EPA-908/5-77-002

DRAFT ENVIRONMENTAL IMPACT STATEMENT
JACKSON WASTEWATER TREATMENT SYSTEM
TOWN OF JACKSON, WYOMING

MAY 1977

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION VIII, DENVER, COLORADO 80203

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
JACKSON WASTEWATER TREATMENT SYSTEM
TOWN OF JACKSON, WYOMING

Prepared By

U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Approved by: _____
Regional Administrator

Date: May, 1977

SUMMARY SHEET

Environmental Impact Statement

Jackson Wastewater Treatment System
Town of Jackson, Wyoming

(X) Draft
( ) Final

Prepared by the U.S. Environmental Protection Agency, Rocky Mountain Prairie Region, Region VIII, Denver, Colorado with the assistance of James M. Montgomery Engineers, Inc., Boise, Idaho.

A. Type of Action: (X) Administrative
( ) Legislative

B. Brief Description of the Proposal:

The Region VIII Administrator of the U.S. Environmental Protection Agency intends to fund Federal matching funds for wastewater treatment for the Town of Jackson, Wyoming, through the authority of the Federal Water Pollution Control Act (as amended, 1972). The purpose of this draft Environmental Impact Statement (EIS) required of Federal agencies under the National Environmental Policy Act (NEPA, 1969) is to notify governmental agencies and the public of this impending project.

The problem is that the present facility does not have sufficient capacity to treat present or future wastewater flows adequately to meet prescribed discharge permit limitations developed under the Federal Water Pollution Control Act. Flat Creek currently receives wastewater from the existing plant and in-stream standards are being exceeded for bacterial contamination. Dissolved oxygen is sufficient presently to protect fish life but will not remain so if additional oxygen demanding wastes were discharged to the stream.

The Town of Jackson proposes to build a stabilization lagoon system in the State-owned South Park Elk Feedground five miles south of the town. Because this option has major legal difficulties in acquiring the land from the state, would adversely affect the elk herd, is located in a flood plain, and would have substantial secondary impact (the long sewer line, or interceptor would facilitate growth), EPA has decided not to fund this option.

C. Alternatives Considered:

Alternative systems include lagoon systems located at three other sites other than the Elk Feedground. Mechanical plants are evaluated including upgrading at the existing site or building a new mechanical plant approximately two miles west of the town. Another option of upgrading the existing plant to meet standards but with no reserve capacity is also considered. The No Action alternative is also evaluated as to costs and environmental impacts.

D. Environmental Impacts:

Water Quality of Flat Creek is being degraded by discharge from the present plant. This can be improved either by moving the discharge point to the Snake River where dilutional flow is available or by upgrading the quality of the effluent to Flat Creek. Land development in South Park is presently limited due to a high ground water table which limits the closeness of septic tank systems. The alternatives differ greatly as to the amount of land potentially developable along the central sewer and hence the secondary growth impacts of the various alternatives is of great importance. Protecting the scenic attributes of the pastoral setting of South Park is also an important objective and will be affected by the choice of alternatives. Construction of an outfall line to the Snake River (necessary for 5 of the 7 alternatives) is a major problem since the River is proposed for Wild and Scenic designation and the need to keep such a facility hidden from river users is considered necessary. Odor problems exist with the lagoon system since these systems will have noticeable odors especially during spring thaw.

E. Distribution:

The draft EIS is being provided to the following:

Local Agencies

Town of Jackson
Teton County 208 Planning Agency
Teton County Conservation District
Teton County Planning Commission
Jackson Planning Commission
Teton County Public Health Office

State Agencies

State Clearing House
Department of Environmental Quality
State Water Engineer
Wyoming Game and Fish Department
State Archeologist
University of Wyoming

Federal Agencies

U.S. Soil Conservation Service
Agricultural Stabilization and Conservation Service

Federal Agencies (Cont'd.)

