Cultural Resource Inventory of the Proposed Lined Ditch Reach of the Florida Farmers Ditch on Private Lands in La Plata County, Colorado

Written by

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Prepared for

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Submitted to

Mr. Joseph Toumey
Bureau of Reclamation, Western Colorado Office
835 East 2nd Avenue, Suite 300
Durango, CO 81301
(970) 385-6540

State of Colorado Archaeological Permits 2010-72/2011-58
SEAS Project No. 11-001
March 2011

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Abstract

From March 11 to March 20, 2011, Stratified Environmental & Archaeological Services, LLC (SEAS) conducted an intensive Class III cultural resources inventory for the proposed Lined Ditch Reach of the Florida Farmers Ditch Project. The proposed project is situated on private lands in La Plata County, Colorado. The purpose of the project is water conservation. Three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767) and one newly recorded segment of a previously recorded site (5LP 5661.6) were encountered and documented during the course of the cultural resource inventory. SEAS inventoried the project area for cultural resources at the request of Warren Rider, Watershed Scientist for Wright Water Engineers, Inc. on behalf of Florida Mesa Canal Company, with the Bureau of Reclamation (BOR) as lead agency. The survey was conducted under State of Colorado Archaeological Permits 2010-72/2011-58. The cultural resource survey was completed to identify and record historic properties that might be affected by the proposed project and to comply with Section 106 of the National Historic Preservation Act (P.L. 59-209) and other applicable federal regulations. The project area (APE) is approximately 43.86 acres (17.76 ha) and the total area surveyed is approximately 77.06 acres (31.20 ha).

The cultural resource inventory for the proposed Lined Ditch Reach of the Florida Farmers Ditch Project encountered and documented one newly recorded segment of a previously recorded linear site (5LP 5661.6) and three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767). Site segment 5LP 5661.6 dates to at least 1923 but was completely reconstructed and enlarged by the BOR's Florida Project during the 1962 to 1964 era. None of the original canal features occur within the project area. The canal is not associated with events or persons that have made a significant contribution to the broad patterns of our history, it is not the work of a master, nor does it possess high artistic value. Detailed documentation of the site segment in the field has adequately characterized its limited information potential in archival form and no further cultural resource work, including fencing or monitoring, is considered necessary.

Site 5LP 9767, an Ancestral Pueblo habitation with at least one pithouse, is recommended NRHP-eligible under Criterion D. Sites 5LP 9765 and 5LP 9766, a culturally modified ponderosa pine tree and an Ancestral Pueblo artifact scatter, respectively, are both considered potentially eligible (need data) to the NRHP under Criterion D. For all three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767), it is recommended that the proximal side of the Florida Farmers Ditch disturbance corridor be temporarily fenced and marked with blue flagging tape during construction activities. In addition, a qualified archaeologist should monitor all earth-disturbing construction activities within 50 ft of the site boundaries. Provided the avoidance and monitoring recommendations are implemented for the three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767), cultural resource clearance for the proposed Lined Reach of the Florida Farmers Ditch to proceed is recommended as no significant or potentially significant cultural properties will be affected.

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Colorado Historical Society - Office of Archaeology and Historic Preservation

COLORADO CULTURAL RESOURCE SURVEY

Cultural Resource Survey Management Information Form

Please complete this form and attach a copy behind the Table of Contents of each standard survey report.

I. PROJECT SIZE

Total federal acres in project: 0 Acres surveyed: 0

Total state acres in project: 0 Acres surveyed: 0

Total private acres of project: 43.86 Acres surveyed: 77.06

Other : _____ Acres surveyed: 0

Total acres surveyed: 77.06

II. PROJECT LOCATION

County: La Plata Principal Meridian: NMPM

USGS Quad map name(s) and date(s): Durango East, CO 1963

NOTE: The legal location information below is meant to summarize the location of the survey and does not need to be precise.

Township: 35 North Range: 8 West Sec: 19 1/4s W/2, NW/4, NW/4

Township: 35 North Range: 8 West Sec: 30 1/4s W/2, NW/4

Township: 35 North Range: 8 West Sec: 30 1/4s W/2, SW/4

Township: 35 North Range: 8 West Sec: 30 1/4s E/2, SE/4, SW/4

Township: 35 North Range: 8 West Sec: 31 1/4s E/2, NW/4

Township: 35 North Range: 8 West Sec: 31 1/4s NW/4, SW/4, NE/4

Township: 35 North Range: 9 West Sec: 24 1/4s E/2, NE/4

Township: 35 North Range: 9 West Sec: 24 1/4s E/2, SE/4

Township: 35 North Range: 9 West Sec: 25 1/4s NE/4, NE/4, NE/4

III. SITES

Smithsonian Number	Resource Type				Eligibility				Management Recommendations						
	Prehistoric	Historical	Paleontological	Unknown	Eligible	Not Eligible	Need Data	Contributes to National Register District	No Further Work	Preserve/Avoid	Monitor	Test	Excavate	Archival Research	Other
5LP 5661.6		X				X			X						
5LP 9765	X						X			X	X				
5LP 9766		X					X			X	X				
5LP 9767	X				X					X	X				

IV ISOLATED FINDS

Please note that by definition IFs are not eligible to the National Register and require no further work.

Smithsonian Number	Resource Type			
	Prehistoric	Historical	Paleontological	Unknown

Smithsonian Number	Resource Type			
	Prehistoric	Historical	Paleontological	Unknown

Principal Investigator: _____ Date: 04/03/11

Douglas E. Loebig

1.0 Introduction

From March 11 to March 20, 2011, Stratified Environmental & Archaeological Services, LLC (SEAS) conducted an intensive Class III cultural resources inventory for the proposed Lined Ditch Reach of the Florida Farmers Ditch Project. The proposed project is situated on private lands in La Plata County, Colorado. The purpose of the project is water conservation. Three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767) and one newly recorded segment of a previously recorded site (5LP 5661.6) were encountered and documented during the course of the cultural resource inventory. SEAS inventoried the project area for cultural resources at the request of Warren Rider, Watershed Scientist for Wright Water Engineers, Inc. on behalf of Florida Mesa Canal Company, with the Bureau of Reclamation (BOR) as lead agency. The survey was conducted under State of Colorado Archaeological Permits 2010-72/2011-58. The cultural resource survey was completed to identify and record historic properties that might be affected by the proposed project and to comply with Section 106 of the National Historic Preservation Act (P.L. 59-209) and other applicable federal regulations.

2.0 Proposed Project Description

The project area is located approximately four miles east of Durango in La Plata County, Colorado (Figures 2.1, 2.2, and 2.3; Table 2.1). The project crosses portions of Sections 19, 30, and 31 in Township 35 North, Range 8 West, NMPM and portions of Sections 24 and 25, Township 35 North, Range 9 West, NMPM, entirely on private lands. The purpose of the project is water conservation along the Florida Farmers Ditch. The Florida Farmers Ditch is an earthen structure and much water loss occurs through seepage. To minimize water loss during conveyance, Wright Water Engineers, Inc. proposes to line the canal with shotcrete placed over 30 mil PVC synthetic liner sandwiched between two layers of 8-ounce non-woven geotextile fabric. Prior to lining the ditch, the ditch profile will be restored to an optimal trapezoidal flow path, versus the existing eroded U-shaped flow path. Only two of the lateral gates may be replaced and most of the existing gates and features will remain intact. Safety features will also be added for public protection near the siphons and include safety cables, egress ladders, and warning signs.

From 1962 to 1964, the Florida Farmers Ditch underwent extensive remodeling, including re-alignments, which was sponsored by the BOR. The 1962-1964 remodeling of the Florida Farmers Ditch involved enlarging the canal system and installing new gates and laterals in association with the construction of Lemon Reservoir, whose purpose was to provide late season irrigation water for local farmers. Prior to the construction of Lemon Reservoir, irrigation water was available during the early season spring runoff from the Florida River when the river level was high. The construction of the reservoir and the canal enlargements enabled irrigation water to be conveyed throughout the growing season. All of the diversion gates, siphons, baffles, drop structures, and other features documented during the cultural resource inventory date to the 1962 to 1964 refurbishment and are under 50 years old. The current project area involves 14,463 linear ft of the existing canal and no new alignments are proposed. The work area for the project is 50 ft on either side of the existing canal centerline. Four staging areas totaling 10.66 acres will also be utilized during construction. No new access is proposed and access to the work areas will be from county roads and the ditch riders access road that parallels the canal throughout its length. The project area, or area of potential effect (APE), is approximately 43.86 acres (17.76 ha), which includes the canal work area and staging areas. The total area surveyed, which includes 50-foot buffers on either side of the canal work area, where feasible, is 77.06 acres (31.20 ha).

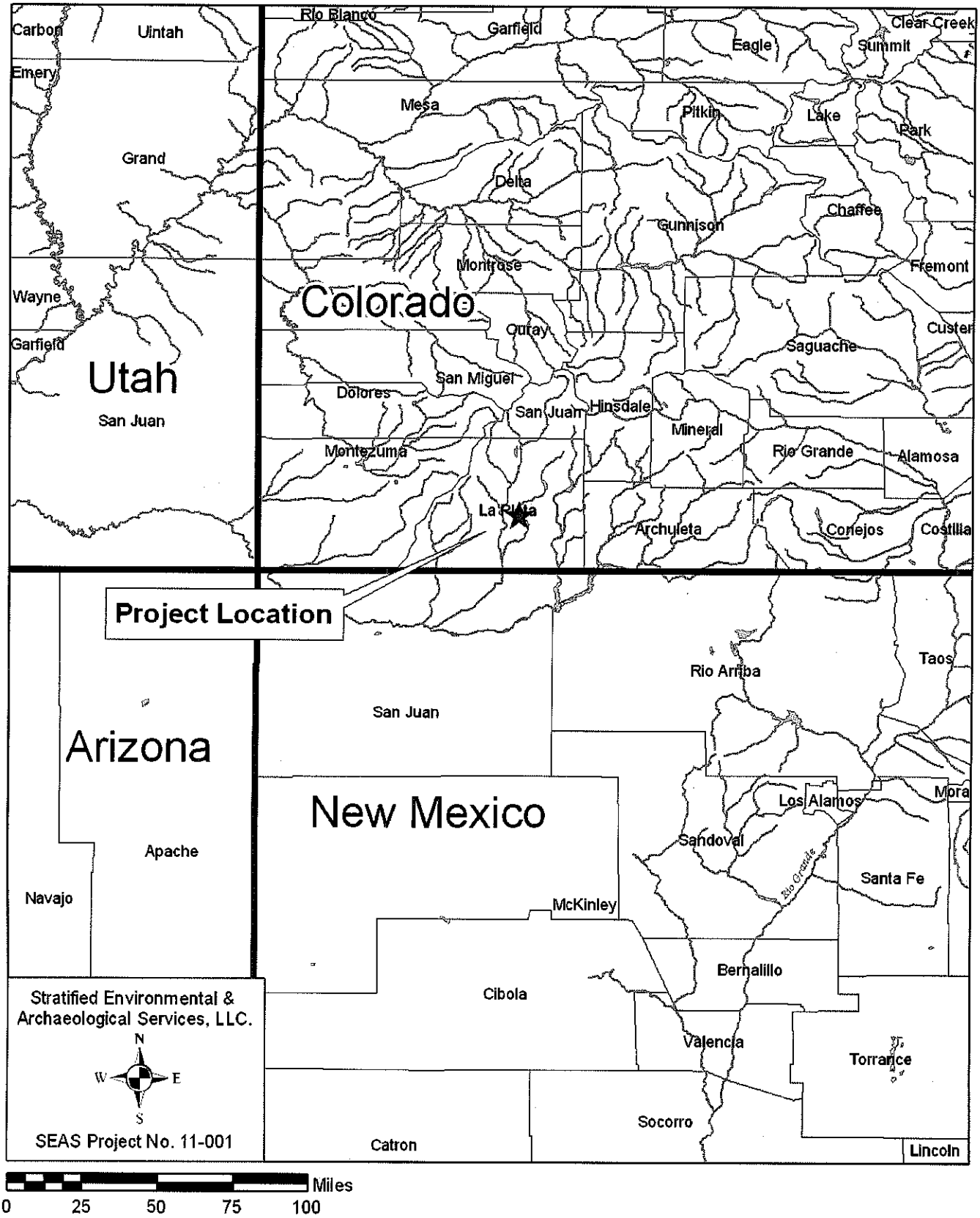

Figure 2.1 General Project Map

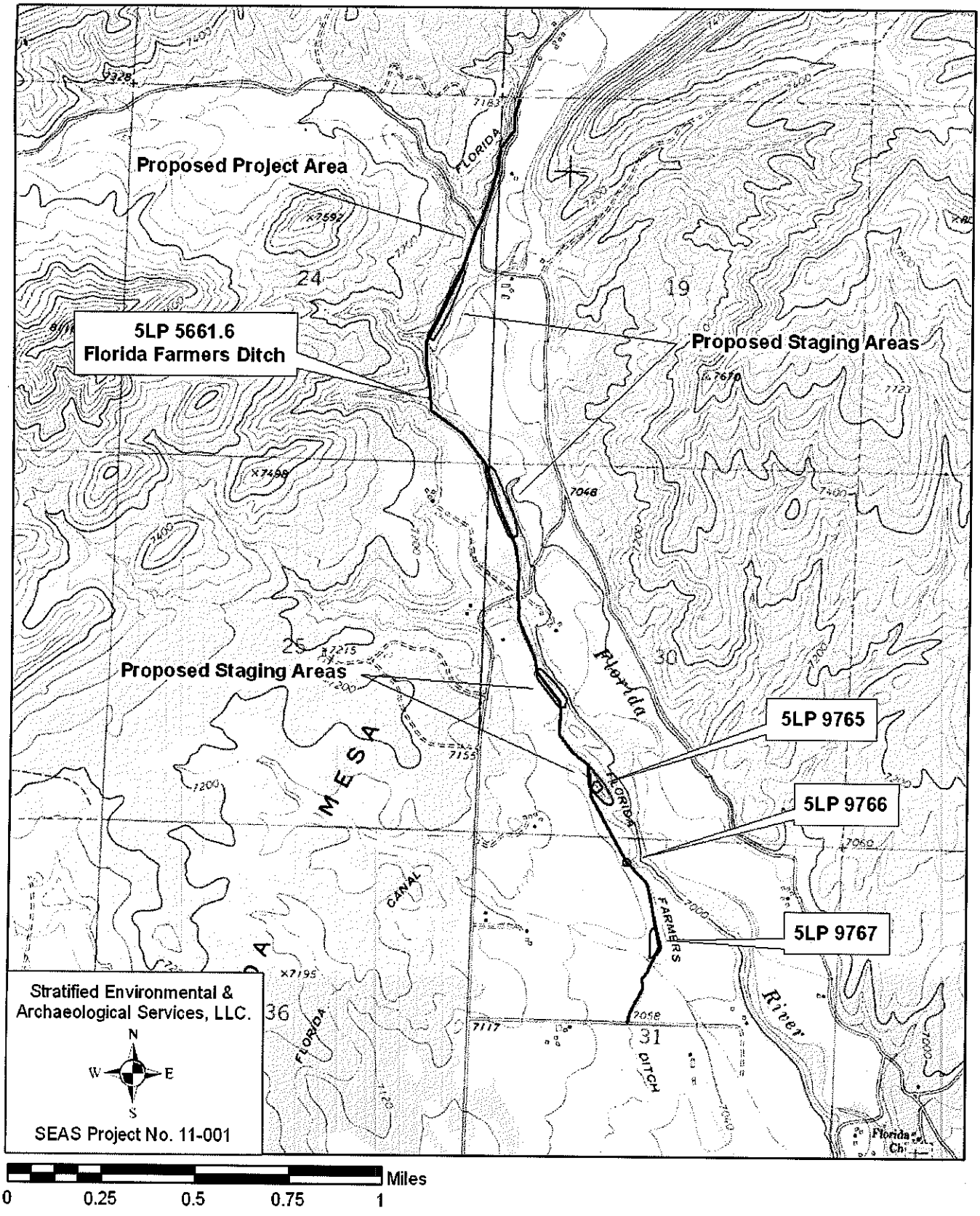

Figure 2.2 Project Location Map: Durango East, CO 1963 USGS 7.5' Series Quadrangle (1:24,000 Scale)

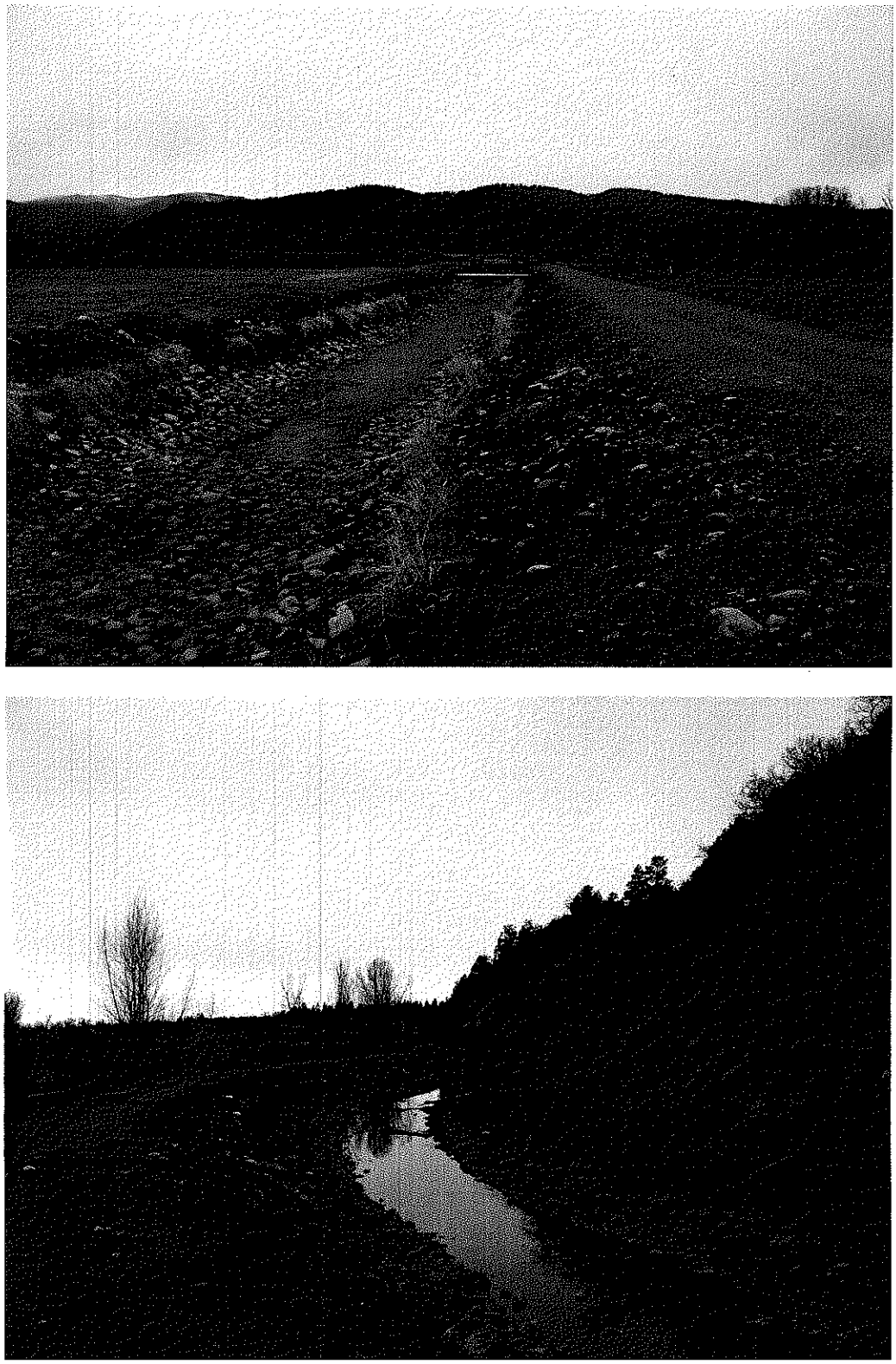

Figure 2.3 View North of Florida Farmers Ditch from South End of Project (Top) and View Southwest from North End of Project (Bottom)

Table 2.1 Project Area Information

Florida Mesa Canal Company's Proposed Lined Ditch Reach of the Florida Farmers Ditch	
Project Location	W/2, NW/4, NW/4 of Section 19, T35N, R8W, NMPM W/2, NW/4; W/2, SW/4; E/2, SE/4, SW/4 of Section 30, T35N, R8W, NMPM E/2, NW/4; NW/4, SW/4, NE/4 of Section 31, T35N, R8W, NMPM E/2, NE/4; E/2, SE/4 of Section 24, T35N, R9W, NMPM NE/4, NE/4, NE/4 of Section 25, T35N, R9W, NMPM Private Lands in La Plata County, CO
USGS Quadrangle 7.5' Map	Durango East, CO 1963; USGS Map Code 37107-C7-TF-024
Project Dimensions	14,463 ft x 100 ft (33.20 acres) Four irregular-shaped staging areas totaling 10.66 acres
Total Area of Potential Effect (includes the four staging areas)	43.86 acres (17.76 ha)
Total Area Surveyed (includes canal 50-foot buffer zone)	77.06 acres (31.20 ha)

3.0 Environmental Setting

Elevation in the project area ranges from approximately 7,060 ft (2,152 m) to 7,160 ft (2,182 m) above mean sea level (amsl). The project occurs on the west side of the Florida River and the watershed drains the southern San Juan Mountains between the Animas River Basin to the west and the Los Piños River Basin to the east. The Florida River is a major tributary of the Animas River, which empties into the San Juan River of the Southern Colorado River Basin in Farmington, New Mexico. The nearest settlement for which historical climate records are available is from Durango (Station 052441) for the period 1991 to 2010 (WRCC 2011). Table 3.1 summarizes climatic data from the station. Average annual maximum temperature at the Durango Water Resources climate station is 63.4° F and average annual minimum temperature is 33.8° F for the same period. The killing frost-free growing season lasts from 110 to 130 days. Average annual total precipitation is 20.96 inches and average total snowfall is 65.0 inches, with a pattern of annual bimodal precipitation. May and June are the driest months of the year, from 0.57 inches in June to 1.16 inches in May. August to October is the wettest period, ranging from 2.02 inches in October to 2.81 inches in August. A less pronounced peak in precipitation occurs from December to February. The peak of precipitation from August through October is primarily the result of late afternoon to evening, convective thunderstorms characteristic of the monsoon season, when moisture pumps into the Southwest along the western edge of the Bermuda High from the Gulf of Mexico (Sellers and Hill

Table 3.1 Weather Data at the Ignacio 1 N, Colorado Climate Station from 1948 to 1993 (Station 054250)

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temp. (F°)	38.8	44.6	52.1	62.2	71.9	82.9	87.5	84.7	77.5	66.1	51.4	41.8	63.4
Minimum Temp. (F°)	7.1	12.7	20.6	26.6	33.7	41.1	49.4	47.7	39.4	29.9	19.5	10.5	28.2
Total Precip. (in)	1.3	0.98	1.14	0.91	0.90	0.53	1.41	1.69	1.42	1.5	1.06	1.17	14.02
Total Snowfall (in)	9.5	6.2	4.0	1.2	0.1	0	0	0	0	0.3	1.4	6.2	28.9

1974: 10-14; Gillespie 1985: 14-15). Regionally, the amount and intensity of precipitation delivered at any given locale is highly influenced by elevation and geographic setting.

Surface geology in the project area consists of tilted Cretaceous sedimentary beds of Kirtland Shale/Fruitland Formation (shale sandstone, and coal) and Pictured Cliffs/Lewis Shale at the far north end of the project. To the south lies ancient alluvium deposits of Pliocene and Pleistocene age, mixed with patches of Holcene alluvium within the lower river valley (Twedo 1979; Aubrey 1991). Soils in the project area are primarily classified as Falfa clay loam and Ustic Torriorthents-Ustollic Haplagids complex (12 to 60 percent slopes). The Falfa clay loam is comprised of deep and well-drained calcareous loess. Falfa clay loam characteristics include a high water retention capacity, slow permeability, the runoff rate is medium, and poses a moderate hazard of erosion. The Ustic Torriorthents-Ustollic Haplargids complex is derived from glacial outwash (Ustic-Torriorthents) and alluvium (Ustollic Haplargids). The soils are deep, well-drained to excessively drained, and characterized by variable permeability, low water retention capacity, rapid runoff rate, and a high hazard of water erosion (Pannell 1981: 33-34, 67-68). It is these latter soils and associated excessive draining that necessitates the lining of the Florida Farmers Ditch for water conservation.

Ground visibility ranges from approximately 40 to 90 percent. Much of the project area has been previously disturbed by agriculture and canal construction/maintenance activities. Dominant plant species in the project area include bluestem wheatgrass, Western wheatgrass, crested wheatgrass, smooth brome, broom snakeweed, Gambel oak, ponderosa pine, Rocky Mountain juniper, rabbitbrush, yellow sweetclover, cranesbill, meadow timothy, reed canarygrass, water sedge, cattails, wire rush, foxtail barley, and redtop bentgrass.

4.0 Cultural Overview and Previous Investigations

4.1 Cultural Overview

Through time and space the Four Corners region has been occupied by a rich and diverse array of cultural traditions including Paleo-Indian, Archaic, Ancestral Pueblo, Navajo, Ute, and European Americans. The project area occurs within the Animas Drainage Unit of the Southern Colorado River Basin. The cultural histories of the Animas and adjacent Upper San Juan-Piedra and La Plata Drainage Units are quite similar, although with some notable distinctions. The following comparative percentages reflect data current only up to 1999. Documented Paleo-Indian components are completely lacking within the Animas and La Plata Drainage Units, while only one Paleo-Indian component has been identified in the USJP Drainage Unit (0.1 percent of identified components). The Archaic period is more substantial, with 12.8 percent of identified components attributed to the Archaic in the La Plata, 7.3 percent in the Animas, and 4.5 in the USJP Drainage Units (Lipe 1999: 406).

The primary difference between the eastern drainage units in the Southern Colorado River Basin is the presence of a large Pueblo II (PII) occupation near Chimney Rock in the USJP Drainage Unit, which is lacking in the La Plata and Animas Drainage Units. While 23.2 percent of identifiable components in the USJP are attributed to the PII period, only 13.6 percent in the La Plata Drainage Unit, and only 4 percent of identifiable components in the Animas Drainage Unit have been designated PII affiliation. By Pueblo III (PIII) period times, survey data from all three drainages suggests a steep or continual decline in occupation with only 2.5 percent in the La Plata, 1.6 percent in the USJP, and 1.4 percent in the Animas Drainage Units of identifiable components attributable to the PIII period. The La Plata and Animas Drainage Units appear to have had a more substantial Basketmaker III (BMIII) occupation, while the Pueblo I (PI) period occupation in the USJP spikes. Of identifiable components in each drainage unit, 21.5 percent in the La Plata and 35 percent are BMIII in the Animas, while only 9.6 percent are considered BMIII in the USJP. In the La Plata Drainage Unit, 24.4 percent of components were identified as being of PI affiliation. In the Animas Drainage Unit, 34.4 percent are identified as PI, while 46.8 percent are classified as PI in the USJP. This difference between the drainage units may be due more to the nature of the archaeological remains as the vast majority of BMIII and PI sites in the Animas drainage are of a transitional nature, having components with mixed traits from both periods. The Animas Drainage Unit has evidence of a modest Basketmaker II (BMII) occupation as well (8.3 percent of identified components), while the Basketmaker II (BMII) period occupation appears less substantial in the USJP (1.9 percent of identified components) and La Plata (6.2 percent of identified components) Drainage Units (Lipe 1999: 406).

Following the abandonment of the region by Ancestral Pueblo peoples by ca. AD 1280 to 1300, possibly after AD 1400, Numic (Ute and Paiute) and Athabaskan (Navajo and Apache) peoples began to migrate into the Four Corners region, though the timing and nature of these migrations are not fully understood. Of the eastern drainage units, the post-pueblo occupation is more substantial in the La Plata Drainage Unit, with 19 percent of identified components attributed to this period, as compared to 9.7 percent in the Animas and 12.3 percent in the USJP Drainage Units.

4.1.1 Paleo-Indian

Paleo-Indian occupation of the region occurred at the termination of the Pleistocene (ca. 12,000 to 8,000 B.C.). Archaeological evidence suggests that these peoples had developed a highly specialized and

mobile subsistence strategy focused on large, Pleistocene megafauna. Archaeological remains of these cultures typically contain spear points in association with bones of the extinct megafauna and other game. Paleo-Indian sites do not appear to be abundant in the region, although this may be due to the lack of diagnostic artifacts on surface scatters. Paleo-Indian sites have been reported from the Arroyo Cuervo region, San Juan Mountains, and Chaco Canyon areas (York 1990; Hayes et al. 1981; Irwin-Williams 1973). Paleo-Indian components have not been identified in either the Animas or La Plata Drainage Units and only one is reported for the USJP Drainage Unit (Lipe 1999: 406).

4.1.2 Archaic

The Archaic period (ca. 8,000 to 2,000 B.P.) is characterized by a period in which subsistence systems became more generalized, probably in response to demographic trends and extinction of the Pleistocene megafauna. Subsistence strategies included a wide variety of resources, such as small game, birds, fish, and plants. A technological shift accompanied the focus on a wider variety of resources, reflecting the processing and storage techniques required for the subsistence change. Irwin-Williams (1979) defined the Oshara Tradition of the Northern Southwest through a series of phases, including the Jay, Bajada, San Jose, Armijo, and En Medio. These sites are generally distinguished by dart point and other artifact style changes, reflecting gradual technological and demographic shifts with decreasing mobility through time. As stated earlier, 7.3 percent of identified components in the Animas Drainage Unit are designated as Archaic. The lack of local excavation data with well-dated occupations, which is particularly lacking in the Southern Colorado River Basin, makes it difficult to identify common trends in the area. The appearance of maize in the Southern Colorado River Basin of Colorado by ca. 400 B.C. ushered in a transition to the more sedentary lifestyle of the Ancestral Pueblo Tradition, though the rate of this change appears to have varied considerably throughout the Four Corners region (Lipe and Pitblado 1999: 130).

4.1.3 Ancestral Pueblo Tradition

The project area occurs within the Upper San Juan Branch of the Ancestral Pueblo, based primarily on pottery types with predominantly crushed rock and sand temper.

4.1.3.1 Basketmaker II Period (The Los Piños Phase)

Several BMII period Ancestral Pueblo sites have been excavated within the Animas Drainage Unit, including the well known and documented Talus Village and Falls Creek sites. The remarkable preservation at these sites enabled Morris and Burgh (1954:75-78) to characterize the assemblage of these BMII sites as having expanding-stem and corner-notched dart points, horseshoe-shaped deep basin metates, one and two-hand manos, numerous cores, hammerstones, and choppers. They also documented the first appearance of cultivated corn and squash, tubular stone pipes, expanding-stem and spindle drills, sandals made of cross-woven yucca fibers, plaited rush stems, leather and close-coiled basketry. The structures tend to be shallow pithouses, some with a second chamber, which foreshadows the formalization of the antechamber in later Basketmaker III pithouses. Lipe (1999:152) notes that the general inability to confirm the presence of BMII and Archaic sites from surface manifestations precludes the recognition of a region-wide settlement pattern in lieu of more data.

For the Upper San Juan Branch, the Los Piños phase corresponds with the Basketmaker II period (ca. A.D. 1 to 400). Habitation sites are characterized by shallow, circular to ovular pithouses with a cribbed roofing system, oftentimes accompanied by a cobble apron around the perimeter. This phase, as originally defined by Dittert et al. (1963), was thought to mark the introduction of maize agriculture in the region, though subsequent work suggests the cultivation of maize began by 400 B.C. (e.g., see Sesler and

Hovesak 2002). The appearance of large extramural storage cists during this phase suggests food surpluses were generated. Other feature types include hearths, pit ovens, and occasional cairns, which sometimes mark human burials. Crude, brownware pottery can occur and may indicate a Mogollon affiliation or, conversely, the earliest local attempts at ceramic production in the Four Corners region. Eddy (1966: 472-473) notes that the center of the Los Piños phase site distribution may be near Bayfield, Colorado. In the Navajo Reservoir District, Los Piños phase sites tend to be located on low rises of Pleistocene cobble terraces overlooking river bottomlands. The shallow pitstructures tend to be distributed over sites in a random fashion, which probably housed nuclear families. The presence of an oversized structure at each village, as reported by Eddy (1966: 477-478), and the presence of red painted walls on one, suggest religious or community architecture was an established pattern early in the sequence. The greater proportion of hunting tools (points, knives, and scraper) as compared to the later phases indicates a greater reliance on hunting. Grinding equipment was relatively abundant during this period, suggesting a mixed subsistence economy based on hunting, gathering, and farming.

4.1.3.2 Basketmaker III Period (The Sambrito Phase)

The Basketmaker III (BMIII) period (AD 500-750) is well documented within both the La Plata and Animas drainage units. Wilshusen (1999a:184-185) notes that early BMIII sites are primarily concentrated in the area west of and including the La Plata Drainage Unit. Most of the BMIII remains in the Animas Drainage Unit occur rather late in the BMIII period and are usually defined as transitional BMIII-Pueblo I (PI) sites as they consistently post-date AD 750 and exhibit traits of both periods (p.184). Basketmaker III sites are generally 1-3 household habitations located in close proximity to arable lands and upland resources. The pithouses are typically dual-chambered, relatively shallow structures with a variety of food processing features. A series of shallow discontinuous rooms are usually placed in an arc north of the pithouse with a midden area to the south. This site pattern foreshadows the layout of the later Pueblo periods. Dependence on corn, beans and squash increases dramatically during the BMIII period. Pottery is, at this point, abundant and consists of plain gray to brown wares with some vessels exhibiting "stitched" basketry designs.

The Sambrito phase (ca. A.D. 400 to 700) of the Upper San Juan Branch is a Basketmaker III period manifestation characterized by deeper, single and dual chambered pithouses and a polished brownware (Sambrito Brown) ceramic assemblage. Eddy (1966: 478-479) notes that the new pottery type and the presence of ramp entries, ramp hallways, and antechambers in pithouses indicates that this under represented phase may have been influenced by Mogollon migrants far to the south. Settlements tend to be at the edge of river terraces, while surface structures and obvious middens are generally absent. A decrease in grinding implements is puzzling, though the previous basin metate type is replaced by the one-end closed trough metate. Dart points are absent during this phase and replaced by corner-notched arrow points. Sambrito Village was the only excavated site reported by Eddy (1966: 483) from the Sambrito phase that contained large intercommunity structures.

4.1.3.3 Pueblo I Period (Rosa and Piedra Phases)

The Pueblo I period (AD 750-900) habitation sites are well represented in the La Plata, USJP, and Animas Drainage Units. These sites are generally characterized by deep, single-chambered pitstructures with contiguous arching sets of jacal rooms placed to the north. Ceramics are typified by neck-banded graywares and white slipped decorated pottery, with some redwares. The period increasingly appears to

be one of rapid aggregation and development. Many of the village communities of this period rival the size and complexity of the more infamous masonry Pueblo III communities (Wilshusen 1999b:224-226). After AD 875, these large communities begin to fragment and it appears that populations may have dispersed and/or moved southward in response to environmental and cultural stresses.

The Rosa phase (ca. A.D. 700 to 850) of the Upper San Juan Branch is associated with the early Pueblo I period and marked by larger villages, a decline in storage cists in favor of aboveground, jacal storage room facilities, and a greater variety of ceramic types, including neck-banded, black-on-white, and redwares (Dittert et al. 1961). Stockading of settlements becomes common and pitstructures are deeper and larger. The greater frequency of sites and surface structures at habitations, including areas of new colonization, suggest the population was expanding. Settlements are still affiliated with river terraces, though colonization onto alluvial fans begins. In the Navajo Reservoir District, agriculture appears to be centered on floodplain farming, as during the preceding phases (Eddy 1966: 487). In the Fruitland project area, Rosa phase settlements are small (1 to 2 pitstructures), dispersed, and likewise are centered on perennial stream courses (Sesler and Hovesak 2002: 194). Trade increased during this period, including exotic lithic materials, Mesa Verde whiteware, San Juan redware, and marine shells. Open bowl forms of pottery appear for the first time. Projectiles points tend to decrease thru time and point types consist of side-notched, expanding stem, and triangular varieties. Scrapers are relatively abundant in the flaked lithic assemblages. A marked increase in ground stone artifacts suggests a greater reliance on farming than in previous phases. While larger pitstructures are apparent, large community structure types seem to be lacking as compared to earlier times (Eddy 1966: 490).

