RECLAMATION

Managing Water in the West

Irrigation Infrastructure Report for the Rio Grande Pueblos

U.S. Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Albuquerque, New Mexico

September 2017
Addendum: February 2022

Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

The mission of Reclamation's Native American Program is to make the benefits of the Reclamation program available to Indian tribes and to fulfill Reclamation's Indian Trust responsibilities.

Irrigation Infrastructure Report for the Rio Grande Pueblos

Prepared for

United States Congress

Prepared by

U.S. Department of the Interior
Bureau of Reclamation

Citation:
Reclamation (Bureau of Reclamation). 2017. Irrigation Infrastructure Report for the Rio Grande Pueblos. Prepared for United States Congress. Albuquerque, NM: Bureau of Reclamation, Office of the Area Manager.

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Acronyms and Abbreviations

Act	Rio Grande Pueblos Irrigation Infrastructure Act of 2009
BIA	Bureau of Indian Affairs
Bureau	Bureau of Reclamation (Reclamation)
CAP	Continuing Authorities Program
District	Middle Rio Grande Conservancy District (MRGCD)
EQIP	Environmental Quality Incentives Program
FT	Feet
FY	Fiscal Year
GIS	Geographical Information System
HDPE	High Density Polyethylene
MRGCD	Middle Rio Grande Conservancy District
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PL	Public Law
RCPP	Regional Conservation Partnership Program
Reclamation	Bureau of Reclamation
Rehab	Rehabilitation
Secretary	Secretary of the Interior, US Department of the Interior
Stat.	Statutes at Large
Study	Study and Report, authorized by the Rio Grande Pueblos Irrigation Infrastructure Act of 2009
TBD	To Be Determined
US	United States
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture

About this Report

This report has been prepared within the legislative authority of Section 9106, Rio Grande Pueblos, New Mexico, of the 2009 Omnibus and Public Lands Act. Reflective of the scope, the section is referred to in practice as the Rio Grande Pueblos Irrigation Infrastructure Act. The report consists of:

- Chapter 1: This chapter provides background information, including a brief history of irrigation in the Rio Grande Valley and a discussion of the authorizing legislation;
- Chapter 2: This chapter describes the study methods utilized in development of the report, including agency consultation, contributing resources, and data collection;
- Chapter 3: This chapter presents the results of the study, specifically the extent and condition of the irrigation infrastructure at each of the eighteen Pueblos within the Rio Grande Basin in New Mexico, and a list of projects identified to address the repair, rehabilitation and reconstruction of the irrigation systems; and
- Chapter 4: This chapter presents the methods used to evaluate the proposed projects in keeping with the requirements of the legislation and presents a summary of the project priorities and estimated cost for the improvements at each Pueblo.
- Chapter 5: This chapter provides an addendum with implementation information related to the future construction phase of the project.

Chapter 1: Background

Introduction

There is a commonly used quote within irrigation literature focused on the Southwest Region, attributed to Will Rogers and shown at right. While there is some question whether he actually said such, it is certainly believable; there is no doubt that irrigation is essential to productive farming in the Rio Grande Valley (Fleck, 2013).

> *"The Rio Grande is the only river I ever saw that needed irrigation"*
>
> Will Rogers

In the northern Rio Grande Valley, ancestral Puebloans developed a very successful culture and economy based on floodwater farming, irrigation through stream diversions, and subsistence hunting and gathering. Prehistoric Puebloans continued to improve on agricultural methods, including soil and moisture conservation methods. The earliest historical records, from the sixteenth century Spanish expeditions, noted the prevalence of agriculture within Puebloan communities throughout the Rio Grande Valley (Anschuetz, 1984; Cordell, 1984; Hammond and Rey, 1940).

By the end of the Sixteenth Century, the Pueblos intensified production through expansive irrigation infrastructure, both to increase production of native foods and to support production of European crops such as wheat (Wozniak, 1987).

Those irrigation systems continued to be utilized and improved upon in subsequent decades and centuries, by Indian irrigators as well as Hispanic and European settlers in the region. The irrigation network evolved and expanded, with numerous community-based irrigation networks that were managed by local governments or by a community-elected official. These systems were known as *acequias*, a term which is still used to denote community-based irrigation ditch systems ("History: The Politics of Water", 2017).

Congress authorized the Colorado River Indian Irrigation Project in 1867, which led to the establishment of the Indian Irrigation Service under the Department of the Interior. This organization led construction and early administration of irrigation projects on Indian lands in New Mexico, and elsewhere, through the 1940's (Wozniak, 1998).

Still, there was little overall plan, management or cooperation regarding facilities within the Rio Grande Basin until the larger scale projects were initiated beginning in the early 1900's. In 1911, Elephant Butte Dam was completed in the lower Rio Grande Valley. El Vado Dam was completed in 1935, and the associated renovation of numerous irrigation facilities in the Middle Rio Grande Valley was finished the following year. Additional storage reservoirs, diversion dams and related irrigation construction and rehabilitation

projects continued through the following decades, including construction of Cochiti Dam by 1974 (Wozniak, 1998).

Recognizing that the smaller irrigation systems did not have the same attention and support that the larger conservancy and irrigation districts had, the Water Resources Development Act of 1986 authorized the US Army Corps of Engineers (USACE) to rehabilitate the acequia systems in New Mexico. Many of these systems had been in use for hundreds of years but did not have the regional organizational structures and funding for routine maintenance and prevention of deterioration. These acequias are predominantly located in North-Central New Mexico, and some extend into the systems serving Pueblo communities in the Rio Grande Basin. The USACE rehabilitated about 35 community ditches and acequia systems in New Mexico under this authority by the mid-1990's (Wozniak, 1998).

The irrigation ditches on the Pueblo lands in the Rio Grande Basin were primarily maintained by the Pueblo farmers throughout the centuries. As previously noted, there were larger scale rehabilitation efforts undertaken with the support of the Indian Irrigation Service through the 1940's. Since that time, irrigation infrastructure support has been provided by the Bureau of Indian Affairs, Bureau of Reclamation, USACE, and Natural Resources Conservation Service (NRCS) through various programs and authorities.

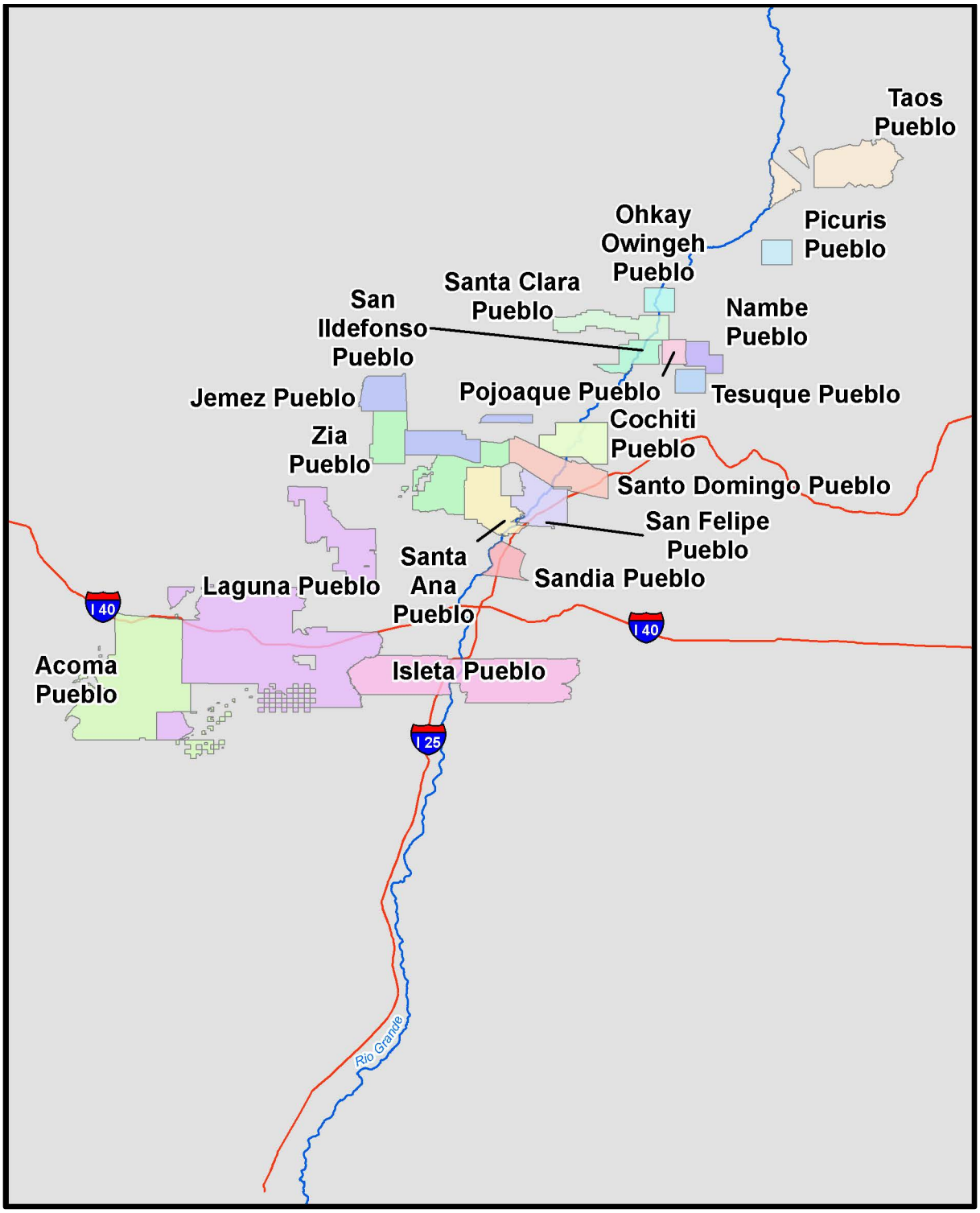
In general, however, there has not been adequate funding available to adequately rehabilitate the Pueblo irrigation infrastructure in recent decades. As a result, the Pueblo irrigation systems are predominantly and significantly aged and deteriorated. There are many systems that cannot withstand seasonal high storm flows and require extensive, labor intensive, rehabilitation annually. In addition, the Pueblo irrigation systems are plagued by inadequate baseline water flows, limited transport capacities, and high sediment loads within the water supplies (HKM Associates, 1984; Wozniak, 1998).

Despite these deficiencies, agriculture continues to be an integral part of the Puebloan culture and lifestyle. In New Mexico, there are nineteen Federally recognized Pueblo tribes. With the exception of the Zuni, in West-Central New Mexico and on the west side of the Continental Divide, all of these are located within the Rio Grande Basin.

The eighteen New Mexico Pueblo tribes within the basin, in alphabetic order, are Acoma, Cochiti, Isleta, Jemez, Laguna, Nambé, Ohkay Owingeh, Picuris, Pojoaque, San Felipe, San Ildefonso, Sandia, Santa Ana, Santa Clara, Santo Domingo, Taos, Tesuque and Zia. The general location for each of these eighteen Pueblos is shown in Figure 1-1, Location and Vicinity Map.

Within the body of this report, the Rio Grande Pueblos are discussed in general order from north to south, and from upstream to downstream within the Rio Grande Basin to the extent that makes reasonable order, given that some Pueblos are located on tributaries to the Rio Grande.

Figure 1-1: Location and Vicinity Map



Authorizing Legislation

In July 1998, the Secretary of the Interior hosted a national consultation with Indian tribes on Indian water rights and uses. That forum requested a study to assess the condition of Pueblo Indian water delivery systems on the Rio Grande and its tributaries in New Mexico. The results of that study affirmed the need for widespread, programmatic rehabilitation of irrigation infrastructure throughout Pueblo lands. Further, the study recommended the need for $3 million for a feasibility study, followed by an estimated $65-100 million in rehabilitation, and the potential for an additional $50-100 million in water conservation efforts ("Pueblo Irrigation Facilities Rehabilitation Report", undated (*circa 2000*)).

In 2009, the United States Congress passed the Omnibus and Public Lands Act, Public Law 111-11. Included within the legislation, as Section 9106 and titled *Rio Grande Pueblos, New Mexico*, was the authorization to plan and implement improvements to irrigation infrastructure for the eighteen Pueblos in the Rio Grande Valley in New Mexico. The following paragraphs discuss the details of the legislation, including purpose and scope, specific requirements, grants and limitations, implementation, consultation, cost sharing, and appropriation authorizations.

The purpose of the Act was to direct the Secretary of the Interior to complete a threefold task: (1) to assess the condition of the irrigation infrastructure of the Rio Grande Pueblos; (2) to establish priorities for the rehabilitation of that irrigation infrastructure in accordance with specified criteria; and (3) to implement projects to rehabilitate and improve the irrigation infrastructure.

Applicability to the eighteen Rio Grande Pueblos within the Rio Grande Valley in New Mexico was explicit in the Act language, as well as the requirement that the individual Pueblos would be required to notify the Secretary of their consent to participate in the assessment study and development of project listings. Each of the eighteen Pueblos have provided the required consent. That documentation is included in Appendix A.

As defined in the Act, Pueblo irrigation infrastructure refers to any diversion structure, conveyance facility, or drainage facility that is in existence as of the date of enactment of the Act (March 30, 2009), and is located on lands of one of the Rio Grande Pueblos associated with the delivery of water for the irrigation of agricultural lands or for the carriage of irrigation return flows and excess water from the land served.

The specific requirements of the Act can be summarized as follows:

- **Infrastructure Study:** Conduct a study of Pueblo irrigation infrastructure and, based on the results of the study, develop a list of projects recommended for implementation over a ten-year period to repair, rehabilitate, or reconstruct Pueblo irrigation infrastructure *(PL 111-11, Section 9106(c)(1))*.

- **Project Prioritization:** Prioritize the project listing included within the Study based on a review of specified factors and consideration of the projected benefits of the project upon completion. Any project is considered eligible if it addresses at least one factor. The specified factors are summarized below *(PL 111-11, Section 9106(c)(2))*.

> Specified Factors (Public Law 111-11, Section 9106, Paragraph (c)(2)(B)):
>
> 1. The extent of disrepair of the Pueblo irrigation infrastructure, and the effect of the disrepair of that infrastructure;
> 2. Whether, and to what extent, the repair, rehabilitation, or reconstruction of the Pueblo irrigation infrastructure would provide an opportunity to conserve water;
> 3. The economic and cultural impacts that the Pueblo irrigation infrastructure in disrepair has on the applicable Rio Grande Pueblo; and the economic and cultural benefits that the repair, rehabilitation, or reconstruction of the Pueblo irrigation infrastructure would have on the applicable Rio Grande Pueblo;
> 4. The opportunity to address water supply or environmental conflicts in the applicable river basin if the Pueblo irrigation infrastructure is repaired, rehabilitated, or reconstructed; and
> 5. The overall benefits of the project to efficient water operations on the land of the applicable Rio Grande Pueblo.

- **Consultation:** In developing the list of projects, the Secretary is required to consult with the Director of the Bureau of Indian Affairs, including the Six Middle Rio Grande Pueblos' Designated Engineer; the Chief of the NRCS; and the Chief of Engineers (USACE). The purpose of this consultation is to evaluate the extent to which programs under these agencies' jurisdiction may be used to assist in evaluation and implementation of Pueblo irrigation infrastructure projects *(PL 111-11, Section 9106(c)(3))*.

- **Report:** Submit a report (Study) to the Committee on Energy and Natural Resources of the Senate and the Committee on Resources of the House of Representatives that includes the list of projects recommended for implementation and any findings of the Secretary with respect to the study, the consideration of the specified factors, and the specified agency consultations *(PL 111-11, Section 9106(c)(4))*.

As described in the Act, the report mentioned above was to be completed within two years after the date of enactment of the authorizing legislation. However, that date was extended due to delays in funding appropriation. This report constitutes the first submittal in accordance with the requirements of the Act.

The Act included a provision for periodic review of the report. Specifically, every four years, the report is required to be reviewed and the project listing updated, in consultation with the Rio Grande Pueblos and as the Secretary determines to be appropriate.

While authorized, Reclamation will update the report every four years or as specified in potential future reauthorization legislation.

Subject to appropriation, the Act authorizes the Secretary to provide grants or enter into contracts with the Pueblos to plan, design, construct or otherwise implement projects to repair, rehabilitate, reconstruct or replace Pueblo irrigation infrastructure. There are limitations imposed on any assistance. Projects that are not deemed eligible include on-farm improvements, and repair, rehabilitation, or reconstruction of any major impoundment structure.

When planning for the implementation of any specific project, the legislation requires consultation with, and approval from, the applicable Pueblo; consultation with the Director of the Bureau of Indian Affairs (BIA); and coordination, as appropriate, with work conducted under the BIA's irrigation operations and maintenance program.

The cost sharing provisions of the legislation specify a Federal share of no more than 75 percent, with the stipulation that the Secretary has the discretion to waive or limit the required non-Federal share if the Rio Grande Pueblo demonstrates financial hardship. The non-Federal share may also be satisfied by in-kind contributions, including the contributions of valuable assets or services. Further, any potential State contributions can also be utilized as non-Federal share.

In addition, for projects within the Six Middle Rio Grande Pueblos (Cochiti, Isleta, San Felipe, Sandia, Santa Ana, and Santo Domingo), the Secretary may accept a partial or total contribution from the Middle Rio Grande Conservancy District (MRGCD) toward the non-Federal share. The MRGCD, or District, is a political subdivision of the State of New Mexico that was established in 1923 and is further discussed in the following chapter.

The Act authorized up to $4 million to conduct the Study, and up to $6 million for each fiscal year 2010 through 2019. Through fiscal year (FY) 2018, nearly $3 million has been appropriated. The Study, including field surveys, has utilized these funds. In addition, supplemental funding was provided by other Reclamation programs, including Native American Affairs, Drought Relief, and support from the Albuquerque Area Office.

Chapter 2: Study Methods

Close coordination with the eighteen Rio Grande Pueblos was key in completing this study. Their support, cooperation and contributions contributed immeasurably to this effort. The consulting agencies provided support and expertise, through historical documents and related irrigation infrastructure studies completed by or for the respective agencies.

The irrigation infrastructure for each Pueblo was tabulated from survey data for most of the Pueblos. For the Pueblos where surveys have not yet been completed, available data and Pueblo coordination was essential to progressing with the Study. With Pueblo input, an assessment of existing conditions was completed, followed by development of project lists. Finally, a standard unit cost methodology was developed to allow planning level cost assessments for each project.

Agency Consultation

Consultation was undertaken with the Bureau of Indian Affairs, NRCS, and USACE. In addition, coordination with the Middle Rio Grande Conservancy District was essential. With continued coordination between agencies, there are definite opportunities for synergy and for maximizing the impact of each dollar spent. This cooperative planning and implementation will result in a greater positive impact on the infrastructure, economy and culture for each of the Pueblos within the Rio Grande Basin.

Middle Rio Grande Conservancy District

Six of the Rio Grande Pueblos (Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia and Isleta) are located within the geographic boundaries of the Middle Rio Grande Conservancy District, or MRGCD. The MRGCD was created by the State of New Mexico with the passage of the Conservancy Act in 1923 to provide flood protection from the Rio Grande, drain swampy areas, and provide irrigation water for farming (Kinzli, et. al, 2010).

The agency is described as a political subdivision of the State of New Mexico and is largely funded through the State and irrigation water user fees. The District serves the Middle Rio Grande valley, encompassing about 150 miles of the Rio Grande. The District currently serves about 62,000 acres of irrigated agricultural lands and maintains 1,420 miles of canals, laterals and drains.

On March 13, 1928, Congress passed an Act ("the 1928 Act" (45 Stat. 312)) authorizing the Secretary of the Interior to enter into an agreement with the MRGCD for the "conservation, irrigation, drainage, and flood control of Pueblo Indian lands" in the middle Rio Grande valley. The 1928 Act acknowledged that the Pueblo water rights associated with approximately 8,346 acres of irrigated Pueblo lands were *prior and paramount* to any rights of the District or other property holders, and that the water rights for any Pueblo *newly*

reclaimed lands would be recognized as equal to those of like District lands and protected accordingly.

Further, the 1928 Act provided that the prior and paramount lands would not be subject by the MRGCD to any pro rata share of future operation and maintenance costs, but that the United States would reimburse the MRGCD for operation and maintenance costs associated with the newly reclaimed lands. In 1928, the Secretary of the Interior entered into an agreement with the MRGCD pursuant to the 1928 Act for the one-time construction of various irrigation facilities, including the construction of El Vado Dam and Reservoir.

On May 16, 1938, the Secretary of the Interior officially established the acreage of Pueblo lands benefitted by MRGCD infrastructure to total 20,242.05 acres, which encompassed 8,847 acres of prior and paramount lands, 11,074.40 acres of newly reclaimed lands, and 320.65 acres purchased pursuant to the Pueblo Lands Act of 1924.

On August 27, 1935, Congress passed an Act ("the 1935 Act" (49 Stat. 887)), which authorized the Secretary of the Interior to enter into operation and maintenance agreements with the MRGCD for costs associated with such work on the Pueblos' newly reclaimed lands. The parties entered into the first operation and maintenance agreement in 1936. The District is bound to provide operation and maintenance services in accordance with their current agreement with the Secretary, BIA Agreement Number A16AC00027, pursuant to the requirements of the 1928 Act, for facilities listed in the Agreement's attachment, Schedule C.

In addition, the District provides services through the Agreement for Pueblo facilities listed in Schedule A of the Agreement. These additional services are annually updated and agreed to, in consultation with the Pueblos. For the agreement year ending February 28, 2017, the payment for the applicable infrastructure serving the newly reclaimed lands (Schedule A) within the six Pueblos was $721,843.50.

As discussed previously in Chapter 1, facilities maintained and operated by the District are eligible for inclusion as projects within the scope of the Rio Grande Pueblos Irrigation Infrastructure Act. In such cases, the District may be expected to contribute toward the project cost, and the District has indicated a willingness to do so, on a case by case basis and where the project meets the District's operational and maintenance criteria, provided that MRGCD has the fiscal resources to do so.

Bureau of Indian Affairs

The BIA historically has had substantial involvement in the funding and oversight of the irrigation infrastructure on the Pueblos, and in endeavoring to see the fulfillment of key Indian Trust responsibilities for all Pueblos. In recent years, the agency's limited funding related to Pueblo irrigation infrastructure has been primarily directed toward the six Middle Rio Grande Pueblos to fulfill statutory obligations to the six Pueblos pursuant to the Acts of March 13, 1928 (45 Statutes at Large 312) and August 27, 1935 (49 Statutes at Large 887).

BIA pays most of that funding to MRGCD for operations and basic maintenance of a portion of the facilities serving the six affected Pueblos. The BIA also has two full time employees who provide technical assistance support for irrigation projects within the region.

NRCS

Within the program authorities accorded to the United States Department of Agriculture's (USDA) NRCS is the Environmental Quality Incentives Program (EQIP). The EQIP program is one of the programs annually authorized under the Agricultural Act, commonly referred to as the *Farm Bill*. This program has been utilized by Pueblo administrations and individual Pueblo farmers in the past and has the potential to significantly benefit the Rio Grande Pueblos in the future.

EQIP Program

EQIP provides financial and technical assistance for agricultural landowners on a competitive application basis within each state based on national and state priorities. Relevant national priorities include conservation of ground and surface water resources, and reduction in soil erosion and sedimentation. The priorities established for the State of New Mexico for 2017 include addressing insufficient water, soil erosion, and water quality degradation.

Applicants are required to develop a conservation plan for inclusion in the application. The conservation plan identifies the "conservation practices or activities to be implemented, the timing of implementation, location, natural resource concerns to be addressed, conservation benefits to be achieved, and operation and maintenance required for the life of the practice or activity" (NRCS, 2017b).

Applicants that submit the required documentation and are accepted into EQIP receive payments to offset the costs associated with implementing their proposed conservation measures. The payment amount is specified within the applicable State Field Office Technical Guide. The Guide lists various scenarios, which describe typical scopes of projects, including materials quantities, and lists the Service's internally determined regional average cost to implement the scenario. The NRCS then pays through EQIP a percentage of that standard payment incentive upon implementation. While participants generally receive 75 percent of the payment listed in the Guide, historically underserved participants – a definition which includes Tribal members – receive 90 percent of the total incentive payment of a scenario covered within their plan and application.

Potential Rio Grande Pueblos EQIP Fund Account

Consultation with the NRCS has identified an opportunity for cooperation through EQIP that could significantly extend the ability to undertake irrigation infrastructure improvements funded by the Rio Grande Pueblos Irrigation Infrastructure Act. One of the NRCS' initiatives is through their Regional Conservation Partnership Program (RCPP). As

described in their announcement, the NRCS seeks through the RCPP to "co-invest with partners in innovative, workable and cost-effective approaches to benefit farming, ranching, and forest operations, local economies, and the communities and resources in a watershed or other geographic area" (NRCS, 2017a). The RCPP program annually solicits proposals from groups that propose to utilize the requested funds in one of several NRCS programs, including EQIP.

Eligible partners include Indian Tribes, state or local units of government, agricultural producers, and similar cooperatives. The RCPP funding is allocated to three funding pools: Critical Conservation Areas, National, and State fund pools. The maximum project funding is $10 million. Proposed projects for all funding pools must address one or more National resource concern priority. These priorities include (NRCS, 2017a):

- Excess/Insufficient Water/Drought
- Water Quality Degradation
- Soil Quality Degradation
- Inadequate Habitat for Fish & Wildlife
- Air Quality Impacts
- Energy
- Climate Change

Successful proposals subsequently result in establishment of a fund account through the covered NRCS program, which allows individual participants eligible within that proposal to submit projects that then compete for funding within that specific fund account. The Rio Grande Pueblos would meet the eligibility requirements for the RCPP program, and could submit an irrigation infrastructure funding proposal, addressing the resource concerns for drought and insufficient water, through the State or National resource fund pool.

Reclamation has initiated discussions with the Pueblos to increase awareness of this potential funding source. The opportunity envisioned would be for the Pueblos to apply for RCPP funding for the FY2019 announcement. Success in that proposal would result in an EQIP fund account that would establish a dedicated pool for irrigation infrastructure and related water resource conservation projects. This would provide the Pueblos with additional funding leverage and opportunities for cooperation between the NRCS program and the Reclamation program, through the Rio Grande Pueblos Irrigation Infrastructure Act, to maximize the infrastructure repairs that could be implemented. Reclamation will continue coordination with the Pueblos to encourage and support pursuit of an RCPP proposal next year.

USACE

The mission of the USACE is to "provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy and reduce risks from disasters." (USACE, 2012) Key mission areas include navigation, ecosystem restoration and flood risk management.

> *"Federal recognition of an Indian Tribe constitutes designation of a Native community as a political sovereign within the U.S. federalist system. As a result, the Corps, as part of the federal government, has a unique 'Trust relationship' with each tribe based on the U.S. Constitution, treaties, statutes, court decisions and executive orders. That 'Trust relationship' requires the Corps to protect and preserve tribal resources to the greatest extent possible."*
>
> ("Albuquerque Tribal Program", 2017)

USACE projects typically partner with other entities, either through specific project authority from Congress or through an existing authority specified in the USACE's Continuing Authorities Program (CAP). Each authority under the overarching CAP authority is typically known by its section within the original legislation. Each program has a specific stipulated cost share structure, which can be different depending on whether the request is for feasibility or construction funding, documented for each project within a cost share agreement between the sponsor and the USACE prior to project start. Those programs most relevant to the Rio Grande Pueblos are discussed below.

Tribal Partnership Program

The Water Resources Development Act of 2000, Section 203, provided the USACE with authority to perform feasibility studies, planning and design for projects that will substantially benefit tribes. Known as the *Tribal Partnership Program*, authority extended to projects related to flood damage reduction, environmental restoration and protection, watershed planning, cultural resource studies, and other projects as determined appropriate.

This program has supported studies for several Pueblos. Watershed assessments are in process or completed for the Pueblos of Zia, Santo Domingo, Santa Clara, Santa Ana, San Felipe and Acoma. Initial assessments have also been completed for Picuris and Laguna. These assessments are intended to aid the Pueblos in watershed management, conservation and project planning. The cost share for watershed assessment studies is typically 75/25, where the USACE provides 75 percent of the cost and the Pueblo, as project sponsor, provides the remaining 25 percent of the cost.

While the partnership program originally encompassed planning activities only, the USACE's authority was expanded in 2016 to include project construction. This expanded authority is of great significance for the tribes, as it may provide the ability to address larger scale projects that are essential to rehabilitating the Pueblo infrastructure but are typically beyond the scope of construction that can be undertaken by Reclamation. Construction

activities exceeding $10 million must receive Congressional authorization prior to implementation.

The Section 203 program requirement for feasibility studies is a 50/50 cost share (the beneficiary contributes 50% of the costs and USACE contributes 50% of the costs). For construction, the cost share is 75/25, with the USACE providing 75 percent of the cost. In accordance with the negotiated agreement, in-kind services may constitute all or a portion of the sponsor's share obligation. Under the auspices of the Tribal Partnership Program, the USACE also has provision to waive the first $455,000 of tribal share for both feasibility and construction projects.

Continuing Authorities Program

As previously discussed, Tribal support is also possible through the USACE's Continuing Authorities Program, which contains several standing authorities provided by Congress to execute projects without specific congressional authorization. The most relevant sections for this Study include:

- Section 14, Emergency Streambank and Shoreline Erosion;
- Section 205, Flood Damage Reduction;
- Section 206, Aquatic Ecosystem Restoration; and
- Section 1135, Project Modification for Improvement to the Environment degradation associated with a federal project (USACE, 2012)

Section 14 projects address emergency streambank protection measures to prevent damage to public facilities and infrastructure such as roads, bridges, hospitals, schools and water treatment plants. The feasibility phase requires a 50/50 cost share. The cost share requirement is typically a 65/35 agreement (USACE, 2005).

