephemeral in nature and hardly considered reliable for municipal or domestic use. The ephemeral water bodies do, however, play a role in water supplied for irrigation and livestock purposes. Table 4-2 lists the inventoried ephemeral water resources in the FBFA (Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area, BIA, June 2017).

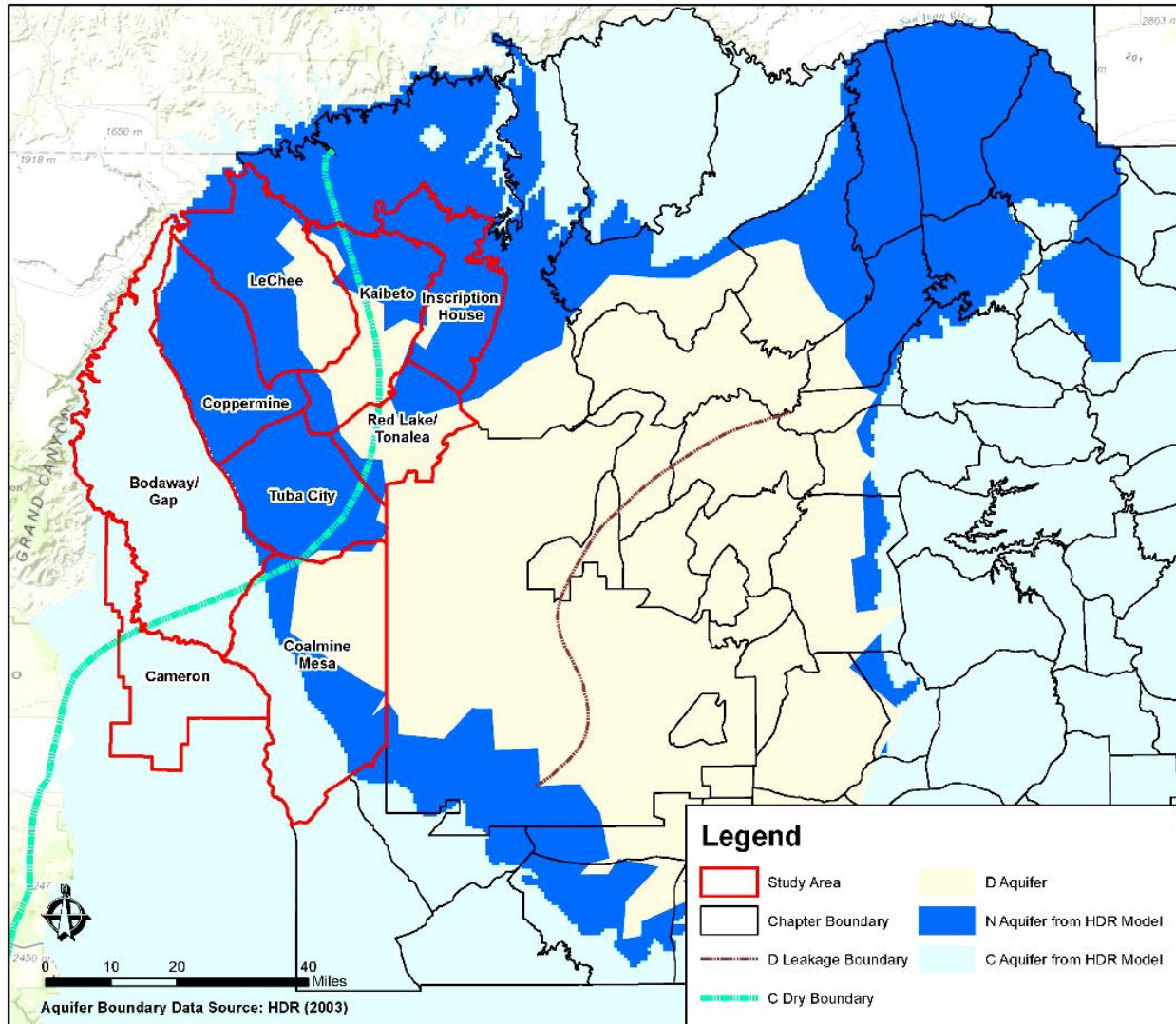
Table 4-2. Irrigation and Livestock Water Sources in the Former Bennett Freeze Area

Type	Number
Dam	180
Livestock Tank	63
Livestock Tank and Earthen Dam	19
Livestock Tank and Windmill	41
Windmill	3
Total	306

Source: Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area, BIA, June 2017.

4.1.2.2 Groundwater

The groundwater on the Navajo Nation comes from several stacked and local aquifer sources. The most significant sources of water within the FBFA include five aquifers: the Coconino (C), Navajo (N), Morrison (M), Mesa Verde (V), and the Dakota (D) (Map 4-5). These aquifers consist of mainly permeable sandstones with clay and mudstone layers that serve as confining units. The northern portion of the FBFA is served by the Navajo (N) aquifer, and the southeast portion is served by the Coconino (C) aquifer. In the southwest portion of the FBFA, these aquifers are dry, and the communities must rely on alluvial aquifers of the Little Colorado River Basin. The Navajo (N) aquifer is considered one of the most pristine aquifers in the nation and yields the highest quality of water. Water from the Navajo (N) aquifer is generally calcium bicarbonate in nature near recharge areas, but through geochemical processes of ion exchange becomes more sodium bicarbonate in nature as water moves to points of natural discharge in the northwest extents. The groundwater supply of both the Navajo (N) and Coconino (C) aquifers is considered sufficient with storage estimated to be 526 million acre-feet and 413 million acre-feet, respectively. Other localized pockets of colluvium, alluvial deposits, with good hydraulic characteristics can provide small amounts of water but these are not major sources of groundwater and are not considered feasible for development.



Source: Navajo Nation Dept. of Water Resources (NNDWR) and the 9 Chapters (Bodaway, Cameron, Coalmine, Coppermine, Inscription House, Kaibeto, LeChee, Tonalea, and Tube City Chapters) Regional Water Plans February 2016; and the Navajo Nation Water Management Branch (NNWMB) and Navajo Tribal Utility Authority’s (NTUA) Master Public Water System Plans for 9 Chapters April 2016; and Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area June 2017.

Map 4-5. Groundwater Aquifer Extents within the Former Bennett Freeze Area

4.1.2.3 Water Quality

According to studies in 2008 FBFA Recovery Plan, 2016 Master Public Water System Plan for 9 Chapters; and Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area June 2017, several issues concerning water quality have developed in the FBFA. Notably, there are water quality issues associated with the presence of abandoned uranium mines (AUM) located in the Bodaway-Gap, Cameron, Coalmine Canyon, and Tuba City Chapters. These issues are in local pockets of alluvium and colluvium near the mine sites and no significant level of radionuclide contamination has been detected in the major source aquifers of the area; however, the mere presence of this contamination within the area presents a risk to public health.

Also, it is not clear if hydrologic connections exist between these localized aquifers and the deeper groundwater sources.

Other areas of concern for water quality include: lack of vegetation, overgrazing, road building, and trash dumping (Rich 2018). Trash dumping, due to lack of landfills, leads to widespread contamination of both surface and groundwater sources. Lack of vegetation, overgrazing, and road building contribute to erosion, which is one of the largest environmental factors affecting water quality in the area.

The lack of infrastructure exacerbates water quality issues and creates higher risks to public health where livestock windmills may be more conveniently located than regulated drinking water sources. Some anecdotal reports, indicating windmills may be contaminated with uranium, have been received (2008 FBFA Recovery Plan, NNEPA Uranium Report). However, source water testing is required for all public water systems, and while no regulated sampling scheme is outlined in the water code for windmill sites, the Navajo Nation Safe Drinking Water Act (NNSDWA) grants Navajo Nation Environmental Protection Agency (NNEPA) authority to sample and test water quality at any impoundment, diversion, or well site within the Navajo Nations jurisdiction. Additionally, the Navajo Nation aquifer protection program, approved by the Resource Development Committee through resolution RDCJN-56-17, outlines regulations to protect aquifer sources at livestock and other agricultural operations on the Navajo Nation.

4.1.2.4 Water Infrastructure

With the lack of development during the Bennett Freeze, one of the most pressing needs is the expansion of infrastructure throughout the FBFA. The lack of infrastructure within this area establishes the most significant water resource issue on the Navajo Nation that also contributes to poor economic development and a sustained level of poverty (NNDWR 2011). It is estimated approximately 30 to 40 percent of households in the FBFA lack connection to a municipal and domestic water system (NNDWR 2016). This forces the communities to depend upon water hauling for everyday uses.

Water hauling on the Navajo Nation is a common practice that also costs money that could be utilized for other projects. The 2008 Draft NN Water Resources Development Strategy estimated costs associated with water hauling and revealed that the total cost of water hauling was \$43,000 per acre-foot, compared to the average \$600 per-acre foot for a typical subdivision in the region (NNDWR 2011). Also, the Navajo Water Code prohibits any development within 0.5-mile of a well or windmill (NNDWR 2008). Table 4-3 shows the total number of households by Chapter without access to potable water.

Table 4-3. Percent of FBFA Households without Access to Public Water System

Chapter	Affected Households	Total Households*	Percent of Households
Tuba City	21	2,433	1
Tonalea	25	651	4
Bodaway-Gap	33	474	7

Tolani Lake	26	202	13
Cameron	67	326	21
Coalmine Canyon	41	190	22
Kaibeto	101	465	22
Leupp	186	450	41

*Total number of household's data extracted from 2010 US Census. Indian Health Services did not provide data for Coppermine.

Other contributing factors to the water scarce region include lack of employment to sustain the economy, inadequate water infrastructure hindering economic growth and development, old infrastructure that is deteriorating, and limited capital to invest in new development.

To develop a strategy for water resources, the NNDWR conducted an existing infrastructure inventory in 2016 in the FBFA (Table 4-4). This inventory aids in the assessment to improve water supply to the communities within the FBFA.

Table 4-4. Existing Infrastructure in the Former Bennett Freeze Region

No.	Location	PWSID	Active Wells	Storage Tank	Distribution Piping	Pressure Zones	Booster Station
1	Cameron	AZ0403010	2	2	1	3	0
2	Bodayay-Gap	AZ0403010	2	5	1	17	2
3	Coalmine Canyon	AZ0400207	1	1	1	1	0
4	Kaibeto	NN0400348	2	2	1	6	1
5	Coppermine	NN0400814	2	3	1	5	1
6	Second Chance – White Mesa	AZ0400209	2	3	1	9	1
7	LeChee	AZ0400206		3	1	3	1*
8	Tuba City – Rare Metals	AZ0400206	7	6	1	16	1

9	Inscription House	NN0400283	2	4	1	17	1
10	Red Lake - Tonalea	NN0400379	1	1	1	2	0

*Supply booster from the City of Page water system.

The Master Public Water System Plan, Tuba City Regional Water Plan, and Chapter water plans for the nine affected Chapters were prepared by Brown and Caldwell for the Navajo Nation Department of Water Resources in 2016. These plans outline current public water system capabilities and infrastructure for the nine Chapters affected by the freeze, provide estimates for future demands, and recommends capital improvements related to capacity, distribution, and storage.

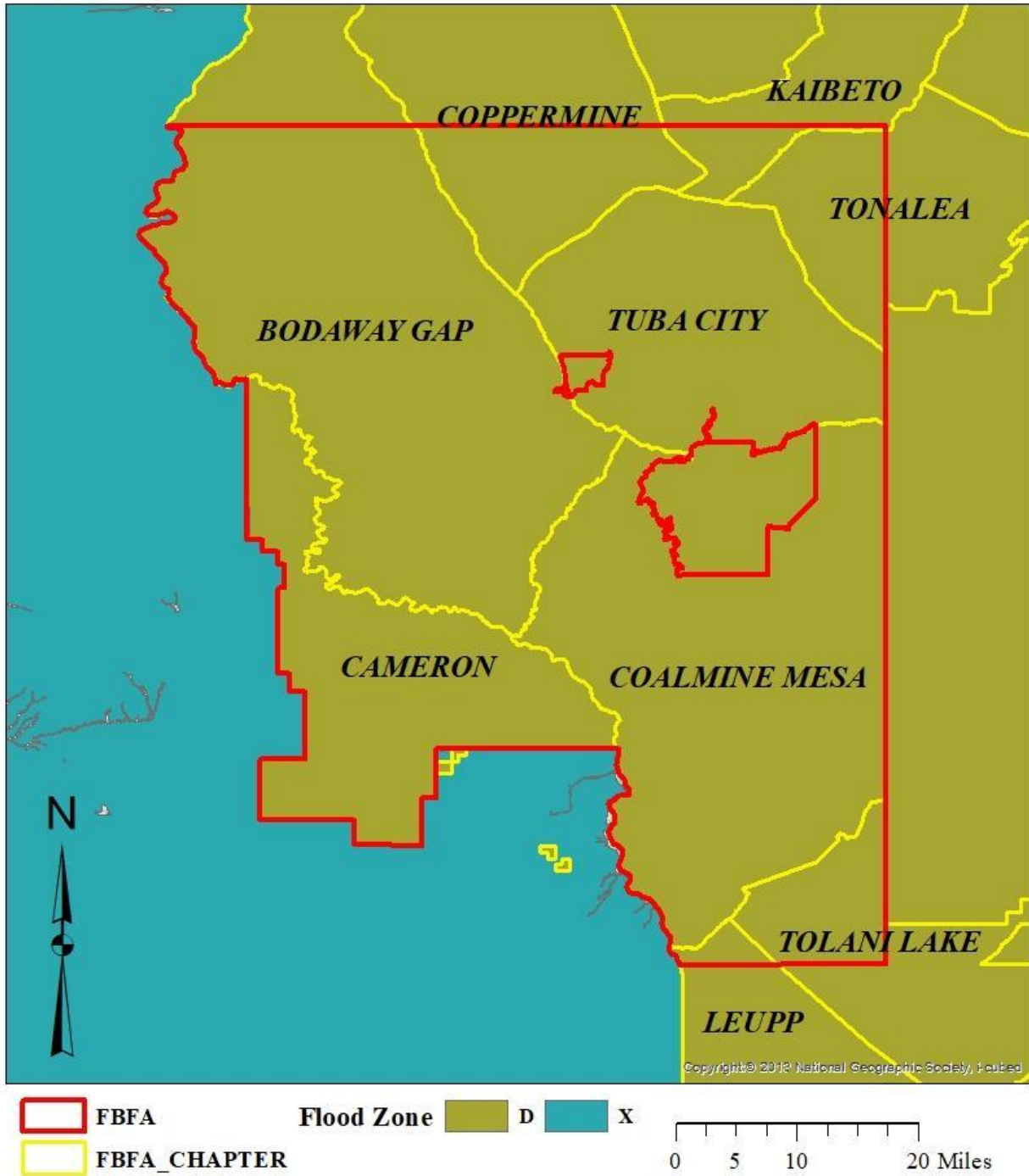
4.1.2.5 Floodplain Management

According to a map produced using data from the Federal Emergency Management Agency’s (FEMA) Flood Map Service Center (Map 4-6) the entire planning area is designated to be in flood zone D (FEMA 2019) The Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The designation of Zone D is also used when a community incorporates portions of another community’s area where no map has been prepared. (FEMA 2011).

Floodplain maps and flood hazard maps are an important management tool for use by resource managers. They assist in developing lands in a responsible manner that protects lives and property within a community. However, flood risks are dynamic and can change over time. Water flow and drainage patterns can be altered dramatically due to surface erosion, land use, and natural forces. Consequently, flood maps have a variable expiration date. Thus, the Federal Emergency Management Agency has been updating the nation’s flood maps using the latest data gathering and mapping technology and new flood maps are being issued nationwide. (FEMA 2011).



FBFA Flood Zone Map



Map 4-6. Flood Zone Map for the Former Bennett Freeze Area

4.1.3 Air Quality

The Navajo Nation is a federally recognized Indian Tribe with inherent powers of sovereignty and authority to manage and control the use of Navajo lands and resources. In conjunction with management and development of Navajo resources, the Navajo Nation Council has recognized the need to preserve and protect the Nation's pristine air resources.

The NNEPA has the authority to regulate sources of air pollution on the Navajo Nation through its Navajo Air Quality Control Program (NAQCP). To ensure that air on the Navajo Nation is safe and of good quality, the NAQCP undertakes monitoring and analysis of air quality data to establish existing conditions of air quality and take steps to protect the air quality by regulating sources of air pollution. The program also works with local, tribal, state, and federal agencies to plan and implement innovative strategies to protect Navajo Nation's future air quality.

Air emissions on the Navajo Nation are addressed through programs developed to meet the air resource management needs of the Navajo Nation in accordance with the CAA and amendments.

The USEPA regulates criteria pollutants using the National Ambient Air Quality Standards (NAAQS), (40 CFR § 50.6), which establish ambient levels for each criteria pollutant using health and welfare-based criteria. The NAAQS are regulated to protect human health and the environment. The NAAQS consists of six criteria pollutants for which the Navajo Nation monitors four: particulate matter 2.5 (PM_{2.5}, or airborne particles 2.5 microns in diameter and smaller), ozone (O₃), sulfur dioxide (SO₂), and nitrogen dioxide (NO₂). There are two series of standards. The "primary" standards are designed to provide an adequate margin of safety that is essential to protecting public health. The "secondary" standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of a criteria pollutant in the ambient air. The primary standards protect public health and secondary standards protect public welfare by preventing damage to property such as farm crops and buildings, visibility impairment in national parks and wilderness areas, and the protection of ecosystems.

The Navajo Nation has proposed a rule to establish a minor source permitting program under the Navajo Nation Clean Air Act. Under the proposed Navajo Nation Minor Source Permit Regulations, the Nation will provide air pollution permits for minor sources to help reduce methane and volatile organic compounds (VOCs) emissions. Under the proposed rule, minor sources must not emit more than 5 tpy (tons per year) of VOCs in an attainment area. Also, under the proposed rule if the Navajo Nation were to become designated as non-attainment, the applicable threshold for a proposed source or modification will be determined based on the designation where the source is or would be located. If the source straddles the two areas, the more stringent thresholds would apply.

The Navajo Nation's proposed minor source rule will help reduce methane emissions by identifying oil and gas facilities on the Navajo Nation through a permitting process. Tracking oil and gas emissions from wells, monitoring the types of oil and gas wells and retaining location information of oil and gas wells will provide a foundation for future assessments and recommendations on reducing emissions, including planning for regulatory initiatives to further reduce emissions from applicable sources. The Navajo Nation then can provide recommendations to industrial sources such as oil and gas facilities, agriculture, and businesses and homes to lessen emissions.

The "Tribal Minor New Source Review Program for Indian Country", (76 Fed. Reg. 38784 (July 1, 2011), 40 CFR §§ 49.151-161), currently regulates minor sources on the Navajo Nation. After the Navajo Nation issues its own Minor Source Program regulations, the NAQCP will seek to implement this program in place of the federal government. The NAQCP implementation will give the Navajo Nation greater control over its air resources and will allow the Navajo Nation to regulate emissions of air pollution that may impact the environment, public health and welfare, and cultural and religious resources. The proposed rule also would impose fees to cover the costs of administering the minor source program, including permit application, revision and renewal fees, annual emissions fees, fees for coverage under general permits, and registration fees.

4.1.3.1 Operating Permits Program

The NNEPA received delegation approval for Part 71 Operating Permit Program (also known as Title V) from USEPA Region IX on Oct. 13, 2004 and March 21, 2006. This authority allows NNEPA to administer an air program under the CAA. The goal is to ensure that air emissions from the 13 major sources, with potential to emit pollutants over 100 tons per year, are regulated. These sources are required to obtain 5-year operating permits that include emission limits and compliance measures, such as monitoring, record keeping, reporting, and testing to maintain compliance with those limits in accordance with Navajo Nation Operating Permit Regulations and Navajo Nation Acid Rain Deposition Control Regulations. The Title V facilities provide information on emissions to both the USEPA and the NNEPA.

The 13 major Title V sources on the Navajo Nation are: Navajo Generating Station, Four Corners Power Plant, Peabody Western Coal Company-Kayenta Complex, Resolute Natural Resources-Aneth Unit, Western Refinery-Wingate Plant, Kinder Morgan-El Paso Natural Gas Compressor Stations (Leupp, Navajo, Dilkon, Window Rock, White Rock, and Gallup), Transwestern Pipeline Company-Leupp Compressor Station, and Preferred Sands of Arizona.

In addition to the Title V facilities, a variety of point, area, and mobile sources contribute to air pollution on the Navajo Nation. To protect air quality on the Navajo Nation, the NAQCP works closely with all entities that contribute to air pollution problems on the Navajo Nation. The program undertakes routine monitoring to better understand these problems and takes steps to identify and regulate sources of air pollution.

Navajo Nation Minor Source Permit Regulations, expected to be finalized and presented to the RDC for approval in early 2020, are being developed by NNEPA. Following RDC approval, USEPA will then review the regulations. Once approved by RDC and USEPA these regulations will be applicable to identified sources within the FBFA.

4.1.3.2 Air Monitoring Section

The Navajo Nation Air Monitoring Section is responsible for operating and maintaining the NAQCP ambient air monitoring network on the Navajo Nation. The NAQCP uploads collected air quality data to USEPA's Air Quality Systems (AQS) database, which is then used to determine compliance with the NAAQS.

On the Navajo Nation, the air monitoring network maintained by the NAQCP, collects gaseous, particulate and meteorological data that are uploaded to the AQS database as part of its structure to maintaining a highly reliable, continuous ambient air monitoring network and/or special studies that meet federal and tribal requirements.

The AQS contains ambient air pollution data collected by the USEPA, state, local, and tribal air pollution control agencies from over thousands of monitors. The AQS also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information.

Two monitoring sites are currently operated on the Navajo Nation; one at Shiprock, New Mexico and the other at Nazlini, Arizona. Neither of these monitoring sites are located in the FBFA. The Shiprock station is equipped with federal reference method gaseous analyzers that monitor for ground-level O₃, SO₂ and oxides of nitrogen (NO, NO₂, NO_x). The Shiprock station is also equipped with a 10-meter meteorological tower that measures wind speed, wind direction, relative humidity, temperature, precipitation, and solar radiation. The Nazlini station consists of collocated federal reference method monitors that measure filter-based PM_{2.5}.

4.1.3.3 Navajo Nation Open Burn Regulations

The purpose of the Navajo Nation Open Burn Regulations (NNOBR) is to protect the health, safety, and general welfare of all residents on the Navajo Nation. The regulations are intended to discourage open burning disposal practices where alternative methods are feasible and practicable. These regulations apply to all persons and all property within the Navajo Nation. These regulations apply to all persons and all property within the Navajo Nation, as defined in 7 NNC §254(A). The NNOBR are promulgated under the authority of § 1103 of the Navajo Nation Air Quality Pollution Prevention and Control Act, 4 NNC §§1101-1162.

Open burning is defined as the burning of hazardous materials and household waste that releases chemicals into the air without controls. Open burning is prohibited within the Navajo Nation unless an Open Burn permit is obtained, or the event is an exempted activity. Individuals who conduct open burning without a permit or are within a 10-mile radius of a transfer station/disposal facility are in violation of NNOBR and are subject to field citations or other penalties.

Fires set for agriculture, forestry and silvicultural, and cultural and traditional purposes are an exempted activity under the open burn regulations. However, they must be registered with the NNEPA-NAQCP for information purposes only. Agricultural burning refers to the burning of vegetation from an agricultural activity necessary for disease or pest control or for crop propagation and or crop rotation, also includes branding livestock. Agricultural burning does not include the burning of manure. Forestry and silvicultural burning refers to the burning of vegetation debris from forestry or silvicultural activities necessary for disease or pest control to reduce fire hazards, reforestation, or ecosystem management. Fires set for cultural and traditional purposes means the open burning is conducted pursuant to Navajo beliefs, customs and practices that have been passed through generations, usually orally or through practices. Registration forms for agriculture, forestry and silvicultural, and cultural and traditional burning can be obtained from the NNEPA-NAQCP website, and submitted through email, fax or in person.

4.1.4 Climate

Due to the arid climate of the region, drought has been and will continue to be of major concern to the Navajo people (Navajo Nation Drought Contingency Plan 2003). The impacts of drought will affect domestic water haulers, public drinking water systems, dryland and irrigation farmers, ranchers, recreation, wildlife, and forestry (NNDWR 2003).

Drought is common on the Navajo Nation and likely to increase due to changes in precipitation and heat patterns associated with climate change. Irrigation farming communities within the FBFA with access to the Little Colorado River alluvium, wells, or springs are considered by the NNDWR to be of low to medium drought risk. Communities within the FBFA with storage reservoirs are considered by NNDWR to be of medium to high drought risk. Dry cycles can reduce surface water supply which can impact irrigation farms. The Red Lake – Tonalea irrigation project is located within the low to medium drought risk region of the FBFA. Irrigation projects and dryland farming communities within the Kerley Valley (Upper Moenkopi-Tuba City) region are considered in a high drought risk category.

Drought affects a wide variety of ecological processes that are vital to aquifer recharge, water quality, and other dynamics critical to the hydrologic environment. Access to water and the impacts of drought on existing water supplies should be considered in development plans for the FBFA. Communities within the higher drought risk regions may require more strategic planning associated with development of water infrastructure and water access than communities in lower drought risk areas of the FBFA. The Navajo Nation Drought Contingency Plan (NNDWR 2003) should be consulted on all such matters.

4.1.4.1 Climate Resilience

Global warming and climate variability are likely to result in changes to the climate (e.g., temperature, precipitation timing, duration, intensity, and frequency), to the hydrology (e.g., snowmelt timing, streamflow), and to the ecosystems (e.g., species geographic distributions and population sizes) of the Navajo Nation (Nania et al. 2014). Much of the Navajo Nation economy and lifestyle are based on traditional practices such as livestock grazing (e.g., sheep, cattle, goats) and craft-making (e.g., weaving, jewelry production, artistry) (Nania et al. 2014) all of which are likely to be impacted by climatic changes.

Across the southwestern US, temperatures have increased on average 2°F within the last century and the 2001 to 2010 decade was the hottest on record (Melillo et al. 2014). The Navajo Nation is located within the hottest and driest region of the US and across this region of the arid west, temperatures have increased on average 1.6°F. Temperature data indicate that since 1995, the Navajo Nation has consistently experienced annual average temperatures warmer than the long-term average of 1905–2011 (Crimmins et al. 2013).

The southwest US including the Navajo Nation has experienced several multi-year to decades long droughts from 1905 to 2011 (Technical Review of the Navajo Nation Drought Contingency Plan – Drought Monitoring Michael Crimmins, Nancy Selover, Karen Cozzetto, and Karletta Chief, 2013). Moreover, the period from 1994 to 2009 was the longest drought measured during the 20th century (Crimmins et al. 2013, Crimmons et al. 2017). Historically, winter precipitation was primarily snow and has transitioned to predominantly rainfall during the winter season. Overall, a long-term decrease in both

regional winter precipitation and regional annual precipitation has been observed starting in the 1930s (Redsteer et al. 2014). Warmer temperatures can influence evapotranspiration rates which can further reduce combined with a reduction in annual precipitation has led to an overall decrease in available surface water features. Elders from the Navajo Nation report a significant loss of surface water including springs and other water features. More than 30 percent of historical perennial water features on the reservation have disappeared or are ephemeral (Redsteer et al. 2018). Decreasing surface water availability translates to a decrease in water available for cities, agriculture, and ecosystems across the entire Navajo Nation and drought and increased warming foster wildfires and increased competition for scarce water resources for people and ecosystems (Melillo et al. 2014).

Average annual temperatures are anticipated to rise an additional 3.5°F to 9.5°F by the end of the 21st century with the greatest temperature increases expected during the summer and fall seasons (Melillo et al. 2014). Climate projections for the mid- to late-21st century show a warmer climate with less annual precipitation across the entire southwest region of the US. Temperature projections modeled with a low-emissions scenario (conservative estimate of change) indicate that temperatures will rise 1°F to 3°F during 2021–2050 period. Temperature projections modeled with a high-emissions scenario (substantial estimate of change) do not differ significantly from the predictions with low-emissions scenario until 2070 where model predictions indicate a 5°F to 9°F during 2070–2099 (Crimmins et al. 2013). Model projections show that temperature increases are anticipated to be greater in summer and least in winter seasons. The same simulations also indicate increases, by a minimum of 17 days, in the length of the annual freeze-free growing season by mid-21st century (Crimmins et al. 2013; Melillo et al. 2014; Nania et al. 2014).

4.2 Agriculture and Rangeland Management

The Department of the Interior’s Bureau of Indian Affairs (BIA) holds primary responsibility for the stewardship of Indian trust lands, specifically, the conservation and protection of the land.

The Bureau of Indian Affairs’ mission is to fulfill its trust responsibilities and promote self-determination on behalf of Tribal Governments, American Indians and Alaska Natives.

BIA utilized Range Handbook over the years to manage agricultural and range activities in which it is being updated and a draft 2018 Procedural Handbook for Agricultural and Range Handbook. The purpose of this handbook is to provide the basic policies, requirements, responsibilities, and accountability that apply to the Bureau of Indian Affairs (BIA) Agricultural and Range Management Program. The Agricultural and Range Management Program administers federal laws and regulations and tribal laws and policies pertaining to agricultural land development and management, farmland leases, and rangeland permits.

In order to protect, conserve, utilize, and manage Indian agricultural and grazing lands, BIA must inventory and monitor agricultural resources; develop agricultural resources management and conservation plans for the trust Indian assets; and conduct lease and permit administration, compliance, and enforcement. This handbook provides operating procedures for BIA and Tribal employees that manage and protect the trust agricultural resources and it contains helpful information in performing these functions.

The handbook implements the Department of the Interior's Fiduciary Trust Model. Additionally, the handbook supersedes Supplement 1 and 2 in 55 BIAM and reflects changes to 25 CFR 166 grazing permit regulations and portions of 25 CFR 162 related to agricultural leases, which have been revised to implement the American Indian Agricultural Resources Management Act (AIARMA) and NEPA. See the Glossary of Terms and List of Acronyms for additional assistance.