The Piedra phase is a late Pueblo I period manifestation (ca. A.D. 850 to 950). The period is characterized by notable demographic shifts, larger villages, and jacal architecture, further foreshadowing later Ancestral Pueblo settlement patterns. Ceramic variation from the previous period is minimal, with the exception of increased abundance of neckbanded wares (Dittert et al. 1961). Settlement patterns show a move away from the major river valleys, which culminated during the following Arboles phase. The move to the uplands during the Piedra phase was due to headward erosion of the river channel and subsequent and successive entrenchment of agricultural fields (Eddy 1966: 494). In addition, settlements during the Piedra phase became aggregated, with larger multi-household habitations occurring in more concentrated areas (Sesler and Hovesak 2002: 195). Contiguous sets of rooms appear for the first time, though village layout is still random and unorganized. Paved floors appear during the Piedra phase and probably represent storage rooms as interior features are lacking. The paved floors may have prevented food loss from burrowing rodents and decreased moisture contact with foods, which would have prevented loss through spoiling. Stockaded settlements become even more common and the higher ratio of incinerated houses may indicate increased warfare. Eddy (1966: 493) notes that ample evidence of cannibalism at Sambrito Village and burnt human skeletons within incinerated houses at Bancos Village is further evidence of increased strife. A decreased reliance on hunting and an increase in grinding equipment suggest the economy was increasingly dependent upon agriculture. Hoes appear for the first time and indicate a trend of increasing productivity and greater energy investments in agricultural plots.

Whalen (1981) suggests the origin of the roomblock, or pueblo, during the Pueblo I period is an adaptive reorientation from a hunting and gathering subsistence system with some food production to a system primarily sustained by food production. As the intensification of agriculture proceeds and becomes more labor intensive, the need for larger residential groups and permanent habitation sites rises in response to a complex scheduling of processing, storage, and preparation activities required to maintain the cultural

system. The pueblo, or roomblock, is interpreted to represent an architectural solution to the social consequences of agricultural intensification.

4.1.3.4 Pueblo II Period (The Arboles Phase)

The early Pueblo II (PII) period (AD 950-1050) is poorly understood. Sites dating to this period are few in number and have not been subject to extensive professional excavations, as have the more ubiquitous and formidable PI and late PII-PIII period sites (Lipe and Varien 1999: 253). With the exception of the Chimney Rock communities in the Piedra Drainage Unit, PII period sites in the eastern drainages, including both the La Plata and Animas Drainage Units, are lacking and tend to be limited to special activity areas rather than habitation sites. Pueblo II period sites seem to increase in frequency as one moves closer to the border with New Mexico in both the La Plata and Animas Drainage Units. Pueblo II sites are generally recognized by the appearance of corrugated grayware pottery and the introduction of horizontal-laid masonry architecture. Decorated wares are more elaborate and exotic pottery more frequent, suggesting trade networks were forming in the Four Corners region. As Eddy et al. (1984:73) note, the Animas Drainage Unit is largely abandoned by AD 800, while the La Plata Drainage Unit has both PII and PIII period sites present, but with a marked decreased in frequency compared to previous periods (p.66).

The Arboles phase (ca. AD 950 to 1050) marks the introduction of masonry architecture, corrugated pottery, and slipped pottery in the Upper San Juan region (Dittert et al. 1961). Pitstructures increase in size during this time, though there is a near absence of masonry-lined kivas, which is in contrast to the pattern seen throughout the remainder of the San Juan Basin. Paved floor rooms, recessed floor rooms, and masonry rooms are present in the Arboles Phase. Population density decreases throughout the phase and occupation of the area terminates by AD 1050. Settlement patterns show a continuing shift to the north, though far less concentrated than during the preceding Piedra phase. Trade decreases throughout the period. Environmental stress, repeated crop failures, and conflict during this period may have provoked migration out of the Upper San Juan region (Eddy 1966: 500-505).

The Gallina Ancestral Pueblo Branch is often assumed to represent a displaced outgrowth of early pueblo societies from the Upper San Juan Branch to the west. The work by Hall (1944) and Bahti (1949) identified a number of shared traits between the Upper San Juan Branch and the Gallina Branch, citing architectural traits such as ramadas, stratified adobe walls, contiguous sets of surface storage rooms, and patterning of fire pit and pit feature constellations. Other shared traits include miniature pottery, basket-impressed pottery, abundance of petrified wood tools, and small, stemmed, and side/basal-notched points. Parallels in mortuary practice were noted as well, whereby the deceased were placed on their backs with the knees drawn up. The move towards slightly higher elevations in the east, in the piedmont zone abutting the northern Jemez uplift, may have been a move towards more reliable monsoonal moisture and a movement away from hostile populations in the Four Corners region. Much of the Upper San Juan population may have formed the concentrated Ancestral Pueblo communities near Chimney Rock, which were eventually abandoned by AD 1175.

4.1.4 Navajo Tradition

Both Dinetah and Gobernador phase Navajo sites are present in the La Plata and Animas Drainage Units in low to moderate numbers (12.4 percent and 6.3 percent of identifiable components, respectively). These sites tend to increase with frequency south towards the New Mexico border, probably due to the presence of the Ute Indians in southern Colorado. Dittert (1958) initially defined the Dinetah phase as

occurring between ca. A.D. 1550 to 1692 and characterized the artifact assemblages as including Dinetah Gray sherds, but lacking Gobernador Polychrome pottery and other indications of later Puebloan influence. While Dittert's definition of the Dinetah phase has been criticized for a basis on negative traits, recent studies have confirmed the presence of a pre-Gobernador phase Navajo occupation in the San Juan Basin, possibly dating back to A.D. 1350 (Winter and Hogan 1992). Several early Navajo habitation sites were recently excavated in northwestern New Mexico that produced tree-ring samples from Navajo forked-stick hogans. The construction cutting dates from the pre-Gobernador phase sites cluster between A.D. 1541 and 1679 and the pottery assemblages are composed primarily of Dinetah Gray with only later intrusive Gobernador Polychrome sherds present (Brown 1996; Kearns 1996; Hancock 1997). The Gobernador phase (ca. 1692 to 1780) has historically been considered a period of intense interaction between Navajo and the Pueblos following the Pueblo Revolt of 1680, the campaign that successfully ousted the Spanish colonialists from New Mexico. The re-conquest of New Mexico in 1692 forced the abandonment of many pueblos, due to fear of Spanish reprisals. Many of the Rio Grande Pueblos sought refuge among the Hopi, Zuni, and Acoma Pueblos, as well as the Navajo of the Dinetah region (Hogan 1991; Dozier 1966). It was during this period that the Navajo probably adopted numerous Pueblo cultural elements, including polychrome pottery, intensive agricultural practices, masonry architecture, ceremonial elements, matrilineal and matrilocal descent, clan structure, Hero Twin stories, and origin legends (Powers and Johnson 1987: 5; Eddy et al 1984: 98; Hester 1962: 89). However, recent archaeological investigations in the Dinetah region strongly suggest that substantial contact and trade between these groups occurred prior to the re-conquest period (Sesler and Hovezak 2002: 201-203). Furthermore, new data suggests that pueblito architecture and settlements apparently post-date the Spanish re-conquest period and do not appear to be associated with Pueblo refugees. Tree-ring and other data strongly indicate that pueblito settlements are contemporaneous with the forked-stick hogan features in the general vicinity of these sites. The pueblitos were constructed from ca. 1710 to 1754, as established by tree-ring data, well after the Pueblo refugees had returned to their respective homelands following the re-establishment of Spanish colonial rule (Towner 2003). In light of recent archaeological evidence and historical accounts of that period, the pueblitos have been re-interpreted to represent defensive structures built by the Navajo in response to repeated raiding excursions by the formidable Capote Ute-Comanche alliance, which also wreaked havoc on the Spanish settlements of the Upper Rio Grande Valley and Chama Valley (Towner 2003). By ca. 1780, due to increased warfare with the Ute and their allies, the Navajo had abandoned the Dinétah region and moved to their present range south of the San Juan River and Largo Canyon. After the Treaty of Guadelupe Hildago was signed, conflicts between the United States and the Navajo arose, resulting in the removal of the Navajo from their homeland and containment at Fort Sumner from 1863 to 1868 (Van Valkenburgh 1938: 14-20). The Navajo were returned to their homeland following the treaty at Fort Sumner to a reservation of 3,500,000 acres and subsequent land acquisitions have restored the Navajo Nation to more than 15,000,000 acres (Kluckhohn and Leighton 1974: 43).

4.1.5 Ute Tradition

4.1.5.1 Ute Prehistory

The timing of the Ute Indian occupation of southwestern Colorado is less well understood than that of the Navajo. Sites that can be positively attributed to the Ute Indians are lacking, but are undoubtedly present. The non-recognition of Ute sites is probably due to the extreme mobility of the Ute Indians, particularly following the adoption of an equestrian lifestyle, and the correspondingly diffuse archaeological remains,

the lack of diagnostic artifacts attributable to southwestern Colorado Ute Indians, and the focus of professional archaeologists on the more recognizable Ancestral Pueblo sites. The Ute Indians were formed into at least seven bands at the time of historic contact. The Southern Ute Indians consist of three bands, including the Mouache and Capote bands, currently located on the Southern Ute Indian Reservation, and the Weeminuche band, currently located on the Ute Mountain Ute Indian Reservation. Historically, the Capote band inhabited the area east of the Continental Divide to the Sangre de Cristos, the San Luis valley, and as far south as Chama and Tierra Amarilla, New Mexico region. The Mouache band lived in areas east of the Culebra and Sangre de Cristo Mountains and from the Trinidad to Denver areas along the Front Range (Schroeder 1965:54). The Weeminuche band inhabited the region in southwestern Colorado west of the Continental Divide, to the Abajo Mountains and canyonland areas of southeastern Utah, and from the Uncompahgre River in the north to the San Juan River in the south (Park et al 1938: 632). The Weeminuche band, unlike the Capote and Mouache bands, often had amiable relationships with the Navajo Indians. The Weeminuche band was reported to be living among the Navajo near the Carrizo Mountains in 1818, and frequently participated in raiding excursions together. In 1833, Navajos were reported to be living among the Weeminuche in the vicinity of the La Plata River and Ute (Datil) Mountain (Schroeder 1965: 64). The peaceful interactions between the Navajo and Weeminuche and the likely adoption of cultural traits between the two groups has probably further obscured the ability of archaeologists to distinguish Ute and Navajo ethnicity from the non-perishable material culture of the archaeological record.

While less than 1 percent of sites surveyed and documented in southwestern Colorado have been assigned Numic affiliation, virtually none have been excavated (Wilshushen and Towner 1999: 367). At Talus Village north of Durango, several tree-ring samples yielded non-cutting dates ranging from A.D. 1447vv to 1559vv, and are probably of Ute affiliation and post date the earlier Basketmaker components for which the site is famous (Rayne 1997). Sites attributable to Utes are better documented in nearby west-central Colorado, where ample evidence suggests sites typified by scatters of brown ware and side-notched points are of Ute origin and date ca. A.D. 1100 to 1900 (Reed 1994).

4.1.5.2 Ute History

The earliest historical reference to the Ute Indians is in A.D. 1626, when the Jemez Pueblo Indians told the Spaniards the Ute visited the area prior to Spanish settlement in A.D. 1598. The Spanish waged war on the Ute between A.D. 1637 and 1641, for unknown reasons and 80 Ute Indians were captured and used as slave labor in Santa Fe. By 1670, following the Ute adoption of the horse and the rise of the tribe as a formidable force, the Spanish arranged their first treaty with the Ute (Schroeder 1965: 54). However, intermittent Ute raiding parties, particularly the Mouache and Comanche alliance, hampered the settlement of northern New Mexico and southern Colorado until the United States took control of the territory in 1848, after the Treaty of Guadalupe Hildalgo was signed with Mexico. However, conflicts with the Ute Indians apparently continued as the governor of New Mexico arranged the Treaties of Abiquiu with the Ute in 1855, whereby the Ute relinquished all territory in New Mexico with the exception of that area north of the San Juan River (Callaway et al 1986: 355). Due to increasing encroachment by Anglo and Hispanic settlers and subsequent conflicts with the Ute near Colorado City and the San Luis Valley, the Treaty of 1868 redefined the territory of the seven Ute bands and restricted them to the western third of Colorado. The Colorado Gold Rush began with the discovery of gold in the Colorado Springs and Denver area in 1859. By 1860, miners had found rich mineral deposits in the San Juan Mountains. Miners kept pouring into the region despite the Treaty of 1868 and by 1874, the United States had forced the Ute bands to sign another treaty, whittling the original Ute Reservation down to two

narrow strips of land along the Colorado-Utah and Colorado-New Mexico borders (Delaney 1974: 52-55). Following the Meeker Massacre of 1879, the Northern Ute bands were forced from Colorado to remote lands in eastern Utah and the Southern Ute lands were again reduced to a small strip of land along the Colorado-New Mexico border. In 1894, the Hunter Act was passed, leading to the privatization of Indian lands. The Weeminuche had not signed the treaty as had the Capote and Mouache bands, and the Weeminuche were eventually given the western half of the remaining reservation lands (Ute Mountain Ute Indian Reservation). The checkerboard of land ownership that resulted from private allotments of the Capote and Mouache land on the east half of the reservation (Southern Ute Indian Reservation) was partially restored in 1937, when previous land holdings of some 222,016 acres of the original 523,079 acres not allotted (and sold to European settlers at $1.25 an acre) were returned back to the Ute (Delaney 1975: 67-79).

4.1.6 European Tradition

By 1859, the presence of gold was confirmed in the mountains of Colorado. In 1861, miners had crossed the Continental Divide and entered the San Juan Mountains. Placer mining, a low investment technique based on exploiting surface gravel deposits with pans, shovels, picks, and sluice boxes, was the primary mining technique employed throughout most of the 1860s. Miners established Animas City, just north of present-day Durango in 1861, for processing gold from ore. By the late 1860s, high investment lode mining (underground) was established due to limited and dwindling placer mine deposits, which required heavy machinery, a large work force, transportation, and processing mills (Husband 1984: 20, 27). By 1874, stimulated by the mining activity, small communities at the gateways into the San Juan Mountains were springing up in Silverton, Lake City, Del Norte, Parrott City, and Animas City. The mining operations were in desperate need of mills, smelters, and efficient transportation, problems that were cured by the railroads. Due to disagreements with the inhabitants of Animas City, the Denver & Rio Grande (D&RG) railroad created the town of Durango in 1880 to use as a railroad hub, which was also strategically located near substantial coal deposits. By 1882, the D&RG linked Antonito in the San Luis Valley with Pagosa Springs, Durango, and Silverton. Within several months, the population of Durango swelled to 2,500 people and the town became a financial, business, and agricultural center that supported the regional mining operations. Gold had lured the miners into southwestern Colorado, but silver was the primary source of mineral wealth generated, with gold, copper, lead, and zinc recovered as by products. Silver mining was dealt a permanent and devastating blow throughout Colorado during the market crash and depression beginning in 1893 (Smith 1996: 234-246).

The need for substantial coal mining in the region was initiated by the expanding railroad system. The La Plata Coal Field, including parts of La Plata, Montezuma, Dolores, and San Miguel Counties, became developed during this period. Further economic stimulation came from the lode mining operations, which required a major fuel source for their extensive smelting needs. Coke oven operations soon appeared in Rico and Durango, followed by similar ventures in nearby Hesperus and Perins. By 1920, the value of coal production in the region surpassed that of mineral mining. A depression in coal related production occurred from 1923 to 1945 throughout the nation (Husband 1984: 41-42).

Also fueled by the mining rush, ranches and farms sprung up throughout the western valleys of Colorado during the late 1860s to early 1870s. The cattlemen practiced open range grazing and the industry boomed along with the towns they helped sustain. The first herds were Shorthorn cattle, but within a short period, more hardy Hereford cattle replaced them. The extremely harsh winter of 1885-1886 nearly

devastated the cattle industry, though it quickly bounced back. The inevitable end of open range grazing began in 1891, when National Forest reserves were created, in part, to regulate grazing on public lands and to address watershed concerns. While the cattle industry experienced grave difficulties with farmers and their fences, as well as competition with Hispanic and Basque sheepherders, open range grazing did not end until 1934, when the Taylor Grazing Act protected unappropriated public lands. While many cattlemen turned to sheep herding during the cattle price depression prior to World War I, soon after World War II, the cattle and sheep markets both fell drastically and the industry never fully recovered (Husband 1984: 71-72). Cattle and sheep are still raised on many farms and ranches in rural portions of La Plata County, however, very few operations are completely dependent on livestock for income. Following World War II, the regional economy has become increasingly dependent on tourism and the energy extraction industry, primarily oil and natural gas production.

4.2 Research Design

The project was designed to determine if any sites eligible, or potentially eligible, for nomination to the National Register of Historic Places (NRHP) are located within the project area and to formulate recommendations to ensure those cultural properties are not impacted by development activities. At a broader scale, the study will also enhance our general knowledge of sites within the region; to provide data that would be helpful in understanding the distribution of prehistoric and historic populations; types of organizational strategies utilized by these peoples; and to allow patterns postulated by researchers to be confirmed, rejected, or modified. Site density was expected to be moderate in the project vicinity given the disturbed context of the canal, record search results, proximity to the Florida River, and previous experience in the area.

4.3 Previous Investigations

SEAS conducted a records search on the Compass website, Colorado's on-line cultural resource database. According to the records search, nine previous projects have occurred within a one-half mile radius of the current project area. The cultural resource inventories were initiated for compliance projects, including oil and gas facilities, road improvement projects, land exchanges, and utility projects. Five previously recorded sites and 22 isolated finds have been recorded within a one-half mile radius of the project. The sites include a European American historic habitation (5LP 7073), an historic European American ore chute (5LP 1326), an unknown prehistoric open architectural site (5LP 7076), and two unknown prehistoric open camps (5LP 7074 and 5LP 7075). With the exception of the ore chute, the previously recorded sites are officially considered NRHP-eligible cultural properties. None of the previously recorded sites occur within the project area or buffer zones and will not be affected. However, a previously unrecorded segment of a previously recorded linear site, the Florida Farmers Ditch (5LP 5561), is the subject of the project and is described below in Section 5.

4.4 Methodology and Definitions

The project area and buffer zones were inspected by walking parallel transects spaced no more than 15 meters apart to cover 100 percent of the proposed project area. The project area, or APE, is approximately 43.86 acres (17.76 ha), which includes the canal work area and staging areas. The total area surveyed, which includes 50-foot buffers on either side of the canal work area, where feasible, is approximately 77.06 acres (31.20 ha). For this inventory, a site was defined as any manifestation of past

human activity consisting of a feature and /or 10 or more artifacts. An isolated find is defined as one to nine artifacts in a definable space not associated with a feature or structure, typically representing an expedient activity. However, site and IF definitions are guidelines only. All cultural manifestations are individually evaluated for data potential.

All field notes, maps, photographs, and inventory documents are on file at the SEAS office west of Ignacio, Colorado. Sites are mapped, photographed, and site forms completed. Artifact inventory forms are completed with exact counts for artifact classes up to 100 items. For sites with more than 100 artifacts in any artifact class, inventories may include 100 or more items per artifact class, until the nature of the assemblage has been adequately characterized. A primary flake is defined as having 100 percent cortex on the dorsal surface; a secondary flake is defined as having 1 to 99 percent cortex on the dorsal surface; a tertiary flake is defined as having no cortex on the dorsal surface. Bifacial thinning flakes are recognized by faceted, retouched, or lipped platforms, diffuse bulbs, thin cross sections, multiple flake scars paralleling the dorsal surface margin, and eraillures. Pressure flakes are small (less than 1 cm), thin, and usually non-cortical with a high frequency of collapsed platforms. Many non-cortical flake fragments occur in the artifact assemblages in which the flake type is not apparent. These flakes were assigned as indeterminate flakes, though the vast majority originated during late stage core reduction or tool manufacturing processes. Hammerstones are generally large chunks or cobbles and recognized by battering wear on edges, which is often seen on cores (core/ hammer stone). Utilized flakes are unshaped and exhibit retouch or wear patterns on one or more edges and were evidently used for expedient purposes. Retouched edges or use wear patterns would have to be visually obvious in the field without magnification to be assigned to the utilized flake category. Flaked lithic tools include both informal tools, such as cores, utilized flakes, or hammer stones, and formal tools in which purposeful shaping is evident, such as scrapers, bifaces, projectile points, drills, knives, or choppers.

Features, diagnostic points, or any other unique attributes of the site, are measured, photographed, drawn, and described. Small to medium-sized sites are generally mapped at a one-inch equals 20 meters scale and plotted in relationship to existing and proposed infrastructure, and local topography. All site boundaries and site datums are recorded to sub-meter accuracy with GPS equipment. For this project, a Trimble Geo XT Pocket PC with TerraSync software was utilized to record location data. Site dimensions and areas were calculated from the GPS data. From March 11 to 20, 2011, SEAS archaeologists Geoff Thompson, Paula Fluder, Jamie Karlson, and Doug Loebig conducted the cultural resource inventory.

5.0 Survey Results

Three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767) and one newly recorded segment of a previously recorded linear site (5LP 5661.6) were encountered and documented during the course of the cultural resource inventory. Table 5.1 summarizes site types, cultural/temporal affiliations, and NRHP eligibility recommendations.

Table 5.1 Site Summary Table (SEAS Project No. 11-013)

Colorado Site No.	Temporary SEAS Site No.	Cultural Affiliation	Site Type	NRHP Evaluation
5LP 5661.6	SEAS 11-001-04	European American	Historic Canal (Florida Farmers Ditch, 1923 to present)	NRHP-Not Eligible
5LP 9765	SEAS 11-001-01	Ancestral Pueblo, late Pueblo I period (Piedra phase, AD 850-950)	Artifact scatter	NRHP-Potenially Eligible (Need Data), Criterion D
5LP 9766	SEAS 11-001-02	Unknown historic	Culturally modified ponderosa pine tree	NRHP-Potentially Eligible (Need Data), Criterion D
5LP 9767	SEAS 11-001-03	Ancestral Pueblo, late Pueblo I period (Piedra phase, AD 850-950)	Habitation	NRHP-Eligible, Criterion D

5.1 Previously Recorded Sites

5.1.1 Site 5LP 5661.6

Site Number: 5LP 5661.6 (SEAS 11-001-04)
USGS Map: Durango East 1963, USGS Map Code 37-107-TF-024
Land Ownership: Private Lands
Legal Location: W/2, NW/4 of Section 19, Township 35 North, Range 8 West, and E/2, NE/4 and E/2 SE/4 of Section 24, Township 35 North, Range 9 West, and NE/4, NE/4, NE/4 of Section 25, Township 35 North, Range 9 West, NMPM and W/2, NW/4 and W/2, SW/4 and E/2, SE/4, SW/4 of Section 30, Township 35 North, Range 8 West, NMPM and E/2, NW/4 and NW/4, SW/4, NE/4 of Section 31 Township 35 North, Range 8 West, NMPM
Datum UTM Coordinates: Zone 13; N 4130998 m, E 252254 m, (NAD 27)
Zone 13; N 4131204 m, E 252205 m, (NAD 83) @ North End,
Zone 13; N 4127020 m, E 252811 m, (NAD 27)
Zone 13; N 4127226 m, E 252762 m, (NAD 83) @ South End,
Site Type: Irrigation Canal (Florida Farmers Ditch)
Cultural Affiliation: European American (1923 to present, remodeled with realignments from 1962 to 1964)

Site Dimensions and Area:	14,463 ft (4,408 m) x 25 ft (7.62 m); 361,575 ft² (33,589 m²)/ 8.03 acres (3.36 ha)

Site Description:

From 7,060 ft (2,152 m) to 7,160 ft (2,182 m) amsl, site segment 5LP 5661.6 is located on the west side of the Florida River Valley. On the north side, the ditch segment cuts into the lower steep slope that forms the valley side and eventually tops out on Florida Mesa on the south side. The aspect is primarily northeast to east and slopes range from 0 to 60 degrees. The soils vary considerably but consist of coarse gravelly and cobbly loam alluvium and glacial outwash on the north end (Ustic Torriorthents-Ustollic Haplargids complex) to clay loam calcareous loess on the south end (Falfa clay loam). Vegetation covers approximately 40 to 90 percent of the ground surface. Plant communities along the canal consist of conifer woodlands, irrigated farmlands, and a wetland fringe community along the inner banks of the canal. Dominant plant species along the segment include ponderosa pine, Colorado piñon pine, Gambel oak, Rocky Mountain juniper, smooth brome, cranesbill, heath aster, various wheatgrasses, meadow timothy, reed canarygrass, water sedge, narrowleaf cottonwood, sandbar willow, wire rush, common spikerush, and yellow sweetclover. Major disturbance sources include annual maintenance and cleaning activities with a track hoe, and water erosion. Site segment 5LP 5661.6 measures 14,463 ft (4,408 m) by an average of 25 ft (7.62 m) wide, with an area of 361,575 ft² (33,589 m²) or 8.03 acres (3.36 ha).

Five segments of site 5LP 5661, the Florida Farmers Ditch, have been previously recorded for Colorado Department of Transportation (CDOT) projects (Eckhardt et al. 2000) and for a major Tri-State Generation and Transmission power line (Fetterman and Honeycutt 2007). The three segments recorded for CDOT projects (5LP 5661.1, 5LP 5661.2, and 5LP 5661.3) were field recommended NRHP-eligible (Eckhardt et al. 2000) and the two segments recorded during the transmission project (5LP 5661.4 and 5LP 5661.5) were field recommended NRHP-eligible in 2006 (Fetterman and Honeycutt 2007) but officially determined NRHP-not eligible in 2008.

Site segment 5LP 5661.6 is on the northern portion of the historic Florida Farmers Ditch (Figures 5.1 to 5.7). The northern end of site segment 5LP 5661.6 lies 900 ft west of the Farmers Ditch Diversion Dam on the Florida River, which is not within the current project area. The Florida Farmers Ditch was first adjudicated in November of 1923 (Case No. CA1751) for 71 cfs. The water rights were enlarged 110 cfs (Case No. B-1751) in 1966, following the construction of Lemon Reservoir in 1963 and an enlargement of the canal system that occurred between 1962 to 1964. Currently, the absolute water rights for the Florida Farmers Ditch is 184.99 cfs. The Florida Farmers Ditch provides irrigation water for farms and ranches on the east side of Florida Mesa. Florida Mesa as a landform has exceptionally fertile soils, being covered with a thick mantle of loess. Prior to the construction of Lemon Reservoir, irrigation water was available following spring runoff when river levels were high and farmers often ran out of irrigation water by the middle of the growing season (FDC 2011). The Florida Project, which resulted in the construction of Lemon Reservoir and enlargement and refurbishing of the canal system, sought to provide late season irrigation water to area farms and ranches, including the Southern Ute Indian Tribe.

Feasibility studies for the Florida Project began in the 1930s by the BOR. The purpose of BOR involvement was to promote more efficient irrigation practices and provide a more reliable water supply for area farms and ranches. The Florida Project was authorized as a participating project of the Colorado

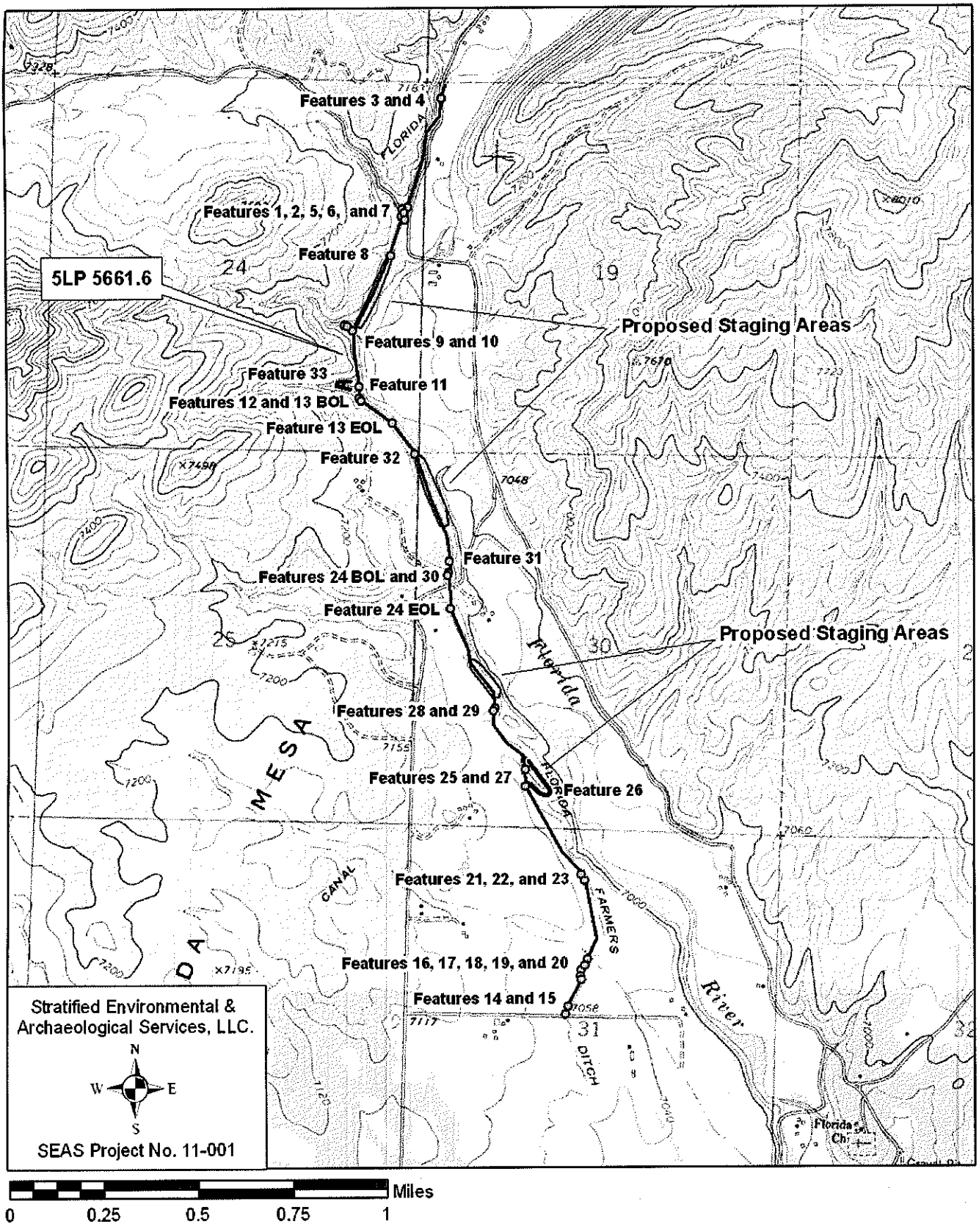

Figure 5.1 Site Plan Map, 5LP 5661.6

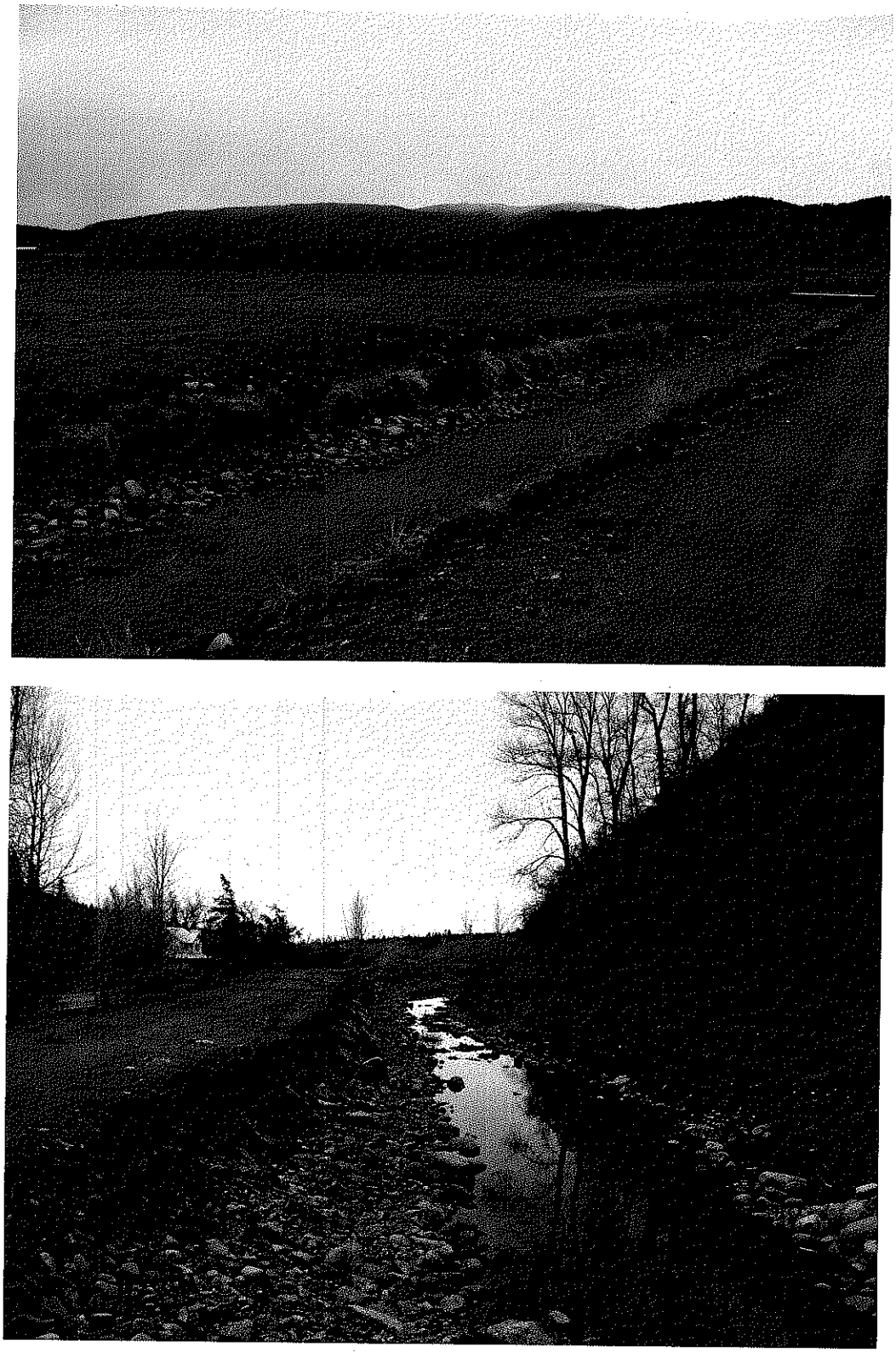

Figure 5.2 Overviews of Site Segment 5LP5661.6 Facing North Near South End (Top) and View South Near North End (Bottom)