U.S. Bureau of Land Management
Bureau of Reclamation
U.S. Army Corps of Engineers
Pacific Northwest River Basin Commission
U.S. Fish and Wildlife Service
U.S. Forest Service
National Park Service
U.S. Department of Housing and Urban Development
U.S. Energy Research and Development
Federal Energy Administration
U.S. Highway Administration
U.S. Department of Health, Education, and Welfare
Public Health Service
National Council on Environmental Quality
National Technical Information Service

Private Organizations

Wyoming Environmental Institute
The Nature Conservancy-Jackson Hole Project
Wyoming Field Institute
Jackson Hole Guide
Jackson Hole News
Sierra Club
Rocky Mountain Center on the Environment
Trout Unlimited
Colorado Open Space Council
The Wilderness Society
National Wildlife Federation
The Denver Post
The Rocky Mountain News
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James M. Montgomery Engineers
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F. Acknowledgements

Many people were helpful in the preparation of this EIS and EPA wishes to extend its appreciation to all who aided in its development. We would like to give special thanks to Ed Cryer of Montgomery Engineers, Duane Wroe and Don Stocker of the Town of Jackson, Gene Zeizel and Bob Abondi of the 208 Planning Agency, Don Armstrong of the Wyoming Department of Environmental Quality and the concerned citizens of Jackson and Teton County.

G. Draft Environmental Impact Statement filed with the National Council on Environmental Quality (CEQ) on: MAY 27 1977 .

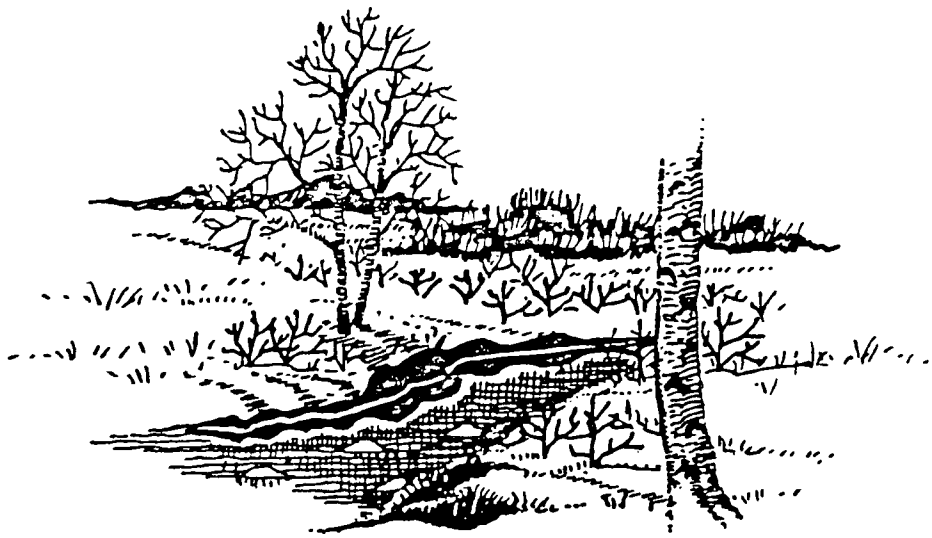
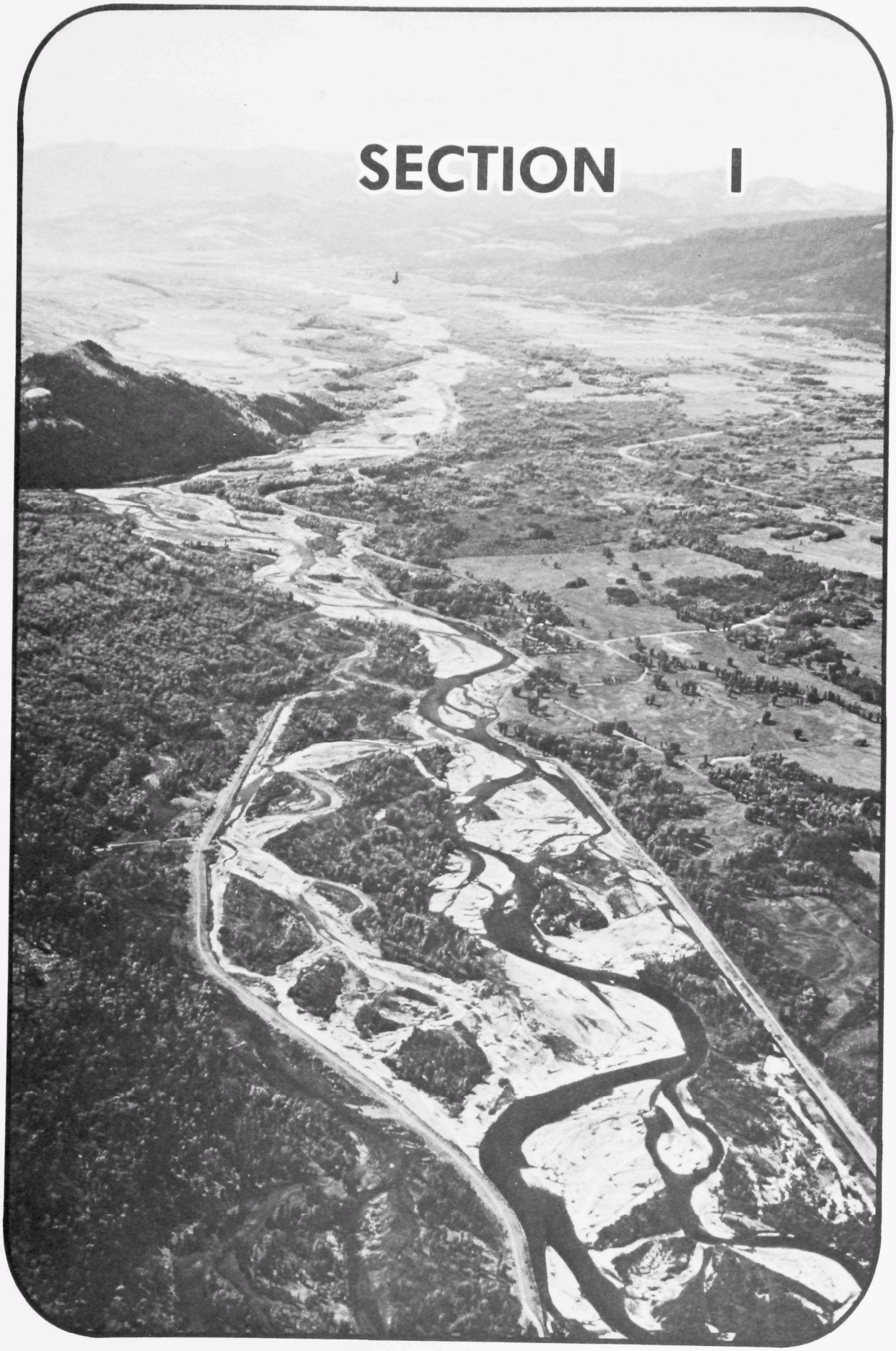