The Act and regulations seek to balance BIA responsibility as trustee of Indian land and resources with the need for Indian tribes and individual Indian landowners to lease and permit their agricultural and range trust lands.

BIA's obligation is to protect and preserve the trust resources on the land, including the land itself, on behalf of the Indian landowners. Protection and preservation includes conservation, best management practices, and protection against misuse of the property. BIA uses the best scientific information available and reasonable and prudent conservation practices to manage trust and restricted Indian lands. Conservation practices must reflect tribal land management goals and objectives.

BIA Soil Conservationists and Rangeland Management Specialists are involved in farmland, rangeland, and livestock management. The natural resources staff may also develop management plans for noxious weed management, watershed management, game and fish management, outdoor recreation, wildfire prevention and control, emergency stabilization and rehabilitation, prescribed fire, and land and livestock law, enforcement, and regulation enforcement and litigation. Additionally, BIA may be asked to function in these disciplines as advisors and instructors. Decisions relative to these disciplines and functions are affected not only by science, laws, regulations, and policies; but may be influenced by social, cultural, and traditional differences within and among Indian groups.

It is the policy of the Bureau of Indian Affairs to:

- Comply with the American Indian Agricultural Resources Management Act of December 3, 1993, as amended.
- Comply with applicable environmental and cultural resources laws.
- Comply with applicable sections of the Indian Land Consolidation Act, as amended.
- Unless prohibited by federal law, recognize and comply with tribal laws regulating activities on Indian agricultural land, including tribal laws relating to land use, environmental protection, and historic and/or cultural preservation.
- Facilitate tribes in the management of Indian agricultural lands either directly or through contracts, compacts, cooperative agreements, or grants under the Indian Self-Determination and Education Assistance Act, as amended.
- Administer land use as set forth by 25 CFR 162 - Leasing and Permitting and 25 CFR 166 - Grazing Permits. (See Exhibit 3 – 25 CFR 162 and Exhibit 4 – 25 CFR 166.)
- Seek tribal participation in BIA agricultural and rangeland management decision-making.
- Integrate environmental considerations into the initial stage of planning for all activities with potential impact on the quality of the land, air, water, or biological resources.
- Investigate accidental, willful, and/or incidental trespass on Indian agricultural land.
- Provide leadership, training, and technical assistance to Indian landowners and permittees/lessees.

- Keep records that document the organization, the functions, the conduct of business, decisions, procedures, operations, and other activities undertaken in the performance of federal trust functions.
- Restrict the number of livestock grazed on Indian range units to the estimated grazing capacity of such ranges, and develop such other rules and regulations as may be necessary to protect the range from deterioration, to prevent soil erosion, to assure full utilization of the range, and like purposes.
- Ensure farming and grazing operations be conducted in accordance with recognized principles of sustained yield management, integrated resource management planning, and sound conservation practices.

The BIA Navajo Regional Office developed Standard Operating Procedures (SOP) and Guidelines to support consistent implementation of the federal regulations for administering grazing and agricultural land use permits on the Navajo Nation. The SOP provides guidance and standards for rangeland management and health, conservation, environmental evaluation and stewardship; and sustainability of Navajo Nation natural resources for agricultural use purposes in the future.

The BIA Navajo Region is given the authority to approve, administer, and grant grazing permits on tribal lands through Title 25 CFR Parts 161, 166, and 167 to regulate grazing and agricultural land use permitting on the Navajo Nation.

The BIA Navajo Region works closely in partnership with the Navajo Nation government, its officials and decision makers on a “Government-to-Government” basis.

The BIA Navajo Region has five agencies (Chinle, Eastern, Fort Defiance, Shiprock, and Western) and the Navajo Partitioned Lands (NPL) Office that implements grazing regulations within the Navajo Nation (BIA Navajo Regional Office, Division of Natural Resources, Working Draft Standard of Operating Procedures for Agricultural Land Permitting, Management and Standards, March 08, 2019).

The roles and responsibilities of the BIA Navajo Region and Navajo Nation are defined in the federal regulations and tribal codes. The current roles and responsibilities of BIA Navajo Region, Navajo Nation Resources and Development Committee, Navajo Nation Department of Agriculture, Navajo Tribal Courts, as well as permit holders are described below.

These roles and responsibilities have changed over time as the relationship between federal and tribal governments has shifted to place more responsibility for the management of tribal resources from federal to tribal jurisdiction. Even though the BIA Navajo Region has taken more of an advisory role in grazing and agricultural land use permitting, the BIA still receives recommendations from the Navajo Nation. The BIA Navajo Region has the sole authority to issue grazing and agricultural land use permits on the Navajo Nation but based on the recommendation of the Navajo Nation Grazing Committee, Farm Boards, and Eastern Navajo Land Board.

4.2.1 Agriculture

The Navajo Nation and the BIA are responsible for the management of all agricultural activity on the Navajo Nation as regulated by (25 CFR Part 167, NNC Title 3). These regulations are designed to

preserve natural resources on the Navajo Nation. In addition, the management of rangeland resources and dryland farms are supported by the Navajo District Grazing Committees and the irrigated farms/croplands are supported by the Navajo Nation Western Farm Board. These two entities are comprised of local elected members of the community that serve as a conduit between the government and the agricultural producers.

There are numerous cropland areas where a variety of traditional crops are grown. The Tuba City/Moenkopi Irrigation project is in the Kerley Valley area of the FBFA. The irrigation area is utilized by the Navajo and Hopi tribal members. This irrigation project is considered an intermittent water source, as its source is diverted from the Moenkopi Wash by a historic diversion dam. In the croplands west of Tuba City are small spring-fed irrigation projects and orchards and vineyards. Most of the crops grown in these areas are for seasonal consumption and for personal use by the families who grow the crops. Crops not used by the immediate families are marketed locally along roadways, and at flea markets and seasonal farmers markets.

4.2.1.1 Navajo Agricultural Land Use Permits

Agricultural Land Use Permits (ALUPs) were established on the Navajo Nation for the purposes of:

- Demonstrating methods of agricultural production, farm management and crop marketing, irrigation management, and other measures.
- Promoting accurate agricultural product and land management recordkeeping.
- Monitoring and preventing plant disease.
- Protecting the Navajo Nation's food supply and agricultural markets.

There are two types of ALUPs depending on whether the land is irrigated or not. ALUPs enable permit holders to use specific areas of land for agricultural use such as crop cultivation, greenhouses, irrigation, and related agricultural activities.

Administration and processing of ALUPs is authorized by NNC Title 3 Farm Board Sections 61-69, 151-154, 171-176 (clustered farm lands). The BIA management of Navajo ALUPs is authorized under Article V of the Treaty with the Navajo Tribe of Indians of June 1, 1868.

The District Grazing Committees oversee scattered/dryland farm lands across the Navajo Nation. The District Grazing Committee and Major Irrigation Farm Board have the authority to enforce and carry out the management duties and responsibilities for small irrigated projects and scattered farm acreage within their districts. Whereas, the applications for irrigated farmlands for the Tuba City/Moenkopi Irrigation Project (i.e., Vanzee, Moenave) are submitted through the Western Agency's Major Irrigation Farm Board.

The functions of the Farm Board are:

- Review and approve the granting, assignment, re-assignment, cancellation, relinquishment, transfer, leasing and subleasing of ALUPs with the concurrence of BIA and Navajo Nation Department of Agriculture.

- Review and recommend approval to the Navajo Nation Resources and Development Committee of the Navajo Nation Council of the granting of ALUPs, and the construction of irrigation project boundary fences, irrigation canal rights-of-way, water use assessments, or other matters involving agricultural land or irrigation water management in accordance with applicable laws.
- Assess and collect fees for water assessments to be used to improve local irrigation operations and maintenance.
- Mediate and maintain office written records of disputes that may arise among ALUP holders. Copies of all official agreements and records shall be furnished to the Navajo Nation Department of Agriculture and BIA.

In the FBFA area of Western Navajo Agency, 201 ALUPs have been issued encumbering 1,189.85 acres of Tribal Trust land (Table 4-5).

Table 4-5. Summary of the approved Agricultural Land Use Permits in the Former Bennett Freeze Area

Land Management District	Cropland Project	Number of Permits	Acres	Type
1	Miscellaneous	6	44.40	Dryland
3	Cedar Ridge	41	284.00	Dryland
3	Little Field	16	55.03	Irrigated
3	Lower Moencopi	10	47.50	Dryland
3	Moencopi/Tuba	57	409.60	Irrigated
3	Moenave	13	53.52	Irrigated
3	Tissi Ei	5	6.75	Irrigated
3	Vanzee	29	49.48	Irrigated
3	Willow Springs	8	48.90	Irrigated
3	Miscellaneous	14	65.67	Dryland
5	Miscellaneous	2	125.00	Dryland

	Total	201	1,189.85	
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4.2.1.2 Noxious/Invasive Weeds

The primary function of the Noxious Weed Eradication program is to provide resource protection on trust lands in compliance with the AIARMA and the Plant Protection Act which consolidates related responsibilities that were previously spread over various legislative statutes, including the Plant Quarantine Act, the Federal Plant Pest Act and the Federal Noxious Weed Act of 1974 and the Federal Insecticide, Fungicide and Rodenticide Act..

Noxious weeds degrade the land ecologically and reduce the value of agricultural production. Continued coordination and cooperation with private, state, and Federal landowners within the reservation boundaries and adjoining lands will eventually allow for the containment and control of weed populations. The Noxious Weed Eradication program also provides education, direction and technical guidance to individual Indians, non-Indian farmers and ranchers, Indian Tribes and Alaska natives involved in controlling noxious weeds.

The BIA Noxious Weed program was initiated in December 1988 in response to congressional directives for improved management on Indian lands. A task force and 10-Year Management Plan were developed and put into the BIA Range and Agriculture Handbook. The Acting Deputy Commissioner of Indian Affairs issued an Interim Policy in 1991 for the Noxious Weed Control Program. This policy directed on-the-ground accomplishments and allocated funds directly for weed control projects. Average annual funding has been approximately \$2 million across Indian Country. Federal funding dollars are appropriated for project-specific implementation; thereby, limiting planning and compliance activities. Program standards and oversight are provided by designated BIA Regional Noxious Weed Coordinators in the Division of Natural Resources at the national level.

The BIA Navajo Region has initiated efforts to control specific target noxious weeds on the Navajo Nation using various methods. In 2009, the BIA Navajo Region created a list of target noxious weed species to prioritize weed management projects. This list is outlined in Table 4-6. High Priority (A) weeds have a potential for widespread expansion and are weeds that the BIA and Navajo Nation consistently request funding for treatment. Medium Priority (B) species are non-native noxious weeds that may occur in isolated patches. Emphasis for these weeds should be on immediate control, prevention of seed spread, and eradication. Low Priority (C) species are normally widespread and well established but are not a high priority due to limited weed funding. All weeds should be managed using education, prevention, identification, monitoring and treatment.

Table 4-6. Bureau of Indian affairs Navajo Region 2009 Noxious Weed List

High Priority – A Rating	
Bull thistle	<i>Cirsium vulgare</i>

Camelthorn	<i>Alhagi camelorum</i>
Canada thistle	<i>Cirsium arvense</i>
Dalmatian toadflax	<i>Linaria dalmatica</i>
Diffuse knapweed	<i>Centaurea diffusa</i>
Leafy spurge	<i>Euphorbia esula</i>
Musk thistle	<i>Carduus nutans</i>
Perennial pepperweed	<i>Lepidum latifolium</i>
Russian knapweed	<i>Acroptilon repens</i>
Russian olive	<i>Elaeagnus angustifolia</i>
Scotch thistle	<i>Onopordum acanthium</i>
Spotted knapweed	<i>Centaurea maculosa</i>
Tamarisk	<i>Tamarix spp.</i>
White top	<i>Cardaria draba</i>
Yellow starthistle	<i>Centaurea solstitialis</i>
Medium Priority – B Rating	
Field sandbur	<i>Cenchrus incertus</i>
Halogeton	<i>Halogeton glomeratus</i>
Low Priority – C Rating	
Cheatgrass	<i>Bromus tectorum</i>
Field bindweed	<i>Convolvulus arvensis</i>

Jointed goatgrass	<i>Aegilops cylindrical</i>
Puncturevine	<i>Tribulus terrestris</i>

BIA Noxious Weed projects have predominantly been organized and developed for site-specific weed issues based on individual land user requests. This current process has resulted in a patchwork approach toward weed management with little coordination between other land users and land management agencies and without consideration for the broader impacts that various noxious weed species have on the Navajo Nation at a landscape scale.

Incidental weed mapping efforts have also been conducted annually from 1998 to 2012 on the Navajo Nation by the BIA, accounting for over 22,000 acres of weed populations documented in the region. Additional mapping efforts have also been conducted by the Arizona Department of Transportation; U.S. Geological Survey (USGS); NRCS; and National Park Service. These incidental data were collected using the protocols developed by the Southwest Exotic Mapping Program (SWEMP) managed by the USGS. SWEMP data provides single species geographic information system (GIS) point data with estimated acreages for each weed infestation. These data are provided by various agencies as a management tool for planning weed removal projects. SWEMP data accounts for approximately 1,800 acres of noxious weed mapping data on the Navajo Nation (SWEMP 2007).

In 2006, the Tribal Invasive Species Council provided a workshop to Navajo agencies and the BIA on how to develop an Integrated Weed Management Plan. An ad hoc working group led by the NNEPA was formed to develop a plan specific to the Navajo Nation. The plan was going to focus on identifying cooperative weed management areas within watersheds on the Navajo Nation. It was anticipated that the plan would enable the NNEPA to obtain funding through the USEPA Clean Water Act Section 319 Grant Funding Program. The Section 319 Program funds projects that implement nonpoint source pollution management programs within watersheds focusing on riparian areas and wetlands. While the plan was a priority, the funding dissolved and the plan was not completed.

In 2010, the BIA Navajo Regional Office and Western Navajo Agency became cooperators for the Moenkopi Cooperative Weed Management Area through a memorandum of understanding between the BIA Navajo Regional Office, Western Navajo Agency, Navajo Partition Lands, the U.S. Department of Agriculture NRCS, the Hopi Tribe, the Navajo Nation, and Peabody Western Coal Company to address noxious weeds within the Moenkopi Watershed (Agreement No. AGN00100004). Under this agreement, the BIA assists with noxious weed management project through educational programs, coordination with other Tribes and agencies, identification and mapping of weed populations, and the provision of project funds. This collaborative agreement was designed to coordinate weed management efforts using a watershed-based approach. Other such efforts have since been organized with the BIA and Navajo Nation serving as important program partners and collaborators. These efforts include the San Juan Basin Weed Management Cooperative and the San Francisco Peaks Weed Management Area.

While these agreements have been important for addressing noxious weed issues using a collaborative and integrative approach, weed populations outside of these management areas are not being addressed in a similar manner. Noxious weed populations in rangelands, farmlands, community areas, and other

riparian areas have created numerous problems for the Navajo people. The BIA Noxious Weed Control Program has continued to assist land users, but without a coordinated and systematic approach towards addressing weed issues. The current approach is driven by consent from the land user through project coordination with the local BIA Noxious Weed Coordinator and resolutions from the local Chapter. This approach has resulted in responsive efforts as opposed to a strategic approach to weed management, often treating all weed populations as equally invasive and with little coordination concerning weed treatments on neighboring lands. Current weed management projects also do not adequately provide treatment methods for preventing and controlling the spread of current populations into non-impacted sites. This leaves many areas of the Navajo Nation vulnerable to infestations; especially along roads or waterways or in agricultural and development areas.

In 2012, the BIA Navajo Regional Office (NRO) determined the need for an integrated and coordinated management plan that utilized methodical, science-based strategies to actively monitor and control noxious weeds. In conjunction with developing a weed management plan, NRO determined that compliance with the NEPA was necessary to facilitate discussions with the public regarding potential impacts of weed management. In addition, completing one wholesale environmental compliance effort for integrated weed control would allow the BIA Noxious Weed Coordinators to streamline processes and to elicit large-scale cooperative projects. The Programmatic EIS evaluates, at a programmatic level, the impacts associated with implementation of the plan; however, each project would be required to complete project-specific NEPA compliance documents, as well as to seek compliance with the National Historic Preservation Act and the Endangered Species Act.

In response to the identified need for a more balanced approach to weed management, the BIA initiated the development of a weed management plan. This Integrated Weed Management Plan (IWMP) identifies weed species of concern, details weed removal strategies, and consolidates the best management practices available for weed control. Best management practices that have been limited in the past are now an integral component of NRO's weed management efforts, such as early detection and eradication, prevention, and education. This plan will encompass a 10-year period but will incorporate a plan review after 5 years. It is estimated that during the first 5 years of the project, approximately 250,000 acres will be treated. Repeated treatments will be necessary for most species since seeds can be viable in soil for 10 or more years. Therefore, reoccurring weed treatments will be implemented until the desired management goal is reached.

The following objectives were developed for the Navajo Nation IWMP:

- Develop the best control techniques described for the target weed species in a planned, coordinated, and economically feasible program to limit the impact and spread of noxious and invasive weeds.
- Identify and prevent the expansion of existing infestations of target weed species, and quickly prevent the spread of new high priority weed species in the project area.
- Coordinate weed removal efforts with adjacent landowners, land managers, and/or federal agencies to prevent the further spread of weed populations (e.g., State roads and Bureau of Land Management).
- Provide and promote economic opportunities to the Navajo people by improving rangeland productivity and potentially providing economic opportunities to remove noxious plant species.

- Develop a public education program focusing on weed identification, prevention, and removal techniques for local communities and non-profit organizations

This action is needed because existing conditions within the Navajo Nation indicate that noxious weed populations have expanded from a few, small infestations to more than 110,000 acres. Studies have shown that many noxious plants can displace, reduce, or eliminate native plants and animals within various habitats within 3 to 10 years (Sheley et al. 1999). These weed species pose a serious threat to biological diversity, livestock forage production, native grassland quality, wildlife habitat quality, and overall ecological health of the region.

Noxious weeds have impacted every habitat on the Navajo Nation, which has affected the economic, historic, and cultural livelihood of the Navajo people. Livestock and agriculture are important economic and societal resources that depend on healthy native grasslands and productive soils. The increasing densities of noxious weeds are further encroaching on important grassland habitats. Many noxious species form dense monocultures (only plant found in an area) that reduce forage quality and quantity for livestock and increase competition for agricultural plants. Russian knapweed, yellow starthistle, halogeton, and other species produce toxic substances that can pose a threat to humans, livestock, and wildlife. Noxious weeds alter physical conditions or disturbance regimes that allow the invasive species to spread further and continue to form monocultures. Because of noxious weeds on rangelands, the overall capacity of the land to support livestock and wildlife has been reduced (Lym and Kirby 1987).

Noxious weeds can alter soil temperature, soil salinity, water availability, nutrient cycles and availability, native seed germination, water infiltration, and precipitation runoff (DiTomaso 2000; Sheley et al. 1999; Lacey et al. 1989). Noxious weeds also occupy space within the landscape and absorb sunlight and utilize soil moisture that otherwise would be available for native plants. Monocultures of noxious weeds can cause greater risk of catastrophic fires, causing further declines in native shrubs and grasses. Species, such as camelthorn, can cause economic damage to infrastructure. Camelthorn follows water sources, and on the Navajo Nation has penetrated infrastructure walls and water lines. This species and others can grow through surfaces impenetrable to other plants, including: pavement, concrete, and the foundations of houses and buildings (USFS 2012).

Disturbed habitats provide a platform for the establishment of noxious weeds. Due to high rates of disturbance, weeds are frequently introduced within development areas and along roads and rights-of-way. Noxious weeds are introduced from vehicles carrying seed or plant material, construction material, or garbage. These linear corridors provide a thoroughfare for rapid weed expansion to adjacent wild, agricultural or rangelands. Also, rights-of-way provide access points for weeds to spread to riparian corridors from runoff or road crossings over waterways.

Finally, the expansion of noxious weeds within riparian areas is also a concern. Riparian areas on the Navajo Nation are regularly disturbed by flooding events that provide an opportunity for noxious weed invasion. Woody noxious species such as tamarisk and Russian olive have formed dense monocultures within many riparian areas on the Navajo Nation, limiting biodiversity. The introduction of the tamarisk leaf beetle and its subsequent migration in the riparian corridors of the Navajo Nation, has left many areas devoid of living plant material. The monocultures of dead, standing tamarisk in riparian areas increases the risk of wildfire. The BIA currently monitors annual tamarisk leaf beetle movement as part of a collaborative effort with the Tamarisk Coalition to document its annual expansion within the

southwestern US. Such monitoring has identified several locations within the Navajo Nation that are heavily impacted from beetle infestations.

4.2.2 Rangeland

Livestock production is an important industry in terms of economic benefit and a cultural way of life for the Navajo people. Most of the land on the Navajo Nation is used for grazing by residents (WHPacific 2008). The livestock producers raise livestock for multiple reasons like financial gain, subsistence, and ceremonial use.

The desire to increase wealth by way of livestock has contributed to a significant increase in the livestock population on the Navajo Nation. Where the larger the number of livestock owned was

Land Management Districts (aka Grazing Districts) were established for the Navajo Nation in 1937 (USDA NRCS R. Davis, Conservation Culture 1997; Fonaroff 1963). “The Land Management districts were conceived as “natural units of land (drainages or sections thereof) in which all natural resources of the land appear in proper perspective in management and are allotted their proper role with respect to present and future human needs from the standpoint of use” (Planning and Policy Records, 1930-1940 National Archives; L. Schuyler Fonaruff, “Conservation and Stock Reduction on the Navajo Tribal Range” Geographic Review, Vol. 53, No. 2, April 1963, Page 215 The FBFA is situated in three Land Management Districts: 1, 3 and 5. In addition, the LMDs were established so administrators could address problems and interests of Navajos better on a smaller scale (L. Schuyler Fonaruff, “Conservation and Stock Reduction on the Navajo Tribal Range” Geographic Review, Vol. 53, No. 2, April 1963, Page 215) then the Navajo Nation as a whole. The original grazing regulations promulgated were for the Navajo and Hopi Indian Reservation to be managed under the Navajo Service Area. Most historical rangeland information and data, at the smallest portion, are restricted to these Land Management Districts. FBFA specific data is generally not available, so rangeland data is presented at Land Management District level for Navajo Nation in general.

Livestock grazing on the Navajo Nation requires an individual to possess a valid grazing permit issued by the BIA based on a recommendation from the Navajo Nation District Grazing Committee. The grazing regulation system, developed in 1944, divided the Western Navajo Agency into five LMDs. The FBFA now includes three LMDs (Table 4-7).

Table 4-7. Land Management Districts and Sub-Units in the Former Bennett Freeze Area

Navajo Chapter	Land Management District	Sub-Unit	Number of District Grazing Committee	Number of Farm Board Committee
Bodaway-Gap	3	3	1	1
Cameron	3	4	1	1

Coalmine Canyon	3	1	1	0
Coppermine	1	3	1	0
Kaibeto	1	2	1	0
Leupp	5	3	1	0
Tolani Lake	5	1	1	0
Tonalea	1	1	1	0
Tuba City	3	2	1	1

*Source: Bureau of Indian Affairs, Branch of Natural Resources.

Grazing Management Overview

To optimize livestock production, livestock are often moved and distributed throughout a grazing area based on the availability of forage resources. To help inform the timing of grazing activities, managers need to understand how different animals forage and how they may be influenced by their environment. Established grazing patterns can be affected by topography, plant distribution and composition, and the location of water, shelter, and minerals (Heitschmidt and Stuth 1991). The total forage production of a given pasture or grazing area does not necessarily reflect the amount of forage available for livestock; therefore, it is important for managers and permittees to recognize restrictions that may affect availability, such as fences, long distances to water, or steep slopes. Once identified, total forage production can be adjusted to account for inaccessible areas. Such areas may be incorporated as an available grazing area if measures, such as developing additional water sources or implementing rotating fencing structures, are used. Such measures can also help conserve forage resources for more sustainable use on rangelands.

Once forage patterns of a herd have been understood, production and forage value data can be used to help determine the number of animals that can sustainably graze in a given pasture or grazing area. Stocking rates are used to determine the number of acres needed per year within a given area to support one animal unit per year. Lower stocking rates indicate that more resources are available for individual animals, which can lower competition between members of the herd and with wildlife. Conversely, high stocking rates indicate lower availability of resources, which can increase competition. For some animals, such competition can be beneficial for short-term livestock production, but is typically not sustainable over prolonged periods of time. The final stocking rate determination, however, must consider the ecosystem as a whole, including utilization needs of wildlife species in the area. For the Navajo Nation, grazing permit holders must reserve 25% of available forage in their customary use areas for wildlife (Samuel Diswood, Navajo Nation Department of Fish and Wildlife, personal communication, November 17, 2016, Figure 4-3). NRCS and local range management experts recommend reserving 50% of the available forage to provide adequate leaf and root mass to produce more forage, maintain plant health, protect the soil, and for wildlife (Holechek 1988, Holechek & Pieper 1992, Galt et al. 2000, Hurd et al.

2007, NRCS 2009). Maintaining the long term viability of rangelands is important for supporting the long-term health of livestock, and the long-term financial gains of permit holders, many of whom depend on grazing as an important source of livelihood. Viable rangelands also provide for the continued health of the environment, by supporting healthier air, water, and soil resources.

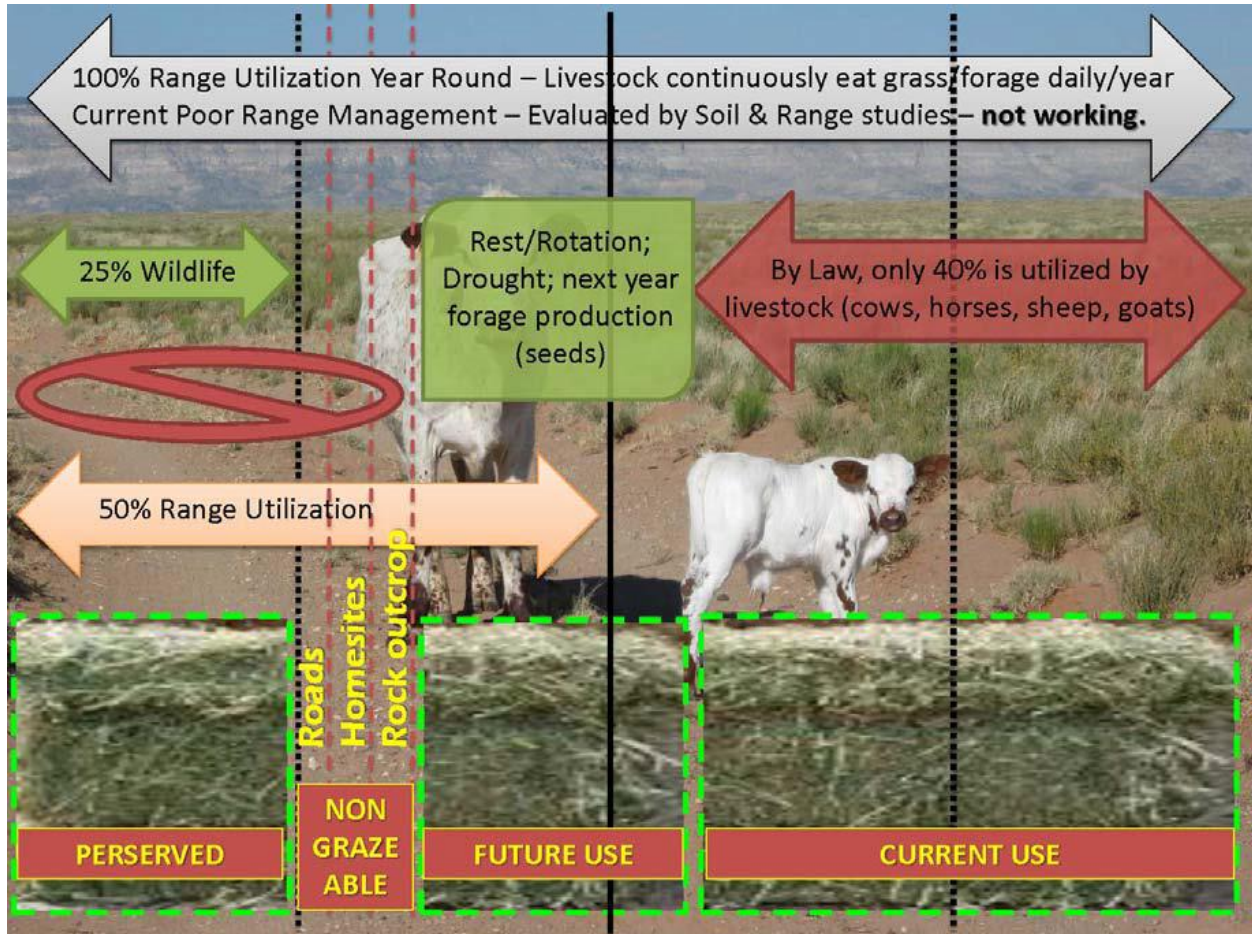


Figure 4-3. Range utilization for Navajo Nation Rangeland. (Western Navajo Agency-Land Management District 3, Unit 2, 2016 Range Inventory)

Stocking rates are correlated with the prevention of overgrazing. When livestock, wildlife, and feral horses graze and browse on a site, each has different species preferences and manner of grazing. If a site has too many animals on it for too long, desired forage species for each animal will become overgrazed. Such activity weakens the ability of preferred species to reproduce and regrow on a site, resulting in a reduction of their percent composition on a site. If such losses continue, noxious weeds and other disturbance-prone plant species can re-colonize a site, reducing the forage availability of a site. The use of stocking rates and carrying capacities to grazing areas should be used with care and in context to dynamic seasonal topographic and behavioral factors.

4.2.2.1 Rangeland Inventory

The carrying capacities within the LMDs in the FBFA were determined by rangeland inventories. The rangeland inventories were based on ecological site descriptions utilizing NRCS methodology. The

rangeland inventories were conducted for LMD 5 in 2007 and 2016, LMD 1 and 3-2 in 2008 and 2015, and LMD 3 in 2014.