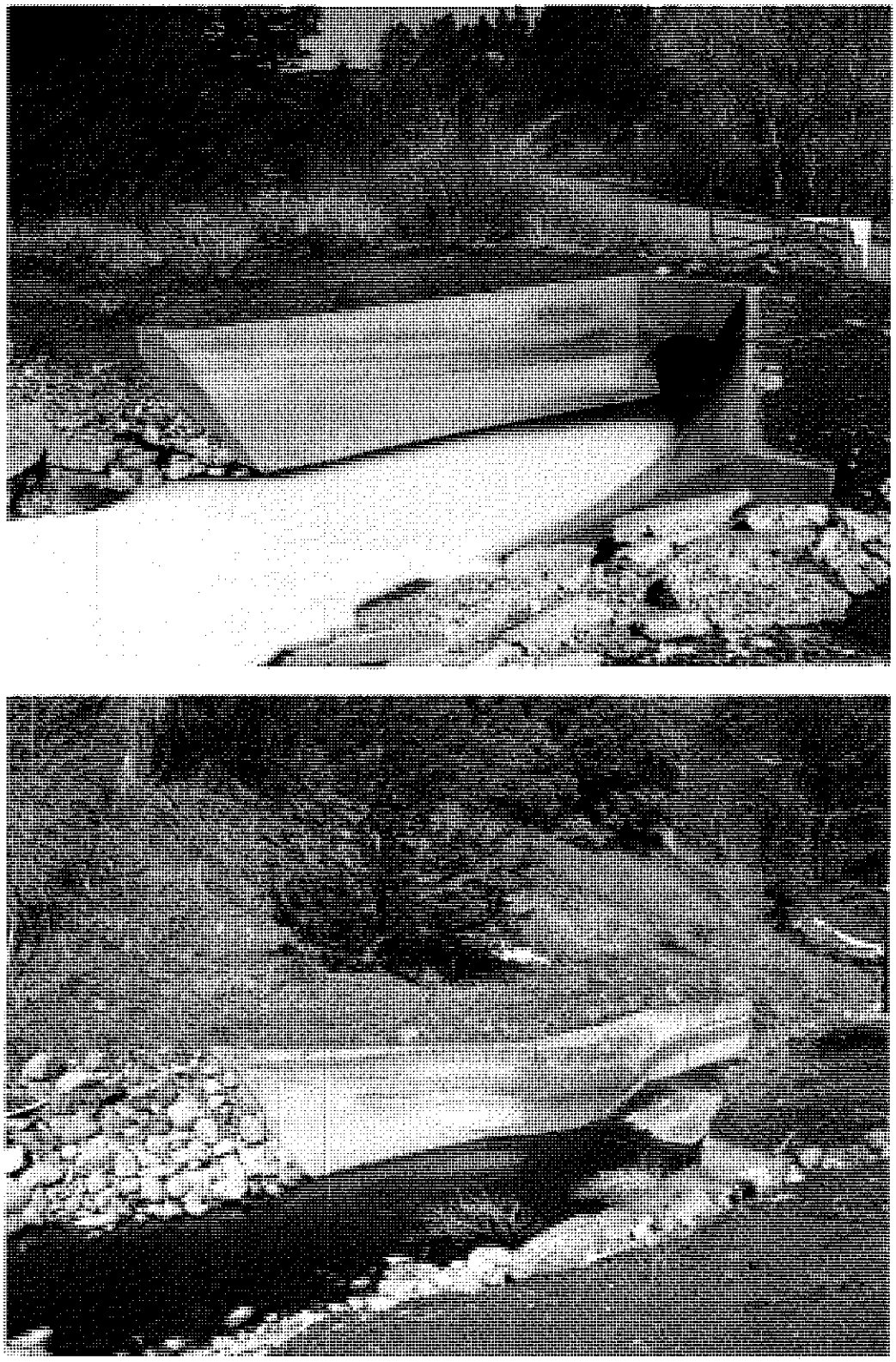

Figure 5.3 View Northwest Towards Feature 1 Siphon (Top) and View Northwest Towards Feature 3 Drop Structure (Bottom), Site Segment 5LP 5661.6

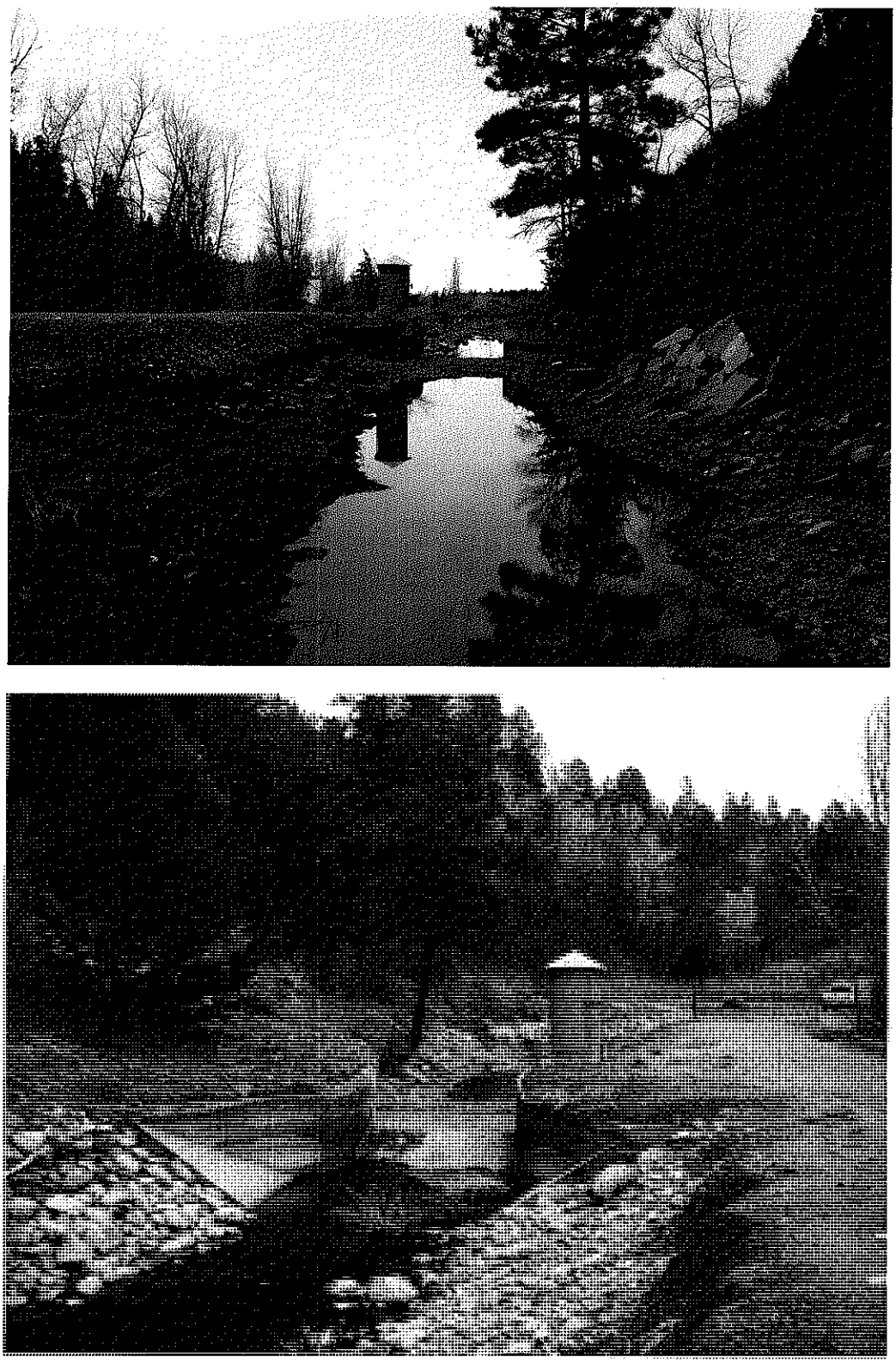

Figure 5.4 View of Feature 3 Drop Structure and Feature 4 Flow Gauge Housing Facing South (Top) and North (Bottom), Site 5LP 5661.6

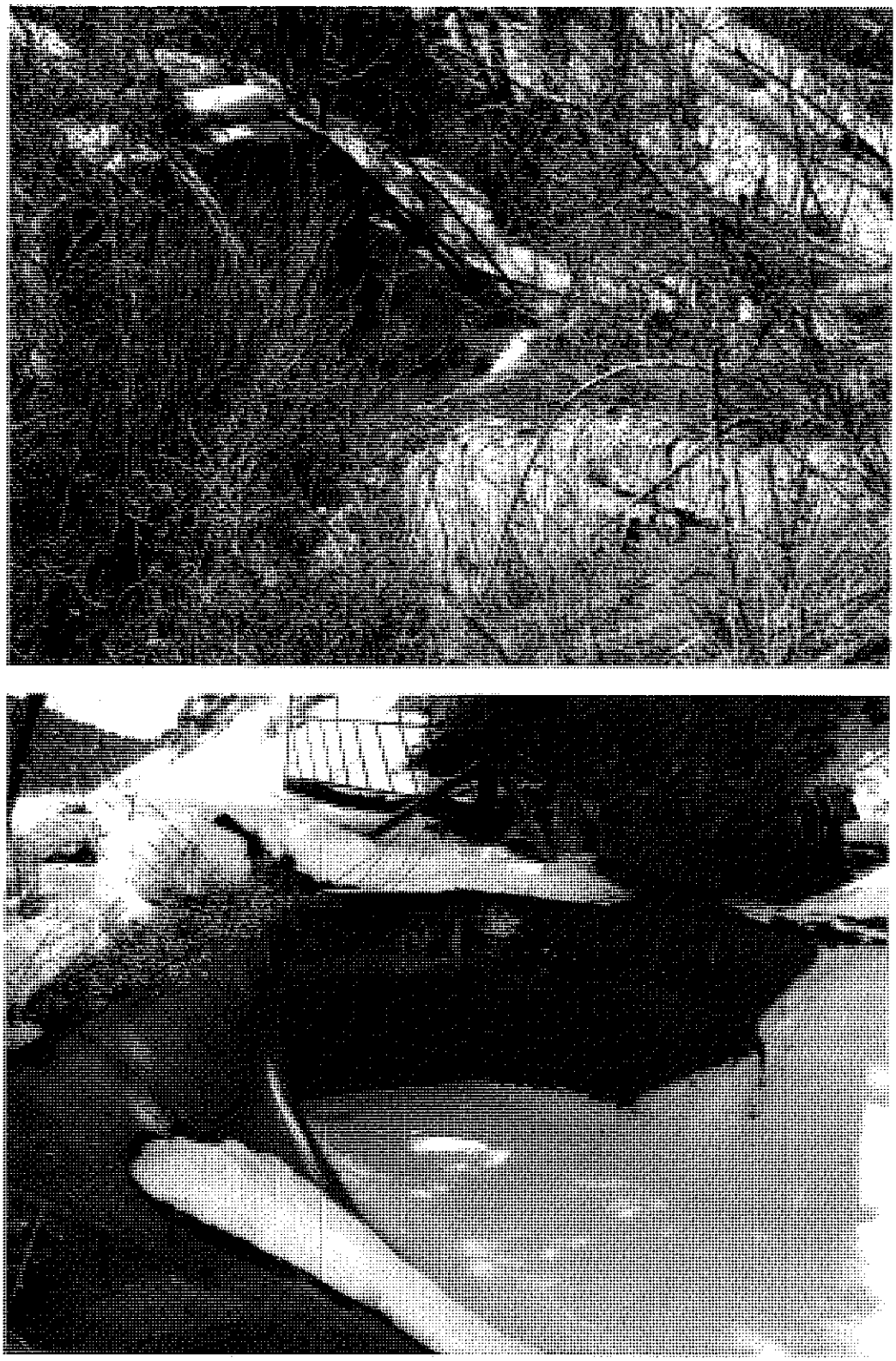

Figure 5.5 View Southwest of Feature 10, Flume Abutments from 1923 Canal (Top) and View South of Feature 13, North Tunnel Opening (Bottom), Site 5LP 5661.6

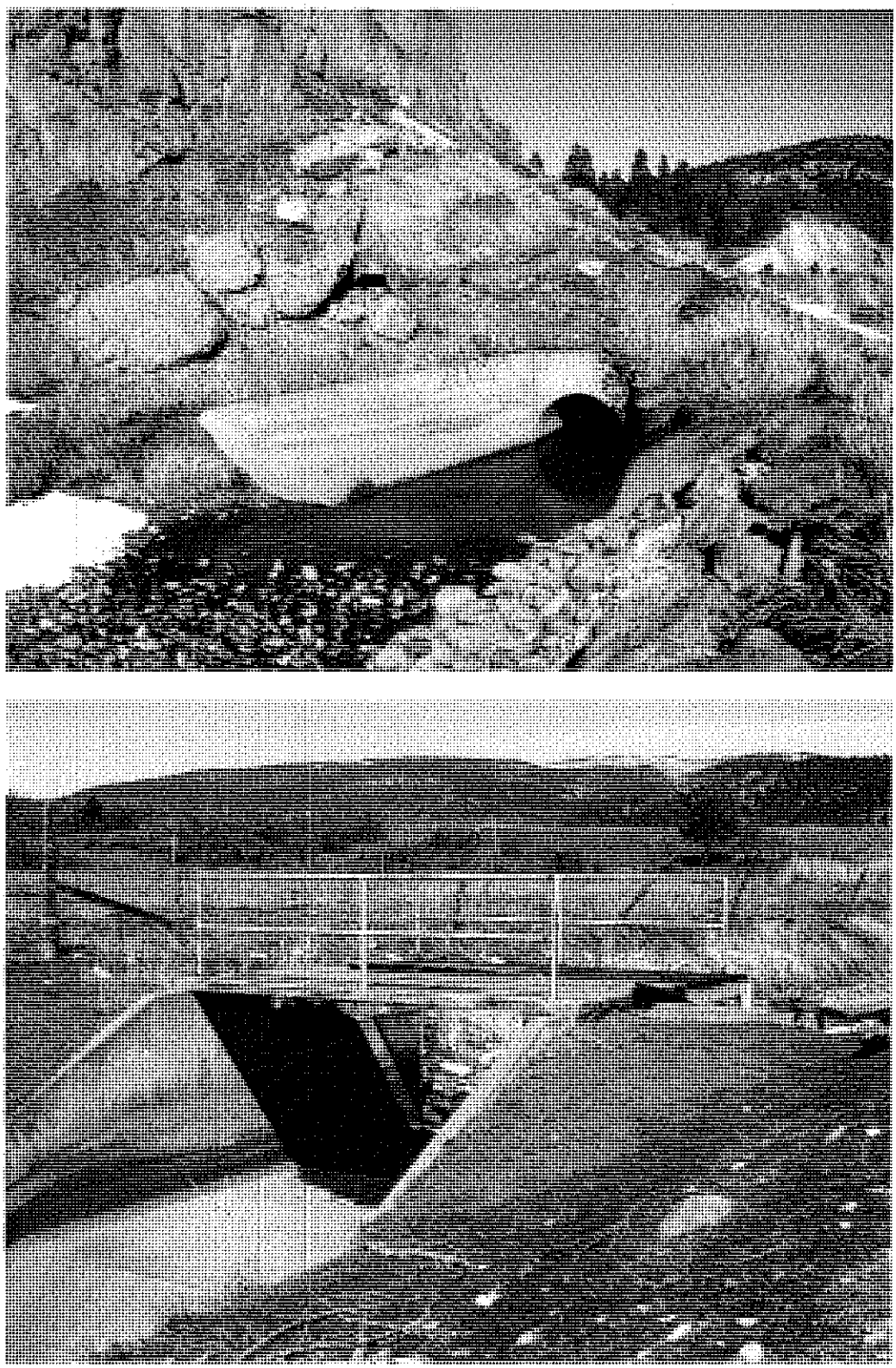

Figure 5.6 View Northwest of Feature 13 Southeast Opening (Top) and View Northeast of Feature 17, Drop Structure (Bottom), Site 5LP 5661.6

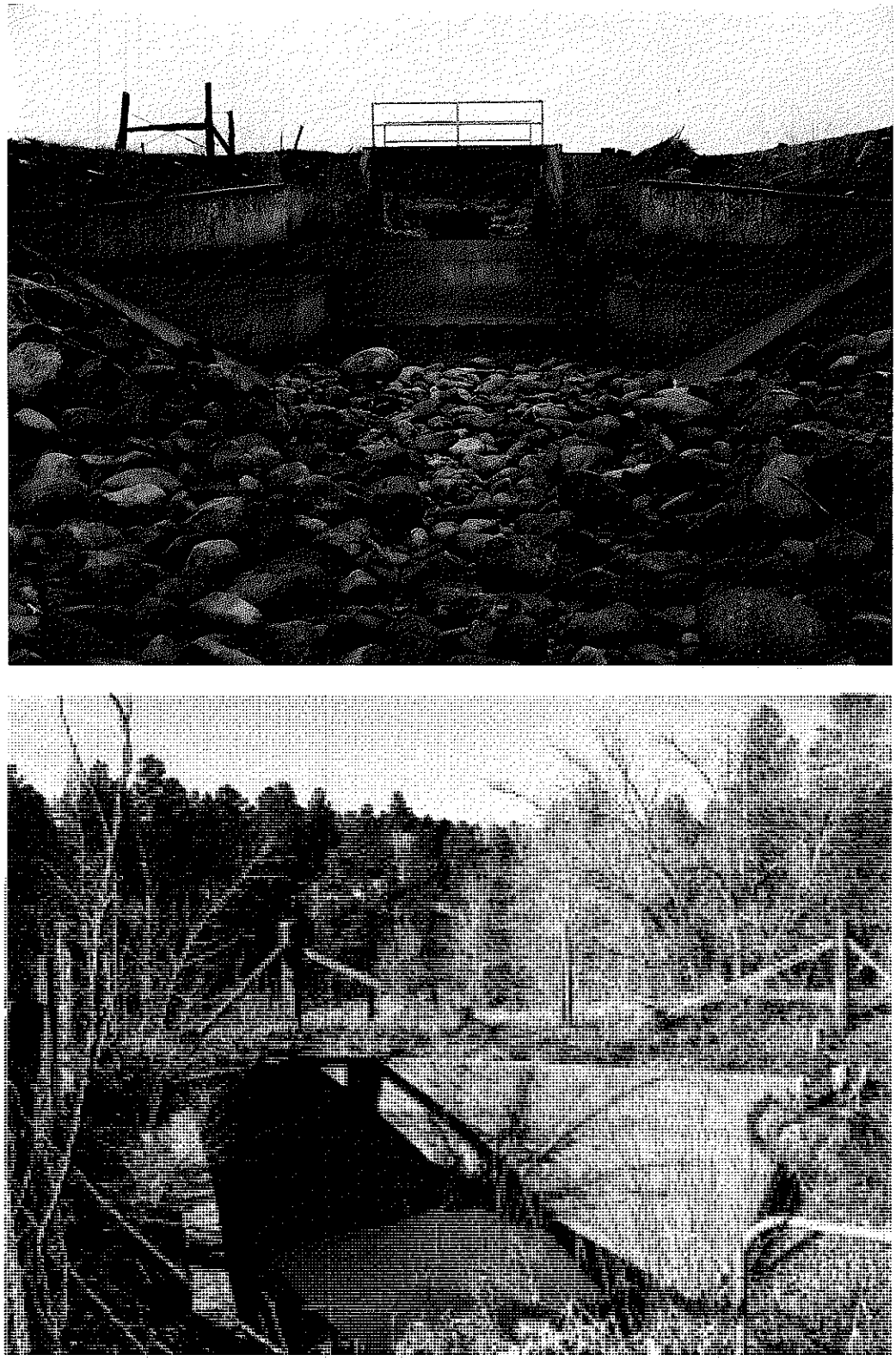

Figure 5.7 View North of Feature 17 Drop Structure (Top) and View Southwest of Feature 24 Siphon Crossing Under CR 234 (Bottom), Site 5LP 5661.6

River Storage Project Act (CRSP) of April 11, 1956 (70 Stat. 105). As stated in the Definite Plan Report, "Construction of an authorized Florida Project is needed to improve and stabilize the farm economy and to bring a better balance to the economy of the San Juan River Basin." Lemon Reservoir was constructed in 1963 to store floodwaters and provide a source of late season irrigation for local farmers through regulated releases. Lemon Reservoir and the 1962 to 1964 enlargement of the Florida Farmers Ditch and the Florida Canal, which included reconstruction of the Florida Farmers Diversion Dam, were undertaken by the BOR. Most of the features documented along 5LP 5561.6 date to the 1962-1964 canal enlargement portion of the BOR's Florida Project, and are under 50 years in age, including the canal itself which was enlarged to increase the conveyance capacity. The canal segment averages 15 ft wide (25 ft with earthen berm) and is 3 to 5 ft deep. A total of 33 features were documented along 5LP 5561.6, including concrete and metal lateral head gates, drop structures, baffles, culverts, debris traps, and siphons, the majority of which date to the 1962 to 1964 era (Table 5.2). However, Features 10, 26, and 33 are abandoned portions of the original canal that contoured through drainage areas. The features are just outside the project area and will not be affected by the proposed project. The features were eliminated during the BOR 1962 to 1964 enlargement project and resulted in a straighter canal trajectory through the drainage areas. Site segment 5LP 5661.6, while lacking historical architectural integrity, is currently in service providing irrigation for numerous farming and ranching operations on the east side of Florida Mesa.

Previous Work: 5LP 5661.1, 5LP 5661.2, and 5LP 5661.3 were field recommended NRHP-eligible (Eckhardt et al. 2000) and 5LP 5661.4 and 5LP 5661.5 were field recommended NRHP-eligible in 2006 (Fetterman and Honeycutt 2007) but officially determined NRHP-not eligible in 2008.

Significance: While site segment 5LP 5661.6 is over 50 years old, it is recommended not eligible to the NRHP as it does not possess unique features of antiquity, nor does it represent significant data potential or historical value. The canal dates to at least 1923, although this section of the Florida Farmers Ditch was completely modified and enlarged by the BOR's Florida Project during the 1962 to 1964 era. The canal is not associated with events or persons that have made a significant contribution to the broad patterns of our history, it is not the work of a master, nor does it possess high artistic value. Detailed documentation of the site segment in the field has adequately characterized its limited information potential in archival form.

Recommendation: No further cultural resource work is recommended.

Table 5.2 Feature Summary Table, Site 5LP 5661.6

Feature No.	Description	UTM Coordinates
1	Concrete siphon that carries canal beneath County Road 237	N 4130455 m, E 252140 m (NAD 27) N 4130662 m, E 252090 m (NAD 83)
2	Lateral head gate, hand screw valve control	N 4130464 m, E 252148 m (NAD 27) N 4130671 m, E 252098 m (NAD 83)
3	Concrete baffles/drop structure	N 4130924 m, E 252294 m (NAD 27) N 4131131 m, E 252244 m (NAD 83)
4	Corrugated metal tube with cone shaped lid-housing for flow gauge equipment	N 4130929 m, E 252296 m (NAD 27) N 4131136 m, E 252246 m (NAD 83)
5	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4130461 m, E 252148 m (NAD 27) N 4130668 m, E 252098 m (NAD 83)
6	Lateral head gate with hand screw valve control, feeds into Feature 7 west of canal and north of CR 237	N 4130452 m, E 252134 m (NAD 27) N 4130659 m, E 252084 m (NAD 83)
7	Concrete siphon that carries lateral diagonally beneath The Florida Farmers Ditch and CR 237	N 4130447 m, E 252132 m (NAD 27) N 4130654 m, E 252082 m (NAD 83)
8	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4130261 m, E 252076 m (NAD 27) N 4130468 m, E 252026 m (NAD 83)
9	Drainage culvert beneath Florida Farmers Ditch	N 4130960 m, E 251885 m (NAD 27) N 4129167 m, E 251835 m (NAD 83)
10	Concrete flume abutments; part of the original canal, approximately 15 m west of modern alignment	N 4130962 m, E 251876 m (NAD 27) N 4129169 m, E 251826 m (NAD 83)
11	Drainage culvert beneath canal	N 4129706 m, E 251920 m (NAD 27) N 4129911 m, E 251872 m (NAD 83)
12	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4129649 m, E 251944 m (NAD 27) N 4129856 m, E 251894 m (NAD 83)
13 (North)	Concrete tunnel through rockslide area, 539 feet long NW-SE	N 4129640 m, E 251941 m (NAD 27) N 4129847 m, E 251899 m (NAD 83) @ north end
13 (South)	Concrete tunnel through rockslide area, 539 feet long NW-SE	N 4129543 m, E 252081 m (NAD 27) N 4129750 m, E 252031 m (NAD 83) @ south end
14	Concrete culvert that carries canal beneath CR 236	N 4127012 m, E 252810 m (NAD 27) N 4127219 m, E 252760 m (NAD 83)

Table 5.2 Feature Summary Table, Site 5LP 5661.6 (Continued)

Feature No.	Description	UTM Coordinates
15	Ditch crossing pipe consisting of a 10-inch metal pipe suspended between concrete abutments. Apparently constructed to carry wastewater from fields to the west	N 4127046 m, E 252324 m (NAD 27) N 4127253 m, E 252774 m (NAD 83)
16	Ditch crossing pipe consisting of a 10-inch metal pipe suspended between concrete abutments. Apparently constructed to carry wastewater from fields to the west	N 4127179 m, E252876 m (NAD 27) N 4127386 m, E 252826 m (NAD 83)
17	Concrete baffles/drop box with a wood plank and metal mesh bridge crossing canal	N 4127200 m, E 252878 m (NAD 27) N 4127407 m, E 252828 m (NAD 83)
18	Valve can (36" diameter round corrugated metal culvert sunk into the ground with thick cast iron lid, surrounded by a rectangular steel pipe enclosure), may not be part of canal system	N 4127165 m, E 252879 m (NAD 27) N 4127372 m, E 252829 m (NAD 83)
19	Lateral head gate hand screw valve controls and flow measuring box	N 4127224 m, E 252894 m (NAD 27) N 4127431 m, E 252844 m (NAD 83)
20	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4127250 m, E 252905 m (NAD 27) N 4127457 m, E 252855 m (NAD 83)
21	Concrete drop structure and perpendicular concrete baffles	N4127582 m, E252898 m (NAD 27) N 4127789 m, E 252848 m (NAD 83)
22	Lateral head gate hand screw valve controls and flow measuring box	N 4127611 m, E 252883 m (NAD 27) N 4127818 m, E 252833 m (NAD 83)
23	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4127612 m, E 252880 m (NAD 27) N 4127819 m, E 252830 m (NAD 83)
24 (North)	Siphon tunnel that carries Florida Farmer's Ditch across CR 234, 470 feet from north opening to south opening	N 4128891 m, E 252315 m (NAD 27) N 4129098 m, E 252265 m (NAD 83) @ north end
24 (South)	Siphon tunnel that carries Farmer's Canal across County Rd. 234, 470' from north opening to south opening	N 4128749 m, E 252324 m (NAD 27) N 4128956 m, E 252274 m (NAD 83) @ south end
25	Lateral head gate hand screw valve control	N 4127991 m, E252644 m (NAD 27) N 4128198 m, E 252594 m (NAD 83)

Table 5.2 Feature Summary Table, Site 5LP 5661.6 (Continued)

Feature No.	Description	UTM Coordinates
26	Segment of the abandoned and backfilled original canal, this segment contours around a finger ridge that the modern Florida Farmers Ditch cuts through	N 4127957 m, E 252748 m (NAD 27) N 4128162 m, E 252699 m (NAD 83)
27	Ditch crossing pipe consisting of a 10-inch metal pipe suspended between concrete abutments, apparently constructed to carry wastewater from fields to the west of the Florida Farmers Ditch	N 4128062 m, E 252645 m (NAD 27) N 4128269 m, E 252595 m (NAD 83)
28	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4128320 m, E 252511 m (NAD 27) N 4128527m, E 252461 m (NAD 83)
29	Wooden farm access bridge over Florida Farmer Ditch	N 4128312 m, E 252508 m (NAD 27) N 4128519 m, E 252458 m (NAD 83)
30	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4128901 m, E 252318 m (NAD 27) N 4129108 m, E 252268 m (NAD 83)
31	16" culvert that carries wastewater from fields to the west of the Florida Farmers Ditch, emptying back into canal	N 4128951 m, E252317 m (NAD 27) N 4129158 m, E 252267 m (NAD 83)
32	Debris trap, consisting of weighted wire mesh nets suspended from a cable	N 4129412 m, E 252173 m (NAD 27) N 4129617 m, E 252123 m (NAD 83)
33	Segment of the abandoned and backfilled original Florida Farmers Ditch, this segment contours around a drainage that the modern canal crosses on an earthen berm with a culvert (Feature 11)	N4129708 m, E 251829 m (NAD 27) N 4129914 m, E 251780 m (NAD 83)

5.2 Newly Recorded Sites

5.2.1 Site 5LP 9765

Site Number:	5LP 9765 (SEAS 11-001-01)
USGS Map:	Durango East 1963, USGS Map Code 37-107-TF-024
Land Ownership:	Private land
Legal Location:	W/2, SE/4, SW/4 of Section 30, Township 35 North, Range 8 West, NMPM
Datum UTM Coordinates:	Zone 13; N 4128023 m, E 252663 m, (NAD 27) Zone 13; N 4128228 m, E 252614 m, (NAD 83)
Site Type:	Artifact Scatter
Cultural Affiliation:	Ancestral Pueblo, late Pueblo I period (Piedra phase, AD 850-950)
Site Dimensions and Area:	50 m (N-S) x 45 m (E-W); 1,513 m^2/ 0.37 acres (0.15 ha)

Site Description:

At 7,080 ft (2,159 m) amsl, the site is on top of a short finger ridge projection of Florida Mesa that extends to the southeast, overlooking the Florida River. The site rests on the gently rounded crest of the finger ridge, near the intersection of the finger ridge with Florida Mesa proper. The Florida River lies 216 m to the east at the base of the steep east slope of Florida Mesa. An unnamed drainage, flowing to the southeast towards the Florida River, lies immediately west of the site. The aspect is neutral. East and west slopes on the site vary from 0 to 20 degrees. The slopes to the east, south, and southwest of the site range between 30 and 45 degrees. Soil depth is at least 1 m, based on the cutbank of the Florida Farmers Ditch. The soil is a reddish brown silt loam alluvium derived from reworked loess and clay shale residuum. At some point, probably during the reconstruction of the Florida Farmer's Canal in the 1960s, the top of the finger ridge on which the site rests was bladed, disturbing the original ground surface and removing vegetation. The current vegetation covers approximately 30 percent of the ground surface. Based on the surrounding vegetation, the original vegetation was transitional between ponderosa pine and Rocky Mountain juniper conifer woodland and Gambel oak chaparral. Vegetation currently on the site includes western wheatgrass, cranesbill, broom snakeweed, hoary aster, Gambel oak, and rabbitbrush. Construction of the original Florida Farmers Ditch (5LP 5661) and subsequent reconstruction in the 1960s cut into the site, changing the grade and causing portions of the site near the cutbanks to be subject to erosion. Otherwise, the depositional setting is neutral to slightly erosional. A portion of the site was apparently removed by the original canal construction and reconstruction projects, based on the presence of artifacts on both sides of the cutbanks. The site measures 50 by 45 m with an area of 1,513 m^2 or 0.37 acres (0.15 ha).

The site is a small Ancestral Pueblo artifact scatter dating to the late Pueblo I period, or Piedra phase (ca. AD 850-950) (Figures 5.8 and 5.9). Features and artifact concentrations were not observed. The surface artifact assemblage consists of 38 flaked lithic artifacts, two metate fragments, a mano fragment, and 17 pottery sherds, all of which were analyzed in the field. The pottery consists of four Piedra/Arboles Gray jar body sherds, eight Piedra/Arboles Gray bowl body sherds, and 6 Piedra/Arboles Gray indeterminate body sherds, and a Piedra Gray bowl sherd with a polished interior, all with crushed rock temper. The crushed rock temper dominant assemblage suggests it post dates AD 850. The flaked lithic assemblage consists of one primary core flake, eight secondary core flakes, 12 tertiary core flakes, 13 indeterminate flake fragments or pieces of angular debris, two cores, and a core/hammerstone (Table 5.3). Gray, red,

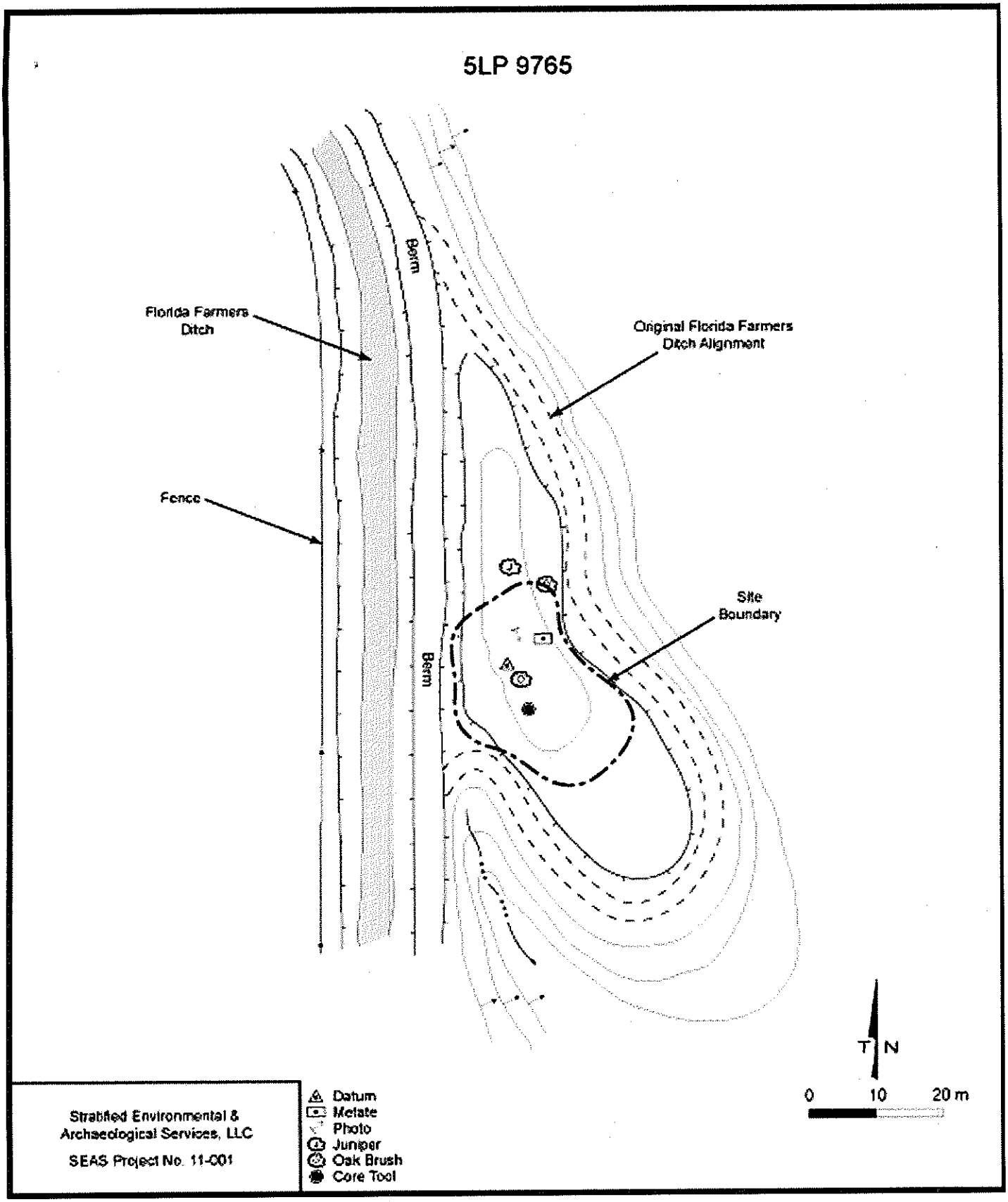

Figure 5.8 Site Plan Map, 5LP 9765

Figure 5.9 Site Overview Facing South, Site 5LP 9765

Table 5.3 Flaked Lithic Artifact Tallies, Site 5LP 9765

Material Type	Primary FL	Secondary FL	Tertiary FL	Pressure FL	Biface Thinning FL	FL Fragment/ Angular Debris	FL Tools	Material Type Totals
Orthoquartzite (gray, red, green and brown)	1	8	7			13	2	31
White quartzite			1			1		2
Course-grained quartzite (red and purple)			1				1	2
Obsidian			1					1
Tan chert			1					1
Black silicified wood			1					1
	1	8	12	0	0	14	3	
Grand Total = 38								

green and brown orthoquartzites (31) are the most common flaked material type, followed by white quartzite (2), course grained red and purple quartzite (2), and one occurrence each of tan chert, obsidian, and black silicified wood. With the exception of the single obsidian flake, all of the lithic materials are locally available and are common flaked lithic materials found on prehistoric sites in the area. The groundstone assemblage consists of two light brown sandstone trough metate fragments from the same metate, and taken together they make up approximately half of a whole metate, and a sandstone mano fragment with unifacial wear. Disturbance on the site resulting from canal construction and the blading of the landform upon which the site rests makes it difficult to determine whether the site functioned as a habitation, field house, or campsite, but from the presence of groundstone and ceramics, it can be inferred that food processing and preparation activities occurred on the site, in addition to core reduction and flaked tool production.