Section 205 provides funding for construction to provide protection from flooding, commonly through the construction of flood control measures such as levees, channels and dams. The feasibility phase requires a 50/50 cost share. The cost share requirement is typically 65/35. Current projects are in design under this authority for the Pueblos of Isleta and Santa Clara (USACE, 2005).

Section 206 encompasses many types of habitat restoration projects, several of which have been initiated with Tribes to restore culturally significant forested habitat along reaches of the Rio Grande, known regionally by the Spanish term *bosque*. The feasibility phase requires a 50/50 cost share, while construction is covered at 65/35 percent (USACE, 2005).

Finally, Section 1135 covers projects where a past USACE project has contributed to degradation of environment quality. For the Pueblos, this authority has covered past projects to restore habitat impacted by USACE projects along the Rio Grande. The feasibility phase requires a 50/50 cost share. Cost share is typically a 75/25 cost share agreement (USACE, 2005).

Individual Project Authority

In addition, the USACE has the ability to address Tribal concerns through individual project authorizations. For example, the USACE has designed a large-scale project to restore the Rio Grande to a more natural alignment and gradient through the river's reach within the boundaries of the Pueblos of Ohkay Owingeh, Santa Clara and San Ildefonso. The project is designed, and the USACE is now seeking Congressional authorization for phased construction. This project will help restore habitat within the bosque for these Pueblos, and indirectly improve irrigation through river gradient restoration, returning the water levels to more normal conditions (USACE, 2015).

External Resources

This Study has utilized information and data available from outside sources, including the MRGCD and BIA. The MRGCD has geographical information system (GIS) layers developed for the irrigation infrastructure within the District, which has provided data on irrigation infrastructure within the Middle Rio Grande Valley.

BIA undertook a GIS project which involved field work in the 2005-2006 timeframe to inventory and map the irrigation infrastructure for most of the Pueblos along the Rio Grande. This data has been invaluable to the Study, particularly for those Pueblos where surveys have not yet been completed. Most of the graphics in the following chapter were developed from the BIA GIS layers, and are attributed accordingly.

MRG Pueblos Condition Assessment

In 2016, DOWL Engineers completed a conditions assessment ("Irrigation Condition Assessment", 2015) under contract to the BIA. The study encompassed an assessment of some of the six Middle Rio Grande Pueblos' irrigation infrastructure facilities that the MRGCD is statutorily obligated to maintain. It did not encompass all the irrigation infrastructure within the six Middle Rio Grande Pueblos, and the DOWL assessment, by design, did not evaluate any of the infrastructure in the other twelve Pueblos. The assessment did, however, provide some useful condition assessment and cost estimates for repair, rehabilitation and maintenance of the irrigation infrastructure managed by MRGCD.

Surveys

The foundation for the Study was the development of detailed field surveys of irrigation infrastructure. These were completed with Reclamation funds through self-determination contracts with each Pueblo, as funding permitted, under the contract provisions of the Indian Self-Determination and Education Assistance Act of 1975, Public Law 93-638, and subsequent amendments.

As previously discussed, the Act authorization has been partially funded. To date, nearly 50 percent of the funding which the Act authorized for the study portion of the

legislation has been provided. The surveys that have been funded have utilized those funds, and supplemental funding provided by other Reclamation programs. These include Native American Affairs, Drought Relief, and support from the Albuquerque Area Office.

Survey contracts have been completed for twelve of the eighteen Pueblos: Acoma, Cochiti, Jemez, Laguna, Ohkay Owingeh, Picuris, San Felipe, San Ildefonso, Santa Ana, Sandia, Santo Domingo and Zia. Of the remaining six Pueblos, the survey for Tesuque has been initiated and is fully funded. The surveys for Isleta and Nambé have started and are partially funded. Funding to complete Nambé and to substantially fund the surveys at Santa Clara are budgeted for late 2017. Much of the survey scope at Taos has been completed, but the irrigation infrastructure is extensive and a significant amount of work remains to be funded and completed. The survey for Pojoaque is also awaiting funding.

It is important to note that the survey scope for some of the Pueblos did not encompass the entire irrigation infrastructure. Instead, the scope of the surveys was reduced in these cases to make best use of the limited funding available. It is anticipated that additional surveys will be necessary in some locations and will be programmed in support of specific project needs.

For each of the Pueblos with completed surveys, the irrigation infrastructure data was tabulated from the plan and profile sheets generated as one of the primary deliverables for the surveying services contracts. That data is included in Appendix B.

Internal Resources

As part of the Study, Reclamation's Technical Service Center, located in Denver, provided an engineering team to review several of the diversion structures on Pueblo lands, to develop preliminary cost estimates for structure rehabilitation. These costs are included in the project costs presented for each Pueblo in the following chapter. Due to time and resource constraints, several diversions will be reviewed and incorporated or refined within subsequent Study updates.

Pueblo Findings

The following chapter details the Study findings for each Pueblo. The process consisted of developing an assessment of the conditions of the infrastructure, utilizing those conditions to determine projects for reconstruction or rehabilitation of the infrastructure, and developing planning level cost estimates for each project. It is noted that the irrigation infrastructure graphics are illustrative of the location of most of the irrigation ditches and turnouts but may not include all infrastructure. This may be due to data limitations in the GIS files utilized, size constraints in the graphics scaling, and to changes to the system since completion of the inventories.

Condition Assessment

As part of this Study, the existing condition of the irrigation infrastructure for each Pueblo was qualitatively categorized to aid in identification of distinct projects requiring repair, rehabilitation or reconstruction. These evaluations were completed in consultation with Pueblo technical representatives most familiar with the irrigation infrastructure and the associated operational and maintenance issues.

It is noted that the MRGCD may not necessarily concur with the Pueblos' assessments, presented in the following chapter, of the condition of the irrigation infrastructure that the District maintains within the six Middle Rio Grande Pueblos. However, it is emphasized that the following chapter presents the Pueblos' input on conditions. As projects receive construction funding in the future, those contracts will encompass any additional surveying, planning, scoping and design required to support construction. It is expected that coordination with MRGCD during the project preconstruction phase will address project scopes to the satisfaction of both the Pueblos and the District.

Project Listing

The project lists were developed based on the needs assessment and input from each of the Pueblos. It is noted that many of the projects have been identified as critical needs for some time, often for decades. However, due to a lack of funds for design and construction, these projects have historically been deferred.

Where survey data was available, the projects include replacement or rehabilitation of existing infrastructure. Therefore, the number of turnouts, check structures and road crossings will typically match existing infrastructure. Where no survey data was available, a uniform standard was applied, which assumes an average of five turnouts, one check structure and one road crossing per mile of irrigation ditch.

Contract Costs

The project construction contract cost estimates provided in this Study are appraisal level cost estimates, developed in accordance with Reclamation guidance for special studies to support future planning efforts (Reclamation, 2016). The contract cost represents the estimated cost of the construction contract in 2017 dollars at the time of bid or award. Appraisal level cost estimates have significant risks and uncertainty and are therefore best utilized for planning purposes, rather than for specific project budgeting purposes. Caution should be exercised when making decisions based on these cost estimates.

The approach was to establish appropriate regional unit costs for various types of projects, applied uniformly to each Pueblo. It is noted that costs vary by location, due to such factors as weather and seasonal limitations, subsurface conditions, environmental conditions, permitting requirements, and proximity to roads suitable for construction traffic.

Unit cost data was solicited from local irrigation construction contractors and the Pueblo of Laguna. Other resources utilized for cost data include the NRCS regional cost data utilized in the EQIP program and the project costs identified in the Middle Rio Grande Pueblos condition assessment report ("Irrigation Condition Assessment", 2015). In addition, cost data from past Reclamation projects implemented at the Pueblos was utilized.

Each of these sources provided valuable contributions, from which a range of unit costs was developed as shown in Table 2-1 on the following page. The unit costs are fully burdened, and include provision for planning, permitting, local tribal taxes and intrinsic cost considerations. The intent is that these appraisal level costs will provide representative contract cost requirements for the potential full ten-year construction timeframe anticipated in the Act.

Due to space limitations in the Study tables presented in the following chapter, there is a nomenclature standard that must be defined. For the purpose of this report, when infrastructure is stated as needing rehabilitation, it is typically being refurbished but not reconstructed. While this can be intuitively apparent, it may not be obvious where irrigation ditches are discussed within the report.

Generally, if an earthen ditch is noted as requiring rehabilitation, this implies also that the Pueblo intends to maintain the ditch as earthen. Rehabilitation of an earthen ditch cleaning, reshaping and compaction. If substantial fill is required to restore grade, there is an additive unit cost for that effort. If the condition of an earthen ditch is noted as needing reconstruction, that implies that the Pueblo plans to reconstruct the ditch as a concrete lined ditch or replace with buried pipe.

For simplicity, ditch projects that are proposed to be constructed as buried pipe are estimated at the same rate as concrete lining. While pipe is typically less expensive, there are variables that affect the cost, and design considerations that must be evaluated before determining feasibility of replacing open ditches with pipe.

The average road crossing over irrigation ditches in the Study was 20 feet in length. The unit cost for these crossings is presented as a lump sum. Within the project estimates, longer road crossings are accommodated by increasing the number of crossings to equate to the total length of crossings. In the limited instances where these crossings are paved roads, an increased cost factor is included.

Major structure repair, rehabilitation or replacement costs were based on the Technical Service Center reviews or on data provided in the Middle Rio Grande Pueblos condition assessment report. Appraisal costs were included for the majority of structures, but there are a few that were not assessed due to a lack of data. Where these occur in the project listings, it is noted that the estimate is yet to be determined. In addition, several dredging projects are needed to restore storage capability to the irrigation impoundments. This is a common need among several of the Pueblo's systems. Sedimentation of storage reservoirs

diminishes water storage volumes over time to a fraction of the original design capability (Norton and Sandor, 1997).

It is relevant to note that the Act excludes consideration of any major impoundments. This term was not defined in the legislation but is understood to refer to the major water retention dams that have been built along the Rio Grande and its tributaries, such as El Vado and Cochiti dams.

Table 2-1: Contract Unit Costs

REPAIRS & REHABILITATION	UNIT	UNIT COST ($)	NOTES
Concrete Lining			
Small	LF	59 - 67	1' bottom, 5' topwidth, 2.5' sides
Medium	LF	78 - 87	2' bottom, 8' topwidth, 2.35' sides
Large	LF	163 - 288	4' bottom, 10' topwidth, 3' sides
Pipe / Culvert Replacement			
Irrigation Pipe	LF	125 - 185	
2-ft to 4-ft CMP	LF	345 - 390	
Siphon Pipe	LF	607 - 826	
Rehabilitation			
Cleaning & Reshaping	LF	8 - 13	
Grade Restoration	LF	288	Large (4’ bottom) ditch, 2-foot raise
Tree & Vegetation Clearing	LF	2 - 4	
Minor Structure Repairs	EA	2,010 – 3,000	
Structure Replacement			
Turnout	EA	3,250 – 9,345	
Check Structure	EA	11,000 – 23,675	
Steel Access Catwalk	EA	2,500 – 7,922	
Large Canal Check Structure	EA	35,674 – 154,000	
Lateral Headgate	EA	9,346 – 37,398	
Flume Upgrade / Replacement			
18" CMP	LF	700 – 1,650	Prefabricated, concrete supports
24" CMP	LF	1,079 – 2,015	Prefabricated, concrete supports
36" CMP	LF	1,456 – 2,400	Prefabricated, concrete supports
Road Crossing Repairs			
24" CMP, concrete headwalls	LS	6,500	New pipe & fill, gravel top
36" CMP, concrete headwalls	LS	10,122	New pipe & fill, gravel top
Miscellaneous			
Subsurface Drainage	LF	30 - 45	
Well Rehab & Repairs	EA	4,500 - 5,500	
Flow Metering	EA	4,940 – 6,500	
Major Structure Replacement	EA	N/A	Individually priced

NOTE: All costs shown shall be considered *appraisal level* costs

Chapter 3: Discussion of Pueblo Findings

The following sections present the findings for each of the Pueblos, specifically the existing irrigation infrastructure, general condition of the infrastructure, and the projects identified as most critical for the next ten years. The Pueblos are generally presented from upstream to downstream within the Colorado River Basin.

As previously discussed, most of the Indian ditches are in deteriorated condition, as well as many of the diversion points. All the ditches support lands that are actively and recently farmed. On many Pueblos, the ditches are primarily earthen ditches. In some areas, this is due to a lack of resources. However, in many areas the ditches are culturally and traditionally significant to the Pueblos, far beyond their irrigation resources. In these situations, it is of great cultural significance that the ditches remain earthen, or dirt, ditches. These are often referred to as traditional ditches.

Taos

Taos Pueblo is the northernmost Pueblo within the Study area, located in the Upper Rio Grande Valley. The community is situated at the base of the Sangre de Cristo Mountains, less than 10 miles upstream of the Rio Grande. Surface water is provided by the Rio Pueblo and Rio Lucero and associated tributaries, which all flow to the Rio Grande. The Pueblo has the distinction of being the oldest continuously inhabited community in the United States.

The BIA reported Taos Pueblo lands as totaling 95,835,746 acres in 2014 (Tiller, 2015). Most of the Pueblo's lands are located east and north of the community, which is just north of the City of Taos. The Pueblo also has a large parcel of land along the east side of the Rio Grande, encompassing a stretch of the river totaling perhaps 12 miles of the reach. Between this parcel and the primary reservation lands, there is also a large parcel along Highway 522.

Figure 3-1: Taos Pueblo (Source: DeLorme, 2006)

The Pueblo historically has farmed an extensive area along the numerous creeks and drainages in the area and includes nearly 100 miles of irrigation ditches. Many of the ditches are earthen lined, and many have only manually constructed, seasonal diversions and turnouts. A temporary diversion on Phiano Ditch is shown at right. The existing concrete lined ditches are also typically in poor condition.

Figure 3-2: Phiano Ditch Diversion

The extent of the system, and the terrain, shown on the following page, has made surveying the irrigation infrastructure a difficult and costly endeavor. Most of the ditches surveyed were dirt ditches. Those that are concrete lined were constructed several decades ago. Due to the logistical issues with access and vegetation, as well as the extensive nature of the remaining ditches, it is likely that future ditch surveys will necessarily be programmed in advance of specific planned projects.

Findings

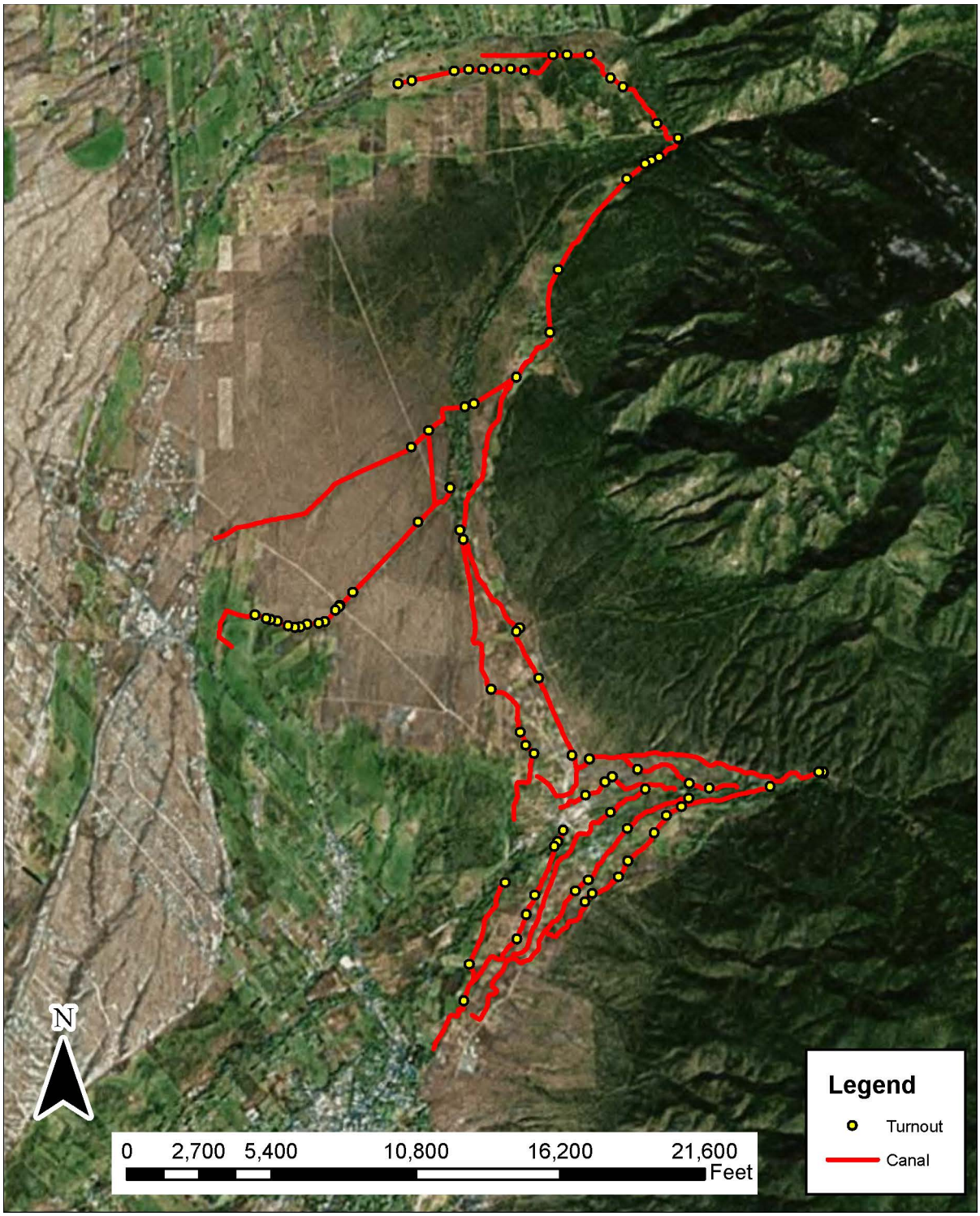
The irrigation infrastructure surveys funded to date were completed in 2014, and the data is tabulated in Appendix B. The Pueblo developed a report in 2013 that detailed many deficiencies in their irrigation infrastructure and has provided supporting documentation for this Study (Suazo, Cordova & Thom, 2013).

Condition Assessment

For ease of discussion, the extensive irrigation system serving the Pueblo can be distinguished between the north ditches, which are fed from diversions on the Rio Lucero, and the south ditches, which are fed from diversions on the Rio Pueblo de Taos. As discussed already, much of the infrastructure has not yet been surveyed. Therefore, many of the ditch lengths as contained in the condition assessment and project listings are estimated from available maps and should be considered preliminary figures.

The Pueblo has designated several ditches as non-traditional ditches, which have been or can be concrete lined or replaced with pipe. At the time of the Report, the Pueblo had a project under construction for the 1908 ditch – so named because that was the year it was lined with concrete – that is designed to accommodate cultural needs and irrigation goals by installing a buried pipeline parallel to the traditional earthen ditch.

Figure 3-3: Taos Irrigation Infrastructure (Source: BIA GIS)



Most ditches and diversions are in poor shape. There are safety concerns as well, with unsafe access to structures in multiple locations. The Rio Lucero and Grouse-Rock Bridge diversion dams are shown in Figures 3-4 and 3-5. Both exhibit severe deterioration and are poorly functioning. The conditions of the entire irrigation system are summarized in the following tables, Tables 3-1 and 3-2.

Figure 3-4: Rio Lucero Diversion

Figure 3-5: Grouse-Rock Bridge Diversion

Table 3-1: Taos North Ditches Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Rio Lucero Diversion	N/A			X	Needs reconstruction
Rio Lucero Pipeline	11,880		X		Areas need reconstruction
Lateral Number 2A	5,280			X	Needs reconstruction
Tenorio Ditch	10,560			X	Needs reconstruction
Tenorio Laterals	5,940			X	Needs reconstruction
Concho Ditch	5,000			X	Needs construction
Governor's Ditch	10,500			X	Needs reconstruction
Pumpkin Ditch	5,280			X	Needs reconstruction
Red White Clay Ditch	5,280			X	Needs rehabilitation
Alberto Ditch	5,280			X	Needs reconstruction
Indian Ditch	18,473			X	Needs reconstruction
Indian Ditch Lateral	1,869			X	Needs reconstruction
1908 Ditch, Upper Section	4,500	X			Reconstructed in 2017
1908 Ditch	12,256			X	Needs reconstruction
1908 Ditch Laterals 1-8	14,888			X	Needs rehabilitation
Tin Ditch	3,300			X	Needs reconstruction
1915 Ditch	2,650			X	Needs reconstruction
Bee Line Ditch	10,560			X	Needs reconstruction
White Rock Ditch	10,560			X	Needs reconstruction
Rock Bridge Ditch	15,126			X	Needs rehabilitation
Rock Bridge Laterals 1-4	7,586			X	Needs rehabilitation
Grouse Ditch	13,214			X	Needs rehabilitation
Grouse Laterals 1-3	12,566			X	Needs rehabilitation
Bee Line Lateral	5,858			X	Needs reconstruction

Table 3-2: Taos South Ditches Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Cicada Nose Ditch	8,315			X	Needs reconstruction
Pottery Ditch	7,090			X	Needs rehabilitation
Pottery Ditch Laterals	1,465			X	Needs rehabilitation
North Ash Pile Ditch	7,963			X	Needs rehabilitation
Buried Roots Ditch	453			X	Needs rehabilitation
Buried Roots Lateral	50			X	Needs rehabilitation
Pull Leaf Ditch	10,560			X	Needs rehabilitation
Deer Jaw Ditch	6,600			X	Needs rehabilitation
Elk Horn Ditch	5,280			X	Needs reconstruction
South Ash Pile Ditch	9,191			X	Needs rehabilitation
C Ditch	2,650			X	Needs reconstruction
B Ditch	5,280			X	Needs reconstruction
Phiano Ditch	5,698			X	Needs rehabilitation
Phiano Ditch Laterals	5,295			X	Needs rehabilitation
Acequia Madre del Pueblo	7,660			X	Needs rehabilitation
Mirabal Acequia	4,620			X	Needs reconstruction
Acequia Madre del Prado	N/A			X	Needs rehabilitation
One Tree Ditch	6,746			X	Needs reconstruction

Project Listing

The engineering team from Reclamation's Technical Service Center inspected a total of eleven diversion structures at Taos. Several were found in fair or poor condition. Several of the structures are rock diversions, which the Pueblo is pursuing as a means of providing a durable, low maintenance diversion which is congruent with the landscape and traditional values of the Pueblo. The Mirabal diversion was listed in poor condition and is inoperable.

Preliminary replacement estimates were developed for the Rio Lucero diversion ($6.46 million) and the Grouse-Rock Bridge diversion ($5.58 million). There are numerous smaller structures that are in disrepair as well (Suazo et al., 2013).

The project list is shown in the following two tables, due to the number of ditches and diversions in poor condition. Priority was placed on estimating projects which the Pueblo has identified in the referenced infrastructure report (Suazo et al., 2013) and recent work plans. For those ditches that have not yet been surveyed, the infrastructure details such as the number of required turnouts, check structures and road crossings is estimated.

The project lists include rehabilitation of several of the primary ditches and extension of pipelines to ensure adequate water delivery to downstream users. The projects total over $63 million. Project worksheets are included in Appendix C.

Table 3-3: Taos North Ditches Project List

PROJECT	LENGTH (FEET)	CONTRACT COST
Rio Lucero Diversion Reconstruction	N/A	$6,459,000
Rio Lucero Pipeline Reconstruction	5,000	$625,000
Lateral 2A Reconstruction	5,000	$504,337
Tenorio Ditch Reconstruction	10,560	$999,330
Tenorio Laterals Reconstruction	5,940	$565,007
Concho Ditch Pipeline Reconstruction	5,000	$662,372
Governor's Ditch Reconstruction	10,500	$994,110
Pumpkin Ditch Reconstruction	5,280	$491,012
Red White Clay Ditch Rehabilitation	5,280	$106,012
Alberto Ditch Reconstruction	5,280	$496,732
Indian Ditch Reconstruction	18,473	$2,812,829
Indian Ditch Lateral Reconstruction	1,869	$223,893
1908 Ditch (Remainder) Reconstruction	12,256	$1,907,120
1908 Ditch Laterals	14,888	$1,297,118
Tin Ditch Reconstruction	3,300	$317,972
1915 Ditch Reconstruction	2,650	$261,422
Bee Line Ditch Reconstruction	10,560	$993,464
White Rock Ditch Reconstruction	10,560	$993,464
Rock Bridge Ditch Rehabilitation	15,126	$633,328
Rock Bridge Laterals Rehabilitation	7,586	$255,460
Grouse Ditch Rehabilitation	13,214	$288,136
Grouse Ditch Laterals Rehabilitation	12,569	$276,873
Grouse-Rock Bridge Diversion Reconstruction	N/A	$5,577,000
Bee Line Diversion Reconstruction	N/A	$5,577,000
Concho Ditch Diversion Reconstruction	N/A	$5,577,000
Bee Line Lateral Reconstruction	5,858	$571,390
TOTAL		$39,466,381

NOTE: All costs shown shall be considered *appraisal level* costs

Table 3-4: Taos South Ditches Project List

PROJECT	LENGTH (FEET)	CONTRACT COST
Cicada Nose Ditch Reconstruction	8,315	$1,087,633
Pottery Ditch Rehabilitation	7,090	$447,581
Pottery Ditch Laterals Rehabilitation	1,465	$45,789
North Ash Pile Ditch Rehabilitation	7,963	$422,477
Buried Roots Ditch & Lateral Rehabilitation	503	$24,039
Pull Leaf Ditch Rehabilitation	10,560	$212,024
Deer Jaw Ditch Rehabilitation	6,600	$150,794
Elk Horn Ditch Reconstruction	5,280	$491,012
South Ash Pile Ditch Rehabilitation	5,280	$699,184
C Ditch Reconstruction	2,650	$359,682
B Ditch Reconstruction	5,280	$501,992
Phiano Ditch Rehabilitation	5,698	$411,190
Phiano Ditch Laterals Rehabilitation	5,295	$240,799
Acequia Madre del Pueblo Rehabilitation	7,660	$271,824
Mirabal Acequia Reconstruction	4,620	$937,572
Acequia Madre del Prado Structures	N/A	$30,872
Cicada/Elk Horn Diversion Reconstruction	N/A	$5,577,000
One Tree Ditch Reconstruction	6,746	$591,182
Pull Leaf Diversion Reconstruction	N/A	$5,577,000
Buried Roots Diversion Reconstruction	N/A	$5,577,000
TOTAL		$23,656,646

NOTE: All costs shown shall be considered *appraisal level* costs

Picuris

Picuris is one of the smaller Pueblos in the study area, encompassing about 17,000 acres. The Pueblo is situated high in the Sangre de Cristo Mountains south of Taos, along the Rio Pueblo. In addition to farming and ranching, Picuris is a member of the Inter-Tribal Bison Cooperative and manages a herd of bison for economic and cultural purposes (Tiller, 2015).

Most of the Pueblo's farmlands are situated on the north side of the Rio Pueblo, fed from a diversion point upstream from

Figure 3-6: Picuris Pueblo
(Source: DeLorme, 2006)

the developed area. There are developed agricultural lands on the south side of the river as well, although the irrigation infrastructure serving those fields has not been functional for some years.

Findings

Picuris' irrigation infrastructure surveys were completed in 2013, and are presented in Appendix B. There are nearly 4.5 miles of irrigation ditch serving the Pueblo's farmlands. There are several flumes to channel irrigation water across drainage channels, and three road crossings, most of which are in severely deteriorated condition. The system is presented graphically in Figure 3-8.

Condition Assessment

The irrigation system consists of a diversion from the Rio Pueblo, feeding into North Ditch, which constitutes 70 percent of the Pueblo's ditches, and Middle and South ditches, both of which are fed from the North Ditch. All ditches are in aged condition. Much of the North Ditch and Middle Ditch have been concrete lined in the past but are in such deteriorated condition that some sections have been removed and others lined with a manufactured high-density polyethylene (HDPE) liner, which has now deteriorated.

The Rio Pueblo diversion is poorly functional as well, with a large amount of sediment entrainment in the diverted irrigation water. In addition, the river provides inadequate water flow during much of the farming season.

Figure 3-7: Rio Pueblo Diversion

This situation has been exacerbated recently due to modifications to the system in order to divert water upstream for other non-Pueblo users. These users have secondary water rights to the Pueblo. The Tribe is seeking to address the issue through the State Engineer's Office, New Mexico.

The inadequate water supply is of paramount concern for the Pueblo. To improve irrigation conditions, the feasibility of a sediment basin should be assessed in future as well.