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION I



SNAKE RIVER FLOOD PLAIN

SECTION I

INTRODUCTION

LOCATION AND SETTING

The Town of Jackson is located in Teton County, east of the Idaho-Wyoming state line (Figures 1 & 2) in a valley generally known since the days of the early trappers as Jackson Hole. The valley is roughly delineated by Yellowstone Park to the north, Hoback Canyon to the south and the Teton and Gros Ventre mountain ranges on the west and east, respectively.

The region, as has been pointed out by numerous authors, offers one of the most spectacular visual experiences found anywhere in the United States. The most predominant features of the area are the Teton Mountains, which tower over the valley in a panorama of stark precipitous rocky forms, and a rich variety of subtle colors. The valley of Jackson Hole is approximately eighty miles long and fifteen miles wide offering a relatively smooth expanse of land cut by the Snake River, numerous creeks and subdrainages. Six morain lakes, Jackson Lake, Leigh Lake, Jenny Lake, Bradley Lake, Taggart Lake and Phelps Lake, are the result of glacial action and lie along the base of the mountains.

The service area for the Town of Jackson considered in this Study constitutes those areas presently serviced by the existing treatment facility and adjacent lands the town may wish to include after completion of the ongoing comprehensive planning study. Several serviceable growth areas adjacent to the town have been considered and are discussed in Section II under Land Use Planning.