Previous Work: None

Significance: The site is recommended potentially eligible (need data) to the NHRP under Criterion D as a surface inspection of the site was not adequate for determining the site's research potential. Previous blading of the site may have obscured surface evidence of pitstructures or surface architecture and the site warrants further investigation.

Recommendation: It is recommended that all construction activities be confined to the existing Florida Farmers Ditch disturbance corridor within 50 ft. of the site boundaries. In addition, the east edge of the canal disturbance corridor should be temporarily fenced and a qualified archaeologist should monitor all earth-disturbing construction activities within 50 ft of the site boundaries.

5.2.2 Site 5LP 9766

Site Number:	5LP 9766 (SEAS 11-001-02)
USGS Map:	Durango East 1963, USGS Map Code 37-107-TF-024
Land Ownership:	Private Lands
Legal Location:	NE/4, NE/4, NW/4 of Section 31, Township 35 North, Range 8West, NMPM
Datum UTM	Zone 13; N 4127699 m, E 252803 m, (NAD 27)
Coordinates:	Zone 13; N 4127906 m, E 252753 m, (NAD 83)
Site Type:	Culturally modified tree
Cultural Affiliation:	Unknown historic
Site Dimensions and Area:	12 m diameter, 47 m^2/ 0.01 acres (0.005 ha)

Site Description:

At 7,060 ft (2,152 m) amsl, the site is located on the eastern edge of Florida Mesa, overlooking the Florida River 160 m to the east. The aspect is east, and the slope is 0 to 2 degrees. The top of the steep, 45-degree slope on the eastern edge of Florida Mesa is approximately 12 meters east of the site. The soil is at least 1 m deep, based on the cutbank of the Florida Farmers Ditch (5LP 5661). The soil is re-deposited, mechanically disturbed silt clay loam with occasional quartzite river cobbles derived from reworked loess and clay shale residuum, and underlying Pleistocene cobble deposits. The alluvial

deposits overly shale bedrock that is exposed in the canal adjacent to the site. A linear berm of re-deposited soil surrounds the culturally modified ponderosa pine that the site consists of, covering the historic ground surface and the original base of the tree. The area surrounding the site is fairly well-stabilized with recent mechanical deposition present on the site. Originally, the site was in a slightly erosional environment. Vegetation and pine needles cover approximately 80 percent of the site surface. Dominant plant species consist of ponderosa pine, Gamble oak, various grasses, and rabbitbrush. The site rests on a flat area covered with a layer of disturbed soil from construction of the original Farmer's Canal, and by the reconstruction of the canal and backfilling of the earlier canal alignment in the early 1960s. The site measures approximately 12 meters in diameter with an area of 47 m^2 or 0.01 acres (0.005 ha).

The site consists of a single ponderosa pine tree measuring 90 cm in diameter at chest height that has been culturally modified (Figures 5.10 and 5.11). The cultural modification consists of a rectangular scar measuring 40 cm wide by 90 cm high on the west side of the tree. Three horizontal cut marks are visible on the exposed wood. The tree continued to grow after it was peeled, and the bark now bulges approximately 7 cm beyond the exposed wood inside the scar. The bottom of the scar is currently approximately 20 cm above the modern ground surface, but soil was deposited around the tree during either the original canal construction project, or the reconstruction project, burying the ground surface to an estimated depth of 40-50 cm. The head of a metal nail or spike is visible protruding from the wood at the base of the scar. It is unknown if there is any association between the scarring of the tree and the spike, but the spike must have been driven into the tree after the tree was peeled, as the head is flush with the peeled wood. The barren scar may represent aboriginal bark peeling to access inner bark used as a starvation food, a seasonal delicacy, a medicinal tea, or a poultice. In addition, the sap was used to waterproof objects and the outer bark used for construction of cradleboards, trays, and other purposes (Martorano 1981). The cultural scarring of this tree, unusually rectangular in outline, may not have been for the cambium as a food source, but probably as a cradleboard or tray. However, given the presence of the spike within the scar, the modification may not represent aboriginal use and it may be of historic European American origin. The site has good research potential and dating potential through incremental tree boring.

Previous Work: None

Significance: The site is recommended NHRP-potentially eligible (need data) under Criterion D. The site may be an example of Ute protohistoric to early historic cultural affiliation, although the metal spike may indicate a later historic affiliation. The site may have good research potential in light of the tree-ring dating potential.

Recommendation: It is recommended that all construction activities be confined to the existing Florida Farmers Ditch disturbance corridor within 50 ft of the site boundaries. In addition, the west edge of the Florida Farmers Ditch corridor should be temporarily fenced and a qualified archaeologist should monitor all earth-disturbing activities within 50 ft of the site boundaries.

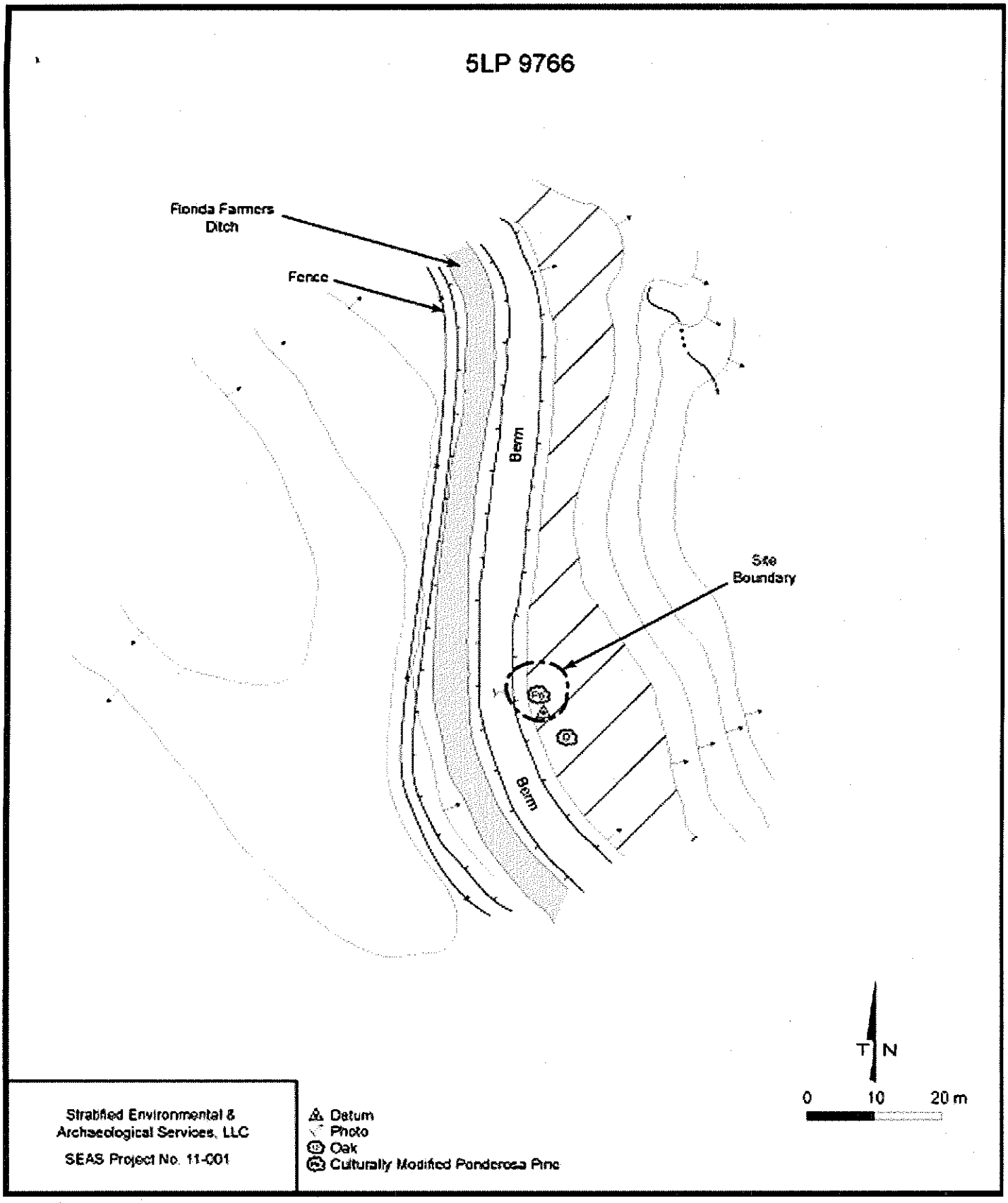

Figure 5.10 Site Plan Map, 5LP 9766

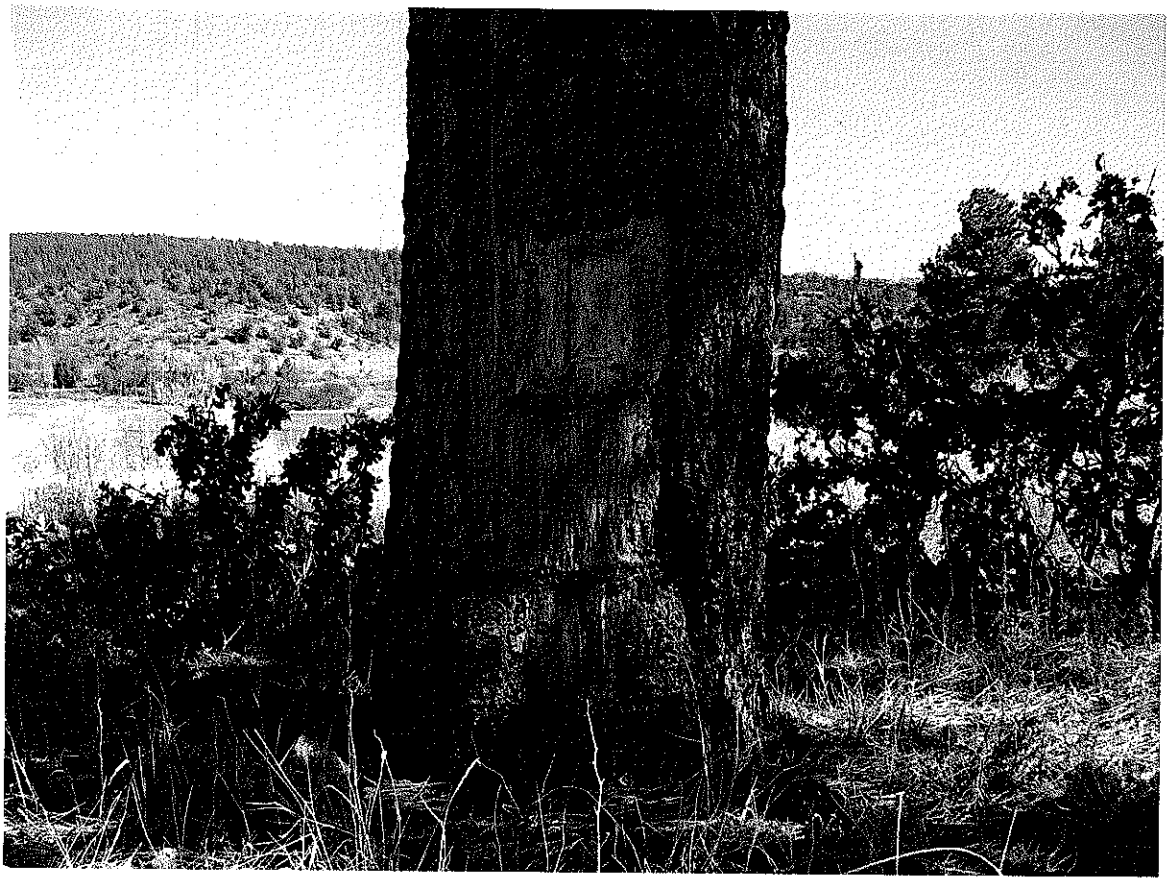

Figure 5.11 View Facing East of Culturally Modified Tree, Site 5LP 9766

5.2.3 Site 5LP 9767

Site Number:	5LP 9767 (SEAS 11-001-03)
USGS Map:	Durango East 1963, USGS Map Code 37-107-TF-024
Land Ownership:	Private Lands
Legal Location:	SE/4, NE/4, NW/4 and NE/4, SE/4, NW/4 and NW/4, SW/4, NE/4 of Section 31, Township 35 North, Range 8 West, N.M.P.M.
Datum UTM Coordinates:	Zone 13; N 4127345 m, E 252929 m, (NAD 27) Zone 13; N 4127552 m, E 252879 m, (NAD 83)
Site Type:	Habitation
Cultural Affiliation:	Ancestral Pueblo, late Pueblo I period (Piedra phase, AD 850-950)
Site Dimensions and Area:	129 m (N-S) x 51 m (E-W), 4,808 m²/ 1.19 acres (0.48 ha)

Site Description:

At 7,090 ft (2,162 m) amsl, the site is located on a slight rise near the east edge of Florida Mesa overlooking the Florida Farmers Ditch (5LP 5661) and irrigated pastureland that extends to the east rim of Florida Mesa. The Florida River is 320 m to the north-northeast of the site. The aspect ranges between southeast and northeast. The slope on undisturbed portions of the site ranges between 0 and 3 degrees.

The Florida Farmers Ditch truncated the eastern end of the site and the current cutbank has a 40-degree slope. The soil is at least 2 m deep based on the canal cutbank. The soil is a brown clay loam alluvium derived from reworked loess and clay shale residuum. A few quartzite cobbles are present on the surface that may be of cultural origin, since they do not appear naturally in the canal cutbank. The site is in an erosional environment, especially where the site has been truncated by the Florida Farmers Ditch. Vegetation covers approximately 20 percent of the site surface. Dominant plant species include big sagebrush, rabbitbrush, cranesbill, various grasses, wild crabapple, Utah juniper, Gambel oak, James buckwheat, prickly pear cactus, cliff fendlerbush, river hawthorne, and long-leaved phlox. The site has been disturbed by the reconstruction of the Florida Farmers Ditch and by the leveling of a portion of the site surface. The site is heavily impacted by grazing, and trampling of the site by livestock and resultant erosion pose a continuing threat to the site. The site may extend to the west onto private land, although no artifacts were observed in the area immediately beyond the fence line. The site measures 129 m by 51 m with an area of 4,808 m^2 or 1.19 acres (0.48 ha).

The site is an Ancestral Pueblo habitation dating to the late Pueblo I period, or Piedra phase (ca. AD 850-950) (Figures 5.12 and 5.13). The site consists of at least a single habitation with evidence for presence of another habitation unit that has apparently been mostly removed by canal construction. The site has two loci with a sparse scatter of artifacts in between. Features 1, 2 and 4 are in the southern locus (Locus A). Feature 1 is a concentration of approximately 20 quartzite river cobbles found in a 1.5 by 3 m area. Several cobbles are in a rough east-west alignment. The cobble scatter is adjacent to the east side of a disturbed area where the surface has been bladed away. Feature 1 is inferred to be the remnant of a surface room, or rooms, which were otherwise bladed away. Feature 2 is a midden 6 m north of Feature 1 that consists of an artifact concentration and area of soil staining. Feature 2 measures approximately 10 m in diameter. Feature 4 is a subtle depression in the disturbed area that is inferred to be a pitstructure. The center of the depression is approximately 6 m east of Feature 1. Feature 4 measures approximately 6 m in diameter. Feature 3 is in the northern locus (Locus B) which is approximately 40 m north of Locus A. Feature 3 consists of a concentration of burned jacal. The concentration consists of 50-100 pieces of burned jacal eroding out of a 6 m long section along the top of the canal cutbank. Beam impressions are present on some of the jacal pieces, confirming it is structural in nature. Feature 3 is apparently the only remnant of a surface structure removed by canal construction. Any associated middens or pitstructures have apparently been destroyed or obscured by the canal.

The artifact assemblage consists of 46 flaked lithic artifacts, three indeterminate groundstone fragments, a mano fragment, a whole two-hand mano, and 150-200 pottery sherds, 102 of which were examined in the field. The analyzed pottery sample consisted of 65 Piedra/Arboles Gray jar body sherds, 21 Piedra/Arboles Gray bowl body sherds, 19 Piedra/Arboles indeterminate sherds, one Piedra/Arboles Gray mug handle fragment, one Piedra Gray jar body sherd, and six Piedra Gray bowl body sherds. The lack of sand tempered pottery (Rosa Gray) and dominance of crush rock tempered wares indicates the site probably post dates AD 850. The flaked lithic assemblage consists of four primary core flakes, four secondary core flakes, 10 tertiary core flakes, one pressure flake, 17 indeterminate flake fragments and pieces of angular debris, four cores, a scraper, a hammerstone, a core tool, and an indeterminate cobble tool (Table 5.4). Gray, red, green and brown orthoquartzites (21) are the most abundant flaked lithic materials, followed by red, gray and pink course grained quartzite (12), white, gray, pink, yellow and tan chert (7), red chert (4), gray siltstone (3), and black silicified wood (1). The groundstone consists of two sandstone indeterminate groundstone fragments, a complete sandstone two-hand mano with unifacial wear, and a sandstone indeterminate mano fragment with unifacial wear. All of the flaked lithic materials

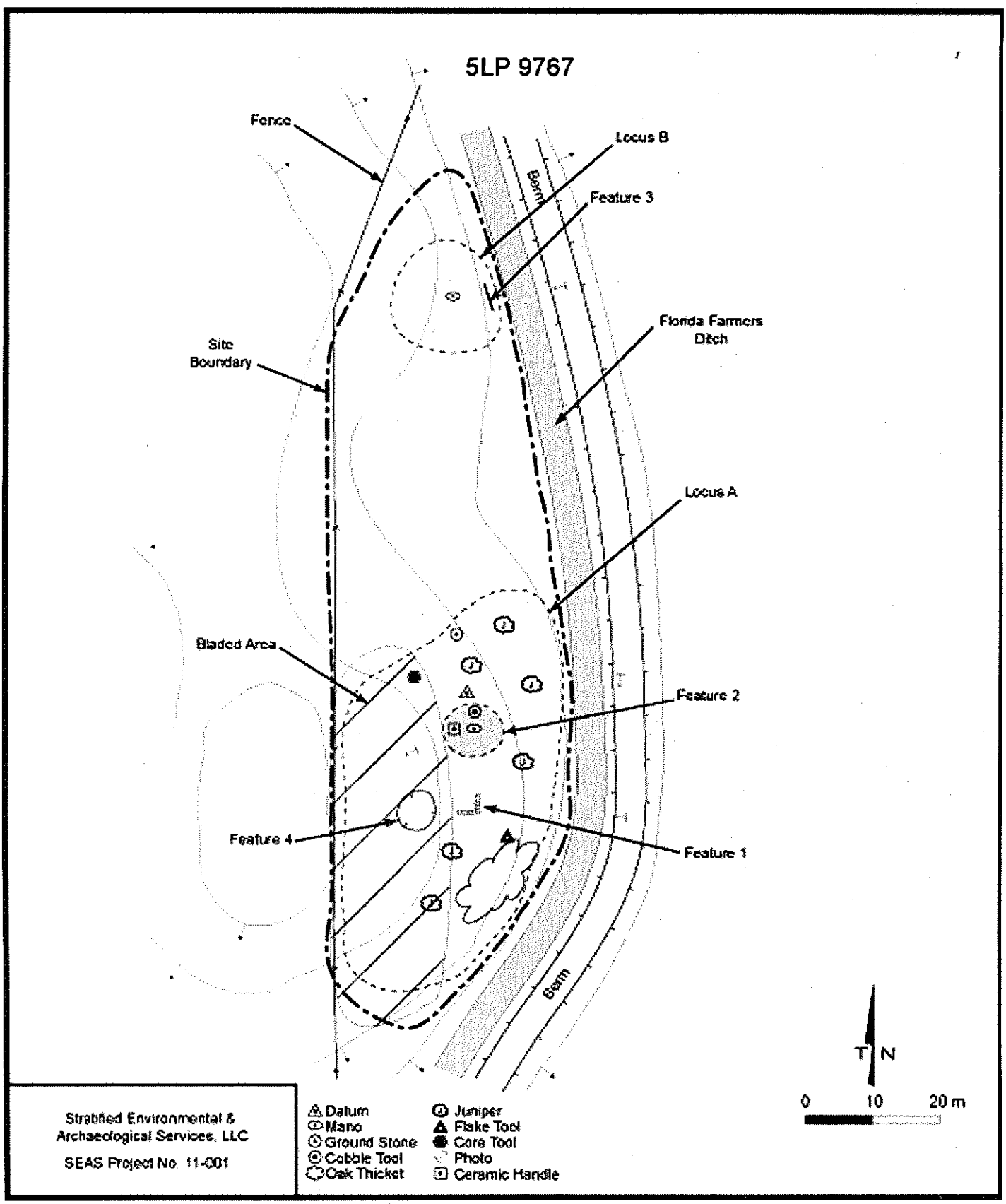

Figure 5.12 Site Plan Map, 5LP 9767

Figure 5.13 Site Overview Facing Southeast Towards Locus A and Feature 2, Site 5LP 9767

Table 5.4 Flaked Lithic Artifact Tallies, Site 5LP 9767

Material Type	Primary FL	Secondary FL	Tertiary FL	Pressure FL	Biface FL	Indeterminate Flake Fragment	FL Tools	Material Type Totals
Fine-grained orthoquartzite (gray, red, green and brown)	1	2	3			8	5	19
Course-grained quartzite (red, gray and pink)	2	2	2			3	3	12
Chert (white, gray, pink, yellow and tan	1		2	1		3		7
Red chert			4					4
Black silicified wood			1					1
Gray siltstone						3		3
	4	4	12	1		17	8	
Grand Total = 46								

are locally available and are common flaked lithic materials found on prehistoric sites in the area. The artifact assemblage, presence of a pithouse depression, and burned and unburned surface structures indicate that the site functioned as a residential habitation, and that activities including core reduction, flaked lithic tool production/refurbishing, plant food processing, animal product processing, and food preparation, storage, and consumption activities occurred at the site. The site is surrounded by irrigated farmlands which would have been good dryland farming soils in prehistoric times. While a burnt jacal surface structure has been mostly removed by canal construction, and an unburnt surface structure mostly removed by mechanical blading, a pitstructure is present that is at least intact below the plow zone/bladed surface of the site. Additional buried features are likely present in the deep soils and the site has good research potential despite historical disturbances.

Previous Work: None

Significance: The site is recommended NHRP-eligible under Criterion D as the site represents a habitation with a mostly undisturbed subterranean structure in association with a diverse artifact assemblage. Burnt jacal found on the site suggests the presence of an incinerated surface structure, although it may have been mostly removed by canal construction. Additional subsurface pit features and cultural deposits may be obscured by previous blading.

Recommendation: It is recommended that all construction activities be confined to the existing Florida Farmers Ditch disturbance corridor within 50 ft. of the site boundaries. In addition, the east edge of the site along the west edge of the Florida Farmer Ditch corridor should be temporarily fenced and a qualified archaeologist should monitor all earth-disturbing construction activities within 50 ft of the site boundaries.

6.0 Summary and Conclusions

The cultural resource inventory for the proposed Lined Ditch Reach of the Florida Farmers Ditch Project encountered and documented one newly recorded segment of a previously recorded linear site (5LP 5661.6) and three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767).

Site segment 5LP 5661.6 dates to at least 1923 but was completely reconstructed and enlarged by the BOR's Florida Project during the 1962 to 1964 era. None of the original canal features occur within the project area. The canal is not associated with events or persons that have made a significant contribution to the broad patterns of our history, it is not the work of a master, nor does it possess high artistic value. Detailed documentation of the site segment in the field has adequately characterized its limited information potential in archival form and no further cultural resource work, including fencing or monitoring, is considered necessary.

Site 5LP 9767, an Ancestral Pueblo habitation with at least one pithouse, is recommended NRHP-eligible under Criterion D. Sites 5LP 9765 and 5LP 9766, a culturally modified ponderosa pine tree and an Ancestral Pueblo artifact scatter, respectively, are both considered potentially eligible (need data) to the NRHP under Criterion D. For all three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767), it is recommended that the proximal side of the Florida Farmers Ditch disturbance corridor be temporarily fenced and marked with blue flagging tape during construction activities. In addition, a qualified archaeologist should monitor all earth-disturbing construction activities within 50 ft of the site boundaries. Provided the avoidance and monitoring recommendations are implemented for the three newly recorded sites (5LP 9765, 5LP 9766, and 5LP 9767), cultural resource clearance for the proposed Lined Reach of the Florida Farmers Ditch to proceed is recommended as no significant or potentially significant cultural properties will be affected.

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Pastorius Reservoir

Emergency Action Plan

Main Dam DAMID: 300126
East Dike DAMID: 300142
NATID: CO-00894

Prepared by:
Florida Canal Company
PO Box3496
Durango, CO 81302
with assistance from
Wright Water Engineers, Inc.

February 2011

061-110.060

Table of Contents

BASIC EAP DATA

Purpose

The purpose of this Emergency Action Plan (EAP) is to reduce the potential for loss of life and injury and to minimize property damage during an unusual or emergency event at Pastorius Reservoir. Additionally, this EAP establishes responsibilities and procedures in the event of a failure or potential failure of Pastorius Reservoir.

Potential Impacted Areas

Pastorius Reservoir is located in La Plata County, on the Florida Canal, tributary to the Florida River. See Appendix A-1 for a general location and vicinity map of Pastorius Reservoir and the surrounding area. The nearest downstream community consists of sporadically rural homes and non-inhabitable structures along the West Fork and Cottonwood Gulch, all within three miles downstream of the reservoir.

No other community would be affected by a failure of either the main dam or the east dike of Pastorius Reservoir, or flooding from large releases. In the event of a dam failure, the inundation maps in Appendix A-2 show the depth of inundation and the arrival time of the peak flow at critical downstream sections. A summary of downstream residences, which may be at risk, is provided in Appendix A-4.

Directions to Dam

Also see Location and Vicinity maps (See Appendix A-1)
From the Town of Durango, Colorado, proceed south on Camino del Rio (US Highway 550) for 5.2 miles. Continue on US Highway 160 for 3 miles. Turn right on Colorado 172 for 2.1 miles. Turn right on County Road 302 for 0.8 miles. Turn right on County Road 304 for 0.3 miles.

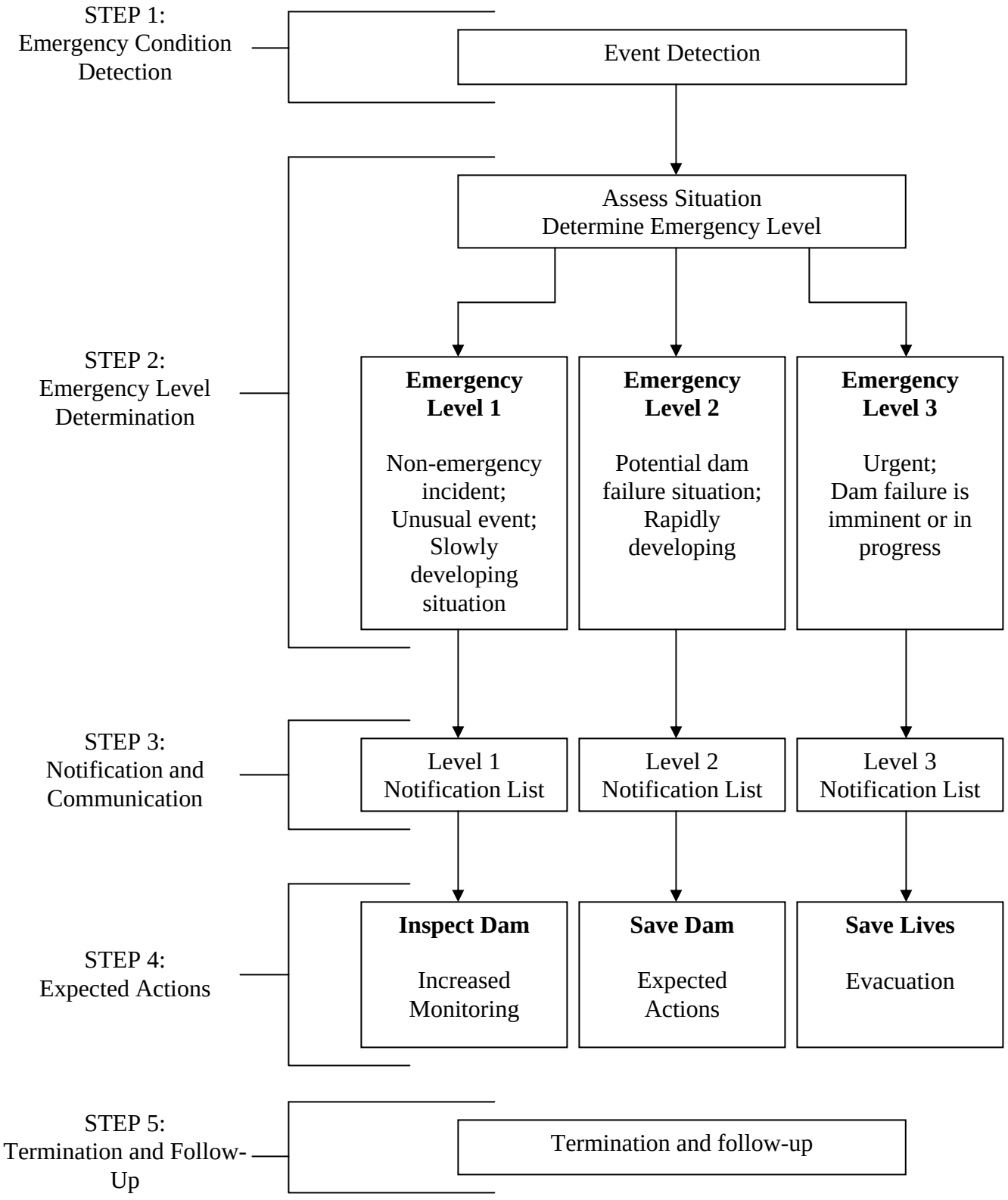
DESCRIPTION OF DAM (Main Dam)

Dam Name:	Pastorius Reservoir
State of Colorado DAMID:	300126
NATID (Nat. Inventory of Dams):	CO - 00894
Dam Owner:	Florida Canal Company
Type of Dam:	Earth Fill
Hazard Classification:	Significant
County:	La Plata
Location:	Section 10, Township 34N, Range 9W
	Latitude: 37.20, Longitude: -107.81
Nearest Town:	Aztec, NM
Distance to Nearest Town:	30 miles
Name of Drainage, River, or Stream:	Cottonwood Gulch, tributary to the Florida River
Year Constructed:	1965
Dam Height:	26 (feet)
Crest Length:	1090 (feet)
Crest Width:	22 (feet)
Drainage Basin Area:	480 (acres)
Maximum Reservoir Surface Area:	45 (acres)
Reservoir Normal Capacity:	295 (acre-feet)
Reservoir Maximum Capacity:	565 (acre-feet)
Outlet Diameters:	1 foot each
Outlet Type:	Twin VCP/Cast Iron
Outlet Max. Discharge Capacity:	20 (cfs)
Emergency Spillway Type:	Open Channel (concrete)
Emergency Spillway Width:	5.5 (feet)
Spillway Freeboard:	5.8 (feet)
Maximum Spillway Capacity:	1100 (cfs)

DESCRIPTION OF DAM (East Dike)

Dam Name:	Pastorius Reservoir
State of Colorado DAMID:	300142
NATID (Nat. Inventory of Dams:	CO - 00894
Dam Owner:	Florida Canal Company
Type of Dam:	Earth Fill
Hazard Classification:	Significant
County:	La Plata
Location:	Section 10, Township 34N, Range 9W
	Latitude: 37.20, Longitude: -107.81
Nearest Town:	Aztec, NM
Distance to Nearest Town:	30 miles
Name of Drainage, River, or Stream:	Cottonwood Gulch, tributary to the Florida River
Year Constructed:	1965
Dam Height:	15 (feet)
Crest Length:	510 (feet)
Crest Width:	16 (feet)
Drainage Basin Area:	480 (acres)
Maximum Reservoir Surface Area:	45 (acres)
Reservoir Normal Capacity:	295 (acre-feet)
Reservoir Maximum Capacity:	565 (acre-feet)
Outlet Diameters:	N/A
Outlet Type:	N/A
Outlet Max. Discharge Capacity:	N/A
Emergency Spillway Type:	Open Channel (concrete)
Emergency Spillway Width:	5.5 (feet)
Spillway Freeboard:	5.8 (feet)
Maximum Spillway Capacity:	1100 (cfs)

EMERGENCY ACTION PLAN OVERVIEW



ROLES AND RESPONSIBILITIES

Dam Owner/Manager

- Respond to observed or reported conditions, incidents, or unusual events to detect if an existing or potential emergency exists (see *Step 1 - Event Detection*).
- As soon as an emergency event is detected, immediately determine the emergency level (see *Step 2 - Emergency Level Determination*).
  - Level 1: Non-emergency incident; Unusual event; Slowly developing situation
  - Level 2: Potential dam failure situation; Rapidly developing
  - Level 3: Urgent; Dam failure is imminent or in progress
- Immediately notify the personnel in the order shown on the notification flow chart for the appropriate emergency level (see *Notification Flow Charts*).
- Provide updates of the situation to the Local Emergency Manager to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.
- Facilitate exercise of the EAP as necessary to ensure the effectiveness of the EAP and emergency response.

Local Emergency Manager

- Typically City Police or Fire Department or County Sheriff Department personnel act as the Local Emergency Manager.
- Serve as the primary contact person responsible for coordination of all emergency actions.
- Maintain communication with media.
- When a Level 2 situation occurs:
  - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
  - Alert public as appropriate.
- When a Level 3 situation occurs:
  - Initiate warnings and order evacuation of people at risk downstream of the dam.
  - Carry out the evacuation of people and close roads within the evacuation area (see Appendix A-1 *Inundation Map*).
  - Alert the general public of the emergency.
- Decide when to terminate the emergency.
- Participate in annual review and update of the EAP.

Colorado Division of Emergency Management

- Respond to specific requests from the Local Emergency Manager to help minimize the impacts of an emergency event.

Dam Owner's Engineer

- Provide assistance and expertise with technical issues related to dam.

State Dam Safety Engineer (Colorado Division of Water Resources)

- Advise dam owner on emergency level determination if time permits.
- Advise dam owner on remedial actions to take if a Level 2 event occurs and if time permits.
- Advise the Local Emergency Manager when conditions are safe to terminate the emergency.

FIVE-STEP EAP PROCESS

The following steps are in reference to the preceding flow chart and outline the procedures that must be carried out for effective implementation of this EAP.

Step 1 Event Detection

This step describes the detection of an unusual or emergency event. Information is provided herein to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or federal), landowners, visitors to the dam, or the public. All reports of an unusual or emergency event should be verified by the dam owner.
- Evaluation of instrumentation data
- Earthquakes or other environmental events felt or reported in the vicinity of the dam
- Forewarning of conditions which may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

If the above observations reveal an unusual or an emergency situation exists, the Dam Owner/Manager will utilize the methodology outlined in Step 2 to classify the situation.