Figure 3-8: Picuris Irrigation Infrastructure (Source: BIA GIS)

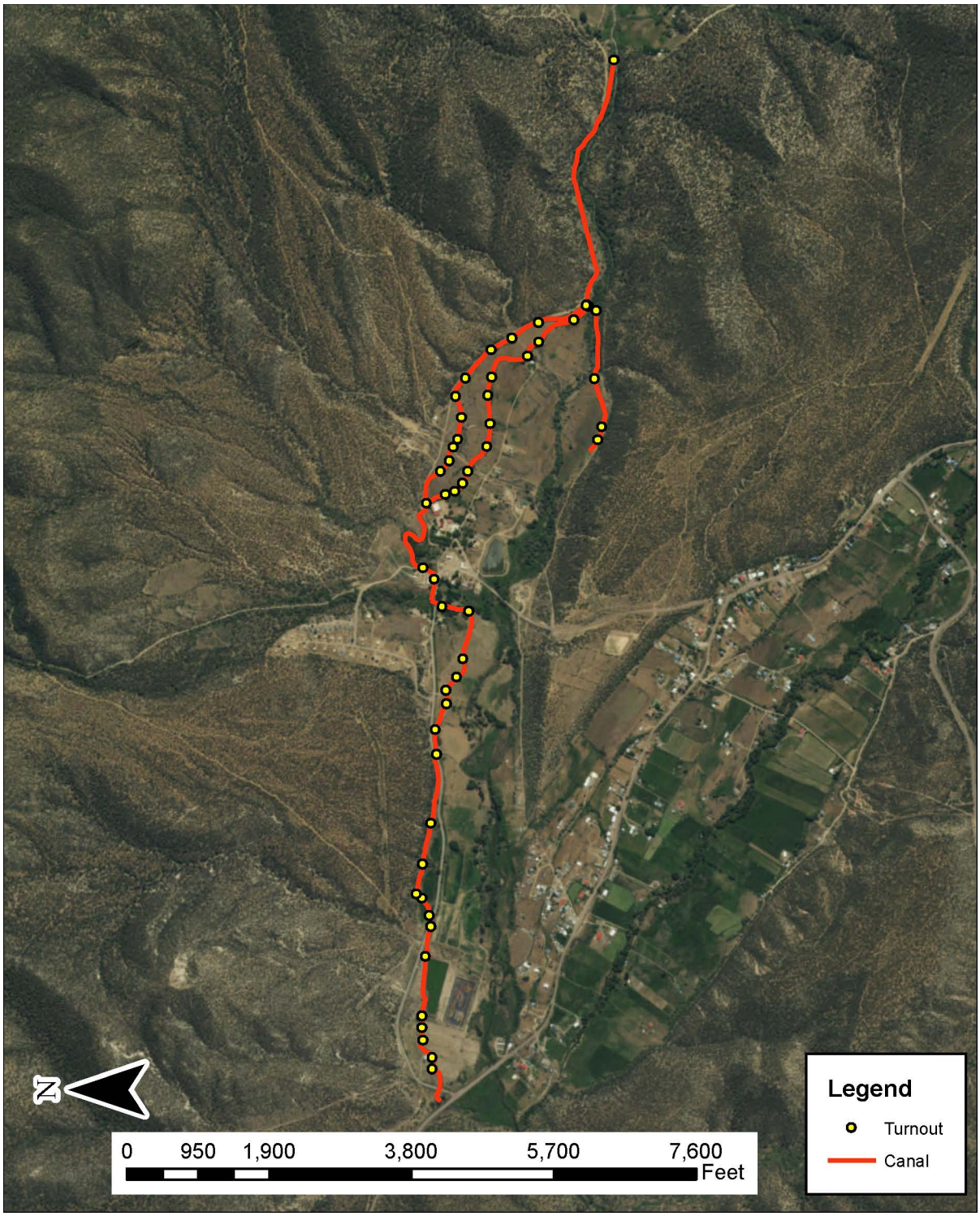


Table 3-5: Picuris Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Rio Pueblo Diversion				X	Needs reconstruction
North Ditch:					
North Ditch Flume	55			X	Unusable, renders entire ditch unusable
North Ditch - Section 1	5,445		X		Serviceable, deteriorated
North Ditch - Section 2	1,580			X	Needs reconstruction
North Ditch - Section 3	2,705		X		Serviceable, deteriorated
North Ditch - Section 4	1,365			X	Damaged HDPE lined section
North Ditch - Section 5	5,643		X		Serviceable, deteriorated
Middle Ditch:					
Middle Ditch - Section 1	500		X		Serviceable, deteriorated
Middle Ditch - Section 2	510			X	Needs reconstruction
Middle Ditch - Section 3	2,911			X	Serviceable, deteriorated
South Ditch	2,746			X	Unusable throughout

Project Listing

From the needs assessment, the reconstruction efforts necessary to restore functionality to the Pueblo's irrigation system were developed as shown in Table 3-6.

Table 3-6: Picuris Project List

PROJECT	LENGTH (feet)	CONTRACT COST
Rio Pueblo Diversion Reconstruction	N/A	$5,692,000
North Ditch:		
North Ditch Flume Replacement	55	$110,825
North Ditch Reconstruction	16,738	$1,970,401
Middle Ditch Reconstruction	3,921	$657,166
South Ditch Reconstruction	2,746	$255,628
TOTAL:		$7,967,517

NOTE: All costs shown shall be considered *appraisal level* costs

The projects total nearly $8 million, with almost three-quarters of that cost attributed to the Rio Pueblo Diversion. The flume and ditch projects total just under $2.3 million. Details are provided in Appendix C.

Figure 3-9: Existing Flume Structure

Ohkay Owingeh

Ohkay Owingeh encompasses 12,237 acres of land, about 30 miles north of Santa Fe. Both the Rio Grande and the Rio Chama run through reservation lands. The Pueblo was formerly known as San Juan Pueblo until 2007, when the Tribe officially changed the name imposed during the Spanish colonial period. The Eight Northern Pueblos Indian Council is seated in Ohkay Owingeh (Tiller, 2015).

Agriculture is an important part of Ohkay Owingeh's diverse economy and cultural traditions. Tribal farmlands are situated on both the Rio Grande and the Rio Chama, served by approximately 13 miles of irrigation ditches and a primary diversion on each river. There are some acequias through Pueblo lands that serve Pueblo farmlands as well as private land holdings outside the reservation boundaries.

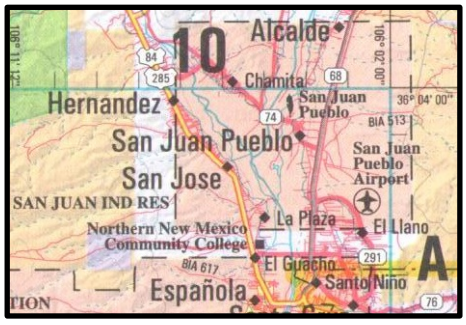


Figure 3-10: Ohkay Owingeh Pueblo
(Source: DeLorme, 2006)

Findings

Surveys were completed in 2015 for the Acequia Madre, Ranchitos Lateral, Chamita, El Guique, El Llano and Middle Ditch, as well as the Interior Drain. The joint use acequias

have not been surveyed, and include Hernandez Ditch, Upper Alcalde, and Salazar Ditch. The irrigation infrastructure is tabulated in Appendix B and shown in Figure 3-13.

Condition Assessment

The Pueblo has recently completed reconstruction on Chamita Ditch, shown below, as well as a portion of the Acequia Madre. The existing conditions are shown in Table 3-7.

Figure 3-11: Chamita Ditch, Before

Figure 3-12: Chamita Ditch, After

Figure 3-13: Ohkay Owingeh Irrigation Infrastructure (Source: BIA GIS)

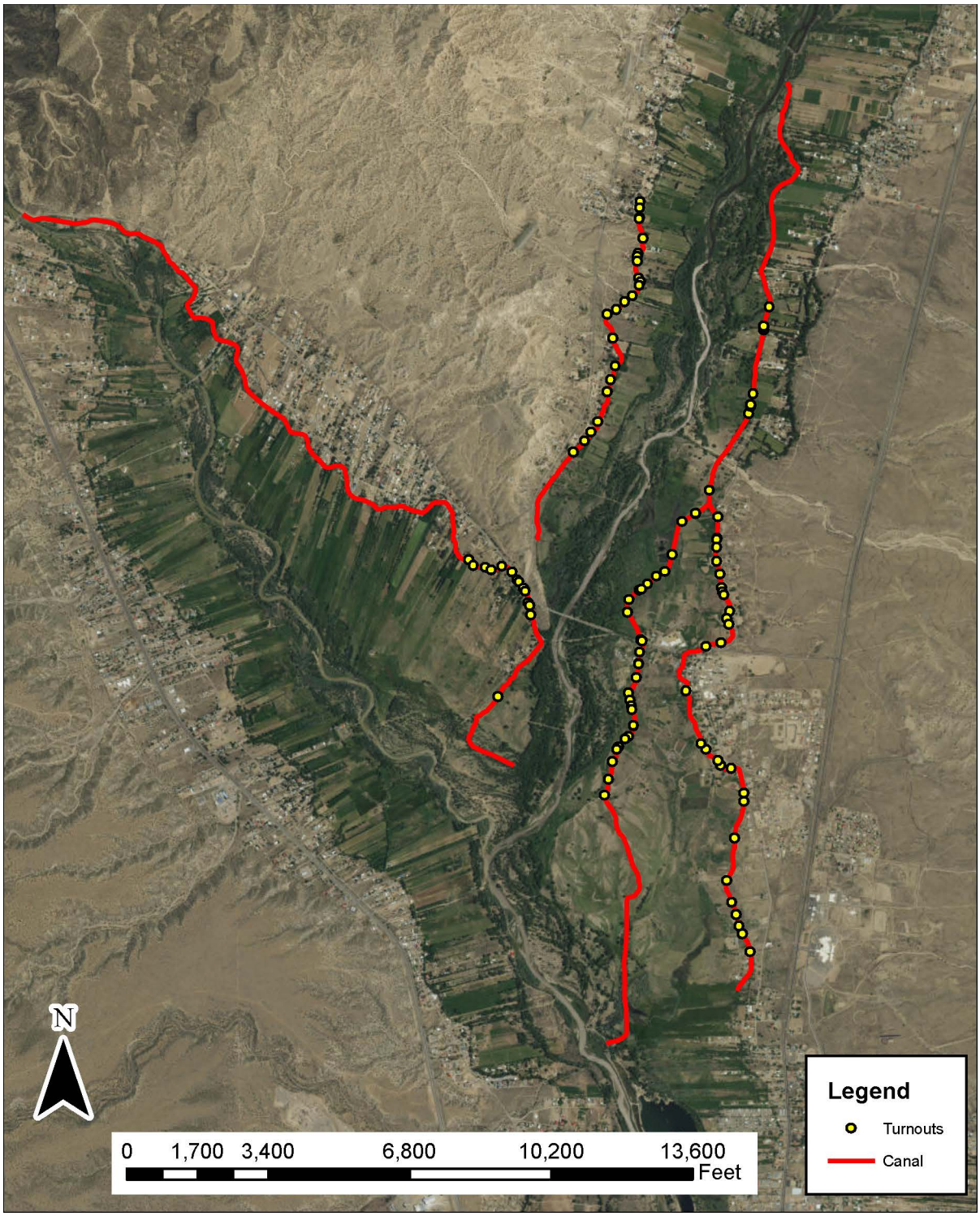


Table 3-7: Ohkay Owingeh Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
El Llano	3,741			X	Needs reconstruction
El Guique	6,996			X	Needs reconstruction
Acequia Madre:					
Acequia Madre, Section 1	2,574			X	Needs rehabilitation
Acequia Madre, Section 2	4,046		X		Aging, serviceable
Acequia Madre, Section 3	3,780			X	Needs rehabilitation
Acequia Madre, Section 4	800	X			Recently reconstructed
Acequia Madre, Section 5	113			X	Needs rehabilitation
Acequia Madre, Section 6	5,900			X	Needs rehabilitation
Ranchitos Lateral	1,750			X	Needs rehabilitation
Acequia Madre Wasteway	300			X	Needs rehabilitation
Middle Ditch:					
Middle Ditch, Upper Section	5,615		X		Deteriorated, serviceable
Middle Ditch, Lower Section	5,615			X	Needs reconstruction
Chamita Ditch	3,898	X			Recently reconstructed
Chamita Ditch Wasteway	300			X	Needs rehabilitation
Chamita Diversion (Chama River)	N/A			X	Needs reconstruction
Chamita Diversion Ditch, Upper Section	15,700			X	Needs rehabilitation
Chamita Diversion Ditch, Remainder	--	X			Recently rehabilitated
Salazar Diversion (Chama River)	N/A			X	Needs reconstruction
Interior Drain	7,439			X	Needs rehabilitation

Project Listing

There are two diversion structures on the Rio Chama that were reviewed by the Technical Services Center team. Estimates were subsequently developed for rehabilitation of the Salazar dam and the Chamita dam and settling basin. In addition, the Pueblo has several ditches that need to be reconstructed or rehabilitated. The interior drain is in poor shape as well, with sedimentation and vegetation growth, and needs to be restored to adequately serve its purpose. Project needs exceed $21 million, and are detailed in Appendix C.

Table 3-8: Ohkay Owingeh Project List

PROJECT	LENGTH (feet)	CONTRACT COST
El Llano Reconstruction	3,741	$365,845
El Guique Reconstruction	6,996	$869,778
Acequia Madre:		
Acequia Madre, Section 1, Rehabilitation	11,947	$460,234
Acequia Madre, Concrete Reconstruction	4,046	$542,086
Ranchitos Lateral Rehabilitation	1,750	$26,000
Acequia Madre Wasteway Rehabilitation	300	$3,900
Middle Ditch:		
Middle Ditch, Upper Section Reconstruction	5,615	$1,154,655
Middle Ditch, Lower Section Reconstruction	5,615	$502,374
Chamita Ditch Wasteway Rehabilitation	300	$3,900
Chamita Diversion Reconstruction	N/A	$5,633,000
Chamita Diversion Ditch Rehabilitation	15,700	$172,700
Salazar Diversion Reconstruction	N/A	$11,452,000
Interior Drain Rehabilitation	7,439	$96,707
TOTAL:		$21,283,179

NOTE: All costs shown shall be considered *appraisal level* costs

Santa Clara

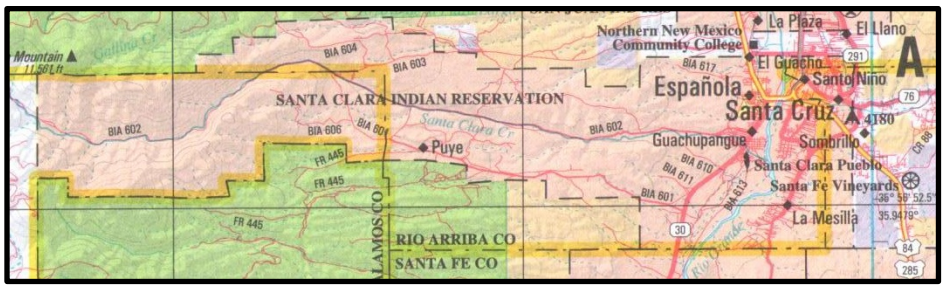
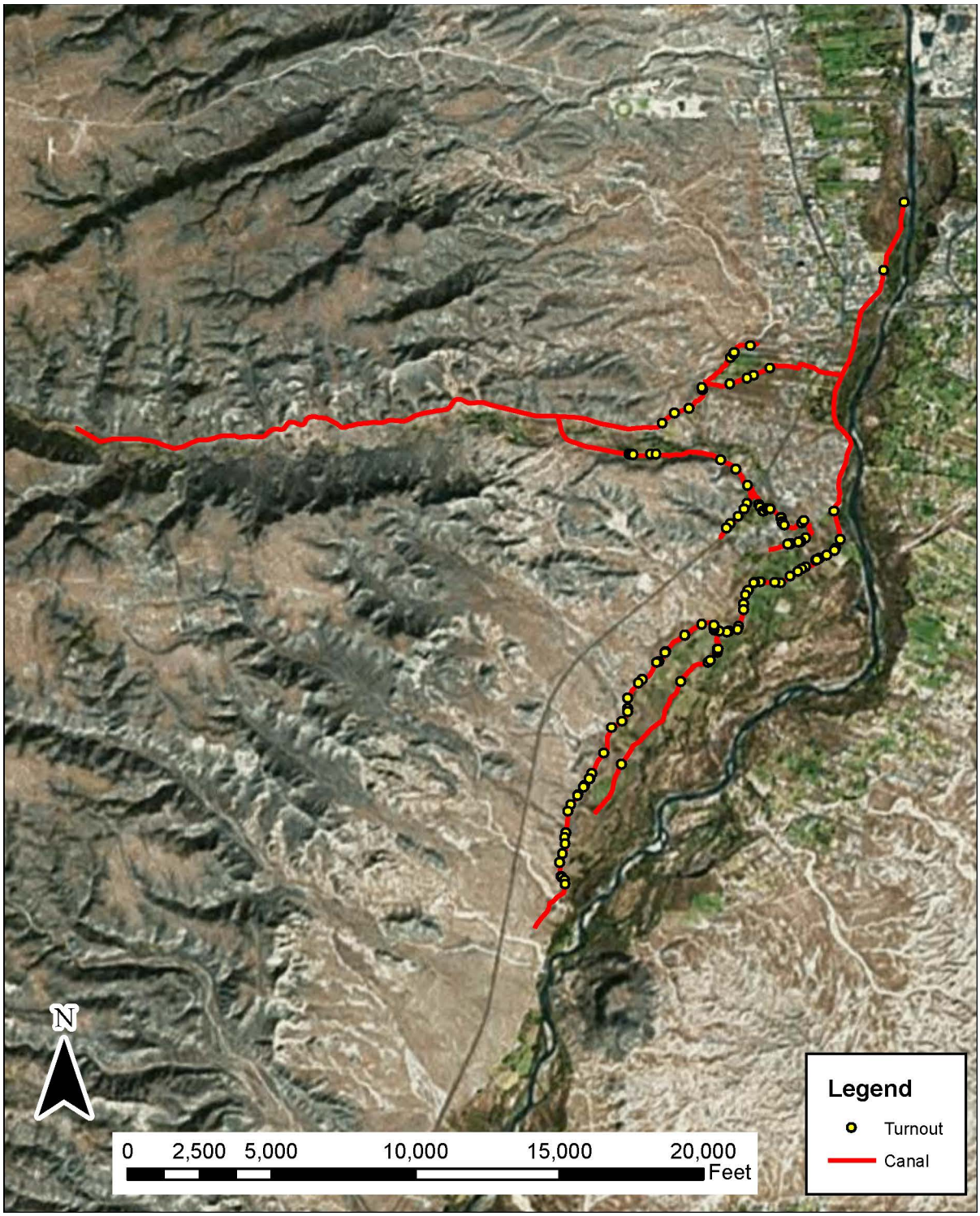


Figure 3-14: Santa Clara Pueblo (Source: DeLorme, 2006)

Santa Clara Pueblo has nearly 54,800 acres, surrounding the city of Española and extending west to include most of the Santa Clara Creek drainage. The Rio Grande, Santa Clara Creek, and Santa Cruz River traverse Pueblo lands. The Pueblo is one of the few Tribes that has entered into a self-governance agreement with the BIA, which affords the Pueblo increased control over fiscal matters (Tiller, 2015).

The Pueblo has nearly 15 miles of irrigation ditches, supplied by one diversion from Santa Clara Creek and two diversions on the Rio Grande. Most of the ditches are traditional, but there are a few with aged and deteriorated concrete lining. The irrigation infrastructure is shown on the following page.

Figure 3-15: Santa Clara Irrigation Infrastructure (Source: BIA GIS)



Findings

At the time of the Report, Surveys of the irrigation infrastructure for Santa Clara were expected to be substantially funded in late 2017. However, the Pueblo had enough background information available to provide most of the ditch lengths and turnout information. While this data is considered preliminary, pending surveys, it is tabulated and included in Appendix B.

Condition Assessment

The Main Ditch diversion from the Rio Grande has design issues but is still in service. The inlet structure and sluice gate 2,000 feet downstream still function but are very old and deteriorated, as shown below. The upper half of the ditch itself has been recently reconstructed and is in good shape.

Figure 3-16: Main Ditch Inlet Structure, Upstream View

Figure 3-17: Main Ditch Inlet Structure, Downstream View

Most of the remaining conveyances are in poor shape. The Santa Clara Creek diversion, and the upper Canyon Ditch from the diversion point, are in fair shape. The condition assessment is summarized in Table 3-9.

Figure 3-18 : Main Ditch

Table 3-9: Santa Clara Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Main Ditch:					
Diversion from Rio Grande	N/A			X	Needs redesign, stabilization
Inlet Structure/Sluice Gate	N/A		X		Needs reconstruction
Main Ditch, Upper Section	18,365	X			Serviceable
Main Ditch, Lower Section	11,894			X	Needs reconstruction
H. Suazo Ditch	2,620			X	Needs rehabilitation
Guachupangue Ditch:					
Guachupangue Ditch, Upper	2,000			X	Needs reconstruction
Guachupangue Ditch, Lower	1,805			X	Needs rehabilitation
Canyon Ditch:					
Canyon Ditch, Upper	21,120		X		Areas need reconstruction
Canyon Ditch, Middle	1,000			X	Needs reconstruction
Canyon Ditch, Lower	7,000			X	Needs rehabilitation
Canyon Ditch Lateral	2,194			X	Needs rehabilitation
Holcomb Ditch	1,500			X	Needs rehabilitation
Middle Ditch	8,490			X	Needs rehabilitation
River Ditch:					
Rio Grande Diversion	N/A			X	Needs reconstruction
River Ditch	16,000			X	Needs rehabilitation

Project Listing

The project list for the Pueblo, summarized in Table 3-10, provides estimates for addressing all irrigation ditches. The cost is relatively low for the miles of ditches to be rehabilitated, at about $5.5 million, because most would remain earthen, traditional ditches. However, costs for the improvements needed may change as surveys are completed and accurate inventories are available for the number of turnouts, check structures, road crossings and other appurtenances.

Table 3-10: Santa Clara Project List

INFRASTRUCTURE CONDITION	LENGTH (feet)	CONTRACT COST
Main Ditch:		
Diversion Reconstruction	N/A	$700,000
Inlet Structure/Sluice Gate Reconstruction	N/A	$23,675
Main Ditch, Lower Section Reconstruction	11,894	$1,546,726
H. Suazo Ditch Rehabilitation	2,620	$44,015
Guachupangue Ditch:		
Guachupangue Ditch, Upper Section Reconstruction	2,000	$204,872
Guachupangue Ditch, Lower Section Rehabilitation	1,805	$199,825
Canyon Ditch:		
Canyon Ditch, Upper Canyon Section, Select Reconstruction	21,120	$728,640
Canyon Ditch, Section below Piped Area, Reconstruction	1,000	$159,000
Canyon Ditch, Lower Section Rehabilitation	7,000	$311,848
Canyon Ditch Lateral Rehabilitation	2,194	$99,772
Holcomb Ditch Rehabilitation	1,500	$47,122
Middle Ditch Rehabilitation	8,490	$352,224
River Ditch:		
Rio Grande Diversion Reconstruction	N/A	$782,250
River Ditch Rehabilitation	16,000	$320,116
TOTAL:		$5,520,085

NOTE: All costs shown shall be considered *appraisal level* costs

Pojoaque

Pojoaque is centered along US Highway 84/285, northwest of Santa Fe and immediately west of the Pueblo of Nambé, and totals 12,315 acres (Tiller, 2015). The Pueblo is one of the stakeholders in the Aamodt Litigation Settlement (Public Law 111-291). That effort has been time consuming for the Tribal Administration personnel but has resulted in agreements which conclude long standing water rights settlements and compensation through needed infrastructure improvements benefitting Pojoaque, as well as Nambé, San Ildefonso and Tesuque.

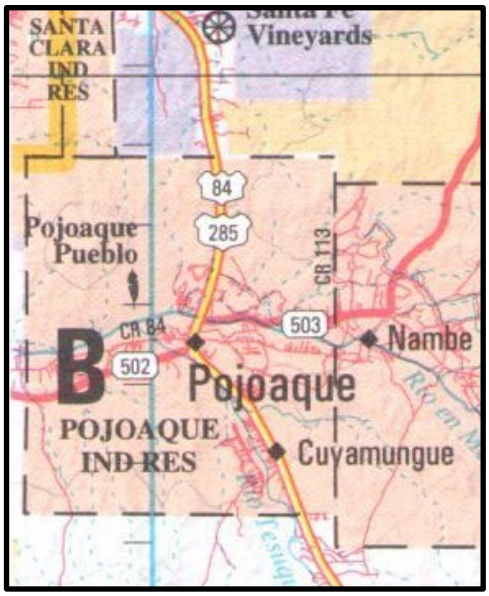


Figure 3-19: Pojoaque Pueblo
(Source: DeLorme, 2006)

The Pueblo's farmlands are along the Rio Pojoaque. The irrigation infrastructure surveys have not yet been funded. At the Pueblo's request, no preliminary project listings were developed for inclusion in the Study. The Pueblo has expressed the need first for a watershed planning study, due to the complex land ownership and numerous acequias within the area.

Findings

Information on irrigation ditches is based on existing data from the BIA GIS and information from the Pojoaque Basin GIS. The irrigation system shown on the following page reflects the Acequia del Rincon only.

Condition Assessment

The irrigation infrastructure is comprised primarily of three traditional ditches totaling over eight miles: Rincon Ditch, Acequia Otra Vanda, and the Acequia Larga de Jacona. The condition assessment is summarized in Table 3-11.

Table 3-11: Pojoaque Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Acequia del Rincon	11,754		X		Serviceable, needs rehabilitation
Acequia Larga de Jacona	9,573		X		Serviceable, needs rehabilitation
Acequia Otra Vanda	22,179		X		Serviceable, needs rehabilitation

Figure 3-20: Pojoaque Irrigation Infrastructure (Source: BIA GIS)

San Ildefonso

San Ildefonso encompasses 37,176 acres, with the Rio Grande and the Rio Pojoaque flowing through Pueblo lands. As previously discussed, San Ildefonso is one of the stakeholders in the Aamodt Litigation Settlement (Tiller, 2015).

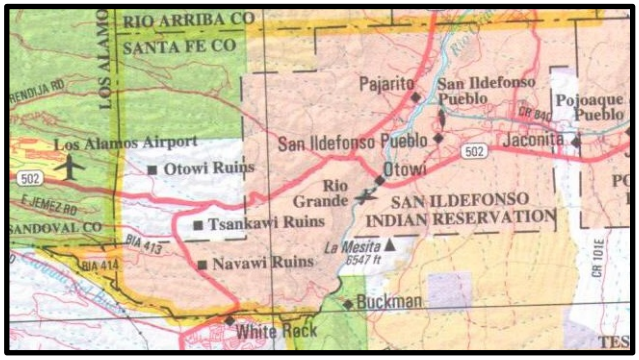


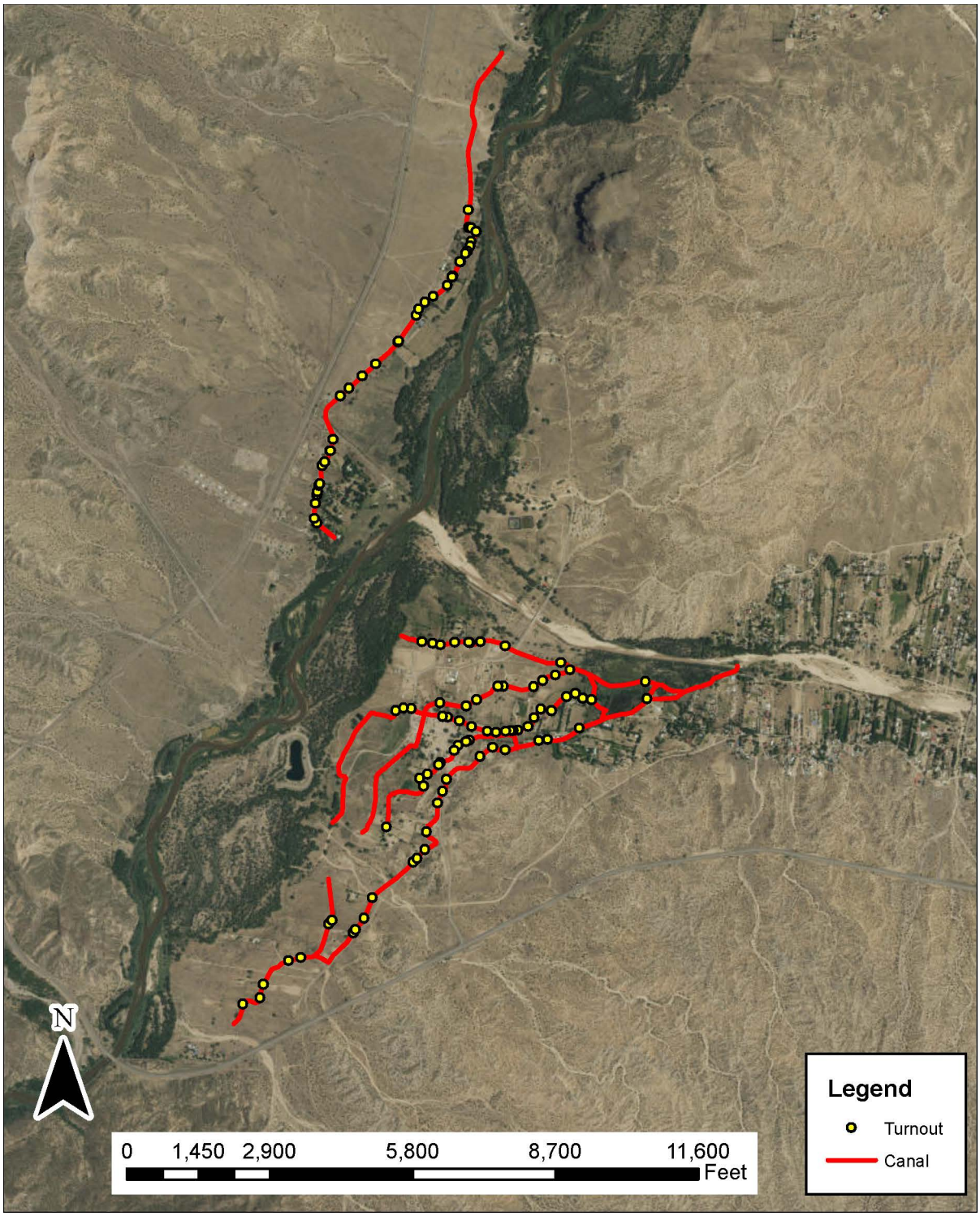
Figure 3-21: San Ildefonso Pueblo
(Source: DeLorme, 2006)

The Pueblo has extensive farmlands but is hampered by poor water flows through the irrigation system. The Aamodt Litigation Settlement includes a project to address this need (Reclamation, 2017).