The existing sewage collection system flows by gravity to the Wastewater Treatment Plant (WWTP) southwest of town. (See Figure 2)

Transportation to and from Jackson is available only by highway and air. Five general highway routes provide Jackson with a major link to the rest of the country--State Highway 22 from Idaho, U.S. 89 South, U.S. 189-187 East, U.S. 289-28 East and U.S. 287-89 North. One commercial airline has regularly scheduled flights to Teton County Airport. These flights, however, are restricted to smaller planes (approximately 50 passenger) due to the limited facilities at the Teton County Airport. There are no rail lines to provide bulk carrier services in the immediate area.

The economic activity of Jackson and vicinity is based primarily on tourism (scenic experiences, skiing, hunting and fishing) and agriculture. The two National Parks in the area, Teton and Yellowstone, and Teton-Bridger National Forest draw visitors from all over the nation with the Town of Jackson providing the bulk of the necessary services. Agriculture, and ranching in particular, while

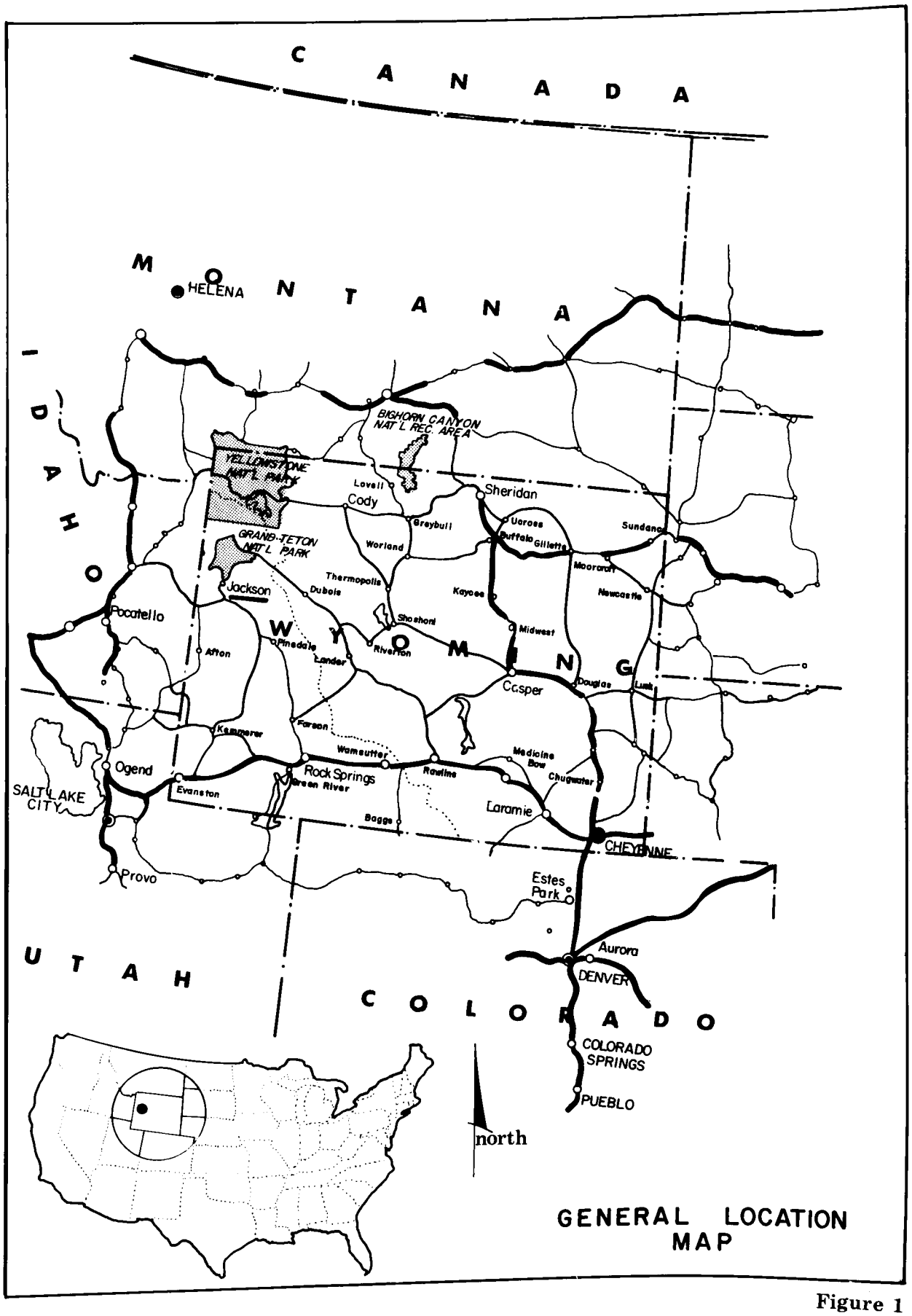
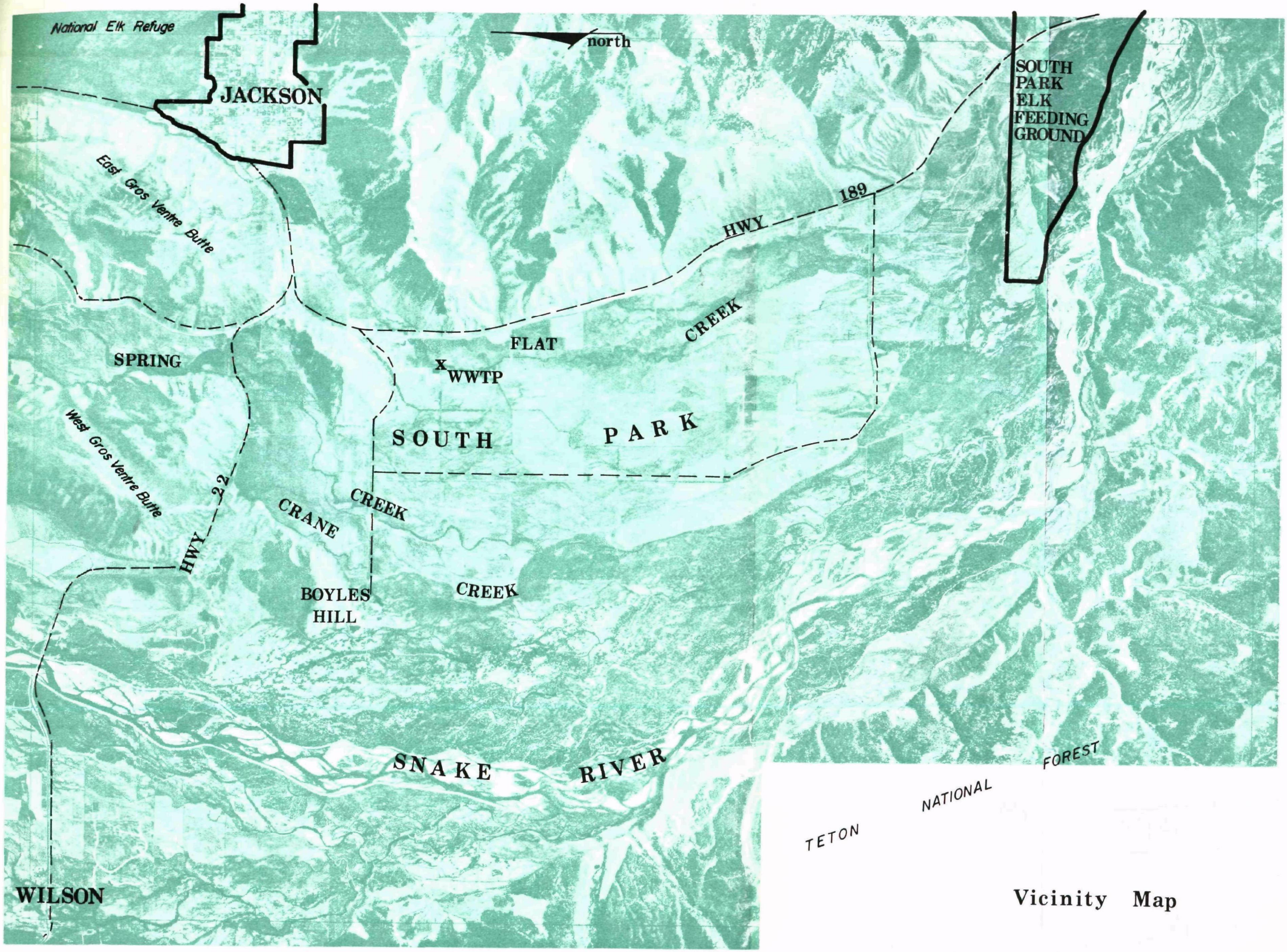