See the *Guidance for Determining the Emergency Level* table and *Examples of Emergency Situations* in Step 2 for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected and verified, the Dam Owner/Manager is responsible for classifying the event into one of the following three emergency levels:

Emergency level 1—Nonemergency, unusual event, slowly developing:

This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. The State Dam Safety Engineer and the Dam Owner's Engineer should be contacted to investigate the situation and recommend actions to be taken. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Local Emergency Manager should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency level 2—Potential dam failure situation, rapidly developing:

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Local Emergency Manager should be notified of this emergency situation and placed on alert. The dam owner should closely monitor the condition of the dam and periodically report the status of the situation to the Local Emergency Manager and State Dam Safety Engineer. As time permits, remedial actions should be taken to delay, moderate, or prevent failure of the dam. If the dam condition worsens and failure becomes imminent, the Local Emergency Manager must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

The State Dam Safety Engineer should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam owner should initiate remedial repairs (note local resources that may be available – see Appendix A-3 *Resources Available*). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the spillway has, or is expected to, result in flooding of downstream areas where people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent–Dam failure is imminent or in progress:

This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the spillway is causing downstream flooding of people and roads. The Local Emergency Manager should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see Appendix A-1 *Inundation Map* and Appendix A-4 *Summary of People at Risk*).

See following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency Level*
Spillway flow	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Overtopping flow not eroding the embankment slope; reservoir level expected to lower	2
	Overtopping flow not eroding the embankment slope; reservoir level expected to rise	3
	Overtopping flow eroding the embankment slope	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Rapid flow rate increase with cloudy discharge from existing seepage area(s)	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	1
	Rapidly enlarging sinkhole	2
Embankment cracking	New cracks in the embankment greater than 1/4-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly progressing slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenances with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

*Emergency level 1: Non-emergency, unusual event, slowly developing
*Emergency level 2: Potential dam failure situation, rapidly developing
*Emergency level 3: Urgent; dam failure is imminent or in progress.

Examples of Emergency Situations

The following are typical examples of conditions that may occur at a dam that usually constitute an emergency situation. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the emergency spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency level condition and are provided as guidance only. Not all emergency conditions may be listed and the dam owner is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Emergency Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the emergency spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

1. Significant erosion or head cutting of the spillway is occurring at a rapid rate and a breach of the control section appears to be imminent.
2. Flow through the emergency spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level has reached the top of the dam and is projected to continue to lower.
2. Flow is occurring over the embankment, but it is not eroding the embankment slope and the reservoir is expected to continue to lower.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

1. Flow is occurring over the embankment causing damage to the embankment slope.
2. The reservoir level has exceeded the top of the dam and is expected to continue to rise.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or soon will be inundated by a rise in the reservoir:
    a. Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
    b. Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

1. Sudden or rapidly progressing slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification:
After the emergency level has been determined, people on the following notification flowcharts (pages 14-16) for the appropriate emergency level shall be notified immediately.

Communication:

Emergency Level 1—Non-emergency, unusual event; slowly developing:
The Dam Owner should contact State Dam Safety Engineer and the Dam Owner's Engineer, describe the situation, and request technical assistance on the next steps that should be taken.

Emergency Level 2—Potential dam failure situation; rapidly developing:
The following message may be used to help describe the emergency situation to the Local Emergency Manager:

> *"This is (Identify yourself; name, position, etc.).*
> *We have an emergency condition at (name of dam).*
> *We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2.*
> *We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.*
> *Reference the Inundation Map in your copy of the Emergency Action Plan.*
> *We will advise you as soon as the situation is resolved or if the situation gets worse.*
> *I can be contacted at the following number _____.*
> *If you cannot reach me, please call the following alternative number_____."*

Emergency Level 3—Urgent; dam failure is imminent or in progress:
The Local Emergency Manager should be contacted immediately and the potentially flooded area must be evacuated (see Appendix A-1 *Inundation Map*). The following actions should be taken:

1. Call 911 and be sure to say, "This is an emergency". The following message may be used to help describe the emergency situation to the Local Emergency Manager:

   "This is an emergency. This is (identify yourself; name, position). (name of dam) is failing. The downstream area must be evacuated immediately. Repeat, (name of dam) is failing; evacuate the area along low-lying portions of (name of stream).
   We have activated the emergency action plan for this dam and are currently under Emergency Level 3.
   Reference the Inundation Map in your copy of the Emergency Action Plan.
   I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number_____."

2. Do whatever is necessary to bring people in immediate danger to safety if directed by the Local Emergency Manager (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees). See Appendix A-4 *Summary of People at Risk*.

3. Keep in frequent contact with the Local Emergency Manager to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.

4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to reestablish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to reestablish contact with the Local Emergency Manager and emergency services.

The following pre-scripted message may be used as a guide for the Local Emergency Manager to communicate the status of the emergency with the public:

Attention: This is an emergency message from (the Local Emergency Manager). Listen carefully. Your life may depend on immediate action.
(Name of dam) is failing. Repeat. (Name of dam) is failing.
If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on (names of roads or highways) or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message

Emergency Level 1 Notifications

Non-Emergency,
Unusual Event, Slowly Developing

Dam Owner

Organization: Florida Canal Co.
970-769-6152 (Cell)

Name: Justin Catalano,
Superintendent
Organization: Florida Canal Co.
970-259-7250 (Home)
970-749-9800 (Cell)

(1)

(2)

Colorado Division of Water Resources (contact at least one of the following)

Matthew J. Gavin
Dam Safety Engineer
970-247-1845 (Office)
970-769-4197 (Cell)
970-946-6863 (Home)

Rege Leach
Division Engineer
970-247-1845 (Office)
970-769-3887 (Cell)

Tom Fiddler
Water Commissioner
970-247-1845 (Office)
970-769-1930 (Cell)

Mark Haynes
Chief of Dam Safety Program
303-866-3581 X-8276 (Office)
303-204-6613 (Cell)

Dam Owner's Engineer

Name: Peter Foster, P.E.
Wright Water Engineers, Inc.
Phone: 970-259-7411

Notes:
(1), (2), etc. denotes call sequence

See *Emergency Service Contacts* (page 17) for alternate contacts in the event that persons shown cannot be contacted.

Emergency Level 2 Notifications

Emergency Event, Potential Dam Failure Situation; Rapidly Developing

Dam Owner

Organization: Florida Canal Co.
970-769-6152 (Cell)

Name: Justin Catalano, Superintendent
Organization: Florida Canal Co.
970-25-7250 (Home)
970-749-9800 (Cell)

(1)

(2)

(3)

Colorado Division of Water Resources (contact at least one of the following)

Matthew J. Gavin
Dam Safety Engineer
970-247-1845 (Office)
970-769-4197 (Cell)
970-946-6863 (Home)

Rege Leach
Division Engineer
970-247-1845 (Office)
970-769-3887 (Cell)

Tom Fiddler
Water Commissioner
970-247-1845 (Office)
970-769-1930 (Cell)

Mark Haynes
Chief of Dam Safety Program
303-866-3581 X-8276 (Office)
303-207-6613 (Cell)

Local Emergency Manager

911
or
Name: Butch Knowlton
Phone: 970-385-2900 (Office)

Available Resources

See Appendix A-3

Notes:
(1), (2), etc. denotes call sequence

See *Emergency Service Contacts* (page 17) for alternate contacts in the event that persons shown cannot be contacted.

Emergency Level 3 Notifications

Urgent Event,
Dam Failure is Imminent or in Progress

Dam Owner

Organization: Florida Canal Co.
970-769-6152 (Cell)

Name: Justin Catalano, Superintendent
Organization: Florida Canal Co.
970-259-7250 (Home)
970-749-9800 (Cell)

(2)

Colorado Division of Water Resources (contact at least one of the following)

Matthew J. Gavin
Dam Safety Engineer
970-247-1845 (Office)
970-769-4197 (Cell)
970-946-6863 (Home)

Rege Leach
Division Engineer
970-247-1845 (Office)
970-769-3887 (Cell)

Tom Fiddler
Water Commissioner
970-247-1845 (Office)
970-769-1930 (Cell)

Mark Haynes
Chief of Dam Safety Program
303-866-3581 X-8276 (Office)
303-204-6613 (Cell)

(1)

Local Emergency Manager

911
or
Name: Butch Knowlton
Phone: 970-385-2900 (Office)

National Weather Service

970-243-7007
or
1-800-868-7964

(1)

Colorado Division of Emergency Management

Name: Patricia Gavelda
Phone: 970-247-7674
or
24-hr Emergency No.
303-279-8855

Notes:
(1), (2), etc. denotes call sequence

See *Emergency Service Contacts* (page 17) for alternates in the event person shown cannot be contacted.

*Additional secondary calls should be made by the Local Emergency Manager according to the Local Emergency Operations Plan

Emergency Service Contacts

Agency/Organization	Principal Contact / Title	Address	Office Telephone Number	Alternate Telephone Number(s)
Florida Canal Co.	Justin Catalano Superintendent	10555 Hwy 550 Durango, CO	970-259-8471	970-749-9800
La Plata County Emergency Preparedness	Butch Knowlton Director	1060 E. 2nd Ave Durango, CO	970-385-2900	970-247-0275
Florida Canal Co.	Organization	1056 main Ave., Suite 207 PO Box 2138 Durango, CO		970-769-6152
NWS		Grand Junction	970-243-7007	
State Engineer's Office	Matthew J. Gavin Dam Safety Engineer	106 Rock Point Dr Suite E Durango, CO	970-247-1845	970-769-4197 (C) 970-946-6863 (H)
State Engineer's Office	Rege Leach Division Engineer	106 Rock Point Dr Suite E Durango, CO	970-247-1845	970-769-3887 (C)
State Engineer's Office	Tom Fiddler Water Commissioner	106 Rock Point Dr Suite E Durango, CO	970-247-1845	970-769-1930
State Engineer's Office	Mark Haynes Chief, Dam Safety Program	1313 Sherman St. Room 818 Denver, CO	303-866-3581 X-8276	303-204-6613
Wright Water Engineers	Peter Foster, P.E.	1666 N. Main Suite C Durango, CO	970-259-7411	970-749-0256
State of Colorado	OEM	Golden, CO	303-279-8855	
Colorado Division of Wildlife		151 E. 16th St. Durango, CO	970-247-0855	
Colorado Division of Emergency Management	Patricia Gavelda	9195 East Mineral Avenue, #200 Centennial, CO	970-247-7674	

Step 4 Expected Actions

If the Local Emergency Manager receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Dam Owner. After the Dam Owner determines the emergency level, the State Dam Safety Engineer should be contacted for technical consultation and the following actions should be taken.

Emergency Level 1 – Non-emergency, unusual event; slowly developing:

A. The Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the State Dam Safety Engineer; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
B. Record all contacts that were made on the *Contact Checklist* (Appendix B–1). Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form* (Appendix B–2). Note the time of changing conditions. Document the situation with photographs and video if possible.
C. The Dam Owner should contact the State Dam Safety Engineer and Dam Owner's Engineer and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2 – Potential dam failure situation; rapidly developing:

A. The Dam Owner should report the situation to the State Dam Safety Engineer and request investigation of the situation and recommend corrective actions.
B. The Dam Owner should contact the Local Emergency Manager to inform him/her that the EAP has been activated and, if current conditions get worse, the emergency level may increase and the emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.
C. Provide updates to the Local Emergency Manager to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.
D. If time permits, the Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the State Dam Safety Engineer; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
E. Record all contacts that were made on the *Contact Checklist* (Appendix B–1). Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form* (Appendix B–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.
F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with the State Dam Safety Engineer. See *Resources Available* (Appendix A–3) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. Place sandbags along the low areas of the top of the dam to reduce the likelihood of overtopping and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open outlet(s) to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required. Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials, such as hay bales, bentonite, soil or rock fill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rock fill materials in the damaged area to restore freeboard.
3. Stabilize slides on the downstream slope by placing a soil or rock fill buttress against the toe area of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform field survey to determine if there has been any settlement and movement of the dam embankment, spillway and low level outlet works.
3. Drain reservoir if required.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

A. The Dam Owner shall immediately contact the Local Emergency Manager and others shown on the notification flow chart.
B. The Local Emergency Manager shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see Appendix A-1 *Inundation Map*).
C. The Local Emergency Manager shall alert the general public and immediately evacuate at-risk people and close roads as necessary.
D. The Dam Owner shall maintain continuous communication and provide the Local Emergency Manager with updates of the situation to assist him in making timely decisions concerning warnings and evacuations.
E. The Dam Owner should record all contacts that were made on the *Contact Checklist* (Appendix B–1). Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form* (Appendix B–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.
F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Local Emergency Manager is responsible for terminating EAP operations and relaying this decision to the Dam Owner. It is then the responsibility of each person to notify the same group of contacts that he or she notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 2 or 3 event, the State Dam Safety Engineer will inspect the dam or require the inspection of the dam to determine if any hazardous conditions exist that could potentially result in loss of life, injury, or property damage. If it is determined that hazardous conditions no longer exist, the State Dam Safety Engineer will advise the Local Emergency Manager to terminate EAP operations as described above.

The Dam Owner shall assure that the *Dam Emergency Situation Report* (Appendix B–3) is completed to document the emergency event and all actions that were taken. The Dam Owner shall distribute copies of the completed report.

MAINTENANCE – REVIEW, REVISION, AND EXCERCISES

Emergency Action Plans should be considered "Living Documents". This means that: (1) They will never be complete, (2) They should be reviewed not less than annually, (3) Reviews should include participation of the local emergency manager, (4) All updates should be made promptly. Additionally, emergency incidents at dams and/or dam failures are not common events. Therefore, training and exercises are necessary to maintain emergency response readiness, timeliness, and effectiveness.

The EAP therefore requires periodic maintenance to remain current and as useful and effective as possible. The three steps in Maintenance include:

Review

The EAP minimum annual review should include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current.
- Contacting the LEM to verify where the EAP is kept and if responsibilities as described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.
- Review people at risk information for changes in development within the dam failure flood inundation area downstream of the dam.

Revision

The EAP will be revised if any of the contacts, responsibilities, services or service providers, or people at risk information has changed. The Dam Owner is responsible for updating the EAP documents. The EAP document held by the Dam Owner is the master document. When revisions occur, the Dam Owner should provide the revised pages and a revised Revision Summary Page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP Exercise

Periodic training and exercises are necessary to help ensure that all dam owner personnel are thoroughly familiar with the emergency action plan and their individual roles and responsibilities.

EAP exercising can include:

- Orientations
- Phone Drills
- Table Top Exercises
- Functional Exercises

As a minimum, owners of high and significant hazard dams should conduct an orientation and a phone drill yearly. The orientation can be a simple meeting where those individuals and entities with a stake in the EAP come together to review the roles and responsibilities described in the EAP. Orientations are

especially useful for bringing new staff and/or leadership within any of the various organizations up to speed with regard to the components of the EAP.

Phone drills represent the next level of complexity with regard to EAP exercises. Phone drills can be part of the EAP review process to confirm contact information in the notification flow charts.

A comprehensive EAP exercise program should include provisions for table top and functional exercises. Tabletop and Functional exercises are typically more complex and are therefore conducted at lower frequencies, on the order of about every 6 years. Owners of high hazard dams should maintain a comprehensive exercise program which includes the components listed above. The program should be considered a normal part of the O&M program for the structure with the various exercises planned and executed as the owner would perform O&M on the physical components of the dam itself.

Key personnel from State dam safety and local emergency management agencies should be invited to participate in any orientation and exercises provided by the dam owner.

RECORD OF HOLDERS OF THIS EAP

Copy Number	Organization Name and Address	Person(s) Receiving Copy
1	Local Emergency Manager (La Plata County) 1060 E. 2nd Ave., Durango, CO 81301	Butch Knowlton 970-385-2900 970-247-0275 (H)
2	Colorado Division of Emergency Management 15075 S. Golden Rd., Golden, CO 80401	303-273-1622 (General) 303-273-1779 (Disaster Officer) 303-279-8855 (24-hr Emergency)
3	Dam Safety Engineer, Office of the State Engineer 160 Rock Point Dr., Durango, CO 81301	Matthew J. Gavin 970-247-1845
4	Wright Water Engineers, Inc. 1666 N. Main, Suite C, Durango, CO 81301	Peter Foster 970-259-7411 (O)
5	Florida Canal Company 1056 Main Ave, Suite 207 PO Box 2138 Durango, CO 81301	970-769-6152
6	Florida Canal Company 10555 Highway 550, Durango, CO 81303	Justin Catalano 970-259-7250 (H) 970-749-9800 (C)
7		
8		
9		
10		
12		
13		
14		
15		
16		

RECORD OF REVISIONS AND UPDATES MADE TO EAP

Revision Date	Revision(s) Made

APPENDIXES: MAPS, SUPPORTING DATA, FORMS, & GLOSSARY

Appendix A

A–1 Inundation Map
A–2 Location and Vicinity Maps
A–3 Resources Available
A–4 Summary of People at Risk
A–5 Plan and Profile View of Dam
A–6 Reservoir Elevation Area-Capacity Data

Appendix B

B–1 Contact Checklist
B–2 Unusual or Emergency Event Log Form
B–3 Dam Emergency Situation Report Form
B–4 Glossary of Terms

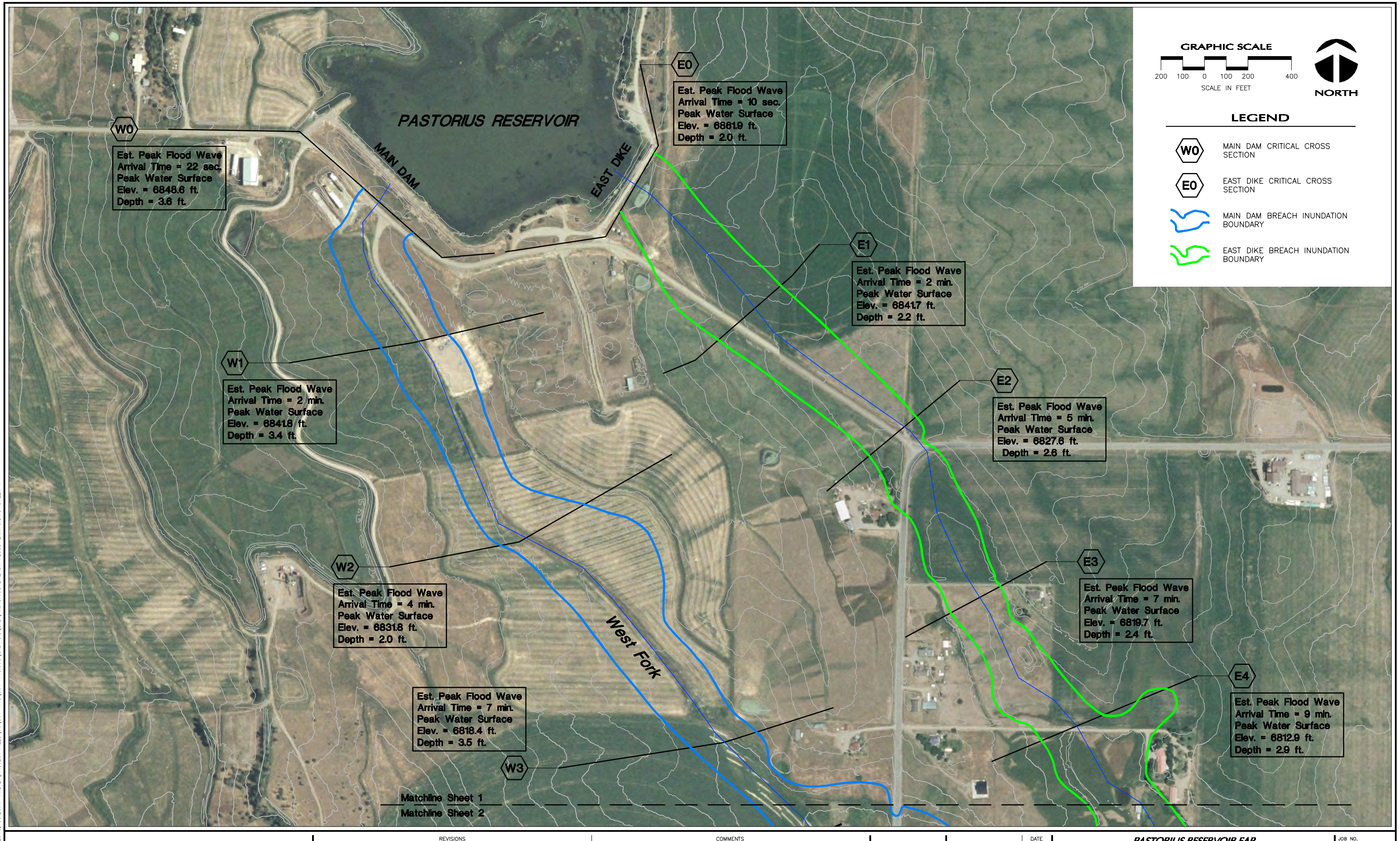
Appendix A-1
Inundation Map

The Pastorius Reservoir Dam Breach Inundation Map was created by Wright Water Engineers, Inc. (WWE) in May 2010 to show potential inundation areas resulting from the failure of either the main dam or the east dike of Pastorius Reservoir. WWE determined an approximate peak breach flow using the MacDonald & Langridge-Monopolis method for a dam failure caused by piping. Input parameters used for this determination were acquired from existing Pastorius Reservoir data filed with the Office of the State Engineer in Colorado. Specifically, data was acquired from the most current dam safety inspection reports, dated March 11, 2009, and a Preliminary Emergency Preparedness Plan, dated November 14, 2001.

Calculated breach characteristics, in addition to information available in the above-referenced documents, such as stage-storage capacity values, dam geometry, etc., were then used to conduct a dam break analysis using HEC-HMS 3.4. The dam breach peak flow output by the model compared reasonably with the empirically calculated value.

Homes, roads and structures potentially at risk of being affected by flooding from the failure of the Pastorius Dam were determined, and cross sections were taken at these locations. Channel geometry and reach lengths were assessed from 5-foot contour topography provided by La Plata County and the Town of Durango. This data was input into the HEC-HMS model, allowing for an output of a peak flow at each critical location.

The HEC-HMS output flows were input into HEC-RAS 4.0 at relevant cross section, and a steady flow analysis was performed. The velocity and depth of water at each cross section was computed and the width of inundation was determined and delineated.



WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. SUITE 100A
DENVER, CO 80211
(303)480-1700 FAX(303)480-1020

REVISIONS				COMMENTS
NO.	BY	DATE	DESCRIPTION	SOURCES: ELEVATIONS, DEPTH AND INUNDATION BOUNDARY DETERMINED USING HEC-RAS 4.0.
1	–	–	–	5-FOOT CONTOUR DATA FROM CITY OF DURANGO AND LA PLATA COUNTY. AERIAL
				IMAGERY FROM NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP)/USDA FSA PHOTOGRAHY
				FIELD OFFICE, PUBLICATION DATE 09/29/2005.

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DETAIL	KAL	06/03/10
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APPROVAL		
SCALE		1"=400'
Pastorius Breach Floodplain 5.dwg		

PASTORIUS RESERVOIR EAP

DAM BREACH INUNDATION

JOB NO. D61-110.060
REVISION NO. 0
SHEET NO. 1

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Matchline Sheet 1

Matchline Sheet 2

West Fork

E5

Est. Peak Flood Wave
Arrival Time = 11 min.
Peak Water Surface
Elev. = 6806.6 ft.
Depth = 1.7 ft.

E6

Est. Peak Flood Wave
Arrival Time = 13 min.
Peak Water Surface
Elev. = 6802.2 ft.
Depth = 2.1 ft.

W4

Est. Peak Flood Wave
Arrival Time = 11 min.
Peak Water Surface
Elev. = 6805.6 ft.
Depth = 2.1 ft.

W5

Est. Peak Flood Wave
Arrival Time = 13 min.
Peak Water Surface
Elev. = 6801.6 ft.
Depth = 2.6 ft.

E7

Est. Peak Flood Wave
Arrival Time = 16 min.
Peak Water Surface
Elev. = 6794.7 ft.
Depth = 1.9 ft.

W6

Est. Peak Flood Wave
Arrival Time = 15 min.
Peak Water Surface
Elev. = 6796.0 ft.
Depth = 2.3 ft.

Cottonwood Gulch

Matchline Sheet 2

Matchline Sheet 3

GRAPHIC SCALE

200 100 0 100 200 400

SCALE IN FEET

NORTH

LEGEND

- W0 — MAIN DAM CRITICAL CROSS SECTION
- E0 — EAST DIKE CRITICAL CROSS SECTION
- MAIN DAM BREACH INUNDATION BOUNDARY
- EAST DIKE BREACH INUNDATION BOUNDARY

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PASTORIUS RESERVOIR EAP

DAM BREACH INUNDATION

JOB NO. 061-110.060

REVISION NO. 0

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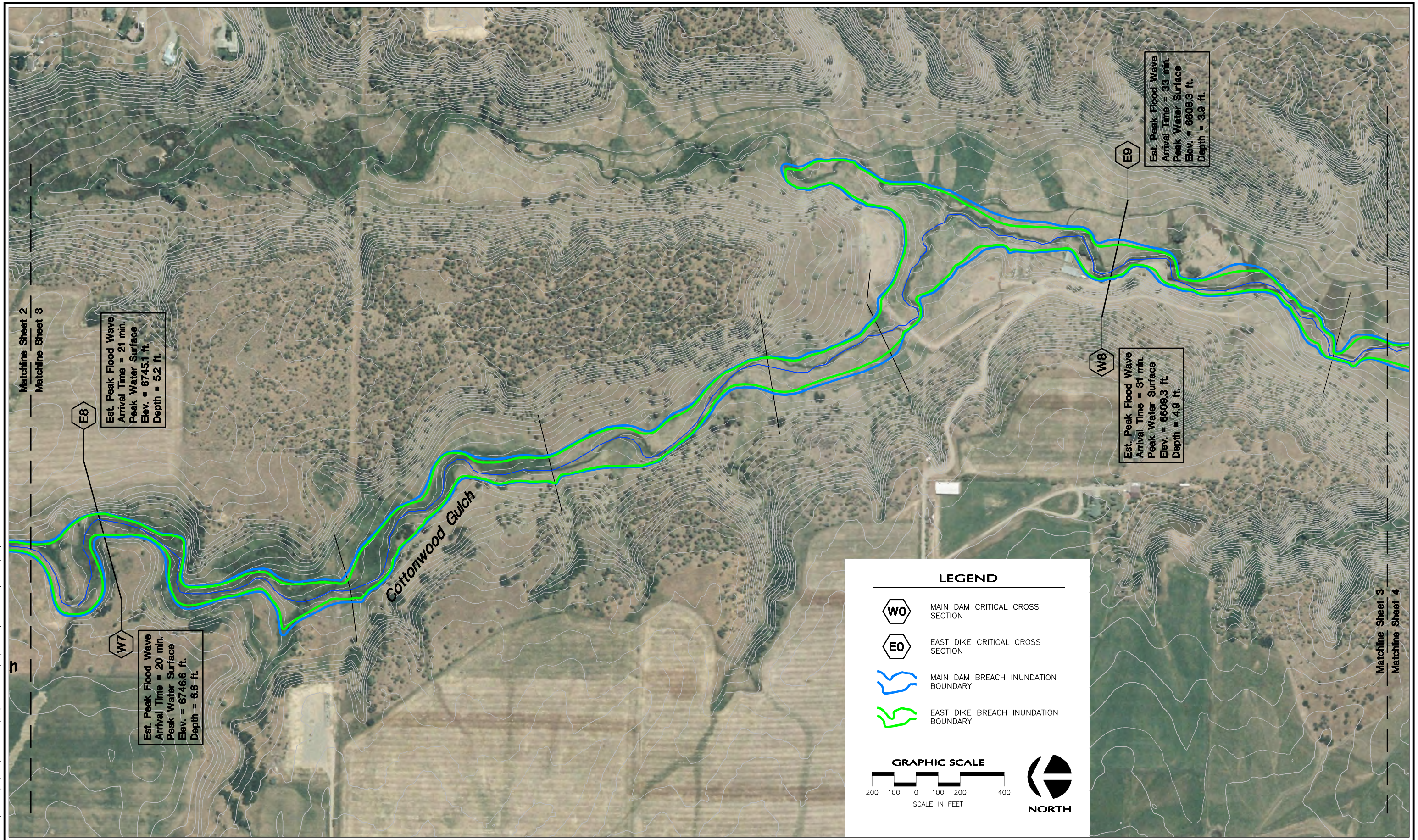

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NO.	BY	DATE	DESCRIPTION	SOURCES: ELEVATIONS, DEPTH AND INUNDATION BOUNDARY DETERMINED USING HEC-RAS 4.0.
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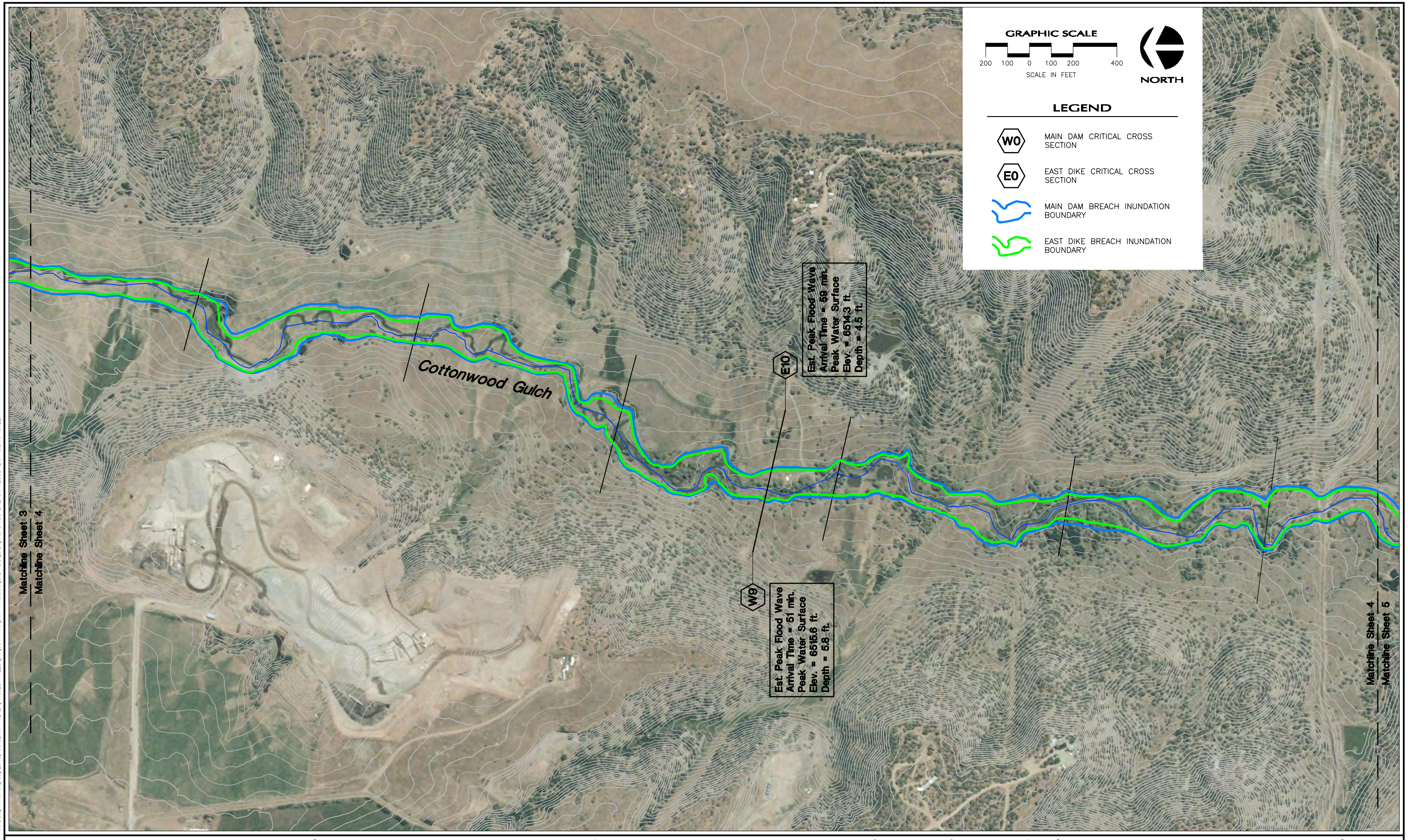
DETAIL	KAL	06/03/10
CHECK	DWF/TAE	06/03/10
APPROVAL		
SCALE		1"=400'
Pastorius Breach Floodplain 5.dwg		

PASTORIUS RESERVOIR EAP

DAM BREACH INUNDATION

JOB NO. 061-110.060
REVISION NO. 0
SHEET NO. 3



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WWE
WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. SUITE 100A
DENVER, CO 80211
(303)480-1700 FAX(303)480-1020

REVISIONS				COMMENTS
NO.	BY	DATE	DESCRIPTION	SOURCES: ELEVATIONS, DEPTH AND INUNDATION BOUNDARY DETERMINED USING HEC-RAS 4.0.
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CHECK	DWF/TAE	06/03/10
APPROVAL		
SCALE		1"=400'
Pastorius Breach Floodplain 5.dwg		

PASTORIUS RESERVOIR EAP

DAM BREACH INUNDATION

JOB NO. 061-110.060
REVISION NO. 0
SHEET NO. 4

Matchline Sheet 4

Matchline Sheet 5

Cottonwood Gulch

NOTE: Downstream Limit of Study Extends Beyond All Structures that Could Potentially be at Risk and Extends Just Upstream of FEMA Regulatory Floodplain

LEGEND

- W0 — MAIN DAM CRITICAL CROSS SECTION
- E0 — EAST DIKE CRITICAL CROSS SECTION
- MAIN DAM BREACH INUNDATION BOUNDARY
- EAST DIKE BREACH INUNDATION BOUNDARY

GRAPHIC SCALE

200 100 0 100 200 400

SCALE IN FEET

NORTH

WRIGHT WATER ENGINEERS, INC.
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DENVER, CO 80211
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SCALE		1"=400'
Pastorius Breach Floodplain 5.dwg		