4.2.2.2 Navajo Grazing Permits

In the FBFA, there are 723 Navajo Grazing Permits that allows for 43,024 Sheep Units Year Long (SUYL) to graze within the area. In addition, there are 1,702 horses permitted in the FBFA, which is equivalent to 8,510 SUYL. Enforcement actions by BIA and the Navajo Nation are hindered by a lack of funding and staffing shortages. A summary of Navajo grazing permits issued by the BIA for the FBFA is displayed in Table 4-8.

Table 4-8. Status of Grazing Permits for the Former Bennett Freeze Area by Land Management District, Based on Annual Tally Counts

LMD/Unit	No. of Grazing Permit Holders	Status of Grazing Permits After Compliance Check				
		In Compliance	In Probate	Non-Use	Non-Compliance (overstocking)	In Dispute
1-1 Tonalea	72	40	8	4	15	5
1-2 Kaibeto	12	8	2	0	0	2
1-3 Coppermine	49	12	4	11	8	14
LMD 1 FBFA Total:	133	60	14	15	23	21
3-1 Coalmine Canyon	82	12	38	5	17	10
3-2 Tuba City	208	140	36	4	12	16
3-3 Bodaway/Gap	170	72	33	15	10	40
3-4 Cameron	201	116	52	10	12	11
LMD 3 FBFA Total:	661	340	121	29	34	67
5-1 Tolani Lake	17	13	1	2	0	1
5-3 Leupp	8	6	1	0	0	1
LMD 5 FBFA Total:	25	19	2	2	0	2
FBFA Grand Total	819	419	137	46	57	90

Note: LMD = Land Management District, FBFA = Former Bennett Freeze Area.

Table 4-9 lists the number of grazing permits in compliance with annual tally counts for the past 6 years in LMD 3.

Table 4-9. Land Management District 3 and Unit Number Grazing Permits in Compliance with Annual Tally Counts for the Past 6 Years

LMD3-Subunit	Total SUYL Permitted	Yearly Tally Compliance In Sheep Units					
		2013	2014	2015	2016	2017	2018
3-1 Coalmine Canyon	5,282	1,851	1,853	1,144	1,448	3,434	3,216
3-2 Tuba City	11,681	4,942	5,737	6,405	6,342	6,245	5,845
3-3 Bodaway/Gap	12,043	4,511	5,694	6,336	661	5,261	5,886
3-4 Cameron	11,585	2,765	3,067	3,194	2,736	3,644	3,219
LMD 3 Total SUYL Tallied:	40,591	14,069	16,351	17,079	11,187	18,584	18,166

LMD = Land Management District, SUYL = Sheep Units Year Long.

Table 4-10 list the number of grazing permits within the FBFA check for compliance within the past 6 years.

Table 4-10. Land Management District 3 and Unit Grazing Permits Checked for Compliance for the Past 6 Years

LMD3-Subunit	No. of Permits	Yearly Tally Compliance Checks for Grazing Permits					
		2013	2014	2015	2016	2017	2018
3-1 Coalmine Canyon	82	39	41	24	24	66	82
3-2 Tuba City	208	85	101	94	93	118	208
3-3 Bodaway/Gap	170	87	105	98	11	122	170
3-4 Cameron	201	65	57	77	59	78	101
LMD 3 Total Permits Checked:	661	276	304	293	187	384	561

4.3 Forestlands

POLICIES, PROGRAMS AND REGULATORY FRAMEWORK:

- NN Ten-Year Forest Management Plan (RCJY-133-01)
- P.L. 93-638 Forest Mgmt. Contract (NABID-96-12)
- Navajo Forestry Department's Plan of Operation (GSCS-80-99)
- Navajo Nation Forest and Woodland Regulations (RCMA-48-01)
- Regulation of Forest Use (23 NNC 2701-2705)
- Forest and Woodland Violations (17 NNC 520-529)
 - T17-523, Fire violation
 - T17-525, No permit violation / forest products
 - T17-527, Unauthorized use of a motor vehicle
 - T17-528, Special Closure of Use Restrictions
- Fire Prevention - General (17 NNC 2701-2705)
 - T17-2733, Manufacture, possession, sale or use of fireworks
- National Indian Forest Resource Mgmt. Act (P.L. 101-630)
- General Forest Regulations (25 CFR 163)
- BIA manuals on forest management (53 IAM)

As provided in 25 U.S.C. § 3102, the purposes of the National Indian Forest Resources Management Act (NIFRMA) are to:

- (1) allow the Secretary of the Interior to take part in the management of Indian forest lands, with the participation of the lands' beneficial owners, in a manner consistent with the Secretary's trust responsibility and with the objectives of the beneficial owners;
- (2) clarify the authority of the Secretary to make deductions from the proceeds of sale of Indian forest products, assure the use of such deductions on the reservation from which they are derived solely for use in forest land management activities, and assure that no other deductions shall be collected;
- (3) increase the number of professional Indian foresters and related staff in forestry programs on Indian forest land; and
- (4) provide for the authorization of necessary appropriations to carry out this chapter for the protection, conservation, utilization, management, and enhancement of Indian forest lands.

NIFRMA defines Indian forest land as "Indian lands, including commercial and non-commercial timberland and woodland, that are considered chiefly valuable for the production of forest products or to maintain watershed or other land values enhanced by a forest cover, regardless of whether a formal inspection and land classification action has been taken." (25 USC § 3104(b), NIFRMA requires that Indian forest land management activities undertaken by the Secretary shall be designed to achieve the following objectives:

- (1) the development, maintenance, and enhancement of Indian forest land in a perpetually productive state in accordance with the principles of sustained yield and with the standards and objectives set forth in

Navajo Nation Division of Natural Resources and the Bureau of Indian Affairs Navajo Region

May 2020

forest management plans by providing effective management and protection through the application of sound silvicultural and economic principles to:

- (A) the harvesting of forest products,
 - (B) forestation,
 - (C) timber stand improvement, and
 - (D) other forestry practices;
- (2) the regulation of Indian forest lands through the development and implementation, with the full and active consultation and participation of the appropriate Indian tribe, of forest management plans which are supported by written tribal objectives and forest marketing programs;
- (3) the regulation of Indian forest lands in a manner that will ensure the use of good method and order in harvesting so as to make possible, on a sustained yield basis, continuous productivity and a perpetual forest business;
- (4) the development of Indian forest lands and associated value-added industries by Indians and Indian tribes to promote self-sustaining communities, so that Indians may receive from their Indian forest land not only stumpage value, but also the benefit of all the labor and profit that such Indian forest land is capable of yielding;
- (5) the retention of Indian forest land in its natural state when an Indian tribe determines that the recreational, cultural, aesthetic, or traditional values of the Indian forest land represents the highest and best use of the land;
- (6) the management and protection of forest resources to retain the beneficial effects to Indian forest lands of regulating water run-off and minimizing soil erosion; and
- (7) the maintenance and improvement of timber productivity, grazing, wildlife, fisheries, recreation, aesthetic, cultural and other traditional values.”

Lastly, as defined in 25 U.S.C. § 3103(7) of NIFRMA, “forest resource” means “all the benefits derived from Navajo forest lands, including forest products, soil productivity, water, fisheries, wildlife, recreation, and aesthetic or other traditional values of Navajo forestlands.” “Forest products” are defined by 25 USC § 3103(7) as:

- (A) timber,
- (B) a timber product, including lumber, lath, crating, ties, bolts, logs, pulpwood, fuelwood, posts, poles and split products,
- (C) bark,
- (D) Christmas trees, stays, branches, firewood, berries, mosses, pinyon nuts, roots, acorns, syrups, wild rice, and herbs,
- (E) other marketable material, and
- (F) gravel which is extracted from, and utilized on, Navajo forest lands.

OVERVIEW

Navajo forest lands are a vast resource that includes both commercial and non-commercial timberlands and woodlands and are considered chiefly valuable to produce forest products, to maintain watersheds, and other land values enhanced by forest cover.

Currently, the Navajo Nation Ten-Year Forest Management Plan (FMP) provides forest management direction for 596,726 acres of the Defiance Plateau-Chuska Mountains, which includes commercial

timberland. In addition the Draft Woodland Management Plan (WMP), when finalized will establish goals and objectives for management and direction of the Navajo Nation's 4.8 million acres of woodlands. Currently the Navajo Forestry Department (NFD) has only an advisory or custodial role in other uses of the woodlands such as recreation, fishing and hunting, grazing, residential development, mineral exploration, development and rights-of-way. These are subject to regulation by the Resources and Development Committee of the Navajo Nation Council, other Navajo resource management departments and the BIA. Thus, woodlands are being managed through 1) RCMA-48-01 - Navajo Nation Forest and Woodland Regulations, 2) Navajo Nation Codes and 3) 25 CFR 163 – General Forest Regulations.

It is important to understand that public scoping information gathered during the development of the FMP (RCJY-133-01) was used to extrapolate various viewpoints on woodland management. This was done since the Woodland Management Plan is part of the FMP. This plan also follows the same template used in the development of the FMP. Information that was determined pertinent was then incorporated into the development of woodland management goals and objectives.

The WMP is a strategic plan, not an operational plan. This is because the WMP applies to such a large area, funding is limited, and woodland environmental data that pertain to specific areas on the ground are not available. The WMP recommends harvest limits that apply to broad classes of land. Implementation of specific projects will depend on subsequent procedures for site-specific planning and design. The WMP also provides direction for implementation of a woodland harvest in-conjunction with the Navajo Nation Forest and Woodland Regulations.

Woodlands are forestlands not included within the timberland classification, stocked or capable of being stocked, with tree species of such form and size to produce forest products that are generally marketable within the region for products other than lumber, pulpwood, or veneer. Woodlands are areas that have at least a 10% crown cover from predominantly pinon, juniper, or oak trees. Commercial woodlands are lands qualifying as forests, containing less than 5% commercial timber species crown cover, diameters at least 3 inches at root collar (DRC) of woodland species and considered of high site quality capable of growing at least 5 cubic feet/ac/year of merchantable material. Commercial woodlands describes that portion of the woodland producing marketable woody products which are currently or prospectively accessible, not withdrawn from such uses, and not already accounted for within commercial or noncommercial timberland.

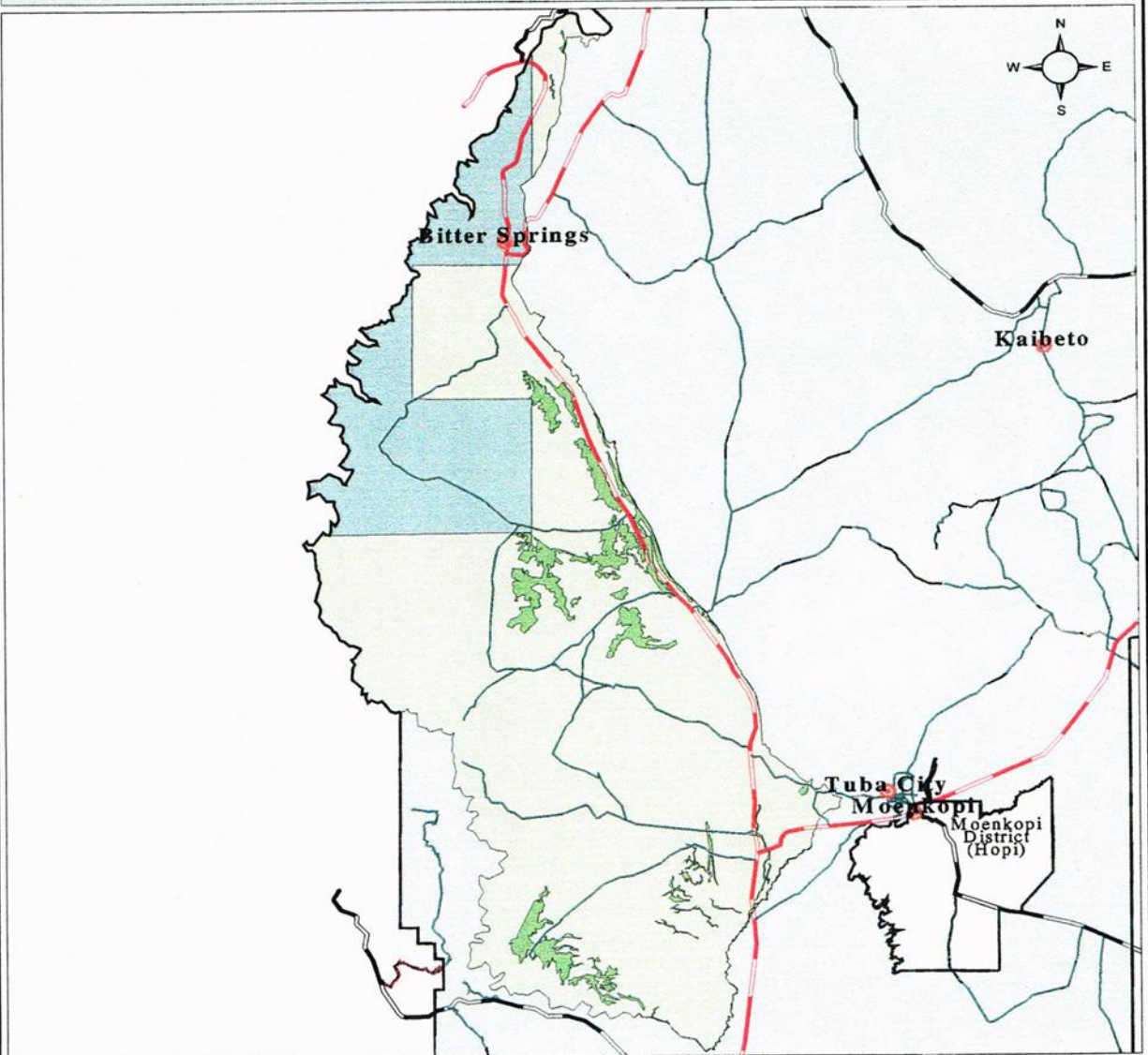
A total of 1,137,765 acres were classified as commercial woodlands, leaving 3,679,694 acres as non-commercial for the Navajo Nation. These amounts were determined in development of the Woodland Inventory Assessment Report (WIAR) and were based on tree type, size and density (no acres were excluded for steep slopes, drainages, etc.). The exact exclusion acres will not be known until actual on-the-ground activities occur. For planning purposes, based on experience and knowledge, it will be assumed that 25% of the woodland area be excluded from treatment.

The following forest land data is specific to Navajo Nation Chapters affected by the Bennett Freeze (Maps 4-7 through 4-25; Figures 4-4 through 4-14) and represents the best available forest land information for the FBFA. This data was obtained from the WIAR Chapter Data Book developed by ArrowWood Associates in 1999 and displays data collected from 1986 through 1991.

Figure 4-4. Forest Types and Total Acreage Found within the Former Bennett Freeze Area

Chapter	Woodland Acres	Chapter Acres	Juniper	Juniper-piñon	Piñon	Piñon-juniper	Ponderosa Pine	Woodlands w/in Commercial Forest	Non-forest
Bodaway-Gap	28,032	561,534	28,010	15	0	7	0	0	427,644
Cameron	37,979	236,785	4,680	15,726	0	17,573	0	0	198,639
Coalmine Mesa (Coalmine Canyon)	3,204	405,485	3,204	0	0	0	0	0	402,210
Coppermine	120,795	244,426	68,350	43,670	0	8,776	0	0	122,354
Kaibeto	106,681	237,158	60,856	23,088	0	22,737	0	0	130,477
Leupp	4,094	295,658	4,094	0	0	0	0	0	291,294
Tolani Lake	11,217	150,944	11,217	0	0	0	0	0	139,644
Tonalea	49,113	150,617	31,556	16,776	0	781	0	0	100,027
Tuba City	69,278	227,921	66,425	1,946	0	906	0	0	158,639
TOTAL:	430,393	2,510,528	278,392	101,221	0	50,780	0	0	1,970,928

Bodaway/Gap Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Cover Type



Cover Types

- Juniper (J)
- Juniper Pinyon (JP)
- Pinyon (P)
- Pinyon Juniper (PJ)
- Ponderosa Pine within Woodland Area (PP)
- Woodland within the Commercial Forest (WwCF)
- Eastern Woodlands (EW)
- Commercial Forest (CF)
- NonForest (NF)
- Outside Woodland GIS Coverage

Roads

- Interstate Highway
- US Highway
- State Highway
- BIA Road
- County Road

Other Features

- Navajo Nation Boundary
- City

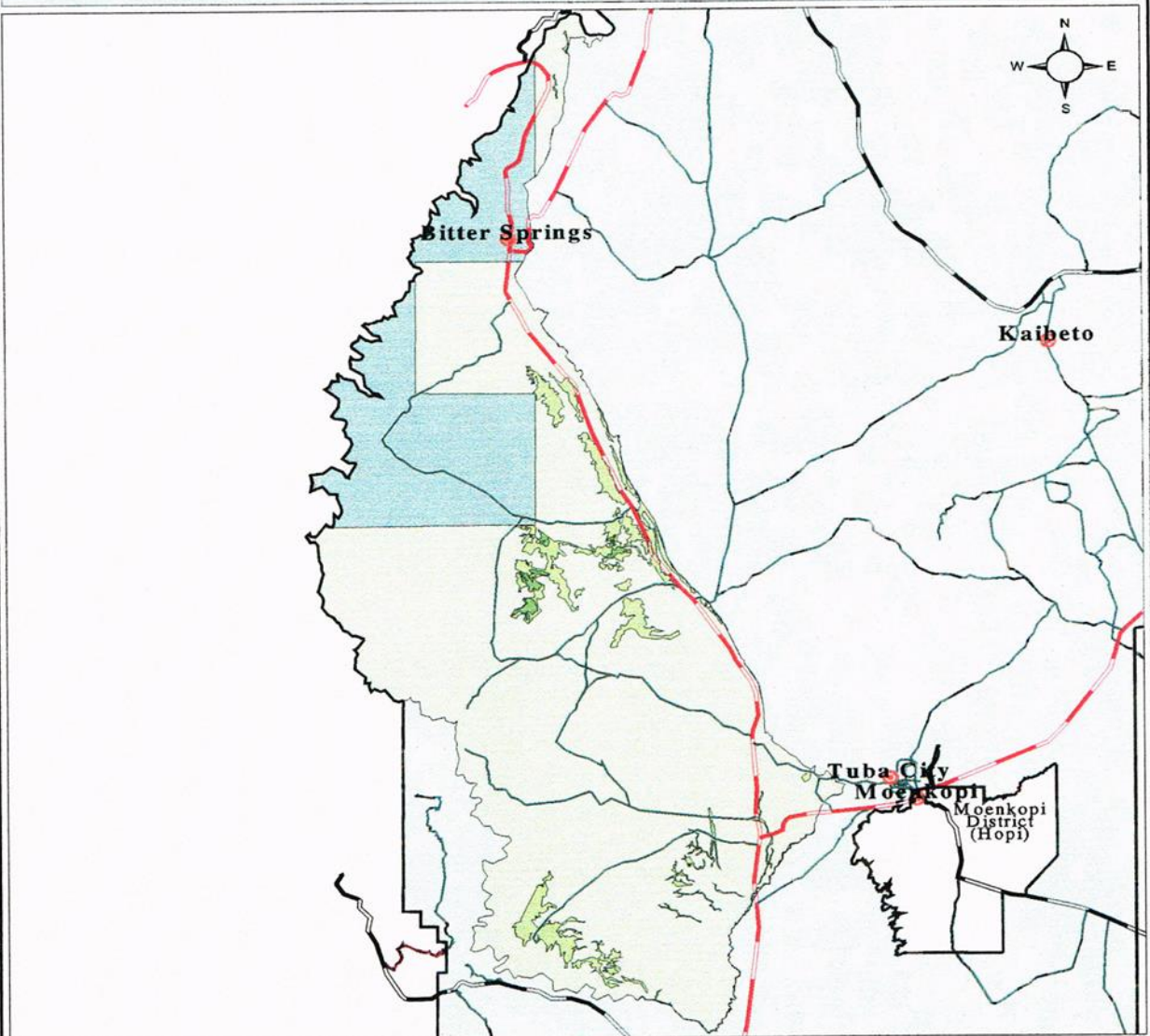
Cover Type	Acres
J	28,010
JP	15
P	0
PJ	7
PP	0
WwCF	0
EW	0
Total Woodland Acres:	28,032
CF	0
NF	427,644
Outside	105,858
Total Chapter Acres:	561,534

Map Scale = 1:630,000

Map Prepared by

Map 4-7. Bodaway-Gap Chapter Woodlands Map Area by Cover Type (WIAR 1999)

Bodaway/Gap Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
 Area by Crown Density Class



Crown Density Class	
	0% - 25% (no bar)
	26% - 50% (1 bar)
	51% - 75% (2 bar)
	76% + (3 bar)
	Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF)
	Pinyon Juniper within the Commercial Forest (/PJ wCF)
	Eastern Woodlands (EW)
	Commercial Forest (CF)
	NonForest (NF)
	Outside Woodland GIS Coverage

Roads	
	Interstate Highway
	US Highway
	State Highway
	BIA Road
	County Road
Other Features	
	Navajo Nation Boundary
	City

Crown Density Class	Acres
No Bar	26,244
1 Bar	1,788
2 Bar	0
3 Bar	0
PP/PJ wCF	0
/PJ wCF	0
EW	0
Total Woodland Acres:	28,032
CF	0
NF	427,644
Outside	105,858
Total Chapter Acres:	561,534

Map Scale = 1:630,000

Map Prepared by

Map 4-8. Bodaway-Gap Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Figure 4-5. Bodaway-Gap Chapter Per Acre Volume Summary Table by Diameter Class (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Per Acre Volume Summary Table by Diameter Class
 Chapter Databook
 Chapter - BODAWAY/GAP
 2 Plots

Date:10/11/99
 Time:16:39:26
 ArrowWood Associates LLC

Diameter Class	Commercial Woodland				Non-Commercial Woodland				Total Woodland			
	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead
Seed/Saplings												
3 - 5.9"					3.74				3.74	3.74		3.74
6 - 8.9"					8.75				8.75	8.75		8.75
9 - 11.9"					3.72				3.72	3.72		3.72
16 - 19.9"					11.24				11.24	11.24		11.24
Chapter Totals					27.47				27.47	27.47		27.47

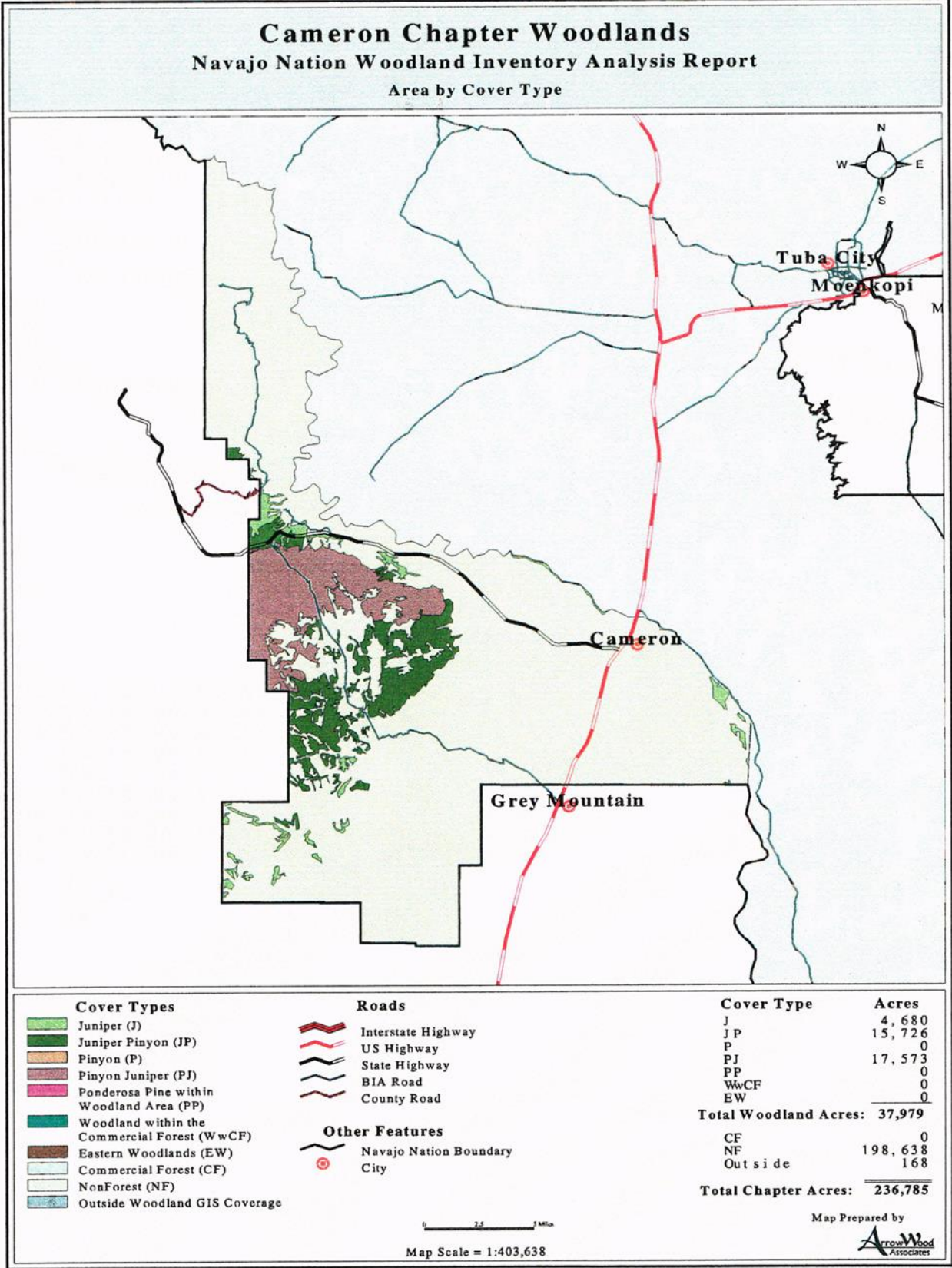
Figure 4-6. Bodaway-Gap Chapter Per Acre Volume Summary Table by Species (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Stand and Per Acre Product Volume Summary Table by Species -- BODAWAY/GAP Chapter
 2 Plots

Date:10/11/99
 Time:16:54:24
 ArrowWood Associates LLC

Species	Trees Per Acre	Quadratic Mean Diameter (inches)	Basal Area Sq. Ft. per Acre	Total Volume — Cubic Feet per Acre —	Volume to a Merchantable Top per Acre	Board Foot Volume per Acre Scribner	Annual Net Growth Cubic Feet per Acre per Year	Cords per Acre	Line Posts per Acre	Corner Posts per Acre	Christmas Trees per Acre
Juniper	91.41	3.60	10.72	37.66	27.47		0.46	0.34			
Chapter Totals	91.41	3.60	10.72	37.66	27.47		0.46	0.34			

All volumes are net.

