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Thirty-three Mile Water Supply Project
Level II, Feasibility Study

October 1, 1999

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SECTION 1

INTRODUCTION

Study Background

The Thirty-three Mile Road Improvement and Service District, hereinafter referred to as the 33MRISD, is located west of the City of Casper as shown in Figure 1-1. The 33MRISD encompasses an area of approximately 16 square miles, and is primarily composed of small farming and ranching operations.

There are approximately 50 residences situated in the 33MRISD. Most of these homes utilize onsite groundwater wells for domestic use. Some of the ranches also utilize groundwater wells for livestock water. For the most part, the water quality of the wells is poor, and not suitable for human use, and in some cases not even suitable for livestock use. Because of the poor water quality, many of the homeowners purchase and haul potable water from nearby Casper, and store it in buried cisterns for domestic use.

In 1997, the property owners in the area petitioned the Natrona County Commissioners to form an improvement and service district. The objective was to become a legally recognized entity that had the authority to finance and construct a central water supply system. The 33MRISD subsequently applied to the Wyoming Water Development Commission (WWDC) to perform a Level I Reconnaissance Study to determine if the components and interest for a public water supply system for the area exists.

In the Spring of 1998, the WWDC authorized a Level I Study for a water supply system. The study was completed in November, and indicated the best source of supply to be the adjacent Pioneer Water and Sewer District water system. The cost per customer was estimated to be approximately $125 per month for up to 15,000 gallons of water.

Purpose

In the Spring of 1999, the WWDC authorized this Level II Study. The purpose of this study as quoted in the WWDC consultant contract is “to determine the feasibility of developing a water supply system for the 33MRISD. All major system components will be evaluated, including service area, supply, transmission, storage, treatment and distribution”.

Scope of the Study

The scope of this Level II Study as defined by the WWDC consultant contract is summarized under the following tasks:

- **Task 1** - Scoping meetings and workshops
- **Task 2** - Land use planning
- **Task 3** - Analysis of potential water supplies
- **Task 4** - Environmental studies/construction permits
- **Task 5** - Surveying
- **Task 6** - Geological/geotechnical investigations
FIGURE NO. 1-1
33 MILE ROAD IMPROVEMENT & SERVICE DISTRICT LOCATION MAP

LEGEND

DISTRICT BOUNDARY

COUNTY ROAD 121 (SEE KEY BELOW)

COUNTY ROAD KEY
110 THIRTY THREE MILE RD
120 GARBUTT ROAD
121 BISHOP ROAD
122 JOHNSON LATERAL
123 LOCKNER ROAD
124 ENBERG ROAD
206 TEN MILE ROAD

NATRONA COUNTY INTERNATIONAL AIRPORT

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SECTION 1

INTRODUCTION

Task 7 - Preliminary designs and cost estimates
Task 8 - Economic analysis and project financing
Task 9 - Reports, executive summaries, and results presentations

The “draft” report is due October 1, and the final report is due November 1, 1999.

Previous Reports

Previous reports utilized in preparing this Level II Study are listed below:

• Natrona County Regional Water Supply Project, Level II Feasibility Study, prepared by Civil Engineering Professionals, Inc., dated November, 1994, hereinafter referred to as the “Regional Water System Study”.


The 33MRISD is located west of the Airport in Natrona County. The 33MRISD encompasses approximately 16 square miles, or nearly 10,000 acres of land. There are 43 different property owners, with properties ranging from 10 acres to over 1000 acres in size. There are 25 properties that are 160 acres or larger. Land ownership in the 33MRISD area as determined through County Assessor records, is shown on Figure 2-1.

Historically, the lands within the 33MRISD have been used for ranching. The Casper-Alcova Irrigation District provides irrigation to many of the properties via the Johnson Lateral. Nearly all of the area has been zoned as Agriculture (A), with a very small area being zoned Ranching and Farming (RF). Excerpts from the Natrona County Zoning Resolution (pages 13, 14 and 15) follow hereinafter, and further define the zoning intent and uses for both the RF and A classifications.

On December 15, 1998, the county adopted a Natrona County Development Plan. The plan provides a policy for physical development of the County over the next 20 years. The 33MRISD falls under the Casper Creek, Area D, of the Rural Area Plan as described on the subsequent two pages (7-16 & 7-17) which were excerpted from the Plan. Recommended land uses as described in the Plan are “range land and irrigated cropland, farms, and ranches”.

In terms of future development, without a water system the 33MRISD is not expected to develop significantly. However, if a reliable public water supply becomes available, the 33MRISD could undergo considerable development. In order for any property to be subdivided, certain County and State development requirements must be met. A subdivision is considered as the division of land into three or more lots smaller than 35 acres. A major land subdivision is considered as the division of land into three or more lots or parcels 35 acres through 80 acres in size each. Without changing the current RF and A zoning designations, the minimum lot size is 10 acres. Subdividing into lots smaller than 10 acres requires a change in zoning. Other County requirements for subdividing include providing permanent access and providing a surveyed plan of the areas divided. The plan must be prepared by a Wyoming licensed surveyor. Written certification of a Wyoming licensed engineer must also be provided certifying to the adequacy of the domestic water source and that the water source meets county, state, and federal standards.

In addition to the County subdivision requirements, any subdivision plans dated after July 1, 1997 must be submitted to Wyoming Department of Environmental Quality (WDEQ) for review of water rights and water supply adequacy. A flow chart (Figure 3-1 attached hereinafter) for the WDEQ review as excerpted from the WDEQ Subdivision Program Guidance Document is included hereinafter.

Based upon the current zoning classification of the land within 33MRISD, and the 20-year County Development Plan, it is assumed that future development in the area will be limited to 10 acre and larger parcels, which will continue to be rural ranch, and ranch or agriculture type developments. The water supply system will be planned to be compatible with the current zoning and land use, with the ability to accommodate modest growth of similar types of development.
FIGURE NO. 2-1
33 MILE ROAD IMPROVEMENT & SERVICE DISTRICT
DISTRICT BOUNDARY AND LAND OWNERSHIP MAP

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CHAPTER VI

ZONING DISTRICTS

Section 1. Ranching and Farming (RF)

a. The intent and purpose of the RF District is to establish and preserve areas which have the potential for or have historically been used for commercial farming or ranching operations; with such residences and accessory structures as required, free from other uses; except those which are compatible with and convenient to the residents of the district.

b. The following are permitted uses in this district:
   (1) Accessory buildings and uses.
   (2) Agriculture, light.
   (3) Agriculture, rural.
   (4) Arena, recreational.
   (5) Dwellings: any combination of single-family dwellings, mobile homes, seasonal dwellings or bunk houses under single ownership, incidental and customary to the primary use, and not for rent or lease.
   (6) Forestry.
   (7) Home occupation.
   (8) Mobile home storage, temporary.
   (9) Storage of flammable and combustible liquids.
   (10) Wind generator.

c. In addition to the above permitted uses, the following uses may be approved by conditional use permit:
   (1) Airstrip.
   (2) Arena, commercial.
   (3) Auto service station.
   (4) Campground.
   (5) Cemetery.
   (6) Club or lodge, associated with agriculture.
   (7) Communication tower and facility, commercial and public, excluding offices, warehouses and storage facilities.
   (8) Day care facility, commercial.
   (9) Feed lot.
   (10) Greenhouse, commercial.
   (11) Guest or dude ranch and hunting facility.
   (12) Heliport.
   (13) Home business.
   (14) Home fuel conversion.
   (15) Hot mix batch plants, temporary.
   (16) Park, playground, golf course and other similar open space, recreational facility.
   (17) Place of worship.
(18) Public facility.
(19) Recreational facility, public or private.
(20) Sales Barn.
(21) Sanitary landfill.
(22) Sawmill.
(23) School--elementary, junior and senior high school; college and university.
(24) Sewage treatment facility.
(25) Storage, explosives.
(26) Temporary housing and appurtenant facility associated with highway, pipeline and powerline construction and mineral exploration.
(27) Utility installation.
(28) Other similar and compatible uses, as determined by the Board and not listed as a permitted use in any other district.

d. Minimum district size is 35 acres or the legally described 1/16 section is required for a zone change to this district classification.

e. Minimum lot size is 20 acres.

f. Minimum setbacks are 60 feet adjacent to all Federal, State and County roads with rights-of-way width less than 120 feet; 25 feet adjacent to all other roads; 10 feet from all property lines not abutting a road.

g. No Maximum height.

h. No minimum open space.

Section 2. Agricultural (A)*

a. The intent and purpose of the Agricultural District is to provide for limited service functions which generally require large open spaces.

b. The following are permitted uses in this district:
   (1) Accessory buildings and uses.
   (2) Dwellings: any combination of single-family dwellings, mobile homes, seasonal dwellings or bunk houses under single ownership, incidental and customary to the primary use, and not for rent or lease.
   (3) Forest and wildlife management.
   (4) Home occupation.
   (5) Recreational activities associated with agricultural.

c. In addition to the above permitted uses, the following uses may be approved by conditional use permit:
   (1) Air strip.
   (2) Auto service stations.
   (3) Campground
(4) Cemetery.
(5) Clubs and lodges.
(6) Communication tower and facilities.
(7) Feed lot.
(8) Junk yard.
(9) Kennel.
(10) Land reclamation.
(11) Livestock experimentation.
(12) Mobile home park.
(13) Public facility.
(14) Recreational facility, public or private.
(15) Schools,
(16) Storage of explosives.
(17) Storage of flammable and combustible liquids.
(17) Other similar and compatible uses, as determined by the Board and not listed as a permitted use in any other district.

d. No minimum district size.

e. Minimum lot size is 10 acres.

f. Minimum setbacks are as follows:
   (1) 110 feet from the centerline of a public road
   (2) 50 feet from all property lines not abutting a road; corner lot 110’ from the centerline or 50 feet from the right-of-way line of a public road, whichever is greater.

g. No maximum height.

h. No minimum open space.

Section 3. Homestead (H)

a. The intent and purpose of the H District is to establish an area of single family residential and rural agricultural uses, preserving areas of open space free from other commercial, business or industrial uses; except those which are compatible with and convenient to the residents of the district. This district may be suitable for areas which preclude the feasibility of higher density population.

b. The following are permitted uses in this district:
   (1) Accessory buildings and uses.
   (2) Agriculture, light.
   (3) Agriculture, rural.
   (4) Animal clinic.
   (5) Arena, recreational.
CASPER CREEK

14. **RECREATION**
   Limited developed recreation areas.

15. **HISTORIC RESOURCES**
   Salt Creek historic area (abandoned townsites)

B. **RECOMMENDATIONS**

1. **LAND USE**
   Grazing and mineral production.

2. **ZONING**
   Ranching, Agriculture, and Mining.

3. **TRANSPORTATION**
   Maintain existing county roads.

4. **DEVELOPMENT PLAN**
   Maintain oil production and support communities. BLM proposals:
   - Salt Creek Historic district.
   - Area of Critical Environmental Concern (ACEC) special watershed management.
   Emphasis on mineral development.

**AREA D. CASPER CREEK**

A. **EVALUATIONS**
   **SITE/SITUATION SUMMARY**

1. **LOCATION - SIZE - CURRENT ZONING**
   Central area northwest of Casper; nine townships; Ranching and Farming.

2. **ACCESS - ROADWAYS**


3. **CORRIDORS**
   U.S. 20-26; BN mainline; pipeline, pipeline corridor.

4. **WATER - RIVERS, CREEKS, RESERVOIRS**
   Casper Creek, major drainage basin. Goldeneye Reservoir.

5. **LANDFORMS - TOPOGRAPHY**
   Rolling Plains, Pine Mountain.

6. **LAND USES - COVERAGES**
   Mixed rangeland and irrigated lands.

7. **IRRIGATED LANDS**
   Two-thirds of a township north of 20-26 along Casper Creek, 33 Mile Road.

8. **LAND OWNERSHIP**
   Most private ownership.

9. **COMMUNITIES**
   No communities

10. **WILDLIFE HABITATS**
    Antelope habitat west end, potential eagle habitat at Pine Mountain.

11. **SENSITIVE/CRITICAL AREAS**
    None

12. **AGRICULTURAL DEVELOPMENT**
    Significant irrigated cropland; grazing.
SAND DUNES

13. **MINERAL DEVELOPMENT**
   Some oil and gas development west.

14. **RECREATION**
   Formal recreation development at Goldeneye reservoir.

15. **HISTORIC RESOURCES**
   None

B. **RECOMMENDATIONS**

1. **LAND USE**
   Range land and irrigated cropland, farms, and ranches.

2. **ZONING**
   Ranching, Agriculture, and Mining.

3. **TRANSPORTATION**
   Maintain 33 Mile Road.

4. **DEVELOPMENT PLAN**
   Extensive irrigated agriculture. BLM proposals:
   Developed recreation (Goldeneye Reservoir).
   Wildlife (waterfowl and crucial big game habitat).

**AREA E. SAND DUNES**

A. **EVALUATIONS**
   **SITE/SITUATION SUMMARY -**

1. **LOCATION - SIZE - CURRENT ZONING**
   East county line north of Casper; nine townships; Ranching and Farming.

2. **ACCESS - ROADWAYS**
   I-25, Ormsby Road.

3. **CORRIDORS**
   Crossed by pipelines east of and parallel to I-25.

4. **WATER - RIVERS, CREEKS, RESERVOIRS**
   None.

5. **LANDFORMS - TOPOGRAPHY**
   Sandy plains, sand dunes moving northeast.

6. **LAND USES - COVERAGES**
   Brush range land, grazing.

7. **IRRIGATED LANDS**
   None.

8. **LAND OWNERSHIP**
   Majority private.

9. **COMMUNITIES**
   None.

10. **WILDLIFE HABITATS**
    None

11. **SENSITIVE/CRITICAL AREAS**
    Sand dunes.
DEQ submits 1 copy of application to SEO for review of water rights and adequacy.

County/applicant submit application to DEQ. Letter sent to county contacts and other involved parties with notice of receipt by DEQ.

DEQ review dependent on systems proposed. Connection to existing systems or centralized systems are forwarded to SPO for review. GPC reviews on-site systems.

30 days or less elapse, DEQ and SEO reviews completed. Application is complete and technically adequate.

Yes

DEQ provides final comments and recommendations, favorable or unfavorable, to county contacts and other involved parties.

No

County completes review of subdivision application.

DEQ contacts applicant and discusses comments verbally, and sends review with comments requesting additional information. DEQ sends notice to county contacts and other involved parties of need for 30 days extension for review.

Applicant responds with additional information within 50 days of original submittal.

Yes

DEQ/SEO finishes review of application.

Application is complete and technically adequate.

Yes

County completes review of subdivision application.

No

DEQ provides "unfavorable" recommendation due to incomplete application, to county contacts, and other involved parties. Total time elapsed since receipt of application is a maximum of 60 days.

DEQ sends notice to county contacts and other involved parties of need for 30 days extension for review.

Applicant responds with additional information within 60 days of original submittal.

Yes

Application is complete and technically adequate.

Yes

County completes review of subdivision application.

No

Total time elapsed from receipt of application is a minimum of 80 days.

Figure 3-1. Flowchart of the DEQ Subdivision Application Review Process
This section evaluates the water supply needs of the 33MRISD. The data used for evaluating water supply needs was taken from the Regional Water System Study.

Currently, there are an estimated 60 potential water taps in the 33MRISD. The current population is estimated to be 210, (3.5 people per tap). The general regional population is projected to grow at an annual rate of 1½ percent over the 50-year design life, which equates to almost doubling of the population. However, the growth rate in the 33MRISD could be much higher if water becomes available. Some property owners may subdivide and sell small parcels for development if reliable potable water is available. For the purpose of this study, demands have been based upon the area population doubling from 210 to 420. This growth could occur in the first 10 years, or could occur over the 50-year design life of the system.

The following water demand definitions are used in this study:

- **Average Day Demand (ADD)**, is determined by calculating the amount of water utilized over a period of a year or longer, divided by the population and the number of days in the period, and is expressed in gallons per capita per day (gpcpd). The average day demand takes into account the overall water usage over a long period of time and averages it over the number of users. The following average day demands were used in the Regional Water System Study:
  
<table>
<thead>
<tr>
<th>Location</th>
<th>gpcpd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casper</td>
<td>220</td>
</tr>
<tr>
<td>Evansville</td>
<td>220</td>
</tr>
<tr>
<td>Mills/Wardwell</td>
<td>200</td>
</tr>
</tbody>
</table>

The residents in the 33MRISD are expected to utilize public water for domestic uses, and continue to use their wells for lawn and garden watering. For the purpose of this study, the average day demand is assumed to be 200 gpcpd, even though it may be somewhat conservative for domestic use only. The ADD equates to a flow rate of .486 gpm per tap.

- **Maximum Day Demand (MDD)**, is the one day when the maximum per capita water usage occurs as determined from water usage records, or it can be calculated. Maximum day demand is the amount of water production needed to satisfy maximum day system demands, and is the rate which the water supply and treatment systems should be designed. If determined from records, MDD is the highest one day usage which occurs over the course of a year, divided by the number of users on that day. Maximum day factors were evaluated in the Regional Water System Study and a factor of 3 was used. For the purpose of this study, maximum day demand is assumed to be 600 gpcpd, or a flow rate of 1.46 gpm per tap.

- **Peak Hour Demand (PHD)**, is the maximum water usage rate which can occur in the water system in any one hour. The peak hour demand is the water demand placed on the entire water system including plant production and system storage. PHD is used
to determine the size of the water transmission and storage facilities in the system. It can be calculated by applying a peaking factor which typically ranges from 4 to 6 times the ADD. The peak hour demand factor used in the Regional Water System Study was 6 x ADD. For the purpose of this study, the PHD used is 1200 gpcpd, or 2.92 gpm per tap.

As indicated previously, some of the property owners intend to water livestock with the water supply system. The exact amount and type of the livestock is unknown, but the following assumptions for the area have been made:

- 300 horses at 20 gpcpd = 6,000 gpd
- 3000 cows at 10 gpcpd = 30,000 gpd
- 2000 sheep at 5 gpcpd = 10,000 gpd

Total = 46,000 gpd = 32 gpm

In terms of water demands and system sizing, livestock watering is also expected to create maximum day and peak hour demands. For the purpose of this study livestock water demands are expected to remain steady over time. Livestock MDD is assumed to be 96 gpm, and PHD assumed to be 192 gpm.

Water system demand projections for 33MRISD have been developed for the two different design populations, and are shown in Table 3-1. Note that time has not been incorporated into the figures since it will be difficult to predict how fast or slow the area may develop if public water becomes available.

<table>
<thead>
<tr>
<th>Population</th>
<th>Average Day Demand</th>
<th>Maximum Day Demand</th>
<th>Peak Hour Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>210</td>
<td>420</td>
<td></td>
</tr>
<tr>
<td></td>
<td>61.1</td>
<td>90.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>183.3</td>
<td>271</td>
<td></td>
</tr>
<tr>
<td></td>
<td>366.6</td>
<td>542</td>
<td></td>
</tr>
</tbody>
</table>

For the purpose of this study and for sizing the system, the combined domestic and livestock water needs for a population of 420 are estimated to be 130,032 gpd for ADD, 390,240 gpd for MDD, and 780,480 gpd for PHD for ADD.
SECTION 4  WATER SUPPLY ALTERNATIVES

The previous Level II Study evaluated two water supply alternatives; a groundwater supply and a connection to the nearby Pioneer Water and Sewer District water system. The Level II Study states that, “Wells in the district are used for irrigation only and the quality of wells is marginal at best....It was concluded in the groundwater portion of this study that developing a well field for the water district would be expensive because the wells would need to be deep and the water would require special treatment to meet WDEQ standards. The well yields and water quality of existing wells are not the quality required for a potable water system such as the proposed district’s system”. Because the groundwater supply has historically been poor in the 33MRISD area, and the Level II further confirms historical information, a groundwater supply is not evaluated further herein.

Two water supply alternatives are identified and evaluated in this section. There are two existing public water supply systems in the area which could potentially serve the 33MRISD as shown in Figure 4-1. Option No. 1 is a supply from the Pioneer Water and Sewer District water system which lies south of 33MRISD. Option No. 2 is a supply from the Airport water system which lies southeast of 33MRISD. Each of these options is discussed in detail hereinafter.

Option No. 1 - Pioneer Water and Sewer District Connection

The Pioneer Water and Sewer District, hereinafter referred to as “Pioneer”, is a large rural district located south of the 33MRISD (See Figure 4-1). Pioneer was formed during the “boom” in the early 1980's for the purpose of building a water supply and distribution system. As with 33MRISD, the private wells in the Pioneer area were of poor quality and unreliable quantity, and a central groundwater supply was not economically feasible. Between 1981 and 1984, Pioneer designed and constructed a $3.5 million water supply system. Water was originally supplied to Pioneer by the Mills-Wardwell Impact Joint Powers Board. With the formation of the Central Wyoming Regional Water System (CWRWS) in 1994, Pioneer now obtains its water from the CWRWS as a wholesale water customer.

A general layout of the Pioneer water system is shown in Figure 4-1. In 1994, the CWRWS purchased the 10-inch Pioneer water transmission line along Poison Spider Road, the booster station and the water storage tank. The booster station located along the Poison Spider Road, on the east side of the Pioneer draws water from the CWRWS, and pumps it westward through the 10-inch transmission pipeline to the water storage tank situated on the west side of the District, on Emigrant Gap Ridge. Pioneer also provides water to the Poison Spider School, a small rural subdivision behind the school, and the Poison Spider Improvement and Service District. The tank has a storage capacity of 500,000 gallons, and an overflow elevation of 5667. The operation of the booster station is controlled by the water levels in the tank, i.e. when the tank level drops, the booster pump comes on, and when the tank fills, the pump goes off.

Because of the large size of Pioneer, and the variations in topography, water system pressures could range from 50 to 150 pounds per square inch (psi). To keep the pressures in the lower portion of Pioneer at a safe level, three large pressure reducing valves (PRVs) are located on the main lines which are supplied by the 10-inch transmission line. The stations are located at an approximate...
LEGEND

- WATER STORAGE TANK
- BOOSTER STATION
- PRESSURE RELEASE VALVE

FIGURE 4-1
POTENTIAL WATER SUPPLY SYSTEMS
Elevation of 5445. The pressure reducing valves in these stations reduce the upstream pressure of about 95 psi to 30 psi. With the main PRVs active, pressures downstream of the PRVs range from 40 to 95 psi. As a backup measure, individual PRVs are installed in each of the service meter pits which serve the Pioneer customers.

The Pioneer water system was originally designed for a population of about 1000. The current population is estimated to be around 500. There are currently about 175 regular taps and another 75 "pasture taps". The booster pump station has two pumps, each having a capacity of 400 gallons per minute (gpm), which equates to 576,000 gallons per day (gpd). The 500,000 gallon water storage tank is primarily used for system balancing and reserve storage. There are no fire protection capabilities in the Pioneer system, and therefore storage for fighting fires is not part of the District’s storage needs.