PASTORIUS RESERVOIR EAP

DAM BREACH INUNDATION

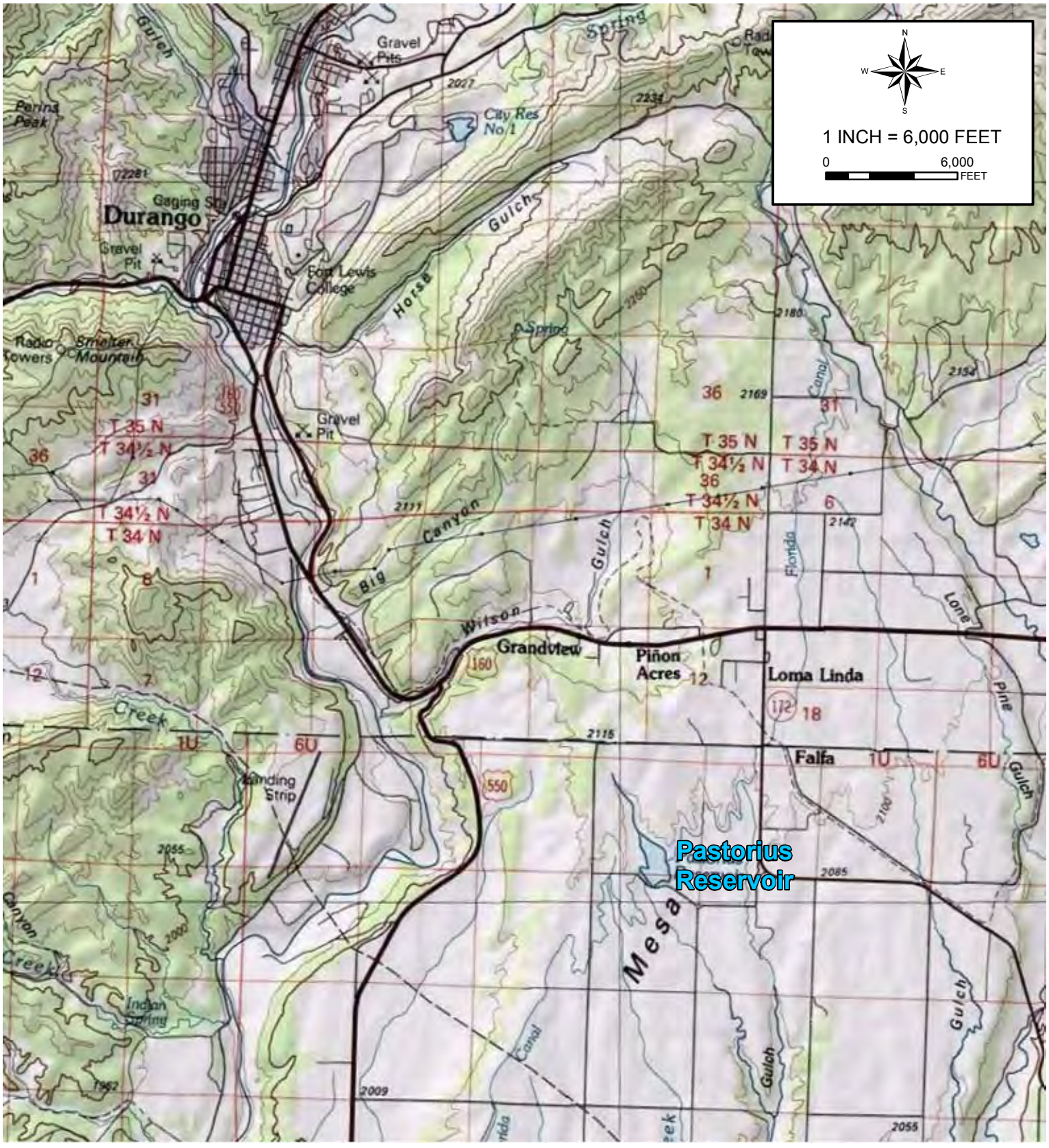
JOB NO. 061-110.060

REVISION NO. 0

SHEET NO. 5

ISSUE DATE: --/--/-- Plot Date/Time: 06/03/2010, 05:36:55 PM; Z:\PROJECT FILES\06\061-110\061-110.060\CAD-GIS\CAD\PASTORIUS BREACH FLOODPLAIN 5.DWG-SHEET 5

Appendix A-2
Location and Vicinity Maps



P:\061-110\060 Seepage Reduction Program\EAP\Mapping\Location Map.mxd

WWE
WRIGHT WATER ENGINEERS, INC.
1666 NORTH MAIN AVE. STE C
DURANGO, CO, 81301
(970) - 259 - 7411

LA PLATA COUNTY, COLORADO

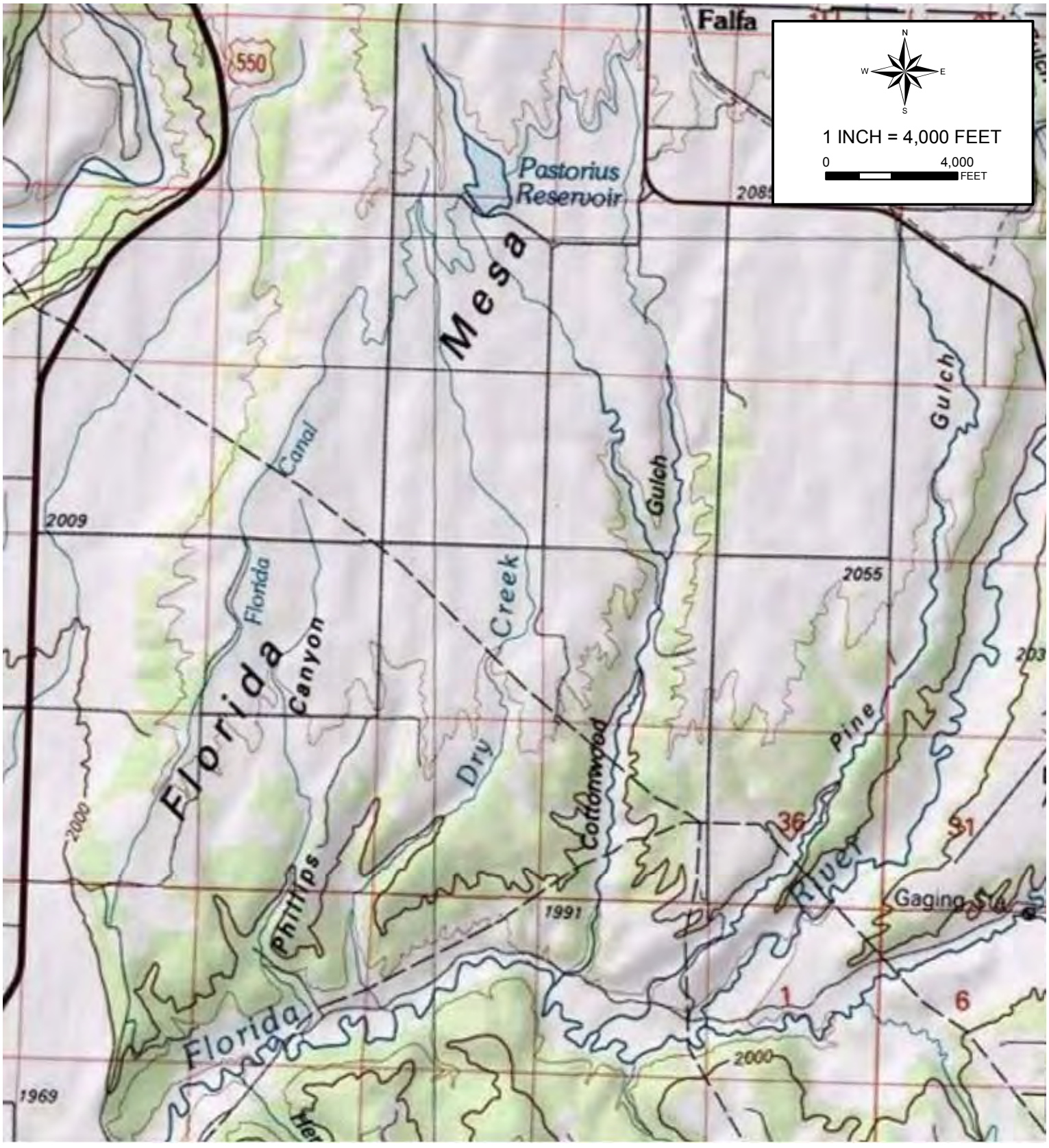
LOCATION MAP

PASTORIUS RESERVOIR - EAP

T 34 N, R 9 W, NMPM

PROJECT NO. 061-110.060

FIGURE 1



P:\061-110\060 Seepage Reduction Program\EAP\Mapping\Vicinity Map.mxd

WWE
WRIGHT WATER ENGINEERS, INC.
1666 NORTH MAIN AVE. STE C
DURANGO, CO, 81301
(970) - 259 - 7411

LA PLATA COUNTY, COLORADO

VICINITY MAP

PASTORIUS RESERVOIR - EAP

T 34 N, R 9 W, NMPM

PROJECT NO. 061-110.060

FIGURE 2

Appendix A-3
Available Resources

Resources Available

Locally available equipment, labor, and materials:

Heavy equipment service and rental	Sand and gravel supply	Ready-mix concrete supply
Name: Coopers Construction Co. Address: P.O. Box 2504 Durango, CO 81302 Phone: 970-259-1009	Name: C & J Gavel Address:27661 Highway 16 Durango, CO 81301 Phone: 970-385-4112	Name: Sky Ute Sand & Gravel Address:4101 CR 222 Durango, CO 81303 Phone: 970-385-0609
Name: Brown Bros. Construction Address:29012 Highway 160 Durango, CO 81301 Phone: 970-249-0161	Name: Sky Ute Sand & Gravel Address:4101 CR 222 Durango, CO 81303 Phone: 970-382-0609	Name: SandCo Address: Trimble Lane Durango, CO 81301 Phone: 970-247-1303

Pumps	Diving Contractor	Sand Bags
Name: Target Rental Address:989 S. Camino del Rio Durango, CO 81301 Phone: 970-247-0161	Name: United Underwater Contr. Address:532 34 Road Clifton, CO 81520 Phone: 970-523-1311	Name: Basin Co-Op Address:26103 Highway 160 Durango, CO 81301 Phone: 970-247-3066

Other:	Other:	Other:
Name: Address: Phone:	Name: Address: Phone:	Name: Address: Phone:

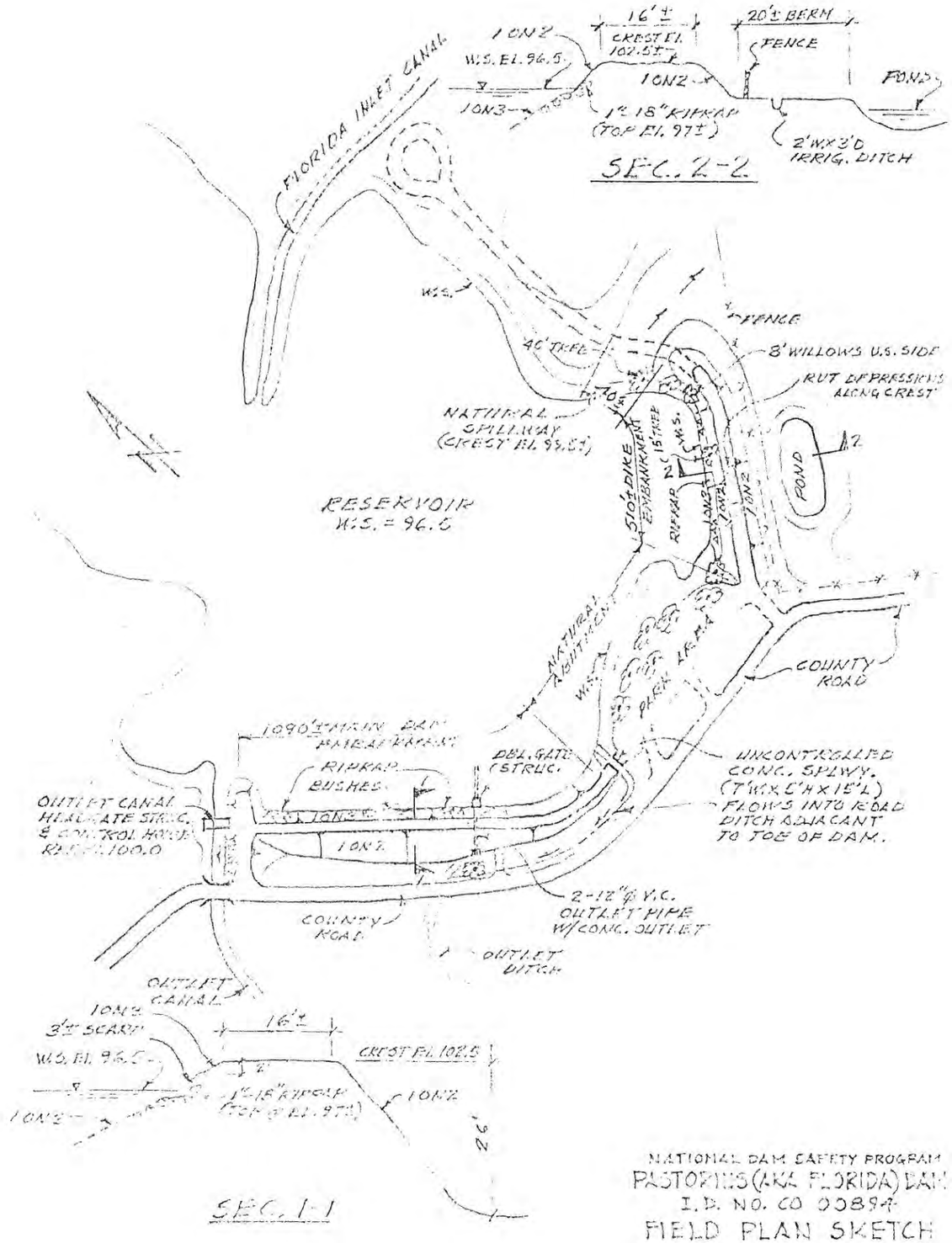
Other locally available resources:

Appendix A-4
Summary of People/Structures At Greatest Risk

Summary of People/Structures at Greatest Risk

Residence/Business	Address	Phone No.
Phil McClendon	4200 County Road 302 Durango, CO 81303	970-247-4742
James & Marlene Cole	4526 County Road 302 Durango, CO 81301	Not Available
United Dairy Farmers, Inc.	3955 Montgomery Road Cincinnati, OH 45212	970-247-8463

Appendix A-5
Plan and Profile Views of Dam



NATIONAL DAM SAFETY PROGRAM
PASTORIUS (AKA FLORIDA) DAM
I.D. NO. CO 00894
FIELD PLAN SKETCH

PLATE C-1

MAINTENANCE OF DAM AT PASTORIUS RESERVOIR

I hereby certify that these plans for the maintenance of the Dam at Pastorius Reservoir, were prepared by me or under my direct supervision for the owners thereof.

Harry L. Goff
Reg. PE & LS
Colo. Reg. No. 7140

Accepted and approved for the Florida Canal Company and Florida Canal Enlargement Company whose address is Box 3345, Durango, Colorado 81301

By: Steve Simon
President

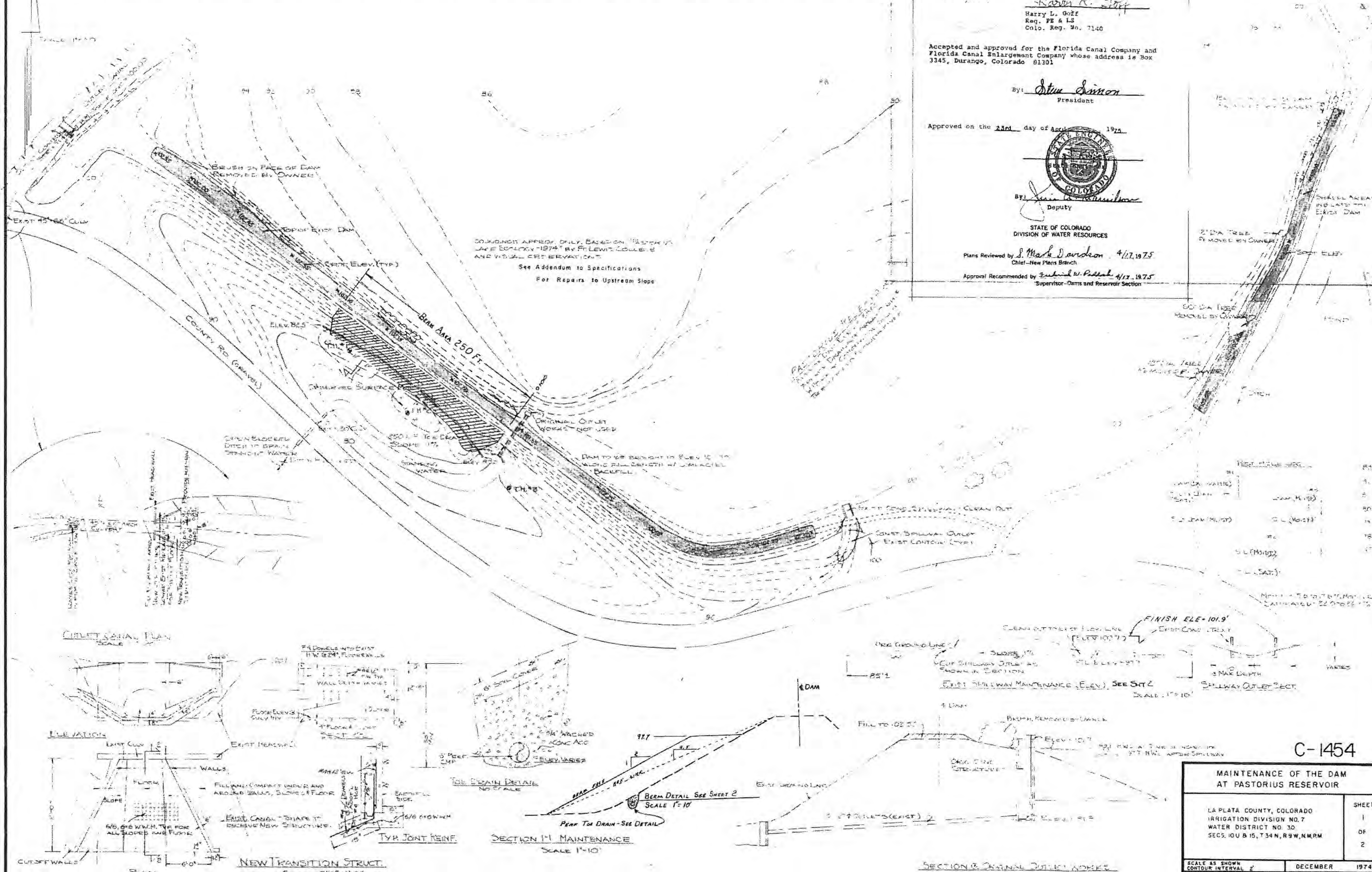
Approved on the 23rd day of April 1975

By: [signature]
Deputy

STATE OF COLORADO
DIVISION OF WATER RESOURCES

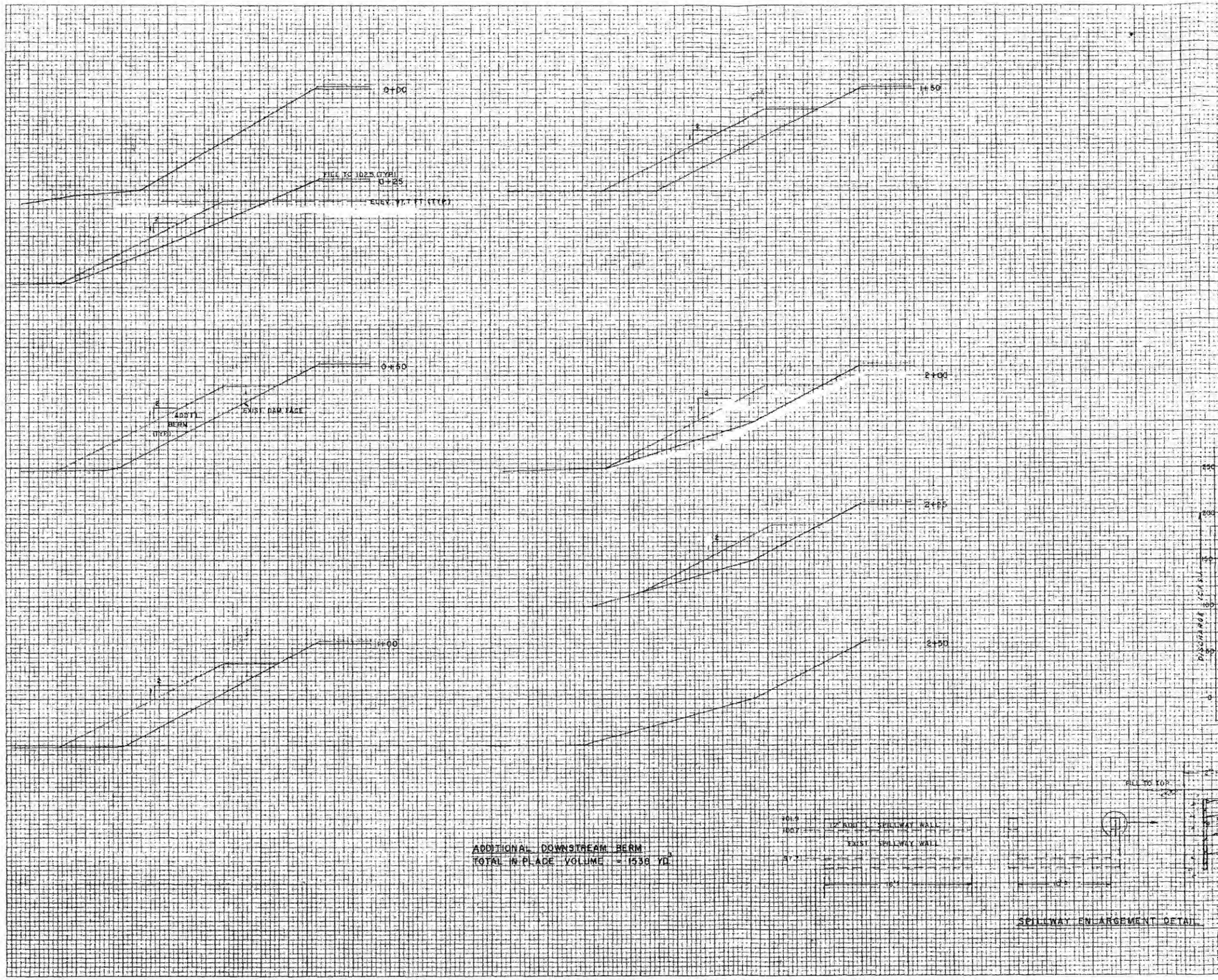
Plans Reviewed by S. Mark Davidson 4/17, 1975
Chief—New Plans Branch

Approval Recommended by Frederick W. Paddock 4/17, 1975
Supervisor—Dams and Reservoir Section



C-1454

MAINTENANCE OF THE DAM AT PASTORIUS RESERVOIR	
LA PLATA COUNTY, COLORADO IRRIGATION DIVISION NO. 7 WATER DISTRICT NO. 30 SECS. 10 U & 15, T 34 N, R 9 W, N.M.P.M.	SHEET 1 OF 2
SCALE AS SHOWN CONTOUR INTERVAL 2'	DECEMBER 1974
ERNST ENGINEERING CO.	DURANGO, COLORADO



I HEREBY CERTIFY THAT THESE PLANS FOR THE MAINTENANCE OF THE DAM AT PASTORIUS RESERVOIR WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION FOR THE OWNERS THEREOF.

HARRY L. GOFF
REG. PE AND LS
COLO. REG. NO. 7140

ACCEPTED AND APPROVED FOR THE FLORIDA CANAL COMPANY AND FLORIDA CANAL ENLARGEMENT COMPANY WHOSE ADRESS IS BOX 3343, DURANGO, COLO. 81301

BY: _____ PRESIDENT

APPROVED ON THE ____ DAY OF _____, 19__

STATE ENGINEER

BY: _____ DEPUTY

C-1454

MAINTENANCE OF THE DAM AT PASTORIUS RESERVOIR

LA PLATA COUNTY COLORADO
IRRIGATION DIVISION NO. 7
WATER DISTRICT NO. 30
SECS. 30 & 31, T34N, R9W, N.M.P.M.

SHEET 2 OF 2

SCALE 1"=10' | MARCH 1979

ERNST ENGINEERING CO. DURANGO, COLORADO

K&E PLATE 3, CROSS SECTION KEUFFEL & ESSER CO.

Notes

1. The gate support structure shall be attached to the inlet structure with a 2 inch notch into the existing concrete and holes drilled into the concrete for rebar; the rebar shall be imbedded in both structures to provide stability. The hole and rebar shall be on 6 inch centers. The contact between the gate structure and the existing inlet structure shall be water tight.

2. Rebar (1/2 inch) shall be included in the gate support structure on 6 inch centers

3. The gate shall be attached with galvanized bolts embedded in the concrete, as per the gate manufacturers specification.

4. The trash rack shall be 1/2 inch thick 2 inch wide galvanized steel bars on edge and placed on 3 inch centers. The outside width of the top of the rack shall be 3 feet and the length 6 feet 3 inches. The front and sides of the rack shall also be steel bars a sufficient depth to rest on the gate support structure. The rack shall be hinged at the front lower end so that the rack can be lifted off the gate.

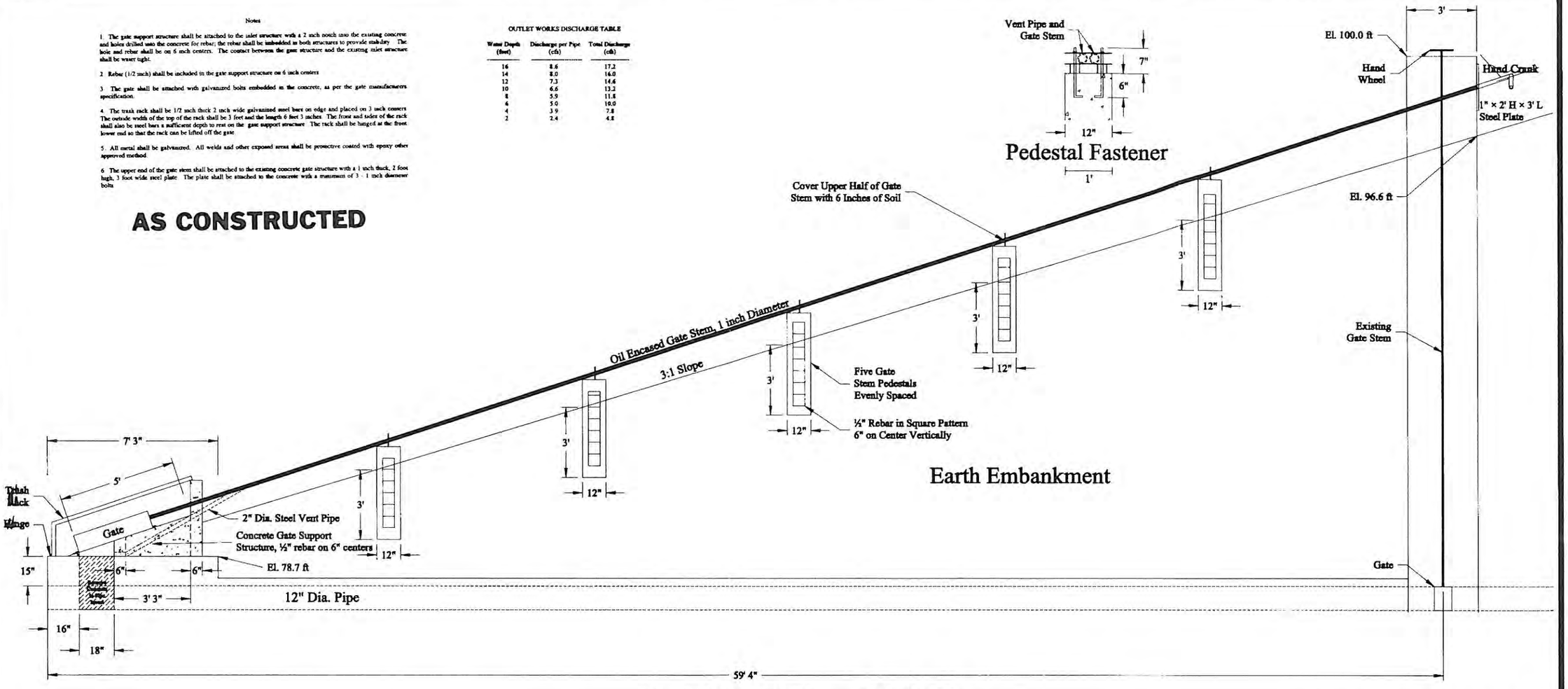
5. All metal shall be galvanized. All welds and other exposed areas shall be protective coated with epoxy other approved method.

6. The upper end of the gate stem shall be attached to the existing concrete gate structure with a 1 inch thick, 2 foot high, 3 foot wide steel plate. The plate shall be attached to the concrete with a minimum of 3 - 1 inch diameter bolts

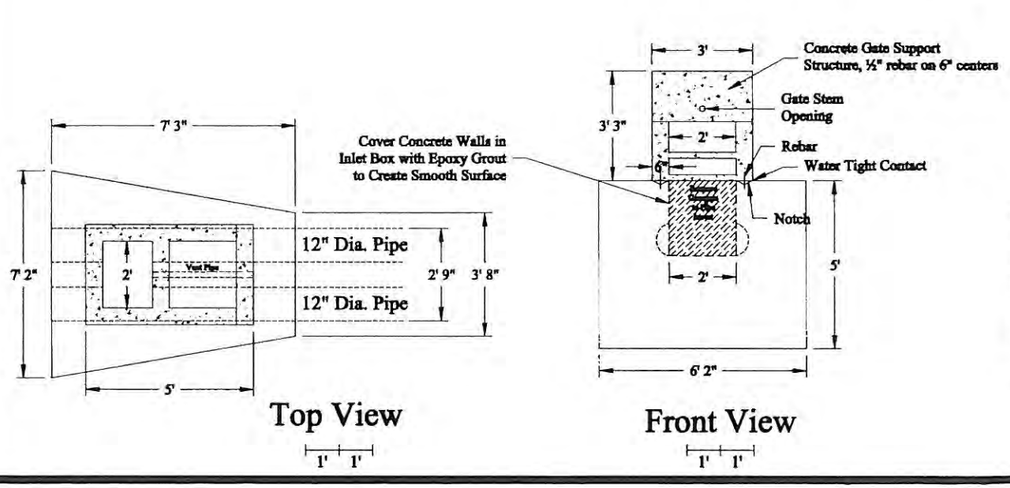
OUTLET WORKS DISCHARGE TABLE

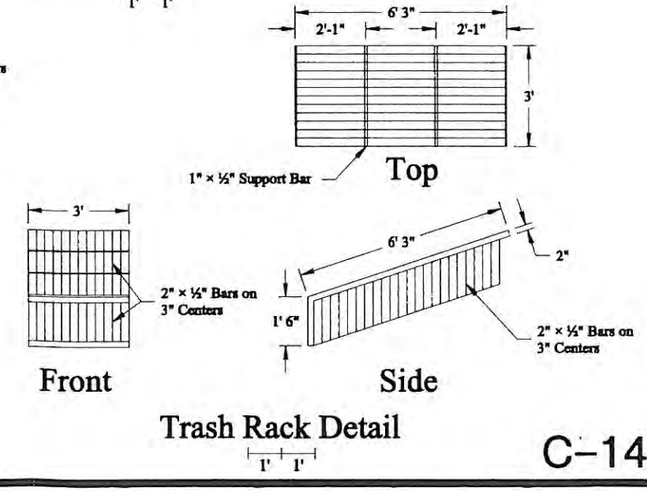
Water Depth (feet)	Discharge per Pipe (cfs)	Total Discharge (cfs)
16	8.6	17.2
14	8.0	16.0
12	7.3	14.6
10	6.6	13.2
8	5.9	11.8
6	5.0	10.0
4	3.9	7.8
2	2.4	4.8

AS CONSTRUCTED



Cross Section of Dam at Outlet Pipe





C-1454A

I hereby certify that these plans for the modification of the Outlet Works at Pastorius Dam were prepared by me for the Florida Canal Company in March, 1998.

Steven C Harris
Steven C Harris
Colorado Registration No. 14303

Approved on the _____ day of _____, 1998.

By: _____ AS BUILT
State Engineer

By: _____ ACCEPTED
Deputy

FILING PURPOSES ONLY
12/14/2001

These plans represent the AS-CONSTRUCTED condition of the outlet works of Pastorius Dam to the best of my knowledge and judgment, based in part on information furnished by other as of the 30th day of April, 1998.

Steven C Harris
Steven C Harris Colorado PE 14303

Pastorius Dam and Reservoir Outlet Gate

Scale: 1" = 2'	Drawing Description	Drawing by: Quinn Harris
Date: 3/1/98		Revised: -
Harris Water Engineering, Inc.		Copyright: -

103040

Appendix A-6
Reservoir Elevation-Area-Capacity Data

Pastorius Reservoir
Elevation-Area-Capacity

Elevation (feet)	Volume (acre-feet)	Surface Area (acres)
6844.4	0.0	0.0
6845.4	0.5	0.1
6846.4	0.3	0.0
6847.4	1.5	0.2
6848.4	7.5	1.1
6849.4	13.7	2.1
6850.4	25.0	3.8
6851.4	37.2	5.6
6852.4	55.0	8.3
6853.4	74.3	11.1
6854.4	100.0	15.0
6855.4	125.9	18.9
6856.4	158.0	23.7
6857.4	190.0	28.5
6858.4	230.0	34.5
6859.4	266.4	40.0
6860.4	305.0	45.8

Appendix B-1
Contact Checklist

Contact Checklist

(to be completed during an emergency)

Dam Name: _____, DAMID: _____

_____ County, Colorado Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 8–11 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the Notification Flowcharts for critical contact information and page 17 for contact information for other possible emergency services.

Emergency Level 1 (see page 14)	Person Contacted	Time Contacted	Contacted by
___ State Dam Safety Engineer	_____	_____	_____
___ Dam Owner's Engineer	_____	_____	_____
___	_____	_____	_____

Emergency Level 2 (see page 15)	Person Contacted	Time Contacted	Contacted by
___ Local Emergency Manager	_____	_____	_____
___ State Dam Safety Engineer	_____	_____	_____
___ Available Resources	_____	_____	_____
___	_____	_____	_____

Emergency Level 3 (see page 16)	Person Contacted	Time Contacted	Contacted by
___ Local Emergency Manager	_____	_____	_____
___ State Dam Safety Engineer	_____	_____	_____
___	_____	_____	_____
___	_____	_____	_____

Appendix B-2
Unusual or Emergency Event Log

Unusual or Emergency Event Log

(to be completed during an emergency)

Dam Name: _____, DAMID: _____

_____ County, Colorado Date _____

When and how was the event detected? _____

_____

Weather Conditions: _____

_____

General description of the emergency situation: _____

_____

Emergency level determination: _____ Made by: _____

ACTIONS AND EVENT PROGRESSION

Date	Time	Action/event progression	Taken by

Report prepared by: _____ Date: _____

Appendix B-3
Dam Emergency Situation Report

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: _____ State DAMID: _____

Dam location: _____ _____County _____
(City) *(County)* *(Stream/River)*

Date:_____ Time: _____

Weather conditions: _____

General description of emergency situation: _____

_____

_____

Area(s) of dam affected: _____

_____

_____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

_____

Other data and comments: _____

_____

Observer's name and telephone number:_____

Report prepared by: _____ Date: _____

_____

Appendix B-4
Glossary of Terms

Glossary of Terms

Abutment That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

Acre-foot A unit of volumetric measure that would cover one acre to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

Boil A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

Conduit A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Control section A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section A slice through the dam or portion thereof showing elevation vertically and direction of natural water flow horizontally. Also a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.

Dam A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water.

Dam failure The uncontrolled release of a dam's impounded water.

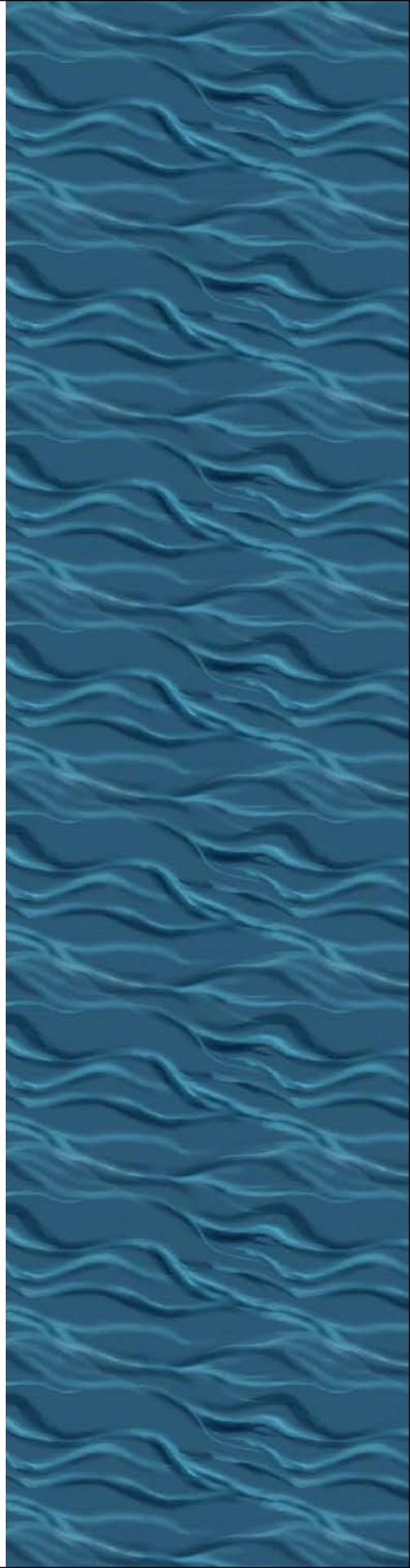
Dam Owner Any person, private or non-profit company, special district, federal, state, or local government agency, or any other entity in direct routine control of a dam and reservoir, and/or directly involved in the physical operation and maintenance of a dam, or proposes to construct a dam.