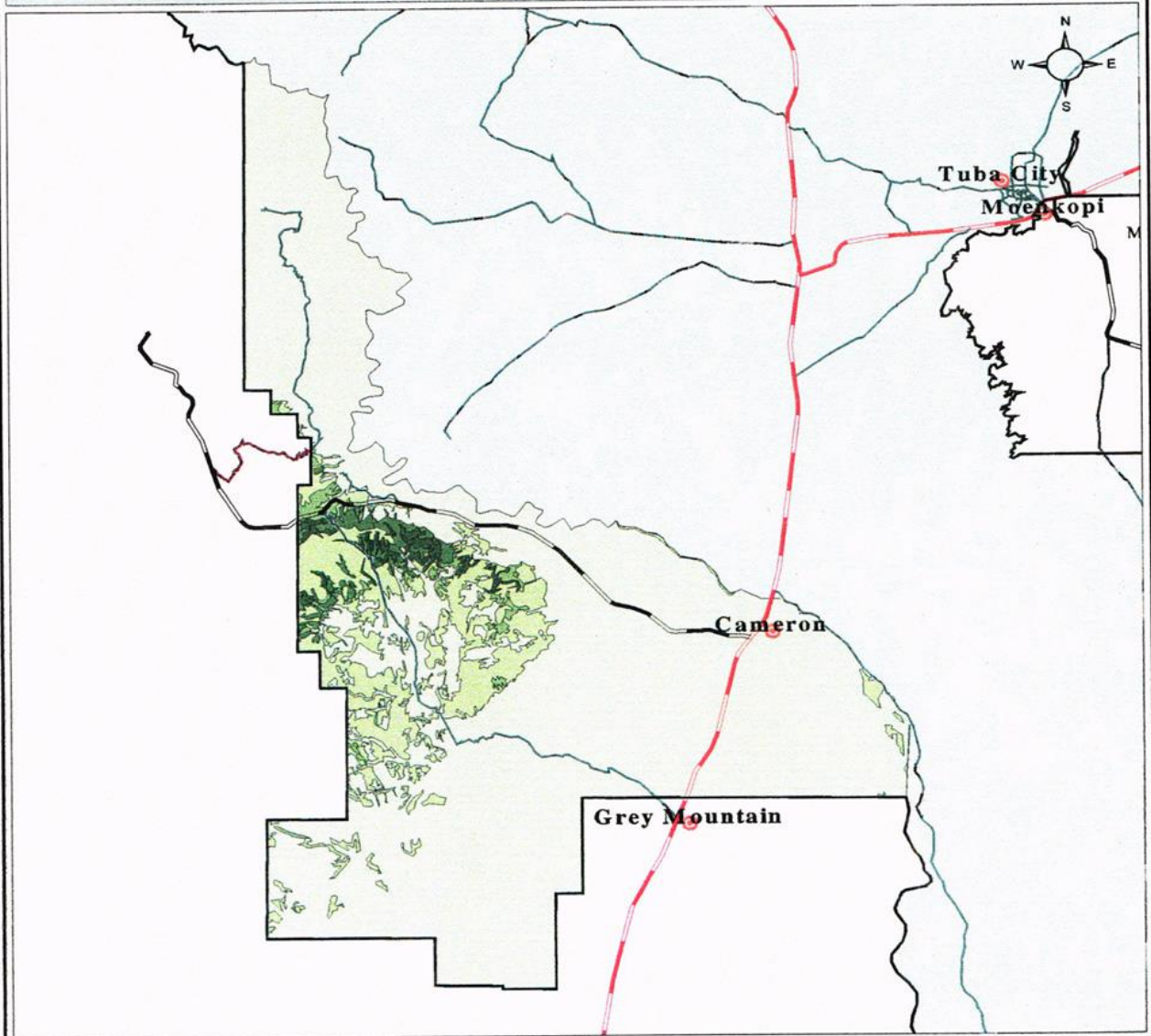


Map 4-9. Cameron Chapter Woodlands Map Area By Cover Types (WIAR 1999)

Navajo Nation Division of Natural Resources and the Bureau of Indian Affairs Navajo Region

May 2020

Cameron Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



Crown Density Class

	0% - 25% (no bar)
	26% - 50% (1 bar)
	51% - 75% (2 bar)
	76% + (3 bar)
	Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF)
	Pinyon Juniper within the Commercial Forest (/PJ wCF)
	Eastern Woodlands (EW)
	Commercial Forest (CF)
	NonForest (NF)
	Outside Woodland GIS Coverage

Roads

	Interstate Highway
	US Highway
	State Highway
	BIA Road
	County Road

Other Features

	Navajo Nation Boundary
	City

Crown Density Class	Acres
No Bar	28,646
1 Bar	3,237
2 Bar	3,614
3 Bar	2,483
PP/PJ wCF	0
/PJ wCF	0
EW	0
Total Woodland Acres:	37,979
CF	0
NF	198,638
Outside	168
Total Chapter Acres:	236,785

0 2.5 5 Miles
 Map Scale = 1:403,638

Map Prepared by

Map 4-10. Cameron Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Figure 4-7. Cameron Chapter Per Acre Volume Summary Table by Diameter Class (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Per Acre Volume Summary Table by Diameter Class
 Chapter Databook
 Chapter - CAMERON
 4 Plots

Date:10/11/99
 Time:16:39:30
 ArrowWood Associates LLC

Diameter Class	Commercial Woodland				Non-Commercial Woodland				Total Woodland			
	Green Volume Trees)	Dead Wood Volume Live Trees	Dead Volume	All Volume & Dead	Green Volume Trees)	Dead Wood Volume Live Trees	Dead Volume	All Volume & Dead	Green Volume Trees)	Dead Wood Volume Live Trees	Dead Volume	All Volume & Dead
Seed/Saplings												
3 - 5.9"	19.53			19.53	5.65	0.69		6.34	11.66	0.39		12.05
6 - 8.9"	54.32	2.24		56.57	40.75	0.61		41.37	46.63	1.32		47.95
9 - 11.9"	118.11	16.97		135.08	60.34	14.08		74.42	85.34	15.33		100.68
12 - 15.9"	344.91	17.99		362.90	7.57	42.92		50.50	153.59	32.13		185.72
16 - 19.9"	163.73	16.55		180.29	69.90	41.97		111.88	110.52	30.97		141.49
20" and up	478.24	165.65		643.89	272.81	62.81		335.62	361.73	107.32		469.05
Dead (all sizes)							17.53	17.53			9.94	9.94
Chapter Totals	1,178.86	219.41		1,398.28	457.05	163.10	17.53	637.69	769.48	187.48	9.94	966.91

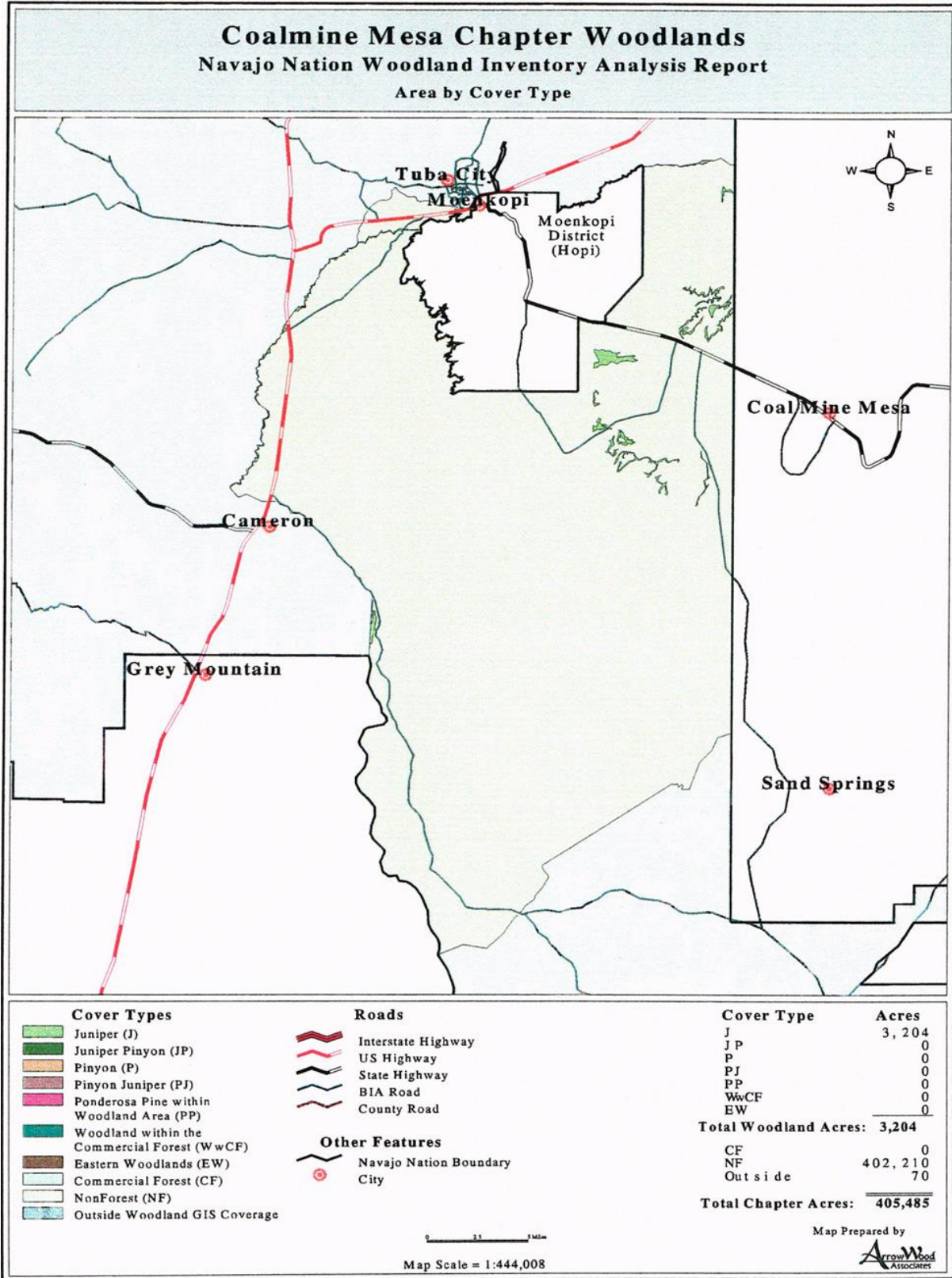
Figure 4-8. Cameron Chapter Per Acre Volume Summary Table by Species (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Stand and Per Acre Product Volume Summary Table by Species -- CAMERON Chapter
 4 Plots

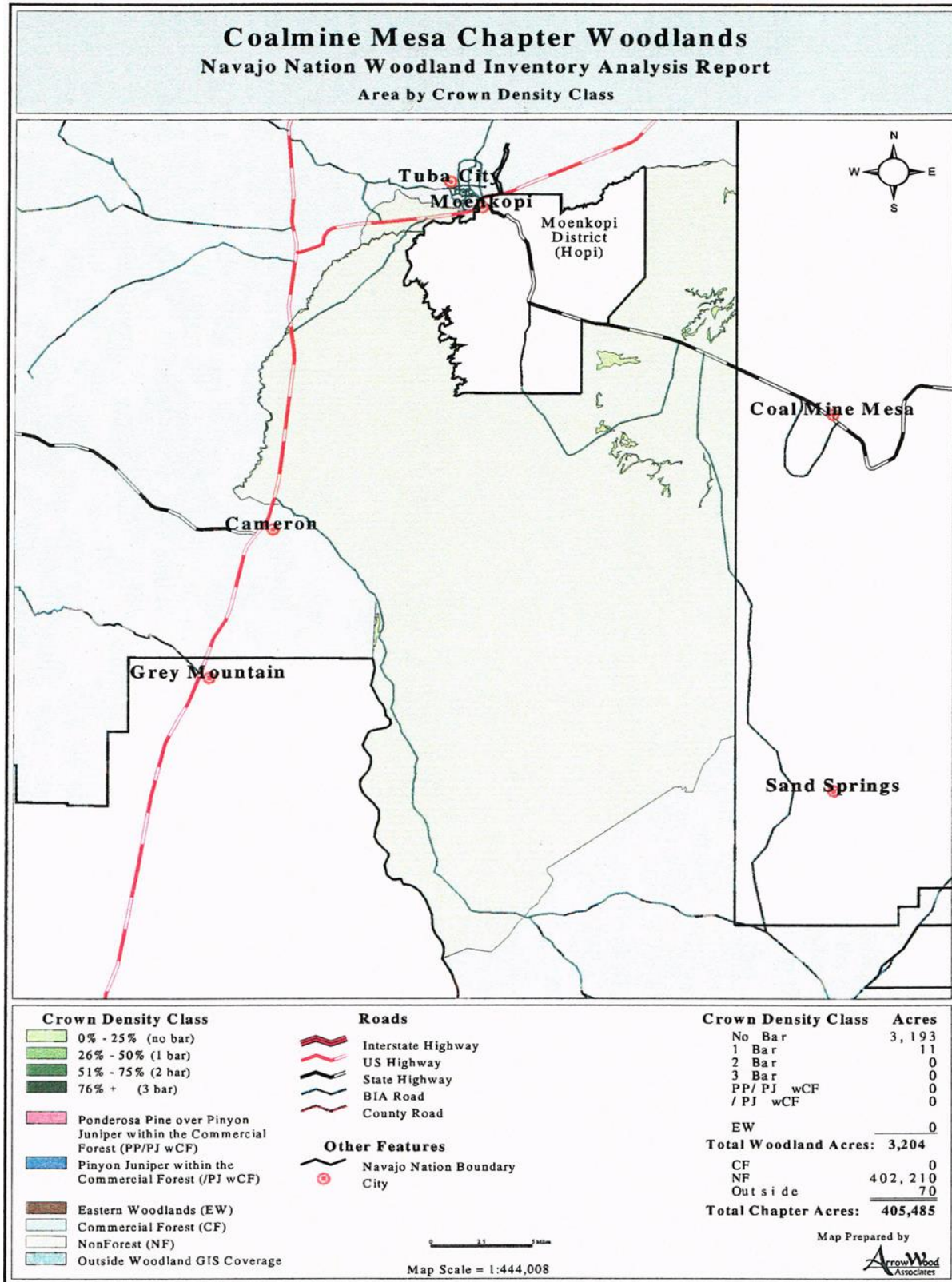
Date:10/11/99
 Time:16:54:27
 ArrowWood Associates LLC

Species	Trees Per Acre	Quadratic Mean Diameter (inches)	Basal Area Sq. Ft. per Acre	Total Volume — Cubic Feet per Acre —	Volume to a Merchantable Top — Cubic Feet per Acre —	Board Foot Volume per Acre Scribner	Annual Net Growth Cubic Feet per Acre per Year	Cords per Acre	Line Posts per Acre	Corner Posts per Acre	Christmas Trees per Acre
Juniper	59.47	15.70	92.28	788.84	788.84		2.81	10.49	6.49		
Pinyon	96.25	4.55	18.72	180.87	178.06		-0.05	2.35			9.19
Chapter Totals	155.73	8.81	111.01	969.71	966.91		2.76	12.85	6.49		9.19

All volumes are net.

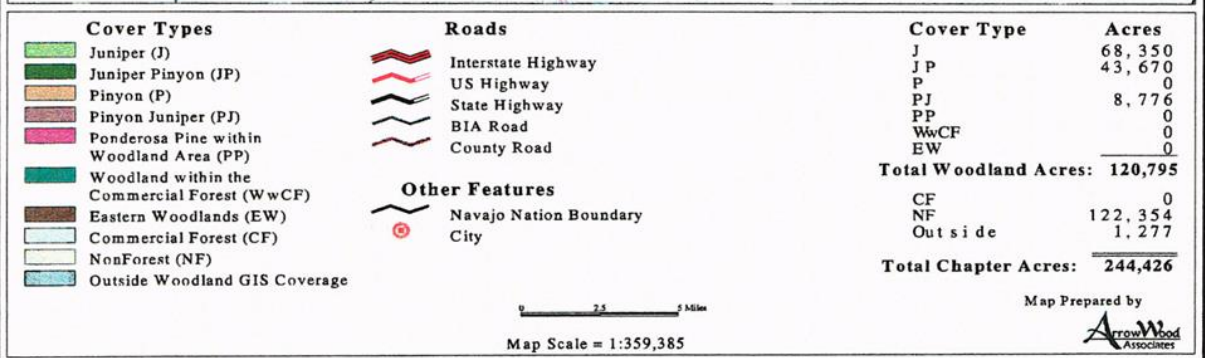
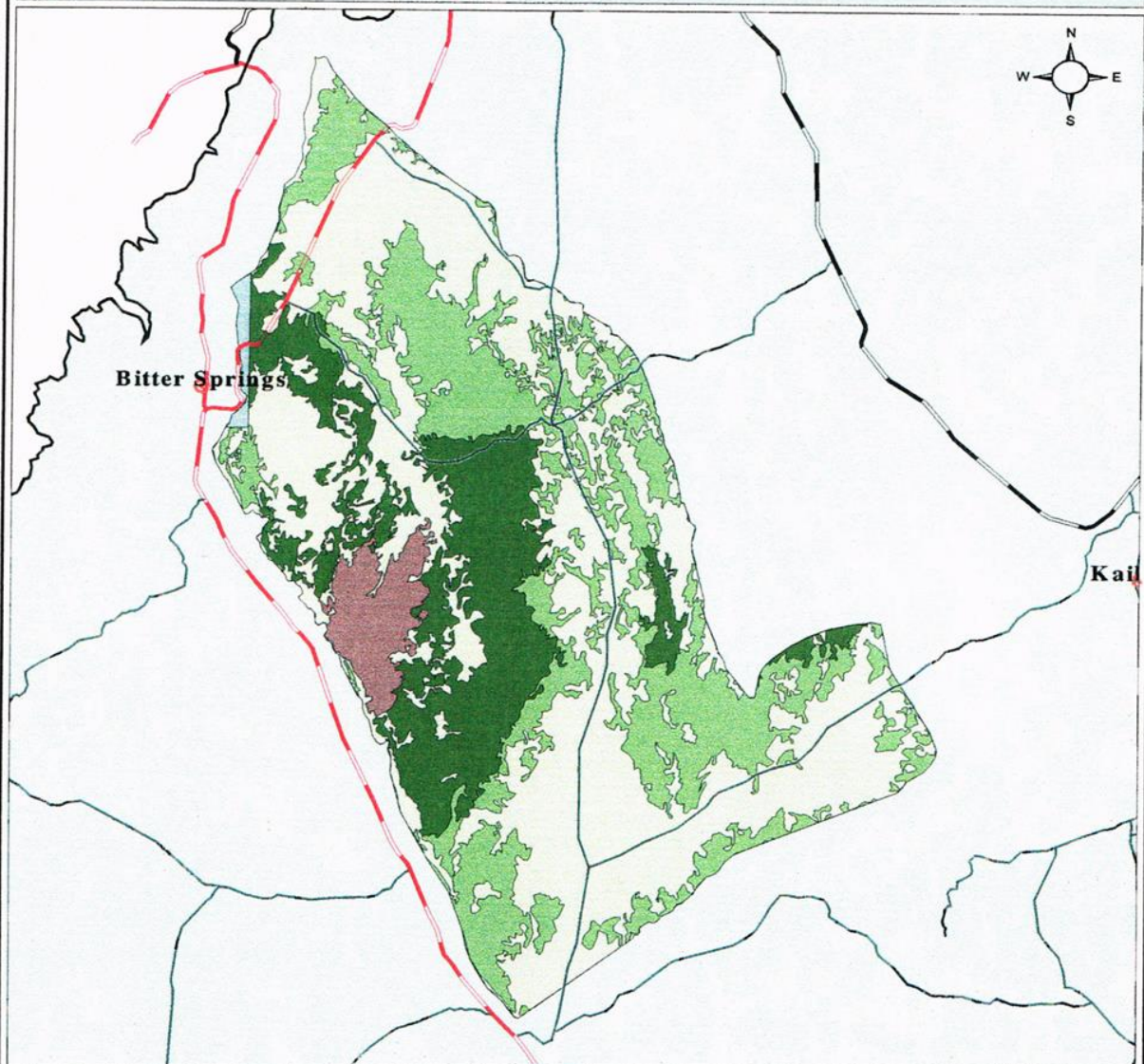


Map 4-11. Coalmine Mesa (Coalmine Canyon) Chapter Woodlands Map Area By Cover Type (WIAR 1999)



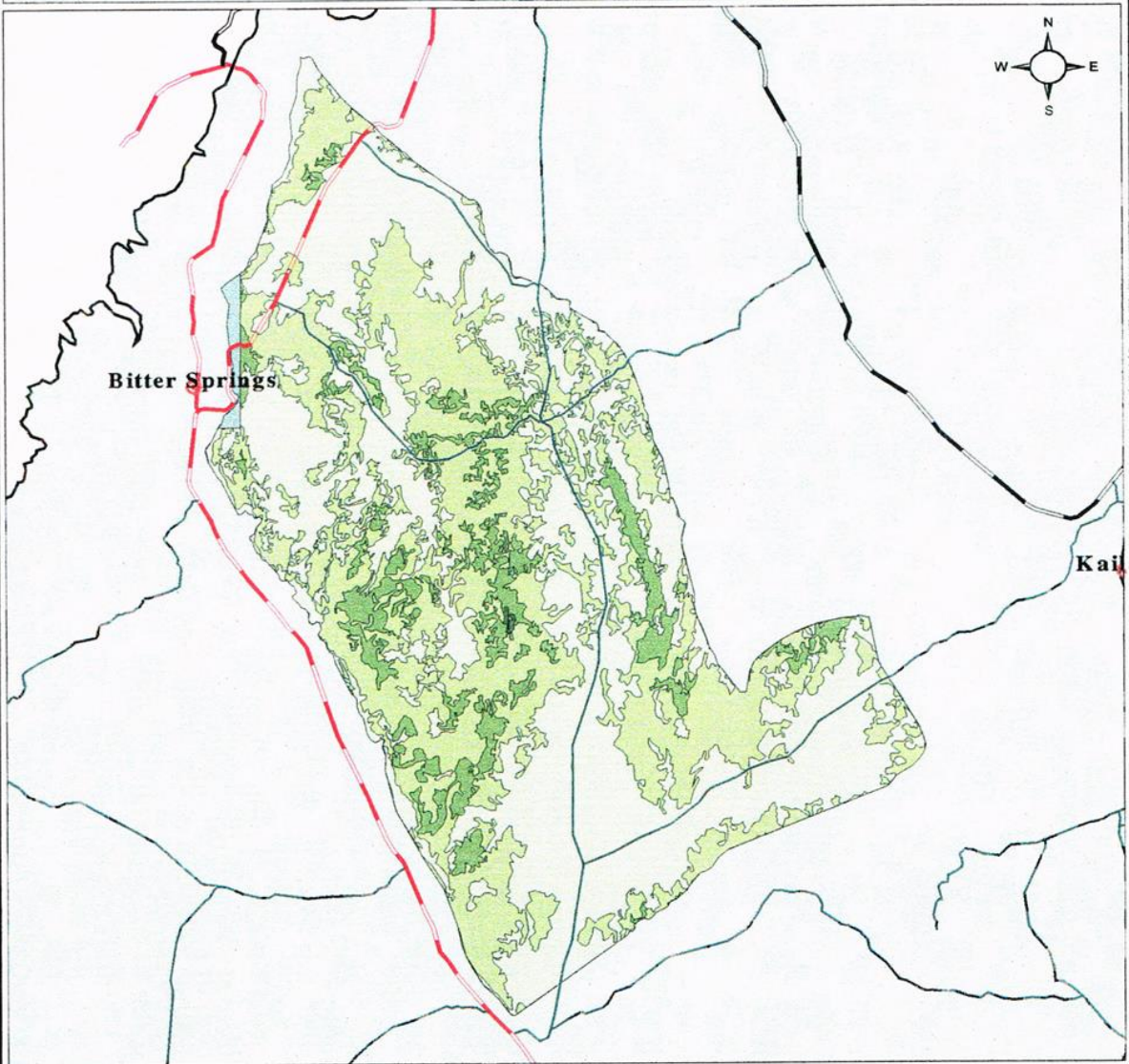
Map 4-12. Coalmine Mesa (Coalmine Canyon) Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Coppermine Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Cover Type



Map 4-13. Coppermine Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Coppermine Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



Crown Density Class	
	0% - 25% (no bar)
	26% - 50% (1 bar)
	51% - 75% (2 bar)
	76% + (3 bar)
	Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF)
	Pinyon Juniper within the Commercial Forest (PJ wCF)
	Eastern Woodlands (EW)
	Commercial Forest (CF)
	NonForest (NF)
	Outside Woodland GIS Coverage

Roads	
	Interstate Highway
	US Highway
	State Highway
	BIA Road
	County Road
Other Features	
	Navajo Nation Boundary
	City

Crown Density Class	Acres
No Bar	100,414
1 Bar	20,254
2 Bar	127
3 Bar	0
PP/ PJ wCF	0
/ PJ wCF	0
EW	0
Total Woodland Acres:	120,795
CF	0
NF	122,354
Out side	1,277
Total Chapter Acres:	244,426

Map Scale = 1:359,385

Map Prepared by

Map 4-14. Coppermine Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Figure 4-9. Coppermine Chapter Per Acre Volume Summary Table by Diameter Class (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Per Acre Volume Summary Table by Diameter Class
 Chapter Databook
 Chapter - COPPERMINE
 13 Plots

Date:10/11/99
 Time:16:39:38
 ArrowWood Associates LLC

Diameter Class	Commercial Woodland				Non-Commercial Woodland				Total Woodland			
	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead
3 - 5.9*	19.67	0.09		19.76	1.15			1.15	2.80	0.00		2.81
6 - 8.9*	136.46	5.98		142.45	0.92	0.05		0.98	12.97	0.58		13.56
9 - 11.9*	26.66			26.66	0.56	0.02		0.59	2.88	0.02		2.91
16 - 19.9*	113.13	51.80		164.94	14.04	2.47		16.52	22.85	6.86		29.72
20* and up					56.76	12.68		69.44	51.71	11.55		63.27
Dead (all sizes)			15.07	15.07			23.46	23.46			22.71	22.71
Chapter Totals	546.40	65.92	15.07	627.40	143.35	16.30	23.46	183.12	179.19	20.71	22.71	222.63

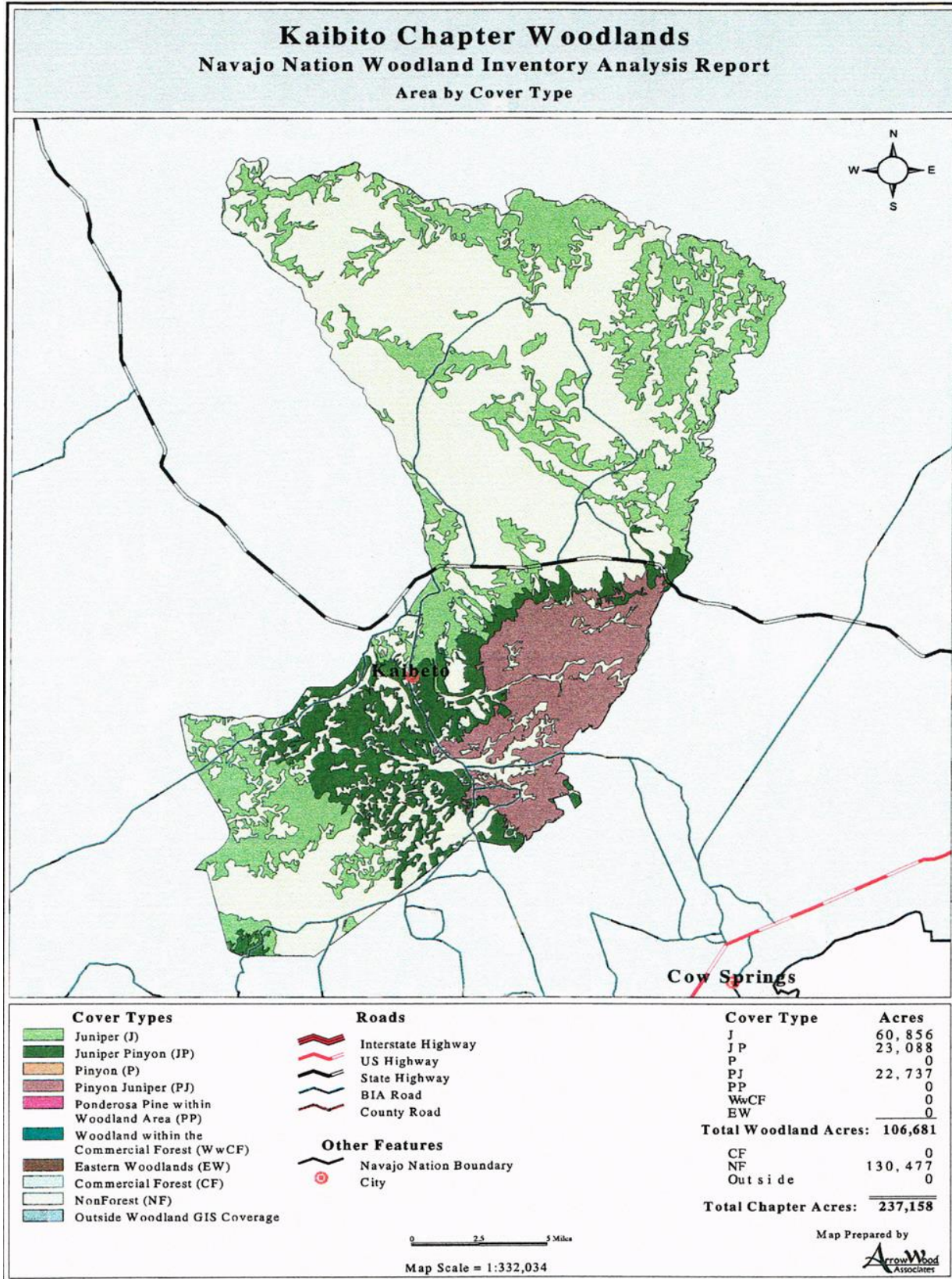
Figure 4-10. Coppermine Chapter Per Acre Volume Summary Table by Species (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Stand and Per Acre Product Volume Summary Table by Species -- COPPERMINE Chapter
 13 Plots

Date:10/11/99
 Time:16:54:35
 ArrowWood Associates LLC

Species	Trees Per Acre	Quadratic Mean Diameter (inches)	Basal Area Sq. Ft. per Acre	Total Volume — Cubic Feet per Acre	Volume to a Merchantable Top — Cubic Feet per Acre	Board Foot Volume per Acre per Scribner	Annual Net Growth Cubic Feet per Acre per Year	Cords per Acre	Line Posts per Acre	Corner Posts per Acre	Christmas Trees per Acre
Gambel Oak											
Juniper	18.00	14.54	26.11	141.87	141.87		0.78	1.88	1.22	0.88	
Pinyon	17.65	9.19	10.06	80.75	80.75		-0.61	1.06			1.73
Chapter Totals	35.65	11.89	36.18	222.63	222.63		0.16	2.95	1.22	0.88	1.73

All volumes are net.