The Pioneer water system has adequate capacity to serve the projected water demands of the 33MRISD. The likely point of connection for supplying the 33MRISD is the 10-inch transmission line located along Willy Road, near the intersection of 10 Mile Road and US Highway 20-26. The available pressure at the point of connection should be 95 psi, but conversations with Pioneer indicate the pressure is around 150 psi. It is believed the 3 major pressure reducing valve stations are not operating properly or are being bypassed.

To serve the 33MRISD, a transmission pipeline would need to be extended from the 10-inch Pioneer pipeline on Willy Road eastward to 10 Mile Road, then northward across highway 20-26 along 33 Mile Road. A conceptual layout of the transmission pipelines and their alignments is shown in Figure 4-2. A computer generated hydraulic model was developed to determine the size of the pipelines needed to meet the 33MRISD projected water demands.

A brief description of the water transmission system and the assumptions used in the conceptual design are highlighted below:

- A connection will be made to the Pioneer 10-inch transmission line. The existing pipe is "Permastran", and special fittings and adaptors will be needed. The 33MRISD transmission line will be an 8-inch pipeline.

- A master meter vault will be installed downstream of the connection point near the Highway 20/26 right-of-way.

- The 8-inch transmission main will be constructed in the Willy Road and 10-Mile Road rights-of-way. A cased undercrossing (highway bore) will be required to cross under Highway 20/26.

- Once across Highway 20/26, the 8-inch transmission pipeline will be aligned in the Thirty-three Mile Road right of way. The other transmission pipelines in the
FIGURE NO. 4-2
CONCEPTUAL PLAN
OPTION NO. 1
PIONEER WATER & SEWER
DISTRICT CONNECTION

CIVIL ENGINEERING PROFESSIONALS, INC.
355 N. Lincoln
Cheyenne, Wyoming 82001
(307) 266-4346
(307) 266-0103 Fax
33MRISD will be aligned in the existing county road rights-of-way wherever possible.

- Each property will receive one 3/4-inch water service and meter pit as part of the overall project cost. The pit will be located at the edge of the property in the road right-of-way. The service line from the meter pit to the home will need to be constructed by the homeowner and is not part of the project cost. The size of the service line should be determined based on the desired pressure and flow at the house, and the distance from the transmission main to the house.

- Water system isolation valves are located at approximately one mile intervals. A WDEQ variance will be required for this extensive spacing.

- Flushing hydrants will be located at the end of all dead end water transmission pipelines.

- Air release, air vacuum valves will be located at all high points along the pipeline alignments.

- The irrigation canal/ditch crossings will require special construction considerations. These crossings should be made in the off season. Backfilling the ditch should be performed with a dirt/bentonite mix to help seal the disturbed bank areas and prevent leakage.

- All disturbed areas of the borrow ditches will be seeded and mulched.

- Graveled roadways that are disturbed by the borrow ditch construction will be regraveled with two inches of crushed road base. To conserve project costs, the graveling has been assumed to be limited to a 10-foot wide portion of the road. Re-graveling the entire roadway width is not economically feasible.

- Asphalt patching is limited to the 33 Mile Road crossings, and the paved areas around the highway 20/26 intersection. Special care will need to be taken during construction along 33 Mile Road to minimize damage to the asphalt pavement.

- Permitting requirements will include the following agencies:
  - Wyoming Department of Transportation - US 20/26 undercrossing license.
  - Natrona County Road and Bridge Department - County roadway license.
  - Casper Alcova Irrigation District - Canal Crossings

- Right-of-way acquisition will include pipeline rights-of-way totaling approximately 20,000 feet in length. Rights-of-way will be needed for the following pipelines:
  - The 6-inch pipeline connecting Garbutt Rd and Bishop Rd.
SECTION 4  WATER SUPPLY ALTERNATIVES

- The 4-inch pipeline serving property No. 9.
- The 4-inch pipeline serving property No. 18
- The 4-inch pipeline serving properties No.6 and 7
- The 4-inch pipeline serving the Cox and Canchola properties.

Conversations with the Pioneer Board of Directors indicate that Pioneer is willing to provide water to 33MRISD. Some of the conditions of any agreement to purchase water from Pioneer include the following key issues:

- 33MRISD must install a master metering station near the point of connection to measure the water purchased from Pioneer. Pioneer must have access to the meter and will base its invoices on the amount of water passing through the master meter. The meter should be located near the 10 Mile Rd./ Highway 20/26 intersection and the connecting pipeline should be an 8-inch pipeline. Pioneer will take over ownership and operation of the 8-inch pipeline from the point of connection in Willy Road up to the meter vault.

- The cost of the water purchased from Pioneer will be no more than 1.5 times the CWRWS wholesale rate to Pioneer. The additional 50 percent is added to cover transmission and pumping costs. The estimated purchase price at the time of this writing is $1.25 per 1000 gallons.

- 33MRISD must operate and maintain its water system. Pioneer is not interested in providing operations personnel or maintenance services.

- Pioneer will assess a one-time connection fee. The fee is based upon the size of the meter at the connection point. A 4-inch meter is adequate to measure flows of up to 600 gpm. The current fee for a 4-inch meter connection is $4,750.

- Pioneer will also assess a CWRWS System Investment Charge of $600 per tap for each tap in 33MRISD.

The estimated cost to design and construct Option No. 1 is $1,915,812. A breakdown of estimated quantities and costs is given in Tables 4-1, 4-2 and 4-3. The project costs are divided into two categories: WWDC/RUS Components and SLIB/RUS Components due to the eligibility of the components for state and federal funding, as described following Table 4-3.
## SECTION 4

### WATER SUPPLY ALTERNATIVES

---

### Table 4-1

**Option No. 1 - Estimated Construction Costs, Pioneer Connection**

**WWDC/RUS Project Components**

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<th>Cost</th>
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<tr>
<td>Legal Fees</td>
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<tr>
<td>Right-of-Way Acquisition</td>
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### Cost of Project Components

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<tr>
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<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
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<td>$25,000.00</td>
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<td>10,000.00</td>
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<tr>
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**Construction Cost** $1,273,950.00

**Engineering (10%)** 127,395.00

**Subtotal** 1,401,345.00

**15% Contingency** 210,202.00

**Construction Cost Total** $1,611,547.00

**Project Cost Total** $1,776,547.00
SECTION 4  WATER SUPPLY ALTERNATIVES

Table 4-2
Option No. 1 - Estimated Construction Costs, Pioneer Connection
SLIB/RUS Project Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
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<tr>
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<td>Mobilization</td>
<td>LS</td>
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<td>$5,000.00</td>
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<td>2</td>
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<table>
<thead>
<tr>
<th>Item Description</th>
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<th>Qty</th>
<th>Unit Price</th>
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<tr>
<td>15% Contingency</td>
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<td></td>
<td></td>
<td>16,665.00</td>
</tr>
</tbody>
</table>

| Construction Cost Total | $127,765.00 |
| Project Cost Total      | $139,265.00 |

Table 4-3
Option No. 1 - Total Estimated Project Cost, Pioneer Connection

| WWDC/RUS Project Components | $1,776,547.00 |
| SLIB/RUS Project Components | $139,265.00   |

TOTAL CONSTRUCTION COST $1,915,812.00

Financing for the 33MRISD water system is expected to come from both State of Wyoming and Federal agencies. The Wyoming Water Development Commission (WWDC) typically provides grants of up to 60 percent of the costs associated with pipeline construction. The State Land and Investment Board (SLIB) typically provides grants for 50 percent of the cost of the service lines and meter pits, provided they are constructed within public rights-of-way, and owned by 33MRISD.

Both the WWDC and SLIB offer loans for those portions of the cost not covered by grants. The WWDC and SLIB loans are available at an interest rate of 7.25% for a term of up to 30 years. Lower interest loans are available through the Rural Utilities Service (RUS) at a current interest rate of 5-1/4 percent for up to a 25 year term. For the purpose of this study, it is assumed a RUS loan is preferred over the higher interest state loans.

The financing plan for Option 1 is given in Table 4-4. The plan includes a WWDC grant of
$1,065,928, and a SLIB grant of $69,632. The remainder of the project would be funded with a $780,252 loan from RUS, at an interest rate of 51/4 percent for a 25 year term. Repayment of the loan results in a monthly debt retirement payment of $78.79 per tap.

Table 4-4
Option No. 1 - Proposed Financing Plan, Pioneer Connection

<table>
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<tr>
<th>Description</th>
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<tr>
<td>Total WWDC/RUS Project Cost</td>
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<tr>
<td>60% WWDC Grant</td>
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<tr>
<td>40% RUS Loan</td>
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<tr>
<td>Annual Debt Service (RUS: 25 years, 5.25%)</td>
<td>$51,733.00</td>
</tr>
<tr>
<td>Total SLIB/RUS Project Cost</td>
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<tr>
<td>50% SLIB Grant</td>
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<tr>
<td>50% RUS Loan</td>
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<tr>
<td>Annual Debt Service (RUS: 25 years, 5.25%)</td>
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<tr>
<td>Total Annual Debt Service ($51,733 + 5,069)</td>
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<tr>
<td>Total Annual Cost per Tap (60 taps)</td>
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<tr>
<td>MONTHLY CAPITAL ASSESSMENT PER TAP</td>
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Option No. 2 - Airport Connection

The Natrona County International Airport, hereinafter referred to as Airport, is located to the east and slightly south of the 33MRISD. The Airport has its own water distribution system, and water storage tank. The airport receives its water supply from the City of Casper through two metered connections. Currently, the Airport provides water to the Forgey and BB Brooks Co. properties in the 33MRISD.

Recently, the CWRWS took over ownership and operation of Airport water storage tank. The tank is 100 feet tall and has a storage capacity of 1.5 million gallons. The Airport area is relatively flat topographically, and the water pressure provided by the tank when full is fairly consistent at 40 to 45 psi throughout.

The Airport water system is fairly distant from the 33MRISD, nearly 2 miles further away than the Pioneer System. What makes this option attractive however, is the number of additional water users that could be served by a transmission line running from the Airport to the 33MRISD. The Landmark Industrial Park (Landmark) is located directly adjacent to, and west of the Airport.
SECTION 4 WATER SUPPLY ALTERNATIVES

Landmark is only partially developed, but does have two significant businesses: Teton Homes and Community Alternatives Center (CAC). Teton employs around 150 workers, and CAC houses up to 190 inmates and has a staff of 25. Landmark does not have a central water system, and the two businesses rely on poor quality, shallow wells with questionable fire protection capabilities.

In addition, the Ten Mile Industrial Park Subdivision (Ten Mile) is located directly adjacent to and west of Landmark. Ten Mile was constructed during the late 1970's boom, and includes graveled roadways, water and sewer lines, and water and waste treatment facilities. However, the economic downturn hit in the early 1980's, and the subdivision was never occupied. It currently sits vacant with unused water and sewer lines. If a reliable public water supply was available to Landmark and Ten Mile, the additional users and potential future users could possibly result in lower debt retirement costs for 33MRISD than Option No. 1.

The conceptual design for Option 2 is shown in Figure 4-3. In order for the Airport to supply water to the 33MRISD, a 12-inch transmission pipeline would be extended from a connection near the Airport Terminal, southward to Highway 20/26, then westward along the 20/26 right-of-way to Landmark Lane. The 12-inch pipeline sizing is needed to provide fire flow capabilities to the industrial parks. The 12-inch pipeline would extend westward under Highway 20/26, through Landmark. The existing waterlines in Ten Mile have been previously evaluated, and appear to have been constructed of low pressure class PVC. It is believed these pipelines can be operated at the 30-50 psi pressures available from the Airport system and therefore could be used to carry water through Ten Mile. However, for the purpose of this study, and in order to be conservative, it is assumed that a new transmission pipeline will be constructed around Ten Mile, rather than using the existing lines. If this option is determined to be feasible, a thorough investigation of the viability to use the existing Ten Mile water system should be performed. Using the existing pipeline system could reduce project costs considerably.

Once through Landmark, the transmission pipeline would extend northward to the 20/26 right-of-way and travel northwestward along the Highway 20/26 right-of-way until reaching the Ten Mile Road intersection. The transmission pipeline would then be routed northward under Highway 20/26, and continue northward along the Thirty-Three Mile Road right-of-way, similar to the Option No. 1 alignment.

Because the Airport tank is considerably lower than the Pioneer tank, it cannot provide adequate operating pressures to serve 33MRISD. Therefore, a booster station will be needed to pump the water throughout the 33MRISD. The booster station would be located along Thirty-Three Mile Road at the northern end of the District. The operating pressure of the 12-inch transmission pipeline will range from 35 to 50 psi, depending on demands. In order to provide the 33MRISD with adequate operating pressures throughout the vast transmission system, the pressure will need to be increased to 100 psi through the booster station.

There are several considerations involved with the design and operation of a booster station. Of particular importance are: 1) sizing the pump for water demands; 2) emergency operation during
power outages; and 3) the pumping control system. Pump sizing is dependent upon the method chosen to provide service during power outages. One method is to provide a fuel-fired electrical generator that comes on during power failures. The other method is to provide a water storage tank situated at an elevation to provide adequate water pressures. If an electrical generator is used for standby power, the pumps should be designed to meet peak hour demands, or about 542 gpm. If a water storage tank is provided in lieu of standby power, the pumps should be designed to meet maximum day demands, or about 270 gpm, and the tank designed to store average day demand flows for one day.

In terms of system operation, the pumps are usually operated from system pressure. Typically, if a water storage tank is provided with the system, the water levels in the tank are monitored and used to automatically turn the booster pumps on and off. If a water storage tank is not provided, the system pressure can be measured on the booster discharge piping and a pressure switch can be used to turn the pump on and off.

With these considerations in mind, two booster station system configurations were developed. Configuration 1 meets the system needs without a water storage tank, and includes two 40 horsepower pumps each rated at 542 gpm capacity, a diesel-fired electric generator, and a pressure sensing system with programmable logic controller (PLC) to control the on-off operation of the pumps. Because of the large variation in demands, it would also be advantageous for the pumps to be provided with variable frequency drive (VFD) motors that match pumping capacity with variable demands. This booster system configuration is fairly complex, but reliable.

Configuration 2 for the booster station system includes a water storage tank in the system. The booster station would have two 20 horsepower pumps each with 270 gpm capacity, and a radio telemetry system with PLC’s located at the tank and at the booster station to communicate water level information from the tank to the pumps. There is no need for VFD motors since the variable demands can be easily matched with the pump operation and flows from the tank. A 100,000 gallon capacity welded steel water tank would also be required. This configuration is not as complex as configuration 1, but is a little more expensive because the cost of the water storage tank is about $50,000 more than the additional cost of VFD’s and the standby generator needed in Configuration 1. For operation and maintenance considerations, booster system configuration 2 with a water storage tank is assumed to be preferred, and is shown in Figure 4-3.

The remainder of the water transmission system under this Option would be sized and aligned the same for 33MRISD as in Option No. 1. The only exception is that the 8-inch transmission pipeline along Enberg Road would be extended further westward to connect to the water storage tank. The tank would be located at the highest point available at the end of Enberg Road, and have an overflow elevation of 5500 feet. The configuration of the tank at this location would be 22-feet diameter and 40-feet tall.

Permitting requirements for Option No.2 would include the same agencies as Option 1, plus buried utility company crossings encountered along Highway 20/26. These utilities include petroleum
pipelines and telecommunications.

Rights-of-way acquisition for Option No. 2 would include the same areas as Option No. 1, plus the following:

- The 12-inch transmission pipeline along Highway 20/26. It is expected that the WYDOT will not allow construction of the pipeline in the existing right-of-way, and that easements from private property owners would be needed.
- The 8-inch pipeline along the Enberg Road past the end of the District boundary.
- The site for the tank, approximately 1/3 acre.
- The site for the booster station, approximately 1/4 acre.

The estimated cost to design and construct Option No. 2 is $3,024,648. A breakdown of the estimated quantities and costs is given in Tables 4-5, 4-6, and 4-7. The project costs are divided into the same categories (WWDC and SLIB) as Option No. 1.

**Table 4-5**
Option No. 2 - Estimated Construction Cost, Airport Connection

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<th>Final Design</th>
<th>Permitting and Mitigation</th>
<th>Legal Fees</th>
<th>Right-of-Way Acquisition</th>
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<th>Item</th>
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<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
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<td>6&quot; Water Transmission Line LF</td>
<td>38,000</td>
<td>9.00</td>
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<td>12</td>
<td>6&quot; Valve EA</td>
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<td>650.00</td>
<td>7,800.00</td>
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<tr>
<td>13</td>
<td>6&quot; Fitting EA</td>
<td>40</td>
<td>200.00</td>
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<td>4&quot; Water Transmission Line LF</td>
<td>27,000</td>
<td>7.00</td>
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Table 4-6
Option No. 2 - Estimated Construction Costs, Airport Connection
SLIB/RUS Project Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization</td>
<td>LS</td>
<td>1</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; Meter Pits and Services</td>
<td>EA</td>
<td>60</td>
<td>$1,500.00</td>
<td>$90,000.00</td>
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<tr>
<td>3</td>
<td>2&quot; Meter Pits and Services</td>
<td>EA</td>
<td>2</td>
<td>$3,000.00</td>
<td>$6,000.00</td>
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<tr>
<td>4</td>
<td>Surface Restoration</td>
<td>LS</td>
<td>1</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
</tr>
</tbody>
</table>

Construction Cost Subtotal $106,000.00
Engineering (10%) $10,600.00
Subtotal $116,600.00
15% Contingency $17,490.00

Construction Cost Subtotal $134,090.00

TOTAL CONSTRUCTION COST $147,590.00
Financing for Option No. 2 is expected to be obtained similar to Option No. 1. The financing plan for Option No. 2 is given in Table 4-8. The plan includes a WWDC grant of $1,726,235 and a SLIB grant of $73,795. The remainder of the project costs will be funded with a $1,224,618 loan from RUS at an interest rate of 5-1/4 percent for a 25 year term. However, repayment of the loan results in a monthly debt retirement payment of $78.24 per tap, which is very similar to Option No. 1. Since the 12-inch transmission pipeline would pick up two large customers, these customers must be converted to “equivalent dwelling units (EDU)”. EDU’s for this project are considered to be the water usage typical for the average dwelling unit. The EDU for this project is 200 gpcpd times 3.5 people per dwelling unit, or 700 gal per day.

The calculations for Teton’s and CAC’s conversion to EDU’s are given below. Water usage figures are taken from WDEQ rules and regulations.

Teton (150 employees plus 10 staff)
160 x 30 gpcpd = 4800 gpd ÷ 700 = 6.85 EDU

CAC (190 beds plus 25 staff)
190 x 100 gpcdp = 19,000
25 x 30 gpcpd = 750
19,750 gpd ÷ 700 = 28.2 EDU

Total EDU = 35.05
Use 35 EDU

Table 4-8
Option No. 2 - Proposed Financing Plan, Airport Connection

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Total WWDC/RUS Project Cost</td>
<td>$2,877,058.00</td>
</tr>
<tr>
<td>60% WWDC Grant</td>
<td>$1,726,235.00</td>
</tr>
<tr>
<td>40% RUS Loan</td>
<td>$1,150,823.00</td>
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<tr>
<td>Annual Debt Service (RUS: 25 years, 5.25%)</td>
<td>$83,780.00</td>
</tr>
</tbody>
</table>
### Table 4-8 - Option No. 2 - Proposed Financing Plan, Airport Connection Cont.

<table>
<thead>
<tr>
<th>Total SLIB/RUS Project Cost</th>
<th>$ 147,590.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% SLIB Grant</td>
<td>$ 73,795.00</td>
</tr>
<tr>
<td>50% RUS Loan</td>
<td>$ 73,795.00</td>
</tr>
<tr>
<td>Annual Debt Service (RUS: 25 years, 5.25%)</td>
<td>$ 5,372.00</td>
</tr>
</tbody>
</table>

| Total Annual Debt Service ($83,780+ 5,372) | $ 89,152.00 |
| Total Annual Cost per Tap (60 taps + 35 EDU) | $ 939.00 |
| MONTHLY CAPITAL ASSESSMENT PER TAP | $ 78.24 |

#### Preferred Alternative

Option No. 1 and No. 2 appear to be very equal in terms of debt retirement cost per tap, both being estimated in the $78 per month range for debt service. Conversations with Teton indicate a "mild interest" in being part of the Option No. 2 water project depending on the cost. However, CAC appears to be moving to a new location, which would significantly affect the number of EDU’s used to compute the debt share. If CAC is not part of the above calculation, the debt retirement cost per tap changes from $78.24 to $110.94 per month. Conversations with Teton indicate that a cost of $777 per month ($110.94 x 7EDU’s) is too expensive.

Based upon debt costs, and the probable loss of CAC to help pay their prorata share, Option No. 2 does not appear feasible. Option No. 1, the Pioneer connection is therefore selected as the preferred alternative and will be the subject of the preliminary design in the next section.
In the previous section, the preferred alternative for a water supply system was determined to be Option No. 1, a connection to the Pioneer water system. This section presents the preliminary design for Option No. 1 and provides more detail concerning the design, construction considerations and estimated costs.

Water System Design

The conceptual design for the water system under Option 1 as presented in Section 4 was developed with only cursory field work. After selection of Option No. 1 as the preferred alternative, the following additional field work was performed:

- A field survey to develop a profile of the proposed pipeline alignments. The profile is primarily used to determine the need for and locations of air/vacuum relief valves, and water line blow-offs.

- Field reconnaissance to evaluate any special construction requirements for the irrigation canals/ditches and the natural drainages that will be crossed during construction of the pipelines.

- Soil types and subsurface conditions were observed by excavating backhoe pits at intervals along the proposed pipeline alignments. Because of the large size of the project area, and budget constraints, a proportionately small number of excavations were performed. Test areas were selected where high groundwater tables or poor subsoils were suspected. Results of the soils and subsurface investigations are provided in Appendix B.

- Reconnaissance of underground utilities along the proposed pipeline alignments to attempt to identify any potential conflicts with construction and estimate the associated costs.

The preliminary design of the water transmission system is shown in plan view in Figure 5-1. Slight changes in pipeline alignments have been made to reduce costs. All pipeline sizing has been verified by hydraulic modeling, print-outs are included in Appendix A. The preliminary profiles for the proposed alignments are shown in Figure 5-2. The location of air/vacuum valves and the irrigation canal/stream crossings are indicated in the profile drawings. As indicated in Section 4, irrigation ditch crossings will require special construction considerations, and should only be crossed under during the non-irrigation season, between October 15 and April 15. Crossing under the Johnson lateral will require excavations of up to 15 to 20 feet in depth with vertical fittings to accomplish the crossing. The small irrigation crossings can be accomplished without vertical fittings by deflecting the pipe within manufacturers limits.

Because of corrosive soils, and in accordance with CWRWS design policies, materials used in
construction for the pipelines should be AWWA C900 PVC piping with PVC fittings, or AWWA C904 High Density Polyethylene (HDPE) piping with fused fittings. Valves should be AWWA approved resilient seat gate valves. Since these valves and associated valve boxes are ductile iron materials, the valves and boxes should be protected from soil corrosion with sacrificial anodes. Flushing hydrants are typically 6-inch fire hydrants, and are constructed of ductile iron material. The flushing hydrants should also be protected with sacrificial anodes. Service system materials should include brass corp stops, and curb stops, and HDPE service piping with compression fittings. Some service lines on private property will be extremely long, perhaps up to 3000 feet. Sizing of service line piping should account for head losses and elevation changes.