Drain, toe or foundation, or blanket A internal water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.

Drainage area (watershed) The geographic area onto which rainfall ultimately flows to the dam.

Drawdown	The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.
Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Emergency Action Plan (EAP)	A written document prepared by the dam owner, describing a detailed plan of actions for response to emergency or unusual events, including alerting and warning emergency officials in the event of a potential or imminent dam failure or other emergency related to the safety of the dam and public.
Engineer	A Professional Engineer registered and licensed in Colorado in accordance with section 12-25-101, C.R.S. The Engineer must be sufficiently qualified and experienced in the design, construction, and safety evaluation of the type of dam under consideration.
Filter	Those layers of sand and gravel in an internal drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	The vertical dimension between the crest (or invert) of the emergency spillway and the crest of the dam.
Groin	That area along the intersection of the face of a dam and the abutment.
Hazard Classification	The placement of a dam into one of four categories (High, Significant, Low, No Public Hazard) based on the hazard potential derived from an evaluation of the probable incremental adverse consequences due to failure or improper operation of the dam.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation Map	A map depicting the area downstream from a dam that would reasonably be expected to be flooded in the event of a failure of the dam.
Local Emergency Manager	Person(s) responsible for developing, organizing and exercising a community's emergency operations plan. Typically City Police or Fire Department or County Sheriff's Department personnel act as the Local Emergency Manager.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.

Outlet	A conduit (usually regulated by gates or valves) used for controlled or regulated releases of impounded water from the reservoir.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Reservoir	A body of water impounded by a dam.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway	An appurtenant structure that conducts overflows from a reservoir.
Spillway (Principal or Service)	The overflow structure designed to limit or control the operating level of a reservoir, and first to be activated in runoff conditions.
Spillway (Emergency)	The appurtenant structure designed to pass the Inflow Design Flood in conjunction with the routing capacity of the reservoir and any principal or service spillway(s).
Spillway crest	The elevation of the floor of a spillway, grade control structure, or ogee crest above which spillway flow begins.
State Dam Safety Engineer	For purposes of this EAP, Division of Water Resources Division or local field office engineer responsible for safety inspections and determining the safe reservoir storage level of assigned dams.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.



WWE
Wright Water Engineers, Inc.
2490 West 26th Ave., Suite 100A
Denver, Colorado 80211
(303) 480-1700 TEL
(303) 480-1020 FAX
www.wrightwater.com
e-mail: sclark@wrightwater.com

February 11, 2011

Via Email (ppage@uc.usbr.gov)

Mr. Pat Page, Chief, Water Management Group
Western Colorado Area Office
Bureau of Reclamation
835 E. 2nd Ave Ste #300
Durango, CO 81301

Re: Vegetation Habitat Assessment
Proposed Florida Farmers Ditch Lining Project, La Plata County, Colorado

Dear Mr. Page:

As you are aware, portions of the Florida Farmers Ditch (Ditch), located between County Roads (CR) 234 and 236 east of the city limits of Durango, in La Plata County, Colorado (See Figure 1) experience seepage and are proposed to be lined (Project). In this letter report Wright Water Engineers, Inc. (WWE) identifies the 1) vegetation habitats in the vicinity of the Project and associated hydrology; 2) possible negative impacts of Ditch lining on the identified vegetation habitats; and 3) perceived significance of any potential negative impacts.

METHODOLOGY

WWE conducted a field study of the Project area on November 17-18, 2010 to identify existing vegetation habitat types and associated hydrology, each habitat's potential reliance on Ditch seepage, and potential impacts that may result from the Project. Where potential negative impacts were identified for a particular vegetation habitat type, WWE reviewed the federal list of special status species for La Plata County to assess the likely occurrence of any listed species in the negatively impacted habitat.

ENVIRONMENTAL SETTING

The approximately two-mile long Project area extends from the Florida River valley adjacent to CR 234, up the Florida Mesa hillside, and through irrigated fields on top of the Florida Mesa to CR 236. Elevations range from 7,000' to 7,200' above sea level.

Observed Vegetation Habitats

Table 1 below describes the observed vegetation habitats in the vicinity of the Ditch.

Table 1. Observed Habitats

Habitat	Location Within Project Area	Brief Habitat Description
Colorado Plateau Pinon-Juniper Woodland	Hills and ridges	**Tree canopy** – Utah juniper (*Juniperus osteosperma*), rocky mountain juniper (*Juniper scopulorum*), pinon pine (*Pinus edulis*); **Shrub layer** – big sagebrush (*Artemisia tridentata*), mountain mahogany (*Cercocarpus montanus*), gambel oak (*Quercus gambelii*), antelope bitterbrush (*Purshia tridentata*), rabbitbrush (*Ericameria nauseosa*); **Herbaceous layer** – Indian rice grass (*Achnatherum hymenoides*), western wheat grass (*Pascopyrum smithii*), smooth brome (*Bromus inermis*), buckwheat (*Eriogonum sp.*), aster (*Aster sp.*), and heterotheca (*Heterotheca sp.*) potentially Knowlton's cactus (Endangered Species)
Rocky Mountain Ponderosa Pine Woodland	Exposed terrain, either in association with Colorado Plateau Pinon-Juniper Woodland, or in isolated stands	**Tree canopy** – ponderosa pine (*Pinus ponderosa*); **Woody understory** – ponderosa pine saplings, rocky mountain juniper, Utah juniper, pinon pine, gambel oak, antelope bitterbrush, wild crabapple (*Peraphyllum ramoisissimum*), mountain mahogany, mountain snowberry (*Symphoricarpos oreophilus*); **Herbaceous layer** – various grasses and forbs
Rabbitbrush Shrubland and Grassland	Cleared, dry shelves on woodland fringes	**Shrub layer** – rabbitbrush, big sagebrush, rose (*Rosa sp.*); **Herbaceous layer** – indian rice grass, crested wheat grass, western wheat grass, broom snakeweed (*Gutierrezia sarothrae)*, smooth brome, sweet clover (*Melilotus sp.)*, stipa (*Stipa sp.),*lamb's ear (*Verbascum Thapsus*),
Riparian – Palustrine Emergent Vegetation	Interior Ditch banks*	**Herbaceous layer** – spotty patches of reed canary grass (*Phalaris arundinacea*), Baltic rush (*Juncus balticus*), cinnamon-leaved willow herb (*Epilobium sp.*), red top (*Agrostis sp.*), dock (*Rumex sp.*)
Riparian – Palustrine Scrub-Shrub Vegetation	Exterior Ditch Banks*	**Tree layer** – spotty cottonwood (*Populus sp.*); **Shrub layer** –spotty willows (*Salix sp.*); **Herbaceous layer** – spotty reed canary grass, Baltic rush, cinnamon-leaved willow herb, red top, dock
Cottonwoods with Primarily Upland Understory	Ephemeral drainages and slopes surrounding Ditch	**Tree layer** – few mature cottonwood; Woody understory – ponderosa pine, pinon pine, Utah juniper, rocky mountain juniper; **Shrub layer** – spotty willows, gambel oak, antelope bitterbrush, roses, snowberry; **Herbaceous layer** – upland grasses and forbs
Steep Slope – Predominantly Barren with Erosion	Steep slopes up-gradient of Ditch	**Herbaceous layer** - Minimal grasses and forbs, mostly barren
Agricultural Irrigated Land	Irrigated fields surrounding Ditch	**Herbaceous layer** – hayfield grasses
Disturbed land	Adjacent to Ditch and maintenance road	**Herbaceous layer** – spotty grasses and forbs including invasive species

*Please note that the Ditch is annually maintained for vegetation growth with herbicides.

Observed Hydrology

The northern portion of the Ditch lining project between CR 234 and CR 237 is characterized by steep slopes up-gradient of the Ditch. Surface runoff, from both intermittent and year round channels, and irrigation ditch seepage from up-gradient canals may be contributors to the vegetation in the vicinity of the Ditch. East and down-gradient of the Ditch, slopes are gradual down to CR 234. Irrigation practices in the Florida River Valley and road runoff may be significant hydrology factors to the vegetation communities in the vicinity of the Ditch.

Further south, and out of the Florida River Valley, slopes continue to be steep up-gradient of the Ditch with intermittent channels culverted beneath the Ditch. A flat shelf is present on the down-gradient (east) side of the ditch. Several incised, ephemeral drainages are present that bisect the flat shelf. These drainages appear to have historically conveyed irrigation return flows down-gradient towards the Florida River Valley. Irrigation return flows and surface runoff may be significant contributing sources of water for vegetation communities in the vicinity of the Ditch.

The southernmost portion of the Ditch is bounded on both sides by relatively flat irrigated fields. Irrigation return flows appear to contribute to the vegetation communities in the vicinity of the Ditch.

Possible Negative Impacts to Vegetation Habitats

The Project area is divided into five segments based on the predominant vegetation habitats identified in each segment (see attached Habitat Assessment figures). Table 2 (attached) describes the surface drainage, vegetation habitats identified in each segment, potential impacts to the vegetation habitats, and the significance of the impacts.

Aside from the Ditch and irrigated fields, the majority of the identified habitat types are typical of the area, do not appear to have been modified by up-gradient irrigation or Ditch seepage, and should not be impacted by the lining. It is worth noting that slopes below the previously lined Ditch adjacent to the Payne Canyon Siphon, as well as the area in the vicinity of the landslide, are well vegetated and are vegetated similarly to the surrounding area. Historic water conveyance or seepage, or up-gradient irrigation appear to have modified the following vegetation habitats: Riparian-Palustrine Scrub-Shrub, Riparian-Palustrine Emergent Vegetation, and Cottonwoods with Upland Understory. Lining of the Florida Farmers Ditch could have potential negative impacts on these habitat types.

Possible Negative Impacts and their Perceived Significance

Riparian-Palustrine Scrub-Shrub and Riparian-Palustrine Emergent Vegetation: Historic irrigation practices up-gradient of the Ditch appear to have formed pockets of riparian scrub-shrub vegetation on the up-gradient slope of the Ditch. Additionally, sparse riparian emergent vegetation has formed at the Ditch waterline. The riparian vegetation adjacent to the Ditch has sparse coverage and lacks diversity due to annual herbicidal control. Both of these habitat types, based on diversity and species composition, are not generally associated with exceedingly high-value habitats. Lining could have minor direct impacts on the riparian vegetation. It is important

to note that the sparse vegetative coverage is not dense enough to provide habitat for special status species that require densely vegetated riparian corridors. Furthermore, it is likely that minimal riparian vegetation may re-establish after Ditch lining activities are complete.

Cottonwoods with Primary Upland Understory: This habitat type is found in deeply incised drainages that originate up- and down-gradient of the Ditch and maintenance road. It appears that up-gradient irrigation practices and natural surface drainage formed this habitat type prior to the construction of the Ditch. Following construction, the Ditch has intercepted this water, or culverts and flumes have conveyed it down-gradient of the Ditch. In either case, the Project should not impact this habitat type. Within the Project area, this habitat appears unlikely to contain listed special status species.

CONCLUSION

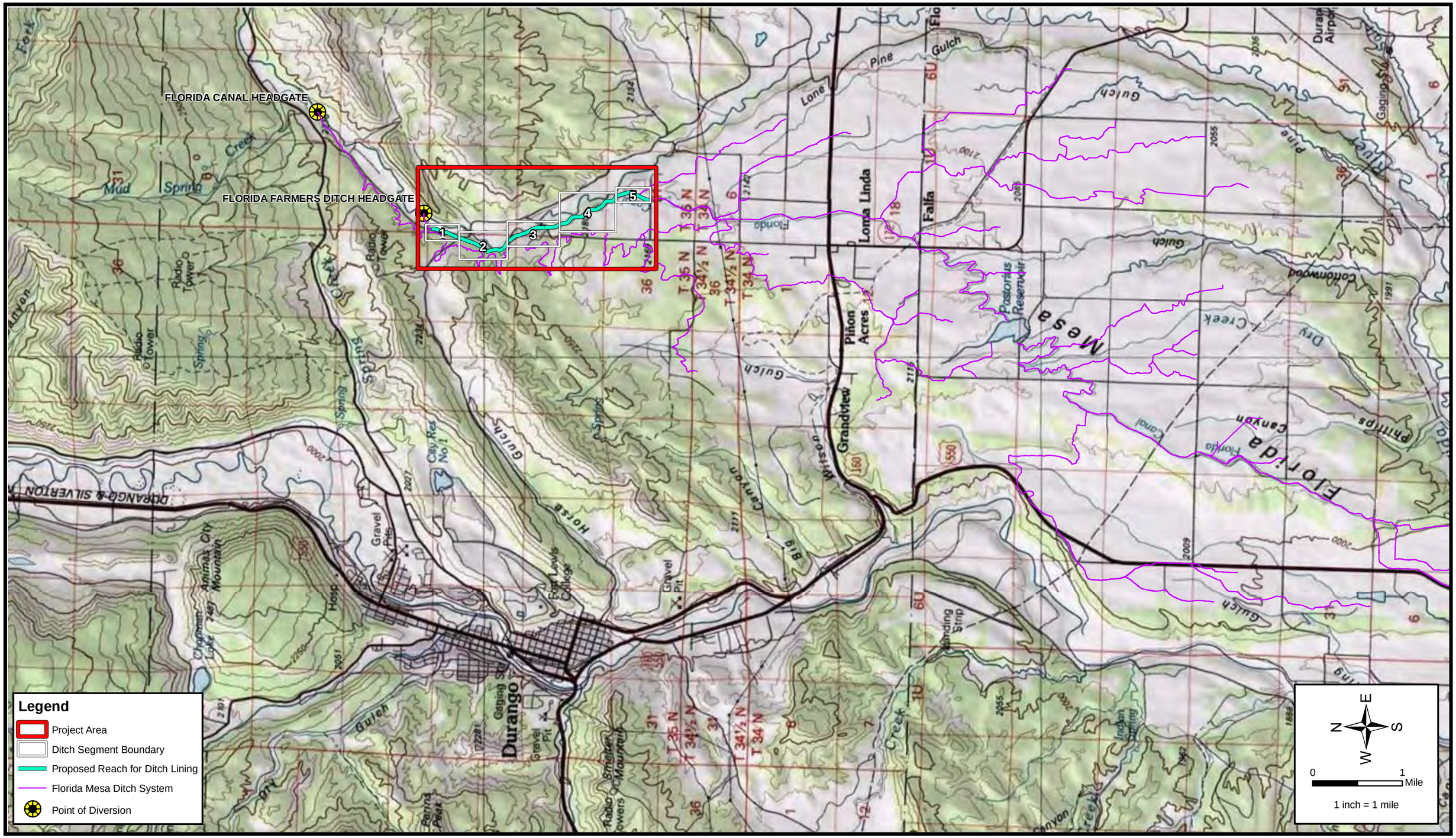
The majority of the vegetation communities in the vicinity of the Project are typical of the area and do not appear to have been modified by up-gradient irrigation, Ditch seepage, or previous Ditch lining. These vegetation communities should not be impacted by Ditch lining. Multiple sources of water including historic water conveyance or seepage, or up-gradient irrigation appear to have modified the following vegetation habitats: Riparian-Palustrine Scrub-Shrub, Riparian-Palustrine Emergent Vegetation, and Cottonwoods with Upland Understory. Based on our assessment, Ditch lining is expected to have minimal negative impacts on the Riparian vegetation communities associated with the Ditch. Based on the ecological value of Riparian habitat, Ditch lining impacts are perceived to be of minor significance.

Sincerely,

By _____
Samantha R. Clark
Senior Wetland and Environmental Scientist

By _____
Warren C. Rider
Watershed Scientist

Attachments: Location Map
Habitat Assessment Figures
Table 2



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Ditch alignments were provided by the San Juan RC&D Office of the USDA, Durango, Colorado.

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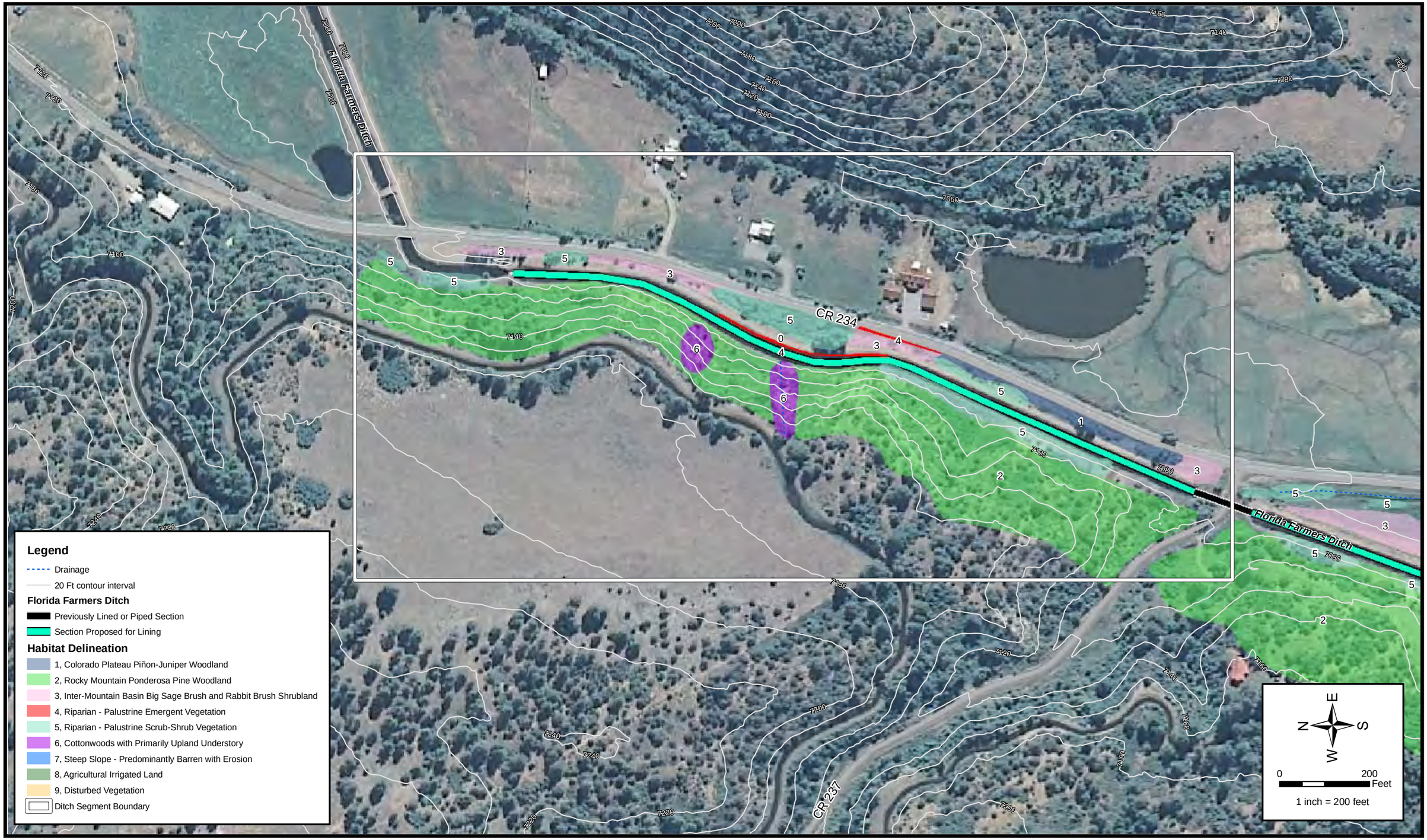
LA PLATA COUNTY, COLORADO

HABITAT ASSESSMENT - LOCATION MAP

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No.
061-110.060

FIGURE 1



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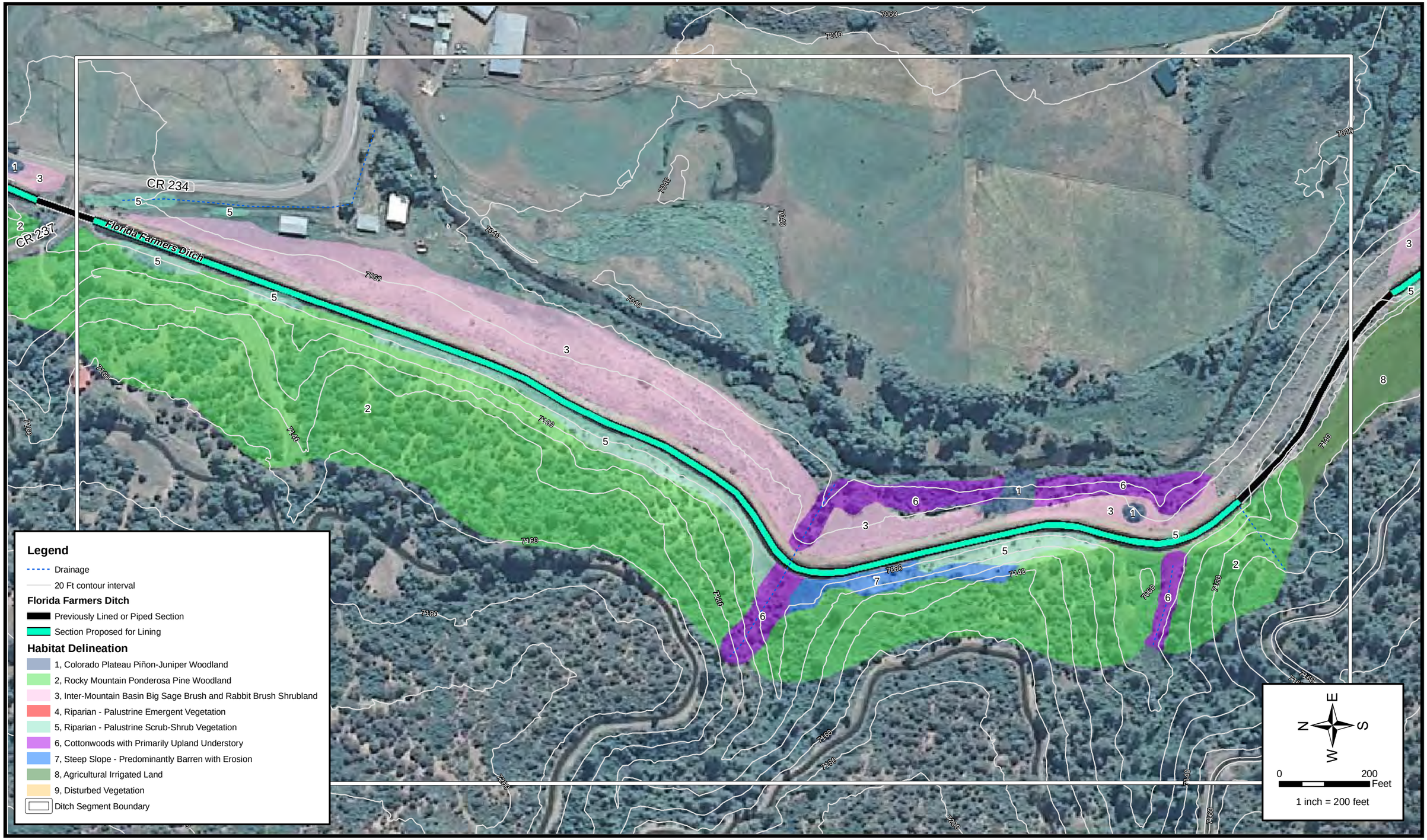
HABITAT ASSESSMENT - DITCH SEGMENT 1

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No.
061-110.060

SEGMENT 1



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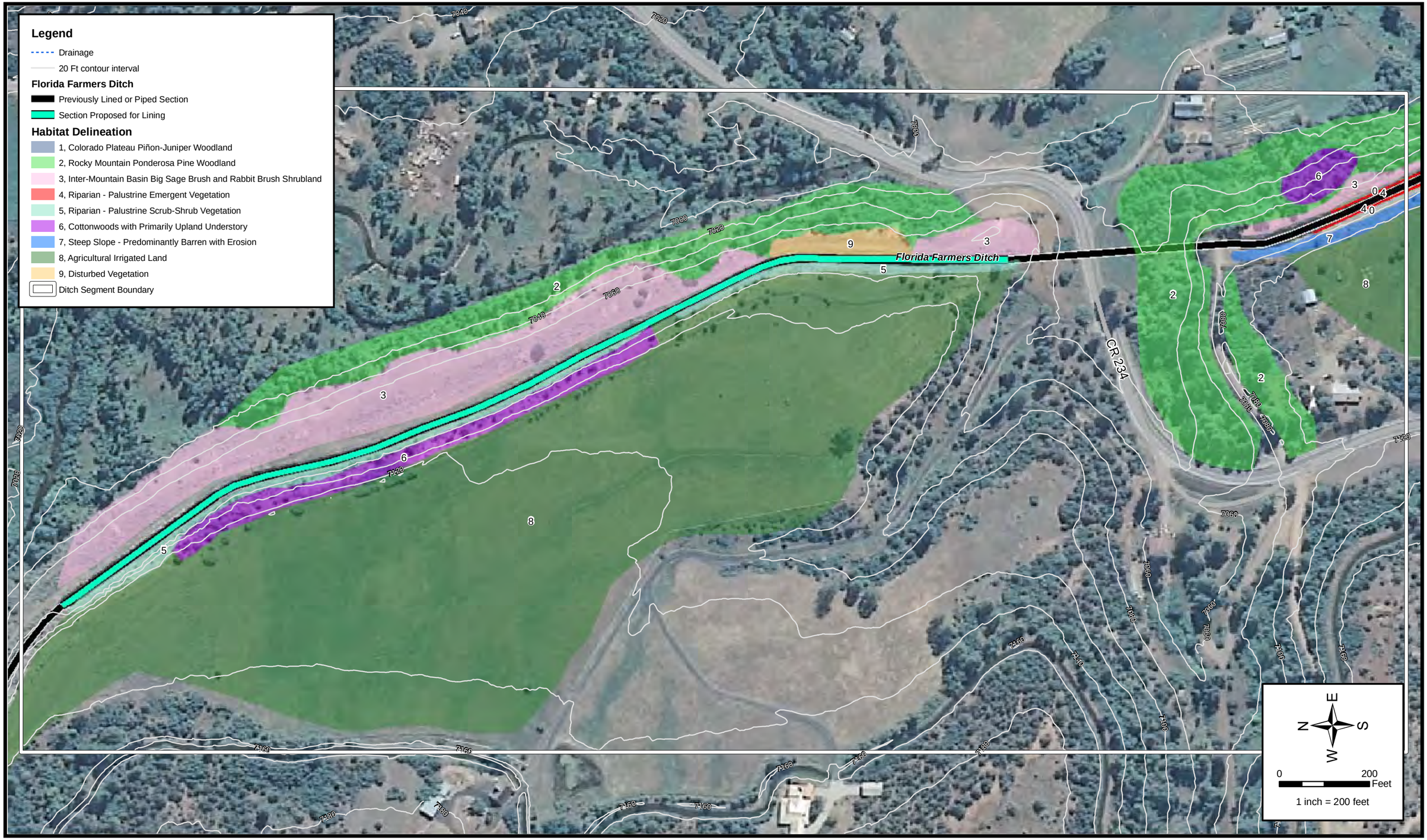
HABITAT ASSESSMENT - DITCH SEGMENT 2

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No.

061-110.060

SEGMENT 2



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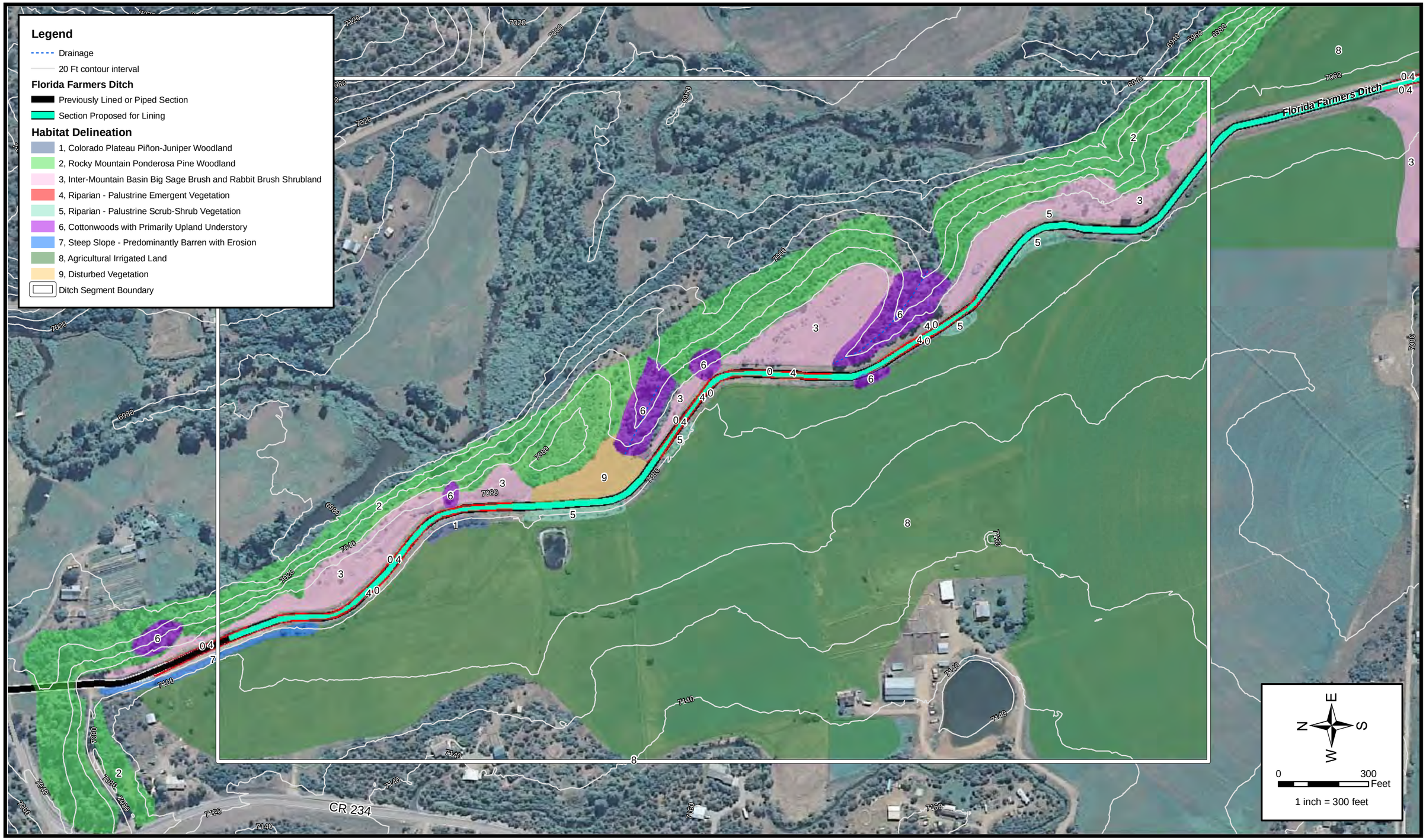
HABITAT ASSESSMENT - DITCH SEGMENT 3

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No.

061-110.060

SEGMENT 3



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HABITAT ASSESSMENT - DITCH SEGMENT 4

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No.

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SEGMENT 4

Legend

- Drainage
- 20 Ft contour interval

Florida Farmers Ditch

- Previously Lined or Piped Section
- Section Proposed for Lining

Habitat Delineation

- 1, Colorado Plateau Piñon-Juniper Woodland
- 2, Rocky Mountain Ponderosa Pine Woodland
- 3, Inter-Mountain Basin Big Sage Brush and Rabbit Brush Shrubland
- 4, Riparian - Palustrine Emergent Vegetation
- 5, Riparian - Palustrine Scrub-Shrub Vegetation
- 6, Cottonwoods with Primarily Upland Understory
- 7, Steep Slope - Predominantly Barren with Erosion
- 8, Agricultural Irrigated Land
- 9, Disturbed Vegetation
- Ditch Segment Boundary

Florida Farmers Ditch

CR 236

N E S W

0 200 Feet

1 inch = 200 feet

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HABITAT ASSESSMENT - DITCH SEGMENT 5

FLORIDA MESA CANAL COMPANIES' WATER LOSS REDUCTION PROJECT

Project No. 061-110.060

SEGMENT 5

Table 2
Florida Canal Companies – NEPA Submittal
Vegetation Habitats Identified by Segment, Potential Impacts, and Significance of Impacts

Segment	Surface Drainage	Ditch Habitat	Habitat Upgradient of Ditch	Habitat Downgradient of Ditch	Potential Impacts from Ditch Lining?	Significance of impact
1	Steep slope from west east towards Ditch, gradual slope down to CR 234	Spotty riparian palustrine emergent vegetation at waterline*; pockets of riparian scrub-shrub vegetation on upgradient bank from irrigation water return flows	Ponderosa pine woodland, one drainage flows toward the Ditch surrounded by cottonwoods with upland understory, one additional pocket of cottonwoods with upland understory	Pockets of palustrine, scrub-shrub vegetation connected by a ditch with palustrine emergent vegetation at the base of CR 234 and pinon-juniper woodland	Yes – riparian vegetation associated with the Ditch*; No - remainder of upgradient and downgradient habitat – riparian vegetation adjacent to CR 234 appear to be supported by road runoff, irrigation in the valley, and the Florida River alluvium	Not significant - minor impact to spotty riparian vegetation not dense enough to provide special status species habitat, may re-establish after Ditch lining
2	Steep slope from west east towards Ditch, primarily flat shelf east of ditch	Riparian scrub-shrub vegetation on upgradient bank from irrigation water return flows	Ponderosa pine woodland, two drainages flow toward the Ditch surrounded by cottonwoods with upland understory, eastern drainage is conveyed via a culvert under the Ditch	Primarily rabbitbrush shrubland/grassland and pinon-juniper woodland	Yes – riparian vegetation associated with the Ditch*; No - remainder of upgradient and downgradient habitat	Not significant - minor impact to spotty riparian vegetation not dense enough to provide special status species habitat, may re-establish after Ditch lining
3	Primarily gentle gradient from west east towards Ditch except steeper slopes around CR 234, Steep gradient from Ditch east to Florida River	Spotty riparian palustrine emergent vegetation at waterline in southern portion*; pockets of riparian scrub-shrub vegetation on upgradient bank from irrigation water return flows	Agriculture irrigated land and pockets of cottonwoods with upland understory, ponderosa pine forest adjacent to CR 234	Primarily rabbitbrush shrubland/grassland, ponderosa pine woodland, and disturbed land. Pocket of cottonwood with upland understory present downgradient of lined section	Yes – riparian vegetation associated with the Ditch*; No – remainder of upgradient and downgradient habitat	Not significant - minor impact to spotty riparian vegetation not dense enough to provide special status species habitat, may re-establish after Ditch lining
4	Gentle gradient from west east towards Ditch, Steep gradient from Ditch east to Florida River	Spotty palustrine emergent vegetation at waterline*; pockets of riparian scrub-shrub vegetation on upgradient bank from irrigation water return flows	Agriculture irrigated land and pockets of cottonwoods with upland understory, pinon-juniper woodland, and barren slopes	Primarily rabbitbrush shrubland/grassland, ponderosa pine woodland, and disturbed land. Two steeply incised historic drainages vegetated with cottonwoods with upland understory	Yes – riparian vegetation associated with the Ditch*; No – remainder of upgradient and downgradient habitat	Not significant - minor impact to spotty riparian vegetation not dense enough to provide special status species habitat, may re-establish after Ditch lining
5	Primarily flat – gentle gradient west to east	Spotty riparian palustrine emergent vegetation at waterline*	Agriculture irrigated land, rabbitbrush - grassland, and pinon-juniper woodland	Well pad, agriculture irrigated land with prominent irrigation ditch lateral and pond surrounded by riparian scrub-shrub vegetation	Yes – spotty emergent vegetation in Ditch*; No – surrounding irrigated land	Not significant - minor impact to spotty riparian vegetation not dense enough to provide special status species habitat, may re-establish after Ditch lining

*Riparian vegetation directly associated with ditch is not permanent and is controlled annually with herbicides.