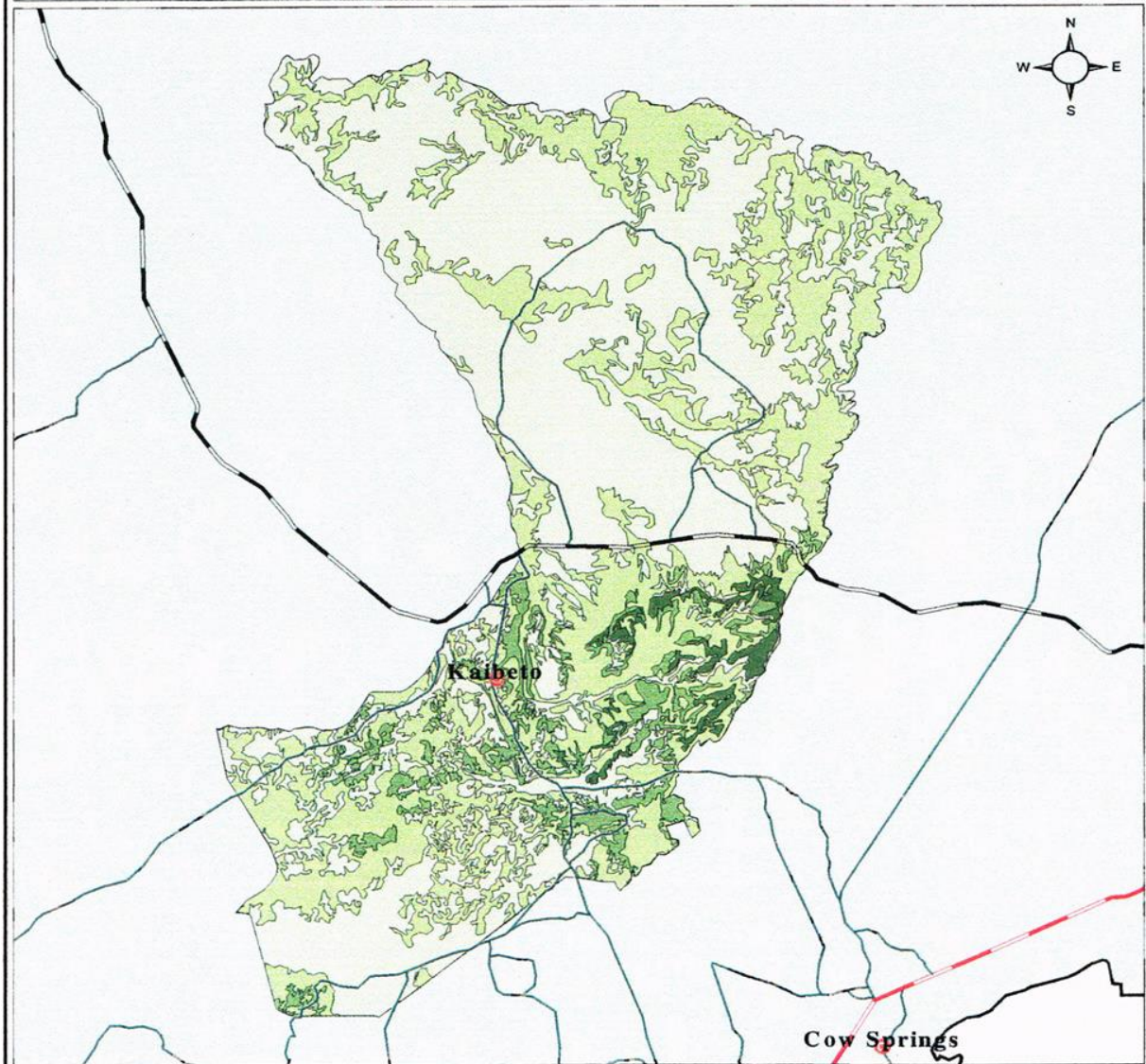


Map 4-15. Kaibito Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Navajo Nation Division of Natural Resources and the Bureau of Indian Affairs Navajo Region

May 2020

Kaibito Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



<p>Crown Density Class</p> <ul style="list-style-type: none"> 0% - 25% (no bar) 26% - 50% (1 bar) 51% - 75% (2 bar) 76% + (3 bar) <ul style="list-style-type: none"> Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF) Pinyon Juniper within the Commercial Forest (PJ wCF) <ul style="list-style-type: none"> Eastern Woodlands (EW) Commercial Forest (CF) NonForest (NF) Outside Woodland GIS Coverage 	<p>Roads</p> <ul style="list-style-type: none"> Interstate Highway US Highway State Highway BIA Road County Road <p>Other Features</p> <ul style="list-style-type: none"> Navajo Nation Boundary City 	<table border="0"> <thead> <tr> <th align="left">Crown Density Class</th> <th align="right">Acres</th> </tr> </thead> <tbody> <tr><td>No Bar</td><td align="right">90,695</td></tr> <tr><td>1 Bar</td><td align="right">12,094</td></tr> <tr><td>2 Bar</td><td align="right">3,893</td></tr> <tr><td>3 Bar</td><td align="right">0</td></tr> <tr><td>PP/PJ wCF</td><td align="right">0</td></tr> <tr><td>/PJ wCF</td><td align="right">0</td></tr> <tr><td>EW</td><td align="right">0</td></tr> <tr><td>Total Woodland Acres:</td><td align="right">106,681</td></tr> <tr><td>CF</td><td align="right">0</td></tr> <tr><td>NF</td><td align="right">130,477</td></tr> <tr><td>Outside</td><td align="right">0</td></tr> <tr><td>Total Chapter Acres:</td><td align="right">237,158</td></tr> </tbody> </table>	Crown Density Class	Acres	No Bar	90,695	1 Bar	12,094	2 Bar	3,893	3 Bar	0	PP/PJ wCF	0	/PJ wCF	0	EW	0	Total Woodland Acres:	106,681	CF	0	NF	130,477	Outside	0	Total Chapter Acres:	237,158
Crown Density Class	Acres																											
No Bar	90,695																											
1 Bar	12,094																											
2 Bar	3,893																											
3 Bar	0																											
PP/PJ wCF	0																											
/PJ wCF	0																											
EW	0																											
Total Woodland Acres:	106,681																											
CF	0																											
NF	130,477																											
Outside	0																											
Total Chapter Acres:	237,158																											

0 2.5 5 Miles
 Map Scale = 1:332,034

Map Prepared by

Map 4-16. Kaibito Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Figure 4-11. Kaibito Per Acre Volume Summary Table by Diameter Class (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Per Acre Volume Summary Table by Diameter Class
 Chapter Databook
 Chapter - KAIBITO
 5 Plots

Date:10/11/99
 Time:16:40:04
 ArrowWood Associates LLC

Diameter Class	Commercial Woodland				Non-Commercial Woodland				Total Woodland			
	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Live Trees	Dead Tree Volume	All Volume Live & Dead
Seed/Saplings												
3 - 5.9"	48.78			48.78	5.08			5.08	12.08			12.08
6 - 8.9"	175.59	3.35		178.95	11.92	0.84		12.76	38.15	1.24		39.39
9 - 11.9"	92.83	26.78		119.62	30.43	1.45		31.89	40.43	5.51		45.94
12 - 15.9"	262.92	10.28		273.21	31.96	2.86		34.83	68.97	4.05		73.02
16 - 19.9"					97.17	18.13		115.30	81.60	15.22		96.83
20" and up	265.72	80.70		346.43	82.14	10.38		92.53	111.56	21.65		133.21
Dead (all sizes)			144.70	144.70			1.83	1.83			24.72	24.72
Chapter Totals	845.86	121.12	144.70	1,111.69	258.73	33.68	1.83	294.25	352.81	47.69	24.72	425.23

Figure 4-12. Kaibito Per Acre Volume Summary Table by Species (WIAR 1999)

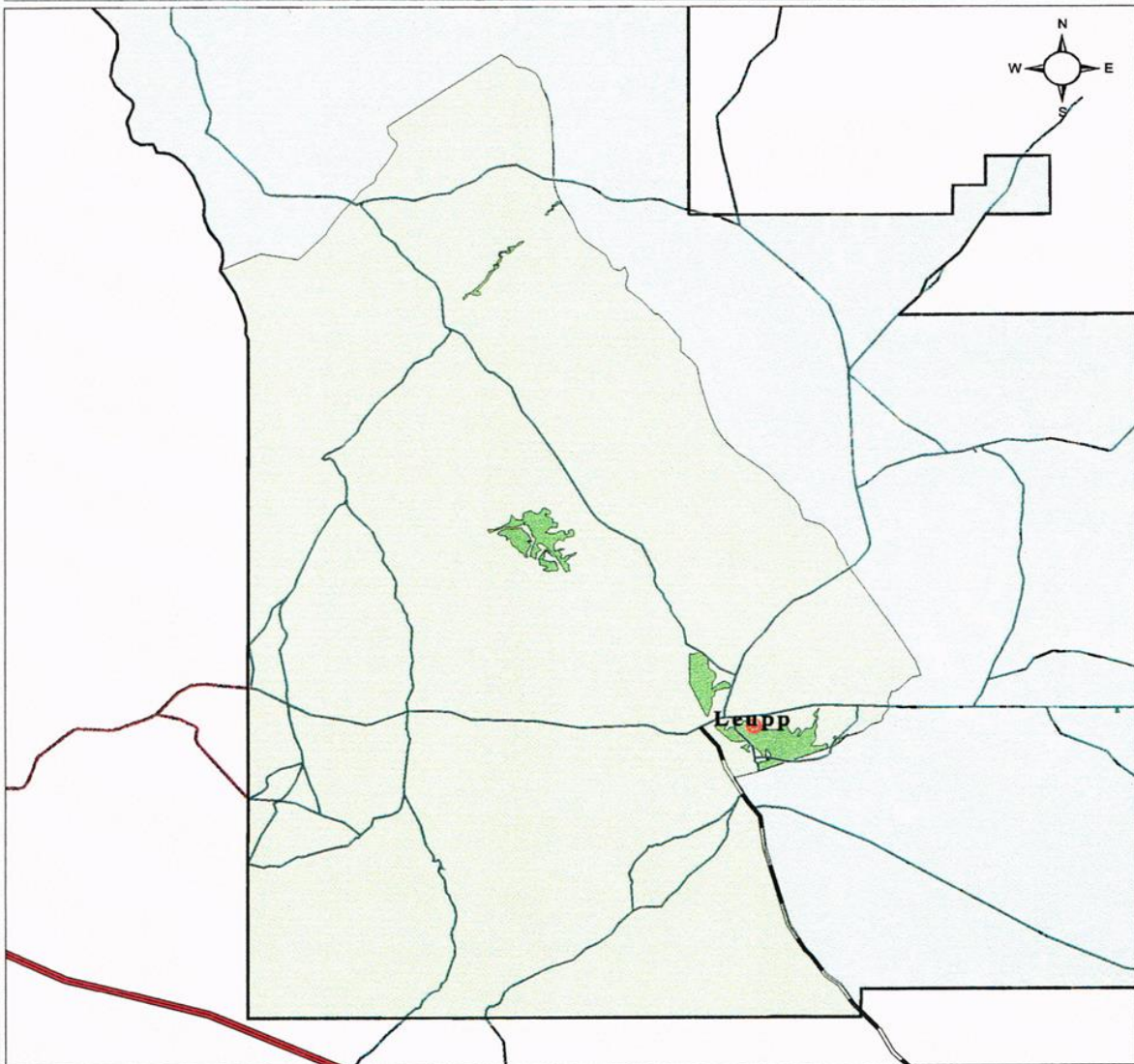
Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Stand and Per Acre Product Volume Summary Table by Species -- KAIBITO Chapter
 5 Plots

Date:10/11/99
 Time:16:54:59
 ArrowWood Associates LLC

Species	Trees Per Acre	Quadratic Mean Diameter (inches)	Basal Area Sq. Ft. per Acre	Total Volume — Cubic Feet per Acre	Volume to a Merchantable Top — Cubic Feet per Acre	Board Foot Volume per Acre Scribner	Annual Net Growth Cubic Feet per Acre per Year	Cords per Acre	Line Posts per Acre	Corner Posts per Acre	Christmas Trees per Acre
Juniper	38.84	15.05	54.39	288.65	288.65		1.09	3.83	3.20	1.60	
Pinyon	72.39	6.46	21.89	137.59	136.57		1.00	1.79			14.65
Chapter Totals	111.23	9.46	76.28	426.24	425.23		2.09	5.63	3.20	1.60	14.65

All volumes are net.

Leupp Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Cover Type



Cover Types

- Juniper (J)
- Juniper Pinyon (JP)
- Pinyon (P)
- Pinyon Juniper (PJ)
- Ponderosa Pine within Woodland Area (PP)
- Woodland within the Commercial Forest (WwCF)
- Eastern Woodlands (EW)
- Commercial Forest (CF)
- NonForest (NF)
- Outside Woodland GIS Coverage

Roads


- Interstate Highway
- US Highway
- State Highway
- BIA Road
- County Road

Other Features

- Navajo Nation Boundary
- City

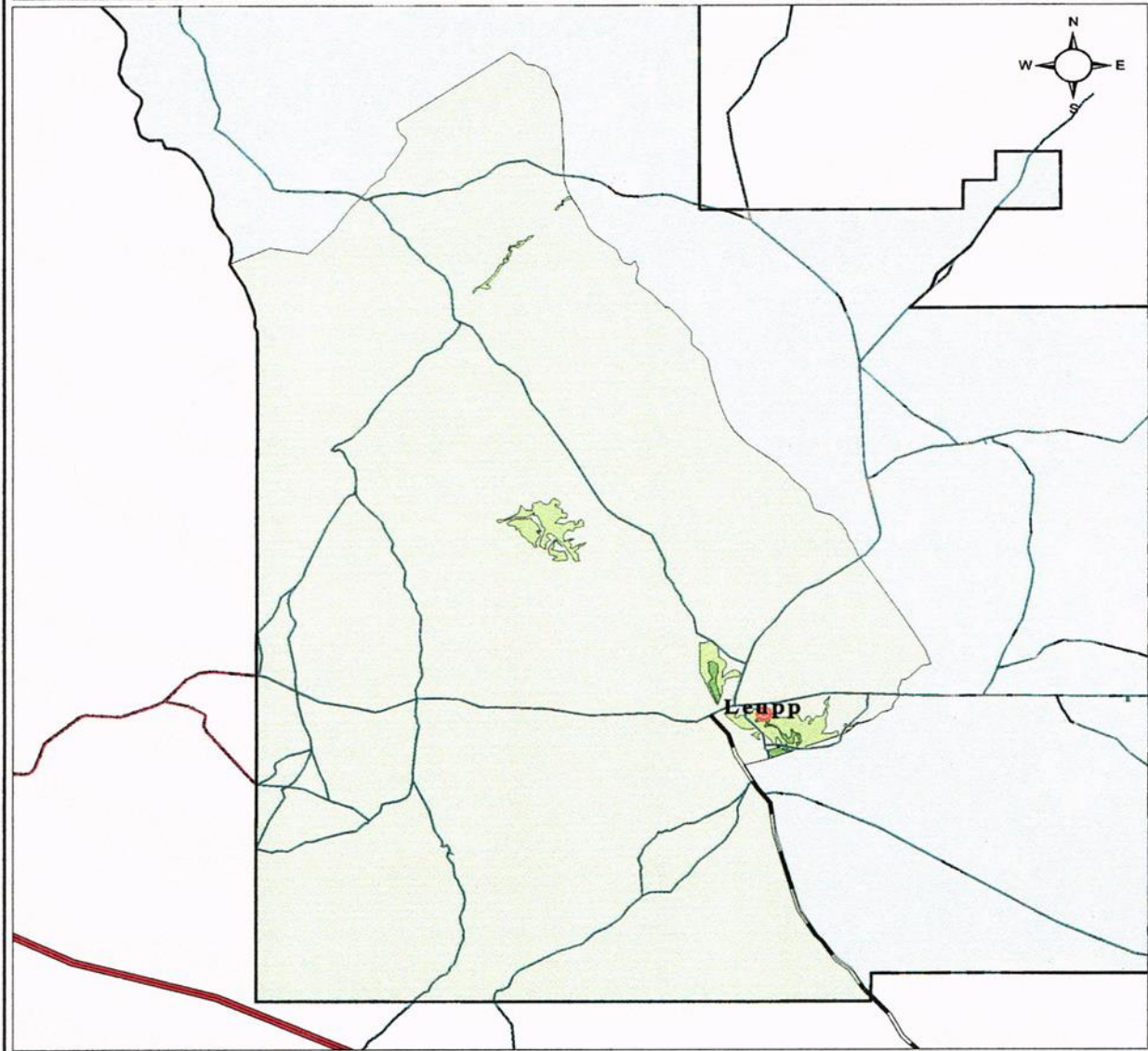
Cover Type	Acres
J	4,094
JP	0
P	0
PJ	0
PP	0
WwCF	0
EW	0
Total Woodland Acres:	4,094
CF	0
NF	291,294
Outside	270
Total Chapter Acres:	295,658

0 2.5 5 Miles
 Map Scale = 1:333,242

Map Prepared by


Map 4-17. Leupp Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Leupp Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



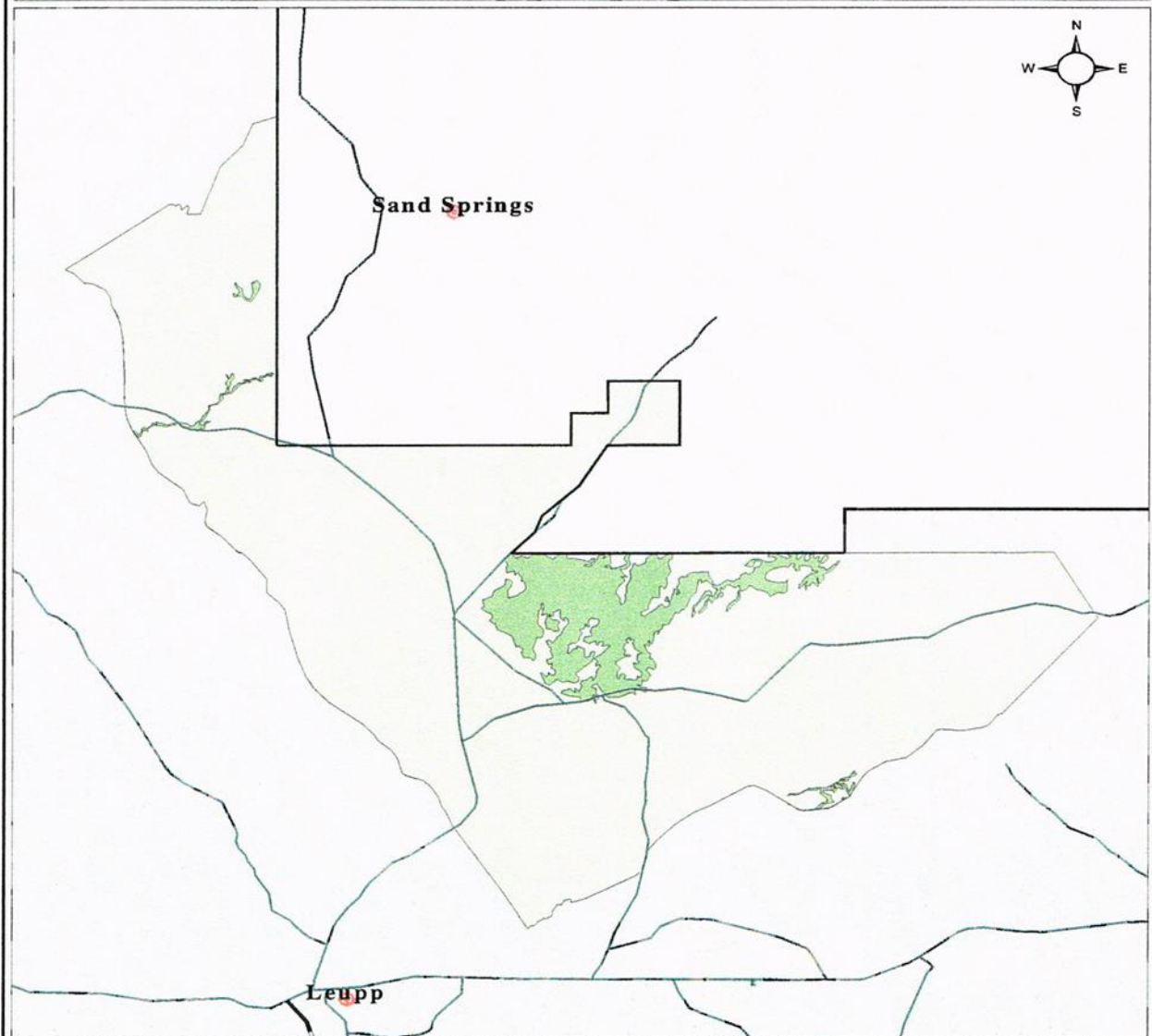
<p>Crown Density Class</p> <ul style="list-style-type: none"> 0% - 25% (no bar) 26% - 50% (1 bar) 51% - 75% (2 bar) 76% + (3 bar) <ul style="list-style-type: none"> Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF) Pinyon Juniper within the Commercial Forest (PJ wCF) Eastern Woodlands (EW) Commercial Forest (CF) NonForest (NF) Outside Woodland GIS Coverage 		<p>Roads</p> <ul style="list-style-type: none"> Interstate Highway US Highway State Highway BIA Road County Road <p>Other Features</p> <ul style="list-style-type: none"> Navajo Nation Boundary City 		<p>Crown Density Class</p> <table border="0"> <tr><td>No Bar</td><td align="right">3,679</td></tr> <tr><td>1 Bar</td><td align="right">397</td></tr> <tr><td>2 Bar</td><td align="right">19</td></tr> <tr><td>3 Bar</td><td align="right">0</td></tr> <tr><td>PP/PJ wCF</td><td align="right">0</td></tr> <tr><td>/PJ wCF</td><td align="right">0</td></tr> <tr><td>EW</td><td align="right">0</td></tr> <tr><td>Total Woodland Acres:</td><td align="right">4,094</td></tr> <tr><td>CF</td><td align="right">0</td></tr> <tr><td>NF</td><td align="right">291,294</td></tr> <tr><td>Outside</td><td align="right">270</td></tr> <tr><td>Total Chapter Acres:</td><td align="right">295,658</td></tr> </table>	No Bar	3,679	1 Bar	397	2 Bar	19	3 Bar	0	PP/PJ wCF	0	/PJ wCF	0	EW	0	Total Woodland Acres:	4,094	CF	0	NF	291,294	Outside	270	Total Chapter Acres:	295,658
No Bar	3,679																											
1 Bar	397																											
2 Bar	19																											
3 Bar	0																											
PP/PJ wCF	0																											
/PJ wCF	0																											
EW	0																											
Total Woodland Acres:	4,094																											
CF	0																											
NF	291,294																											
Outside	270																											
Total Chapter Acres:	295,658																											

Map Scale = 1:333,242

Map Prepared by

Map 4-18. Leupp Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Tolani Lake Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
 Area by Cover Type



<p>Cover Types</p> <ul style="list-style-type: none"> Juniper (J) Juniper Pinyon (JP) Pinyon (P) Pinyon Juniper (PJ) Ponderosa Pine within Woodland Area (PP) Woodland within the Commercial Forest (WwCF) Eastern Woodlands (EW) Commercial Forest (CF) NonForest (NF) Outside Woodland GIS Coverage 	<p>Roads</p> <ul style="list-style-type: none"> Interstate Highway US Highway State Highway BIA Road County Road <p>Other Features</p> <ul style="list-style-type: none"> Navajo Nation Boundary City 	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Cover Type</th> <th style="text-align: right;">Acres</th> </tr> </thead> <tbody> <tr> <td>J</td> <td style="text-align: right;">11,217</td> </tr> <tr> <td>JP</td> <td style="text-align: right;">0</td> </tr> <tr> <td>P</td> <td style="text-align: right;">0</td> </tr> <tr> <td>PJ</td> <td style="text-align: right;">0</td> </tr> <tr> <td>PP</td> <td style="text-align: right;">0</td> </tr> <tr> <td>WwCF</td> <td style="text-align: right;">0</td> </tr> <tr> <td>EW</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Total Woodland Acres:</td> <td style="text-align: right;">11,217</td> </tr> <tr> <td>CF</td> <td style="text-align: right;">0</td> </tr> <tr> <td>NF</td> <td style="text-align: right;">139,644</td> </tr> <tr> <td>Outside</td> <td style="text-align: right;">83</td> </tr> <tr> <td>Total Chapter Acres:</td> <td style="text-align: right;">150,944</td> </tr> </tbody> </table>	Cover Type	Acres	J	11,217	JP	0	P	0	PJ	0	PP	0	WwCF	0	EW	0	Total Woodland Acres:	11,217	CF	0	NF	139,644	Outside	83	Total Chapter Acres:	150,944
Cover Type	Acres																											
J	11,217																											
JP	0																											
P	0																											
PJ	0																											
PP	0																											
WwCF	0																											
EW	0																											
Total Woodland Acres:	11,217																											
CF	0																											
NF	139,644																											
Outside	83																											
Total Chapter Acres:	150,944																											

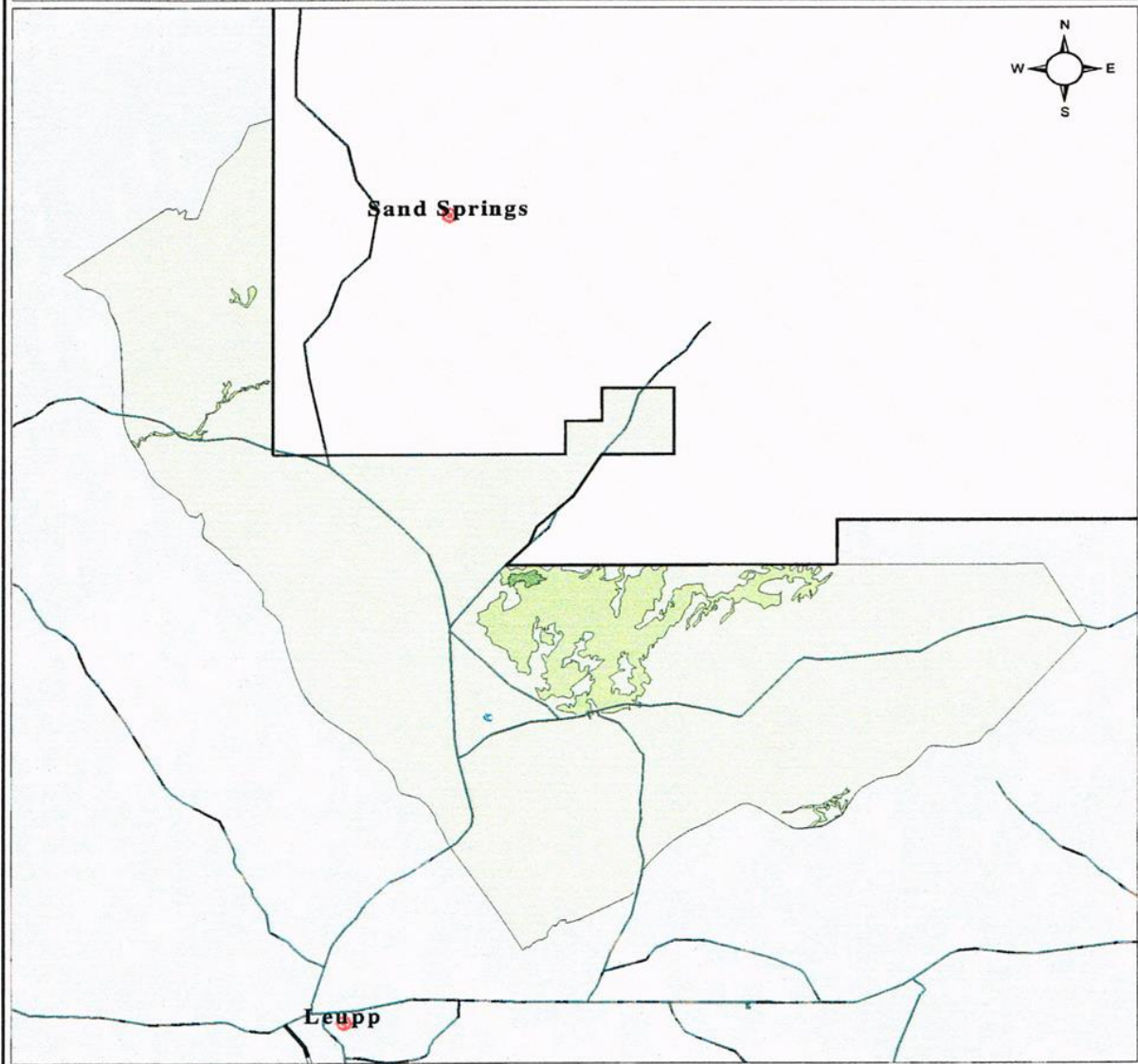
0
5 Miles

 Map Scale = 1:298,576

Map Prepared by

Map 4-19. Tolani Lake Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Tolani Lake Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



Crown Density Class	
	0% - 25% (no bar)
	26% - 50% (1 bar)
	51% - 75% (2 bar)
	76% + (3 bar)
	Ponderosa Pine over Pinyon Juniper within the Commercial Forest (PP/PJ wCF)
	Pinyon Juniper within the Commercial Forest (/PJ wCF)
	Eastern Woodlands (EW)
	Commercial Forest (CF)
	NonForest (NF)
	Outside Woodland GIS Coverage

Roads	
	Interstate Highway
	US Highway
	State Highway
	BIA Road
	County Road

Other Features	
	Navajo Nation Boundary
	City

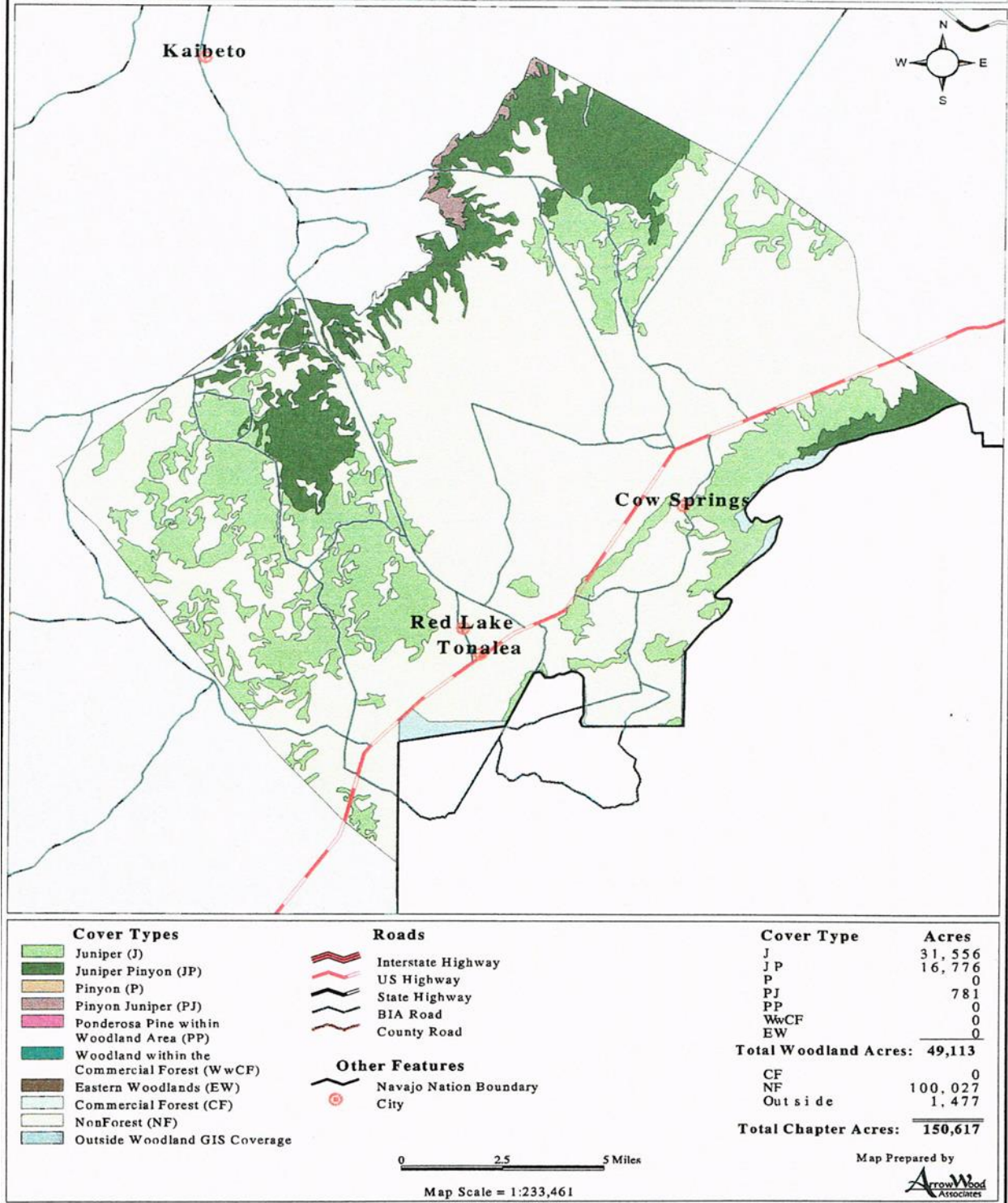
Crown Density Class	Acres
No Bar	11,022
1 Bar	195
2 Bar	0
3 Bar	0
PP/PJ wCF	0
/PJ wCF	0
EW	0
Total Woodland Acres:	11,217
CF	0
NF	139,644
Outside	83
Total Chapter Acres:	150,944