The type of piping used for the pipelines has some economical importance. If PVC piping is used, the pipe laying operation typically includes excavation with a backhoe and two men in the trench to join and install the piping. HDPE piping is typically fused on the ditch bank, and can be installed without having any workers in the trench. Where underground utility conflicts are minimal as is expected with the project, the trenching excavation can be performed with a wheel type trencher. There could be significant cost savings if HDPE piping is used and is installed using a trencher. When the project is designed and bid, the bid documents should be prepared to allow the Contractor to use either PVC or HDPE piping, and installation should allow the use of a trencher.

It should be noted that the preliminary design presented herein does not include a re-chlorination system as suggested in the previous Level I Study. Conversations with Pioneer indicate they have never had a problem maintaining a chlorine residual in the system. In addition, the CWRWS will soon be implementing a new chloramine disinfection system which provides for even longer lasting residuals. Once the new chloramine system is placed into service, information will become available to determine if there is a need for a re-chlorination system.

**Preliminary Cost Estimate**

The cost estimates for Option No. 1 that were presented in Section 4 have been more closely detailed and refined in this section. Information from the field investigations has also been used to provide more accurate cost estimates. The preliminary cost to construct Option No. 1 is estimated to be $1,880,075 and assumes year 2001 construction. A detailed breakdown of estimated quantities and costs is presented in Tables 5-1, 5-2, and 5-3. A brief description of each item and the assumptions used is given below. The preliminary financing plan is summarized in Table 5-4 and includes a WWDC grant of $1,044,486, a SLIB grant of $69,632 and a RUS loan of $765,957. The debt retirement cost per tap is $929.35 per year, or $77.45 per month.

- **Mobilization** - includes the cost to mobilize equipment and crew to the project site. It also includes the cost of Contractors bonds and insurance, which typically run 1-3 percent of the construction cost.
- **Connect to Pioneer system** - includes the cost to excavate and remove the concrete
thrust block on the bend in Willy Rd. Discussions with Pioneer indicate the thrust block may be 10 cubic yards of concrete. The item also includes cutting in a new tee, and the special fittings required to work with the Permastran pipe.

- 8-inch water transmission line - this item includes the cost of purchasing the pipe, and the installation and bedding costs. The current material price for PVC and HDPE pipe is $6.00 to $6.50 per foot. These prices vary in direct relation to the price of oil. With 40 percent of the project area expected to be constructed in poor, wet soil conditions, the overall average cost for piping is expected to be $12 per foot.

- 4, 6, and 8-inch valve - includes the cost of the valve, valve box and sacrificial anode.

- 4, 6, and 8-inch fitting - includes the cost of the fitting plus the concrete thrust block.

- 6-inch water transmission line - same as the 8-inch piping, includes pipe cost, installation, and bedding. The current material price for 6-inch PVC and HDPE pipe is $3.00 to $3.50 per foot.

- 4-inch water transmission line - same as the 6 and 8-inch piping. The current material price for 4-inch PVC and HDPE is $1.80 to $2.25 per foot.

- Flushing hydrant assembly - includes the cost for the fittings, a gate valve, and 6-inch fire hydrant.

- Air/vac release valve - includes the cost of a manhole, 1-inch connection, air/vac valve, and vent piping.

- Irrigation crossing - includes the cost of the extra depth, and dewatering activities (if needed) to cross under the smaller irrigation canals, and culverts. Depths are expected to range from 6 to 12 feet.

- Major irrigation crossing - includes the cost of extra depth, fittings, dewatering, and bentonite backfill to cross under the major canals and waste ditches. Depths are expected to range from 12 to 20 feet.

- Highway undercrossing - includes the cost of boring, and encasing the 8-inch pipeline under Highway 20/26. There is some thought that an encased sewer line crossing exists from the old Ten Mile Industrial Park project. However, field reconnaissance did not verify the undercrossing. If during final design a crossing is found, the under crossing could be used thereby saving costs.

- Master meter station - includes the cost of a concrete vault with 4-inch meter, piping,
SECTION 5 - PRELIMINARY DESIGN OF OPTION NO. 1 - PIONEER CONNECTION

valving and by-pass.

- Select backfill - Clean, dry granular material is required for use in replacing unsuitable soil where pipelines cross under roadways or other areas where high density compaction is required. The price includes the cost of importing suitable material and disposing of the unsuitable material.

- Foundation material - clean, dry, 1 to 4-inch rock is required for use in stabilizing the bottom of the trench when unstable, wet soils are encountered. The price includes the cost of importing the rock material and disposing of the unsuitable material. It is assumed that local gravel pits in the 33MRISD area can be used as sources for both the select backfill and foundation material.

- Seeding and mulching - includes the cost to reseed and mulch a few sensitive areas disturbed by construction. The item only includes areas susceptible to soil erosion, and does not include all areas of the project. The 33MRISD will perform other seeding if needed.

- Gravel road restoration - includes the cost to replace graveled roadways disturbed by construction. This cost only assumes a 10-foot wide, 2-inch thick layer of gravel will be placed over disturbed areas, it does not include re-graveling the entire roadway which would be cost prohibitive.

- Pavement repair/ patching - includes the cost to replace pavement disturbed by trenching across 33 Mile Road.

- Enberg road repair - includes the cost to replace the portions of the road disturbed by pipeline construction. The roadway is currently built up with 2 to 6-inch rock to stabilize the roadway.

- 3/4-inch water service and pit - includes the cost of the tap, corp stop, curb stop, meter pit with meter, backflow preventer and meter readout.
## Table 5-1

### Preliminary Cost Estimate, Preferred Alternative

<table>
<thead>
<tr>
<th>WWDC/RUS Project Components</th>
<th>Cost of Project Components</th>
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<tr>
<td>Preparation of Final Designs and Specifications</td>
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<td>Permitting and Mitigation</td>
<td>15,000.00</td>
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<tr>
<td>Legal Fees</td>
<td>10,000.00</td>
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<tr>
<td>Right-of-Way Acquisition</td>
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</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
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<td>$25,000.00</td>
<td>$25,000.00</td>
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<tr>
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<td>8&quot; Fitting</td>
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<tr>
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<td>6&quot; Fitting</td>
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<td>40</td>
<td>200.00</td>
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<td>9</td>
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<tr>
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<tr>
<td>13</td>
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<tr>
<td>14</td>
<td>Irrigation / Stream Crossing</td>
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<tr>
<td>15</td>
<td>Major irrigation Crossing</td>
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<td>Select Backfill</td>
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<tr>
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<td>Foundation Material</td>
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<tr>
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<td>Gravel Road Restoration</td>
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<td>100,000.00</td>
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<td>22</td>
<td>Pavement Repair/Patching</td>
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<td>500</td>
<td>20.00</td>
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<td>23</td>
<td>Enberg Road Repair</td>
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</tbody>
</table>

**Construction Cost** $1,245,700.00

**Engineering (10%)** 124,570.00

**Subtotal** 1,370,270.00

**15% Contingency** 205,540.00

**Construction Cost Total** $1,575,810.00

**PROJECT COST TOTAL** $1,740,810.00
Table 5-2
Preliminary Cost Estimate, Preferred Alternative
SLIB/RUS Project Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization</td>
<td>LS</td>
<td>1</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; Water Service and Pit</td>
<td>EA</td>
<td>60</td>
<td>1,500.00</td>
<td>90,000.00</td>
</tr>
<tr>
<td>3</td>
<td>Surface Restoration</td>
<td>LS</td>
<td>1</td>
<td>6,000.00</td>
<td>6,000.00</td>
</tr>
</tbody>
</table>

Construction Cost Subtotal $101,000.00
Engineering (10%) $10,100.00
Subtotal $111,100.00
15% Contingency $16,665.00
Construction Cost Total $127,765.00

PROJECT COST TOTAL $139,265.00

Table 5-3
Option No. 1 - Preliminary Total Estimated Project Cost, Preferred Alternative

<table>
<thead>
<tr>
<th>Project Components</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWDC/RUS</td>
<td>$1,740,810.00</td>
</tr>
<tr>
<td>SLIB/RUS</td>
<td>$139,265.00</td>
</tr>
<tr>
<td>TOTAL CONSTRUCTION COST</td>
<td>$1,880,075.00</td>
</tr>
</tbody>
</table>

Table 5-4
Option No. 1 - Preliminary Proposed Financing Plan, Preferred Alternative

| Total WWDC/RUS Project Cost               | $1,740,810.00 |
| 60% WWDC Grant                            | $1,044,486.00 |
| 40% RUS Loan                              | $696,324.00   |
| Annual Debt Service (RUS:25 years, 5.25%) | $50,692.00    |

| Total SLIB/RUS Project Cost               | $139,265.00   |
| 50% SLIB Grant                            | $69,632.00    |
| 50% RUS Loan                              | $69,633.00    |
| Annual Debt Service (RUS: 25 years, 5.25%) | $5,069.00     |

Total Annual Debt Service ($50,692 + 5,069) $55,761.00
Total Annual Cost per Tap (60 taps) $929.35
MONTHLY CAPITAL ASSESSMENT PER TAP $77.45
Construction Permits and Licenses

Based upon the preliminary designs, the following agencies will need to be involved in approving the necessary permits and licenses for construction.

- **Wyoming Department of Environmental Quality** - Permit to Construct
- **Army Corps of Engineers** - Permit to cross streams
- **Natrona County Road and Bridge Department** - License to construct pipelines in County road rights of way
- **Wyoming Department of Transportation** - License to cross under Highway 20/26
- **Casper Alcova Irrigation District, BuRec** - Permission to cross irrigation canals.

In addition, because federal funds may be used, the State Historical Preservation Office (SHPO) will require that a cultural resource survey be performed to determine if historical resources or sites exist in the project area, and what if any mitigation efforts are required. Since nearly all of the pipelines are located within existing county road rights-of-way, little mitigation efforts, if any are anticipated. Also, a biological assessment may be required to determine if threatened or endangered species are present in the area. A detailed environmental report for the project along with responses from various permitting agencies are presented in Appendix D.

Land and Right-of-Way Acquisition

There are a few pipelines that are not able to be constructed in county road rights of way. Rights of way and easement agreements for the pipelines will need to be obtained by the 33MISD prior to bidding the project. Typically, the minimum permanent right of way width is 20 feet, but 30 feet is more convenient. A 40-foot width should be temporarily obtained during construction to accommodate equipment and construction activities. The pipelines which will require right of way acquisitions, and the affected landowners are shown in Table 5-5.

Pioneer Water Purchase Contract

It is probable that the funding agencies will require the execution of a water purchase agreement between Pioneer and 33MRISD prior to approval of funding. Pioneer appears amenable to selling water as indicated by their letter dated September 14, 1999 (See Appendix E).
Table 5-5 - Rights of Way Acquisition Needs

<table>
<thead>
<tr>
<th>Description of Pipeline</th>
<th>Affected Land Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 6-inch pipeline between Bishop and Garbutt Roads</td>
<td>Bressler, Davis, Ulman, and Bryant</td>
</tr>
<tr>
<td>2. 4-inch pipeline to serve Riddle property</td>
<td>Bressler, BLM, Riddle</td>
</tr>
<tr>
<td>3. 4-inch pipeline running east off 33 Mile Road</td>
<td>Cox, Canchola, and Legerski</td>
</tr>
<tr>
<td>4. 4-inch pipeline to serve Forgey Ranch property</td>
<td>Forgey</td>
</tr>
<tr>
<td>5. 8-inch pipeline to serve property at west end of</td>
<td>Baughman, Smith</td>
</tr>
<tr>
<td>Enberg Road</td>
<td></td>
</tr>
</tbody>
</table>
This section presents the economic analysis for the project represented in the preliminary design. The intent of this section is to provide the fiscal information necessary to determine the end cost to users under the funding scenarios involving WWDC assistance and other state and federal funding in conjunction with local contributions. The information presented herein can be utilized in applications to the various cooperating agencies, including RUS and the State Lands and Investment Board.

Equivalent Dwelling Units
An equivalent dwelling unit (EDU) is the level of service provided to a typical residential dwelling. For the purpose of this study, one EDU is equivalent to a 3/4-inch tap. There are no businesses currently operating in the 33MRISD. All customers are residential units, either homes or ranch houses etc. As part of the project cost, each customer will receive a 3/4-inch tap with the meter pit set at the property line. The meter will be capable of recording flows of 0 to 25 gallons per minute. Initially, the 33MRISD expects to install 60 taps.

Debt Financing Plan
As indicated in Section 4, there are three sources of project financing which have historically been available for rural water projects. The agencies are summarized as follows:

- Wyoming Water Development (WWDC) - Typically provides grant and loan funding in a 60:40 mix, respectively. Loan rates are 7-1/4 percent interest for a term of up to 30 year terms. Eligible components include water transmission pipelines, booster stations, and water storage tanks. Distribution pipelines, water meters and water services are usually not eligible.

- State Land and Investment Board (SLIB) - Typically provides grant and loan funding in a 50:50 mix. Loan rates are 7-1/4 percent interest for a term of up to 30 years. Usually all components of a water system are eligible as long as they are owned and operated by the District.

- Rural Utilities Service (RUS) - A federal agency, part of the US Department of Agriculture typically provides grants and loans for water system projects. Only those areas of the state with median incomes below the state median income level qualify for grants. Currently, the MRISD does not qualify for RUS grant funds. Loan interest rates vary with the national prime rate. Loan terms are up to 25 years, and the current interest rate is 5 1/4 percent.

Based upon the previous Level I Study, and discussions with WWDC and RUS representatives, the most favorable financing plan is as follows:

- A WWDC grant for 60% of the cost of all water transmission pipelines and
associated appurtenances, ($1,044,486).

- A SLIB grant to fund 50% of the cost of all water service taps and meter pits, ($69,632).

- RUS to provide a loan for the 40% not funded by the WWDC grant and the 50% not funded by the SLIB grant, ($765,957). The interest rate is assumed to be 5-1/4 percent for a 25 year term.

The total estimated project cost as previously given in Section 5 is $1,880,075. The financing plan results in a WWDC grant of $1,044,486, a SLIB grant of $69,632, and a RUS loan of $765,957. Based upon the loan terms, the annual debt retirement payment to RUS would be $55,761. Based upon 60 EDU’s, the monthly debt retirement payment is $77.45 per tap.

**Annual Operating Budget**

In addition to the debt payment, the 33MRISD will need to pay for water purchased from Pioneer, and for the operation and maintenance of the water system. An estimated annual operating budget is given in Table 6-1, and a brief discussion of each item follows.

- Operator: The 33MRISD will be required to have a licensed operator responsible for the system. WDEQ requires the system to have a primary operator and a backup operator. The operator will also be responsible for water sampling and testing.

- Water Purchase: Water purchased from Pioneer is expected to cost $1.25 per 1000 gallons, sold at the master meter. The 33MRISD should expect “some unaccounted-for” water losses in the 20 plus miles of transmission pipelines, plus the water used by the District to flush the system semi-annually. A factor of 1.15 has been used to cover the unaccounted-for and flushing water. The water usage per tap is assumed to average 15,000 gallons per month.

- Meter Reading/Billings: The 33MRISD will need to meter and send out water bills. It is assumed these duties will be performed quarterly. This process could be performed on a volunteer basis to reduce costs if necessary.

- Bookkeeping: The budget also assumes a bookkeeper will be needed for an average of 4 hours per month to prepare accounts receivable, accounts payable, and develop income and balance sheets. The 33MRISD will need to have an audit performed every year, and a bookkeeper should enable the audit process to be streamlined and simple.

- Supplies: Supplies for the District include paper, envelopes, postage, and other miscellaneous materials.
Repairs/Maintenance: Repairs and maintenance include fixing water leaks, meter problems, flushing hydrants, etc. Initially, for a new system the budget should be low. As the system ages, more repairs should be expected.

Reserve Funds: The reserve fund is usually required by RUS to cover delinquent debt payments. Typically, the reserve fund is approximately 5 percent of the annual debt payment.

Bonding and Insurance: Bonding and insurance costs for the 33MRISD board and its employees is estimated to cost $1800 per year.

Telephone: The 33MRISD should have a separate phone and listing in the phone book, so customers have a contact to call in times of need or other.

**Table 6-1, Operating and Maintenance Budget Estimate**

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<thead>
<tr>
<th>Description</th>
<th>Estimated Annual Cost</th>
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<td>Operator:</td>
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<tr>
<td>Primary $25/hr x 20 hr x 12 mo</td>
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<td>Backup $20/hr x 4 hr x 12 mo</td>
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<td>$250/qtr x 4 qtrs</td>
<td>$1,000.00</td>
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<td>Purchase Water:</td>
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<tr>
<td>15,000 gal/tap x 60 taps x 12 mo x $1.25/1000 x 1.15</td>
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<tr>
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<tr>
<td>Bookkeeping:</td>
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<td>4 hr/mo x $40/hr x 12 mo</td>
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<td>Stationary, envelopes, stamps, etc.</td>
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<tr>
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<td>Water leaks, meter repairs, flushing</td>
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<tr>
<td>Required by state and federal funding agencies</td>
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<td>5% of debt retirement payment</td>
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<td>Monthly Cost Per EDU</td>
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Proposed Water Rate Schedule

There are several possible water rate schedule scenarios. The most typical approach is to assess the debt retirement payments to all properties that are benefitted by having water line adjacent to the property, and to develop a user fee rate schedule for those property owners that use the water system.

The debt retirement payments can be made part of the monthly or quarterly water user fee, or can be made a part of the annual property tax assessment by the County. The funding agencies prefer the latter, because it is a more reliable method of ensuring that payments are made. It is a board and funding agency decision, but for the purpose of this study, it is recommended that the debt retirement payments be paid as property tax assessments. This means that every year as part of the County property tax assessment, a water debt assessment would be included. For those property owners whose property taxes are escrowed by a mortgage company, the annual assessment would become part of the monthly mortgage payment. Then, on a quarterly basis, the County assessor would pay the collected assessments to the 33MRISD, and in turn, the 33MRISD would use the assessment to make the debt retirement payment to RUS.

Assuming the debt retirement payment is made by the property owners through a property assessment, a user rate schedule would be used to pay the annual operating costs of the water system. The water user fee is usually based on the amount of water used by each customer. If each customer uses an average of 15,000 gallons per month, the total annual usage by the 33MRISD would be 10.8 million gallons. To cover the annual operating budget of $36,585, the 33MRISD would need to charge $3.39 per 1000 gallons used, as measured at each individual meter pit.

Therefore, the water rate schedule can be fairly simple. Under the above described scenario, each property in the District would be assessed about $929.35 annually for water system debt retirement as part of their property tax assessment. On a quarterly basis, and as determined through meter readings, each water user would also be charged $3.39 per 1000 gallons used. For the average property that uses 15,000 gallons per month the monthly user fee would be $50.81. Therefore, for the typical property owner that makes monthly water assessment payments to a mortgage company, the total monthly cost for the water supply would be $128.26. The proposed rate schedule is summarized in Table 6-2. It should be noted that even though the rate seems extremely high compared to typical city rates, many of the property owners pay similar costs to purchase and haul potable water for very limited domestic use.
Table 6-2 - Proposed Rate Schedule for Average User

| Monthly Debt Retirement Payment (through property assessment) | $77.45 |
| Monthly Water User Fee (15,000 gal x 3.39/1000 gallons)       | $50.81 |
| Total                                                       | $128.26 |

**One-Time Cost to Homeowners**

In addition to the ongoing debt retirement costs and the operation and maintenance costs, there will be one time costs to the water user. The one time cost to each property will vary considerable depending on the service tap size and distance from the home to the meter pit. These costs are expected to be at least $1,500 per home for those with a 3/4-inch tap that are located 100 feet of the meter. A summary of the one-time costs is given below.

- **Regional Water System Investment Charge** - Each service connecting to the water system will be required to pay the RWS investment charge. A copy of the RWS JPB Growth Policy is included in Appendix C. The charge is based upon the tap size and is summarized below:
  - 3/4" tap $600.00
  - 1" tap $1,002.00
  - 1-1/2" tap $1,998.00
  - 2" tap $3,198.00

- **Pioneer Water System Fee** - Pioneer will assess a one time charge of $4,750 for the metered service to 33MRISD. Based upon 60 taps, the prorata cost per tap would be $79.17.

- **Service Line Installation** - The property owner will need to install the water service line from the meter pit to the house. The size of the service line will depend on the flow needed, and the distance from the meter to the house. Estimated construction costs for service lines range from $5 to $8 per linear foot.

- **House Plumbing Conversion** - The existing plumbing system will need to be connected to the new water service, and the well connection disconnected. Costs will vary depending upon each individual house.

- **Oversize Service Tap Charge** - Each home will get a 3/4 inch tap and meter as part of the overall project cost. If a larger tap is desired, the District should charge the additional cost over the cost of the 3/4 inch tap to the homeowner. The additional cost will be based on actual construction costs.
This section presents a preliminary implementation schedule for the project. The schedule is presented in Table 7-1 and assumes the property owners approve the project and the funding agencies provide the grants and loans described in Section 6. The schedule is an optimistic one, and may need to be revised and updated as the project progresses.

Table 7-1 - Preliminary Implementation Schedule

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<td>November 1, 1999</td>
<td>Final Study Complete, WWDC Application Due</td>
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<tr>
<td>November 30, 1999</td>
<td>WWDC Meets to Review Application</td>
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<td>December 15, 1999</td>
<td>Apply to RUS</td>
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<td>January 5, 2000</td>
<td>Public Hearing for WWDC</td>
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<tr>
<td>February 15, 2000</td>
<td>Advertise Public Meeting for Bond Election</td>
</tr>
<tr>
<td>April 1, 2000</td>
<td>Legislature Approves WWDC Funds for Project</td>
</tr>
<tr>
<td>April 4, 2000</td>
<td>Hold Public Hearing prior to Bond Election</td>
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<tr>
<td>April 15, 2000</td>
<td>Apply to SLIB</td>
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<tr>
<td>May 4, 2000</td>
<td>Bond Election for RUS Loan</td>
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<td>July 15, 2000</td>
<td>SLIB Approves Funding</td>
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<td>August, 2000</td>
<td>Begin design</td>
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<td>Begin Construction</td>
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<td>December, 2001</td>
<td>Finish Construction</td>
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APPENDIX A
Scenario: Average Day Current

Color Coding Legend
Link: Diameter (in)

- <= 4
- <= 6
- <= 8

Title: 33 Mile Road & S District
Civil Engineering Prof Inc

Project Engineer: Thomas Brauer

## Node Elevation Demand

<table>
<thead>
<tr>
<th>Node Label</th>
<th>Elevation (ft)</th>
<th>Demand (gpm)</th>
<th>Pressure (psi)</th>
<th>Calculated Hydraulic Grade (ft)</th>
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## Scenario: Average Day Current
### Steady State Analysis
#### Pipe Report

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<th>End Node</th>
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<th>Current Status</th>
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<th>Discharge (gpm)</th>
<th>Friction Slope (ft/1000ft)</th>
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### Scenario: Peak Hour Existing 6X
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#### Junction Report

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<th>Pressure (psi)</th>
<th>Calculated Hydraulic Grade (ft)</th>
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#### Steady State Analysis

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APPENDIX B
Thirty-three Mile Water Supply Project
Subsurface Exploratory Report

September, 1999

Prepared by
Civil Engineering Professionals, Inc.
355 N. Lincoln Street
Casper, Wyoming 82601
(307) 266-4346
SUMMARY

Based on the observation of the test pits, subsurface conditions can be generalized as follows. Three to six inches of vegetation and/or topsoil was generally encountered at the surface of the test pit locations. The topsoil/vegetation was underlain by brown to dark brown lean clay with various amounts of sand. At test pits #1 and #3 claystone bedrock was encountered at a depth of 2.5 feet, which was highly weathered and became slightly weathered with depth. Various amounts of alkali was also encountered in test pits #6, #7, #9 and #10. Ground water was encountered in 3 of the 10 test pits at depths varying from 4.0 to 6.5 feet. The ground water appears to be most prevalent in the lower lying areas, which from a visual observation would account to about a third of the area.