Irrigation surveys were completed in 2016, and are tabulated in Appendix B. The irrigation infrastructure consists of two distinct areas: on the east side of the Rio Grande, south of the Rio Pojoaque, which is fed from a diversion on the Rio Pojoaque; and on the west side of the Rio Grande, fed from a ditch that continues from the Santa Clara reservation and from a diversion on the Rio Grande.

There is an inadequate water supply to the main ditch on the west side of the Rio Grande, which continues on San Ildefonso lands from the Pueblo's boundary with Santa Clara to the north. The Pueblo must instead rely on the Rio Grande diversion for the irrigation ditches on the west side of the river, but the diversion is ineffective and does not provide adequate flow for the irrigation needs. The irrigation system is illustrated in Figure 3-22 on the following page.

Figure 3-22: San Ildefonso Irrigation Infrastructure (Source: BIA GIS)



Findings

The Pueblo's irrigation system consists of about 14 miles of ditches. Some are concrete lined or encased in pipe, but most are maintained as traditional ditches. The Rio Pojoaque diversion will be enhanced through construction within the scope of the Pojoaque Basin project and is tentatively scheduled for completion in 2020.

Condition Assessment

In support of the condition assessment, Reclamation's Technical Service Center provided input on costs to replace the diversion dam on the Rio Pojoaque. However, this project will now be completed by the Aamodt project, so it is not shown in the project listing.

Rehabilitation of the junction box further downstream on the Eastside system, shown at right, was also evaluated, and is included within the ditch reconstruction needs in the project listing.

Figure 3-23: Junction Box

The results of the condition assessment are shown in Tables 3-12 and 3-13. In addition to the deteriorated ditch system needing rehabilitation, there are several arroyo crossings that impact the ditch alignments, filling the system with sediment periodically, degrading irrigating ability, and requiring extensive maintenance.

Figure 3-24: Deteriorated Reservoir Outfall

Project Listing

As shown in the needs assessment, most of the infrastructure is in fair to poor shape, requiring rehabilitation or reconstruction. There are several concrete lined ditches that are aged and deteriorated, and many sections of traditional ditch that need to be rehabilitated to restore serviceability.

The project list is shown in Table 3-14, and detailed in Appendix C. As scoped, the project costs total about $7.2 million.

Table 3-12: San Ildefonso Condition Assessment: East Side

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Rio Pojoaque Diversion	N/A			X	Ineffective, low flow, needs redesign
Diversion Ditch	2,020	X			Concrete ditch, serviceable
Montoya Ditch	6,163		X		Needs rehabilitation
Lateral 1, Concrete Section	2,900		X		Serviceable, deteriorated
Lateral 1, Dirt Section	486			X	Needs reconstruction
Ortiz Ditch, Concrete Section	9,787			X	Needs reconstruction
Ortiz Ditch, Dirt Section	206			X	Unusable
Little Canal	583		X		Serviceable, deteriorated
Middle Ditch, Concrete Section	5,094			X	Needs reconstruction
Middle Ditch, Dirt Section	2,143			X	Needs rehabilitation
Middle Ditch, Dirt Section	2,000			X	Unusable
Lateral Ditch 2	1,483			X	Filled in by arroyo deposition
Lateral Ditch 2, End Section	1,500			X	Unusable, needs rehabilitation
Acequia de los Indios, Concrete Section	2,710			X	Needs reconstruction
Acequia de los Indios, Dirt Section	978			X	Needs rehabilitation
Acequia de los Indios Heading	N/A			X	Inadequate water supply
Line No 1 Ditch	4,633			X	Needs reconstruction
Line 7 Extension	2,047			X	Needs rehabilitation, improved water supply
Artesian Well	N/A			X	Needs repairs to utilize as drought relief well
El Rancho Pond	N/A			X	Sedimented, overgrown, structure needing rehabilitation

Table 3-13: San Ildefonso Condition Assessment: West Side

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Northern Section, From Border	15,000			X	Very little flow, needs rehabilitation throughout
Rio Grande Alternate Heading	N/A		X		Ineffective, needs redesign to provide adequate flow
Concrete Section from Alternate Heading	8,990	X			Serviceable
Remainder	3,419		X		Primarily concrete, areas need rehabilitation

Table 3-14: San Ildefonso Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
Westside Ditch:		
Northern Section Rehabilitation	15,000	$195,000
Remainder, Reconstruction	5,219	$492,155
Rio Grande Alternate Heading	N/A	$1,800,000
Eastside Ditch:		
Montoya Ditch Rehabilitation	6,163	$209,668
Eastside Lateral 1 Reconstruction	3,386	$297,984
Ortiz Ditch Reconstruction	10,093	$995,493
Little Canal Reconstruction	206	$42,311
Middle Ditch, Reconstruction	583	$524,900
Middle Ditch, Rehabilitation	7,294	$118,333
Lateral Ditch 2 Reconstruction	3,483	$241,361
Acequia de los Indios, Reconstruction	1,500	$320,576
Acequia de los Indios, Rehabilitation	2,710	$52,830
Acequia de los Indios Heading	N/A	$37,398
Line No 1 Ditch Reconstruction	4,633	$349,961
Line 7 Extension Rehabilitation	2,047	$52,611
Artesian Well	N/A	$4,500
El Rancho Pond Rehabilitation	N/A	$1,500,000
TOTAL:		$7,235,081

NOTE: All costs shown shall be considered *appraisal level* costs

Nambé

Nambé is north of Santa Fe and encompasses a land base of about 19,218 acres at the base of the Sangre de Christo Mountains and abutting National Forest lands. The Pueblo's water resources include Nambé Lake, an impoundment of the Nambé River, formed by a dam constructed as part of the San Juan-Chama project. The lake and the downstream Nambé Falls are popular recreation areas in the region (Tiller, 2015).

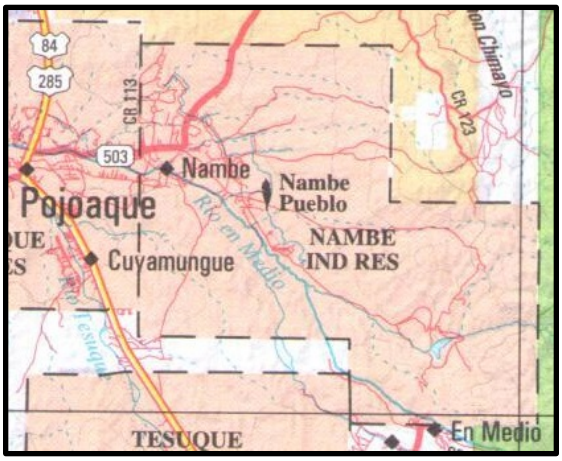


Figure 3-25: Nambé Pueblo

(Source: DeLorme, 2006)

Findings

The surveys of the irrigation infrastructure at Nambé have been partially funded, and full funding was expected in late 2017. The Pueblo's farmlands are situated along several tributaries to the Rio Pojoaque, including the Rio Medio, Nambé River and Rio Chupadero. The system as inventoried in the BIA GIS is presented on the following page. Some of the minor ditches are not depicted.

Condition Assessment

Existing historic maps of the area ditches were utilized to develop a preliminary inventory of the irrigation ditches. As such, the data shown in the following table is also considered preliminary but provides an estimate for planning purposes.

Most of the ditches are traditional. Those that are piped or concrete lined in sections are typically aged and deteriorating. Structures have not yet been inventoried and will undoubtedly have a need for rehabilitation projects in the future.

Figure 3-26: Nambé River Diversion

Figure 3-27: Nambé Irrigation Infrastructure (Source: BIA GIS)

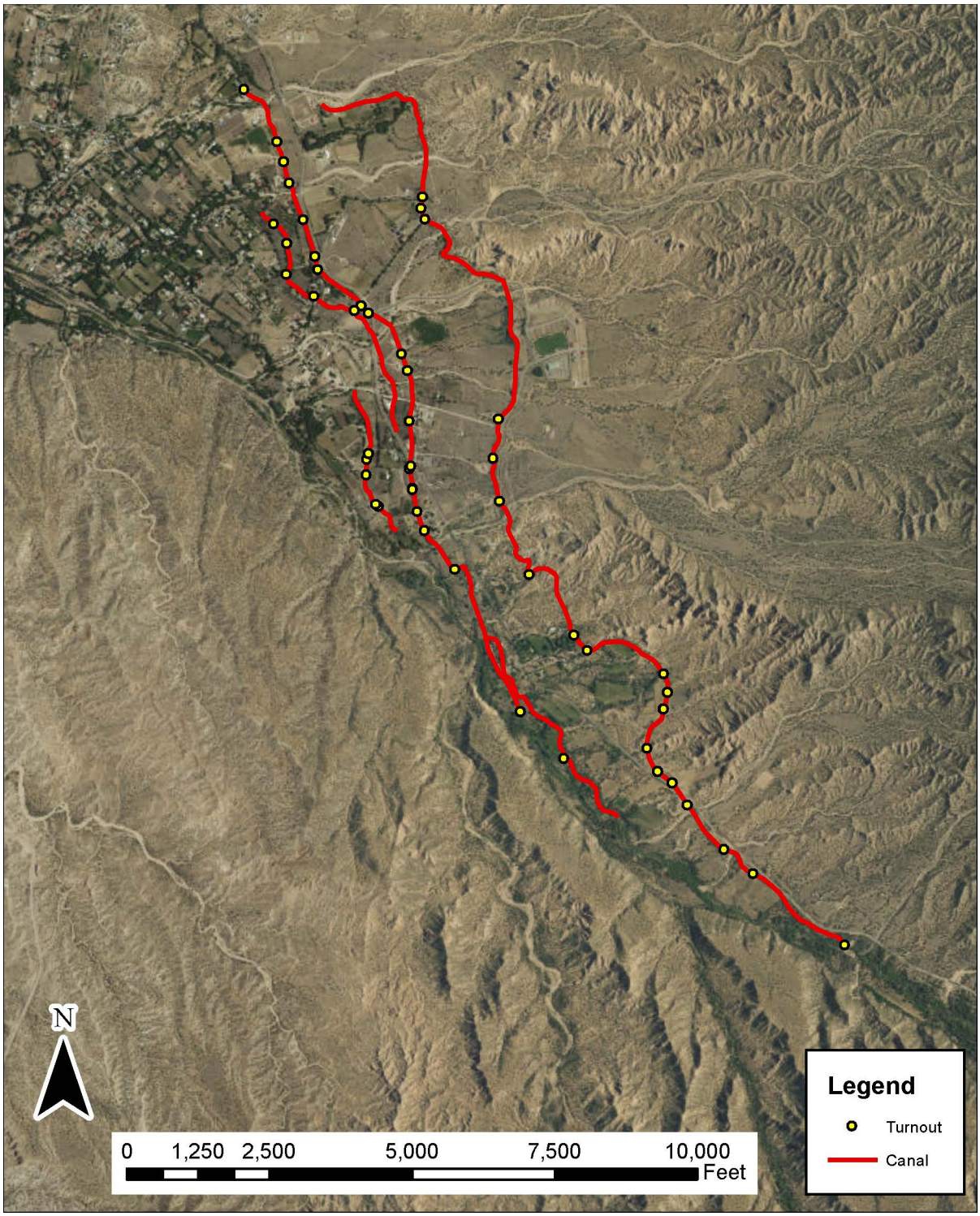


Table 3-15: Nambé Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Highline Ditch					
Recent Rehabilitated Section	390	X			Serviceable
Remainder	19,735			X	Needs rehabilitation
Consolidated Ditch					
Rehabilitated Section	1,600		X		Serviceable
Remainder	8,400			X	Needs reconstruction
Consolidated Lateral Ditch	3,300			X	Needs reconstruction
La Nueva Ditch	13,875			X	Needs rehabilitation
La Nueva Lateral	3,399			X	Needs rehabilitation
Chili Line	5,800			X	Needs reconstruction
Community Ditch	16,447			X	Needs reconstruction
Oak Ditch	5,344			X	Needs rehabilitation
Juan Vigil Ditch	4,781			X	Needs rehabilitation
La Mocha Feeder	1,688			X	Needs rehabilitation
Acequia del Llano	6,750			X	Needs reconstruction
Trujillo Ditch	3,500			X	Needs rehabilitation
Old Trujillo Ditch	6,549			X	Needs rehabilitation
Uncle Moe Ditch	2,625			X	Needs rehabilitation
Richards Ranch Ditch	5,625			X	Needs rehabilitation
Old Felipe Ditch	1,688			X	Needs rehabilitation
Cano Ditch	12,812			X	Needs rehabilitation
Jose G. Ortiz Ditch	3,721			X	Needs rehabilitation
Ortiz Ditch	8,831			X	Needs rehabilitation

Project Listing

The preliminary project list is shown in the following table. As survey data is completed and structures assessed, it is anticipated that the estimated costs may require updating in future. The project needs assessed total about $7.1 million for the Pueblo's infrastructure. The project worksheets are presented in Appendix C.

Table 3-16: Nambé Project List

PROJECTS	LENGTH (feet)	CONTRACT COST
Highline Ditch Rehabilitation	19,735	$411,099
Consolidated Ditch		
Upper Section Reconstruction	1,600	$48,422
Remainder, Reconstruction	8,400	$808,390
Consolidated Lateral Ditch Reconstruction	3,300	$241,850
La Nueva Ditch Reconstruction	13,875	$1,322,087
La Nueva Lateral Rehabilitation	3,399	$75,059
Chili Line Reconstruction	5,800	$551,318
Community Ditch Reconstruction	16,447	$1,552,351
Oak Ditch Rehabilitation	5,344	$116,190
Juan Vigil Ditch Rehabilitation	4,781	$108,871
La Mocha Feeder Reconstruction	1,688	$183,824
Acequia del Llano Reconstruction	6,750	$661,590
Trujillo Ditch Rehabilitation	3,500	$85,718
Old Trujillo Ditch Rehabilitation	6,549	$146,105
Uncle Moe Ditch Rehabilitation	2,625	$74,343
Richards Ranch Ditch Rehabilitation	5,625	$123,093
Old Felipe Ditch Rehabilitation	1,688	$48,790
Cano Ditch Rehabilitation	12,812	$278,268
Jose G. Ortiz Ditch Rehabilitation	3,721	$88,591
Ortiz Ditch Rehabilitation	8,831	$192,393
TOTAL:		$7,118,352

NOTE: All costs shown shall be considered *appraisal level* costs

Tesuque

Tesuque is the southernmost of the Pueblos within the Eight Northern Pueblos Council and is situated just nine miles north of Santa Fe. The Pueblo contains a total area of just over 17,050 acres, with the Rio Tesuque running through the center of the Pueblo's lands. Tesuque is one of the stakeholders in the Aamodt Litigation Settlement and will benefit in the future by the Rio Tesuque channel modification project, which will restore the river channel and reduce the risk of damage to the Pueblo's irrigation water storage ponds (Reclamation, 2017; Tiller, 2015).

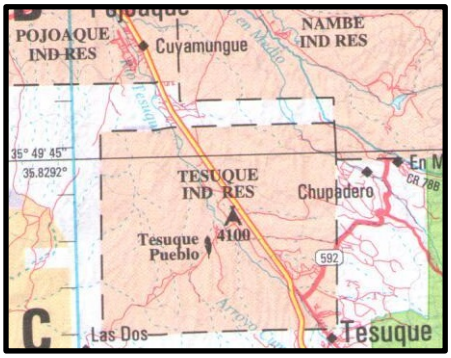


Figure 3-28: Tesuque Pueblo
(Source: DeLorme, 2006)

Findings

Tesuque's irrigation water is sourced primarily from the Rio Tesuque. As shown in the image at right, the river is subject to a wide range of flow conditions depending on precipitation. This imposes a lot of sediment into the irrigation system.

Figure 3-29: Rio Tesuque

The irrigation surveys for the Pueblo have been funded and are currently in progress. The existing infrastructure is shown in Figure 3-31.

Condition Assessment

The Technical Service Center team provided review of several of the structures at Tesuque and found several in poor or unusable condition. One example is the diversion dam shown below, which is severely eroded and needs to be replaced.

Figure 3-30: Tesuque Diversion Dam

Further assessment is needed to evaluate the cost to replace or rehabilitate many of these structures. In addition, much of the infrastructure is aged buried pipe, installed with no provision for access in the event the pipe is clogged with sediment.

The condition assessment is preliminary, as the surveys are not completed and structural inspections to date have not been comprehensive. The ditch names and lengths are also preliminary. Many of the ditch names as shown on the condition assessment were developed from the preliminary survey data, which relied on historic maps for place names. It is expected there will be some adjustment to align nomenclature with the Pueblo's preferences in future.

Figure 3-31: Tesuque Irrigation Infrastructure (Source: BIA GIS)

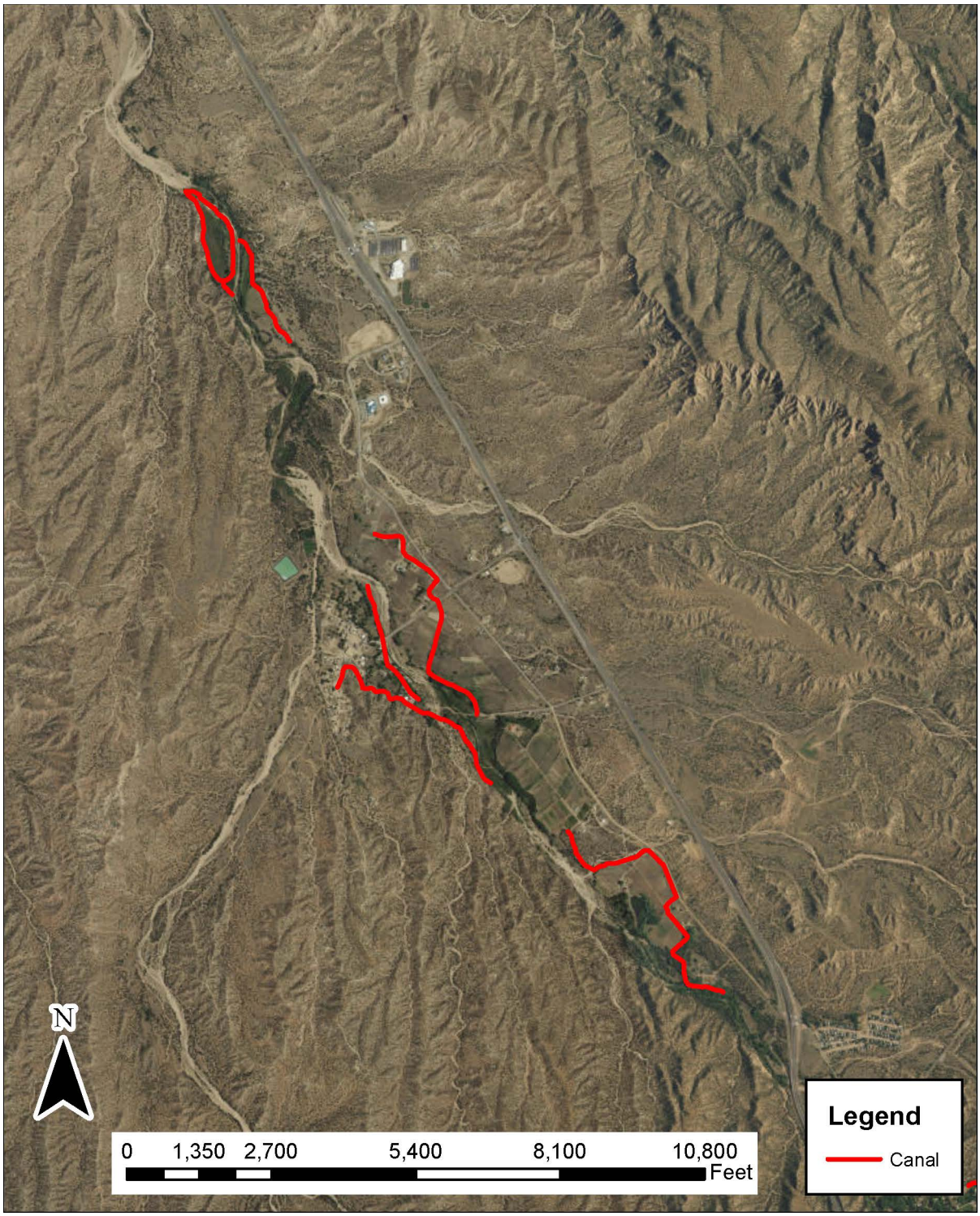


Table 3-17: Tesuque Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Upper Ponds Diversion	N/A			X	Flood damage, sedimented
Upper Ponds Infiltration Gallery	N/A		X		Sedimented
Navajo Pond Diversion	N/A			X	Needs reconstruction
Navajo Pond (Impoundment)	N/A			X	Sedimented, overgrown, leaking
Buried Piping, Various Locations	13,115				Aged, condition unknown
Dayschool Ditch	1,055		X		Aging, invasive species intrusion
Pueblo Ditch	5,458			X	Needs rehabilitation
Corral Ditch - Piped Section	2,119		X		Aged infrastructure, serviceable
Corral Ditch - Lower Section	5,853			X	Sedimented, unusable
Pine Ditch	1,033			X	Unusable
Ranch Pond Diversion	N/A			X	Sedimented, overgrown
Mitchell Ditch	3,543			X	Unusable
Camel Rock Ditch	1,439			X	Unusable
Chupadero Diversion, Ditch	1,254			X	Unusable
Acequia del Medio	3,236	X			Serviceable
Post Ditch	13,605			X	Needs rehabilitation
Quiyo Ditch	3,426			X	Needs rehabilitation
Sowamaggy Ditch	2,610			X	Needs rehabilitation
Indian Ditches 3 - 6	4,545			X	Needs rehabilitation
Sowamaggy Ditch	2,610			X	Needs rehabilitation
Unknown Ditches 1 - 4	4,128			X	Needs rehabilitation
Wild Plum Ditch	6,299			X	Needs rehabilitation
Old Chupadero Ditch 2	1,514			X	Needs rehabilitation
Old Chupadero Ditch 3	2,005			X	Needs rehabilitation
Bridge Well	N/A	X			Serviceable
Artesian Well	N/A	X			Serviceable
Ballpark Well	N/A			X	Needs power
Community Well	N/A			X	Out of service

Project Listing

The preliminary project list is shown in the following table. The deficiencies associated with the Rio Tesuque diversion are not shown, as that project is planned for completion as part of the Aamodt project.

Table 3-18: Tesuque Project List

PROJECTS	LENGTH (feet)	CONTRACT COST
Upper Ponds Diversion Rehabilitation	N/A	TBD
Upper Ponds Infiltration Gallery	N/A	TBD
Navajo Pond Diversion Reconstruction	N/A	$1,500,000
Navajo Pond Rehabilitation	N/A	$612,000
Buried Piping, Various, Reconstruction	13,115	$1,639,375
Dayschool Ditch Rehabilitation	1,055	$39,227
Pueblo Ditch Rehabilitation	5,458	$97,410
Corral Ditch - Piped Section	127	$457,015
Corral Ditch - Lower Section Reconstruction	7,845	$1,681,105
Pine Ditch Rehabilitation	1,033	$35,735
Ranch Pond Diversion Rehabilitation	N/A	$750,000
Mitchell Ditch Rehabilitation	3,543	$69,845
Camel Rock Ditch Rehabilitation	1,439	$43,451
Chupadero Diversion, Ditch	1,254	$541,416
Post Ditch Rehabilitation	13,605	$1,806,241
Quiyo Ditch Rehabilitation	3,426	$462,372
Sowamaggy Ditch Rehabilitation	2,610	$59,582
Indian Ditch 3	1,369	$174,375
Indian Ditches 4 - 6 Rehabilitation	4,545	$530,947
Unknown Ditches 1 - 4 Rehabilitation	4,128	$87,786
Wild Plum Ditch Rehabilitation	6,299	$267,765
Old Chupadero Ditches 1 - 3 Rehabilitation	1,514	$121,253
Ballpark Well	N/A	TBD
TOTAL:		$10,976,900

NOTE: All costs shown shall be considered *appraisal level* costs

There are additional structure evaluations required. In addition, investigation is needed to determine planning level cost estimates for several dredging projects necessary to restore storage capability to the irrigation impoundments. This is a common need among the Pueblo lands in general, and at Tesuque specifically.

Finally, there is a need to bring electrical service to the drought relief well shown in the project list. However, additional review is needed to determine that cost. The estimate

for remaining projects is nearly $11 million, and is supported by worksheets included in Appendix C.

Cochiti

The Pueblo of Cochiti is situated about 35 miles southwest of Santa Fe and 55 miles north of Albuquerque. Cochiti is the northernmost of the six Pueblos within the Middle Rio Grande, and therefore much of their irrigation infrastructure is operated and maintained by the MRGCD. Cochiti has about 50,684 acres within the Pueblo's boundaries (Tiller, 2015).

Figure 3-32: Cochiti Pueblo
(Source: DeLorme, 2006)

The Rio Grande and Santa Fe River both run through Cochiti lands. The Cochiti Dam, on the Rio Grande, is within the Pueblo's boundaries, and Cochiti Lake reservoir is a popular recreation destination in the region. Construction of the dam was completed by the USACE in 1974. Seepage from the dam

Figure 3-33: Cochiti Fields Served by Subsurface Drains

subsequently resulted in elevation of the water table downstream, and damage to productive farmlands. As a result of settlement funding, however, the Pueblo was able to successfully recover productivity by installation of a widespread system of subsurface drains (Matlock, 2009).

Findings

The irrigation system, as scoped, was surveyed in 2005. The primary canals are the Sile Main Canal on the west side, and the East Cochiti Main Canal on the east side of the Rio Grande. There are areas that were not included in the survey scope. As projects are identified for reconstruction in these areas, the surveys will be completed in support of design. The lengths shown, in absence of survey data, are estimated from maps or MRGCD GIS data. The existing irrigation infrastructure survey data is tabulated in Appendix B and illustrated in Figure 3-34.

Condition Assessment

As previously discussed, much of the irrigation infrastructure serving Cochiti Pueblo is maintained by MRGCD. There is a process in place for Pueblo input to the District regarding maintenance issues and concerns.

The condition assessment is summarized in Table 3-19. As shown, the East Cochiti Main is generally in good condition, as is the Sile Main. There are laterals that are in fair condition and require rehabilitation. It is noted that some of the condition assessment is preliminary and subject to update.

Project Listing

The project list, based in part on preliminary lengths as discussed previously, is shown in Table 3-20. The total estimated cost for improvements is about $1.9 million. Details are presented in Appendix C.