Florida Farmers Ditch Lining

Well Impact Analysis

Wright Water Engineers, Inc.

July 2010

061-110-060

TABLE OF CONTENTS

FIGURES

APPENDIX

Florida Farmers Ditch Lining Well Impact Analysis

1.0 INTRODUCTION

The Florida Farmers Ditch is located approximately five miles east of Durango, in La Plata County, Colorado (See Figure 1). It is one of several ditches that comprise the Florida Canal system, which also include the Florida Canal, Florida Canal Enlargement, and Florida Cooperative Canals. The Florida Canal system experiences losses from seepage and to better conserve water, the owners periodically identify ditch reaches that experience heavy seepage losses and complete repairs, lining, piping, or other maintenance that may be necessary. A grant was received from the Colorado Water Conservation Board (CWCB) for selection, preliminary environmental permitting and engineering design for ditch lining.

A reach of the Florida Farmers Ditch, identified in the Florida Mesa Ditch Loss Study (2010), experiences significant ditch loss and has been proposed for lining. This ditch reach is herein referred to as the Proposed Lined Reach and is shown in detail on Figures 2 through 4.

Concerns regarding potential impacts to groundwater source supplies in the vicinity of the ditch lining were raised by the CWCB during initial grant application review. As a result, Wright Water Engineers, Inc (WWE) has prepared this well impact analysis to assess potential impacts to groundwater source supplies resulting from the proposed ditch lining. A database of well permit locations was provided by the State Engineer's Office and wells in proximity to the Proposed Line Reach were included in this analysis.

This report is organized to first present a general discussion of the soils and geology predominant along the Proposed Lined Reach. The next section then discusses the Proposed Lined Reach, by segment, from the valley floor in the alluvium, along the canyon wall across the unconsolidated alluvial terraces, to the top of the Florida Mesa which is predominantly clay loam soil. This section of the report specifically assesses the relationship of the surrounding wells to the ditch seepage. Finally, conclusions are provided.

2.0 SOILS

Soils through the Proposed Lined Reach of the Florida Farmers Ditch range in permeability from slow to moderate (0.1 to 2.0 inches per hour). Moderately permeable soils exist as the Proposed Lined Reach climbs out of the Florida River valley, traversing steep slopes, and slower permeability soils are typically found in the lower reaches of the ditch as it flows on top of Florida Mesa. The soils encountered through the Proposed Lined Reach are also discussed in the Ditch Loss Study:

Hesperus Loam, 3-12 percent slopes. Permeability of the Hesperus Loam is moderate and ranges from 0.6 to 2 inches per hour. Significant ditch loss can be expected in areas where the canals cross over the Hesperus loam for a long distance. This was evident in the ditch loss measurements of the Florida Farmers Ditch, where the most significant loss occurred between the ditch's departure from the alluvial deposits to Payne Canyon siphon, which crosses over this soil type (See Figure 2).

Ustic Torrierthents-Ustollic Haplargids complex. Permeability of the Ustic Torriorthents - Ustollic Haplargids complex varies depending on the texture of the parent material, but ranges from 0.6 to 2 inches per hour. Significant ditch losses have been measured in ditch reaches that overlie the Ustic Torrierthents-Ustollic Haplargids complex. The reach below the Payne Canyon siphon contains soils of the Ustic Torrierthents-Ustollic Haplargids complex, and this is an area that has been identified by the ditch riders of the Florida Canal Companies as an area of known ditch loss (See Figure 2).

Falfa clay loam, 1 to 3 percent slopes and Falfa clay loam, 3 to 8 percent slopes. Permeability of the Falfa soil is slow and ranges from 0.1 to 0.6 inches per hour. Significant ditch losses are not anticipated in sections of ditch that overlie the Falfa clay loam. Loss measurements of ditch reaches that predominately overlie the Falfa clay loam were among the lowest losses observed in the study.

3.0 GEOLOGY

Geologic units along the Proposed Lined Reach are comprised of consolidated rocks of Cretaceous and Tertiary age and unconsolidated sediments of Quaternary age (Figure 3). Cretaceous rocks crop out in a series of northeast-southwest-trending hogback ridges and intervening valleys along the northern margin of the Proposed Lined Reach and dip southward into the northern rim of the San Juan Basin (Robson and Wright 1995).

The Animas Formation is the primary bedrock unit underlying most of the Proposed Lined Reach. The Animas Formation gently dips to the south and is a commonly tapped aquifer on the Florida Mesa.

Unconsolidated sediments consisting of cobbles, gravel, sand, silt, and clay are present on numerous terraces formed by the ancestral Florida River. Geologic mapping shows terrace alluvium units Qt2 and Qt3 along the eastern margin of the Florida Mesa (See Figure 3). These alluvium units are comprised of small boulders, cobbles, gravel, sand, silt, and loess. Cobble-sized clasts range from 3 to 9 inches in diameter (Carroll and others 1999). The Florida Farmers Ditch was constructed on these terrace alluvium deposits for more than 5,600 feet as the canal transitions from the Florida River valley to the Florida Mesa. The boulders and cobbles in the terrace alluvial deposits can create high permeability conditions and can contribute to the development of cavities in the subsurface and slope failure of the canal embankment (Sundale Associates, Inc. 1995). These conditions contribute to high seepage losses.

4.0 WELLS

Figures 2 through 4 show the location of the Proposed Lined Reach within the Florida Farmers Ditch. In general, the Proposed Lined Reach parallels the west edge of the Florida River canyon as the ditch traverses the valley wall toward Florida Mesa. The segment of ditch from the Florida Farmers Ditch headgate to where lining is to begin is underlain by alluvial sands and gravels and is subject to high groundwater conditions associated with the Florida River valley floor. For this reason, this segment is not proposed for ditch lining. The Proposed Lined Reach is anticipated to begin at a point where the ditch begins to traverse the valley walls. From this point to the

beginning of the Payne Canyon siphon, the ditch was constructed using local material overlying bedrock.

Surrounding wells in this area include well permit nos. 201054, 159156-A and 71241. Well permit nos. 159156 and 201054 are completed in, or have perforations within the Florida River alluvium. Recharge of the alluvium is primarily from direct precipitation and losses from the Florida River stream flow. The Florida River stream flows provides a constant sources of recharge to the wells and lining of the ditch should not impact water production in the alluvial wells.

Another well near this reach, permit no. 71241, is constructed in a bedrock formation, based on the well construction records. The direction of groundwater flow in the bedrock formation at the outcrop is controlled by the steep dip angle of the formation, which is about 60 degrees toward southeast in this area. Consequently, leakage from the ditch in this area would also flow toward the southeast. Permit no. 71241 is located to the northwest of the ditch. Therefore, due to its location, relative to the ditch, this well is not believed to have benefited from ditch seepage and should not be impacted by the lining of the ditch.

Additional wells identified in his reach include permit nos. 262378, 68312, 253208, 54795, and 176428. All of these wells are located on the opposite side of the Florida River relative to the Proposed Lined Reach and would not be impacted by lining of the Florida Farmers Ditch due to the primary recharge source being the Florida River stream flow.

Well permit no. 163051-A is located just a short distance to the east of the Payne Canyon Siphon and well permit nos. 61014 and 163085 sit just west the siphon. These wells have been interpreted as being completed in the Animas Formation based on the available well construction records. Due to the presence of the existing siphon combined with the depth of the perforated intervals below a layer of shale within the Animas Formation, these wells are not believed to have benefited from nearby ditch seepage, and would therefore not be impacted by the proposed ditch lining. Recharge to Animas Formation in this area is more likely dominated by vertical infiltration to the aquifer from precipitation and irrigation in nearby irrigated fields.

The Florida Farmers Ditch from the Payne Canyon Siphon to the top of Florida Mesa (Figures 2-3) was constructed primarily on Hesperus Loam and Ustic Torrierthents-Ustollic Haplargids complex soils underlain by unconsolidated terrace alluvium (Figure 2-3). Ditch leakage in this reach is significant because of the unconsolidated terrace sands and gravels. Field observations of the Proposed Lined Reach and evaluation of mapped soils and geology reveals the greatest potential seepage losses occur where the unconsolidated materials (i.e., fan deposits, landslide materials, terrace gravels, etc.) underlie the ditch (Figure 3). In those locations, topography controls the seepage flow direction (i.e., down-gradient toward the Florida River). Therefore, wells to the west of this described reach have not historically benefited from ditch seepage and would not be affected by the ditch lining. Also, no wells exist between the river and the ditch in this area that would benefit from the ditch seepage.

As the Florida Farmers Ditch reaches the top of the mesa, it leaves the Hesperus Loam and Ustic Torrierthents-Ustollic Haplargids complex soils and terrace alluvium and enters Falfa Clay Loam soils. Falfa Clay Loam has a slow permeability ranging from 0.1 to 0.6 inches per hour.

Ditch loss in this area is expected to be minimal due to the slow permeability of the soil. Nearby wells located on the mesa to the west of the ditch are being recharged more by precipitation and irrigation water, than ditch seepage, as identified in a USGS Water-Resources Investigations Report for the Florida Mesa. This report calculated the recharge to groundwater from precipitation and irrigation return flows to be approximately 85% of the annual recharge, with only 15% coming from irrigation ditch seepage, which presumably would include the ditch laterals as well as the ditch main-stems. (Appendix A). Figure 4 shows the irrigated areas near the Proposed Lined Reach and the nearby water wells to the west. Lining of the ditch in this area would not significantly impact water production to nearby wells, due to the fact that most of the recharge to these wells is occurring through vertical infiltration from irrigation and precipitation.

6.0 CONCLUSION

To better conserve water, a reach of the Florida Farmers Ditch has been proposed for ditch lining. The impact the ditch lining could have on nearby domestic water wells has been assessed through an evaluation of the soils and geology, review of the State Engineer's Office well

database and well completion reports, combined with visual observations made in the field. In summary:

- No impacts are expected to occur to the alluvial wells because of their proximity to the Florida River (the primary recharge source for this aquifer system) and the established in-stream flow for the Florida River.

- Impacts to wells in the Proposed Lined Reach where it leaves the valley floor and begins to ascend the canyon wall to the Payne Canyon siphon are not anticipated due to the ditch being constructed on bedrock outcrops which dip away from the only nearby bedrock-completed well.

- No wells exist near the Proposed Lined Reach from the Payne Canyon siphon to the top of the Florida Mesa. Nearby wells to the west of this described reach would not have historically benefited from ditch leakage in this reach because ditch leakage here drains directly back to the Florida River.

- Recharge to the wells located to the west of the Proposed Lined Reach atop the Florida Mesa, is mainly from precipitation and irrigation infiltration as outlined in USGS Water-Resources Investigations Report 95-4190 (see Appendix A). No significant impacts to water production are anticipated for these wells.

7.0 REFERENCES CITED

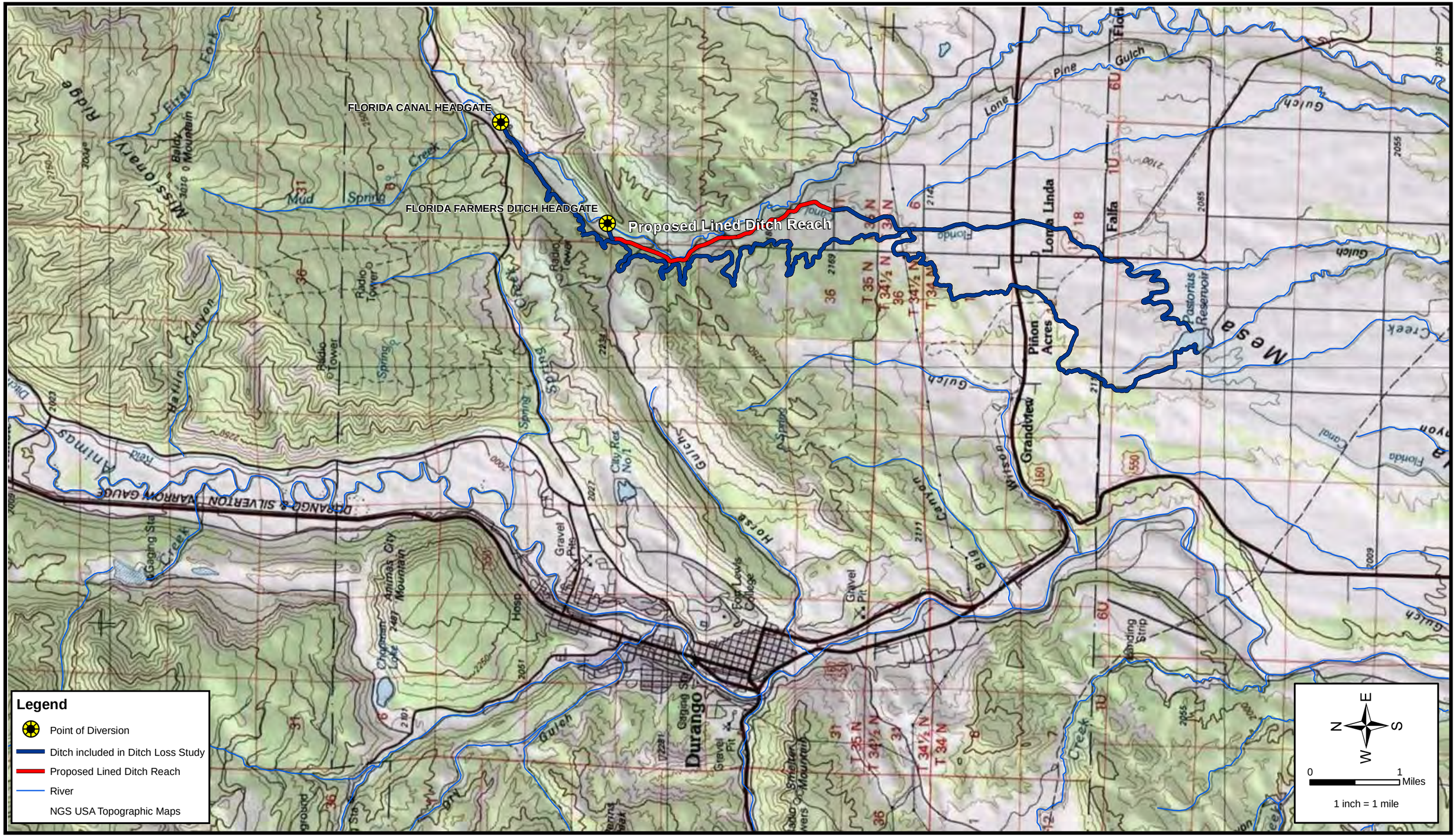
Carroll, C.J., Gillam, M.L., Ruf, J.C., Loseke, T.D., and Kirkham, R.M., 1999, Geologic map of the Durango East Quadrangle, La Plata County, Colorado: Colorado Geological Survey Open-File Report 99-6.

Natural Resources Conservation Service. 1988. La Plata County Soil Survey of La Plata County Area, Colorado.

Robson, S.G., and Wright, W.G., 1995, Ground-Water Resources of the Florida Mesa Area, La Plata County, Colorado: U.S. Geological Survey Water-Resources Investigations Report 95-4190.

Sundale Associates, Inc., 1995, Florida Farmers Ditch-Payne Canyon Slide Investigation, 13 p.

Figures



P:\061-110\060 Seepage Reduction Program\Mapping\Fig 1 - Proposed Lined Reach.mxd

Ditch alignments were provided by the San Juan RC&D Office of the USDA, Durango, Colorado.

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PROPOSED LINED REACH SITE LOCATION MAP

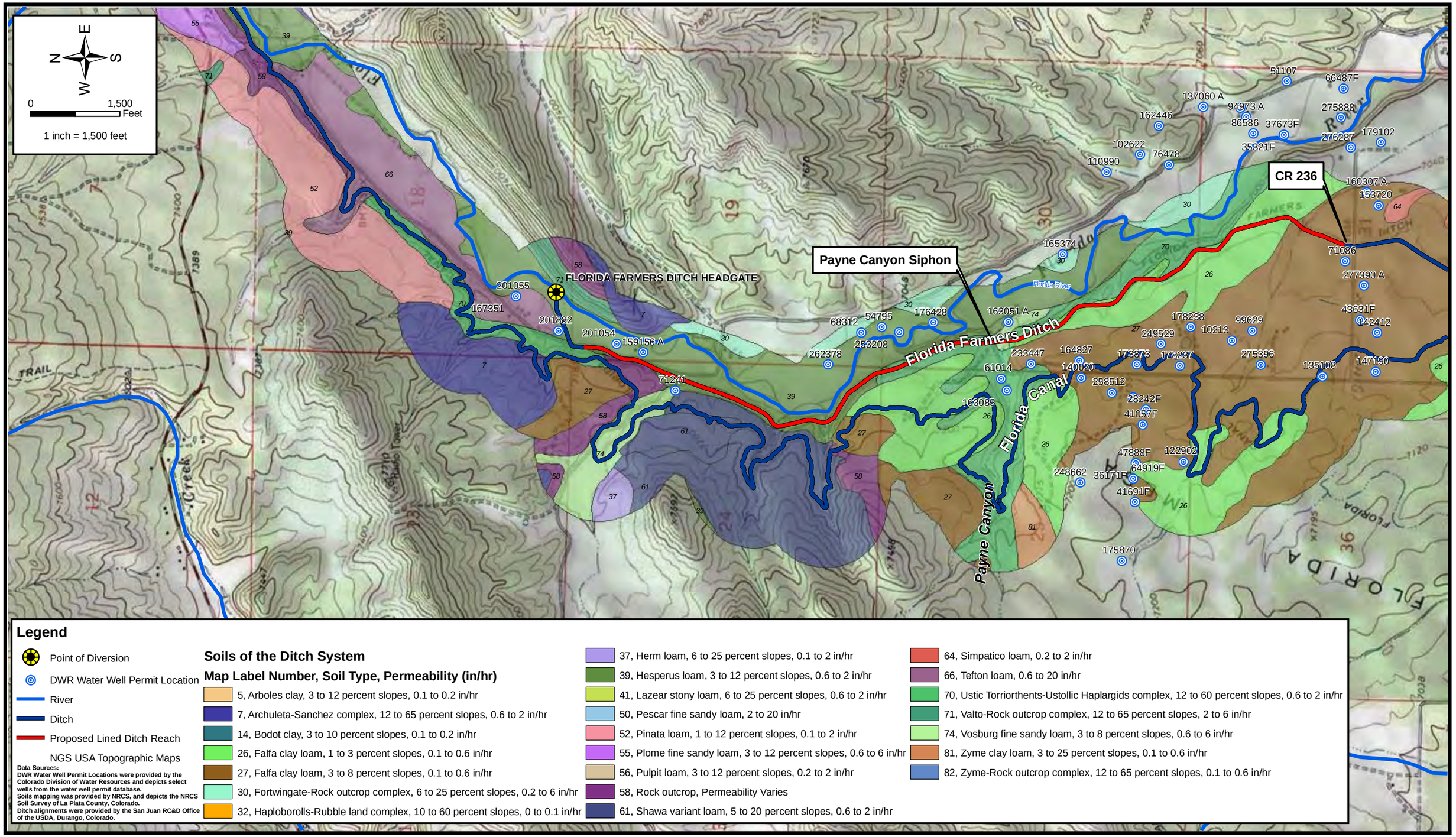
FLORIDA FARMERS DITCH PROPOSED LINING WELL IMPACT ANALYSIS

TOWNSHIP 35 NORTH, RANGE 9 WEST, N.M.P.M.

Project No.

061-110.060

FIGURE 1



Legend

- Point of Diversion
- DWR Water Well Permit Location
- River
- Ditch
- Proposed Lined Ditch Reach
- NGS USA Topographic Maps

Data Sources:
DWR Water Well Permit Locations were provided by the Colorado Division of Water Resources and depicts select wells from the water well permit database.
Soils mapping was provided by NRCS, and depicts the NRCS Soil Survey of La Plata County, Colorado.
Ditch alignments were provided by the San Juan RC&D Office of the USDA, Durango, Colorado.

Soils of the Ditch System

Map Label Number, Soil Type, Permeability (in/hr)

- 5, Arboles clay, 3 to 12 percent slopes, 0.1 to 0.2 in/hr
- 7, Archuleta-Sanchez complex, 12 to 65 percent slopes, 0.6 to 2 in/hr
- 14, Bodot clay, 3 to 10 percent slopes, 0.1 to 0.2 in/hr
- 26, Falfa clay loam, 1 to 3 percent slopes, 0.1 to 0.6 in/hr
- 27, Falfa clay loam, 3 to 8 percent slopes, 0.1 to 0.6 in/hr
- 30, Fortwingate-Rock outcrop complex, 6 to 25 percent slopes, 0.2 to 6 in/hr
- 32, Haploborolls-Rubble land complex, 10 to 60 percent slopes, 0 to 0.1 in/hr
- 37, Herm loam, 6 to 25 percent slopes, 0.1 to 2 in/hr
- 39, Hesperus loam, 3 to 12 percent slopes, 0.6 to 2 in/hr
- 41, Lazear stony loam, 6 to 25 percent slopes, 0.6 to 2 in/hr
- 50, Pescar fine sandy loam, 2 to 20 in/hr
- 52, Pinata loam, 1 to 12 percent slopes, 0.1 to 2 in/hr
- 55, Plome fine sandy loam, 3 to 12 percent slopes, 0.6 to 6 in/hr
- 56, Pulpit loam, 3 to 12 percent slopes, 0.2 to 2 in/hr
- 58, Rock outcrop, Permeability Varies
- 61, Shawa variant loam, 5 to 20 percent slopes, 0.6 to 2 in/hr
- 64, Simpatico loam, 0.2 to 2 in/hr
- 66, Tefton loam, 0.6 to 20 in/hr
- 70, Ustic Torriorthents-Ustollic Haplargids complex, 12 to 60 percent slopes, 0.6 to 2 in/hr
- 71, Valto-Rock outcrop complex, 12 to 65 percent slopes, 2 to 6 in/hr
- 74, Vosburg fine sandy loam, 3 to 8 percent slopes, 0.6 to 6 in/hr
- 81, Zyme clay loam, 3 to 25 percent slopes, 0.1 to 0.6 in/hr
- 82, Zyme-Rock outcrop complex, 12 to 65 percent slopes, 0.1 to 0.6 in/hr

P:\061-110\060 Seepage Reduction Program\Mapping\Fig 2 - Soils.mxd

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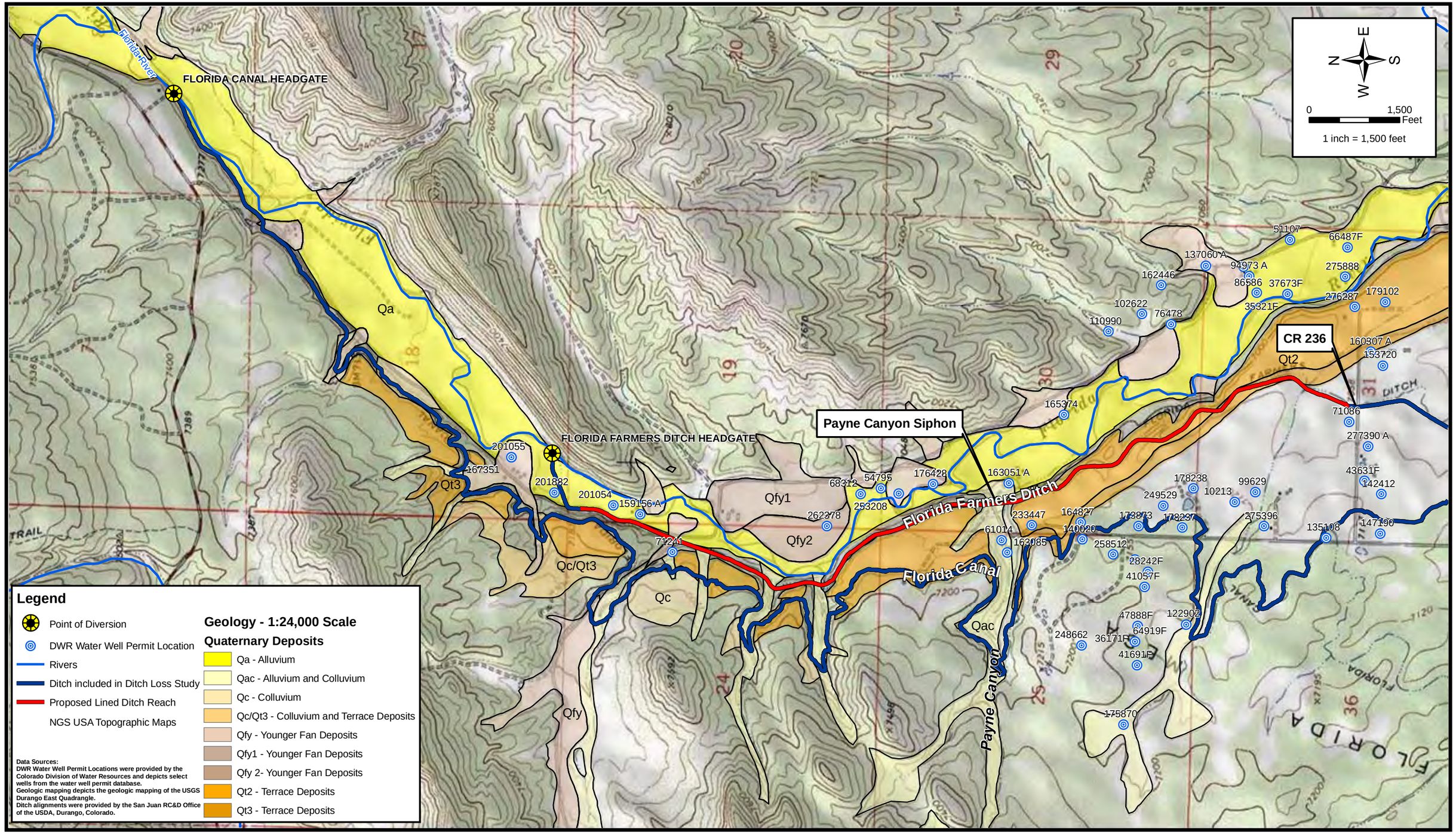
SOILS OF THE DITCH SYSTEM & SURROUNDING WELLS

FLORIDA FARMERS DITCH PROPOSED LINING WELL IMPACT ANALYSIS

Project No.
061-110.060

FIGURE 2



Legend

- Point of Diversion
- DWR Water Well Permit Location
- Rivers
- Ditch included in Ditch Loss Study
- Proposed Lined Ditch Reach
- NGS USA Topographic Maps

Geology - 1:24,000 Scale

Quaternary Deposits

- Qa - Alluvium
- Qac - Alluvium and Colluvium
- Qc - Colluvium
- Qc/Qt3 - Colluvium and Terrace Deposits
- Qfy - Younger Fan Deposits
- Qfy1 - Younger Fan Deposits
- Qfy 2- Younger Fan Deposits
- Qt2 - Terrace Deposits
- Qt3 - Terrace Deposits

Data Sources:
DWR Water Well Permit Locations were provided by the Colorado Division of Water Resources and depicts select wells from the water well permit database.
Geologic mapping depicts the geologic mapping of the USGS Durango East Quadrangle.
Ditch alignments were provided by the San Juan RC&D Office of the USDA, Durango, Colorado.

P:\061-110\060 Seepage Reduction Program\Mapping\Fig 3 - Florida Farmers Qa Geology.mxd

Geologic Map: 1:24,000 Scale, Durango East Quadrangle

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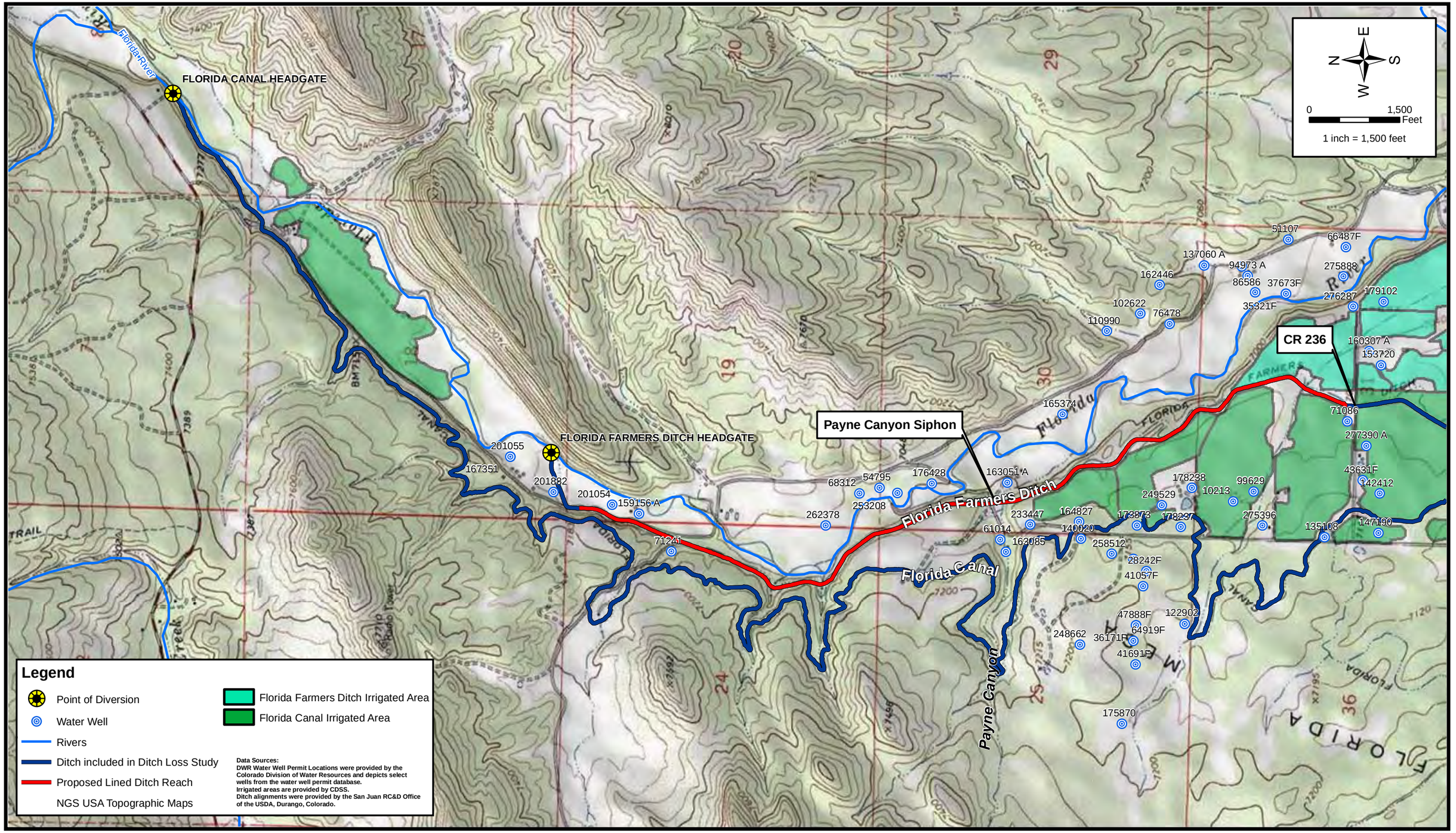
QUATERNARY GEOLOGY OF THE DITCH SYSTEM & SURROUNDING WELLS

FLORIDA FARMERS DITCH PROPOSED LINING WELL IMPACT ANALYSIS

Project No.
061-110.060

FIGURE 3



P:\061-110\060 Seepage Reduction Program\Mapping\Fig 4 - Irrigated Areas.mxd

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IRRIGATED AREAS NEAR THE PROPOSED LINED REACH

FLORIDA FARMERS DITCH PROPOSED LINING WELL IMPACT ANALYSIS

Project No. 061-110.060

FIGURE 4

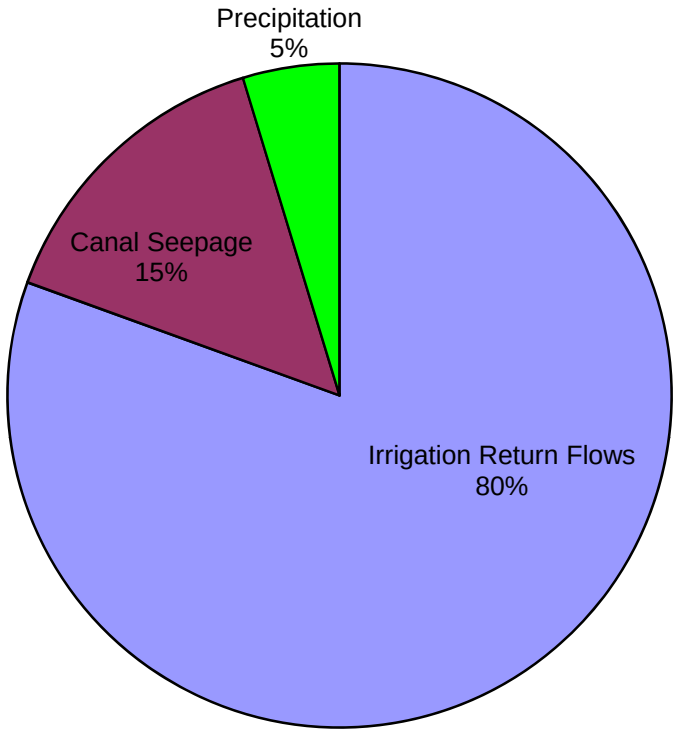
Appendix A

Components of Groundwater Recharge

Florida Mesa Area, La Plata County, Colorado

Components of Ground Water Recharge

Source: U.S Geological Survey, Groundwater Resources of the Florida Mesa Area, La Plata County, Colorado Water-Resource Investigation Report 95-4190



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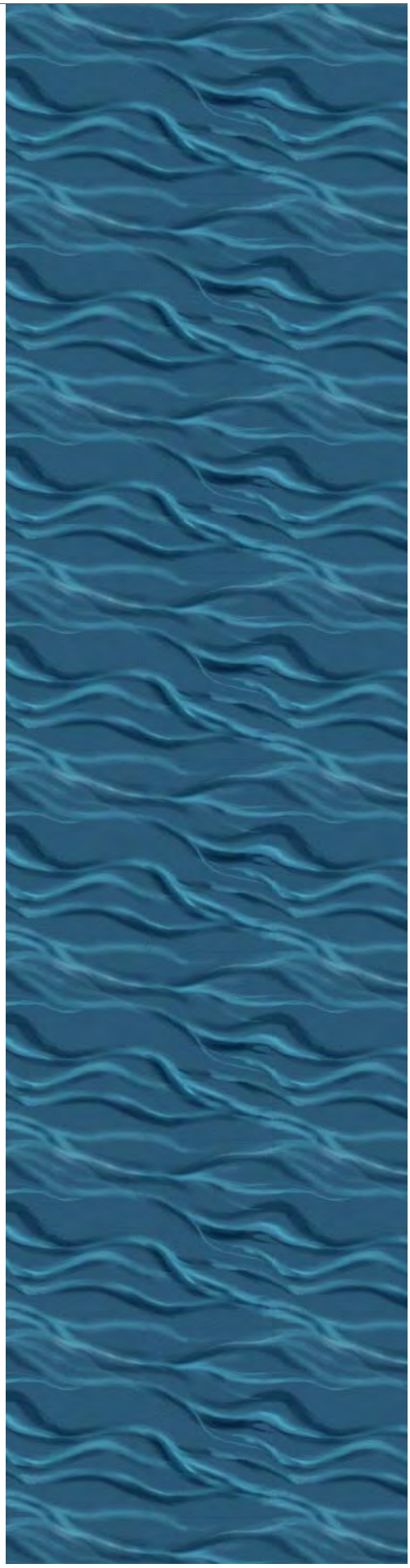

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