FIELD EXPLORATION

The fieldwork was performed using a 580 Case rubber tire backhoe on September 30, 1999. Ten (10) test pits were excavated to depths ranging from 7 to 8 feet at locations indicated on Figure #1.

During excavation of the test pits, a CEPI engineer was on-site to evaluate the materials encountered and observed the excavation activities. Field classification was completed at that time and the appropriate soil classification using the Unified Soil Classification System. Classification of the materials encountered was based on visual and tactual observation of the test pit and is included with this report.

SUBSOIL CONDITIONS

Subsoil’s encountered in the 10 test pits generally consisted of vegetation/topsoil layer underlain by a lean clay with various amounts of sand. At test pits #1 and #3, claystone bedrock was encountered at a depth of 2.5 feet, which was highly weathered and became slightly weathered with depth. Test pits #6, #7, #9 and #10 also had various amounts of alkali throughout the test pits. Test Pit #2 also had various amounts of betonite and generally had a greater amount of sand content than the other test pits.

GROUND WATER CONDITIONS

Ground water was encountered in 3 of the 10 test pits at depths varying from 4.0 to 6.5 feet. The ground water appears to be most prevalent in the lower lying areas. At test pits #7 and #8 the subgrade material were very saturated which would indicate that groundwater is near and could be higher during wetter months. Some small isolated areas may have ground water problems, which are not identifiable in this report. Fluctuations in ground water levels are anticipated to occur due to seasonal variations in precipitation and irrigation, and due to variations in water levels in the near by ponds.
FIGURE NO. 1
33 MILE ROAD
IMPROVEMENT & SERVICE
DISTRICT
SOIL TEST PIT
MAP

CIVIL
ENGINEERING
PROFESSIONALS,
INC.
355 N. Lincoln
Casper, Wyoming 82601
(307) 266-4346
(307) 266-0103 Fax
ANALYSIS

The proposed water line is expected to be constructed using cut and cover techniques. The depth of the water of the water line will be on the order of 6 feet. Based on the materials observed at the test pit locations, the majority of the excavation for the water line will be within overburden soils consisting of lean clay with various amounts of sand. However, in the area along Thirty-three Mile Road starting from Highway 20/26 going to about 2 miles north, the excavation will be within claystone bedrock. The bedrock generally appears to be weathered enough to allow conventional excavation of the water line.

Groundwater appears to be most prevalent in the lower lying areas, which generally consist of about a third of the project. At these locations trench excavations extending near or below the water table will require dewatering. Foundation and select backfill materials will be also be required to facilitate the placement of the water line.

About half of the test pit locations indicated that the subsurface materials were very saturated at the proposed water line depth. It is estimated that half of the project area were the water line will be placed will require various amounts of foundation and select backfill material.
SOIL TEST PIT LOG

TEST PIT #1

0-.5’ Topsoil
.5’-2.5’ Sandy Clay (CL), brown, moist
2.5’-5’ Highly weathered claystone bedrock, dark brown to gray with some rust color, moist
5’-7’ Slightly weathered claystone bedrock, dark brown to gray with some rust color, moist

No ground water present

TEST PIT #2

0-.25’ Topsoil
.25’-8.5’ Clayey Sand (SC), with various amounts of betonite, light brown, moist

No ground water present

TEST PIT #3

0-.5’ Topsoil
.5’-2.5’ Lean clay with sand (CL), brown, moist
2.5’-6’ Highly weathered claystone bedrock, brown, moist
6’-7.5’ Slightly weathered claystone bedrock, brown, moist

No ground water present

TEST PIT #4

0-.5’ Topsoil
.5’-2’ Lean clay, (CL), brown, dry
2’-3’ Lean clay, (CL), brown, moist
3’-8’ Lean clay with sand, (CL), brown, very saturated

Ground water present at 5’

TEST PIT #5

0-.5’ Topsoil
.5’-2’ Lean clay, (CL), brown, slightly moist
2’-3’ Lean clay, (CL), brown, moist
3’-7.5’ Lean clay, (CL), brown, very saturated

Ground water present at 6.5’
TEST PIT #6

0-.5' Topsoil
.5'-2.5' Sandy clay, (CL), dark brown, moist
2.5'-4' Sandy clay, (CL), light brown, moist
4'-8' Sandy clay, (CL), light brown, very moist

No ground water present
Various amounts of alkali throughout test pit

TEST PIT #7

0-.5' Topsoil
.5'-4' Lean clay with sand, (CL), dark brown, very moist
4'-8' Lean clay, (CL), dark brown, saturated

Various amounts of alkali throughout test pit
No ground water present

TEST PIT #8

0-.5' Topsoil
.5'-4' Lean clay, (CL), dark brown, very moist
4'-7' Lean clay with sand, (CL), dark brown, saturated

No ground water present

TEST PIT #9

0-.5' Topsoil
.5'-7' Lean clay with sand, (CL), dark brown, moist to very moist

Strata of sand at 5’
Strata of lean clay with a dark gray color at 6.5’
Various amounts of alkali throughout test pit
No ground water present

TEST PIT #10

0-.5' Topsoil
.5'-7.5' Lean clay with sand, (CL), dark brown, very moist to saturated

Various amounts of alkali throughout test pit
Ground water present at 4’
APPENDIX C
CENTRAL WYOMING REGIONAL WATER SYSTEM (RWS) JOINT POWERS BOARD GROWTH POLICY

Adopted as amended by the Central Wyoming Regional Water System Joint Powers Board

1. **RWS WATER RIGHTS FEES** – As provided for in Joint Powers Agreement (paragraph 7.A page 9) the wholesale water rate shall include costs of acquiring water rights and that rate will be the same for all wholesale purchasers of water from the RWS.

2. **RWS SYSTEM INVESTMENT CHARGES** - The RWS will have a one-time System Investment Charge (SIC) for each new connection in each participating Member’s or WWC’s service area. The purpose of the charge is to provide equity among the owners of the existing RWS physical assets, and to provide funds for the future development of the regional system. The RWS Board may waive all or part of the fee, depending on criteria which will reflect past investment in water production and transmission facilities. The initial fee will be $600.00 for a ¾" connection to be revised from time to time by the RWS as circumstances merit.

3. **WATER CONSTRUCTION STANDARDS** – RWS will require all recipients of RWS water to construct facilities that meet minimum standards as established by the RWS.

The RWS will adopt criteria established by the Wyoming Water Development Commission (WWDC) that no water distribution system serving less than the equivalent to 20, ¾”, taps will be considered a wholesale customer. The tap size required will be dependent on the flow capacity needed to serve the water distribution system. The SIC in place at the time of connection will be assessed and collected by RWS for each connection prior to receiving RWS service.

4. **TREATMENT OF EXISTING WATER CUSTOMERS OF RWS OR ITS MEMBER ENTITIES** - THE RWS will recognize all existing contracts held by its members. The City of Casper, in concurrence with the Casper Public Utilities Advisory Board, will establish a rate that shall be equal to the sum of the RWS rate, plus the actual cost of any services provided by Casper to its customers. This policy will apply to all Wholesale Water customers and their member entities.

Members of the RWS and RWS Wholesale Water customers will not be allowed to expand their geographical service area without the permission of the RWS.

5. **MUNICIPAL GROWTH BOUNDARY AGREEMENTS** – In determining JPB member service areas, the RWS will consider the municipal growth boundary agreements adopted in 1984 & 1986 between City of Casper, Natrona County and Town of Mills. The RWS will
recognize any updates adopted by the municipalities and county. In the absence of updates, the RWS will develop its own modifications for its internal use. Using a map, the RWS will specifically outline its service area considering individual entity growth boundaries.

6. ANNEXATION AGREEMENTS WITHIN MUNICIPAL GROWTH BOUNDARIES - New individual customers located within a municipal growth boundary, may be required to sign annexation agreements with the affected municipality before receiving water service. The municipality will decide whether to require the agreement, when it provides operation and maintenance of the customer’s water distribution system. The RWS will recognize all annexation agreements established by the entities.

Annexation agreements will not be required for new water districts which are situated outside, or which are not contiguous to, the existing municipal growth boundaries.

7. WHOLESALE vs. RETAIL WATER CUSTOMER CHECK LIST - In the event that a new customer requests water service from the RWS, the following checklist will be used to determine if the RWS will sell directly to the customer or the customer will be required to request service from a member entity:

a. Is the proposed water customer within, or contiguous to, the City’s/Town’s/District’s growth boundary, service boundary and/or City/Town corporate limits?

b. Are the City/Town/District and the new customer in agreement that the City/Town/District will assume the operation and maintenance of the proposed water customers’ water distribution system?

• A proposed customer’s water system must meet the RWS system standards prior to being served.

• If a City/Town/District is willing to assume the operation and maintenance of a system, it can provide the water supply through its own lines or through the regional lines, whichever is most cost effective.

• The requirement for a City/Town/District to assume the operation and maintenance of a water customer’s water system does not apply to existing service contracts.

If the answer to either question is no, then the proposed water customer will be a wholesale water customer of the RWS. If the answers are yes, then the proposed water customer will be a retail water customer of the City/Town/District.
CENTRAL WYOMING REGIONAL WATER SYSTEM (RWS) JOINT POWERS BOARD
GROWTH POLICY RECOMMENDATIONS

EXEMPTIONS:

1. Sandy Lake Estates will be exempt from System Investment Charges at the time they actually tie into the regional system. Any new individual service taps within Sandy Lake Estates from that point forward will be subject to the established system investment charge.

2. The Towns of Mills and Evansville will be given a period of 8 years in which to join the RWS without being assessed any system investment charges. After that time period, should the Towns of Mills or Evansville decide to join the RWS, they will be subject to the established system investment charge.

3. For RWS transmission lines, which previously have been local distribution lines, new taps, including individual taps, will be allowed seven calendar days after notifying the RWS Director. The tap specifications will be set by RWS. The request shall be made by the affected entity and the tap shall be that entity’s customer. This policy specifically applies but is not limited to Lines E-7 and E-8 in the Wardwell Water & Sewer District, Line E-4 in the Pioneer Water & Sewer District and Poison Spider Improvement and Service District and Lines E-1, Airport Line, and E-5, Brooks Line, in the City of Casper.

4. Sandy Lake Estates and Poison Spider will be Wholesale Water Customers of the JPB.

5. System Investment Charges will be waived for all taps up to 1 \( \frac{1}{2} \)" on lines E-7 and E-8 running north through Wardwell. System Investment Charges will be collected for the difference on all taps larger than 1 \( \frac{1}{2} \)".

John VanderVoort – Chairman
Central Wyoming Regional Water System Joint Powers Board

Donna Obert – Secretary
Central Wyoming Regional Water System Joint Powers Board
### Central Wyoming Regional Water System

#### System Investment Charge Schedule

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* This ratio is used to scale up the 3/4 inch fee based on meter size. Source: "Water Meters - Selection, Installation, Testing, and Maintenance", AWWA Manual M6, third edition, pages 28-29.
APPENDIX D
ENVIRONMENTAL REPORT

For:

33 Mile Road Improvement and Service District, Water Supply Project

Prepared By:
Civil Engineering Professionals, Inc.
355 N. Lincoln
Casper, WY 82601
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Section 6 - Exhibits/ maps
1.1 Project Description

The Thirty-three Mile Water Supply Project is a project that would provide reliable potable water to the residents and property owners of the Thirty-three Mile Road Improvement and Service District (33MRISD).

The 33MRISD is located west of Casper as shown in Figure 1-1. The 33MRISD encompasses approximately 16 square miles, and there are currently 210 residents living there. Many of the residents currently use individual wells for their water supply. Previous studies and historical information concluded that the wells in the area are of very poor quality and unreliable quantity, unfit for human consumption, and in many cases, unfit for livestock use. Many of the residents haul water from nearby Casper for their domestic use.

1.2 Purpose of the Project

The purpose of the project is to provide a public water distribution system supplied by the Central Wyoming Regional Water System (CWRWS), which will deliver potable water to the residents. Because of the large size of the 33MRISD, the pipeline system will be vast and considerably expensive. The proposed project includes constructing a buried water supply pipeline system that provides a metered water service tap at the property line of each property in the 33MRISD. The water transmission pipeline will be constructed in the borrow ditches of public road rights-of-way. Only about 15 percent of the pipelines will be constructed across private property and the 33MRISD will obtain rights-of-way in which to construct the pipelines and meter pits. The property owner will be responsible for constructing the service line across his property connecting the meter to the home plumbing. The proposed project is shown on Figure 5-1, attached in Section 6.

The total cost of the project is estimated to be $1,880,075. The proposed financing plan includes a grant of $1,044,486 from the Wyoming Water Development Commission (WWDC), a grant from the State Land and Investments Board (SLIB) for $69,632, and a 25-year loan from the USDA Rural Utilities Service (RUS) for $765,957. The total estimated monthly cost to the user for system operation and debt retirement is $128.26.
The proposed action includes constructing a central water transmission and distribution pipeline system that will deliver potable water to the residents of the 33MRISD. The supply for the water system will be obtained from an existing public water system. Nearly all of the transmission pipeline delivery system will be constructed in existing public road rights-of-way. A plan view of the proposed project is given in Figure 5-1, attached in Section 6.

Alternatives to the central water supply system are very limited, and not economically feasible. A 1998 Level I Study performed by the Wyoming Water Development Commission determined that a groundwater supply was not economically feasible because of the excessive depth required for the wells, and the need to treat the poor quality water.

The only other alternative for the residents is to continue to haul water from the nearby Casper or Mills water systems. The cost of hauling water ranges from $100 to $150 per 1000 gallons. The water is usually stored in a buried concrete cistern and pumped into the house plumbing on demand.
Appendix D - Section 3 Affected Environment / Environmental Consequences

3.1 Land Use/Important Farmland/Formally Classified Lands

The current land use in the 33MRISD is defined by the Natrona County Planning Department as “Agriculture”. One small area of less than 100 acres is zoned as “Ranching and Farming”. Future development in the area could be positively impacted if a central water system is constructed.

3.1.1 Affected Environment

The proposed water supply project would be constructed within existing public road rights-of-way whenever possible. These roadways are shown in Figure 1-1, and have 50 to 100-foot wide rights-of-way. Approximately 85 percent of the water transmission lines are expected to be constructed in the roadways and approximately 15 percent would be constructed in rights-of-way obtained from private property owners. The width of the rights-of-way across private lands is expected to be 30 feet.

Also attached in Section 6 is a NRCS soils map and information indicating the types and location of the soils in the project area. Soils classifications and logs are also provided in Section 6.

3.1.2 Environmental Consequences

Since 85 percent of the pipelines are expected to be constructed in the existing roadways, little or no adverse impacts to the environment are expected. For those areas where the pipelines are constructed across private properties, little or no adverse impacts to the land use are expected. The only adverse impacts would be temporary, during construction. Once the pipeline is buried, and the land returned to its original condition, the land inside the right-of-way can be returned to its previous use.

3.1.3 Mitigation

All lands disturbed by construction of the water transmission pipelines will be seeded, mulched, regraveled, or paved as needed, in order to return the lands to their original useable condition prior to construction of the project.

3.2 Flood Plains

The primary flood plain in the area is the South Fork of Casper Creek which courses toward the North Platte River, north and northeast of the 33MRISD. No other significant flood plains exist within the 33MRISD.
Appendix D - Section 3 Affected Environment / Environmental Consequences

3.2.1 Affected Environment

No areas of the project are planned to be located within the nearby Casper Creek flood plain. In addition, as shown on the NRCS Soil Survey map in Section 6, there are no soil units within the project area which are classified as “alluvial soils”.

3.2.2 Environmental Consequences

Construction of the buried water transmission system will have no environmental consequences on the Casper Creek flood plain.

3.2.3 Mitigation

No mitigation efforts other than the standard erosion control requirements are required to protect the flood plain from construction of the water project.

3.3 Wetlands

Wetlands do exist in the surrounding areas of the 33MRISD. All of these wetlands however are situated on private property, not in the roadways. None of the proposed pipeline alignments conflict with any existing wetlands.

3.3.1 Affected Environment

Wetlands occur in the 33MRISD primarily as a result of the irrigation activities. Some wetlands exist in the natural drainages in the area. None of the water transmission pipelines are planned near or in any wetland areas.

3.3.2 Environmental Consequences

None. The pipelines are aligned in existing roadways and road rights-of-way, and are intentionally planned to avoid more costly wetland construction.

3.3.3 Mitigation

Construction of the water supply project will not require any mitigation efforts to avoid adverse impacts on wetlands.

3.4 Cultural Resources

Correspondence from the State Historical Preservation Office (SHPO) indicates that there may be cultural resources in the 33MRISD area. The letter recommends that a cultural
Appendix D - Section 3 Affected Environment / Environmental Consequences

resources survey be performed to determine if any cultural resources exist and what mitigation efforts may be needed. The SHPO letter is included in Section 5 of this report.

3.4.1 Affected Environment

From cursory field evaluations, cultural resources do not exist within the road rights-of-way, where 85 percent of the project will be constructed.

3.4.2 Environmental Consequences

If cultural resources exist, the project will be planned to eliminate any adverse effects.

3.4.3 Mitigation

A cultural resources survey should be performed to determine if resources exist and if they could be affected by construction of the project. A mitigation plan will be developed to address the findings of the survey.

3.5 Biological Resources

Correspondence from the US Fish and Wildlife Department indicates there could be Endangered Species in the project area, and a species planned to be listed as endangered. The endangered species include Black-Footed Ferrets and the listed species, the Mountain Plover. The letter is included in Section 5 of the report. It is recommended that a Biological Assessment be performed to determine the presence of either of these species. If they exist and can be adversely affected by the project, mitigation efforts will be made a part of the construction documents as needed.

3.5.1 Affected Environment

Only those private lands where pipelines are planned could be affected. For the road rights-of-way where 85% of the pipelines are planned, endangered species are not expected to be encountered.

3.5.2 Environmental Consequences

See US Fish and Wildlife letter in Section 5.

3.5.3 Mitigation

To be determined, pending the results of the Biological Assessment.
Appendix D - Section 3 Affected Environment / Environmental Consequences

3.6 Water Quality Issues

The project involves several irrigation canal crossings. A letter from the Wyoming Department of Environmental Quality (WDEQ) addresses water quality issues, and is included in Section 5 of this report. A letter from the Army Corps of Engineers is also included in Section 5.

3.6.1 Affected Environment

The pipelines are proposed to be constructed under existing roadways and will occasionally cross under irrigation canals or ditches. Nearly all canals cross under the roadways in culvert pipes ranging in size from 12 to 96 inches in diameter.

3.6.2 Environmental Consequences

The canal under-crossings could have adverse effects on the water quality if performed during the irrigation season. The irrigation canals operate from April 15 to October 15. Construction in these areas will be planned for the times when there are no flows. If canal crossings are made during the off season, no environmental consequences are expected.

3.6.3 Mitigation

Irrigation and crossings will only be made when the canals are inactive (October 15 through April 15). Mitigation efforts for irrigation canal crossings will include silt fences and other erosion barriers to eliminate siltation and stream bank erosion until disturbed areas are revegetated.

3.7 Coastal Resources

Not Applicable

3.8 Socio-Economic Issues/ Environmental Justice

3.8.1 Affected Environment

The project is planned to provide a reliable and good quality water supply to the residents in the 33MRISD. The current use of private water wells is potentially hazardous to the health of both the residents and in some cases the livestock as well. The project will improve the quality of life for those living in the area. The socio-economic effects will be beneficial.
Appendix D - Section 3 Affected Environment / Environmental Consequences

3.8.2 Environmental Consequences

There do not appear to be any low-income or minority populations in the area. There doesn’t appear to be any adverse effects on the residents from the construction of the project or having a reliable potable water supply.

3.8.3 Mitigation

None

3.9 Miscellaneous Issues

3.9.1 Air Quality

During construction, there will be emissions from vehicles and other construction equipment and fugitive dust from construction activities. Both of these will be temporary, and do not appear to be major sources of pollutants.

3.9.1.1 Air Quality Information

A letter from the Air Quality Division of WDEQ is included in Section 5. During construction, dirt and graveled roads will be watered to reduce dust emissions.

3.9.2 Transportation

The project is located off US Highway 20/26. During construction of the project, construction traffic will cause an increase in traffic leaving and entering 33 Mile Road. Traffic control and warning signs will be posted throughout the construction period to warn traffic of trucks and equipment entering and leaving the construction area.

3.9.3 Noise

The project is to be constructed in an area of ranching and farming operations. Noise levels generated during construction of the project are not expected to be any different, or cause any adverse effects than the existing farm and ranching operations.
Appendix D - Section 4  

Summary of Mitigation

The following is a summary of the mitigation efforts expected for the project.

4.1 Land Use

4.1.1 All areas of roadways, canals, and private property that are disturbed by construction activities will be returned to the same or better condition that existed prior to the project.

4.2 Flood Plains

4.2.1 The project will not be constructed in any flood plains.

4.3 Wetlands

4.3.1 The project will not interfere with or be constructed through any wetlands.

4.4 Cultural Resources

4.4.1 A cultural resources survey should be performed prior to design of the project.

4.4.2 The project will not interfere with or be constructed through any sensitive or historic sites or resources.

4.5 Biological Resources

4.5.1 A Biological Assessment should be performed to determine the presence of threatened or endangered species in the project area.

4.5.2 The project will be designed and pipelines located to avoid any threat or adverse impact upon any threatened or endangered species, if they exist.

4.6 Water Quality Issues

4.6.1 The project will not be constructed across irrigation ditches during the irrigation season.

4.6.2 Discharges from water line chlorination operations will not be allowed to enter any irrigation or other waterways, or drainages.