Figure 3-34: Cochiti Irrigation Infrastructure (Source: BIA GIS)

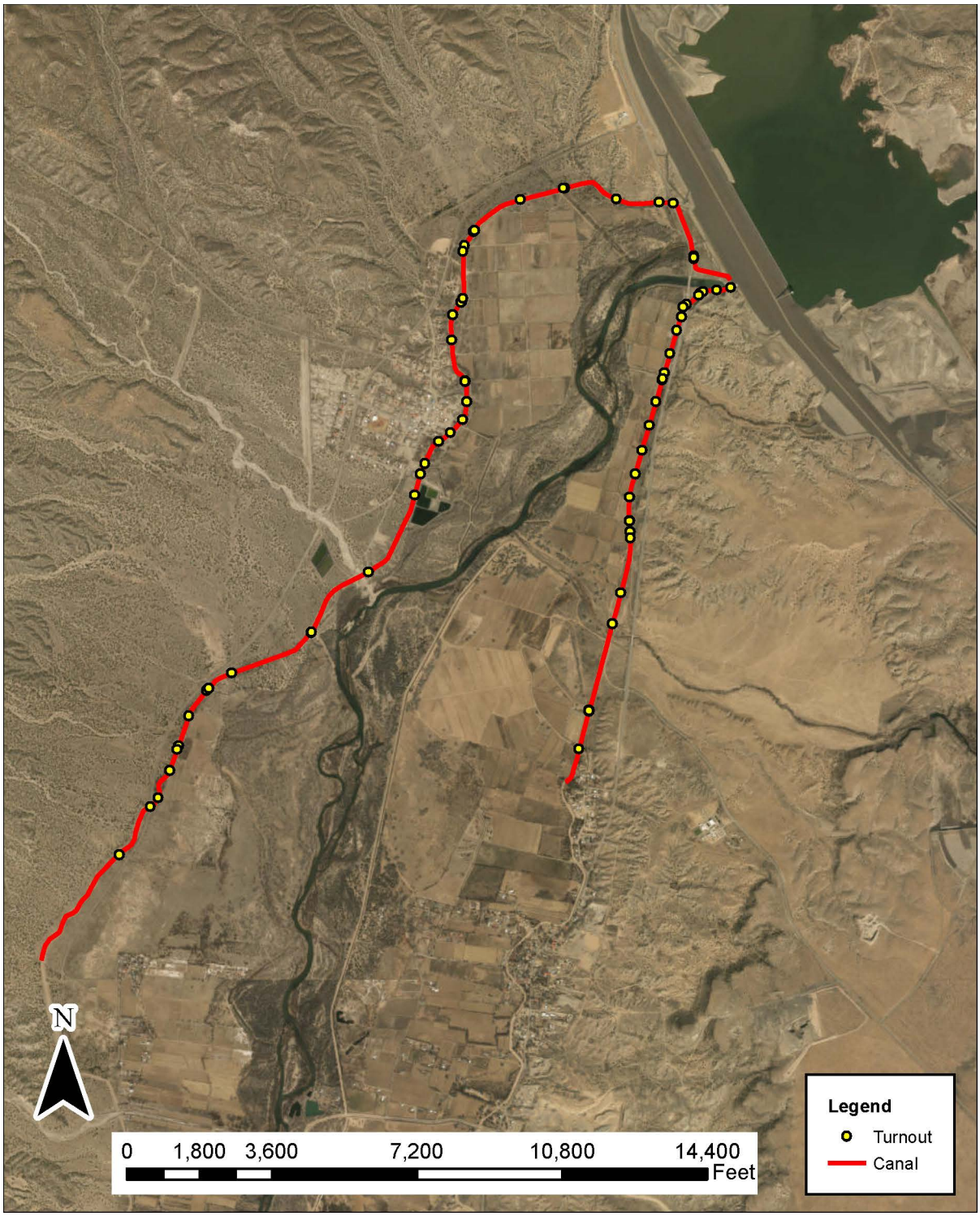


Table 3-19: Cochiti Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Sile Main Canal	31,101	X			Serviceable
Upper Laterals & Sublaterals	72,000	X			Serviceable
Island Lateral	1,060		X		Needs rehabilitation
Sile Main Lateral Ditch 1	1,380		X		Needs reconstruction
Sile Main Lateral Ditch 2	591		X		Needs reconstruction
Sile Main Wasteway	300		X		Needs rehabilitation
Arquero Lateral	8,000		X		Needs reconstruction
Trujillo Feeder	362		X		Needs rehabilitation
Indian Ditch	8,500			X	Needs rehabilitation
Pena Blanca Riverside Drain	11,526	X			Serviceable
Pena Blanca Interior Drain	4,742	X			Serviceable
East Cochiti Main:					
East Cochiti Main Turnout	N/A			X	Needs replacement
East Cochiti Main, Remainder	14,500	X			Serviceable
Baca Lateral	7,000	X			Serviceable
Baca Lateral Sublaterals	21,000		X		Need rehabilitation

Table 3-20: Cochiti Project List

PROJECT	LENGTH (Feet)	CONTRACT COST
Sile Main Canal:		
Island Lateral Rehabilitation	1,060	$57,259
Sile Main Lateral Ditch 1 Reconstruction	1,380	$124,210
Sile Main Lateral Ditch 2 Reconstruction	591	$39,597
Sile Main Wasteway Rehabilitation	300	$3,900
Arquero Lateral Reconstruction	8,000	$685,372
Trujillo Feeder Rehabilitation	362	$30,754
Indian Ditch Rehabilitation	8,500	$804,494
East Cochiti Main:		
East Cochiti Main Turnout Reconstruction	N/A	$9,345
Baca Lateral Sublaterals Rehabilitation	8,000	$172,244
TOTAL:		$1,927,175

NOTE: All costs shown shall be considered *appraisal level* costs

Santo Domingo

Santo Domingo is situated south and west of Cochiti and consists of about 83,300 acres. The Rio Grande bisects the Pueblo lands, and Galisteo Creek, which flows seasonally, crosses lands from the East before joining the Rio Grande (Tiller, 2015).

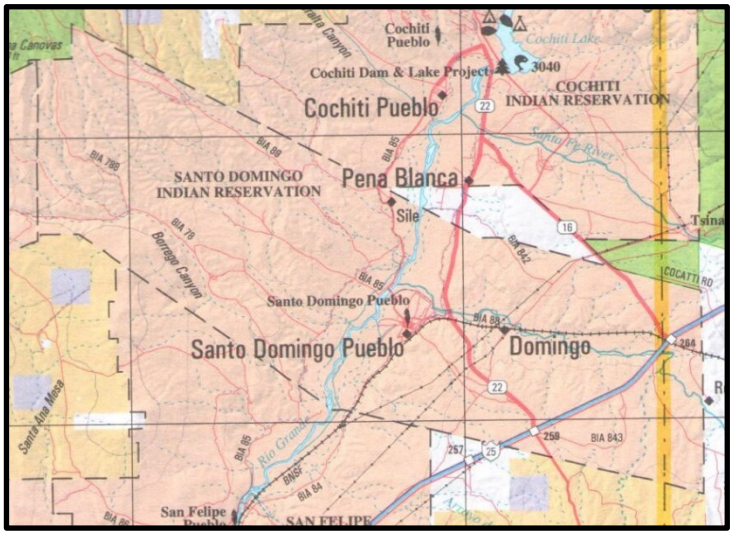


Figure 3-35: Santo Domingo Pueblo
(Source: DeLorme, 2006)

Findings

Irrigation surveys for the Pueblo were completed in 2015. Tabulation of the surveys is provided in Appendix B. The existing system is shown in Figure 3-38.

Santo Domingo struggles with the impact of erosion and sedimentation stemming from the arroyo crossings on their lands, impacting the irrigation ditches as well as causing other damage and civil maintenance impacts. In fact, all of the Pueblos have similar issues, to varying degrees depending on terrain.

Figure 3-36: Flood Erosion in 2013

These arroyos can carry a tremendous amount of water, vegetation, rock and gravel, and finer material during precipitation events. Not only do these storm events cause flooding and erosion, but also significant sediment deposition.

Depending on location, arroyo crossings may incur damage to irrigation infrastructure by deposition of sediment into the irrigation system or through erosion of channels, road crossings, and flume crossings.

Figure 3-37: Sediment Deposition Filling Ditch

Condition Assessment

The condition assessment is summarized in Table 3-21. One of the Pueblo's greatest needs is to raise the elevation of the Augustine Lateral, which serves extensive agricultural lands. The area is hampered by poor water delivery due to the lower elevation of the ditch relative to the fields and turnouts.

In addition, some ditches within the Pueblo's extensive system are filled with sediment to the point of being unusable. There is one project proposed, to infill the Majada Drain, which would have a secondary benefit of improving wetlands and bosque habitat within the adjacent reach of the Rio Grande.

Figure 3-38: Santo Domingo Irrigation Infrastructure (Source: BIA GIS)

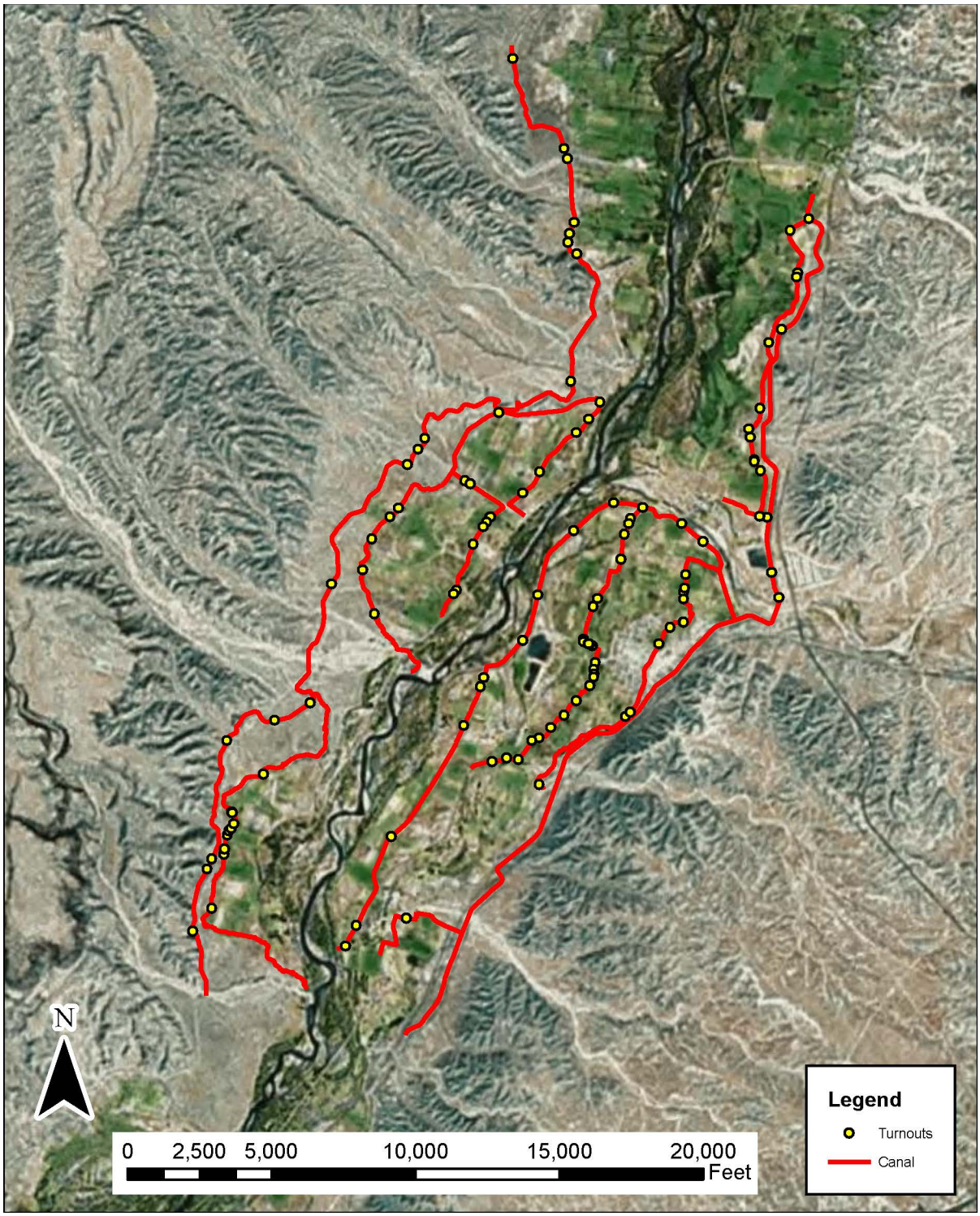


Table 3-21: Santo Domingo Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
WEST SIDE:					
Sile Main	41,000		X		Flow choke points
Rocky Point Lateral	6,500			X	Needs reconstruction
Upper Acequia Section	7,500	X			Piped, good condition
Upper Section Sublaterals	17,000			X	Needs rehabilitation
Santo Domingo Lateral 3	6,500			X	Needs rehabilitation
West-Central Acequia Section	8,500			X	Needs reconstruction
West-Central Section Sublaterals	17,000			X	Needs rehabilitation
South-West Acequia Section	11,000			X	Needs reconstruction
South-West Section Sublaterals	7,000			X	Needs rehabilitation
Lower Acequia Section	6,000			X	Unusable
Lower Section Sublaterals	2,000			X	Needs rehabilitation
Santo Domingo West Riverside Drain	11,000	X			Serviceable
EAST SIDE:					
East Cochiti Main	34,500	X			Serviceable
Pueblo Lateral	2,000			X	Needs reconstruction
Celina Lateral	10,000		X		Areas need rehab
Augustine Lateral	26,000			X	Needs reconstruction
Augustine Lateral Sublaterals	25,000			X	Needs reconstruction
Tribal Ditch 1	9,500			X	Needs reconstruction
Tribal Ditch 1 Sublaterals	10,000			X	Needs reconstruction
Tribal Ditch 2	7,500			X	Needs reconstruction
Tribal Ditch 2 Sublaterals	20,000			X	Needs reconstruction
San Felipe Eastside Acequia 1	2,500			X	Unusable, rehab
East-Central Acequia	4,500			X	Needs reconstruction
East-Central Acequia Sublaterals	23,000			X	Needs reconstruction
Railroad Lateral	8,000		X		Areas need rehab
South-East Acequia & Sublaterals	12,000			X	Currently under reconstruction
San Felipe Eastside Acequia 2	6,000			X	Unusable
Pena Blanca Riverside Drain	9,000	X			Serviceable
Majada Drain	1,600			X	Impacts wetlands
Santo Domingo East Riverside Drain	24,000	X			Serviceable
Santo Domingo Interior Drain	14,600	X			Serviceable
Domingo, Ramona & Rosita Siphons	N/A	X			Serviceable

Project Listing

Santo Domingo has an extensive irrigation infrastructure, much of which are Indian ditches outside the maintenance purview of the District. While the drains are in generally good condition, there is one that is unneeded and should be filled to preserve wetlands in the area. East Cochiti Main and the associated siphons are also in good shape. Most of the remaining infrastructure is in need of rehabilitation or reconstruction. The project list is shown in Table 3-22, and totals about $20.5 million. Supporting documentation is included in Appendix C.

Table 3-22: Santo Domingo Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
Sile Main, Select Rehabilitation	4,100	$53,300
Rocky Point Lateral Reconstruction	6,500	$581,340
Upper Acequia Sublaterals Rehabilitation	17,000	$332,834
Santo Domingo Lateral 3 Rehabilitation	6,500	$155,590
West-Central Acequia Section Reconstruction	8,500	$817,090
West-Central Section Sublaterals Rehabilitation	17,000	$323,488
South-West Acequia Section Reconstruction	11,000	$920,968
South-West Section Sublaterals Rehabilitation	7,000	$141,994
Lower Acequia Section Reconstruction	6,000	$514,718
Lower Section Sublaterals Rehabilitation	2,000	$161,622
Pueblo Lateral Reconstruction	2,000	$192,968
Celina Lateral Rehabilitation	10,000	$190,840
Augustine Lateral Reconstruction	26,000	$7,315,890
Augustine Lateral Sublaterals Reconstruction	25,000	$2,133,610
Tribal Ditch 1 Reconstruction	9,500	$897,994
Tribal Ditch 1 Sublaterals Reconstruction	10,000	$741,494
Tribal Ditch 2 Reconstruction	7,500	$720,744
Tribal Ditch 2 Sublaterals Reconstruction	20,000	$1,486,238
San Felipe Eastside Acequia 1 Rehabilitation	2,500	$58,372
East-Central Acequia Reconstruction	4,500	$425,622
East-Central Acequia Sublaterals Reconstruction	23,000	$1,971,110
Railroad Lateral Rehabilitation	8,000	$156,244
San Felipe Eastside Acequia 2	6,000	$66,000
Majada Drain Infill	1,600	$160,128
TOTAL:		$20,520,198

NOTE: All costs shown shall be considered *appraisal level* costs

San Felipe

San Felipe encompasses 64,153 acres, bordering Santo Domingo on the north and Santa Ana on the west. The Rio Grande traverses the central portion of the lands, and farming occurs on both sides of the river throughout the reach.

In addition to individual farmers, the Pueblo has been successful in implementing a tribal farm, as well as a local farmers market. These initiatives have aided in revitalizing both the economic and cultural benefits to farming for San Felipe and the other Pueblo communities in New Mexico (Robinson-Avila, 2005).

Figure 3-39: San Felipe Pueblo
(Source: DeLorme, 2006)

Findings

The Pueblo has an extensive Indian ditch system and maintains most of their conveyances as traditional earthen ditches. The irrigation surveys, as scoped, were completed in 2017 and a summary of the data is included in Appendix B. The scope did not include all irrigation infrastructure. As future projects are planned for ditches that were not surveyed, the planning and design work will include surveys as needed.

Condition Assessment

The irrigation infrastructure is shown in Figure 3-40, and the condition assessment is presented in Table 3-23. In general, the East Cochiti Main, Angostura and Sile Main are in fair condition. However, the conveyance capability on these canals is degraded due to flow restriction points, such as narrow road crossings. Most other areas are in poor condition.

Perhaps the biggest problem in the system is inadequate water supply within the Indian ditch components, due to inadequate flow into the system from the District headings. This is compounded by the demands on the water volume within the overall system by irrigators on lands contiguous to the Pueblo.

Another issue, common to many of the Pueblos, is that many of the ditches are overgrown with vegetation that impacts the functionality of the conveyance. Invasive species such as Siberian elm, Saltcedar and Russian olive trees cause a high maintenance burden, particularly problematic in areas with narrow ditch corridors where equipment access is limited.

Figure 3-40: San Felipe Irrigation Infrastructure (Source: BIA GIS)

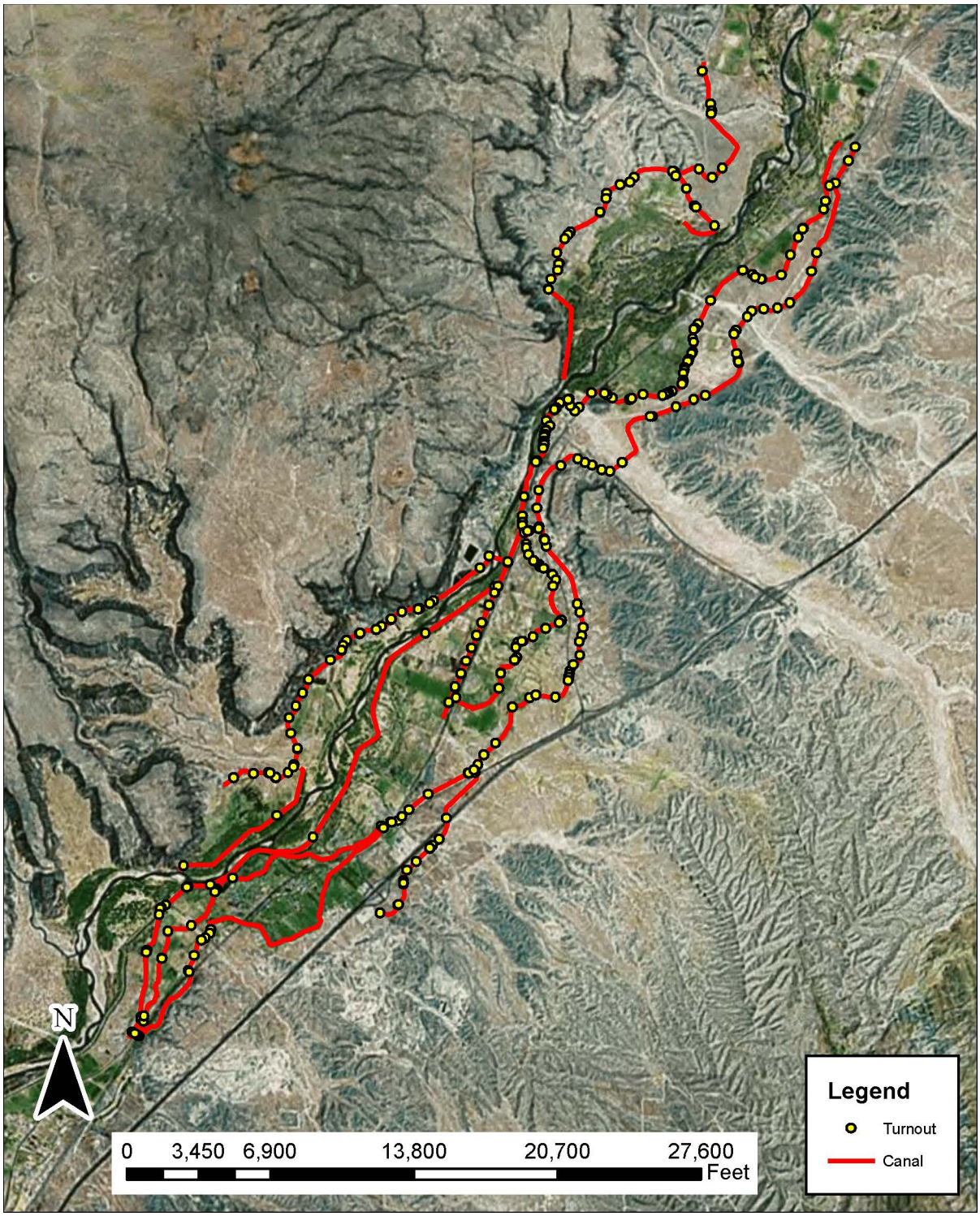


Table 3-23: San Felipe Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
East Cochiti Main	29,000		X		Areas need rehab
East Cochiti, Select Areas	1,000		X		Needs rehabilitation
Lateral Ditch 2	653			X	Needs rehabilitation
Elota Lateral	1,909			X	Needs rehabilitation
Tonque Lateral	2,957		X		Needs rehabilitation
Monica Lateral	400			X	Needs rehabilitation
San Felipe Eastside Acequia	28,636			X	Needs rehabilitation
Indian Ditch Lateral	2,424			X	Needs rehabilitation
Indian Ditch Lateral 1	654			X	Needs rehabilitation
Indian Ditch Lateral 3	961			X	Needs rehabilitation
Angostura Main Ditch	15,533		X		Areas need rehab
Angostura Lateral	2,700			X	Needs rehabilitation
Yeso Drain 1	2,250			X	Needs rehabilitation
Yeso Drain 2	2,000			X	Needs rehabilitation
Algodones Lateral Ditch	9,813			X	Needs rehabilitation
Algodones Lateral Sublateral	3,104			X	Needs rehabilitation
San Felipe Community Ditch	13,675			X	Needs rehabilitation
Turrieta Interior Drain	11,581			X	Needs rehabilitation
S Drain	1,344		X		Needs rehabilitation
Algodones Riverside Drain	23,607		X		Needs rehabilitation
Cubero Lateral	4,065		X		Needs rehabilitation
Sile Main Canal	2,000		X		Areas need rehab
San Felipe Siphon	900			X	Needs reconstruction
San Felipe Westside Ditch, Upper	16,654			X	Needs rehabilitation
San Felipe Westside Ditch, Lower	10,000		X		Crossings need rehabilitation
San Felipe Canal	11,000		X		Needs rehabilitation
San Felipe Riverside Drain	8,000			X	Needs rehabilitation
Algodones Lower Acequia	330			X	Needs rehabilitation
Lower Acequia Lateral 1	3,064			X	Needs rehabilitation
Lower Acequia Lateral 2	2,370			X	Needs rehabilitation
Lower Acequia Lateral 3	1,077			X	Needs rehabilitation
Lower Acequia Lateral 4	799			X	Needs rehabilitation
Lower Acequia Lateral 5	600			X	Needs rehabilitation
Santa Ana Acequia	3,498			X	Needs rehabilitation

Project Listing

The project list developed from the condition assessment is shown in Table 3-24. All ditches identified in the condition assessment as requiring rehabilitation are planned to remain as traditional earthen ditches. As with any project in the Study, should the Pueblo determine that the scope for a specific project change to pipe or concrete lining, this will necessarily increase the programmed cost. The current project cost is estimated to be approximately $4.9 million. The project worksheets are provided in Appendix C.

Figure 3-41: Lateral Turnout Installed on Traditional Earthen Ditch

Table 3-24: San Felipe Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
East Cochiti Main		
East Cochiti, Select Areas Rehabilitation	1,000	$37,700
Lateral Ditch 2 Rehabilitation	653	$14,989
Elota Lateral Rehabilitation	1,909	$42,317
Tonque Lateral Rehabilitation	2,957	$52,597
Monica Lateral Rehabilitation	400	$28,796
San Felipe Eastside Acequia Rehabilitation	28,636	$1,049,890
Eastside Acequia Laterals Rehabilitation	4,039	$154,501
Angostura Lateral Rehabilitation	2,700	$162,821
Yeso Drain 1 Rehabilitation	2,250	$29,250
Yeso Drain 2 Rehabilitation	2,000	$26,000
Algodones Lateral Ditch Rehabilitation	9,813	$359,334
Algodones Lateral Sublateral Rehabilitation	3,104	$371,962
San Felipe Community Ditch Rehabilitation	13,675	$340,121
Turrieta Interior Drain Rehabilitation	11,581	$92,648
S Drain Rehabilitation	1,344	$10,752
Algodones Riverside Drain Rehabilitation	23,607	$188,856
Cubero Lateral Rehabilitation	4,065	$118,211
San Felipe Siphon Rehabilitation	900	$327,600
San Felipe Westside Ditch, Upper Rehabilitation	16,654	$446,190
San Felipe Westside Ditch, Access Rehabilitation	250	$70,854
San Felipe Canal Rehabilitation	11,000	$217,744
San Felipe Riverside Drain Rehabilitation	8,000	$64,000
Algodones Lower Acequia & Laterals Rehabilitation	330	$643,484
Santa Ana Acequia Rehabilitation	3,498	$76,346
TOTAL:		$4,926,963

NOTE: All costs shown shall be considered *appraisal level* costs

Santa Ana

Santa Ana Pueblo, located 18 miles north of Albuquerque, encompasses an area of 138,000 acres that includes the Rio Grande, the lower reach of the Jemez River, and its confluence with the Rio Grande (Tiller, 2015).

The Pueblo was historically known as a center for dryland farming. They now have a diverse agricultural base, including large scale blue corn production, forage and vegetable crops, and native plant nurseries.

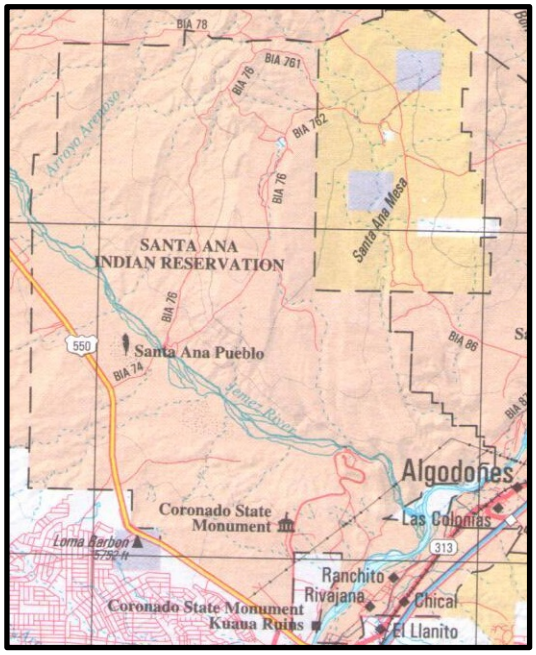


Figure 3-42: Santa Ana Pueblo
(Source: DeLorme, 2006)

Findings

The irrigation surveys were completed in 2014 and are summarized in Appendix B. The infrastructure is shown graphically in Figure 3-43 on the following page.

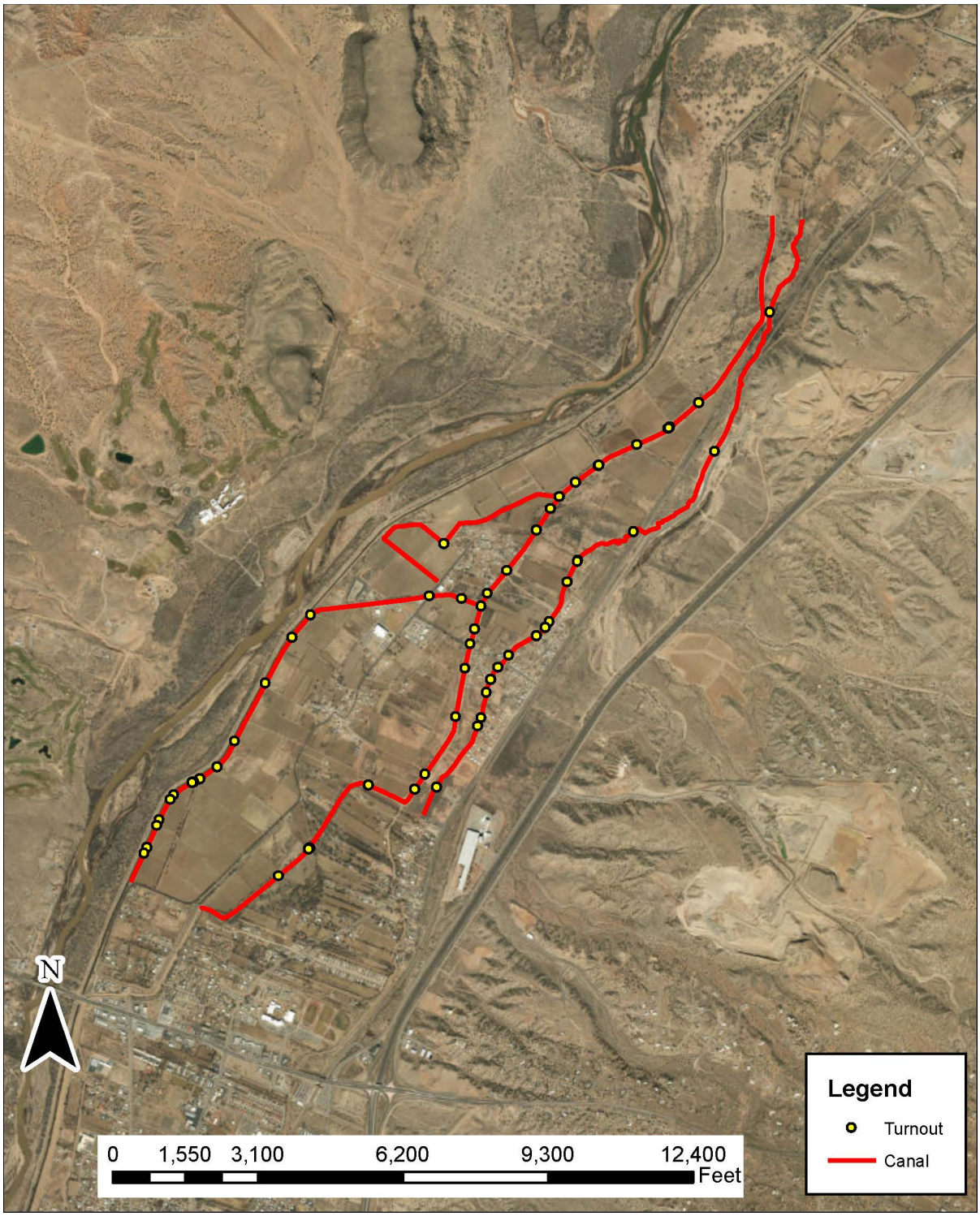
Condition Assessment

The facilities maintained by the District are predominantly in good to fair condition, but the conveyance canals have areas requiring rehabilitation for erosion or sloughing of the banks. The Indian ditches have extensive areas requiring rehabilitation and vegetation control. The condition is summarized below in Table 3-25.