0 2.5 5 Miles
 Map Scale = 1:298,576

Map Prepared by

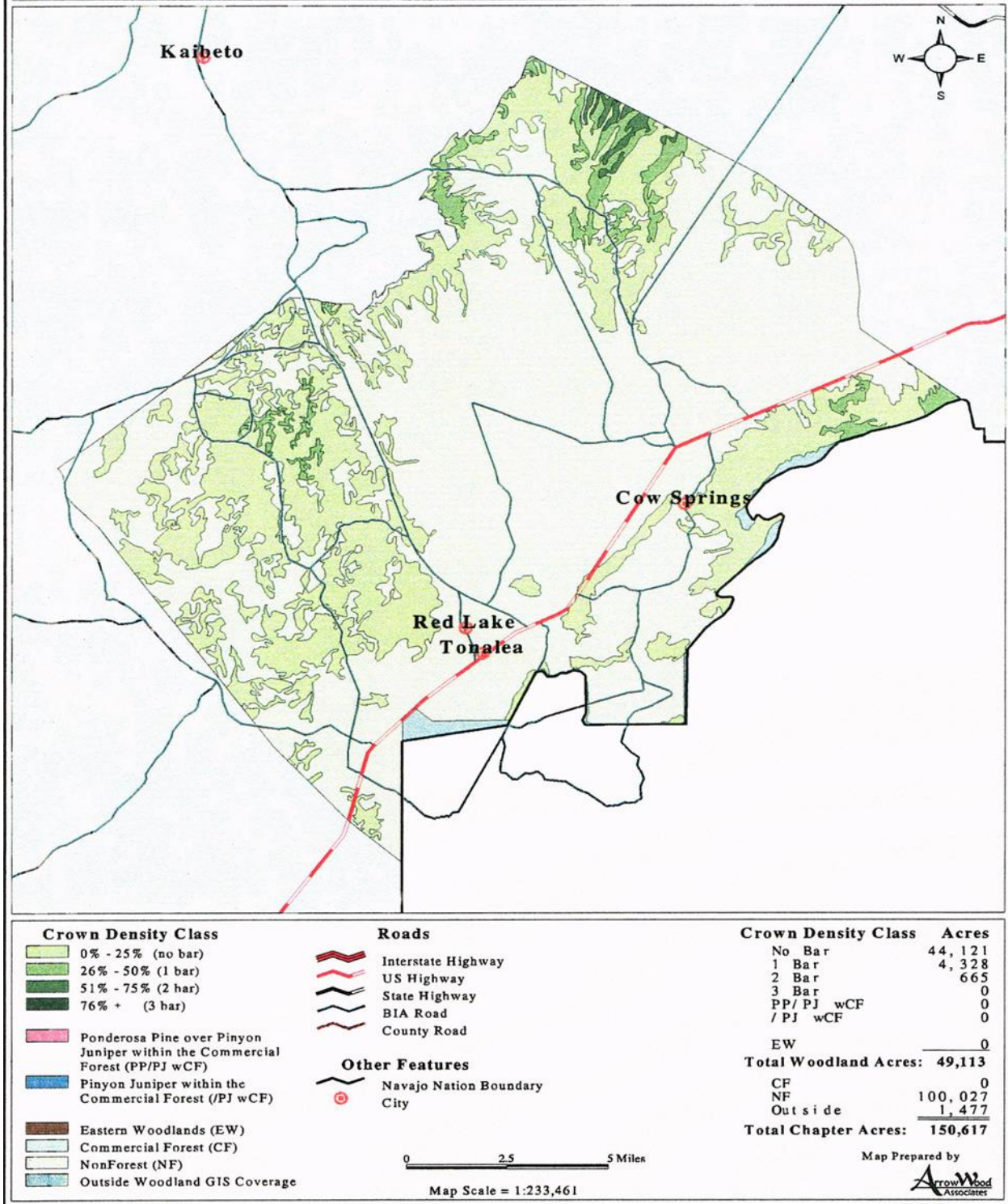
Map 4-20. Tolani Lake Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Tonalea Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
 Area by Cover Type



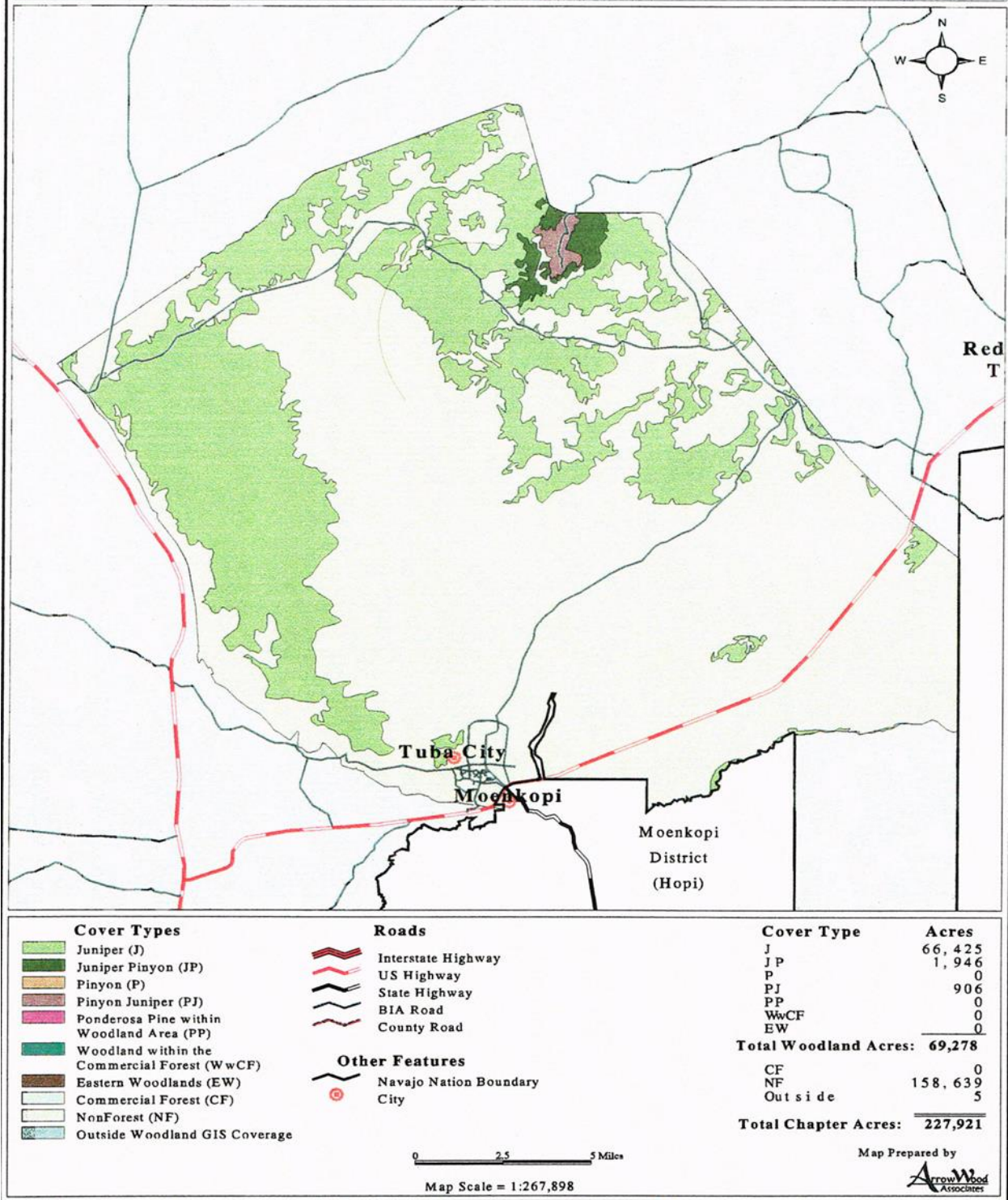
Map 4-21. Tonalea Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Tonalea Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



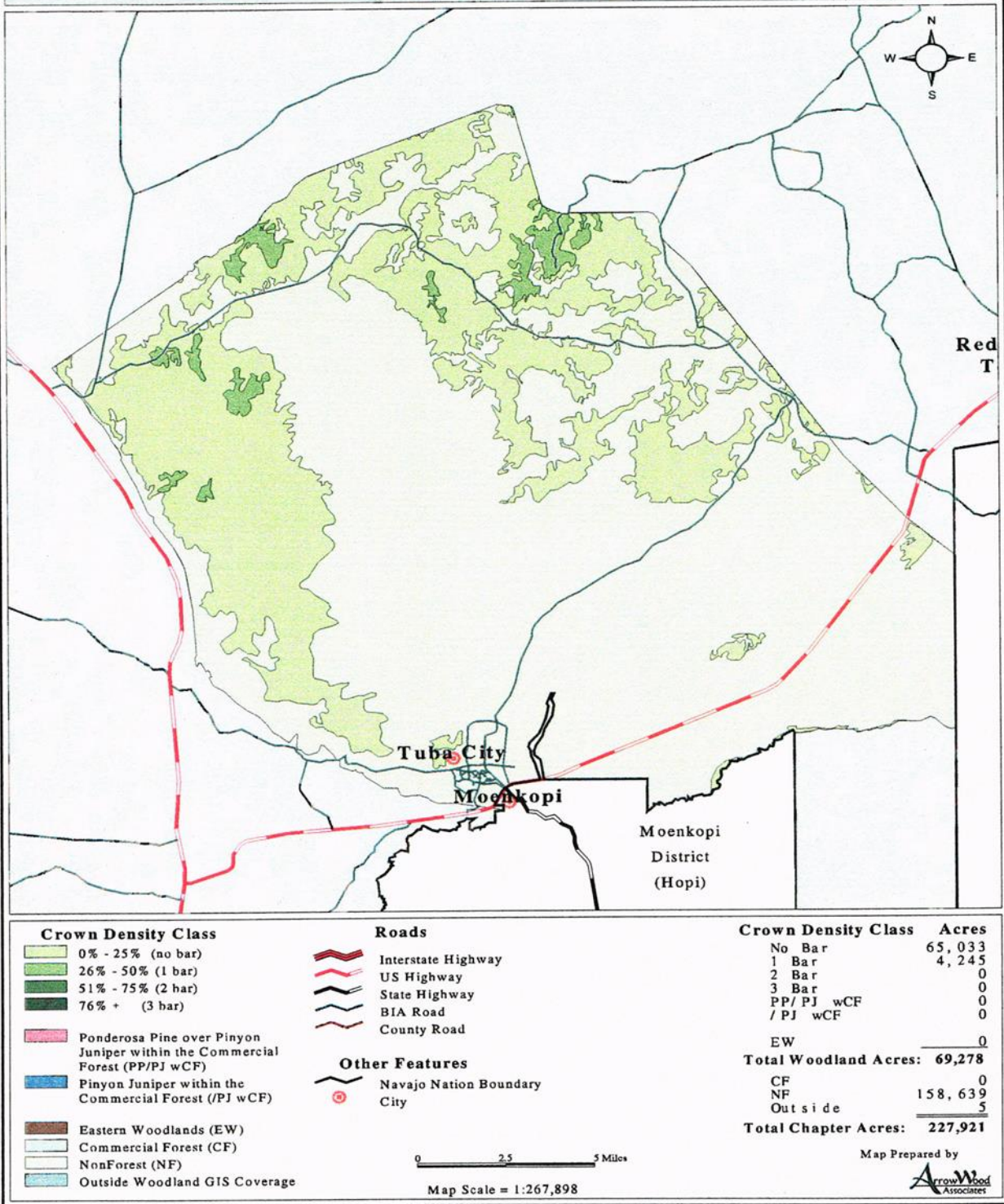
Map 4-22. Tonalea Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Tuba City Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Cover Type



Map 4-23. Tuba City Chapter Woodlands Map Area By Cover Type (WIAR 1999)

Tuba City Chapter Woodlands
Navajo Nation Woodland Inventory Analysis Report
Area by Crown Density Class



Map 4-24. Tuba City Chapter Woodlands Map Area By Crown Density Class (WIAR 1999)

Figure 4-13. Tuba City Chapter Per Acre Volume Summary Table by Diameter Class (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Per Acre Volume Summary Table by Diameter Class
 Chapter Databook
 Chapter - TUBA CITY
 4 Plots

Date:10/11/99
 Time:16:41:09
 ArrowWood Associates LLC

Diameter Class	Commercial Woodland				Non-Commercial Woodland				Total Woodland			
	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead	Green Volume (Live Trees)	Dead Wood Volume Within Tree Live Trees	Dead Tree Volume	All Volume Live & Dead
	3 - 5.9"				0.59				0.59	0.59		
9 - 11.9"				7.07	0.37		7.44	7.07	0.37			7.44
12 - 15.9"				44.52	0.90		45.42	44.52	0.90			45.42
16 - 19.9"				56.16	1.27		57.43	56.16	1.27			57.43
20" and up				87.96	4.62		92.59	87.96	4.62			92.59
Chapter Totals				196.31	7.17		203.49	196.31	7.17			203.49

Figure 4-14. Tuba City Chapter Per Acre Volume Summary Table by Species (WIAR 1999)

Navajo Woodland Inventory Analysis (1986-1991 measurement)
 Stand and Per Acre Product Volume Summary Table by Species -- TUBA CITY Chapter
 4 Plots

Date:10/11/99
 Time:16:55:48
 ArrowWood Associates LLC

Species	Trees Per Acre	Quadratic Mean Diameter (inches)	Basal Area Sq. Ft. per Acre	Total Volume — Cubic Feet per Acre	Volume to a Merchantable Top per Acre	Board Foot Volume per Acre per Scribner	Annual Net Growth Cubic Feet per Acre per Year	Cords per Acre	Line Posts per Acre	Corner Posts per Acre	Christmas Trees per Acre
Juniper	20.72	16.06	32.83	203.49	203.49		1.17	2.70			
Chapter Totals	20.72	16.06	32.83	203.49	203.49		1.17	2.70			

All volumes are net.

4.4 Fish and Wildlife

The Navajo Nation Department of Fish and Wildlife (NNDFW) is dedicated to the conservation of the rich and diverse fish, wildlife, and plant resources of the Navajo Nation. Additionally, the NNDFW oversees developing and recommending policies, rules, and regulations, and management plans relating to the fish, wildlife, and native plant resources on the Navajo Nation, and to provide predator and animal control services on the Navajo Nation. The NNDFW consists of Wildlife Law Enforcement, Research and Management, Natural Heritage Program, Animal Damage/Animal Control Sections, and Zoological and Botanical Park.

The FBFA contains four general habitats comprised of vegetation communities including, woodland, shrubland, grassland, and wetland (Map 4-25). These habitats provide cover, foraging habitat, and movement corridors for animals such as mule deer (*Odocoileus hemionus*) and coyote (*Canis latrans*). The Navajo Nation in its entirety is host to approximately 80 vertebrate species including mammals, birds, reptiles and amphibians, and fishes (Mikesic and Roth 2008).

4.4.1 Vegetation Communities

Various sources of information were used to compile the description of vegetation communities. These include vegetation descriptions of Arizona, Navajo Nation Inventories, government reports, and scientific journal articles. The extent and location of vegetation types were obtained from USDA GIS website and Navajo Nation mapping. Nomenclature for plant species follows USDA, NRCS the PLANTS Database (NRCS 2014).

Woodland

Great Basin Conifer Woodland is characterized by stands of juniper (*Juniperus* sp.) and piñon pine (*Pinus* sp.) trees. This plant community dominates northern and central Arizona between elevations of 5,000 and 7,000 feet. These woodlands harbor many wildlife species that rely on trees for shelter and for many, such as piñon jay (*Gymnorhinus cyanocephalus*), that also rely on juniper and piñon fruits and seeds as their major food source. Common species are mule deer, Uinta chipmunk (*Tamias umbrinus*), bobcat (*Lynx rufus*), grey fox (*Urocyon cinereoargenteus*), whiptail lizard (*Cnemidophorus* sp.), western rattlesnake (*Crotalus oreganus*), Cooper's hawk (*Accipiter cooperii*), common raven (*Corvus corax*), woodpecker (*Picidae* sp.), bushtit (*Psaltriparus minimus*), juniper titmouse (*Baeolophus ridgwayi*), and turkey (*Meleagris gallopavo*) (Lowe 1964). Within the woodlands, oak groves provide habitat for species such as Mexican big-eared bat (*Corynorhinus mexicanus*) and western scrub jay (*Aphelocoma californica*) (Lowe 1964). Cliff faces and rocky areas are habitat for species such as cliff chipmunk (*Tamias dorsalis*) while rocky canyons provide habitat for bighorn sheep (*Ovis canadensis*) (Alden and Freiderici 1999).

Desert Shrubland

Two types of desert shrubland occur on the Colorado Plateau in northern Arizona, sagebrush and shadscale (Brown 1994). Sagebrush dominated shrubland is 1 to 30 feet tall. It is characterized by big sagebrush (*Artemisia tridentata*) but can share sites with other shrubs such as rabbitbrush (*Ericameria nauseosa*), winterfat (*Krascheninnikovia lanata*), Mormon tea (*Ephedra* sp.) and Torrey joint fir (*Ephedra torreyana*) (Lowe and Brown 1973). Patchy perennial grasses are the understory along with Whipple's prickly pears (*Opuntia whipplei*) and ragwort (*Senecio flaccidus*), while annual grasses are common in wet years. Shadscale occurs along drainages of the Little Colorado River in elevations from 3000 to 5000 feet (Brown 1994).

Shadscale is short and very open vegetation with covers of 10 to 25 percent. Shadscale (*Atriplex confertifolia*) is the main species but other frequent shrub species are sagebrush (*Artemisia spinescens*), greasewood (*Sarcobatus vermiculatus*), Mormon tea, spiny hopsage (*Grayia spinosa*) and saltbush (*Atriplex* sp.). The understory is widely scattered perennial grass such as James' galleta (*Pleuraphis jamesii*), squirreltail (*Elymus elymoides*), desert needlegrass (*Stipa speciosa*), and alkali sacaton (*Sporobolus airoides*).

Desert shrubland is characterized by wildlife species that use sagebrush and other shrubs for food and shelter. Vertebrate diversity is low compared to other habitat types. Mammalian species found in this habitat are pronghorn (*Antilocapra americana*), coyote, black-tailed jackrabbit (*Lepus californicus*), antelope ground squirrel (*Ammospermophilus* sp.), mice, Mexican free-tailed bat (*Tadarida brasiliensis*) and western pipistrelle bat (*Parastrellus hesperus*) (West 1983; Lowe 1964). Birds include sage thrasher

(*Oreoscoptes montanus*), sagebrush sparrow (*Artemisiospiza nevadensis*) and predators such as golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*) and Cooper's hawk. Common reptiles are sagebrush lizard (*Sceloporus graciosus*), whiptail lizard, striped racer (*Masticophis lateralis*) and gopher snake (*Pituophis catenifer*) (Turner 1982).

Grassland

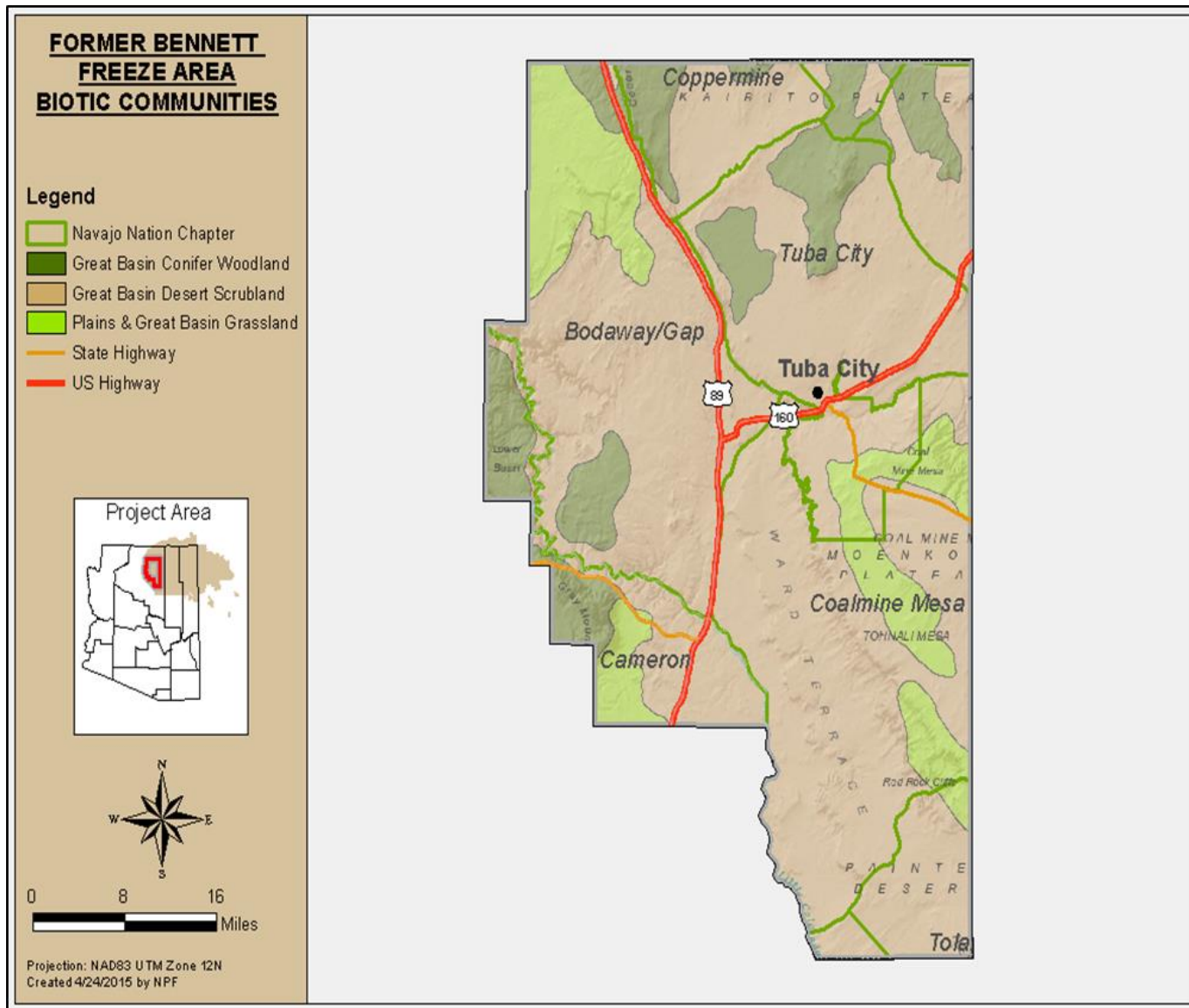
The grassland is situated largely on high level plains, in valleys, and on intervening and adjacent low hillsides, rises, ridges, and mesas in what is predominantly flat and open country. Grasslands of the Navajo Nation occur above 4,000 feet elevation. The upper elevation limits are typically at 7,200 to 7,500 feet. Grasslands consist primarily of short grama grass (*Bouteloua* sp.) and are interspersed with Russian thistle (*Salsola* sp.), narrow-leaf yucca (*Yucca angustissima*), prickly pear (*Opuntia polyacantha*), and cholla (*Opuntia* sp.) (Brown 1994). Shrubland wildlife species include coyote, red-tailed hawk (*Buteo jamaicensis*), and gopher snake (Lowe 1964). Apache pocket mouse (*Chaetodipus* sp.), Ord's kangaroo rat (*Dipodomys ordii*), ferruginous hawk (*Buteo regalis*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and lark sparrow (*Chondestes grammacus*) are a sample of species restricted to grassland habitats. Red-spotted toad (*Bufo punctatus*), one of the few amphibians occurring in Arizona, is found in grasslands where seeps and livestock tanks seasonally hold water (Alden and Friedrici 1999)

Riparian Forest

A riparian forest is characterized by tall, deciduous broadleaf trees restricted to stream banks and the periphery of lakes and ponds. Species restricted to the woodlands are western screech owl (*Megascops kennicottii*), yellow-billed cuckoo (*Coccyzus americanus*), southwestern willow flycatcher (*Empidonax traillii eximius*), canyon tree frog (*Hyla arenicolor*), and Woodhouse's toad (*Anaxyrus woodhousii*).

Wetland and Open Water

Marshes occur in ponds, lakes, reservoirs, springs, seeps, farm ponds and slow-moving watercourses. Bald eagles are found in northern Arizona near lakes and streams (Lowe 1964). Beaver (*Castor canadensis*) occur along permanent streams and raccoon along Little Colorado River. Many shorebirds and waterfowl are restricted to these habitats for breeding or wintering habitat (Brown 1999). These habitat types are also important stopovers for migrating birds during spring and fall. Other species restricted to these habitats are northern leopard frog (*Lithobates pipiens*), terrestrial garter snake (*Thamnophis* sp.) and muskrat (*Ondatra zibethicus*) (Lowe 1964; Alden and Friedericic 1999). Humpback chub (*Gila cypha*), Colorado pikeminnow (*Ptychocheilus lucius*) and bluehead sucker (*Catostomus discobolus*) are found in cold water drainages of the Colorado River (Brown 1985).



Map 4-25. Biotic Communities in the Former Bennett Freeze Area

4.4.2 Threatened and Endangered Species

The Navajo Nation has developed the Navajo Endangered Species List, pursuant to the Navajo Tribal Code (17 NNC § 507). Navajo endangered species include those identified by the Navajo Natural Heritage Program and federally listed threatened and endangered species as designated by the US Fish and Wildlife Service.

The Navajo Natural Heritage Program (NNHP) is the Navajo Nation's rare, threatened, and endangered species office. The NNHP's purpose is to collect, manage, and disseminate biological and ecological information for land use planning to promote the conservation of biological diversity on the Navajo Nation. The NNDFW maintains a comprehensive list of endangered plant and animal species that occur on Navajo lands. This list includes including mammals, birds, amphibians, fish, as well as plants.

Navajo endangered species are designated by group. Group 1 species are those species or subspecies that no longer occur on the Navajo Nation. Group 2 species are considered endangered, or a species or subspecies whose prospects of survival or recruitment on the Navajo Nation are in jeopardy. Group 3 species are those species whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future. Group 4 species are those species for which the NNDFW does not currently have sufficient information to support it being listed as Group 2 or Group 3 but has reason to consider them.

4.4.3 Resource Concentration Protection Areas

The NNDFW has prepared a development planning tool to avoid biologically sensitive areas throughout the Navajo Nation. Areas on the Navajo Nation are categorized according to the potential impact of development on wildlife and their habitats in those areas. This designation is part of the Biological Resource Land Use Clearance Policies and Procedures. See Map 4-26 for designated areas within the FBFA. Rankings include the following:

- 1. Highly Sensitive Areas**—contain the best habitat for endangered and rare plant, animal and game species, and the highest concentration of these species on the Navajo Nation. The purpose of this area is to protect these valuable and sensitive biological resources to the maximum extent practical.

The general rule for this area is no activity or development that is going to result in significant impact to wildlife resources. Restricted development is allowable only if the following criteria are met. All development requires the preparation of a Biological Evaluation (BE). An acceptable BE must fully consider alternatives to the proposed development and provide a compelling reason to develop in this area.