4.7 Coastal Resources

4.7.1 Not Applicable
Appendix D - Section 4 

Summary of Mitigation

4.8 Socio-Economic Issues/Environmental Justice

4.8.1 There are no mitigation efforts as all socio-economic effects of the project are beneficial.

4.9 Miscellaneous

4.9.1 Air emissions will be controlled by watering dirt and graveled roads during construction.

4.9.2 Traffic warning and control signs will be posted on roadways and highways during construction.

4.9.3 Noise created by construction operations is not expected to require mitigation.
Barry Venn, P.E.
Civil Engineering Professionals
355 N. Lincoln
Casper, WY 82601

Dear Mr. Venn:

Thank you for your letter of August 16, regarding a proposed project that will allow the 33 Mile Road Improvement and Service District to construct a buried water distribution system in Natrona County, Wyoming. My staff has determined that the following endangered, and species proposed for listing may be present in the project area.

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Expected Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-footed ferret</td>
<td>Endangered</td>
<td>Potential resident in prairie dog colonies.</td>
</tr>
<tr>
<td>(Mustela nigripes)</td>
<td></td>
<td>Grasslands statewide.</td>
</tr>
<tr>
<td>Mountain plover</td>
<td>Proposed</td>
<td>springs, lakes, and perennial streams.</td>
</tr>
<tr>
<td>(Charadrius montanus)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Black-footed ferrets**

Black-footed ferrets may be affected if prairie dog colonies are impacted (surface disturbing activities, etc.). If black-tailed prairie dog (Cynomys ludovicianus) colonies or complexes greater than 79 acres will be impacted, surveys for ferrets should be conducted even if only a portion of the colony or complex will be disturbed. If a field check indicates that prairie dog towns may be affected, you should contact this office for guidance on ferret surveys.

**Mountain Plover**

In the Federal Register dated February 16, 1999, the U.S. Fish and Wildlife Service gave notice of a proposal to list the mountain plover (Charadrius montanus) as a threatened species pursuant to the Endangered Species Act (ACT) of 1973. The mountain plover is a small bird associated with shortgrass prairie and shrub-steppe landscapes at both breeding and wintering locales. It occupies suitable breeding habitat in many of the Great plains states from Canada south to Texas from late March through July. Mountain plover breeding and wintering habitats are known to include grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. Plovers may nest on sites where vegetation is sparse or absent, or near closely cropped areas, manure piles or rocky
areas. Mountain plovers are rarely found near water and show a preference for previously disturbed areas or modified habitat. If the mountain plover is listed prior to the completion of your project, unnecessary delays may be avoided by considering project impacts to this species now. If a field check indicates that suitable habitat for mountain plovers may be affected, you should contact us for guidance on plover surveys.

**Platte River Depletions**
Since 1978, the Service has consistently taken the position that Federal agency actions or actions financed with federal money, resulting in water depletions to the Platte River system are likely to jeopardize the continued existence of the following species:

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Expected Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whooping crane (Grus americana)</td>
<td>Endangered</td>
<td>Downstream resident of Platte River System</td>
</tr>
<tr>
<td>Interior least tern (Sterna antillarum)</td>
<td>Endangered</td>
<td>“</td>
</tr>
<tr>
<td>Pallid sturgeon (Scaphirhynchus albus)</td>
<td>Endangered</td>
<td>“</td>
</tr>
<tr>
<td>Piping plover (Charadrius melodus)</td>
<td>Threatened</td>
<td>“</td>
</tr>
</tbody>
</table>

Water depletions to the Platte River system may adversely modify or destroy designated critical habitat for the whooping crane. Therefore, actions which may lead to depletions from the Platte River system require formal consultation for effects to these species and designated critical habitat, which are found downstream in Nebraska. The environmental report should disclose the source of water that would be used in the new distribution system, and specify if such water comes from the Platte River system or groundwater that is hydrologically connected to the Platte River system.

In addition, the Service believes actions resulting in such water depletions may affect but are not likely to adversely affect the continued existence of the endangered eskimo curlew (Numenius borealis), endangered American burying beetle (Nicrophorus americanus), threatened Ute ladies'-tresses orchid (Spiranthes diluvialis), and threatened western prairie fringed orchid (Platanthera praeclara). Therefore, actions which may lead to depletions from the Platte River system will not require formal consultation for possible effects to these species.

**Migratory Birds**
The Migratory Bird Treaty Act, 16 U.S.C. 703, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the Act states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The Bald and Golden Eagle Protection Act, 16 U.S.C. 668, prohibits knowingly
taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, movement and noise of construction equipment, etc.), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of the above statutes. Removal of nests or nest trees is prohibited, but may be allowed once young have fledged and/or a permit has been issued. In either case, timing is a significant consideration and you need to allow for this in your project planning. We recommend the area be surveyed for active raptor nests and roosts. If any are found the applicant should contact this office to discuss measures necessary to avoid take of these species.

**Riparian/Wetlands**

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity in Wyoming, impacts to riparian areas should be avoided. Any potential, unavoidable future encroachment into these areas should be minimized and quantitatively assessed in terms of functions and values, areas and vegetation type lost, and potential effects on wildlife.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful.

The Service recommends in kind mitigation of wetland habitat destroyed. The amount of mitigation acreage will depend on acres lost, the relative values of lost and mitigated wetlands, and timing of mitigation.

We appreciate your efforts to ensure the conservation of endangered and threatened species. If you have any further questions, please contact Jerry Williams (307) 772-2374, ext. 24.

Sincerely,

Michael M. Long
Field Supervisor
Wyoming Field Office
cc: Director, WGFD, Cheyenne, WY
    Nongame Coordinator, WGFD, Lander, WY
    Corps of Engineers, Cheyenne, WY
September 10, 1999

Barry Venn
Civil Engineering Professionals, Inc.
355 North Lincoln
Casper, WY 82601

re: Proposed rural water service ten miles west of Casper.

Dear Mr. Venn:

Thank you for providing the Department of Environmental Quality/Water Quality Division (WQD) an opportunity to review the proposed rural water project referenced above. Specific concerns for water quality in the project area will depend on the specific construction practices used to cross the various creeks, irrigation ditches, and other waterbodies. The most likely issue will be increased turbidity caused by construction of the water system. There are a number of permits that will be required for a project of this type, some of which will address the potential for turbidity and other pollutants.

- A Section 404 permit should be obtained from the US Army Corps of Engineers for work in Waters of the US. Should any of the proposed work involve streams, wetlands, lakes or reservoirs you should contact the Corps at 307-772-2300.

- A National Pollutant Discharge Elimination System (NPDES) general construction storm water permit is required any time a project clears, grades or otherwise disturbs five or more acres. The disturbance does not have to be contiguous to require coverage. Contact Brian Heath at WQD, 307-777-7570, for additional information.
A permit to construct from the WQD Water and Wastewater section is normally required for projects of this type. Please contact Dennis Lamb in our Casper office at 307-473-3452 for more information.

If hydrostatic testing or disinfection of the pipeline is required, an NPDES temporary discharge permit will be required before discharging wastewater to waters of the state (defined drainages, lakes, wetlands, reservoirs). Contact Leah Krafft at 307-777-7093 for additional information. To “land apply” the wastewater please contact Dennis Lamb in our Casper office at the number I've listed in the previous paragraph.

If you have any other questions please contact me or any of the folks listed above for further assistance.

Sincerely,

Barbara L. Sahl
Senior Environmental Analyst
Water Quality Division

cc: Brian Heath, WQD, Cheyenne
    Leah Krafft, WQD, Cheyenne
    Dennis Lamb, WQD, Casper
September 10, 1999

WER 9493
Wyoming Water Development Commission
33-Mile Road Improvement and Service District
Natrona County

Barry Venn, P.E.
Civil Engineering Professionals Inc.
355 N. Lincoln
Casper, WY 82601

Dear Mr. Venn:

The Staff of the Wyoming Game and Fish Department has reviewed the funding proposal for the Level II feasibility study for the 33 Mile Road Improvement and Service District. We have no terrestrial or aquatic concerns with this project. The Department has no requirements regarding permitting and constructing this project.

Thank you for the opportunity to comment.

Sincerely,

Bill Wichers
DEPUTY DIRECTOR

TC: cd
cc: USFWS
September 2, 1999

Civil Engineering Professionals, Inc.
Barry Venn, P.E.
355 North Lincoln
Casper, WY 82601

RE: 33 Mile Road Improvement and Service District

Dear Mr. Venn;

Rural Utilities Service (RUS) has no comments, at this time, concerning environmental affects and permitting and constructing the project. RUS supports this project.

If you have any questions, please contact me at (307) 261-6319.

Sincerely,

KARLENE SJODEN
BUSINESS AND COOPERATIVES PROGRAM SPECIALIST

Rural Development is an Equal Opportunity Lender.
Complaints of discrimination should be sent to:
Secretary of Agriculture, Washington, D.C. 20250
September 2, 1999

Mr. Barry Venn, P.E.
Civil Engineering Professionals, Inc.
355 N. Lincoln
Casper, WY 82601

RE: Wyoming Water Development Commission, 33 Mile Road Improvement and Service District, Construction of a Rural Water System; SHPO #0999RLC005

Dear Mr. Venn:

Our staff has received information concerning the aforementioned project. Thank you for giving us the opportunity to comment.

A file search by our staff on September 2, 1999 shows that sites which meet the criteria of eligibility for the National Register of Historic Places are located in and/or in the vicinity of the proposed project. The area has not yet been surveyed for cultural resources. Prior to any ground disturbing activity, an on-site cultural resource survey meeting the Secretary of Interior's Standards for Archaeology and Historic Preservation (48 FR 44716) should be conducted and adverse impacts to any significant cultural resource sites must be mitigated. The survey and any necessary mitigation measures must be conducted by a professionally qualified archeologist or historian. A report detailing the results of these efforts must be reviewed by SHPO staff prior to our commenting on the project's effects on cultural resource sites.

Please refer to SHPO project control number #0999RLC005 on any future correspondence dealing with this project. If you have any questions, contact Richard Currit at 307-777-5497.

Sincerely,

Richard L. Currit
Archaeologist

RLC: jh
August 27, 1999

Mr. Barry Venn, P.E.
Civil Engineering Professionals, Inc.
355 N. Lincoln
Casper, WY 82601

RE: Proposed 33 Mile Road Improvement and Public Service District
Construction of a rural water system
10 miles west of Casper, Wyoming.

Dear Mr. Venn:

The Division has reviewed your August 16, 1999 letter detailing the above referenced project. The Division has determined that the proposed project will have little or no impact on ambient air quality. However, the Division does request that fugitive dust generated from equipment on gravel roads and other construction activities be minimized through watering and good housekeeping practices.

If you have any further questions or comments, please feel free to contact this office.

Sincerely,

Dan Olson
Administrator
Air Quality Division

DO/dgh

cc: D. Hulme
J. Hancock
To: Barry Venn
Fax Number: 307 2016 0103

From: Wildlife Habitat Protection Program
Telephone: 307-777-4506 (our fax number 307-777-4677)

Date: 9-10-99
Pages: 2 (including this page)

Notes: WER 9493 33-Mile Rd TMP

please call (307) 777-4506 immediately if complications develop.
September 10, 1999

WER 9493
Wyoming Water Development Commission
33-Mile Road Improvement and Service District
Natrona County

Barry Venn, P.E.
Civil Engineering Professionals Inc.
355 N. Lincoln
Casper, WY 82601

Dear Mr. Venn:

The Staff of the Wyoming Game and Fish Department has reviewed the funding proposal for the Level II feasibility study for the 33 Mile Road Improvement and Service District. We have no terrestrial or aquatic concerns with this project. The Department has no requirements regarding permitting and constructing this project.

Thank you for the opportunity to comment.

Sincerely,

[Signature]

Bill Wickens
DEPUTY DIRECTOR

TC: cd
cc: USFWS
September 17, 1999

Barry Venn, P.E.
Civil Engineering Professionals Inc.
355 North Lincoln
Casper, WY 82601

Re: 33 Mile Road Improvement and Service District

Dear Mr. Venn:

In response to your request of August 16, 1999, we have reviewed existing water rights within the boundaries of the proposed improvement and service district. We found various stock and domestic water wells, stock reservoirs, and three permits through the Casper Canal within the Casper-Alcova Irrigation District for irrigation, stock, power, manufacturing, and municipal uses. A computer listing of these permits is enclosed for your review. A legend is printed at the end of the printout to assist you with the abbreviations. Please advise us by permit number if you would like copies of the permits, certificates of appropriation where they exist, or maps that accompanied the permits and we will send them to you. Cost of the copies is $.50 per sheet of microfilm print and $.75 per linear foot for map prints.

Environmental effects pertinent to our agency:
We found no wetland, wildlife, or fish preserve water rights within the boundaries. However, any new water right within the drainage area of the North Platte River will be subject to the North Platte Cooperative Agreement (sample letter copy and explanation are enclosed).

Permitting process for water rights:
We must ask a few questions to advise you in this matter.

1. Existing water rights were found for the area. Do you intend to use the existing water rights for your project? If so, are the use(s) and amounts of appropriation to remain the same after the project and you are merely altering the delivery system?
   a. If the goal of the project is to deliver the already permitted water more efficiently, no new permit requirements exist.
   b. If the delivery system is to be altered, please advise us how, and we will inform you of petition and map requirements.
      i) Consent from landowners of the areas of use currently permitted will be required for most petitions to change water rights.
2) If water that is not already appropriated is required for this project, please advise us of the intended use(s) and source of supply. From your map print we cannot determine if you will need water in addition to the permitted amounts/uses and whether the use will be for potable water, stock, irrigation or some other use(s). Is the water to be obtained from a surface creek in the North Platte River drainage, a surface creek from another drainage, or is a well to be the source of supply for the project? Permitting procedures for new water rights and mitigation requirements will vary depending upon this information.

If you have any questions, please contact us.

Sincerely,

LEAH BRATTON
Senior Analyst

Enclosure (computer printout of water rights within proposed improvement/service area)

CC: Randy Tullis, Superintendent
Water Division No. 1
510 West 27th Street
Torrington, WY 82240
MEMORANDUM

TO: Platte River Interested Parties

FROM: John Barnes, Surface Water Administrator

DATE: December 17, 1997

SUBJECT: Platte River Cooperative Agreement Implementation

Please find attached the policy memo and sample letter on how the Surface Water Division of the State Engineer's Office is going to implement the Cooperative Agreement. When we receive a Division I application or petition, the letter will be sent along with the attached response form. The applicant or petitioner must respond if they wish this office to continue processing the application or petition.

Once processed, the application or petition will have limitations added which will require measuring devices, documentation of monthly water use, reporting of water use and depletions upon the request of this office, and notification that mitigation of depletions may be required, if the State enters into a Recovery Plan for the endangered species on the central Platte River in Nebraska.

All activities of this office will be entered into a data base and reported under the Cooperative Agreement on an annual basis.

Please call if me at (307) 777-6168 if you have any questions regarding this matter.
POLICY MEMO

DATE: December 10, 1997

TO: Surface Water Division

FROM: Jeff Fassett, State Engineer

SUBJECT: Cooperative Agreement regarding the North Platte River.

During the three year term of the Cooperative Agreement, the States of Wyoming, Nebraska, and Colorado have agreed to annually report all new water related activities within the boundaries of our individual states which may cause a depletion in the flows in the habitat area in the Central Platte River in Nebraska. Also during this three year period, the parties will be studying and negotiating as to what future water related activities may impact the recovery of the endangered species and the appropriate mitigation for those impacts, if any. Therefore, the following policy is necessary:

For all Division I applications, petitions and water use agreements (except Little Snake River and Separation Creek Drainages) processed after July 1, 1997, regardless of priority date, the following shall apply:

1. Upon receipt and acceptance of the application(s) or petition(s), the applicant or petitioner will be sent the attached Platte River letter to inform them of this program and determine their desire to proceed with the application(s) or petition(s) despite the conditions that may be placed on them. (No letter will be required for Water Use Agreements which will be processed with monthly reporting requirements. No Water Haul permits will be issued and anyone needing temporary water should acquire such through a Water Use Agreement.)

2. The following limitations/conditions will be placed on the permit to comply with possible future reporting needs under the Cooperative Agreement.

   a. The permittee will install a measuring device that is acceptable to the Division Superintendent.

   b. The permittee will maintain a monthly record of the water diverted under the permit. The Division Superintendent may request a copy of the record at any time and the permittee shall provide such record within 10 working days.

   c. If the negotiations pertaining to the Cooperative Agreement for Platte River Research relative to new water related activities should result in the conclusion that the water activity authorized by this permit will cause a depletion which will impact the recovery of the endangered species and their habitat in the Central Platte River in Nebraska and if, after the term of the Cooperative Agreement (approximately July 1, 2000), the State of Wyoming decides to
participate in the basin wide recovery program, the permittee may be required to complete the following:

i. Provide a report to this office. The report will need to include the amount of water diverted each month as determined by readings of the measuring devices, along with monthly estimates of the water consumed or depleted. The report will also need to describe the method used to estimate the consumptive use for direct diversions and water stored.

ii. Mitigate the impacts of the permitted water activity. The mitigation may be in the form of replacing the depletions resulting from the water activity by retiring other existing water uses or securing replacement water from other sources or other forms as may be authorized in the Cooperative Agreement or Program.

(Monthly reporting under Water Use Agreements will serve to meet the requirements of 2.c.i. above with an example limitations as follows: "A record shall be kept of the amount of water diverted under this Order. The records and tabulation of the total amount of water used shall be sent to the Division Superintendent, 510 West 27th, Torrington, WY 82240, Phone: (307) 532-2248, FAX (307) 532-5558 with a copy to the State Engineer's Office, Herchler Building, 4E, Cheyenne, WY 82002, Phone: (307) 777-6475, FAX: (307) 777-5451. The records shall be submitted on or before the 10th of the month following each month water is used under the Order. Said records shall be used as necessary for water administration and water accounting purposes. Failure to file the monthly water use report may be grounds for denial of use of water under this Order")

3. All North Platte permits will be entered into the Platte River database for tracking and monitoring all reporting requirements. (The database to be developed will include all permits, petitions and water use agreements.) This database will be used to prepare the annual report required under the Cooperative Agreement.

cc: Dick Stockdale, Ground Water Division
    Tom Davidson, Deputy Attorney General
Note: This sample letter addresses pending water right applications. If it is used for pending petitions, some modifications will be required.

DATE

ADDRESS:

Re: "Cooperative Agreement for Platte River Research and Other Efforts relating to Endangered Species Habitats along the Central Platte River, Nebraska"

Dear:

On (date), you filed the following applications(s) for permit to appropriate water from the Platte River drainage.

(Insert application TF #'s and names)

To date, no action has taken place on the application(s) because we wanted to insure that you were informed that the above referenced Cooperative Agreement may require that special conditions be placed on all approved permits in the Platte River Basin in Wyoming. We want to insure that you are informed of these conditions prior to making the investments required to perfect the application for permit.

The Cooperative Agreement was signed by the Governors of Wyoming, Nebraska and Colorado and the Secretary of Interior for the United States on July 1, 1997. The Cooperative Agreement was negotiated because the Endangered Species Act was impacting water management activities in all three states and it is very unlikely that Congress will modify the Act to the extent needed to alleviate these impacts.

The term of the Cooperative Agreement is three (3) years. During this three year period, the parties will be studying and negotiating as to what future water related activities may impact the recovery of specific endangered species along the Platte River and the appropriate mitigation for those impacts, if any. At the end of the three-year period, the parties will decide whether or not to implement a basin wide recovery program. Depending on the outcome of the negotiations and other activities that will occur over the next three years, the State of Wyoming may elect to participate in the basin wide recovery program or to have Wyoming and its water users independently seek the federal clearances required under the Endangered Species Act.

In either event, during the three-year term of the Cooperative Agreement, the States of Wyoming, Nebraska, and Colorado have agreed to annually report all new water related activities within the boundaries of our individual states which may cause a depletion in the flows in the habitat area in the Central Platte River in Nebraska. Initially, the required report will be made by this office and will include a tabulation of the permitting activities that occur in each of the three years during the term of the Cooperative Agreement. However, in order to provide data on the extent of the diversions and depletions that will result from each new permitting activity, it is likely that
conditions will be placed on each approved permit that will require the installation of measuring devices and maintenance of a monthly record of the water diverted under each permit.

Further, if the negotiations relative to new water related activities should result in the conclusion that the water activity proposed by your pending application will cause a depletion which will impact the recovery of the endangered species and if, after the term of the Cooperative Agreement, the State of Wyoming decides to participate in the basin wide recovery program, you may be required to complete the following:

1. Provide a report to this office. The report will need to include the amount of water diverted each month as determined by readings of the measuring devices, along with monthly estimates of the water consumed. The report will also need to describe the method used to estimate the consumptive use or diversions and water stored.

2. Mitigate the impacts of the permitted water activity. The mitigation may be in the form of replacing the depletions resulting from the water activity by retiring other existing water uses or by securing replacement water from other sources.

Wyoming’s decision to participate in the basin wide recovery will be based on the outcome of the activities that will occur during the term of the Cooperative Agreement and will be subject to public input and approval by the Governor and the Legislature.

Given the above circumstances, the State Engineer would like you to complete the attached form or provide a letter indicating that you have read the information contained in this letter, that you understand and accept the conditions that may be placed on your permit and that, in light of those conditions, you want him to proceed with his consideration of your application(s). Recognizing that there are many complex issues involved in this matter, and that numerous questions will probably be generated, please do not hesitate to contact Gordon W. "Jeff" Fassett, State Engineer or myself at (307) 777-6475.

Thank you for your attention to this matter.

With best regards,

John R. Barnes
Administrator, Surface Water and Engineering Division

JRB/ms
Wyoming State Engineer
Herschler Building-4W
Cheyenne, Wyoming 82002

I have read your letter of (insert date of letter) and understand that if the application is approved and a permit is issued, certain conditions may be placed on the final permit due to uncertainties relating to the Cooperative Agreement for Platte River Research and Other Efforts relating to Endangered Species Habitats along the Central Platte River, Nebraska.

I understand and accept the conditions that may be placed on the permit, if issued, and, in light of those conditions, I want you to proceed with your consideration of the following application(s).

Temporary Filing Nos.__________________________________________________________
                                                                                   
                                                                                   
Date                                                                                     Signature of Applicant

Comments: ______________________________________________________________________
                                                                                   
                                                                                   
                                                                                   
                                                                                   
DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS, OMAHA DISTRICT  
215 NORTH 17TH STREET  
OMAHA, NEBRASKA 68102-4978

October 7, 1999

Wyoming Regulatory Office  
2232 Dell Range Blvd., Suite 210  
Cheyenne, Wyoming 82009-4942

Barry Venn, P.E.  
Civil Engineering Professionals, Inc.  
355 North Lincoln  
Casper, Wyoming 82601

Dear Mr. Venn:

This letter is in response to your request we received on August 23, 1999, for comments concerning improvements to the water distribution system within the 33 Mile Road Improvement and Service District (District). The District is located north of U.S. Highway 20/26 approximately 10 miles west of Casper and includes Sections within, Townships 34 and 35 North, Ranges 80 and 81 West, Natrona County, Wyoming.