Table 3-25: Santa Ana Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Atrisco Feeder Canal	20,000		X		Serviceable, areas of erosion and headcutting
Albuquerque Main Canal	21,403	X			Recently rehabilitated
Santa Ana Indian Ditch (Acequia)	19,700			X	Needs rehabilitation
Bosque Lateral 1					
Bosque Lateral, Upper Section	300	X			Serviceable
Bosque Lateral, Remainder	10,292		X		Needs rehabilitation
Mirabal Lateral	2,000			X	Needs rehabilitation
Ranchitos Lateral	5,820			X	Need turnouts and gates replaced throughout
Ranchitos Drain	3,000	X			Serviceable

Figure 3-43: Santa Ana Irrigation Infrastructure



Project Listing

The project list developed includes rehabilitation of most of the Bosque Lateral. Remaining Indian ditches are currently proposed to remain as traditional ditches but require rehabilitation throughout.

The Ranchitos Lateral requires replacement of the existing structures throughout, and installation of a diversion box on the Albuquerque Main Canal.

Figure 3-44: Newly Replaced Check Structure

The project list is shown in the table below, and totals about $1.7 million to complete identified upgrades as currently planned. The project worksheets are included in Appendix C.

Table 3-26: Santa Ana Project List

PROJECT	LENGTH (Feet)	CONTRACT COST
Atrisco Feeder Canal, Select Rehabilitation	6,000	$158,000
Santa Ana Indian Ditch Rehabilitation	19,700	$451,622
Bosque Lateral 1 Rehabilitation	10,300	$407,079
Mirabal Lateral Rehabilitation	2,000	$57,622
Ranchitos Lateral Reconstruction	5,820	$544,428
Ranchitos Lateral Distribution Box	N/A	$25,000
Albuquerque Main Concrete Diversion Box	N/A	$30,000
TOTAL:		$1,673,751

NOTE: All costs shown shall be considered *appraisal level* costs

Sandia

Sandia Pueblo extends over almost 24,000 acres, immediately north of Albuquerque and along the east bank of the Rio Grande. The Pueblo made national headlines in late 2015 as an environmental partner and steward among Middle Rio Grande stakeholders when they offered to commit 33 million gallons of the Pueblo's reservoir share of stored water in the El Vado reservoir to benefit Rio Grande habitat during low flow periods in the next year. Sandia's example led to other users' contributions as well (Paskus, 2015; Tiller, 2015).

Figure 3-45: Sandia Pueblo
(Source: DeLorme, 2006)

Findings

The Pueblo's irrigation surveys were completed in 2014, and are tabulated in Appendix B. The irrigation infrastructure is shown in Figure 3-47 on the following page.

Condition Assessment

The condition of the irrigation infrastructure is summarized in Table 3-27. While the District facilities are generally in good to fair condition through the Pueblo's system, there are several culverted crossings that need reconstruction. The Indian ditches need rehabilitation as well. Sandia has been very successful in rehabilitating a significant portion of the sublaterals in the past year, but substantial additional work remains to be completed.

Figure 3-46: Deteriorated Catwalk

There are several road and railroad crossings in disrepair. These are not routine maintenance and construction projects, due to the significance of the work and the jurisdictional complications in addressing State and Federal infrastructure.

The Pueblo also has deteriorated catwalks along the irrigation ditches. This is a pervasive structural concern at all of the Pueblos and can pose a safety hazard to farmers.

Figure 3-47: Sandia Irrigation Infrastructure (Source: BIA GIS)

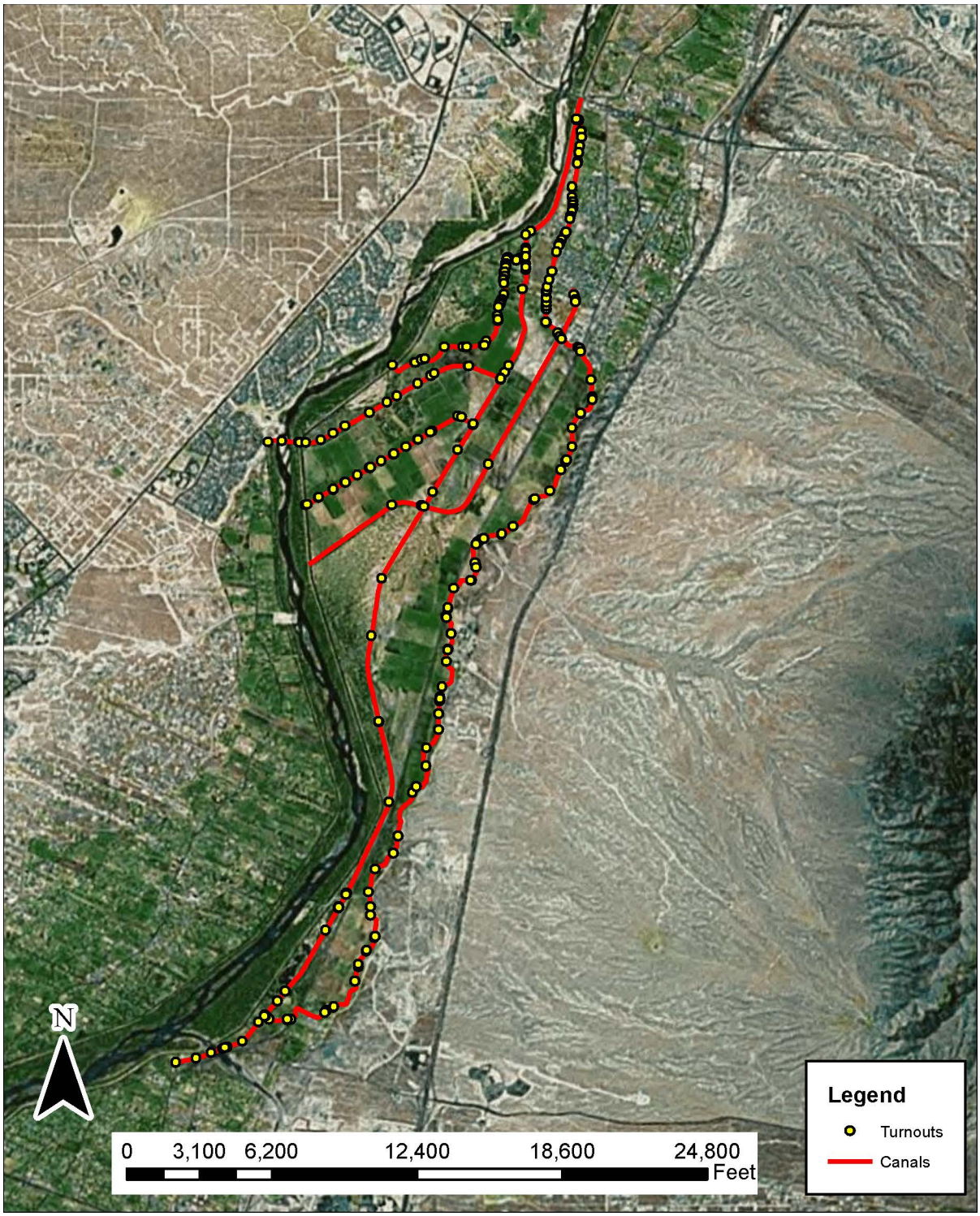


Table 3-27: Sandia Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Albuquerque Main:					
Albuquerque Main Canal	47,800		X		Needs rehabilitation
Albuquerque Main, 3 Structures	N/A			X	Needs reconstruction
Albuquerque Main, 3 Bridges	N/A			X	Needs reconstruction
Albuquerque Main, West Laterals	10,000			X	Needs rehabilitation
Albuquerque Main, East Laterals	12,000			X	Needs rehabilitation
Bosque Lateral 2	9,525	X			Serviceable
Bosque Lateral 2 Sublaterals	8,000	X			Serviceable
Bosque Lateral 3	8,379	X			Serviceable
Bosque Lateral 3 Sublaterals	27,200	X			Serviceable
Corrales Main	9,503			X	Needs rehabilitation
Corrales Siphon	N/A			X	Needs rehabilitation
Corrales Main Sublaterals	27,000	X			Serviceable
Sandia Acequia					
Sandia Acequia	46,238			X	Needs rehabilitation
Sandia Upper Section Sublaterals	62,000			X	Needs rehabilitation
Railroad Crossing	N/A			X	Needs rehabilitation
Garcia Lateral	8,000			X	Needs rehabilitation
Bernalillo Riverside Drain	18,000	X			Serviceable
Albuquerque Riverside Drain	20,000	X			Serviceable
Bernalillo Interior Drain	16,146	X			Serviceable

Project Listing

Based on the condition assessment, the project listing includes several structural projects, including the Corrales Siphon repairs, one railroad crossing and some aged bridges spanning the Albuquerque Main Canal. The project list is shown in Table 3-28 and totals about $12.1 million. Details are provided in Appendix C.

Figure 3-48: Concrete Lined Lateral

Table 3-28: Sandia Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
Albuquerque Main:		
Albuquerque Main Canal Rehabilitation	47,800	$790,400
Albuquerque Main, Structures Replacement	N/A	$544,310
Albuquerque Main, Bridge Replacements	N/A	$5,600,000
Albuquerque Main, Westside Laterals Reconstruction	10,000	$741,494
Albuquerque Main, Eastside Laterals Reconstruction	12,000	$896,244
Corrales Main Rehabilitation	9,503	$326,796
Corrales Siphon Replacement	N/A	$78,000
Sandia Acequia		
Sandia Acequia, Upper Section Rehabilitation	21,700	$983,383
Sandia Upper Section Laterals Rehabilitation	18,000	$340,988
Sandia Acequia, Middle Section Rehabilitation	10,400	$423,408
Sandia Middle Section Sublaterals Rehabilitation	31,000	$468,982
Sandia Acequia, Lower Section Rehabilitation	14,138	$442,008
Sandia Lower Section Sublaterals Rehabilitation	13,000	$209,616
Railroad Crossing Rehabilitation	N/A	$97,041
Garcia Lateral Rehabilitation	8,000	$172,244
TOTAL:		$12,114,914

NOTE: All costs shown shall be considered *appraisal level* costs

Isleta

Isleta has a large land base, extending east and west of the Rio Grande corridor, and totaling over 300,000 acres. Isleta has more acreage in farm production than any other Pueblo, and has an extensive irrigation infrastructure, shown in Figure 3-50 on the following page. Isleta is the furthest south Pueblo within the MRGCD boundaries (Tiller, 2015).

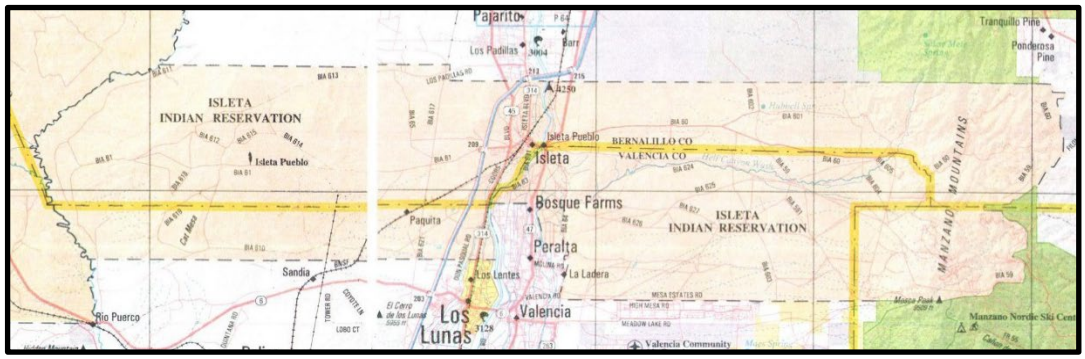
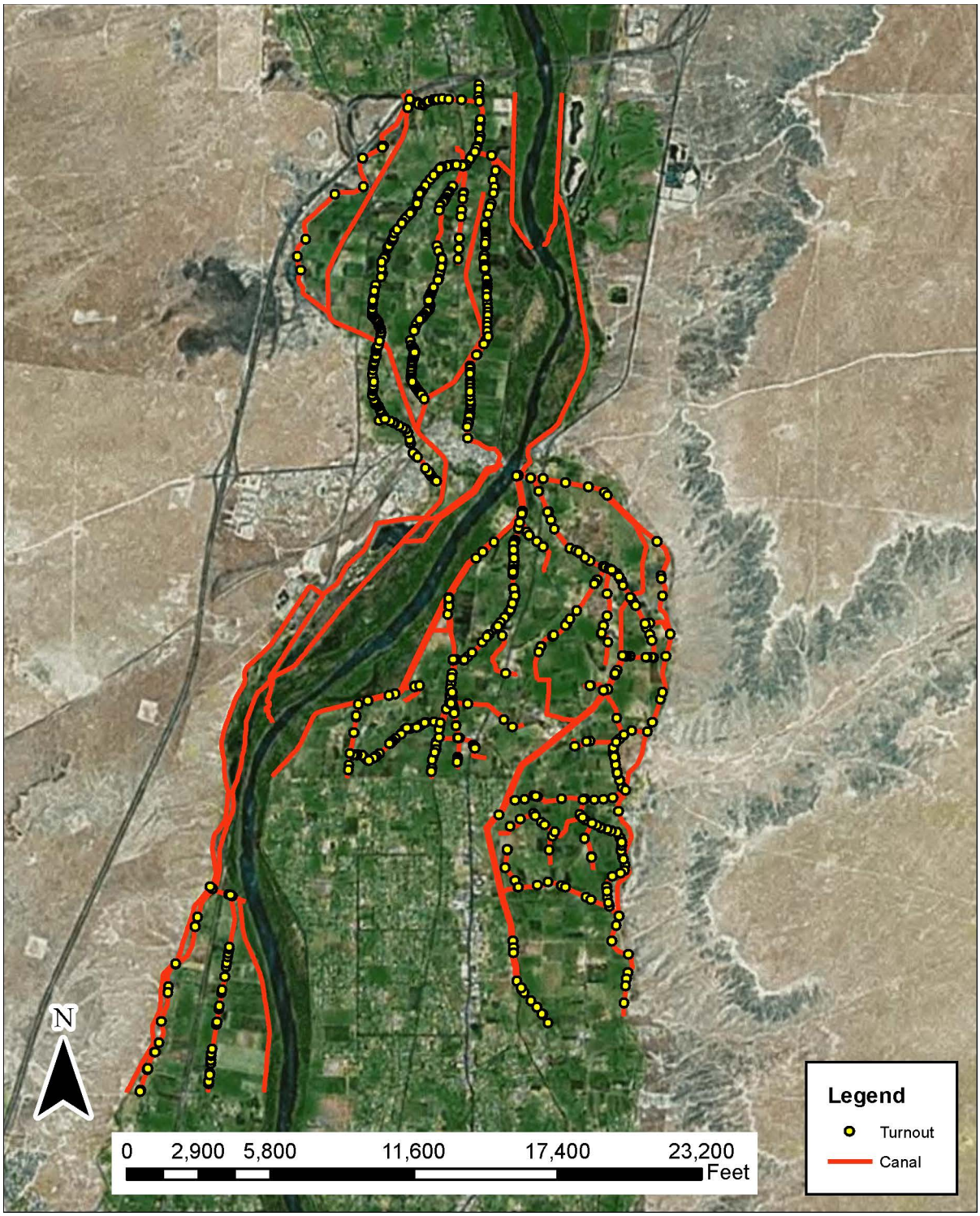


Figure 3-49: Isleta Pueblo (Source: DeLorme, 2006)

Figure 3-50: Isleta Irrigation Infrastructure (Source: BIA GIS)



Findings

Isleta's irrigation surveys have been substantially funded, and field work is underway. The irrigation system includes over sixty miles of ditches. For planning purposes, ditch lengths were estimated from maps and from MRGCD data.

In contrast with some of the Pueblos, the system generally provides adequate water quantities for irrigation needs. However, sedimentation problems are widespread, as exemplified in the two figures below. In addition, there are several areas that lose productivity due to an elevated water table. There is a project in place to design subsurface drainage systems to alleviate this issue for more than 3,000 acres of agricultural lands.

Figure 3-51: Little Chical Sedimentation

Figure 3-52: Cacique Sedimentation

Condition Assessment

The condition assessment is shown in Table 3-29. In addition to the widespread issues mentioned previously, there are some road crossings over irrigation ditches that need to be upgraded or rehabilitated. In addition, there is a railroad crossing that needs reconstruction. Finally, there are structure replacements that need to be evaluated to develop rehabilitation or replacement estimates.

Table 3-29: Isleta Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Acequia Madre	16,629	X			Serviceable
Cacique (Ranchitos) Lateral	15,518			X	Sedimented
Middle Chical Lateral	11,863			X	Needs reconstruction
Sand Ditch	10,399			X	Needs rehabilitation
Acequia Madre East Branch	12,998	X			Serviceable
Acequia Madre Railroad Crossing	60			X	Needs reconstruction
Butte Lateral	N/A		X		Head structure damaged
Butte Lateral, Central Portion	11,808			X	Needs subsurface drainage
Isleta Interior Drain	37,987			X	Needs rehabilitation
Atrisco Riverside Drain	6,556	X			Serviceable
Isleta Riverside Drain	12,857			X	Needs rehabilitation
Barr-Chical Drain	12,347		X		Beaver issues
Indian Lateral 1	2,933			X	Needs rehabilitation
Belen Highline	31,746		X		Needs spoil material removed
Los Lunas Lateral	7,969			X	Needs subsurface drainage
Peralta Main, Northern Section	2,893			X	Sedimented
Peralta Main, Remainder	10,451	X			Serviceable
Peralta Main - TR7 Road Crossing	N/A			X	Needs reconstruction
Peralta Main - TR1 Road Crossing	N/A			X	Needs reconstruction
Cacique, Northern Section	1,800			X	Sedimented
Cacique, Remainder	6,200	X			Serviceable
Little Chical, Northern Section	5,280			X	Sedimented
Little Chical, Remainder	6,720	X			Serviceable
Big Chical, Northern Section	5,006			X	Sedimented
Big Chical, Remainder	22,102	X			Serviceable
Otero Lateral	8,911			X	Needs rehabilitation
Jackson Lateral	1,800			X	Needs rehabilitation
Otero - Cacique Confluence	N/A			X	Needs check structure
Tome Interior Drain	22,719	X			Serviceable
Peralta Riverside Drain, South End	5,280			X	Needs rehabilitation
Lower Chical Acequia	4,200	X			Serviceable

The Belen Highline is noted in the condition assessment as needing extensive historic spoil material removed from the right of way. This work was expected to be completed in 2017, within the scope of the Isleta Settlement. This 2016 agreement was reached between the Pueblo, BIA, MRGCD and Reclamation to address historic issues related to the Isleta Diversion Dam. One element of that agreement is removal of the spoils material accumulated along the Belen Highline.

Project Listing

The project list generated from the condition assessment is summarized in the following table. The estimated total for planned improvements is about $3.8 million. However, it is noted that these figures will likely require revision as surveys are completed and detailed information on existing irrigation infrastructure such as road crossings, turnouts and check structures is obtained. Supporting details are provided in Appendix C.

Table 3-30: Isleta Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
Cacique (Ranchitos) Lateral Sediment Removal	15,518	$201,734
Middle Chical Lateral Reconstruction	11,863	$1,169,325
Sand Ditch Rehabilitation	10,399	$189,687
Acequia Madre EB Railroad Crossing Reconstruction	60	$97,040
Butte Lateral Head Structure Rehabilitation	N/A	$12,540
Butte Lateral, Central, Subsurface Drains	11,808	$354,240
Isleta Interior Drain Rehabilitation	37,987	$493,831
Isleta Riverside Drain Rehabilitation	12,857	$167,141
Barr-Chical Drain Rehabilitation	12,347	$160,511
Indian Lateral 1 Rehabilitation	2,933	$71,554
Los Lunas Lateral Subsurface Drains	7,969	$239,070
Peralta Main, Northern Section Sediment Removal	2,893	$69,432
Peralta Main – Tribal Road 7 Road Crossing Upgrade	N/A	$45,549
Peralta Main – Tribal Road 1 Road Crossing Upgrade	N/A	$45,549
Cacique, Northern Section Sediment Removal	1,800	$21,600
Little Chical, Northern Section Sediment Removal	5,280	$63,360
Big Chical, Northern Section Sediment Removal	5,006	$75,090
Otero Lateral Rehabilitation	8,911	$209,437
Jackson Lateral Rehabilitation	1,800	$40,900
Otero - Cacique Confluence	N/A	$15,000
Peralta Riverside Drain, South End Rehabilitation	5,280	$68,640
TOTAL:		$3,811,230

NOTE: All costs shown shall be considered *appraisal level* costs

Jemez

Jemez has a large land base consisting of three distinct holdings and totaling nearly 176,000 acres. Water features include several tributaries to the Rio Grande, principal among them being the Jemez River. Reservation lands border the Santa Fe National Forest and include significant and scenic forested uplands (Tiller, 2015).

Figure 3-53: Jemez Pueblo
(Source: DeLorme, 2006)

Findings

The irrigation surveys for Jemez were completed in 2016, and are included in Appendix B. The system, supplied from diversions on the Jemez River, is extensive and stretches along both sides of the Jemez River. Figure 3-55 on the following page shows the infrastructure layout.

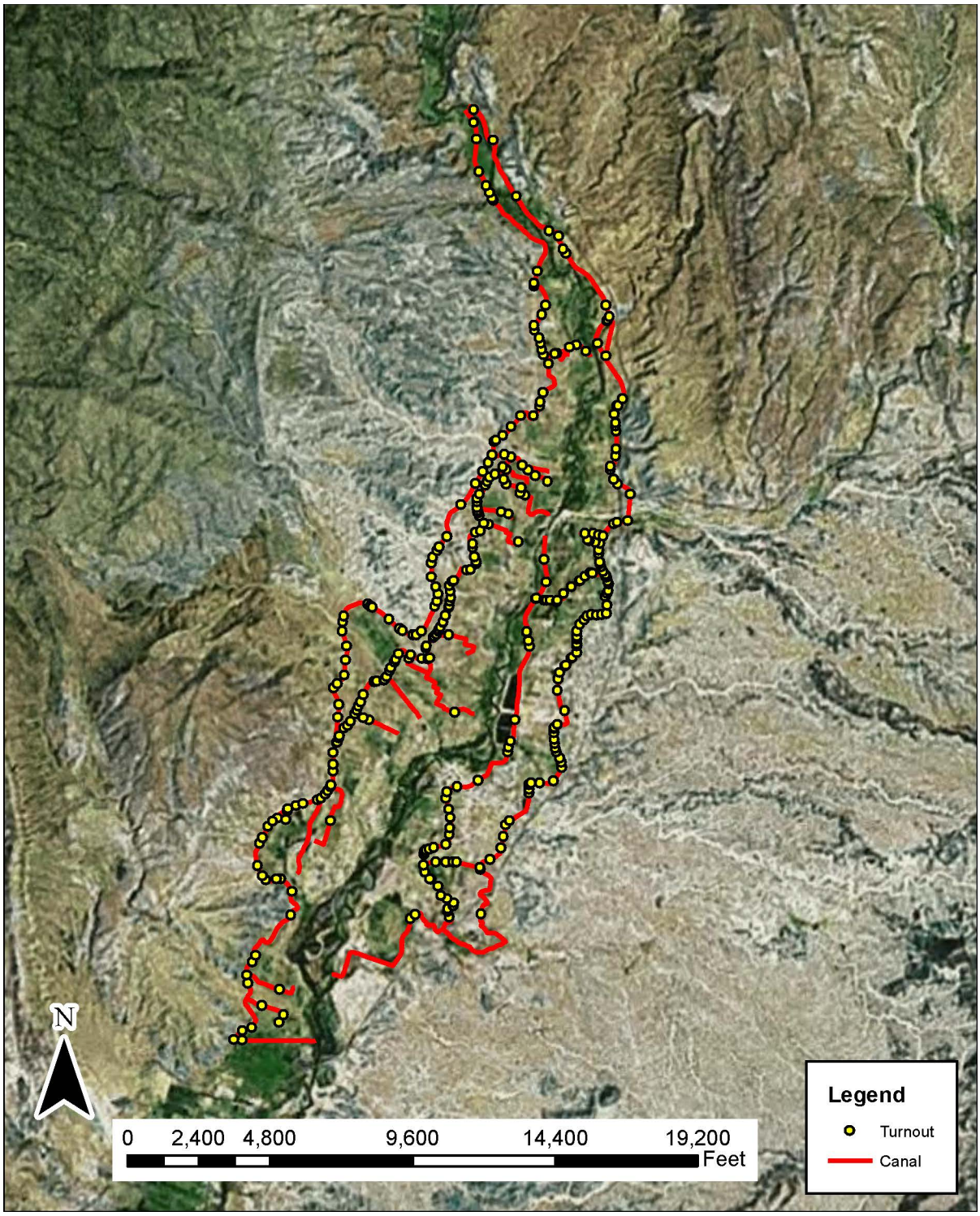
Condition Assessment

The Technical Service Center team reviewed both the Jemez Main diversion and the Pecos diversion. Both are in operational condition but require significant rehabilitation. The estimate for rehabilitation of the Jemez Main diversion is included in the project list, but the Pecos Diversion requires further study.

Figure 3-54: Jemez Main Diversion Dam

The diversions do not supply adequate water volumes throughout the irrigation season, and sedimentation is an ongoing problem as well. The Pecos Diversion is particularly problematic, requiring sediment removal every two to three days.

Figure 3-55: Jemez Irrigation Infrastructure



There are several arroyo crossings and road crossings in poor condition. Much of the main ditch alignments are concrete lined, but the concrete in many areas has deteriorated and needs reconstruction. The condition assessment is presented in Table 3-31.

Table 3-31: Jemez Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
West Ditch:					
Concreted Portion	33,121	X			Serviceable
Dirt Portion	12,734			X	Needs reconstruction
Mexican Ditch Crossing	35			X	Needs rehabilitation
West Ditch Laterals 1 - 21	47,887		X		Needs rehabilitation
East Ditch:					
Main Diversion Dam	N/A			X	Needs reconstruction
Main Diversion Wasteway	200			X	Needs rehabilitation
Northern Section	5,280			X	Needs reconstruction
Remainder Concrete Ditch	32,996		X		Needs rehabilitation
Arroyo Crossings	150			X	Needs reconstruction
State Road 4 Crossing	34			X	Needs reconstruction
East Ditch Lateral 1	819		X		Needs rehabilitation
East Ditch Lateral 2	551		X		Needs rehabilitation
East Ditch Lateral 3	2,944			X	Needs rehabilitation
East Ditch Lateral 4	1,975		X		Needs rehabilitation
Pecos Ditch					
Pecos Diversion Dam	N/A			X	Needs reconstruction
Concrete Ditch	22,433		X		Needs rehabilitation
Jemez Road Arroyo Crossing	105			X	Needs reconstruction
Safety Access to School	N/A			X	No crossing in place
Old Ditch	1,614		X		Needs rehabilitation

Project Listing

As shown in Figure 3-56, from a 2013 storm event, Jemez offers a good illustration of the destructive forces that Pueblo irrigation infrastructure can be subjected to during storm events. Throughout the Pueblos, there is always the potential for emerging project needs, particularly during severe storm events.

The project list is summarized in Table 3-32. Most of the ditches that are currently traditional earthen ditches are proposed to remain so. On the east system, there is a safety related project on the Pecos Ditch. This ditch lies between a residential area and the elementary school, and the children need a safe access over the concrete ditch.

The total project cost is estimated to be about $26.2 million. The project worksheets are included in Appendix C.