Criteria for Allowable Development:

- Residential/business development is allowed within Area 1 if it is:
 - Not within or close enough to the habitat to cause significant impacts
 - Located on the perimeter of the area; if not on the perimeter, there must be no reasonable alternatives
 - Located within 1/8 mile of similar development

- Other types of development are allowed in Area 1 if:
 - It is not within or close enough to habitat to cause significant impacts
 - There are no reasonable alternatives outside the area
- 2. Moderately Sensitive Areas**—This area has a high concentration of rare, endangered, sensitive and game species occurrences or has a high potential for these species to occur throughout the landscape. The purpose of this area is to minimize impacts on these species and their habitats, and to ensure the habitats in Area 1 do not become fragmented.
- The rule for this area is that all development be placed to avoid species and their habitat. Avoidance needs to include an adequate buffer to address long-term and cumulative impacts. The buffer distance will depend on the species and the situation and may be up to 1 mile. All development requires the preparation of a BE.
- 3. Less Sensitive Areas**—This area has a low, fragmented concentration of species of concern. Species in this area may be locally abundant on “islands” of habitat; however, islands are relatively small, limited in number and well-spaced across the landscape. However, the Department recognizes that lands within Area 3 may be not be completely surveyed for the potential occurrence of sensitive species or habitat.
- If the NNHP provides a Data Response for a project in less sensitive areas that states that there are no known or potential species of concern for a specific project, then a BE does not need to be drafted. The project complies with the Endangered Species Act and the Navajo Endangered Species Listing (NESL). The project sponsor can receive a Biological Resource Compliance Form by requesting concurrence from the Director of NNDFW that the project will not affect species of concern.
 - All developments require preparation of a BE. Generally, the need to avoid sensitive habitats should be less frequent in this area; therefore, development in these areas is more likely to proceed as planned with proper and timely planning.
- 4. Community Development Areas**—The NNDFW has determined that areas around certain communities do not support the habitat for species of concern and therefore development can proceed without further biological evaluation. Whenever possible the NNDFW recommends that project sponsors attempt to locate their projects within Community Development Areas.
- For project approval of all developments that are completely contained within Area 4, submit documentation to Department Director, including (but note exceptions below):
 - Location plotted on a 7.5-minute USGS topographic quadrangle map or reasonable facsimile;
 - Brief description of project, including acreage.

Exceptions:

- This applies to all development except that which may have significant impacts outside the community. An example of this is large-scale industrial development that may impact

air or water quality. For projects of this type, follow the standard “Process for planning and approval of development” (Page 4).

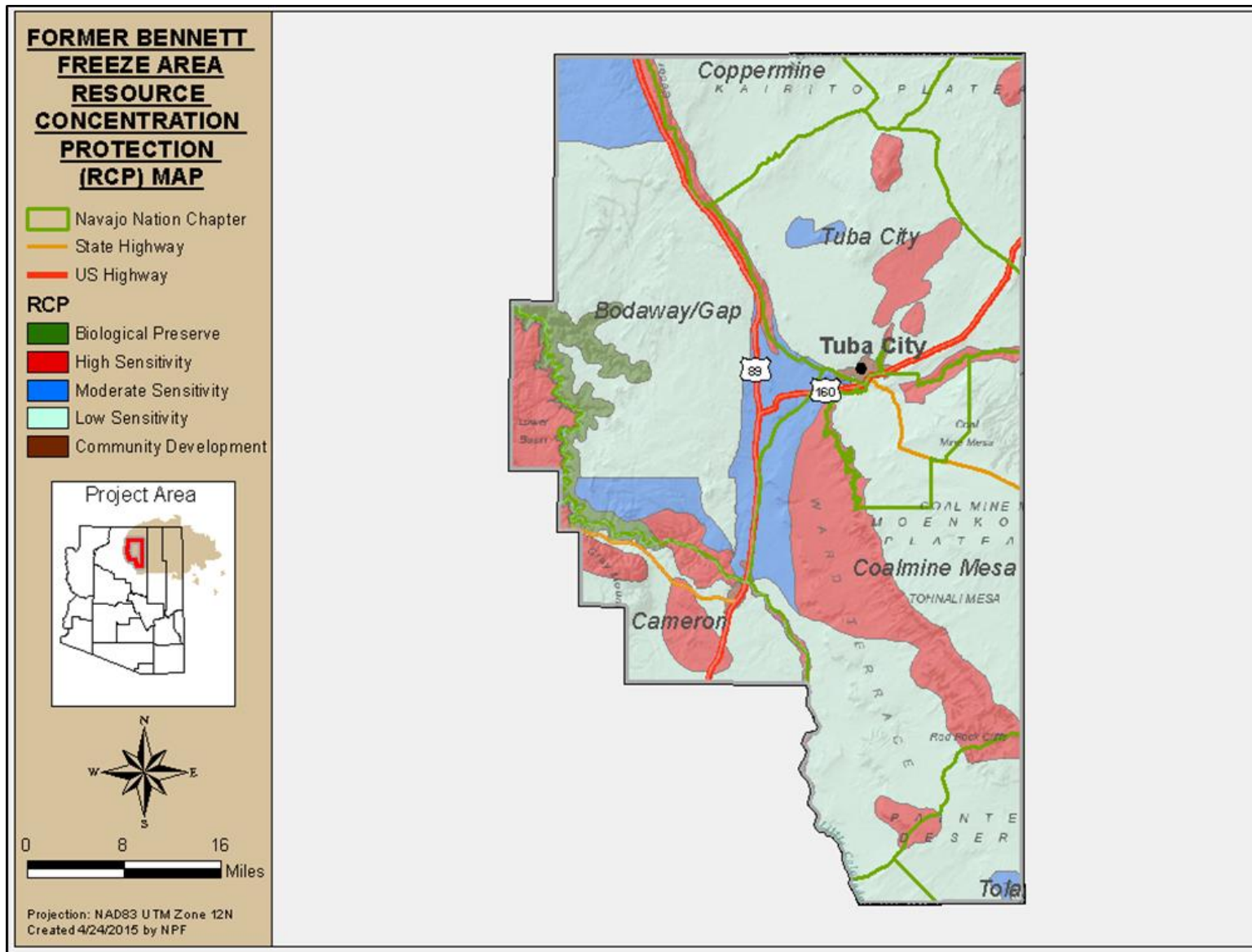
- For certain communities, there are exceptions where one species has the potential to occur. For these exceptions, the biological evaluation need only address that species, and be submitted to the Department for approval. These communities are:
 - Piñon (Mountain Plover)
 - Tuba City (*Puccinellia parishii*)

5. Biological Preserve Areas—These areas contain excellent, or potentially excellent, wildlife habitat and are recommended by the Department for protection from most human-related activities, and in some cases are recommended for enhancement. To date, only a few of these areas have been identified or designated. Future areas will be identified on a case-by-case basis. A variety of protection and enhancement techniques are available, and the Department is interested in working with the Chapter and land user to protect/enhance these habitats by providing technical assistance, and possibly materials and labor. The Department is interested in receiving proposals from Chapters and land users for these types of areas. Ultimately, the Department maintains the authority for designating and managing biological preserves. However, the Department may delegate certain management responsibilities to the local level, under Department oversight.

- No new activity or development is allowed within these Preserves, unless it is compatible with management goals for the area. For projects to develop Biological Preserves, the standard “Process for planning and approval of development” (Page 4) needs to be implemented. This does not include approved pre-existing activities.

6. Recreation Areas—These areas are used for recreation that involves wildlife or have potential for development for this purpose. Recreation can involve consumptive and/or non-consumptive uses of wildlife resources and is often a part of a broader outdoor experience. Examples include fishing lakes, camping and picnic areas and hiking trails. Several areas have been identified as Recreation Areas. Future areas will be identified on a case-by-case basis. A variety of management techniques are available, and the Department is interested in working with the Chapter and land user to develop and/or manage these areas. The Department is also interested in receiving proposals from Chapters and land users for these types of areas. Ultimately, the Department maintains the authority for designating and managing recreational areas that involve wildlife. However, the Department may delegate certain management responsibilities to the local level, under Department oversight. The Department encourages Chapters to plan development in this area compatible with the purpose, for example nature trails, interpretive displays and picnic areas.

- No new development is allowed within Recreation Areas, unless it is compatible with management goals for the area. For projects to develop Recreation Areas, the standard “Process for planning and approval of development” (page 4) needs to be implemented.



Map 4-26. Resource Concentration Protection Designations within the Former Bennett Freeze Area

4.4.4 Navajo Nation Priority Species and Habitats

In 2011, the NNDFW began the process of developing a long-term strategic plan to guide wildlife management on the Navajo Nation. Given the limited resources for managing and monitoring species and ecosystems, a set of highest-priority species, ecosystems, or vegetation communities were selected to focus future NNDFW management activities (Heinz Center 2011).

The 11 highest priority wildlife species identified by the NNDFW are:

1. American black bear (*Ursus americanus*)
2. bobcat
3. Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*)
4. coyote
5. desert bighorn sheep (*Ovis canadensis nelsoni*)
6. golden eagle
7. Gunnison's prairie dog (*Cynomys gunnisonii*)
8. Merriam's wild turkey (*Meleagris gallopavo merriami*)
9. mountain lion (*Puma concolor*)
10. mule deer
11. Rocky Mountain elk (*Cervus elaphus nelson*)

The five priority plant species identified by the NNDFW are:

1. Mesa Verde cactus (*Sclerocactus mesae-verdae*)
2. Navajo sage
3. piñon pine
4. salt cedar (*Tamarix* sp.).
5. Yucca (*Yucca* sp.)

The top five habitats identified in ranked order are:

1. biological preserves
2. mountain ponds and springs
3. high elevation/mountain grasslands and meadows
4. piñon-juniper woodlands
5. lakes

4.5 Cultural Resources

Cultural resources are historic and archaeological sites and traditional cultural places (TCPs). Historic and archaeological properties include, but are not limited to, artifact scatters, structures or structural remains

of various types with associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails. A TCP is a property that has associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community.

Cultural resources and TCPs are only some of the features of the overall ethnographic landscape of the Navajo people (Diné). While these discrete features are important, their overall value is only understood within the overarching cultural landscape of Navajo land, which includes not only cultural resources, but geography, hydrological features, natural resources, wildlife, and livestock (NPS 1995). In other words, Diné sense of place is critical to the expression of Diné culture and interpretation of the archaeological record. This bond to place is timeless, guiding the Foundation of Diné Law (Diné Bi Beehaz'áanii Bitse Siléí). Examples of the cultural and ethnographic landscape include the San Francisco Peaks (Dook'o'ooshíid)—one of the six sacred mountains (dził naat'ááh) that define the ethnographic landscape—the Little Colorado River (Tolchi'ikooh), natural springs, rock piles, boulders, lightning struck trees, plant gather places, and game traps (Martin 2002). While these examples are distinct features within the ethnographic landscape, Navajo land is not discontinuous, but experienced through herding, hunting, farming, and travel amongst these definitive features throughout time immemorial.

The Navajo Nation Heritage and Historic Preservation Department (NNHHPD) ensures Navajo traditional concerns are addressed in undertakings as they pertain to project management, land use planning, and cultural resource management. The NNHHPD maintains records of cultural resources investigations and cultural resource properties within lands administered by that office.

Due to the constraints imposed by the Bennett Freeze, limited infrastructure maintenance occurred in the area; consequently, few cultural resource inventories were conducted within the FBFA for over 50 years and documentation is limited

The table below provides the cultural resource inventory acreage per the nine (9) Navajo Nation Chapters identified within the Former Bennett Freeze Area (FBFA). The results of this table began with cultural resource inventory projects that occurred in the 1980s to the present (2019).

The data was compiled from the Navajo Nation Heritage and Historic Preservation Department (NNHHPD) archival records and database files. Compiling the acreage below was also obtained from the Geographic Information System (GIS) which is currently in the process of providing the location of the various cultural resource projects on a USGS map.

Table 4-11. Acreage Inventoried for Cultural Resources Within the Former Bennett Freeze Area

Chapter	Acres	Archaeological Sites	No. of Projects
Bodaway/Gap	4,974.80	206	447
Cameron	7,288.45	162	452
Coalmine Canyon	1,469.96	92	259
Coppermine	560.49	93	205
Kaibeto	4,538.92	83	367
Leupp	3,374.55	16	236
Tolani Lake	3,574.00	73	140
Tonalea	2,090.80	47	391
Tuba City	7,366.26	224	1,135
	35,238.23	996	3,632

Anticipated archaeological or historic sites in the FBFA include:

1. Agricultural sites: sites comprised of agricultural fields and/or agriculture-related features such as canals, rock piles, and rock alignments.
2. Artifact scatters: sites composed entirely of artifacts and lacking associated features. Some artifact scatters may be comprised of a single material, such as a flaked stone or ceramics, whereas others encompass multiple artifact types.
3. Habitation sites: habitation sites cover a range of site manifestations, from ephemeral Paleoindians campsites to the large villages to historic Navajo homesites.
4. Resource procurement sites: resource procurement sites cover a range of site sub-types, all of which focused on the procurement of some type of resource, such as raw tool stone or plants.
5. Rock art: pictographs or petroglyphs on rock faces and cave walls.

Anticipated TCP types in the FBFA include:

1. Designate a plant gathering areas.
2. Designate a mineral gathering areas.
3. Designated Ceremonial areas.
4. Identify and record historical Navajo homesite areas.
5. Identify and record historical sweat lodge areas
6. Identify and record sacred offering areas (Springs, Lighting Struck Trees, Talking Rocks, etc).
7. Place associated with general Diné origin.

8. Place associated with origin or home of a clan.
 9. Place identified or associated with a Holy Deities/Beings.
 10. Identify and record Sacred Places
-

4.5.1 Historic and Archaeological Resources

Navajo Nation lands are held in trust for the Navajo people by the federal government as such, all development projects across the Navajo lands are to be culturally inventoried (archaeologically surveyed) for compliance with Section 106 (36 CFR 800) under the National Historic Preservation Act (NHPA). The Section 106 process is commonly known as the “archaeological clearance” process. The process requires all federal agencies to consider the effects of undertakings on historic properties. The minimum age of a cultural resource is 50 years, so the process applies to all historic sites (Navajo, Euro-American, etc.), and all prehistoric “Anasazi” sites. The process is designed to ensure protection of cultural resources located on all federal lands. Therefore, before any development occurs on Navajo lands, a cultural resource inventory is required.

When the Section 106 process is initiated, the federal agency determines if an undertaking will have either a “no affect” or an “adverse effect” on historic properties. To explain, each state across the US has a State Historic Preservation Officer (SHPO) that oversees the identification, evaluation, and protection of cultural resources within their state. On the Navajo Nation, the Tribal Historic Preservation Officer (THPO) is authorized to oversee this process for the Navajo Nation. Within the NNHHPD, the THPO oversees the Cultural Resource Compliance Section (CRCS). The CRCS reviews archaeological reports submitted by cultural resource management (CRM) firms who conduct archaeological work on the Navajo Nation. The CRM firms are required to submit a report after they have conducted an in-field cultural resource inventory (archaeological survey). Once reviewed, the THPO signs a Cultural Resource Compliance Form for final approval or disapproval for an archaeological report. The compliance form is forwarded to the BIA for approval and signatory. After a report has been reviewed and a compliance form issued, the report is archived at the NNHHPD-compliance records room.

In 1988, the Navajo Nation implemented the Cultural Resource Protection Act (CMY-88), which states that NNHHPD is responsible for protecting, preserving, and managing cultural resources on the Navajo Nation. Cultural resources identified on the Navajo Nation are also evaluated under the following legislation; Archaeological Resources Protection Act (ARPA); the American Indian Religious Freedom Act (AIRFA); and the Native American Graves Protection and Repatriation Act (NAGPRA). Of importance, Navajo burials are treated according to the Navajo Nation Policy for the Protection of Jishchaa’: Gravesites, Human Remains, and Funerary Items. Finally, the identification and protection of TCPs on the Navajo Nation is dealt with by the policy to protect TCPs.

Development across the Navajo Nation varies from 1-acre homesite leases to larger scale linear and/or large block projects entailing hundreds of acres with the fieldwork entailing pedestrian inventorying (surveying). The project area is 100 percent assessed for cultural resources and ethnographic data is gathered by interviewing Navajo residents in the area.

Typically, a cultural resource report will entail the description of the project/undertaking, the size of the project (acreage), environment, methodology, locational information, map presentation, and description

of the cultural resource findings such as an archaeological site, TCPs, or burial, and ethnographic information, followed by the evaluation of the findings, and lastly, the recommendations for the project development. It is important to note that the information regarding identified TCPs and burials are considered confidential to the public and information pertaining to these resources are restricted to the reviewing agency (NNHHPD 2018).

4.5.2 Traditional Cultural Properties

The NNHHPD division maintains a database of known TCPs on the Navajo Nation. A TCP is a property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. TCPs are rooted in a traditional community's history and are important in maintaining the continuing cultural identity of the community. The cultural practices or beliefs that give a TCP its significance are in many cases still observed at the time a TCP is considered for inclusion in the NRHP. Because of this, it is sometimes perceived that the practices or beliefs themselves, not the property, make up the TCP. While the beliefs or practices associated with a TCP are of central importance, the NRHP does not include intangible resources. The TCP must be a physical property or place—that is, a district, site, building, structure, or object (<https://www.nps.gov/history/tribes/Documents/TCP.pdf>).

TCPs are subject to meeting NRHP criteria. As with historic and archaeological sites, known TCPs will be reviewed at the NNHHPD and ethnographic surveys will be conducted to provide guidance prior to any proposed undertaking.

4.5.3 Navajo Nation Policy for the Protection of Jishchaa': Gravesites, Human Remains, and Funerary Items

The Jishchaa' policy was implemented pursuant to the Navajo Nation Cultural Resources Protection Act. It is intended to complement provisions set forth in the NAGPRAARPA, and NHPA and others.

The Navajo Nation requires a proponent of a proposed undertaking to make a good faith effort to locate gravesites, human remains, and funerary items within the area of potential effect prior to initiation of an undertaking. Such efforts shall include:

1. File searches of existing information, including files maintained at NNHHPD, mission records, and other pertinent materials as appropriate.
2. Archaeological inventory and ethnographic interviews with residents of the local community and with other knowledgeable individuals. Navajo Nation permitting procedures require that investigators contact local Chapters prior to initiating field activities.
3. Other approaches, such as traditional diagnostic techniques, as necessary or appropriate.

If Jishchaa' are encountered during a cultural resource inventory, guidance and management recommendations for proposed undertakings will be developed in consultation with the NNHHD.

4.6 Outdoor Recreation

The Navajo Nation Parks and Recreation was established in 1957 by the Navajo Nation Council and is one of the oldest programs within the Navajo Nation Government. The Navajo Nation Parks and Recreation Department is responsible for developing, implementing and enforcing policies, laws, rules, regulations, standards, and preserving the scenic, cultural, scientific, recreational, and natural resources within the established tribal parks, monuments, and recreation areas.

Navajo Nation Parks and Recreation oversees all Navajo Tribal Parks within Navajo Nation. The Navajo Nation has eight Tribal Parks, two of which are in the FBFA area—the Little Colorado River Tribal Park and Marble Canyon Tribal Park. With the recreation and tourism markets expanding consideration of upgrades, new infrastructure, new development, new sites, safe access/measures and amenities will need to occur. Prior to any development in the parks, feasibility studies should be conducted to consider potential expansion, ensure existing sites are safe and to avoid any federal or tribal protected plant and animal species. Generation of significant revenue will depend on expansion of current visitor sites, creating recreational and camping opportunities, and fees.

The Little Colorado River Tribal Park and Marble Canyon Tribal Park currently have a staff of six. The staffing numbers are stringently based off visitors and season. Staff members also enforce tribal codes, maintain park and recreation areas, collect park fees, assist in emergency search and rescue operations, and conduct ARPA patrols on the Navajo Nation.

The Little Colorado River Tribal Park was established in 1962, for the purpose of recreation and scientific interest. The parks commission makes rules and regulations for the Little Colorado River that are consistent with the authorities of the Navajo Tribal Council to preserve and develop the area for scenic historical recreational and scientific purposes. The Little Colorado River Park includes is 360,992 acres with designated areas for camping, picnicking, hiking, photography and backcountry trails. There are seven backcountry trails that are isolated trails with no improved accessibility. Temporary use permits for filming and photography are issued in the Little Colorado River Tribal Park. Marble Canyon Tribal Park is still undeveloped. However, plans for development do exist. These plans are in the process of being formalized as Navajo Nation Parks and Recreation work to finalize the Western Area Parks General Management Plan.

Each Tribal Park keeps their own record and there is no accurate data on visitor numbers. The estimate for Little Colorado River Tribal Park is 75,000, which is not accurate (Renee Benally pers. comm. with Navajo Nation Park & Recreation Manager Martin Begay, 7/1/2019).

4.7 Minerals

The Minerals Department is the center for all mineral exploration and development on the Navajo Nation. The Department is charged with ensuring the proper management and accountability of the Navajo Nation's mineral resources and is also responsible for oversight of the reclamation of lands that are disturbed by mining activities. The Navajo Nation's minerals wealth comes from large reserves of oil, gas, coal, sand and gravel, and helium. The Navajo Nation Minerals Department is under the Division of Natural Resources and is composed of four different programs.

1. Minerals Audit Program
2. Mine Safety Program
3. Surface Mining Program
4. Oil and Gas Inspection and Enforcement Program

The Minerals Department worked with the Division to develop an Energy and Natural Resources Economic Development Roadmap. The purpose of this Economic Roadmap is to provide a glimpse into the Navajo Nation's history of human resource contributions to the economic prosperity of the West; to learn from past agreements; and to provide an outline to clear a path for economic prosperity to occur throughout the Navajo Nation. The economic areas that fall under the authority of the Minerals Department are helium, renewables, wind, solar, biomass, geothermal, sand and gravel, natural gas, coal for uses other than coal-generated power plants, and uranium (if the Navajo Nation moratorium on uranium is lifted). All these areas will be a focus for boundaries within the Navajo Nation, including the FBFA.

4.7.1 Resource Use Patterns

The extractive mineral resources found within the FBFA include gold, silver, copper, coal, uranium, oil and gas, and sand and gravel. However, not all minerals that are present within the FBFA can be developed. Exploration for gold and silver found those minerals present in the FBFA but in insufficient quantities for commercial mining.

In the early 1900s copper was discovered within the northeast portion of the FBFA. This area was mined but in small quantities. At today's prices, copper would not be economical to mine and process in this area.

Uranium is very abundant within the entire FBFA. This area was mined for uranium in the early 1950s through 1982 when the Navajo Nation government placed a ban on uranium mining and processing due to the radiation sickness, contaminated tailings, and abandoned mines left behind. Even without the Navajo Nation ban on uranium, prices are so low that it would not be economical to mine at this time.

Coal is also abundant within the FBFA. The Black Mesa area has mined coal since the early 1960s with production continuing today. There remains a large amount of reserves on Navajo and Hopi lands within the Black Mesa area.

Currently, there are no operating sand and gravel pits in the FBFA. New operations are being explored and it is expected that sand and gravel mining operations will be seen in the future.

As for oil and gas, limited exploration has indicated that there may not be much oil and gas potential in the FBFA. There has been some interest and future exploration may be expected.

Renewable energy such as solar and wind operations are being looked at by the New Energy Office of the Navajo Nation. New development within the renewables sector is anticipated in the near future.

4.7.2 Navajo Abandoned Mine Lands Reclamation/Uranium Mine Tailing Remediation

The Navajo Abandoned Mine Lands Reclamation/Uranium Mine Tailing Remediation (AML/UMTRA) Department's mission is to restore and reclaim abandoned mine lands on the Navajo Nation. This mission includes:

1. Administration/Management
2. Public Relations
3. Public Facility Projects
4. AML Maintenance Surveillance Plan
5. Monitoring UMTRA sites

The Navajo AML/UMTRA Program is a department under the Division of Natural Resources within the Navajo Nation.

Since its beginning in the 1940s until the mid-1970s, the history of uranium mining has had long-lasting, negative impacts on the land, water, and health of FBFA residents. Coalmine Canyon, Cameron, Bodaway-Gap, and Tuba City have especially borne the brunt of its effects, including ongoing airborne, or downwind, contamination from test pits that have not been closed or remediated, groundwater contamination of 1.5 and 3 billion gallons in the N-aquifer that will be remediated for years to come, and surface water contamination that affects livestock and humans from livestock consumption (WHPacific 2008).

In 2007, the USEPA with the U.S. Army Corps of Engineers in cooperation with the Navajo Nation and the Navajo AML prepared a report documenting data collection and screening results for all known abandoned uranium mines on the Navajo Nation (TerraSpectra Geomatics 2007). The 2007 database lists 602 abandoned mines in the FBFA. Table 4-12 lists the reclamation status of these mines as of 2007.

Table 4-12. Reclamation Status of Abandoned Uranium Mines in the Former Bennett Freeze Area

Status	Number
Reclaimed	354
Partially reclaimed	14
Un-reclaimed	90
Unknown	144
Total	602

Source: TerraSpectra Geomatics 2007.

5. Management Goals and Objectives

Goals and objectives for natural resource planning and management are provided in this section. The goals and objectives listed below provide broad guidance for determining management approaches and activities.

5.1 Primary Goals and Objectives

Goal 1

Develop a centralized data sharing system for the Navajo Nation and BIA to utilize data for development of management plans that integrate multiple resources.

Objectives

1. Develop information and data sharing procedures to improve the ability of the Navajo Nation and BIA to provide current, comprehensive, and integrated data and GIS mapping.
2. Develop communication protocols to increase coordination between the Navajo Nation and BIA.

Goal 2

Develop an interdisciplinary and interdepartmental project and plan development process.

Objectives

1. Identify interdepartmental planning teams for overarching resource management issues and/or specific planning efforts.
2. Through the visioning/team building sessions, identify specific strategies for ongoing interdepartmental communication and project coordination.
3. Provide adaptive planning and safety training to resource department personnel to increase their ability to respond to changing conditions, industry trends, and management of extreme events.

Goal 3

Develop, refine, and implement a land management designation system for the FBFA to help delineate areas for development, restoration, wildlife conservation, etc. and to support other management objectives.

Objectives

1. Apply resource decision making on the optimal spatial scale, such as watersheds and ecosystems.
2. Apply best management practices identified for specific resources.

Management Actions

1. Conduct a visioning/team building and training program on interdepartmental coordination.
2. Create a workflow diagram to illustrate the process, coordination points throughout the process, decision makers, and development milestones.
3. Compel all departments to geographically locate areas of interest and concern, to drive awareness across staff and stakeholders.
4. Develop integrated land management planning models.
5. Review and modify local CLUP zoning regulations and permitted uses to ensure compliance with IRMP goals.

5.2 Water

Goal 1

Provide a dependable, safe, and sustainable water supply for agriculture, livestock, wildlife, and domestic use to ensure future water security.

Objectives

1. Comply with tribal and federal water quality standards, where applicable, in the management of watersheds within the FBFA.
2. Implement the Master Public Water Systems Plan for the Tuba City Chapters.
3. Implement and follow the Navajo Nation Drought Contingency Plan.
4. Improve access to clean potable water for multiple beneficial uses including municipal, domestic, industrial, livestock, and agriculture.
5. Improve water supply diversity and strengthen the system's ability to withstand drought and other climatic influences.
6. Develop a systematic approach to prioritize repairs, upgrades, and maintenance to ensure safety and functionality. Notify communities of dam releases.
7. Design local domestic and agriculture water projects.

Goal 2

Establish sustainable watershed conditions that promote productive soils, vegetation, and habitat.

Objectives

1. Develop and implement a watershed monitoring program to assess ecological function and health of watersheds at a sub-basin level.
2. Use the developed watershed monitoring and assessment program to identify and develop watershed management plans.
3. Identify conservation/restoration areas.

4. Protect wetlands, riparian areas, and natural springs.
5. Prepare and implement a FBFA Flood and Floodplain Management Plan.

Goal 3

Reduce the impacts of erosion, sustain and improve soil quality, retain plant and animal/microbial life above and below the soil surface, and rehabilitate soil damaged by land degradation.

Objectives

1. Stay abreast of best management practices and training for soil and water conservation and erosion prevention and apply these techniques to management and development activities.
2. Ensure projects prepare and implement surface water management as part of the project development in accordance with the tribal and federal water quality regulations.
3. Provide public outreach and education on surface water management.
4. Develop coordinated administrative, educational, and community outreach programs that will teach and encourage water conservation practices.

Management Actions

1. Quantify consumptive water use and demand in the FBFA based on current and future water demands to better identify water infrastructure deficiencies. Update annually.
2. Annually update existing inventories of water resources such as windmills, wells, storage tanks, stock ponds, and reservoirs.
3. Identify and monitor water sources that are safe for human and livestock consumption.
4. Identify and quantify system water loss and implement strategies to prioritize and combat system losses.
5. Conduct and prepare water availability studies and hydrologic assessments that can identify the best locations for well placement, surface water diversion, and water catchment systems.
6. Update, expand, and maintain water distribution systems to improve access to clean potable water.
7. Provide viable water supply alternatives.
8. Inventory earthen dams and reservoirs. Identify purpose/use of each.
9. Monitor the quantity and quality of water wells on an annual basis.
10. Establish secure water source from the Colorado River for livestock and irrigated farmlands.
11. Implement adequate protective buffers along Dobson Pond, Pasture Canyon Reservoir, lakes, streams, wetlands, and riparian zones and maintain the buffer zone identified by Navajo Nation Fish and Wildlife to enhance and preserve water quality.
12. Limit access to riparian areas for grazing.
13. Inventory, conserve, restore wetlands, riparian areas, and natural springs.
14. Partner with Chapters to create conservation projects.
15. Categorize washes according to channel, head scarp, and bank morphology.

16. Identify reaches along streams, rivers, and washes that need bank stabilization and other erosion mitigation.
17. Evaluate soil properties and determine best management practices and functions based on NRCS Ecological Site Descriptions.
18. Identify and map sand dune locations and migration.
19. Develop and implement sand dune migration mitigation where appropriate.
20. Utilize the Web Soil Survey reports from NRCS to identify best management practices based on soil classification and content.

5.3 Air Quality

Goal

Protect the health and welfare of all residents by improving air quality within the exterior boundaries of the Navajo Nation.

Objectives

1. Maintain the National Ambient Air Quality Standards.

Management Actions

1. Identify any air quality violations and take appropriate steps to alleviate the problems.

5.4 Climate Change

Goal

Understand how climate variability and change affects existing resource management strategies and integrate short-term and long-term operational and strategic approaches to manage these impacts.

Objectives

1. Establish plans or programs that monitor and collect data related to climate change.
2. Seek cooperative opportunities with other entities (e.g., USGS, Northern Arizona University, NRCS, etc.) to evaluate environmental and social conditions as they relate to climate change.
3. Utilize and implement the Navajo Nation Drought Contingency Plan where appropriate.

Management Actions

1. Develop climate change vulnerability studies that characterize environmental and social conditions and changes.
2. Provide community outreach focused on climate change and its effects on the natural and human environments.
3. Develop climate change mitigation/adaptation measures as outlined in Considerations for Climate Change and Variability Adaptation on the Navajo Nation.