As you know, the U.S. Army Corps of Engineers regulates the placement of dredged and fill material into wetlands and other waters of the United States as authorized primarily by Section 404 of the Clean Water Act (33 U.S.C. 1344). The Corps regulations are published in the November 13, 1986, edition of the Federal Register (Vol. 51, No. 219) at 33 CFR Parts 320 through 330.

The type of authorization depends on the extent of impacts to wetlands and other waters of the United States. Many activities with minor impacts can be authorized under existing general permits known as nationwide permits. A project specific (individual) permit would be required if the projects total impacts on waters of the U.S., including wetlands, exceeds nationwide permit criteria.

Based on the information provided, it is likely that the project would qualify for authorization under Nationwide Permit (NWP) 12 as defined in Part VII of the Federal Register published on December 13, 1996 (Volume 61, No. 241). A fact sheet describing NWP is enclosed. Please take time to carefully review the terms and conditions of NWP 12 as described in the fact sheet. Please be aware that NWP 12 expires on February 11, 2002, and some other form of authorization may be required if the construction activities extend beyond that date.
Please be aware that the District is responsible for obtaining the appropriate authorization for activities that include a discharge of fill material in waters of the United States. Therefore, I suggest that you advise the District to submit a request for written verification of the applicability of NWP 12, following the procedure described in the fact sheet.

If you have any questions concerning this determination or would like to discuss our permit requirements in more detail, please contact me at (307) 772-2300. Please reference file No. 199940276 in any future correspondence on this project.

Sincerely,

[Signature]

Thomas B. Johnson, P.E.
Project Manager
Wyoming Regulatory Office

Enclosure
Nationwide Permit 12

Utility Line Discharges

Discharges of dredged or fill material associated with installation of utility lines are authorized provided there is no change in preconstruction contours. A "utility line" is defined as any pipeline, including intake and outfall structures, for the transportation of any gaseous, liquid, liquefiable, or slurry substance, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. The term "utility line" does not include activities which drain a water of the United States, such as drainage tile; however, it does apply to pipes conveying drainage from another area. This permit authorizes mechanized landclearing necessary for the installation of utility lines, including overhead utility lines, provided the cleared area is kept to the minimum necessary and preconstruction contours are maintained. This permit does not authorize access roads, temporary or permanent, or foundations associated with overhead utility lines. In addition, activities must comply with all of the following criteria:

a. Excess material must be removed from waters of the United States immediately upon completion of construction. If necessary, excess material may be temporarily sidecast up to three (3) months into waters of the United States, provided that the material is not placed in such a manner that it is dispersed by currents or other forces. The U.S. Army Corps of Engineers (Corps) may extend the period of temporary side-casting not to exceed a total of six (6) months, where appropriate;

b. The disturbed area must be limited to the minimum necessary to construct the utility line;

c. In wetlands, the top 6" to 12" of the trench should be backfilled with wetland topsoil; and

d. Exposed slopes and stream banks must be stabilized immediately upon completion of construction.

Authorized activities must also comply with all General Conditions listed on the attached pages.

Notification Requirements: The applicant is required to notify the Corps in accordance with the Notification Procedure prior to initiating any activities associated with installation of utility lines under the following circumstances:

a. Mechanized landclearing in a forested wetland;

b. A utility line crossing a navigable waterway (Section 10 permit is required);

c. A single project exceeds 500 feet in length (see General Condition 15); or

d. A utility line located parallel and within or adjacent to a streambed.

Activities that require notification are not authorized until written verification is received from the Corps unless the Corps waives verification by failing to respond, either verbally or in written form, within 30 days after receipt of a complete notification.

This permit satisfies the requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act.

Contents adapted from Part VII of the Federal Register (Vol 61, No. 241) published on December 13, 1996. Copies available upon request.
Nationwide Permits

General Conditions

Activities authorized under Nationwide Permits must comply with all of the following conditions:

1. **Navigation:** No activity may cause more than a minimal adverse effect on navigation.

2. **Proper Maintenance:** Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.

3. **Erosion and Siltation Controls:** Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.

4. **Aquatic Life Movements:** No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including those species which normally migrate through the area, unless the activity's primary purpose is to impound water.

5. **Equipment:** Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. **Regional and Case-by-Case Conditions:** The activity must comply with any regional conditions and case-by-case conditions added by the Division Engineer under 33 CFR Part 330.4(e). The following regional conditions have been adopted for all authorized activities in the State of Wyoming:
   a. The permittee must ensure that native vegetation, including woody species if present, are established within 1 year after project completion in wetland areas where land clearing is necessary for construction access.
   b. No activity is authorized within 100 feet of the source in natural spring areas. For purposes of this condition, a spring source is defined as any location where there is natural artesian flow emanating from a distinct point at any time during the growing season. Springs do not include seeps and other groundwater discharge areas where there is no distinct point source.
   c. The permittee must ensure that effluent from outfall structures does not increase erosion downstream due to the concentration of flow.
   d. The permittee must ensure that pipeline projects have been designed to prevent the trench and bedding material from acting as a sub-surface drain in wetlands. It may be necessary to install cutoff collars to prevent piping.

7. **Wild and Scenic Rivers:** No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service.)
General Conditions (Continued)

8. **Tribal Rights:** No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. **Water Quality Certification:** Authorized activities must comply with all conditions issued in accordance with water quality certifications under Section 401 of the Clean Water Act (see 33 CFR Part 330.4(c)). The Wyoming Department of Environmental Quality (WDEQ) issued the following conditions with its water quality certifications for all activities in the State of Wyoming outside the boundaries of the Wind River Indian Reservation:
   a. As much as possible, operations in stream channels should be conducted "in the dry" either by temporarily diverting water around the work area or restricting equipment operation to areas of the stream channel that are above the existing water surface. Work below the water which is essential for preparation of culvert bedding or footing installations is acceptable to the extent that the activity does not create turbidity in excess of the Chapter 1 surface water standards or unnecessary stream channel disturbance.
   b. Fording the stream at one location is acceptable, however, vehicles and other equipment should not push or pull material along the streambed below the existing water level. Frequent fording should not occur in areas where extensive turbidity will be created.
   c. Any temporary structures such as road crossings, bridge supports, cofferdams, or other temporary structures that will be needed during the period of construction should be designed to withstand high flows that could be anticipated during the construction period. All temporary structures must be completely removed from the stream channel at the conclusion of construction and the area restored to a natural appearance.
   d. Care must be taken to cause only minimum necessary disturbance. Streambank vegetation should be protected except where its removal is absolutely necessary for completion of the project. Any vegetation, debris, or other material removed during construction must be disposed of outside the stream channel or adjacent wetland areas where it cannot reenter the channel during high stream flow or runoff events. All cut and fill slopes not protected with riprap should be revegetated with appropriate species or otherwise stabilized to prevent erosion.
   e. Care must be taken to prevent any petroleum products, chemicals, or other deleterious materials from entering the water. All equipment which will be operated within any stream channel, pond, or wetland should be clean and free from fuel and oil leaks. A spill contingency plan should be developed for all projects where a large amount of petroleum products or solvents will be stored on the project site. A plan must be prepared when storage of these materials exceeds the federal limits set forth at 40 CFR Part 112.

The WDEQ has either waived or issued water quality certification for the following Nationwide Permits: 1, 2, 4, 8, 9, 10, 11, 15, 19, 20, 21, 22, 24, 28, 34, 35, and 38.

The WDEQ has issued water quality certification for the following Nationwide Permits in all waters except Class 1 waters as listed on the following page. The following permits cannot be used in Class 1 waters without separate written approval from the WDEQ: 3, 5, 6, 7, 12, 13, 14, 18, 25, 26, 29, 30, 32, 33, 36, & 37.

The WDEQ has denied water quality certification for the following Nationwide Permits in all waters. The following permits cannot be used without separate written approval from the WDEQ: 16, 17, 23, 27, 31, & 40.
General Conditions (Continued)

9. Water Quality Certification (continued):

Wyoming Department of Environmental Quality
Class 1 Waters

a. All surface waters located within the boundaries of national parks and congressionally designated wilderness areas;
b. The main stem of the Snake River through its entire length above the U.S. Highway 22 Bridge (Wilson Bridge);
c. The main stem of the Green River, including Green River Lakes, from the mouth of the New Fork River upstream to the wilderness boundary;
d. The main stem of the Wind River from the boundary of the Wind River Indian Reservation upstream to Boyson Dam;
e. The main stem of the North Platte River from the Mouth of Sage Creek (approximately 15 miles below Saratoga, Wyoming) upstream to the Colorado state line;
f. The main stem of the North Platte River from the headwaters of Pathfinder Reservoir upstream to Kortes Dam;
g. The main stem of the North Platte River from the Natrona County Road 309 bridge (Goose Egg Bridge) upstream to Alcova Reservoir;
h. The main stem of Sand Creek above the U.S. Highway 14 bridge;
i. The main stem of the Middle Fork of the Powder River through its entire length above the mouth of Buffalo Creek;
j. The main stem of the Tongue River, the main stem of the North Fork of the Tongue River, and the main stem of the South Fork of the Tongue River above the U.S. Forest Service boundary;
k. The main stem of the Sweetwater River above the mouth of Alkali Creek;
l. The main stem of the Encampment River from the U.S. Forest Service boundary upstream to the Colorado state line;
m. The main stem of the Clarks Fork River from the U.S. Forest Service boundary upstream to the Montana state line;
n. All waters within the Fish Creek (near Wilson, Wyoming) drainage;
o. The main stem of Granite Creek (tributary of the Hoback River) through its entire length;
p. Fremont Lake;
q. All streams that are tributary to the above listed waters and are otherwise unlisted in Chapter 1, Appendix A of the Wyoming Water Quality Rules and Regulations; and
r. Wetlands adjacent to Class 1 waters are also treated as Class 1.

The U.S. Environmental Protection Agency (EPA) has waived water quality certification for the following Nationwide Permits for activities within the boundaries of the Wind River Indian Reservation: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 14, 15, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 32, 34, 35, 36, 37, 38 & 40.

The EPA has denied water quality certification for the following Nationwide Permits for activities within the boundaries of the Wind River Indian Reservation. The following permits cannot be used without separate written approval from the EPA: 7, 12, 13, 16, 17, 18, 26, 31, and 33.

11. Endangered Species: No activity is authorized which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the Corps if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the Corps that the requirements of the ESA have been satisfied and that the activity is authorized. Authorization of an activity by a nationwide permit does not authorize the "take" of a threatened or endangered species. In the absence of separate authorization (e.g., an ESA Section 10 permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. Fish and Wildlife Service, both lethal and non-lethal "takes" of protected species are in violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. Fish and Wildlife Service on their world wide web page at http://www.fws.gov/r9endspp/endspp.html or by calling the Wyoming State Office at (307)772-2374. In addition, the following regional conditions have been adopted to further protect threatened and endangered species in the State of Wyoming:

a. The permittee must contact the Wyoming State Office of the FWS prior to undertaking any activities under Nationwide Permits 3, 6, 23, 25, 26, 36, and 40 in the following areas:
   1. Niobrara River basin in Niobrara County
   2. Antelope Creek basin in Converse County
   3. Bear Creek basin in Goshen County
   4. Within 0.5 miles of and including the Hutton Lake and Mortenson Lake National Wildlife Refuges and all sections in Township 15 North, Range 65 West, Albany County
   5. Within 0.5 miles of any raptor nest (raptors include all eagles, hawks, ospreys, falcons, and owls) during the nesting season (February 1 through July 15) in all areas.

12. Historic Properties: No activity is authorized which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places, until the Corps has complied with the provisions of 33 CFR Part 325, Appendix C. Non-federal permittees must notify the Corps if the authorized activity may affect any historic properties listed, determined to be eligible, or which the permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the Corps that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places.
General Conditions (Continued)

13. Notification: When required by the terms of a nationwide permit, the landowner (permittee) or a designated agent for the permittee must notify the U.S. Army Corps of Engineers (Corps) with a Pre-Construction Notification (PCN) in accordance with the Notification Procedure prior to initiating any activities subject to regulation under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act. The permittee shall not begin any such activities until the Corps provides confirmation, either verbally or in writing, that the activity may proceed under a nationwide permit. However, the permittee may proceed after 30 days (45 days for Nationwide Permit 26 only) have passed since the Corps receipt of a complete PCN if the permittee has not received a response from the Corps. Subsequently, the permittee’s right to proceed under a nationwide permit may be modified, suspended, or revoked in accordance with the procedure set forth in 33 CFR 330.5(d)(2). The permittee is not authorized to proceed under a nationwide permit if properly notified by the Corps that the activity does not qualify and that an individual Department of the Army permit is required instead.

14. Compliance Certification: Permittees who receive a permit verification from the Corps must submit a signed certification after project completion. The certification will be provided by the Corps with the verification letter and will include:
   a. A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;
   b. A statement that any required mitigation was completed in accordance with the permit conditions.

15. Multiple Use of Permits (Single and Complete Project): Single and complete project means the total project proposed or accomplished by one owner, developer, partnership or other association. The term "real estate subdivision" shall be interpreted to include circumstances where a landowner or developer divides a tract of land into smaller parcels for the purpose of selling, conveying, transferring, leasing, or developing said parcels. This would include the entire area of a residential, commercial or other real estate subdivision, including all parcels and parts thereof. For linear projects such as utility lines and roads, each crossing of a waterbody is considered to be a single and complete project. However, the Corps retains the authority to combine several crossings as a single project such as when a road crosses the same waterbody at several locations. For bank stabilization projects, all of the areas on the same waterbody that are stabilized by one owner are combined to define a single and complete project. Individual channels in a braided stream or individual arms of an irregularly shaped wetland are considered to be part of the same waterbody. As provided at 33 CFR 330.6(c) two or more permits can be combined to authorize a single and complete project. However, permits cannot be combined for the purpose of increasing the filled area limitation. Furthermore, the same permit cannot be used more than once for a single project. In any case where permits 12 through 40 are to be used in combination, the permittee must notify the Corps in accordance with the Notification Procedure. Permits 1 through 11 may be combined without notification to the Corps, unless notification is otherwise required by the terms of the permit.

Contents adapted from Part VII of the Federal Register (Vol 61, No. 241) published on December 13, 1996. Copies available upon request.
Nationwide Permits

Section 404 Only Conditions

Activities authorized under any nationwide permit relative to Section 404 must comply with all of the following conditions:

1. **Water Supply Intakes**: No discharge may occur in the proximity of a public water supply intake except where the discharge is for repair of the public water supply intake structures or for adjacent bank stabilization.

2. **Shellfish Production**: No discharge may occur in areas of concentrated shellfish production, unless the discharge is directly related to a shellfish harvesting activity authorized by Nationwide Permit No 4.

3. **Suitable Material**: No discharge may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts as required by Section 307 of the Clean Water Act. In Wyoming, the Corps issued a prohibition against the use of certain materials as fill in a Public Notice issued on March 21, 1994.

4. **Mitigation**: Discharges must be minimized or avoided to the maximum extent practicable at the project site, unless the Corps approves a compensation plan that is determined to be more beneficial to the environment than on-site minimization or avoidance measures. Mitigation cannot be used in an attempt to offset the acreage of wetland losses that would occur in order to comply with the acreage limitation of a nationwide permit. To be practicable, mitigation must be capable of being done considering costs, existing technology, and logistics in light of the overall project purpose. Furthermore, mitigation must address wetland functional impacts. Examples of mitigation that may be appropriate and practicable include, but are not limited to:
   a. establishing wetland or upland buffer zones to protect aquatic resource functions; and
   b. replacing the loss of aquatic resource functions by creating or restoring similar functions.

To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds or “in lieu fees” to organizations such as The Nature Conservancy, state or county natural resource management agencies, where such fees contribute to the restoration, creation, replacement, or preservation of wetlands.

5. **Spawning Areas**: Discharges in spawning areas during the spawning season of aquatic life indigenous to the waterbody must be avoided to the maximum extent practicable. Spawning seasons for fish species of concern to the Wyoming Game and Fish Department (WGFD) are listed below:
   - Rainbow and Cutthroat Trout - March 15 thru July 31
   - Brown and Brook Trout - September 15 thru November 30

Site specific information on spawning seasons may be obtained from Fisheries Supervisors in WGFD Regional Offices.

6. **Obstruction of High Flows**: Discharges must not permanently restrict or impede the passage of normal or expected high flows to the maximum extent practicable (unless the primary purpose of the fill is to impound waters).
7. **Adverse Effects From Impoundments:** If the discharge creates an impoundment of water, adverse effects on the aquatic system caused by the accelerated passage of water and/or the restriction of flow shall be minimized to the maximum extent practicable.

8. **Waterfowl Breeding Areas:** Discharges into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

9. **Removal of Temporary Fills:** All temporary fills must be removed in their entirety and the affected areas returned to their preexisting contours.

Contents adapted from Part VII of the *Federal Register* (Vol 61, No. 241) published on December 13, 1996. Copies available upon request.
Nationwide Permits

Notification Procedure

When required by the terms of a nationwide permit, the landowner (applicant) or a designated agent for the applicant must notify the U.S. Army Corps of Engineers (Corps) with a Pre-Construction Notification (PCN) as early as possible and prior to initiating any activities subject to regulation under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act. All PCN's must be in writing and must include project specific information. The standard permit application form (Form ENG 4345) may be used for the notification, but must clearly indicate that it is a PCN. All PCN's must include the information required in items 1-5 below:

1. Full name, mailing address, and telephone number(s) of the applicant;
2. Identification of nationwide permit(s) for which the applicant is seeking authorization;
3. Copy of the appropriate portion of a U.S. Geological Survey map with the location of the proposed project labeled;
4. Any other information necessary to determine whether the criteria of the requested nationwide permit(s) will be satisfied, including but not limited to the following:
   a. statement on project purpose and need;
   b. brief project description;
   c. project drawings with appropriate dimensions including lengths, areas, and volumes;
   d. statement of potential environmental effects the project may cause; and
   e. photographs of the project area (recommended but not required).
5. For Nationwide Permits 14, 18, 21, 26, 29, 31, 34, and 38, the PCN must also include a delineation of affected special aquatic sites, including wetlands. Delineations must be prepared in accordance with Corps Wetland Delineation Manual dated January 1987. The applicant may request the Corps to perform a delineation. However, there may be some delay if the Corps does the delineation. Furthermore, a PCN is not considered to be complete until a wetland delineation has been completed and submitted to the Corps. In order to avoid delays, the applicant may hire a qualified consultant to complete a delineation. A list of consultants that advertise the ability to complete delineations is attached.

All Pre-Construction Notification's for activities in the State of Wyoming must be sent to:

Mr. Matthew A. Bilodeau  
U.S. Army Corps of Engineers  
Wyoming Regulatory Office  
2232 Dell Range Boulevard, Suite 210  
Cheyenne, Wyoming  82009-4942

Questions concerning PCN procedure should be directed to Mr. Bilodeau, Mr. Thomas Johnson, or Mr. Chandler Peter in the Wyoming Regulatory Office at the above address or by phone at (307) 772-2300.
FIGURE NO. 5-1
PRELIMINARY DESIGN
OPTION NO. 1
PIONEER WATER & SEWER
DISTRICT CONNECTION

CIVIL
ENGINEERING
PROFESSIONALS, INC.
335 N. Lincoln
Casper, Wyoming 82601
(307) 266-4346
(307) 266-0103 Fax
partially decomposed pine needles and other forest litter. The surface layer is brown loam 2 inches thick. The upper 5 inches of the subsurface layer is very pale brown very fine sandy loam. The lower 21 inches is very pale brown very fine sandy loam and yellowish brown loam. The subsoil is brown clay loam 18 inches thick. Hard sandstone bedrock is at a depth of 46 inches.

Permeability of the Foxton Variant soils is moderate. Available water capacity is high. The effective rooting depth is 40 to 50 inches. Runoff is slow and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Alfack and Foxton soils are used mainly for wildlife habitat or for timber production. The Irsn soils are used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Alfack soils is mainly lodgepole pine, pine grass, and Oregon grape. Production of vegetation suitable for livestock grazing is limited mainly by the tree canopy cover, which limits the understory growth.

The potential plant community on the Irsn soils is mainly bluebunch wheatgrass, Idaho fescue, slimstem muhly, and threetip sagebrush. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production ranges from 1,200 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the available water capacity of the soils and the depth to bedrock.

The potential plant community on the Foxton Variant soils is mainly lodgepole pine, with an understory of Idaho fescue, spike trisetum, and pine grass. Production of vegetation suitable for livestock grazing is limited mainly by the tree canopy cover, which limits the understory growth.

The Alfack soils are moderately well suited to the production of lodgepole pine. The site index for lodgepole pine ranges from 45 to 50. The Foxton Variant soils are well suited to the production of lodgepole pine. The site index for lodgepole pine ranges from 60 to 70. The main concern in producing and harvesting timber is slow regrowth due to the cold climate and short growing season. The available water capacity of the Alfack soils also limits productivity. After trees are harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Trees are subject to windthrow because of the limited rooting depth.

The Alfack soils are in capability subclass V1s, nonirrigated; the Irsn soils are in capability subclass V1ls, nonirrigated; and the Foxton Variant soils are in capability subclass V1e, nonirrigated.

The Alfack and Foxton Variant soils are in a woodland site. The Irsn soils are in the Shallow Igneous, 15 to 19 inch ppt., Foothills and Mountains Southeast range site. Inclusions of Adel soils are in a woodland site.

107—Almy loam, 3 to 15 percent slopes

These very deep, well drained soils are on hillslopes. They formed in slopewash alluvium derived dominantly from sandstone and shale. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 7,100 to 7,400 feet. The annual precipitation is 12 to 14 inches, the annual air temperature is 38 to 40 degrees F, and the average frost-free period is 90 to 100 days.

The surface layer is typically reddish brown loam 3 inches thick. The upper part of the subsoil is reddish brown loam 9 inches thick. The next 10 inches is reddish brown clay loam. The lower 13 inches of the subsoil is light reddish brown loam. The substratum is light reddish brown loam to a depth of 60 inches or more.

Included in this unit are 10 percent Fiveoh loam on convex slopes, 10 percent Thermopolis loam on hill crests, and 5 percent moderately deep soils similar to the Almy soils.

Permeability of the Almy soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, bluebunch wheatgrass, mutton bluegrass, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. This unit is moderately suited to livestock watering ponds because of the seepage potential and slope.

This map unit is in capability subclass V1e, nonirrigated.

The Almy soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Fiveoh and moderately deep soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Thermopolis soils are in the Shallow Loamy, 10 to 14 inch ppt., High Plains Southeast range site.

108—Amodac loam, 2 to 12 percent slopes

These very deep, well drained soils are on hillslopes. They formed in slopewash alluvium and residuum derived
dominantly from sodic shale. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 5,800 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 120 to 130 days.

The surface layer is typically pale brown loam 3 inches thick. The upper 8 inches of the subsoil is pale brown, slightly saline loam. The lower 15 inches of the subsoil is pale brown, very strongly alkaline, slightly saline clay loam. The substratum, to a depth of 60 inches or more, is pale brown, very strongly alkaline, moderately saline clay loam.

Included in this unit are 5 percent Keyner loam and 5 percent Petrie clay loam on concave slopes.