Figure 3-56: Storm Damage to Concrete Ditch

Table 3-32: Jemez Project List

PROJECT	LENGTH (Feet)	CONTRACT COST
West Ditch:		
Dirt Portion, Reconstruction	12,734	$1,436,090
Mexican Ditch Crossing Reconstruction	35	$12,740
West Ditch Lateral 3 Reconstruction	14,399	$1,667,573
West Ditch Laterals 1, 2, 4 - 21 Rehabilitation	33,488	$2,554,570
East Ditch:		
Main Diversion Dam Reconstruction	N/A	$5,692,000
Main Diversion Wasteway Rehabilitation	200	$2,600
Northern Section Reconstruction	5,280	$834,288
Remainder Concrete Ditch Reconstruction	10,889	$948,458
Arroyo Crossings Reconstruction	150	$818,400
State Road 4 Crossing Rehabilitation	N/A	$50,610
East Ditch Laterals 1, 2 & 4 Rehabilitation	819	$181,157
East Ditch Lateral 3 Reconstruction	2,944	$405,880
Pecos Ditch		
Pecos Diversion Dam Reconstruction	N/A	$5,692,000
Concrete Ditch Reconstruction	22,433	$2,246,538
Jemez Road Arroyo Crossing Reconstruction	105	$75,915
Pedestrian Crossing for Day school	N/A	$11,883
TOTAL:		$22,630,702

NOTE: All costs shown shall be considered *appraisal level* costs

Zia

Zia Pueblo is situated similarly to Jemez Pueblo, along the Jemez River and other tributaries to the Rio Grande. On the east side, Zia borders the Pueblos of Santo Domingo and Santa Ana. The total land area is nearly 161,000 acres. The Pueblo is also home to Zia Lake, which is a popular recreation and fishing area, as well as a reservoir for irrigation water (Tiller, 2015).

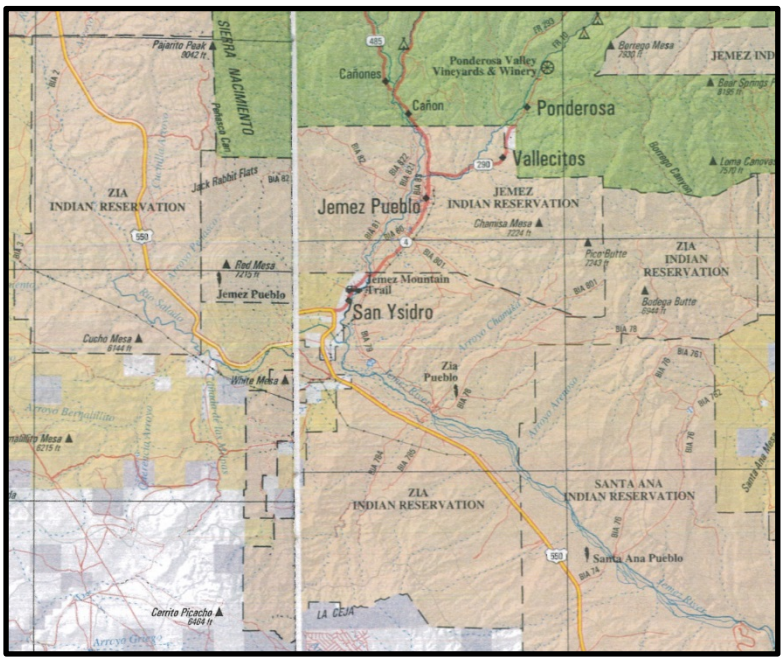


Figure 3-57: Zia Pueblo (Source: DeLorme, 2006)

Findings

The Pueblo's surveys were completed in 2016, and the data is included in Appendix B. The irrigation system consists of over 11 miles of irrigation ditches and buried pipe. The ditches serve farmlands on both the north and south side of the Jemez River. The system is displayed graphically in Figure 3-59 on the following page.

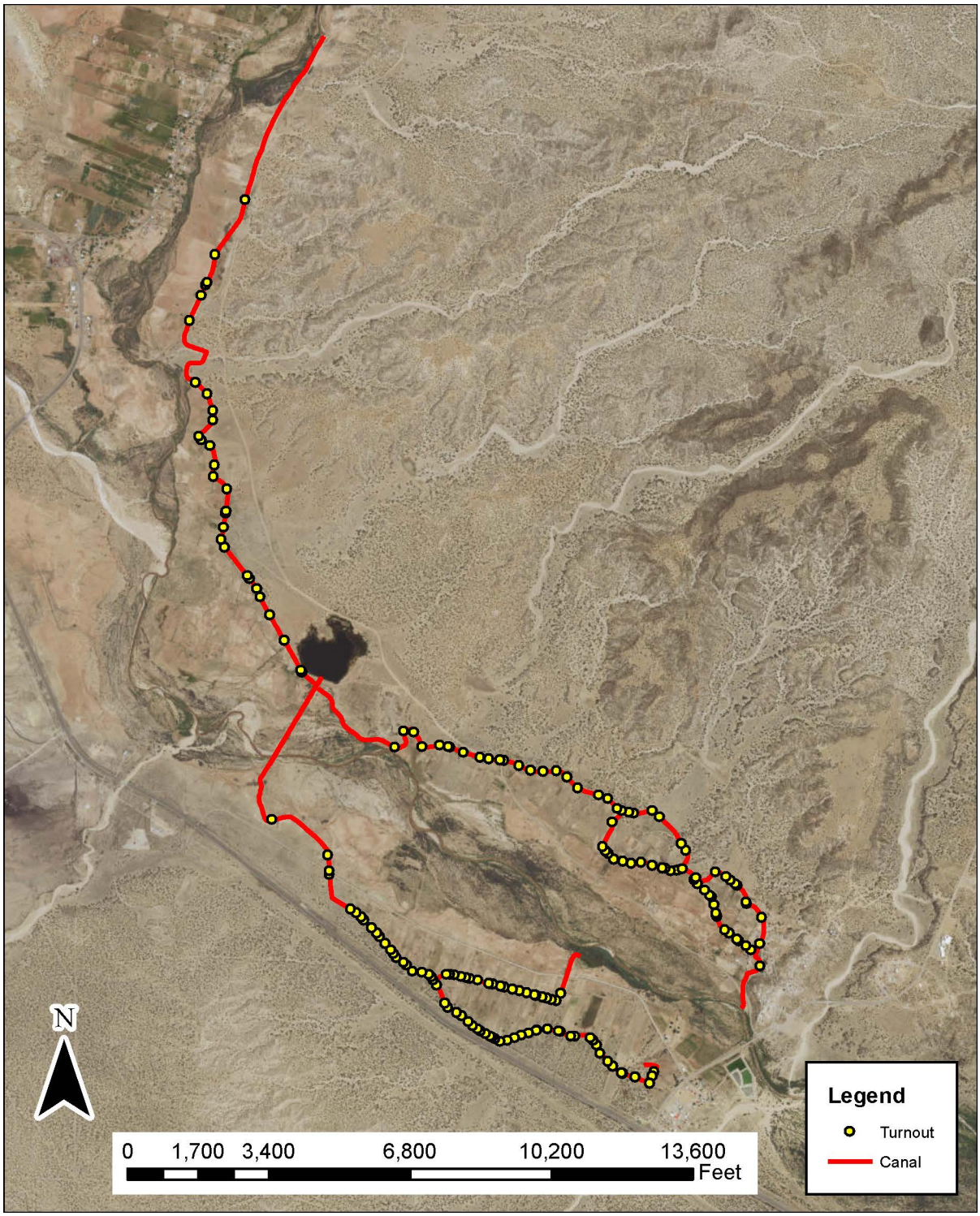
Condition Assessment

Reclamation's Technical Service Center team completed a field review of the diversion structures serving Zia. The Zia Diversion Dam was found to be in operational condition but does not divert adequate water to meet irrigation needs in its current condition. The dam is shown in Figure 3-58.

Figure 3-58: Zia Diversion Dam

Zia Lake is an important cultural and economic feature for the Pueblo and provides irrigation water for the lower portion of the North Ditch. The reservoir, constructed in the late 1930's, is leaking and in poor condition. The Pueblo has been coordinating with the BIA recently to have the condition assessed and monitored under the BIA's Safety of Dams program.

Figure 3-59: Zia Irrigation Infrastructure



Another long-standing deficiency within Zia's system is the flume that crosses the Jemez River, providing water for community cultural and irrigation use on the south side of the river. The flume has been identified as being in deteriorated condition for many years and has been repaired numerous times. However, the flume itself is severely corroded and the concrete piers have sustained ongoing damage due to river erosion.

Table 3-33: Zia Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
North Ditch:					
Zia Diversion Dam	N/A		X		Needs rehabilitation
Zia Lake Reservoir	N/A			X	Needs rehabilitation
North Ditch, Upper Section	12,514	X			Serviceable
North Ditch, Upper Section	4,868		X		Needs rehabilitation
North Ditch, Upper Section	1,240			X	Needs reconstruction
North Ditch, Lower Section	15,078	X			Serviceable
North Ditch, Lower Section	1,600		X		Needs rehabilitation
North Section Lateral 1	2,264	X			Serviceable
North Section Lateral 1	885		X		Needs rehabilitation
North Section Lateral 2	2,462	X			Serviceable
North Section Lateral 3	1,900			X	Needs reconstruction
South Ditch:					
Jemez River Flume Crossing	616			X	Needs reconstruction
South Ditch	6,185	X			Serviceable
South Ditch	10,416		X		Needs reconstruction
South Ditch Lateral	2,070			X	Needs reconstruction

Project Listing

The project list was developed from the condition assessment. Most of the ditch alignments are in serviceable condition, but there is a significant scope of work related to structural projects at Zia.

The condition of Zia Lake was not assessed during the structural reviews conducted for the Study and there is no estimate for structural needs yet available. The rehabilitation cost shown is strictly for restoring the storage capacity by removing the accumulated sediment and vegetation.

The project list is shown in Table 3-34. Excluding potential repairs for the retaining structure at Zia Lake, the project estimate totals approximately $12.6 million. Details are included in Appendix C.

Figure 3-60: Jemez River Flume Crossing

Table 3-34: Zia Project List

PROJECT	LENGTH (Feet)	CONTRACT COST
North Ditch:		
Zia Diversion Dam Rehabilitation	N/A	$8,133,000
Zia Lake Reservoir	N/A	TBD
North Ditch, Upper Section Reconstruction	6,108	$738,997
North Ditch, Lower Section Reconstruction	1,600	$293,988
North Section Laterals 1 & 3 Reconstruction	2,785	$194,836
South Ditch:		
Jemez River Crossing	616	$2,000,000
South Ditch Reconstruction	10,416	$1,006,345
South Ditch Lateral Reconstruction	2,070	$233,809
TOTAL:		$12,600,975

NOTE: All costs shown shall be considered *appraisal level* costs

Acoma

The Pueblo of Acoma is the westernmost Pueblo in the Rio Grande Basin, and borders Laguna. The land base totals nearly 509,000 acres. The irrigation infrastructure is extensive, with more than 30 miles of ditches. The farmlands are situated discontinuously along the Rio San Jose Valley. The Rio San Jose is relied upon for irrigation water and is augmented by several springs in the area (Tiller, 2015).

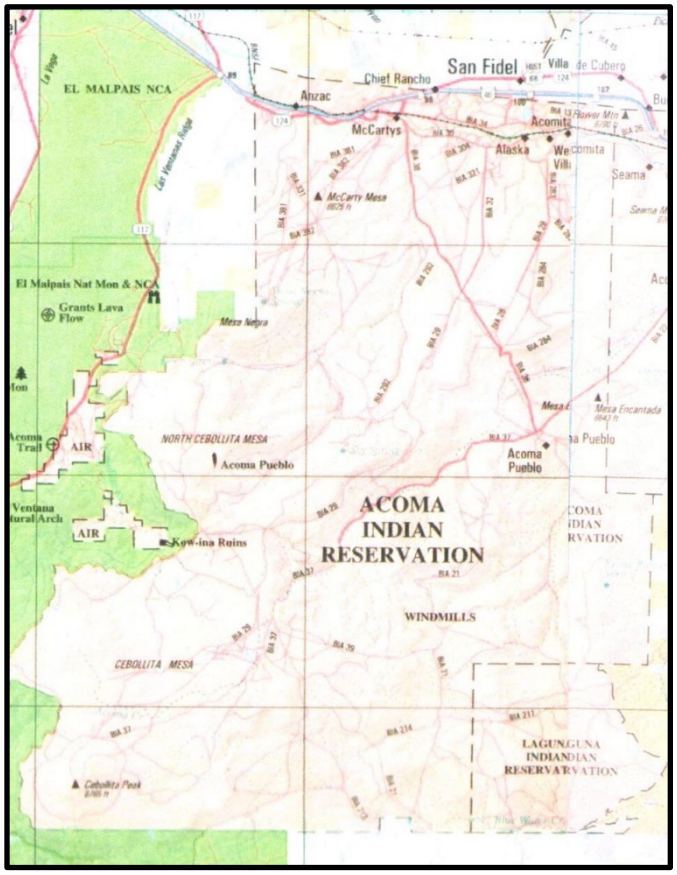


Figure 3-61: Acoma Pueblo
(Source: DeLorme, 2006)

Findings

Irrigation surveys were completed in 2016, and are tabulated in Appendix B. The irrigation infrastructure is shown in Figure 3-62.

Condition Assessment

Acoma has recently completed reconstruction of the Anzac Ditch, which was largely funded in 2014 by the Federal Emergency Management Agency through a nearly $1.4 million award in response to severe flood damage incurred in 2010. Much of the Vallo Ditch is also in good condition.

Nearly all remaining ditches, and all diversions, need significant work. Damaged and deteriorated ditches are especially inefficient because there is such a scarcity of water in this area. The Rio San Jose carries little to no water during the growing season except during precipitation events.

There are two irrigation impoundments on Acoma lands which were constructed by BIA to provide irrigation water for both Acoma and Laguna, which borders Acoma and is geographically downstream of Acoma lands. The Pueblo of Acoma has expressed concern with the condition of Acomita Lake, due to the impoundment leaking and to sedimentation of the basin. The other impoundment is Seama Reservoir, which was not lined and was never able to retain water. In addition, the reservoir was located too far east to provide significant benefit for Acoma farmlands. The unique situation of constructing irrigation impoundments

intended to be shared between the two Pueblos has resulted in jurisdictional complications when maintenance and operation issues arise.

Figure 3-62: Acoma Irrigation Infrastructure

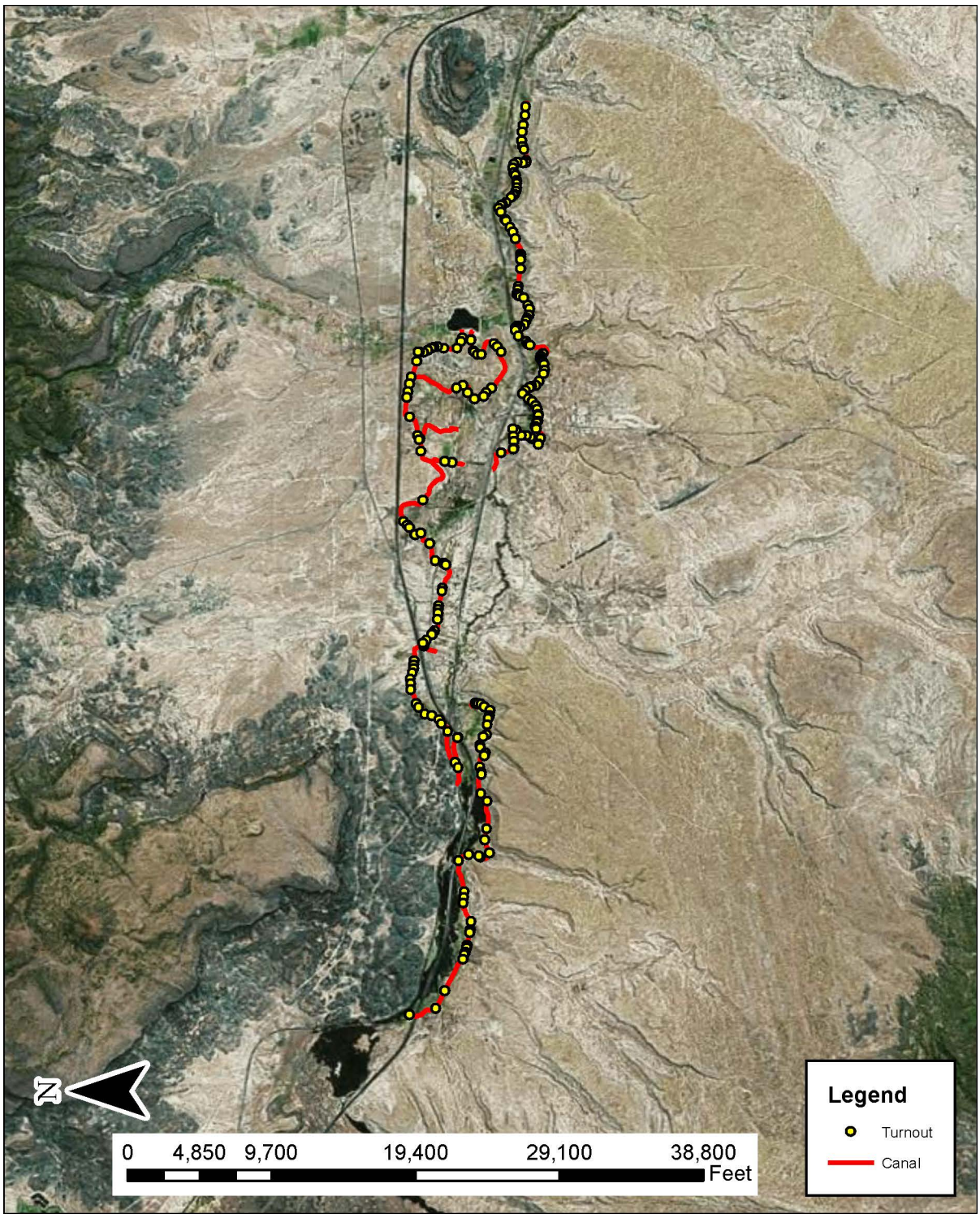


Table 3-35: Acoma Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Anzac Ditch:					
Anzac Diversion	N/A			X	Needs gate repairs
Anzac Ditch to McCarty	22,238	X			Recently reconstructed
S. McCarty Diversion	N/A		X		Serviceable, needs work
Anzac Ditch, McCarty to End	5,277			X	Needs reconstruction
Anzac Lateral 1	892	X			Serviceable
Sandoval Ditch:					
Esteban Diversion	N/A			X	Needs reconstruction
Sandoval Ditch	41,006			X	Needs reconstruction
Sandoval Lateral Ditches 1 - 9	11,931			X	Needs reconstruction
Walter Juanico Lateral	14,143			X	Needs reconstruction
Walter Juanico Lateral 10	563			X	Needs reconstruction
Acomita Ditch:					
North Acomita Diversion	N/A			X	Unusable, needs reconstruction
North Acomita Ditch	6,000			X	Unusable, needs reconstruction
Silt Trap above Acomita Lake	N/A			X	Sedimented, needs rehab
Acomita Lake	N/A			X	Needs rehabilitation
Acomita Lake Diversion	N/A		X		Needs reconstruction
Acomita Ditch, Upper Section	5,700			X	Needs reconstruction
Acomita Ditch, Remainder	12,500			X	Needs reconstruction
Acomita Lateral 1	1,057			X	Needs reconstruction
Acomita Lateral 3	256			X	Needs reconstruction
Acomita Lateral 4	272			X	Needs reconstruction
Vallo Ditch:					
Vallo Diversion	N/A			X	Needs rehabilitation
Vallo Ditch, Upper & Middle	35,272	X			Recently reconstructed
Vallo Ditch, End Section	1,847			X	Needs reconstruction
Old Vallo Ditch	3,086			X	Needs reconstruction
Seama Diversion	N/A			X	Unusable

Project Listing

The Rio San Jose is the primary surface water source for Acoma. This is a very minor stream, and does not adequately meet the needs for Acoma, nor for downstream Laguna. Diversions and impoundments are therefore essential but are in generally poor or unusable condition. The Esteban Diversion is shown in Figures 3-63 and 3-64 below.

Figure 3-63: Esteban Diversion

Figure 3-64: Esteban Diversion, Concrete Deterioration

The project list totals about $54.4 million, as summarized in Table 3-36, and as detailed in the worksheets in Appendix C.

Table 3-36: Acoma Project List

PROJECTS	LENGTH (Feet)	CONTRACT COST
Anzac Ditch:		
Anzac Diversion Gate Repairs	N/A	$37,398
S. McCarty Diversion Reconstruction	N/A	$5,597,000
Anzac Ditch, McCarty to End, Reconstruction	5,277	$682,008
Sandoval Ditch:		
Esteban Diversion Reconstruction	N/A	$5,597,000
Sandoval Ditch Section 1 Reconstruction	11,006	$903,845
Sandoval Ditch Section 2 Reconstruction	10,000	$1,392,087
Sandoval Ditch Section 3 Reconstruction	10,000	$1,107,985
Sandoval Ditch End Section Reconstruction	10,000	$1,062,115
Sandoval Lateral Ditches 1 - 9 Reconstruction	11,931	$783,621
Walter Juanico Lateral Reconstruction	14,143	$1,192,141
Walter Juanico Lateral 10 Reconstruction	563	$50,717
Acomita Ditch:		
North Acomita Diversion Reconstruction	N/A	$5,597,000
North Acomita Ditch Reconstruction	6,000	$529,744
Silt Trap above Acomita Lake, Rehabilitation	N/A	$200,000
Acomita Lake Rehabilitation	N/A	$9,551,250
Acomita Lake Diversion Reconstruction	N/A	$5,597,000
Acomita Ditch, Upper Section Reconstruction	5,700	$557,898
Acomita Ditch, Middle Section Reconstruction	6,250	$774,382
Acomita Ditch, Lower Section Reconstruction	6,250	$537,136
Acomita Ditch Laterals Reconstruction	1,585	$154,899
Vallo Ditch:		
Vallo Diversion Reconstruction	N/A	$6,534,000
Vallo Ditch, End Section Reconstruction	1,847	$171,818
Old Vallo Ditch Reconstruction	3,086	$216,512
Seama Diversion Reconstruction	N/A	$5,597,000
TOTAL:		$54,424,556

NOTE: All costs shown shall be considered *appraisal level* costs

Laguna

Laguna is the largest Pueblo in the Rio Grande Basin, with about 533,000 acres. The Pueblo is comprised of six villages spread along the Rio San Jose. The Rio San Jose is a tributary to the Rio Puerco, which flows into the Rio Grande north of San Acacia (Tiller, 2015).

While the San Jose is relied upon by Laguna, as well as by Acoma to the west, the stream carries very little water for most of the year and water scarcity is a critical concern for irrigators at both Pueblos.

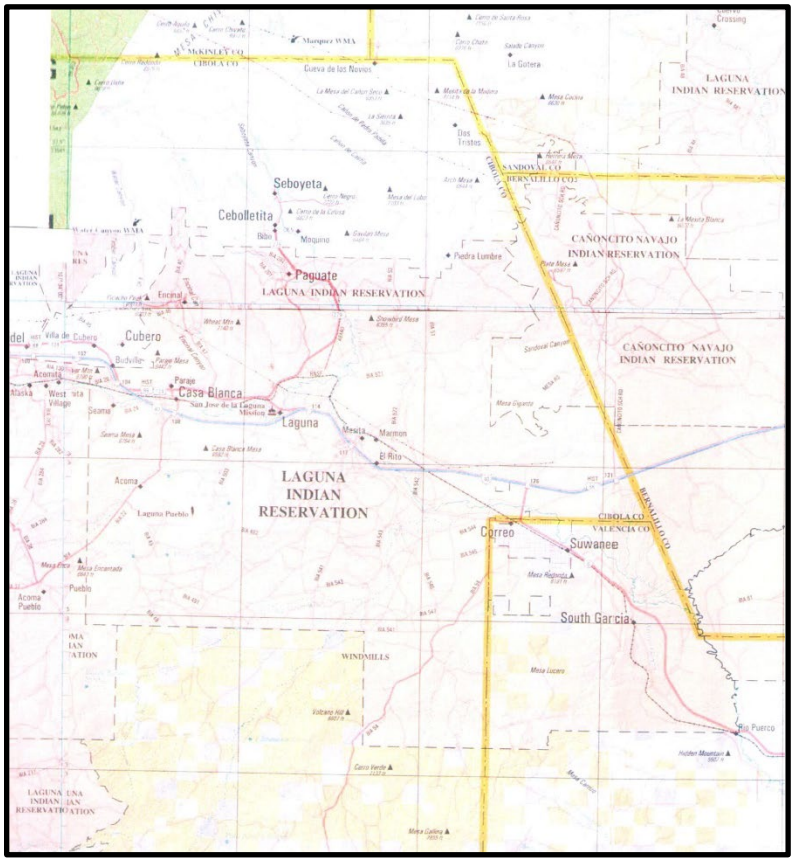


Figure 3-65: Laguna Pueblo (Source: DeLorme, 2006)

Findings

Laguna's irrigation surveys were completed between 2013 and 2015, and include nearly 40 miles of ditches. The system is illustrated in Figure 3-66 on the following page. As previously discussed, there are two impoundments on Acoma lands which were constructed to provide irrigation water for both Acoma and Laguna. This situation creates a potential for jurisdictional issues that complicate maintenance and operation in a region that already faces some of the most dire water scarcity issues in the Rio Grande Basin.

Condition Assessment

The Pueblo has an established ditch maintenance program, and the administrative staff to design and bid repair and reconstruction projects. However, the system is so vast that there is still a tremendous amount of aged infrastructure, summarized in Table 3-37.

Figure 3-66: Laguna Irrigation Infrastructure

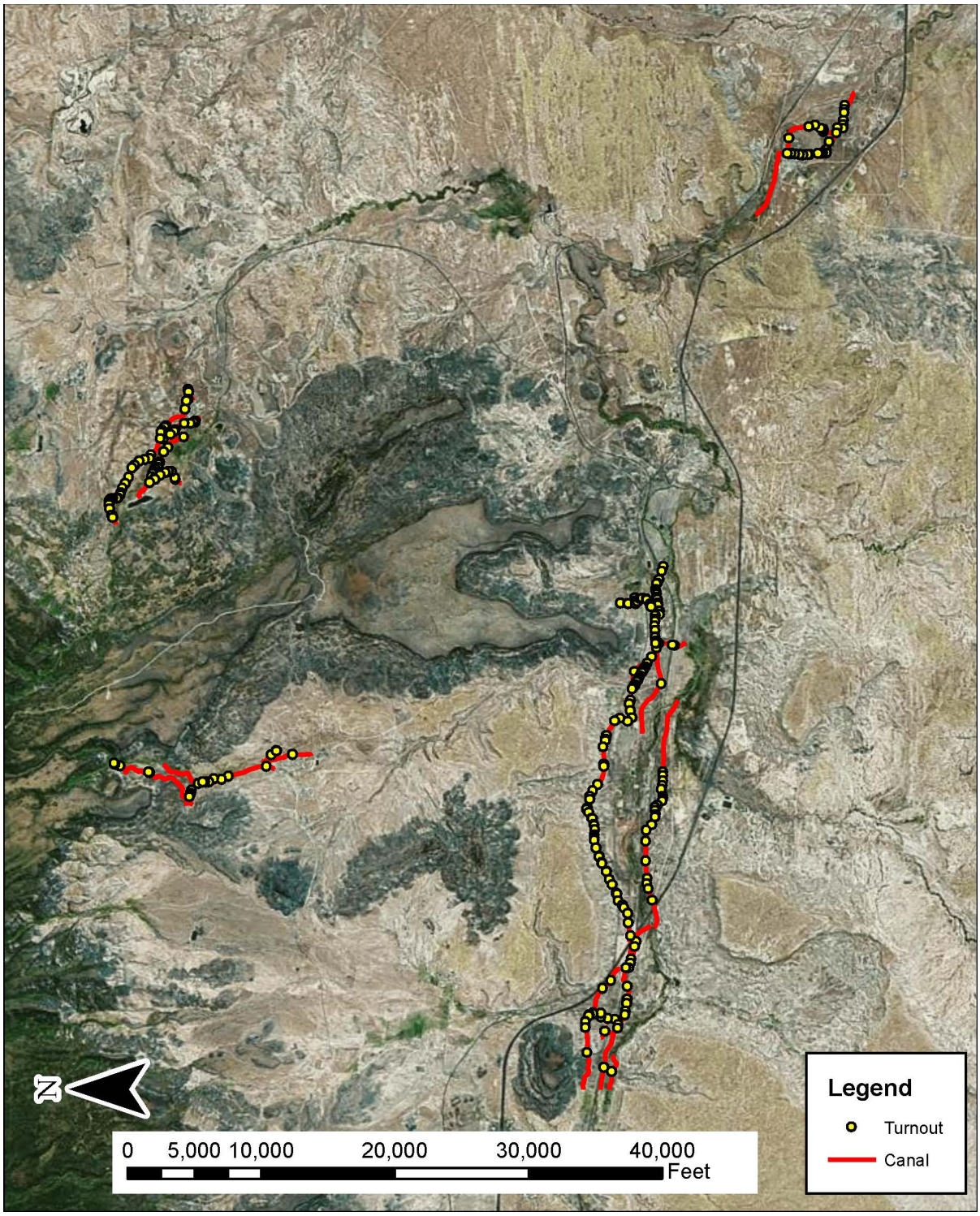


Table 3-37: Laguna Condition Assessment

INFRASTRUCTURE CONDITION	LENGTH (feet)	GOOD	FAIR	POOR	REMARKS
Casa Blanca Ditch, Concrete Section	18,012			X	Needs reconstruction
Casa Blanca Lateral	1,226			X	Needs rehabilitation
Beecher Ditch	10,425		X		Areas need reconstruction
Encinal Main	9,363			X	Needs reconstruction
Old Encinal Main	1,279			X	Needs reconstruction
Encinal Laterals 1 - 3	13,801			X	Needs reconstruction
Encinal Old Dirt Ditch	3,092			X	Needs rehabilitation
New York Ditch	8,662			X	Needs reconstruction
New York Dirt Ditch Lateral	4,142			X	Needs rehabilitation
Reservoir Ditch	907			X	Needs reconstruction
Reservoir Area Ditches	3,988			X	Needs reconstruction
Paraje Ditch	43,640		X		Areas need reconstruction
Paraje Area Ditches & Laterals	42,087			X	Needs reconstruction
North Ditch	12,837	X			Serviceable
North Ditch, Upper Section	4,000	X			Serviceable
North Ditch, Remainder Concrete	7,250		X		Needs reconstruction
North Ditch, Dirt Section	1,592			X	Needs reconstruction
North Ditch Laterals 1 & 2	4,575			X	Needs reconstruction
Middle Ditch, Concrete Section	234	X			Serviceable
Middle Ditch, Dirt Section	4,721			X	Needs reconstruction
South Ditch	4,547		X		Areas need reconstruction
Reservoir Lake Pipeline	1,380		X		Needs reconstruction
Main Ditch, Concrete Section	8,680		X		Needs reconstruction
Main Ditch, Dirt Section	5,667			X	Needs reconstruction
Main Ditch Secondary Ditch	5,553			X	Needs reconstruction
Laguna Ancient Ditch	9,057			X	Needs reconstruction
Laguna Ancient Ditch Lateral 1	1,883			X	Needs reconstruction
Unknown Ditch 1	365			X	Needs rehabilitation
Mesita Diversion Dam	N/A			X	Needs reconstruction

The following two figures provide examples of the aging and deteriorated concrete ditches and diversion structures. The Technical Service Center team conducted field reviews of the Laguna diversion facilities and rated one diversion in fair condition and the others in poor condition. Each of these is estimated to require reconstruction on the order of $6 million each.