5.5 Agriculture

Goal 1

Keep Navajo producers (ranchers and farmers) in compliance with the current Navajo Nation Standard of Operating Plan, Plan of Operation and Procedures, and the Navajo Grazing Regulations.

Objectives

1. Ensure enforcement of Navajo Nation agricultural regulations.
2. Ensure that ALUP requirements are met.
3. Implement consistent procedures and operations among ALUPs.
4. Ensure consistent implementation of other agriculture-related resource management, such as soil and water.
5. Enforce farming regulations to protect farmlands from being idle and/or taken over by other activities.

Goal 2

Develop educational programs and conduct community outreach activities focusing on farming.

Objectives

1. Respond to agricultural producers and community concerns.
2. Educate communities on composting, water harvesting, etc.

Goal 3

To maximize development, productivity, and economic use of local farmland and irrigation water systems while ensuring their protection, conservation, and sustainability.

Objectives

1. Develop an Agricultural Resource Management Plan and Cropland Management Plan as well as individual conservation plans.
2. Develop tribal programmatic resource management plans for maintaining and improving soil conservation and soil health.
3. Promote coordination between the Navajo Nation, private entities, state and federal agencies, local Navajo farmers and farm communities for ensuring proper operation, maintenance, rehabilitation and improvement of local irrigations systems.
4. Continue to seek opportunities to work with cooperative extensions.
5. Develop a cooperative program with farm boards and individual farmers to collect crop yield and economic data as it pertains to agriculture.

Goal 4

Develop markets, services, and opportunities to support Navajo agricultural markets and sales, to revitalize the Navajo rural economy to promote self-sufficiency.

Objectives

1. Promote coordination between the Navajo Nation, private entities, and state and federal agencies to provide Navajo farming communities with adequate research, education, and training in all aspects of agricultural production, irrigation management, marketing and financial management, and other areas related to agriculture on the Navajo Nation.
2. Develop pilot demonstrations on agricultural production, irrigation management, marketing and financial management, and other areas related to agriculture on the Navajo Nation.

Management Actions

1. Inventory/manage ALUPs and monitor annually for adherence.
2. Request Navajo Nation Resource Enforcement under NNC Title 17 Law and Order, to enforce noncompliant activities.
3. Conduct soil testing for if the soil is conducive to farming and the applicant or ALUP permittee insists on pursuing the ALUP, then they need to demonstrate a plan to amend the soil and have the resources to accomplish the plan.
4. Actively manage agriculture ALUPs by transferring inactive and/or abandoned permits to people that want to farm. If the location of ALUPs is non-productive then return to rangelands.
5. Coordinate with other Natural Resource departments to conduct an annual youth conference.
6. Recruit and train Navajo speakers for education and outreach activities.
7. Develop different types of irrigated and dryland farming practices to maximize production and improve air, water, plant, and soil quality using USDA NRCS conservation practices.
8. Develop community gardens.
9. Utilize NRCS-approved conservation practices to promote best management practices to Navajo farmers.
10. Identify areas of concern, implement restoration projects, and preserve productive areas.
11. Utilize management strategies to increase crop yields based on USDA NRCS and Cooperative Extension programs.
12. Monitor, maintain, and evaluate specific conservation projects.
13. Require soil testing to ensure soil properties (i.e., pH, nitrogen, organic carbon) are conducive to farming.

5.6 Noxious/Invasive Weeds

Goal 1

Limit the spread of invasive noxious weeds and other undesirable vegetation and reduce their presence in the FBFA.

Objectives

1. Develop the best control techniques described for the target weed species in a planned, coordinated, and economically feasible program to limit the impact and spread of noxious and invasive weeds.
2. Identify and prevent the expansion of existing infestations of target weed species, and quickly prevent the spread of new high priority weed species in the project area.
3. Provide and promote economic opportunities to the Navajo people by improving rangeland productivity and potentially providing economic opportunities to remove invasive plant species.

Goal 2

Finalize the Draft Navajo Nation Integrated Weed Management Plan/Programmatic Environmental Impact Statement (IWMP PEIS).

Objectives

1. Utilize and implement the IWMP PEIS to approach weed management in a standard and consistent manner.
2. Utilize the IWMP PEIS as guidance on mitigation measures for specific control methods (biological, herbicide, manual, mechanical, and cultural, etc.).

Management Actions

1. Coordinate weed removal efforts with adjacent landowners or managers, including state, local, and federal agencies, to prevent the further spread of weed populations.
2. Develop a public education program focusing on weed identification, prevention, and removal techniques for the local communities and non-profit organizations.
3. Conduct research study on noxious/invasive plants on the ability to control them with universities, USGS, USDA ARS, and other programs (i.e., Thomas, K. and Margaret Hiza Redsteer Establishment of *Salsola tragus* on aeolian sands: A Southern Colorado Plateau case study. 2019. USGS and University of Washington).
4. Communicate, train staff, and update the Plan every 5 to 10 years—5 years for sensitive species and 10 years for updating the weed list.
5. Standardize weed data collection (using GPS) and noxious weed reporting to the Regional Weed Coordinator for annual submittals.
6. Submit noxious weed project proposals in standard format with main noxious weed criteria for federal or matching funding.
7. Evaluate, maintain, and monitor each project with stakeholders through cooperative weed management areas.

5.7 Rangeland

Goal 1

To keep the Navajo producers (ranchers and farmers) in compliance with the current Navajo Nation Standard Operating Plan, Plan of Operation and Procedures, and the Navajo Grazing Regulations.

Objectives

1. Ensure enforcement of Navajo Nation grazing regulations and fencing application procedures.
2. Ensure enforcement of compliance.
3. Ensure that grazing permit requirements are met.
4. Ensure consultation with BIA Division of Natural Resources and NNDA and enforcement of reclamation and resource management directives in areas where other activities other than grazing have been permitted.
5. Establish procedures to determine if adjustment to stocking rate and/or carrying capacity are necessary based on land withdrawal data and procedures for communicating changes to stakeholders.

Goal 2

Reorganize the Navajo Nation land management administrators to be more accountable and accessible to local communities and to better resolve agricultural issues and concerns at a local level.

Objectives

1. Develop a decision-making entity to manage agricultural resources, resolve conflicts, and seek appropriations for the FBFA.
2. Develop an alternative to Probate Process for Grazing Permits or Determination of the Recognized Heir to Grazing Permits (Draft BIA Standard of Operating Procedures, 2019).
3. Develop and implement new policies based on case law from the Navajo Nation courts¹ for the transfer, and/or cancellation of grazing permits.
4. Develop a systematic procedure, based on the requirements set forth in 25 CFR 166 and 25 CFR 167, for establishing grazing terms and fees to be associated with grazing permits.

¹ In *Begay v. Keedah*, 6 Nav. R. 416, 421 (Nav.Sup.Ct.1991), this Court acknowledged the following Navajo Nation policies gleaned from Navajo statutes to be considered when determining the award of a grazing permit: 1) animal units in grazing permits must be sufficiently large to be economically viable, 2) land must be put to its most beneficial use, 3) the most logical person should receive land use rights, 4) use rights must not be fragmented, and 5) only those who are personally involved in the beneficial use of land may be awarded it. *Id.* In *Sista Riggs v. Estate of Attakai*, No. SC-CV-39-04 (Nav. Sup. Ct. June 13, 2007), we held that these factors are to be considered and applied consistent with the Navajo Fundamental Law, specifically, that the clan line typically maintains a land base upon which the clan lives, uses the land for grazing and agricultural purposes and maintains the land for medicinal and ceremonial purposes. For the most part, Navajos maintain and carry on the custom that the maternal clan maintains traditional grazing and farming areas.

5. Encourage grazing permittees within land management districts/units to establish livestock associations or cooperatives to manage livestock for the individual land management districts/unit.
6. Establish new policies and/or regulations to protect livestock, rangelands, and wildlife habitat, and ensure human safety.

Goal 3

Implement integrated management activities that maintain or improve the ecological health of Navajo rangeland.

Objectives

1. Maintain open rangeland for grazing, wildlife, and overall ecological health (i.e., watershed restoration, homesite suitability, avoidance of forage, or water uranium contamination).
2. Coordinate with Chapters to develop resolutions for protection of rangelands to be incorporated into CLUPs.
3. Establish and implement best management practices for grazing livestock.

Goal 4

Develop procedures and specifications for all fencing activities on Navajo rangeland².

Objectives

1. Ensure that all range unit fencing complies with the Navajo Grazing Regulations.

Goal 5

Develop educational programs and conduct community outreach activities focusing on rangeland management and grazing activities.

Objectives

1. Coordinate with other Division of Natural Resources departments to conduct an annual youth conference.

Management Actions

1. Establish a Former Bennett Freeze District Grazing Committee (FBF DGC).
2. Provide guidelines for BIA and Navajo Nation Department of Agriculture (NNDA) to provide technical assistance to the FBF DGC as they meet monthly.
3. Provide an operating budget wherein the joint FBF DGC may pass resolutions, provide recommendations, and make decisions on grazing and dryland farming and provide recommendations to the BIA and NNDA.
4. Identify areas of concern, implement restoration projects, and preserve productive areas.

² RMU, Navajo Nation Fencing Application.

5. Map all open rangelands used for grazing.
6. Coordinate with federal agencies to update Ecological Site Descriptions to determine suitable grazing lands.
7. Restrict development such as solar and wind projects to areas where grazing is not conducive.
8. Implement the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2014) and Nursery Manual for Native Plants (Dumroese et al. 2009).
9. Conduct a comprehensive, accurate, and independent livestock tally for use as a tool to reduce the number of unauthorized livestock and to ensure that supplemental feed and water are only provided to permitted animals.
10. Use available technology to evaluate and monitor the condition of rangeland.
11. Continue to conduct and complete range inventories and monitoring every 10 years.
12. Update and utilize Rangeland Health Monitoring Handbook (NNDA 2005), Draft BIA Range and Agricultural Range Handbook (BIA 2018), Range Management Plan and associated digital applications to provide a landscape-wide standard for consistent data collection and range monitoring.
13. Provide annual training for implementation of Range Handbook guidance.
14. Evaluate and determine whether LMDs need to be revised to protect rangelands in the best interest of the Navajo people.
15. Establish a protocol of communication for rangeland managers concerning land withdrawals from rangelands³.
16. Require permittees to produce their permits upon valid request of a joint FBF DGC, Deputy Livestock Inspector, and/or a law enforcement officer seeking to enforce the laws of the Navajo Nation.
17. Grant authority to the FBF DGC, Deputy Livestock Inspector, and law enforcement officers to seize permits from individuals who have committed a felony.
18. Allow for appropriate administrative action (i.e., cancellation) for Grazing Permits of uncooperative individuals.
19. Develop and work with local schools to educate K-12 students on rangeland health.
20. Recruit and train Navajo speakers for education and outreach activities.
21. Develop pilot demonstrations within the community on best management practices.

5.8 Forestland

Goal 1

Strengthen the ability of forestlands to recover from disturbances, changing environmental conditions, and climate change.

³ For any land withdrawn from Navajo rangeland for purposes other than grazing, the manager of the Navajo Nation General Land Development Department (GLDD) shall provide the NNDA Department notice of the land withdrawal in writing.

Objectives

1. Provide ongoing skills and safety training to resource department personnel to increase ability to respond to changing conditions, industry trends, and management of extreme events associated with natural hazards and climate change.
2. Protect and manage watersheds and streams; restore degraded watersheds.
3. Avoid fragmentation and maintain forest connectivity.
4. Maintain stand densities (appropriate for area) that optimizes and promotes tree growth, forage, and forest production.
5. Integrate fire and fuels management into all timber sales and timber stand improvement activities.
6. Consider Fire Use as a viable management option for fuel reduction and ecosystem maintenance.

Goal 2

Increase active forest management for the benefit of multiple natural resources.

Objectives

1. Determine forest needs to ensure sustainability for wood collection, watershed protection, range management needs, wildlife, and recreation,
2. Investigate niche, international markets; markets open to native producers,
3. Stay abreast of best management practices and training and apply to forest management activities.

Goal 3

Conserve and protect wildlife and their habitat.

Objectives

1. Maintain inventories of threatened and endangered species, big game and fisheries (e.g., distributions, habitat needs, and major threats).
2. Broadly: maintain diversity and heterogeneity of wildlife habitat (i.e., horizontal diversity of landscape, vertical diversity of individual forest stands).
3. Establish collaborative relationships with wildlife agencies and universities to acquire funding for Master and PhD students to conduct field-based, scientific studies on threatened and endangered species and big game species, and to share findings, reports, and publications with the NNDFW for future use in forest and wildlife management plans.

Goal 4

Create economic development opportunities.

Objectives

1. Explore an interdepartmental forestry entrepreneurial program to help Navajo business to harvest forest products.
2. Investigate opportunities for public/private partnership.

3. Explore how to diversify funding/dedicated funding with Navajo Nation entrepreneurs.

Goal 5

Provide education and outreach to Navajo communities.

Objectives

1. Provide education/training on Navajo Nation laws, rules, regulations, policies, etc. for hunting, fishing, trash, grazing, burials, poaching, wood cutting, etc. for enforcement officers, Navajo Nation staff, public, prosecutors.

Management Actions

1. Inventory land to target priority areas that have denuded vegetation and loss and need restoration.
2. Partner with Chapters and schools to create conservation projects, for example:
 - a) building awareness and education,
 - b) developing Pilot demonstrations and
 - c) expanding successful pilot demonstrations to other areas.
3. Employ targeted, temporary fencing of conservation/restoration areas to allow areas to regenerate. Support efforts through education and outreach to communities.
4. Partner with area universities or community colleges to study the forest and create high school/university internships.
5. Use public service announcements on water conservation, wildlife protection, livestock, etc. to share information on how to maintain healthy forestlands including the benefits of thinning.
6. Identify future commercial harvests based on demand and forest health.
7. Implement select forest treatments to maintain forest health.
8. Conduct timber harvests in select management units to promote forest health and generate resource revenue.
9. Conduct forest thinning activities within forestlands to provide room for tree growth, to help diversify vegetation base for wildlife species and reduce the risk of catastrophic wildland fire.
10. Improve management of forest product permitting system to ensure that permits cannot be sold or transferred. Increase enforcement of forest product permit violations to prevent resale of wood and cutting of green trees.
11. Assess markets and identify and recruit buyers for wood waste products and timber products.
12. Conduct before/after studies of forest road access impacts, maintenance requirements, and methods to implement forest restoration projects on unnecessary roads.
13. Reach out to USEPA Region 9 to ensure reduced forest impacts from mining remediation.
14. Continue current monitoring efforts for sensitive wildlife and big game species and conduct habitat improvement projects to provide quality habitat where it has deteriorated.
15. Improve lake conditions to reintroduce trout populations for fishing opportunities.
16. Reduce feral cows in forestlands.
17. Evaluate firewood and timber markets and operations to identify future use of wood products.

18. Partner with the Chapters to designate specific areas to harvest wood through sustainable practices.
19. Conduct an annual area youth conference on natural resource protection/enhancement.
20. Conduct public targeted education/training on natural resource protection/enhancement.
21. Establish Earth Day activities at area schools.
22. Create and fund a Division of Natural Resources team to do continuous resource management training for all interest groups.
23. Create an education program and provide resources to incorporate rainwater harvesting at community level.
24. Conduct public presentations summarizing current research and monitoring efforts for wildlife, specifically for communities within wildlife study areas and communities that may be affected by wildlife-conflict.

5.9 Fish and Wildlife

Goal

Conserve and protect species and habitats for the spiritual, cultural, and material benefit of present and future generations.

Objectives

1. Provide public outreach and education on biodiversity and conservation.
2. Maintain inventories of priority, and threatened and endangered species, big game and fisheries distributions, habitat needs, and major threats.

Management Actions

1. Establish a mapping program for Navajo Nation Priority species.
2. Produce occurrence and habitat maps for priority and threatened and endangered species.
3. Establish collaborative relationships with wildlife agencies and universities to acquire funding for Master and Doctor of Philosophy (PhD) students to conduct field-based, scientific studies on threatened and endangered species and big game species for future use in wildlife management plans.
4. Create local and regional management plans to promote repopulation of endangered species and to protect critical habitat.
5. Conduct habitat improvement projects to provide quality habitat where it has deteriorated.

5.10 Cultural Resources

Goal 1

Identify and preserve historic and archaeological sites and traditional cultural places (i.e., areas of importance).

Objectives

1. Identify cultural resources by level of significance through survey and consultation.
2. Consult with local Navajo communities to increase awareness about preservation and their community's areas of importance. What would they like to see preserved?

Goal 2

Identify TCPs on the FBFA landscape.

Objectives

1. Inventory and synthesize the information from previous reports of all recorded TCPs throughout the project area.
2. Work with the Executive and Legislative Branches of the Navajo Nation to update the Bennett Freeze Compact Agreement regarding the TCPs on Navajo land (eagle, medicinal and herbal gathering, and shrines to name a few).

Goal 3

Promote preservation through education and outreach.

Objectives

1. Establish the connection between environmental sustainability and historic preservation. (Example: the environmental impact from Black Mesa Coal Mining and the removal of hundreds of burials on Navajo land).
2. Work with local communities to establish cultural work sessions with the youth on the traditional activities, such as plant collection and use for wool dyeing.

Goal 4

Implement Geographic Information System (GIS) as a management tool.

Objectives

1. GIS maps and data will be used to show high use areas and sensitive areas to assist in development.

Management Actions

1. Evaluate identified cultural resources through the Sec. 106 process and the Navajo Nation Cultural Resources Protection Act.

2. Continue to identify TCPs prior to any project development activities by ensuring qualified personnel conduct inventories and ensure they work with the local communities.
3. Conduct workshops in each Chapter to discuss the importance of historic preservation including an overview of relevant tribal and federal laws and policies to instill a sense of stewardship of cultural resources.
4. Use GIS to record and manage cultural resources in the FBFA.

5.11 Outdoor Recreation

Goal 1

Improve and develop recreational facilities to provide for environmental preservation, economic growth, and recreation.

Objectives

1. Complete improvement projects identified in the Navajo Nation Parks and Recreation 3-year Strategic Plan.
 - A. Little Colorado River Tribal Park
 - i. Completion of park improvements – Viewpoint One (2019)
 1. access road
 2. parking lot
 3. vendor market
 4. trail improvement
 5. handicapped access
 6. picnic facility
 - ii. Completion of park improvements – Viewpoint Two (2020)
 1. access road
 2. parking lot
 3. trail improvement
 4. vendor market
 - iii. Completion of park improvements – Viewpoint Three (2020-2021)
 1. access road
 2. parking lot
 3. barricades along canyon rim
 4. trail improvements
 - B. Marble Canyon Tribal Park – Backcountry (2019-2020)
 - i. road improvement
 - ii. trails
 - iii. campsites
 - iv. picnic grounds
 - v. signage

2. Complete Western Area Parks General Management Plan (2019-2020).

Management Actions

1. Monitor aircraft tour routes per Grand Canyon Special Flight Rules Area (SFAR) of the Little Colorado River Gorge and Marble Canyon.
2. Designate Dinosaur Tracks as a regional or local park (2020).
3. Designate Painted Desert as a regional or local park (2020).
4. Designate Grand Falls as a regional or local park (2020).

5.12 Minerals

Goal

Ensure the stability and long-term maintenance of AML sites.

Objectives

1. Communicate and collaborate to complete public facility projects.
2. Establish partners on project efforts.
3. Improve public outreach programs and provide adequate information to the public through a series of innovative techniques. Ensure 300,000 plus Navajos and U.S. citizens know who AML is by the end of 5 years. Be more visible at big events and functions with current public relations presentations and items.

Management Actions

1. Monitor and ensure long-term stability of UMTRA project sites. Provide adequate review of technical documents, coordinate with tribal, state, and federal agencies on Navajo UMTRA sites, and address specific technical and project issues.
2. Work closely with the Department of Energy to address project issues.
3. Seek additional funding sources for AML related work issues.
4. Develop, implement, and maintain GIS database of AML sites.

5.13 Land Use and Administration

Goal 1

To effectively coordinate with other resource departments to leverage infrastructure development.

Objectives

1. Determine current infrastructure for power line and water line for suitable and sustainable development.
2. Meet with the Chapters and other stakeholders to gather data.

3. Issue funding notifications to Chapters for grant proposals on infrastructure projects under the FY 2020 Indian Community Development Block Grant.
4. Coordinate with the Office of Environmental Health to determine unmet need for waterline projects and septic tanks.
5. Collaborate with NTUA on determining existing need for power lines or alternative sources of energy for residents.

Goal 2

Improve the quality of life in tribal and native communities.

Objectives

1. Promote self-governance and self-determination through restoring tribal homelands, settling Indian water rights claims, increasing renewable and conventional energy on Indian lands, expanding educational opportunities for Native American youth, and protecting natural and cultural resources in the face of climate change.
2. Strengthen self-governance and self-determination through government-to-government relationships between the federal government and tribal nations. Together, these programs support and strengthen tribal self-governance, sovereignty, self-determination, and self-reliance, applying local expertise and knowledge to managing tribal functions and services.

Goal 3

Adhere to the Code of Federal Regulation Title 25, Indians for oversight, and coordination for the protection, management, planning, conservation, development, and utilization of trust and Indian-owned lands that include acquisition, disposal, tenure, rights-of-way, permits, leasing, sales, and the determination of legal boundaries on Indian land.

Objectives

1. Coordinate environmental studies, rights-of-way, easements, exchanges, partitions, patents in fee, removal of restrictions, permits, and estate planning, and initiation of rights protection issues—such as trespass and land damages.
2. To utilize computer-aided design and GIS software to reflect existing encumbrances, land status, and any features that would aid in community land use development.

Management Actions

1. Perform technical reviews of real estate transactions and approve real estate transactions for contract and self-governance tribal transactions.
2. Provide policy direction, technical assistance, training, administrative review and monitoring in the evaluation of BIA Navajo Region real property operations.
3. Maintain timely and certified federal land title ownership and encumbrance services to record, maintain, and certify land title documents including patents, deeds, probate orders, leases, rights-of-way, cadastral surveys, plats, subdivision, and other Indian land title documents.

4. Provide certified Title Status Reports (TSRs) that are accurate, timely, accountable and efficient, and state the complete status of title ownership and encumbrance for Federal Indian Trust and restricted lands.
5. Perform the timely processing of all trust land titles and title documents in direct support of the trust responsibility.
6. Accomplish the modernization of the recording process including the creation of digital images of recorded title documents in TAAMS Title Image Repository (TIR).

6. References

- Alden, P. and P. Friederici. National Audubon Society field guide to the southwestern states: Arizona, New Mexico, Nevada, Utah. Alfred A. Knopf, New York, 1999. Print.
- Arizona Department of Environmental Quality. 2006. NEMO Watershed Based Plan Little Colorado River. Arizona Department of Environmental Quality. Retrieved from www.ArizonaNEMO.org.
- ArrowWood Associates (ArrowWood). (1999) Navajo Nation Woodland Inventory Analysis Report.
- Brown and Caldwell. 2016. Regional Water Plan for Tuba city Nine Chapters. Prepared for the Navajo Nation Department of Water Resources Water Quality Bureau. Midvale, UT.
- Brown, D. E. 1994. Biotic Communities: Southwestern United States and Northwestern Mexico.
- Brown, T.G. 1985. The role of abandoned stream channels as over-wintering habitat for juvenile salmonids. M.Sc. thesis, University of British Columbia, Dept. of Forestry, Vancouver, BC. Print.
- Crimmins M., N. Selover, K. Cozzetto, and K. Chief. 2013. Technical Review of the Navajo Nation Drought Contingency Plan – Drought Monitoring. Report for the Navajo Department of Water Resources. Ft. Defiance, AZ. A. Meadow (editor).
- DiTomas, J. 2000. Invasive weeds in rangelands: species impacts and management. Weed Science. 488:255-265.
- Dumroese, R. Kasten; Luna, Tara; Landis, Thomas D., editors. 2009. Nursery manual for native plants: A guide for tribal nurseries - Volume 1: Nursery management. Agriculture Handbook 730. Washington, D.C.: U.S. Department of Agriculture, Forest Service. 302 p.
- Ecosphere Environmental Services, Inc. and WHPacific (Ecosphere, WHPacific). (2017). Engineering Evaluation and Condition Assessment of Livestock Water Facilities/Infrastructure in the Former Bennett Freeze Area. Farmington, NM.
- Federal Emergency Management Agency (FEMA). 2011. Unmapped Areas on Flood Hazard Maps Understanding Zone D. Retrieved Jul 21, 2019, from Fact Sheets: https://www.fema.gov/media-library-data/20130726-1806-25045-7880/zone_d_fact_sheet.pdf.
- FEMA. 2019. FEMA Flood Map Service Center. Web. Accessed July 2019. <https://msc.fema.gov/portal>.
- Fonaruff, L. S. 1963. Conservation and Stock Reduction on the Navajo Tribal Range. Geographic Review, Vol. 53, No. 2, April 1963.
- Heinz Center. 2011. Developing a long-term strategic plan for the Navajo Nation Department of Fish and Wildlife: report and workshop summary. The H. John Heinz III Center for Science, Economics and the Environment.
- Lacey, J., C. Marlow, and J. Lane. 1989. Influence of spotted knapweed (*Centaurea maculosa*) on surface runoff and sediment yield. Weed Technology. 3:627-631.

- Lowe, C. H. 1964. *Arizona's Natural Environment: Landscapes and Habitats*. Books on Demand, University of Chicago, 1964. Print.
- Lowe C. H. and D. E. Brown. 1973. *The Natural Vegetation of Arizona*. Arizona Resources Information System, Phoenix, AZ.
- Lym, R. G., and D. R. Kirby. 1987. Cattle foraging behavior in leafy spurge (*Euphorbia esula*) infested rangeland. *Weed Technology*. 1:314-318.
- Martin, J. A. 2002. Navajo Cultural Specialist Traditional Culture Program Navajo Nation Historic Preservation Department. Significant Traditional Cultural Properties of the Navajo People.
- Mason, J. A. 2018. U.S. Geological Survey Open-File Report 2018–1193. Reston: US Geological Survey. Retrieved from <https://doi.org/10.3133/ofr20181193>.
- Mikesic, D. and D. Roth. 2008. Navajo Nation endangered species list: species accounts. Version 3.08. Navajo Natural Heritage Program, Department of Fish and Wildlife, Window Rock, Arizona.
- Melillo, J. M., T. C. Richmond, and G. W. Yohe, Eds. 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp.
- Nania, J., K. Cozzetto, N. Gillet, S. Duren, A. M. Tapp, M. Eitner, and B. Baldwin. 2014. *Considerations for Climate Change and Variability Adaptation on the Navajo Nation*. University of Colorado, Boulder, CO.
- National Park Service. 1995. *Introduction to Cultural Resource Management Laws and Regulations*. Presented by the National Park Service Interagency Resources Division and the Advisory Council on Historic Preservation.
- Navajo Nation Department of Agriculture (NNDA). 2005. *The Land Monitoring Handbook*. Prepared by Cindy Dvergsten, Whole New Concepts, LLC.
- Navajo Nation Department of Water Resources (NNDWR). 2003. *Navajo Nation Drought Contingency Plan*.
- NNDWR. 2008. *Draft Water Resource Development Plan. Resource Development Plan. Strategy for the Navajo Nation. Strategy for the Navajo Nation*. April 6, 2008.
- NNDWR. 2011. *Draft Water Resource Development Strategy for the Navajo Nation*.
- Navajo Nation Heritage and Historic Preservation Department (NNHHPD). 2018. *A Preliminary Class I Synopsis on the Former Bennett Freeze Area*.
- Plant Conservation Alliance. Undated. *National Seed Strategy for Rehabilitation and Restoration 2015-2020*. Available online: www.blm.gov/seedstrategy.
- Redsteer, M. H., K. B. Kelley, H. Francis, and D. Block. 2014. *Increasing Vulnerability of the Navajo People to Drought and 34 Climate Change in the southwestern United States: Accounts from*

- Tribal Elders, in Special Report on Indigenous People, 35 Marginalized Populations and Climate Change; D. Nakashima, J. Rubis, and I. Krupnik, eds., Cambridge University Press, 36 p xx–yy.
- Rich, E. 2018. Oral Communication. Flagstaff, AZ.
- Sheley, R. L., J. S. Jacobs, and M. L. Carpinelli. 1999. Spotted knapweed. Pages 350-361 in Biology and Management of Noxious Rangeland Weeds (R. L. Sheley and J. K. Petrolff, eds.). Oregon State University Press. Corvallis, Oregon.
- Southwest Exotic Mapping Program (SWEMP). 2007. Regional Database, Coconino, Arizona, Navajo counties, AZ.
- TerraSpectra Geomatics. 2007. Abandoned Uranium Mines and the Navajo Nation. Navajo Nation AUM Screening and Assessment Report and Atlas with Geospatial Data. Prepared for the US Environmental Protection Agency and US Army Corps of Engineers. Las Vegas, NV.
- US Department of Agriculture, Natural Resource Conservation Service (USDA, NRCS). 2014. The PLANTS Database (<http://plants.usda.gov>). National Plant Data Team, Greensboro, NC.
- USDA, NRCS. 2016. Web Soil Survey: Tools. Available online: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/tools/>. Accessed 2016.
- US Forest Service (USFS). 2012. Field guides for managing Weed Species in the Southwest. United States Department of Agriculture. Forest Service. Southwestern Region. Available online at: <https://www.fs.usda.gov/detail/r3/forest-grasslandhealth/invasivespecies/?cid=stelprd3813522>.
- West, N. E. 1983. Great Basin-Colorado Plateau sagebrush semi-desert. In, Temperate Deserts and Semi-Deserts, N.E. West ed. pp 331-349, Elsevier Scientific Publishing Co., The Netherlands.
- WHPacific, Inc. 2008. Former Bennett Freeze Area Recovery Plan. Prepared for the Navajo Nation Division of Community Development.