Permeability of the Amodac soils is moderately slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for irrigated hay and pasture.

The potential plant community on these soils are mainly western wheatgrass, needleandthread, prairie Junegrass, bluebunch wheatgrass, birdfoot sagebrush, and gardner saltbush. As the range condition deteriorates, birdfoot sagebrush and prairie Junegrass increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 700 pounds of air-dry vegetation in normal years. Production ranges from 900 pounds in favorable years to 350 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the alkalinity and salinity of the soils. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

If this unit is used for irrigated hay and pasture, the main limitations are the salinity and alkalinity of the soils. The slope is also a concern in the more sloping areas. To maximize production species of plants that tolerate saline and alkaline soils should be planted. Irrigation water should be applied at a rate that ensures optimum production without excessive deep percolation. Deep percolation of irrigation water can cause saline seeps downslope. Applications of irrigation water should be adjusted to the available water capacity and water intake rate of the soils and the crop needs. Sprinkler irrigation is the most suitable method of applying water. Although not as efficient or effective, the contour ditch method can be used if the ditches are designed to adequately apply the water without excessive deep percolation.

This map unit is in capability subclass V1s, irrigated and nonirrigated.

The Amodac soils are in the Saline Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Keyner soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Petrie soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site.

109—Amodac-Keyner complex, 2 to 12 percent slopes

This map unit is on hillslopes. The native vegetation is mainly grasses. Elevation is 5,300 to 6,100 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Amodac fine sandy loam and 40 percent Keyner sandy clay loam. The Amodac soils are on convex slopes, and the Keyner soils are on concave slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are Arvada clay loam on alluvial fans and Orella clay loam on hill crests. Also included are small areas of Rock outcrop on hillslopes. Included areas make up 10 percent of the total acreage.

The Amodac soils are very deep and well drained. They formed in slopewash alluvium and residuum derived dominantly from sodic shale. The surface layer is typically pale brown fine sandy loam 4 inches thick. The upper 3 inches of the subsoil is yellowish brown, slightly saline sandy clay loam; the next 8 inches is light brownish gray, strongly alkaline, slightly saline loam; and the lower 11 inches of the subsoil is light brownish gray, very strongly alkaline, slightly saline sandy clay loam. The substratum, to a depth of 60 inches or more, is grayish brown, very strongly alkaline, moderately saline sandy clay loam. In some areas the surface layer is sandy clay loam, loam, or clay loam.

Permeability of the Amodac soils is moderately slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Keyner soils are very deep and well drained. They formed in slopewash alluvium derived dominantly from sodic shale. The surface layer is typically grayish brown sandy clay loam 2 inches thick. The upper 11 inches of the subsoil is grayish brown clay loam. The lower 10 inches of the subsoil is light grayish brown, very strongly alkaline, slightly saline clay loam. The substratum, to a depth of 60 inches or more, is light grayish brown, very strongly alkaline, moderately saline sandy clay loam. In some areas the surface layer is sandy loam.

Permeability of the Keyner soils is slow. Available water
The upper 1 inch of the surface layer is typically light brownish gray clay loam. The next 2 inches is light olive brown clay loam. The upper 10 inches of the subsoil is grayish brown, very strongly alkaline clay. The next 12 inches is light brownish gray, very strongly alkaline, moderately saline clay. The lower part of the subsoil, to a depth of 42 inches, is olive gray, moderately alkaline, strongly saline clay containing many threads and seams of gypsum. The substratum, to a depth of 60 inches or more, is olive gray, strongly alkaline, strongly saline clay. In some areas the surface layer is fine sandy loam.

Permeability of the Arvada soils is slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate saline and alkaline soils, but it is 10 to 15 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

The Absted soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically light brownish gray clay loam 2 inches thick. The upper 10 inches of the subsoil is light olive brown clay. The next 4 inches is light brownish gray, strongly alkaline, moderately saline clay. The next part, to a depth of 27 inches, is light brownish gray, very strongly alkaline, moderately saline clay loam. The lower part of the subsoil, to a depth of 39 inches, is grayish brown, strongly alkaline, moderately saline clay loam containing common threads of gypsum. The substratum, to a depth of 60 inches or more, is grayish brown, strongly alkaline, moderately saline clay loam. In some areas the surface layer is loam.

Permeability of the Absted soils is slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate saline and alkaline soils, but it is 10 to 20 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Slickspots are areas of clayey, very strongly alkaline soils that support little or no vegetation. The alkalinity of these areas severely limits most agricultural uses.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Arvada soils is mainly western wheatgrass, bottlebrush squirreltail, Indian ricegrass, birdfoot sagebrush, and gardner saltbush. As the range condition deteriorates, birdfoot sagebrush increases. As the range condition further deteriorates, annual forbs invade. The potential plant community produces about 500 pounds of air-dry vegetation in normal years. Production ranges from 700 pounds in favorable years to 350 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the salinity and alkalinity of the soils. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing.

The potential plant community on the Absted soils is mainly western wheatgrass, needleandthread, green needlegrass, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing.

The Arvada soils are in capability subclass IVs, nonirrigated; the Absted soils are in capability subclass IVs, nonirrigated; and Slickspots are in capability class VIII, nonirrigated.

The Arvada soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. The Absted soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Cadoma and Orella soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Keyner soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Silhouette soils are in the Clayey, 10 to 14 inch ppt., High Plains Southeast range site.

113—Arvada, runon-Slickspots complex, 0 to 3 percent slopes

This map unit is on hummocky low terraces. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,300 to 6,400 feet. The annual precipitation is 7 to 9 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Arvada loam and 25 percent Slickspots. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 5 percent Absted fine sandy loam; and 10 percent Petrie clay loam, dry with Petrie clay loam.

The Arvada soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically light brownish gray loam 3 inches thick. The upper 9 inches of the subsoil is light olive brown, very strongly alkaline silty clay. The next 25 inches of the subsoil is brown, very strongly alkaline, moderately saline silty clay. The substratum, to a depth of 60 inches or more, is light olive brown, strongly alkaline,
gly saline silty clay loam. In some areas the surface layer is clay or clay loam.

Permeability of the Arvada soils is very slow. Available water capacity is moderate. The effective rooting depth is 10 to 20 inches for plants that tolerate alkaline and saline soils, but it is 10 to 20 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate. Slickspots are areas of clayey, very strongly alkaline soil that support little or no vegetation. The alkalinity of the soils in these areas severely limits most agricultural use.

This unit is used mainly for livestock grazing and wildlife habitat. The potential plant community on the Arvada soils is mainly greasewood, inland saltgrass, alkali sacaton, basin wildrye, bottlebrush squirreltail, and western wheatgrass. As the range condition deteriorates, greasewood and saltgrass increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in normal years. Production ranges from 500 pounds in favorable years to 700 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity and alkalinity of the soils. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing.

The Arvada soils are in capability subclass VI, nonirrigated, and Slickspots are in capability class VIII, nonirrigated.

The Arvada soils are in the Saline Lowland, 5 to 9 inch Wind River Basin range site. Inclusions of Absted soils are in the Loamy, 5 to 9 inch ppt., Wind River Basin range site. Inclusions of Petrie clay loam, dry, soils are in the Saline Upland, 5 to 9 inch ppt., Wind River Basin range site. Inclusions of Petrie clay loam soils are in the Inclusions of Petrie Clay loam, 5 to 9 inch ppt., Wind River Basin range site. Inclusions of Petrie clay loam soils are in the Inclusions of Petrie Clay loam, 5 to 9 inch ppt., Wind River Basin range site.

1—Bachus-Nathrop complex, 4 to 20 percent slopes

This map unit is on mountain dip slopes. The native vegetation is mainly grasses and shrubs. Elevation is 5,500 to 9,000 feet. The annual precipitation is 15 to 19 inches, the annual temperature is 33 to 36 degrees F, and the frost-free period is less than 80 days. Frost commonly occurs during summer months. This unit is 45 percent Bachus loam and 30 percent Nathrop stony loam. The Bachus soils are on lower portions of dip slopes and the Nathrop soils are on upper portions of dip slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 10 percent Nielsen sandy loam on dip slopes and ridge crests; 5 percent very deep or deep flaggy clay soils on dip slopes and in swales; and 10 percent sandstone Rock outcrop on ridge crests.

The Bachus soils are moderately deep and well drained. They formed in slopewash alluvium and residuum derived from quartzitic sandstone. The surface layer is typically very dark grayish brown loam 5 inches thick. The upper 6 inches of the subsoil is dark grayish brown loam. The next 8 inches is dark grayish brown clay loam. The lower 14 inches of the subsoil is brown stony clay loam. Hard fractured quartzitic sandstone is at a depth of 33 inches.

Permeability of the Bachus soils is moderate. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Nathrop soils are moderately deep and well drained. They formed in residuum derived dominantly from quartzitic sandstone. The surface layer is typically dark grayish brown stony loam 6 inches thick. The upper 5 inches of the subsoil is dark grayish brown very stony clay loam. The next 16 inches is dark brown very stony clay loam. The lower part of the subsoil is pale brown very stony clay loam 9 inches thick. Fractured quartzitic sandstone is at a depth of 36 inches.

The Nathrop soils in this map unit do not have a horizon which contains calcium carbonate and thus are outside the characteristics allowed for the Nathrop series. This difference does not significantly affect the use and behavior of the soils.

Permeability of the Nathrop soils is moderate. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid and the hazard of water erosion is severe. The hazard of wind erosion is slight.

This unit is used mainly for summer livestock grazing and wildlife habitat. The potential plant community on the Bachus soils is mainly Columbia needlegrass, spike fescue, Idaho fescue, bluebunch wheatgrass, and big sagebrush. As the range condition deteriorates, big sagebrush and rabbitbrush increase in abundance. As the range condition further deteriorates, cheatgrass, gumweed, Canada thistle, and stickseed invade. The potential plant community produces about 1,350 pounds of air-dry vegetation in normal years. Production ranges from 1,600 pounds in favorable years to 1,100 pounds in unfavorable years. These soils are poorly suited to livestock watering ponds because of the depth to bedrock and the slope.

The potential plant community on the Nathrop soils is mainly Idaho fescue, Columbia needlegrass, spike fescue, prairie junegrass, bluebunch wheatgrass, western
This unit is 45 percent Bessemer clay loam and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are small areas of Samday cobbly loam on moderately steep hillsides, Rock outcrop on steep sides of drainageways, and areas of cut and fill. Included areas make up 15 percent of the total acreage.

The Bessemer soils are very deep and well drained. They formed in alluvium from various sources. The surface layer is typically grayish brown clay loam 3 inches thick. The upper part of the subsoil is light brownish gray clay loam, 3 inches thick. The lower part of the subsoil, to a depth of 60 inches or more, is very pale brown very cobbly clay loam. In some areas 20 percent of the surface is covered by cobbles or gravel.

Permeability of the Bessemer soils is slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

Urban land is an area covered by streets, parking lots, sidewalks, and other structures.

This unit is used mainly for homesite and urban development.

If the Bessemer soils are used for homesite development and urban development, the main limitations are the restricted permeability and the shrink-swell potential. If the soils are used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. Livings and roads should be designed to offset the effects of shrinking and swelling. Properly designed building foundations and footings and runoff diverted away from the buildings will help to prevent the structural damage caused by shrinking and swelling. The effects of shrinking and swelling can be minimized by backfilling the material that has a low shrink-swell potential. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

The Bessemer soils are in capability subclass IVe, nonirrigated.

124—Blackdraw clay loam, 3 to 10 percent slopes

These very deep, well drained soils are on hillsides. They formed in slopewash alluvium and residuum derived dominantly from sodic shale. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 5,600 feet. The annual precipitation is 10 to 14 inches, the mean air temperature is 46 to 49 degrees F, and the frost-free period is 120 to 130 days.

The surface layer is typically grayish brown clay loam 2 inches thick. The upper 2 inches of the subsoil is grayish brown clay. The next 3 inches is grayish brown, gypsiferous clay. The lower part of the subsoil, to a depth of 13 inches, is grayish brown, gypsiferous, sodic clay. The substratum, to a depth of 60 inches or more, is dark grayish brown sodic clay.

Included in this unit is 10 percent Lolite clay on hill crests.

Permeability of the Blackdraw soils is slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate alkaline soils, but it is 5 to 15 inches for plants that cannot tolerate them. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, Indian ricegrass, bottlebrush squirreltail, birdfoot sedgebrush, and gardner saltbush. As the range condition deteriorates, birdfoot sedgebrush and Sandberg bluegrass increase in abundance. As the range condition further deteriorates, annual forbs invade. The potential plant community produces about 500 pounds of air-dry vegetation in normal years. Production ranges from 650 pounds in favorable years to 300 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the alkalinity, salinity, and available water capacity of the soils. These soils are only moderately well suited to livestock watering ponds because of the piping potential.

This map unit is in capability subclass IVe, nonirrigated.

The Blackdraw soils are in the Saline Upland, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Lolite soils are in the Shale, 10 to 14 inch ppt., High Plains Southeast range site.

125—Blackdraw-Lolite-Gullied land complex, 3 to 20 percent slopes

This map unit is on hills dissected by numerous gullies. The native vegetation is mainly grasses and shrubs. Elevation is 5,300 to 5,800 feet. The annual precipitation is 10 to 14 inches, the mean air temperature is 46 to 48 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Blackdraw clay loam, 20 percent Lolite clay loam, and 20 percent Gullied land. The Blackdraw soils are on hillsides with 3 to 15 percent slopes, the Lolite soils are on hill crests with 6 to 20 percent slopes, and the Gullied land occurs throughout the unit. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are Amodac loam on hillsides,
The Cadoma soils are moderately deep and well drained. They formed in slopewash alluvium and residuum derived dominantly from sodic shale. The surface layer is typically light brownish gray clay loam 5 inches thick. The upper 17 inches of the subsoil is grayish brown and light gray, very strongly alkaline, slightly saline clay. The lower 14 inches of the subsoil is light olive gray moderately alkaline, moderately saline clay containing few common masses of gypsum. Soft sodic shale is at a depth of 36 inches.

Permeability of the Cadoma soils is slow. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Cadoma soils are in capability subclass Vle, nonirrigated; the Renohill soils are in capability subclass Vle, nonirrigated; and the Samday soils are in capability subclass Vlls, nonirrigated.

The Cadoma soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. The Renohill soils are in the Clayey, 10 to 14 inch ppt., High Plains Southeast range site. The Samday soils are in the Shale, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Silhouette soils are in the Clayey Overflow, 10 to 14 inch ppt., High Plains Southeast range site.

**141—Cambria sandy clay loam, 0 to 6 percent slopes**

These very deep, well drained soils are on alluvial fan terraces and plateaus. They formed in alluvium derived dominantly from sandstone and shale. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 5,500 feet. The annual precipitation is 10 to 14
inches, the annual air temperature is 46 to 49 degrees F, and the frost-free period is 120 to 130 days.

The surface layer is typically brown sandy clay loam 4 inches thick. The upper 4 inches of the subsoil is yellowish brown sandy clay loam. The lower part of the subsoil, to a depth of 30 inches, is pale brown clay loam. The substratum, to a depth of 60 inches or more, is very pale brown clay loam. In some areas the lower substratum is loam.

Included in this unit is 10 percent Amodac sandy clay loam.

Permeability of the Cambria soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used mainly for irrigated hay and pasture, livestock grazing, and for wildlife habitat. It is also used for homesite development.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, and big sagebrush. As the range condition deteriorates, big sagebrush and bluebunch wheatgrass, and big sagebrush. As the range condition further deteriorates,

Production ranges from moderately well to a few areas are

available for irrigated hay and pasture, livestock grazing, and for wildlife habitat. It is also used for homesite development.

The Cambria soils are very deep and well drained. They formed in alluvium derived dominantly from sandstone and shale. The surface layer is typically light brownish gray very fine sandy loam 1 inch thick. The upper part of the subsoil is light olive brown loam 7 inches thick. The lower 21 inches of the subsoil is light gray loam. The substratum, to a depth of 60 inches or more, is light brownish gray loam. In some areas the surface layer is loam or sandy loam.

Permeability of the Cambria soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Zigweed soils are very deep and well drained. They formed in alluvium derived dominantly from sandstone and shale. The surface layer is typically pale brown loam 3 inches thick. The upper 9 inches of the subsoil is brownish gray loam. The lower 23 inches of the subsoil is light brownish gray loam. The substratum, to a depth of 60 inches or more, is light brownish gray loam. In some areas the surface layer is sandy loam.

Permeability of the Zigweed soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates,
Natrona County Area, Wyoming

Moslander soils are in the Subirrigated, 15 to 19 inch ppt., oothills and Mountains Southeast range site.

07—Keeline-Taluce-Rock outcrop complex, 6 to 20 percent slopes

This map unit is on hills. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,400 to 6,200 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Keeline fine sandy loam, 20 percent Taluce fine sandy loam, and 15 percent Rock outcrop. The Keeline soils are on hillsides and foot slopes with 6 to 20 percent slopes, the Taluce soils are on hillrests with 6 to 20 percent slopes, and Rock outcrop is on hillcrests and hillsides. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are small areas of Orpha loamy sand on stable dunes, Tullock loamy sand and moderately deep soils similar to Keeline on backslopes, and Blowout alluvium and intermixed with the Keeline and Orpha soils. Included areas make up 15 percent of the total acreage.

The Keeline soils are very deep and somewhat excessively drained. They formed in slopewash alluvium and residuum derived dominantly from sandstone. The surface layer is typically brown fine sandy loam 3 inches thick. The subsoil is yellowish brown fine sandy loam 5 inches thick. The substratum, to a depth of 60 inches or more, is light yellowish brown fine sandy loam. In some areas the surface layer is loamy sand.

Permeability of the Keeline soils is moderately rapid. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Taluce soils are very shallow or shallow and are well drained. They formed in residuum derived dominantly from sandstone. The surface layer is typically brown fine sandy loam 4 inches thick. The underlying material is pale brown fine sandy loam 10 inches thick. Soft, platy sandstone is at a depth of 14 inches.

Permeability of the Taluce soils is moderately rapid. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is rapid and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Rock outcrop consists of exposed sandstone. This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Keeline soils is mainly needleandthread, thickspike wheatgrass, threadleaf sedge, Indian ricegrass, and silver sagebrush.

As the range condition deteriorates, silver sagebrush and rabbitbrush increase in abundance. As the range condition further deteriorates, annual forbs and cheatgrass invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in normal years. Production ranges from 1,500 pounds in favorable years to 700 pounds in unfavorable years. The Keeline soils are poorly suited to livestock watering ponds because of the seepage potential and the slope.

The potential plant community of the Taluce soils is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, threadleaf sedge, mutton bluegrass, and black sagebrush. As the range condition deteriorates, threadleaf sedge increases. As the range condition further deteriorates, annuals invade. The potential plant community produces about 900 pounds of air-dry vegetation in normal years. Production ranges from 1,200 pounds in favorable years to 700 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the depth and the available water capacity of the soils. The Taluce soils are poorly suited to livestock watering ponds because of the depth to bedrock and the slope.

The Keeline soils are in capability subclass IVe, nonirrigated. The Taluce soils are in capability subclass Vle, nonirrigated, and Rock outcrop is in capability class VIII.

The Keeline soils are in the Sandy, 10 to 14 inch ppt., High Plains Southeast range site. The Taluce soils are in the Shallow Sandy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Orpha and Tullock soils are in the Sands, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of moderately deep soils similar to Keeline are in the Sandy, 10 to 14 inch ppt., High Plains Southeast range site.

208—Keyner sandy clay loam, 3 to 10 percent slopes

These very deep, well drained soils are on alluvial fans and fan terraces. They formed in alluvium derived dominantly from sodic sandstone and shale. The native vegetation is mainly shrubs and grasses. Elevation is 5,200 to 6,200 feet. The annual precipitation is 10 to 12 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

The surface layer is typically pale brown sandy clay loam 3 inches thick. The upper 12 inches of the subsoil is pale brown sandy clay loam. The lower 10 inches of the subsoil is very pale brown, very strongly alkaline, slightly saline sandy clay loam. The substratum, to a depth of 60 inches or more, is very pale brown, very strongly alkaline, moderately saline loam.

Included in this unit are 10 percent Cavegulch clay...
loam and 10 percent Petrie clay loam intermixed with the Keyner soils.

Permeability of the Keyner soils is slow. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is moderate. The hazard of wind erosion is moderate. The hazard of water erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, bluebunch wheatgrass, mutton bluegrass, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing. These soils are only moderately well suited to livestock watering ponds because of the slope.

This map unit is in capability subclass IVs, nonirrigated. The Keyner soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Petrie soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Cavegulch soils are in the Saline Upland, 10 to 14 inch ppt., High Plains Southeast range site.

209—Keyner-Absted-Slickspots complex, 0 to 6 percent slopes

This map unit is on alluvial fans and low terraces. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,200 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Keyner sandy loam, 20 percent Absted sandy clay loam, and 15 percent Slickspots. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are small areas of Arvada clay loam on alluvial fans and terraces and Cadoma clay loam on foot slopes. Also included in some areas are small areas of Orella clay loam on low knobs and Vonalee loamy sand on stable dunes. Included areas make up 15 percent of the total acreage.

The Keyner soils are very deep and well drained. They formed in sodic alluvium derived from various sources. The surface layer is typically light brownish gray sandy loam 1 inch thick. The upper 11 inches of the subsoil is grayish brown sandy clay loam. The next 7 inches is light yellowish brown, very strongly alkaline, slightly saline sandy clay loam. The lower 12 inches of the subsoil is light brownish gray, very strongly alkaline, slightly saline sandy clay loam. The substratum, to a depth of 60 inches or more, is light yellowish brown, strongly alkaline, moderately saline sandy clay loam. In some areas the surface layer is loam, sandy clay loam, or loamy sand.

Permeability of the Keyner soils is slow. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Absted soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically pale brown sandy clay loam 3 inches thick. The upper 11 inches of the subsoil is yellowish brown clay. The lower 8 inches of the subsoil is yellowish brown, strongly alkaline, moderately saline clay loam. The substratum, to a depth of 60 inches or more, is light yellowish brown, strongly alkaline, moderately saline clay loam. In some areas the surface layer is clay loam.

Permeability of the Absted soils is slow. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate saline and alkaline soils, but it is 10 to 20 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Slickspots are areas of clayey soils that are very strongly alkaline and support little or no vegetation. This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for irrigated hay and pasture.

The potential plant community on the Keyner and Absted soils is mainly western wheatgrass, bluebunch wheatgrass, needleandthread, mutton bluegrass, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. This unit is only moderately well suited to livestock watering ponds because of the slope.

If this unit is used for irrigated hay and pasture, the main limitations are the salinity and alkalinity of the soils and the presence of Slickspots. To maximize production, species of plants that tolerate saline and alkaline soils should be planted. Irrigation water should be applied at a rate that ensures optimum production without excessive deep percolation. Applications of irrigation water should be adjusted to the available water capacity and water intake.
rate of the soils and to the crop needs. Sprinkler irrigation is the most suitable method of applying water.