Figure 3-67: Rio San Jose Diversion

Project Listing

The project list, excluding repair projects for the diversion dams, is shown in Table 3-38 on the following page, and totals about $22 million. It is noted that several of the projects were scoped as requiring areas of reconstruction but not reconstruction along the entire ditch length. This is subject to change as conditions deteriorate.

As previously discussed, it would be worth investigating the potential of restoring Seama Reservoir to serviceability for the benefit of both Laguna and Acoma Pueblos.

Table 3-38: Laguna Project List

PROJECT	LENGTH (Feet)	CONTRACT COST
Casa Blanca Ditch, Reconstruction	18,012	$1,554,455
Casa Blanca Lateral Reconstruction	1,226	$93,084
Beecher Ditch, Select Area Reconstruction	2,500	$358,934
Encinal Main Reconstruction	9,363	$1,039,687
Old Encinal Main Reconstruction	1,279	$90,903
Encinal Laterals 1 - 3 Reconstruction	997	$630,440
Encinal Old Dirt Ditch Rehabilitation	3,092	$53,196
New York Ditch Reconstruction	8,662	$988,140
New York Ditch Lateral Reconstruction	4,142	$314,287
Reservoir Ditch Reconstruction	907	$92,519
Reservoir Area Ditches Reconstruction	3,988	$364,377
Paraje Ditch, Select Area Reconstruction	10,000	$1,384,448
Paraje Area Ditches & Laterals Reconstruction	42,087	$2,926,484
North Ditch Reconstruction	12,837	$1,277,594
North Ditch Laterals Reconstruction	4,575	$568,595
Middle Ditch Reconstruction	4,721	$640,612
South Ditch, Select Area Reconstruction	1,500	$176,610
Reservoir Lake Pipeline Reconstruction	1,380	$488,696
Main Ditch Reconstruction	14,347	$1,636,686
Main Ditch Secondary Ditch Reconstruction	5,553	$772,023
Laguna Ancient Ditch Reconstruction	9,057	$818,721
Laguna Ancient Ditch Lateral 1 Reconstruction	1,883	$169,661
Unknown Ditch 1 Rehabilitation	365	$18,995
Mesita Diversion Dam	N/A	$5,585,500
TOTAL:		$22,044,647

NOTE: All costs shown shall be considered *appraisal level* costs

Chapter 4: Project Recommendations

The following sections describe the process utilized to prioritize the projects presented in the previous chapter, in keeping with the factors and requirements described in the Act. Recommendations are made based on that process, and conclusions are provided.

Project Prioritization

The method for prioritizing projects was guided by the authorizing legislation, which was discussed in detail in Chapter 1. The Act directed that projects be prioritized in the Study based on review of specified factors and consideration of benefits. For a project to be eligible for funding, at least one factor must be addressed. The factors are reiterated below.

Specified Factors (Public Law 111-11, Section 9106, Paragraph (c)(2)(B)):

1. The extent of disrepair of the Pueblo irrigation infrastructure, and the effect of the disrepair of that infrastructure;
2. Whether, and to what extent, the repair, rehabilitation, or reconstruction of the Pueblo irrigation infrastructure would provide an opportunity to conserve water;
3. The economic and cultural impacts that the Pueblo irrigation infrastructure in disrepair has on the applicable Rio Grande Pueblo; and the economic and cultural benefits that the repair, rehabilitation, or reconstruction of the Pueblo irrigation infrastructure would have on the applicable Rio Grande Pueblo;
4. The opportunity to address water supply or environmental conflicts in the applicable river basin if the Pueblo irrigation infrastructure is repaired, rehabilitated, or reconstructed; and
5. The overall benefits of the project to efficient water operations on the land of the applicable Rio Grande Pueblo.

The factors discussed above address the impact of irrigation infrastructure disrepair, and proposed improvements, in terms of the environment, civil infrastructure, economy and cultural resources of the Pueblos within the Rio Grande Basin. The specific project components identified in the unit contract cost table (Table 2-1) were qualitatively evaluated, on a scale of 1 to 5, for their ability to address each of the specified factors. The higher the score, the better the project addressed that specific factor. The results of this evaluation are shown in Table 4-1 on the following page.

For example, the first project component listed in Table 4-1 is concrete lining, which scored a total of 23. Concrete lining provides a durable and efficient means of conveying irrigation water that positively impacts the function of the irrigation infrastructure, reduces water losses throughout the system, and improves the efficiency of water delivery to the farm field. This component also results in a positive impact on Pueblo culture and Pueblo economies, and enhances the ability to provide water within the river basin. The only factor

for which concrete lining did not receive a top score was the fifth factor, which is for the overall benefit to efficient water operations on the Pueblo. Concrete lining does address this factor to a large degree but was judged to have less impact than some other project components in this regard.

Table 4-1: Project Methodology

PROJECT COMPONENTS	FACTORS					TOTAL
	One	Two	Three	Four	Five	
Concrete Lining	5	5	5	5	3	23
Pipe / Culvert Replacement	3	3	4	5	3	18
Cleaning & Reshaping	4	3	5	4	3	19
Grade Restoration	5	4	5	5	5	24
Tree & Vegetation Clearing	2	3	1	4	3	13
Minor Structure Repairs	2	2	1	1	1	7
Turnout	3	3	5	3	5	19
Check Structure	3	4	5	3	5	20
Steel Access Catwalk	1	1	5	1	5	13
Large Canal Check Structure	3	3	4	4	1	15
Lateral Headgate	3	3	4	4	2	16
Flume Upgrade / Replacement	5	5	4	5	4	23
Road Crossing Repairs	3	1	4	2	4	14
Subsurface Drainage	4	4	5	4	4	21
Well Rehab & Repairs	4	1	3	1	1	10
Flow Metering	1	1	1	3	1	7
Major Structures	5	4	5	5	4	23

As the table shows, the project scores vary from a low of 7 to a high of 24, and this range was utilized to prioritize projects based on the factor ranking. In evaluating prioritization, it was recognized that the major structures component needed to be treated separately. Therefore, major structures were assigned a separate category of priority relative to the other project components.

The primary reason for this is that most of the major structure project estimates were based on preliminary review and replacement values. However, it is expected that detailed engineering study on individual structures, if funded, could result in significant cost savings compared to structure replacement, through development of design modification or rehabilitation options that could restore near term functionality to the structure and extend service life.

In addition, these major structure project components are much larger scale projects than the other project components and may be well suited to design and construction by an agency like the USACE.

The range of project component scores was divided into thirds by factor ranking, allowing categorization into tiers of project priority. The final tier is set aside for major structures, not because the major structure improvements are of lowest priority, but instead because of the reasons previously discussed.

The project priorities are presented below in Table 4-2. The highest number of project types fall into the first tier simply because many of the project types have a high rank among several of the factors.

Table 4-2: Project Prioritization Model

FACTOR RANKING		PRIORITY
24	Grade Restoration	1
23	Concrete Lining	
23	Flume Upgrade / Replacement	
21	Subsurface Drainage	
20	Check Structure	
19	Cleaning & Reshaping	
19	Turnout	
18	Pipe / Culvert Replacement	2
16	Lateral Headgate	
15	Large Canal Check Structure	
14	Road Crossing Repairs	
13	Tree & Vegetation Clearing	
13	Steel Access Catwalk	
10	Well Rehab & Repairs	3
7	Minor Structure Repairs	
7	Flow Metering	
23	Major Structures	TBD

By this method, types of projects were objectively categorized into priorities based on the benefit each brings to the Pueblo in terms of the five factors under consideration. Priority 1 projects include most of the project components related to repair, rehabilitation and reconstruction of irrigation ditches: grade restoration, concrete lining, flume repairs, reshaping earthen ditches, and replacement of turnouts and checks. In addition, subsurface drainage restoration is in the first tier of project rankings.

The second and third priorities contain several project components that are also critical to an efficient irrigation system but did not rank as highly across all five factors. Finally, as previously discussed, major structures were separated into another category, pending further evaluation. It is worth noting that all the project elements do meet the eligibility criteria by addressing at least one factor.

Project Recommendations

With the methodology discussed in the previous section, the Pueblo projects that were presented in Chapter 3 can be categorized by priority. This prioritization is shown in Table 4-3 and demonstrates project needs totaling nearly $280 million.

Table 4-3: Summary of Prioritized Pueblo Projects

PUEBLO	CONTRACT COSTS				
	Priority 1	Priority 2	Priority 3	Major Structures	Total
Acoma	$10,354,306	$0	$0	$44,070,250	$54,424,556
Cochiti	$1,927,175	$0	$0	$0	$1,927,175
Isleta	$3,623,092	$188,138	$0	$0	$3,811,230
Jemez	$11,095,554	$151,148	$0	$11,384,000	$22,630,702
Laguna	$16,459,147	$0	$0	$5,585,500	$22,044,647
Nambe	$7,118,352	$0	$0	$0	$7,118,352
Ohkay Owingeh	$4,198,179	$0	$0	$17,085,000	$21,283,179
Picuris	$2,994,020	$0	$0	$5,692,000	$7,967,517
San Felipe	$4,856,109	$70,854	$0	$0	$4,926,963
San Ildefonso	$3,930,581	$0	$4,500	$3,300,000	$7,235,081
Sandia	$6,417,873	$97,041	$0	$5,600,000	$12,114,914
Santa Ana	$1,673,751	$0	$0	$0	$1,673,751
Santa Clara	$4,037,835	$0	$0	$1,482,250	$5,520,085
Santo Domingo	$20,360,070	$0	$160,128	$0	$20,520,198
Taos	$23,171,155	$30,872	$0	$39,921,000	$63,123,027
Tesuque	$8,114,900	$0	$0	$2,862,000	$10,976,900
Zia	$2,467,975	$0	$0	$10,133,000	$12,600,975
TOTALS:	$132,800,074	$538,053	$164,628	$147,115,000	$279,899,253

NOTE: All costs shown shall be considered *appraisal level* costs

The Priority 1 projects represent approximately forty-seven percent (47%) of the total. Priority 2 and 3 projects are a minor percentage of the projects and major structures projects are about fifty-three percent (53%) of the overall contract costs. Further engineering review of all the major structures on the Pueblo irrigation systems will be necessary to adequately plan and program for those projects. It is noted that even projects in the lower

priority categories are important to restore the irrigation infrastructure, cultural and economic conditions, and in many cases also address safety concerns.

In addition, as has been discussed elsewhere in the Study, there are some other costs that are not included, or may be subject to change. There are a few structures that have not yet been adequately reviewed to determine a contract cost estimate. For those irrigation systems that have not yet been fully surveyed, costs may increase or decrease as existing infrastructure details are obtained. Finally, there were no project estimates provided for the Pueblo of Pojoaque, as the surveys have not been initiated yet and the Pueblo requested time to first undertake further watershed assessment and planning. As authorized, the Study will be reviewed and updated every four years to incorporate these additional infrastructure details and cost changes.

It is acknowledged that the Act stipulates that any projects will be subject to a Federal cost share of no more than 75 percent. The remaining 25 percent is the non-Federal share. The Secretary may waive or reduce the non-Federal share, based on a demonstration of financial hardship by the Rio Grande Pueblo that is the project sponsor. In addition, the Act allows for the non-Federal share to be met through Pueblo in-kind services, State contributions, and District contributions for projects within the Middle Rio Grande Pueblos.

Conclusions

This Study was completed as a requirement of the Rio Grande Pueblos Irrigation Infrastructure Act. The need for significant improvements to the infrastructure has been emphasized for several decades, and is supported by the Pueblos and by the various agencies with Trust responsibilities and interests in the condition of these facilities and in the economic and cultural wellbeing of the affected communities.

The Pueblo irrigation systems are predominantly aged and deteriorated. There are many systems that cannot withstand seasonal high storm flows. In addition, the Pueblo irrigation systems are plagued by inadequate baseline water flows, limited transport capabities, and high sediment loads. These issues result in extensive and labor intensive rehabilitation annually and impose a significant negative impact on the economies, culture and lifestyle for all eighteen Pueblos within the Rio Grande Basin.

Periodic studies have continued to demonstrate the decline in these facilities. Many of the projects that are included in the Study have been identified in past reports as well. The Act was written with the implicit understanding that conditions change with time, as improvements are made on the one hand, and sometimes emerging and catastrophic damages are incurred on the other. Therefore, the Act requires the Study to be updated every four years.

With the delayed funding, and resultant delayed completion of the Study, the authority for this project will soon expire. The legislation authorized up to ten years of

construction funding, through FY 2019. With completion of the Study, there is now a full documentation of the existing conditions for the Rio Grande Pueblos irrigation infrastructure.

The extent of disrepair, and the criticality of these irrigation systems, indicate the need to address these deficiencies in a systematic and comprehensive manner. This cannot be accomplished without adequate construction funding. Project funding will not only increase water use efficiency and agricultural productivity for the Rio Grande Pueblos, but will also have a tremendous benefit to management and conservation of the limited water resources of the Rio Grande Basin.

The agency consultation undertaken as part of this Study has identified opportunities for cooperation among agencies that could extend the ability of each agency's relevant Federal programs to make significant positive impacts on Pueblo lands throughout the Rio Grande Basin. In particular, it is expected that the efforts undertaken for the Study will contribute to opening opportunities for small scale assistance through the NRCS EQIP program. In addition, the USACE's Tribal Partnership Program may provide support on flooding and erosion issues which indirectly benefit irrigation by minimizing damage to irrigation infrastructure. The USACE could also be authorized to undertake or support the required major structures repair, rehabilitation and replacement projects.

In conclusion, this Study could not have been completed without the support and contributions of each of the eighteen Pueblos in the Rio Grande Basin. The Study has identified a need for nearly $280 million in improvements to the irrigation infrastructure on Pueblo lands. These improvements are essential to the Tribal economies, efficient water operations, and preserving the cultural traditions for future generations. A cooperative strategy between the NRCS, USACE, and Reclamation may provide the most effective means of addressing the needs for the Pueblo's irrigation infrastructure.

Chapter 5: Addendum

During final reviews of the draft Study report, comments were received and incorporated from various agency reviewers. However, comments received regarding project funding and implementation could not be easily addressed through document revisions. Therefore, this addendum has been incorporated to provide additional detail on Reclamation's vision to transition the identified Pueblo irrigation infrastructure projects into the construction phase and through the course of authorized construction.

Funding Limitations

As presented in the Study Report, the project identified nearly $280 million in project needs. These projects were prioritized based on the authorizing legislation's specified factors and consideration of benefits. While there were obvious numerical breakpoints in the factor ranking, which suggested clear delineation of priorities, the result was that nearly half of the projects by cost were clustered in the upper third of project priority. The project priorities are summarized in the previous chapter and reproduced in Table 5-1. Of the nearly $280 million in project needs, the Priority 1 projects total nearly $133 million. Note that, as in the previous chapter, major structures are removed from prioritization, primarily because additional study is required to develop an appraisal level estimate for these needs.

In review comments and subsequent coordination meetings, it was recognized that it would be helpful to provide some discussion about how to implement projects when there is a gap between the legislated authorization of $60 million and the estimated project need of $280 million. The legislation was, necessarily, developed in advance of the study that subsequently quantified the project needs. However, the legislation's authorized construction funding totals only 21 percent of the overall identified project need, and about 45 percent of the Priority 1 project needs.

Given this gap between project needs and the original authorization for project funding, it was recognized that providing details on how construction funding could be used may aid decision makers in advancing the program into the construction phase.

Table 5-1: Summary of Prioritized Pueblo Projects

PUEBLO	CONTRACT COSTS				
	Priority 1	Priority 2	Priority 3	Major Structures	Total
Acoma	$10,354,306	$0	$0	$44,070,250	$54,424,556
Cochiti	$1,927,175	$0	$0	$0	$1,927,175
Isleta	$3,623,092	$188,138	$0	$0	$3,811,230
Jemez	$11,095,554	$151,148	$0	$11,384,000	$22,630,702
Laguna	$16,459,147	$0	$0	$5,585,500	$22,044,647
Nambe	$7,118,352	$0	$0	$0	$7,118,352
Ohkay Owingeh	$4,198,179	$0	$0	$17,085,000	$21,283,179
Picuris	$2,994,020	$0	$0	$5,692,000	$7,967,517
San Felipe	$4,856,109	$70,854	$0	$0	$4,926,963
San Ildefonso	$3,930,581	$0	$4,500	$3,300,000	$7,235,081
Sandia	$6,417,873	$97,041	$0	$5,600,000	$12,114,914
Santa Ana	$1,673,751	$0	$0	$0	$1,673,751
Santa Clara	$4,037,835	$0	$0	$1,482,250	$5,520,085
Santo Domingo	$20,360,070	$0	$160,128	$0	$20,520,198
Taos	$23,171,155	$30,872	$0	$39,921,000	$63,123,027
Tesuque	$8,114,900	$0	$0	$2,862,000	$10,976,900
Zia	$2,467,975	$0	$0	$10,133,000	$12,600,975
TOTALS:	**$132,800,074**	$538,053	$164,628	$147,115,000	$279,899,253

Collaborative Funding Opportunities

One important consideration in determining what projects to implement is current condition at the time funding becomes available. Some projects may receive construction funding through other programs, such that reconstruction under the Rio Grande Pueblos irrigation infrastructure authority is no longer required. Reclamation and Pueblo personnel will ensure that no project receives duplicative funding.

Opportunities for Reclamation and the Pueblos to partner with other agencies on projects identified in the Study Report could be extremely advantageous. For example, the Pueblos are encouraged to seek project funding from the Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP), which provides incentive payments for specific reconstruction activities. In illustration, if a Pueblo entered into an EQIP agreement to reconstruct a concrete lined ditch under the calendar year 2020 NRCS payment schedule for New Mexico, the concrete lining payment scenario for a tribal project could be expected to provide an incentive payment of $20.65 per cubic yard of concrete. While that payment may only cover 30 to 40 percent of the actual construction cost, it

significantly reduces the contract funding that would be necessary from the Reclamation program to complete the project.

Project funding from the State of New Mexico presents an opportunity as well. The Pueblos' tribal administrations develop capital improvement plans for submission to the State annually. These plans may include irrigation infrastructure needs but typically such projects do not compete successfully against the larger needs of school and other public facility infrastructure. However, one Pueblo is currently developing an irrigation project in collaboration with Reclamation and the State of New Mexico through the State's Disaster Assistance Program. Due to extreme erosion and flooding that jeopardize a critical irrigation flume crossing the Jemez River, the Pueblo of Zia has been approved for State support on the replacement of the flume and associated irrigation infrastructure repairs.

Similarly, some projects may be eligible for partial or full funding from other Reclamation programs. The WaterSMART (Sustain and Manage America's Resources for Tomorrow) program provides grants through a competitive selection process within several programs. Tribal irrigation improvement projects have been funded through both the Small-Scale Efficiency and the Water and Energy Efficiency program awards. The WaterSMART Drought Program has also funded tribal irrigation projects, including at least one Pueblo project. A new WaterSMART program was initiated in 2021, the Environmental Water Resources Program, which offers another significant potential opportunity for funding tribal projects.

The Rio Grande Pueblos irrigation infrastructure needs have also received regular support through Reclamation's Native American Affairs program. Throughout the past several years, technical assistance funding has been dedicated to Pueblo irrigation infrastructure repairs as well as administrative support for tribes to pursue other funding sources such as WaterSMART grants to magnify Rio Grande Pueblos irrigation infrastructure funding.

The Bipartisan Infrastructure Investment and Jobs Act, signed into law in late 2021, provides another significant opportunity for Reclamation to support tribal infrastructure needs. The legislation includes $8.3 billion in water infrastructure and $2.5 billion for authorized water rights settlement projects. Implementing this law and delivering meaningful results is a top priority for Reclamation and tribal engagement on these new opportunities is underway.

Finally, consultation is ongoing with the U.S. Army Corps of Engineers on the potential for seeking authorization for the Corps to address the major structure repairs and rehabilitation that may be required to fully address the Pueblos' irrigation infrastructure needs. As previously stated, the estimated cost shown in Figure 5-1 for major structures requires additional study to develop even appraisal level costs. The Corps has the expertise to develop the planning, design and construction for this effort.

Implementation Considerations

During development of the draft Study Report, input was sought from each tribe on project prioritization. However, many of the Pueblos were reluctant to prioritize their project needs. Therefore, prioritization in the report was based solely on the factors and benefits of each project as defined in the authorizing legislation. During development of this chapter, the tribes were again provided an opportunity to prioritize project needs. Where input was provided, it was incorporated into the implementation scenario presented in the following section.

Another factor that could influence whether Pueblo Irrigation Infrastructure program funds are utilized for a specific project is future water rights settlements. Such agreements, when enacted, may include funds specifically to address irrigation infrastructure needs. In that case, the project would no longer be considered for funding under this program once a settlement commitment has been finalized. While a Pueblo is in negotiation for a water rights settlement, however, program funding may still be used for specific project funding. Reclamation and the Pueblos will be responsible for ensuring that project condition status is updated as negotiations progress and ensuring that no project received duplicate funding.

Projects that provide benefit to multiple Pueblos may be prioritized for implementation as well. For example, some tribal infrastructure extends beyond the boundaries of one Pueblo and into an adjacent downstream Pueblo's lands. In such a situation, reconstruction of the water conveyance (whether ditch or pipeline) within the border of the upstream Pueblo would benefit both Pueblos.

Where water resources are extremely limited, projects that improve irrigation water availability may be prioritized. Some of the Pueblos have more accessible irrigation water than others. This is particularly true for those Pueblos that are situated along the Rio Grande and with diversion points in good working condition. Irrigation water for other Pueblos may be more limited, whether from deteriorated diversions or inadequate water volumes available for diversion.

Another consideration that affects implementation is project readiness. For example, if a project has been designed and is ready for construction, that project may be prioritized for implementation as funding became available.

In general, the primary irrigation conveyances on each Pueblo's lands were prioritized for implementation, in contrast to the laterals associated with these conveyances. The lateral reconstruction is typically a significantly smaller investment and of a project size that may be quite feasible to obtain alternative funding, such as NRCS EQIP funding.

Project prioritization will also consider whether a Pueblo has received project funding in the past. The program managers are committed to ensuring that all Pueblos covered by the Rio Grande Pueblos irrigation infrastructure authority benefit equitably from the program. In

developing the Study Report, one Pueblo specifically chose not to include any projects for consideration. However, as their planning efforts mature, it is likely that they will want to have projects included in future.

These considerations provide illustration of some of the inputs that would be evaluated in determining what projects may be implemented as construction funding becomes available. The authorizing legislation included the expectation that the Study Report would be updated every four years. Those periodic updates will guide program construction planning as needed in future.

On final note should be made regarding authorization. The original legislation, as noted in the Study Report, stipulated expiration at the end of the 2019 fiscal year. Since then, the legislation has been extended each year within the annual appropriations act, as proposed in the President's Budget, which has allowed additional time for final review of the Study Report and submission of the final report to Congress.

Implementation Scenario

While all the Priority 1 projects scored highly in consideration of the legislated factors, it is recognized that the limited funding authorized necessitates a narrowing of the list of projects to be considered for implementation. Understanding that there are many considerations in prioritizing projects, and that the condition and priority of a specific project may change due to factors ranging from internal Pueblo priority changes to flood impacts, there are multiple implementation scenarios that can be developed. One potential scenario for implementation is presented in this section, to demonstrate how the program funding could be obligated.

Development of this implementation scenario began with a review of all the Priority 1 projects identified in Chapter 3. There are nearly 300 discrete projects comprising the Priority 1 project list. As a reminder, these Priority 1 projects do not include the major structures and include projects from seventeen of the eighteen Pueblos. A strictly mathematical distribution of the program's construction authorization of $60 million between the eighteen Pueblos would result in $3.33 million per tribe. Based on the Study Report, with seventeen Pueblos' project needs tabulated, the distribution would equate to $3.53 million per tribe.

However, it is recognized that a truly equitable distribution is more complicated than that mathematical approach. Development of a reasoned implementation scenario was informed by many considerations, including those listed in the previous section. This evaluation allowed selection of many of the Priority 1 projects and the exclusion of others.

The results of that review form a feasible implementation scenario, summarized in Table 5-2. The project funding is listed for each Pueblo, as well as the percentage of Priority 1 projects that such funding would encompass. For example, the Pueblo of Taos' Priority 1

projects, listed previously in Table 5-1, totaled $23,171,155. Under this implementation scenario, the plan would fund $4,899,792 toward Priority 1 construction projects at Taos. That level of funding would constitute 21 percent of the Priority 1 project needs identified for the Pueblo of Taos in the Study Report.

Table 5-2: Implementation Scenario Summary

PUEBLO	PRIORITY 1 PROJECTS FUNDED	FUNDING
Taos	21%	$4,899,792
Picuris	92%	$2,745,820
Ohkay Owingeh	60%	$2,518,583
Santa Clara	96%	$3,890,941
San Ildefonso	83%	$3,249,250
Nambe	41%	$2,930,217
Tesuque	53%	$4,277,495
Cochiti	88%	$1,701,707
Santo Domingo	22%	$4,500,000
San Felipe	85%	$4,131,770
Santa Ana	73%	$1,222,129
Sandia	31%	$2,021,043
Isleta	57%	$2,082,943
Jemez	46%	$5,125,316
Zia	100%	$2,467,975
Acoma	54%	$5,631,603
Laguna	40%	$6,603,416
TOTAL CONSTRUCTION	45%	$60,000,000

Those locations with a lower proposed funding in this implementation scenario are for various reasons. Typically, it may be because that Pueblo has less infrastructure or because that Pueblo's infrastructure is either in relatively better condition or is less costly to address than other locations. For example, Picuris Pueblo's infrastructure is extremely deteriorated but there are relatively few miles of conveyance to be reconstructed. Therefore, the proposed funding under this scenario for this Pueblo is a little less than $2.8 million but that would reconstruct more than 90 percent of their infrastructure.

Acoma and Laguna Pueblos, on the west side of the Rio Grande Basin, would be considered for some of the highest levels of funding in this scenario. These tribes have extensive irrigation infrastructure and extremely limited water available for diversion. In addition, some of Acoma's ditches extend onto Laguna lands so the more efficiently water is conveyed through the Acoma ditches, the more water is available to Laguna as well. A similar situation exists for Jemez and Zia Pueblos, where efficiencies in water conservation at

Jemez Pueblo allow more water to be available for diversion into Zia Pueblo's irrigation system. This system connectivity exists to lesser extent for some other Pueblos as well.

Annual Construction Plan

As discussed, the implementation scenario presented in the previous section is but one illustration of how the authorized construction dollars might be obligated. It will be important to develop an annual plan each year for implementation. As the program budget is finalized for the year, specific projects will be identified for obligation. The annual plan will therefore be tailored to the funding available each year and will reflect each Pueblo's updated priorities.

In addition, annual planning allows for adjustments based on other funding sources or the opportunity to match other agency or program dollars. Other strategic considerations include funding planning projects which will position a Pueblo to compete for future project funding from other Reclamation or outside agency programs.

This tailoring of the implementation each year also ensures that projects are initiated at the right time for Pueblos to fully commit to their projects. Some Pueblos have limited staffing available to support projects, or for other reasons may need to undertake projects intermittently due to staffing impacts. Others may be able to complete their project needs more rapidly.

Summary

This chapter has been developed as an addendum to the Study Report to provide an updated discussion of funding opportunities and of the foreseen considerations involved in obligating construction funding. Although the program legislation authorized $60 million in construction dollars, which would complete 45 percent of the Priority 1 projects, this Addendum has referenced other programs and other sources of funding that may also be available to complete some of the additional projects identified in the Study Report.

The Secretary of the Interior and Reclamation are committed to working with the Pueblos to identify and address the highest priority projects through collaboration with multiple Reclamation programs and with other agencies, particularly the Natural Resources Conservation Service and the U.S. Army Corps of Engineers.

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