The Keyner and Absted soils are in capability subclass IVs, nonirrigated and irrigated. Slickspots are in capability class Vll.

The Keyner and Absted soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Cadoma and Orella soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Vonalee soils are in the Sandy, 10 to 14 inch ppt., High Plains Southeast range site.

210—Keyner-Hiland association, gently sloping

This map unit is on alluvial fans and terraces. The slope is 0 to 6 percent. The native vegetation is mainly grasses and shrubs. Elevation is 5,100 to 5,800 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 46 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Keyner sandy loam and 35 percent Hiland sandy loam. The Keyner soils are on the lower areas of alluvial fans and on terraces with 0 to 4 percent slopes. The Hiland soils are on the upper areas of the alluvial fans and on terraces with 2 to 6 percent slopes.

Included in this unit are 10 percent Arvada clay loam intermixed with the Keyner soils, 5 percent Vonalee loamy and intermixed with the Hiland soils, and 5 percent Slickspots intermixed with the Keyner soils.

The Keyner soils are very deep and well drained. They formed in alluvium derived from various sources. The surface layer is typically brown sandy loam 4 inches thick. The upper 13 inches of the subsoil is brown sandy clay loam. The lower 7 inches of the subsoil is pale brown, very strongly alkaline, slightly saline sandy clay loam. The substratum, to a depth of 60 inches or more, is pale brown, very strongly alkaline, moderately saline sandy loam.

Permeability of the Keyner soils is slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate saline and alkaline soils, but it is 10 to 20 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Hiland soils are very deep and well drained. They formed in alluvium derived dominantly from sandstone. The surface layer is typically pale brown sandy loam 2 inches thick. The upper 12 inches of the subsoil is light brownish gray sandy clay loam. The next 8 inches is pale brown sandy loam. The lower 14 inches of the subsoil is pale brown sandy loam. The substratum, to a depth of 60 inches or more, is light brownish gray loamy sand.

Permeability of the Hiland soils is moderate. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the unit is mainly western wheatgrass, needleandthread, bluebunch wheatgrass, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Loss of the surface layer of the Keyner soils results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing. The Keyner soils are well suited to livestock watering ponds. The Hiland soils are poorly suited to livestock watering ponds because of the seepage potential.

The Keyner soils are in capability subclass IVs, nonirrigated. The Hiland soils are in capability subclass IVe, nonirrigated.

The Keyner and Hiland soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Arvada soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Vonalee soils are in the Sandy, 10 to 14 inch ppt., High Plains Southeast range site.

211—Kezar-Irson-Clayburn association, hilly

This map unit is on mountain slopes. The slope is 5 to 35 percent. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 7,200 to 8,900 feet. The annual precipitation is 15 to 19 inches, the annual air temperature is 32 to 36 degrees F, and the frost-free period is less than 80 days. Frost commonly occurs during the summer months.

This unit is 30 percent Kezar loam, 25 percent Irson very gravelly sandy clay loam, and 25 percent Clayburn sandy loam. The Kezar soils are on hilltops with 5 to 35 percent slopes, the Irson soils are on hill crests with 5 to 35 percent slopes, and the Clayburn soils are on foot slopes with 5 to 15 percent slopes.

Included in this unit are 5 percent Moslander loam in drainageways, 5 percent very deep stony loam soils adjacent to drainageways, and 10 percent Rock outcrop on ridge crests.

The Kezar soils are moderately deep and well drained.
woodland. Inclusions of Farlow soils are in the Shallow Loamy, 15 to 19 inch ppt., Foothills and Mountains Southeast range site.

214—Lolite-Rock outcrop complex, 10 to 40 percent slopes

This map unit is on ridges and hills. The native vegetation is mainly grasses and shrubs. Elevation is 5,200 to 6,200 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Lolite clay and 20 percent Rock outcrop. The Lolite soils are on crests and side slopes with 10 to 40 percent slopes. The Rock outcrop is on crests and escarpments.

Included in this unit are 5 percent Arvada clay loam on alluvial fans, 5 percent Cadoma clay loam on foot slopes, and 10 percent Samday clay loam intermixed with the Lolite soils.

The Lolite soils are very shallow or shallow and are well drained. They formed in residuum derived dominantly from sodic shale. The surface layer is typically light brownish gray clay 2 inches thick. The subsoil is light brownish gray clay 4 inches thick and contains visible gypsum accumulations. The substratum is gray moderately saline clay 4 inches thick. Soft, sodic shale is at a depth of 10 inches.

Permeability of the Lolite soils is slow. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is rapid and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of exposures of sodic shale.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Lolite soils is mainly western wheatgrass, Indian ricegrass, inland saltgrass, bottlebrush squirreltail, birdfoot sagebrush, and gardner saltbush. As the range condition deteriorates, gardner saltbush and Sandberg bluegrass increase in abundance. As the range condition further deteriorates, annual forbs invade. The potential plant community produces about 300 pounds of air-dry vegetation in normal years. Production ranges from 400 pounds in favorable years to 200 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity, available water capacity, and depth of the soils. The slope, over 30 percent, limits access by livestock and results in overgrazing of the less sloping areas. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

The Lolite soils are in capability subclass VII, nonirrigated. Rock outcrop is in capability class VIII.

The Lolite soils are in the Shale, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Cadoma and Arvada soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Samday soils are in the Shale, 10 to 14 inch ppt., High Plains Southeast range site.

215—Lolite, dry-Rock outcrop complex, 5 to 50 percent slopes

This map unit is on ridges and hills. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,500 to 6,500 feet. The annual precipitation is 7 to 9 inches, the annual air temperature is 44 to 48 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Lolite clay and 30 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 5 percent Persayo clay loam on ridge crests and 15 percent moderately deep clayey soils in swales and on foot slopes.

The Lolite soils are very shallow or shallow and are well drained. They formed in residuum derived dominantly from sodic shale. The surface layer is typically grayish brown clay 2 inches thick. The upper 10 inches of the substratum is light olive gray sodic clay. The lower 3 inches is grayish brown moderately saline clay. Soft platy shale is at a depth of 15 inches. In some areas the surface layer is silty clay or clay loam.

Permeability of the Lolite soils is slow. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is rapid and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of exposures of sodic shale.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Lolite soils is mainly bluebunch wheatgrass, gardner saltbush, bottlebrush squirreltail, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, birdfoot sagebrush and woodyaster increase in abundance. As the range condition further deteriorates, annual forbs invade. The potential plant community produces about 100 pounds of air-dry vegetation in normal years. Production ranges from 200 pounds in favorable years to 50 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the low annual precipitation, alkalinity, salinity, available water capacity, and depth of the soils. The slope, where above 30
The production of vegetation suitable for livestock grazing is limited by the salinity, alkalinity, and available water capacity of the soils. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing. This unit is well suited to livestock watering ponds.

This map unit is in capability subclass VIs, nonirrigated. The Petrie soils are in the Saline Upland, 10 to 14 inch ppm., High Plains Southeast range site. Inclusions of avada and loamy sodic soils are in the Impervious Clay, 10 to 14 inch ppm., High Plains Southeast range site.

235—Petrie-Zigweid complex, wet, 0 to 3 percent slopes

This map unit is in drainageways and basins. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 5,500 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 46 to 49 degrees F, and the frost-free period is 120 to 130 days.

This unit is 40 percent Petrie clay loam and 40 percent Zigweid loam. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are soils similar to the Zigweid, wet soils with a sandy loam substratum. Also included are small areas of Salt flats. Included areas make up 20 percent of the total acreage.

The Petrie soils are very deep and somewhat poorly drained. They formed in alluvium derived dominantly from shale. The surface layer is typically brown loam 2 inches thick. The subsoil is yellowish brown, slightly saline clay loam 13 inches thick. The substratum is light yellowish brown, slightly saline clay loam to a depth of 60 inches or more. These soils are outside the characteristics defined for the Zigweid series because it has a seasonal high water table at a depth of 1.5 to 3 feet.

Permeability of the Zigweid soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate wet, saline, and alkaline soils, but it is 5 to 15 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A seasonal high water table is at a depth of 1.5 to 3 feet from May through September. This water table is the result of irrigation of this or surrounding soils. The depth to the water table varies from year to year and from field to field, depending on the management of the irrigation water. These soils are subject to frequent very long periods of flooding from May through September, as a result of runoff of irrigation water from adjacent soils.

This unit is used for irrigated hay and pasture, homestead development, livestock grazing, or for wildlife habitat.

The potential plant community on this unit is mainly alkali sacaton, inland saltgrass, western wheatgrass, alkali bluegrass, basin wildrye, and greasewood. As the range condition deteriorates, inland saltgrass and greasewood increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 3,000 pounds of air-dry vegetation in normal years. Production ranges from 3,400 pounds in favorable years to 2,500 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity and alkalinity of the soils. Grazing should be delayed until the soils have drained sufficiently and is firm enough to withstand trampling by livestock. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing. This unit is moderately well suited to livestock watering ponds.

Wetness limits the types of construction equipment that can be used. Construction of the ponds is best accomplished during the late fall when the water table is at its deepest depth.

If this unit is used for irrigated hay and pasture, the main limitation is the salinity and alkalinity of the soils. To maximize production, species of plants that tolerate saline and alkaline soils should be planted. Irrigation water should be applied carefully to prevent the raising of the high water table, and ought to be applied at a rate that ensures optimum production without excessive deep percolation. Applications of irrigation water should be
adjusted to the available water capacity and water intake rate of the soils and to the crop needs. Sprinkler irrigation is the most suitable method of applying water.

If this unit is used for homesite development, the main limitations are the frequent flooding and high water table of both soils. The permeability and the shrink-swell potential of the Petrie soils are also limitations. The high water table makes construction of building foundations difficult and limits the construction of buildings with basements. Restricted permeability and the high water table increase the possibility of failure of septic tank absorption fields. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is in capability subclass VIs, nonirrigated, and irrigated.

The Petrie and Zigweid soils are in the Saline Subirrigated, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of very poorly drained soils are in the Wetland, 10 to 14 inch ppt., High Plains Southeast range site.

236—Petrie-Arvada complex, 0 to 6 percent slopes

This map unit is on alluvial fans and terraces. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,100 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Petrie clay loam and 30 percent Arvada fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 10 percent Ulm loam and 10 percent Slickspots.

The Petrie soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically light yellowish brown clay loam 1 inch thick. The upper part of the underlying material is light yellowish brown, strongly alkaline clay loam 4 inches thick. The next 14 inches is light yellowish brown, strongly alkaline, slightly saline clay. The lower part, to a depth of 60 inches or more, is light yellowish brown, very strongly alkaline, slightly saline clay. In some areas the surface layer is clay.

Permeability of the Petrie soils is very slow. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Arvada soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically light brownish gray fine sandy loam 2 inches thick. The upper 16 inches of the subsoil is olive, very strongly alkaline, moderately saline silty clay. The lower 20 inches of the subsoil is pale olive, very strongly alkaline, strongly saline clay loam. The substratum, to a depth of 60 inches or more, is pale olive, very strongly alkaline, strongly saline clay loam. In some areas the surface layer is loam, silty clay loam, or clay loam.

Permeability of the Arvada soils is very slow. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, Indian ricegrass, gardner saltbush, and birdfoot sagebrush. As the range condition deteriorates, birdfoot sagebrush increases. As the range condition further deteriorates, annual forbs invade. The potential plant community produces about 500 pounds of air-dry vegetation in normal years. Production ranges from 700 pounds in favorable years to 350 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the alkalinity of the soils. This unit is only moderately well suited to livestock watering ponds because of the slope.

This map unit is in capability subclass VIs, nonirrigated.

The Petrie and Arvada soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Ulm soils are in the Clayey, 10 to 14 inch ppt., High Plains Southeast range site.

237—Peyton-Holderness loams, 3 to 15 percent slopes

This map unit is on plateaus. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 7,000 to 7,600 feet. The annual precipitation is 15 to 19 inches, the annual air temperature is 35 to 40 degrees F, and the frost-free period is 80 to 100 days.

This unit is 45 percent Peyton loam and 35 percent Holderness loam. The Peyton soils are on convex slopes of 6 to 15 percent, and the Holderness soils are on concave slopes of 3 to 10 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are Bosler sandy loam on nearly level areas, Pinelli loam in swales, and moderately deep sandy clay loam soils over hard sandstone intermixed with the Peyton soils. Also included are small areas of very stony soils and Rock outcrop on hill crests. Included areas make up 20 percent of the total acreage.
271—Salt flats

Salt flats are areas of poorly drained, fine textured, very strongly saline soils with a salt crust on the surface. The salt crust ranges in thickness from less than 1 inch to 3 inches. These areas support little or no vegetation.

In most areas, salt flats have been caused by seepage from irrigation ditches, over-irrigation, and disruption of natural surface drainage patterns.

This map unit is in capability class VIII.

272—Samday very cobbly clay, 20 to 60 percent slopes

These very shallow or shallow, well drained soils are on flats and hills. They formed in residuum derived dominantly from shale. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,200 to 6,200 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

The surface layer is typically grayish brown very cobbly clay 2 inches thick. The underlying material is light olive brown clay 10 inches thick. Soft platy shale is at a depth of 12 inches.

Included in this unit are 5 percent Savageton gravelly clay on foot slopes and 5 percent Rock outcrop intermixed with the Samday soils.

Permeability of the Samday soils is slow. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is medium to rapid and the hazard of water erosion is severe. The hazard of wind erosion is slight.

This unit is used mainly for livestock grazing and woodland habitat. A few areas are used for homesite development.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase in abundance.

The range condition further deteriorates, annual forbs invade. The potential plant community produces about 500 pounds of air-dry vegetation in normal years.

Production ranges from 1,000 pounds in favorable years to 450 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the available water capacity and depth of the soils. The slope, where above 30 percent, limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to homesite development. The main limitations are the depth to bedrock, slope shrink-well potential, and the permeability. Buildings and roads should be designed to offset the effects of shrinking and swelling. Properly designed building foundations and footings and runoff diverted away from the buildings will help prevent the structural damage caused by shrinking and swelling. Installation of septic tank absorption lines in or on the bedrock is not recommended due to the possibility of inadequate filtration and contamination of ground water supplies. Effluent from septic tank absorption fields can also surface in downslope areas and thus create a hazard to health.

This map unit is in capability subclass, VII, nonirrigated.

The Samday soils are in the Shallow Clayey, 10 to 14 inch ppt., Northern Plains range site. Inclusions of Savageton soils are in the Clayey, 10 to 14 inch ppt., Northern Plains range site.

273—Savageton-Samday complex, 3 to 15 percent slopes

This map unit is on hillslopes. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,200 to 5,500 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 55 percent Savageton gravelly clay and 30 percent Samday cobbly silty clay loam. The Savageton soils are on back slopes and areas with a slope of 3 to 8 percent and the Samday soils are in areas with a slope of 6 to 15 percent. The components of this unit are so intrinsically intermingled that it was not practical to map them separately.

Included in this unit are 5 percent Silhouette clay loam on gently sloping alluvial fans; and 5 percent moderately deep or deep, very gravelly soils on hill crests. Also included is 5 percent Rock outcrop intermixed with the Samday soils and on steep sides of gullies.

The Savageton soils are moderately deep and well drained. They formed in slopewash alluvium and residuum derived dominantly from shale. 25 percent of the surface is typically covered by gravel and cobbles. The surface layer is very pale brown gravelly clay 2 inches thick. The upper part of the subsoil is pale yellow clay 14 inches thick. The lower 10 inches of the subsoil is pale yellow clay containing a few clusters of gypsum crystals. The substratum is pale yellow clay 11 inches thick. Soft platy shale is at a depth of 37 inches.

Permeability of the Savageton soils is slow. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Samday soils are very shallow or shallow and are well drained. They formed in residuum derived dominantly from shale. 25 percent of the surface is typically covered by gravel and cobbles. The surface layer is light yellowish
277—Silhouette clay loam, 0 to 6 percent slopes

These very deep, well drained soils are on alluvial fans. They formed in alluvium derived dominantly from shale. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 6,000 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 45 to 49 degrees F, and the frost-free period is 110 to 130 days. The surface layer is typically grayish brown clay loam 3 inches thick. The upper part of the subsoil is grayish brown clay 8 inches thick. The lower part of the subsoil, to a depth of 60 inches or more, is grayish brown clay. included in this unit are 5 percent Petrie clay loam and 5 percent Zigweid loam intermixed with the Silhouette soils. Also included is 5 percent Typic Fluvaquents in drainageways. Permeability of the Silhouette soils is slow. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for irrigated hay and pasture or for homesite development. The potential plant community on this unit is mainly green needlegrass, western wheatgrass, and blue grama. If the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, pricklypear invades. The potential plant community produces about 1,000 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. This unit is only moderately well suited to livestock watering ponds because of the slope. If this unit is used for irrigated hay and pasture, irrigation water should be applied carefully to avoid the build up of a high water table. Irrigation water should be applied at a rate that ensures optimum production without excessive deep percolation. Applications of irrigation water should be adjusted to the available water capacity and water intake rate of the soils and to the crop needs. This unit is used for homesite development, the main limitations are the permeability and the shrink-swell potential. The restricted permeability of the soils increases the possibility of failure of septic tank absorption fields. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. If a septic tank absorption field is to be installed in these soils, increasing the size of the field will help to overcome the restricted permeability.

This map unit is in capability subclass IVe, irrigated and nonirrigated. The Silhouette soils are in the in the Clayey, 10 to 14 inch ppt., Northern Plains range site. Inclusions of Petrie soils are in the Impervious Clay, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Zigweid soils are in the Loamy, 10 to 14 inch ppt., Northern Plains range site. Inclusions of Typic Fluvaquents are in the Subirrigated, 10 to 14 inch ppt., Northern Plains range site.

278—Silhouette-Petrie clay loams, 1 to 6 percent slopes

This map unit is on alluvial fans. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,500 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days. This unit is 50 percent Silhouette clay loam and 30 percent Petrie clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 10 percent Absted fine sandy loam and 10 percent Zigweid loam. The Silhouette soils are very deep and well drained. They formed in alluvium derived dominantly from shale. The surface layer is typically grayish brown clay loam 2 inches thick. The upper 11 inches of the subsoil is brown silty clay. The next 10 inches is pale brown silty clay. The lower part of the subsoil, to a depth of 60 inches or more, is pale brown and light yellowish brown clay loam. In some areas the surface layer is clay. Permeability of the Silhouette soils is slow. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate. The Petrie soils are very deep and well drained. They formed in alluvium derived dominantly from sodic shale. The surface layer is typically grayish brown clay loam 3 inches thick. The upper 16 inches of the underlying material is light yellowish brown, very strongly alkaline clay loam. The next 12 inches is yellowish brown, strongly alkaline silty clay. The lower part, to a depth of 60 inches or more, is light yellowish brown, very strongly alkaline silty clay. In some areas the surface layer is clay. Permeability of the Petrie soils is very slow. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate saline and alkaline soils, but it is 5 to 15 inches for plants that cannot tolerate them. Runoff is slow and the hazard of water erosion is slight. The hazard of wind erosion is moderate.
310—Zigweid loam, 2 to 9 percent slopes

These very deep, well drained soils are on terraces and alluvial fans. They formed in alluvium derived from sandstone, siltstone, and shale. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,600 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

The surface layer is typically grayish brown loam 3 inches thick. The upper part of the subsoil is pale brown loam 11 inches thick. The lower part, to a depth of 60 inches or more, is light gray loam. In some areas the surface layer is very fine sandy loam.

Included in this unit are 5 percent Amodac very fine sandy loam, 5 percent Keyner fine sandy loam intermixed with the Zigweid soils, and 5 percent Haverdad loam on flood plains.

Permeability of the Zigweid soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, bluebunch wheatgrass, needleandthread, and big sagebrush. As the range condition deteriorates, big sagebrush and blue grama increase in abundance. As the range condition further deteriorates, annuals invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The Zigweid soils are only moderately well suited to livestock watering ponds because of the seepage potential and the slope.

This map unit is in capability subclass IVe, nonirrigated.

The Zigweid soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Amodac soils are in the Saline Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Keyner soils are in the Loamy, 10 to 14 inch ppt., High Plains Southeast range site. Inclusions of Haverdad soils are in the Loamy Overflow, 10 to 14 inch ppt., High Plains Southeast range site. In the east-central part of the survey area, the Zigweid soils are in the Loamy, 10 to 14 inch ppt., Northern Plains range site.

311—Zigweid-Theedle loams, 3 to 15 percent slopes

This map unit is on hills and adjacent alluvial fans. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,500 feet. The annual precipitation is 10 to 14 inches, the annual air temperature is 44 to 49 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Zigweid loam and 30 percent Theedle loam. The Zigweid soils are on foot slopes and alluvial fans with 3 to 9 percent slopes and the Theedle soils are on hillsides with 6 to 15 percent slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately.

Included in this unit are 5 percent Cushman loam on hillsides, 5 percent Forkwood loam on foot slopes and alluvial fans, and 10 percent Shingle loam on ridge crests.

The Zigweid soils are very deep and well drained. They formed in alluvium derived dominantly from sandstone and shale. The surface layer is typically brown loam 7 inches thick. The upper part of the subsoil is light olive-brown loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light yellowish brown loam.

Permeability of the Zigweid soils is moderate. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Theedle soils are moderately deep and well drained. They formed in slopewash alluvium and residuum derived dominantly from sandstone and shale. The surface layer is typically light brownish gray loam 2 inches thick. The underlying material is light brownish gray loam 34 inches thick. Soft shale is at a depth of 36 inches.

Permeability of the Theedle soils is moderate. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, bluebunch wheatgrass, needleandthread, and big sagebrush. As the range condition deteriorates, big sagebrush and rabbitbrush increase in abundance. As the range condition further deteriorates, annual forbs and cheatgrass invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in normal years. Production ranges from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The Zigweid soils are only moderately
APPENDIX E
September 14, 1999

Re: Water service for Thirty Three Mile Road S & I District:

Dear Board Members / Tom,

Pioneer Water & Sewer District Board, at their meeting last night reviewed your request for water service. After much discussion the following items were determined.

1.) Pioneer is willing to sell water to the Thirty Three Mile System. Pending your obtaining approval and/or concurrence from the Central Wyoming Regional Water System Joint Powers Board.

2.) Cost of water to be no more than one and one-half the rate charged Pioneer. (currently $.84)

3.) Tap fee for an eight (8) inch connection will be $11,100

4.) Pioneer will request that the line from the existing Pioneer line be no less than eight (8) inches and that this line to the point of metering be under Pioneer ownership.

5.) Pioneers' first preference would be that the System be maintained & operated by the Thirty Three Mile S & I Board.

6.) The second option: that they would be willing to discuss having this area join with the current Pioneer District.

Pioneer is willing to work with Thirty Three Mile to serve the users of both districts in the best possible manner.

If you have any questions regarding this please call.

Sincerely,

Steve Dobos, President
Delane Baldwin, V. P.
John Naquin, Secretary
A.L. Anderson, Treasurer
Bill Holder, Director
Floyd Field, Manager

thirty.ltr