CANADA
MONTANA
HELENA
IDAHO
WYOMING
UTAH
COLORADO
BIGHORN CANYON NAT'L REC. AREA
YELLOWSTONE NAT'L PARK
GRAND TETON NAT'L PARK
Lovell
Cody
Sheridan
Greybull
Worland
Thermopolis
Jackson
Dubois
Pocatello
Afton
Pinedale
Lander
Riverton
Shoshoni
Kaycee
Midwest
Casper
Douglas
Lusk
Newcastle
Moorcroft
Sundance
Buffalo
Gillette
Kemmerer
Farson
Wamsutter
Rock Springs
Green River
Rawlins
Medicine Bow
Chugwater
Laramie
Evanston
Ogend
SALT LAKE CITY
Provo
Bagge
CHEYENNE
Estes Park
Aurora
DENVER
COLORADO SPRINGS
PUEBLO
north
GENERAL LOCATION MAP

Figure 1



Vicinity Map

Figure 2

smaller in total economic scope, is the traditional livelihood of the area, and in some form or other encompasses much of the privately held land in the valley. There are no significant industrial manufacturers in the community. The nontourist commercial activity is basically for support and maintenance of the resident population.

WATER QUALITY MANAGEMENT PROBLEMS

Present System Inadequacies

The Town of Jackson, in cooperation with Teton County, is currently in the final stages of developing their comprehensive plan to provide guidance for growth and development. A planning period of fifteen years (1990) was selected as a manageable time increment for generating an economic and environmentally sound plan for directing land uses in Teton County. In considering the difficulty of predicting growth and the pressures for development in an area such as Jackson, it was decided by EPA to utilize two alternative wastewater planning periods, fifteen and twenty years (1990 and 1995).

At present, only the Town of Jackson and limited areas to the southwest are provided with municipal wastewater services. The collection system was inspected in 1975 for inflow and infiltration, and it was determined by EPA that it would be cost effective to correct approximately 600,000 gal/day of the peak infiltration rather than consider providing capacity in any new facilities. Construction to eliminate approximately 75% of the infiltration and inflow will begin in the summer of 1977.

The existing treatment plant (discussed in detail in Section II) is an activated sludge extended aeration system designed for 0.8 million gallons per day (mgd) at ultimate capacity with effluent discharged to Flat Creek. The plant was to be upgraded in stages with sludge digestion and disinfection to be added when the system reached the necessary capacity. These additions were never made. A report on sewage facilities for the Town of Jackson prepared by R. D. Connell in 1973 concluded that given the existing hydraulic and organic capacity of the system, it was already overloaded with a maximum day flow of 1.34 mgd and a corresponding influent BOD of 130 mg/l. In 1976, the flow had exceeded 1.7 mgd (average day peak month) with a raw BOD over 120 mg/l. Connell's report pointed out a number of deficiencies in the system and suggested corrective actions, but no significant inplant modifications have been made.

In terms of instream water quality, three major problems or inadequacies with the present system are contributing to the degradation of Flat Creek. While these are discussed in more detail later, they include: 1) the inability to waste excess sludge from the clarifiers, 2) carryover of solid and organic matter from the polishing pond and 3) carryover of bacterial contamination. The State of Wyoming has recommended to the Town that several interim improvements be made to correct the causes of these three conditions. These interim modifications are discussed in Section IV.

Potential Problems

Teton County is undergoing growth pressures of the type seen in other recreation oriented communities across the country. The comprehensive plan, being prepared for the Town and County, is directing the majority of the new higher density residential growth in an area adjacent to the Town of Jackson. (In order to develop to the proposed densities, it will be necessary to provide centralized wastewater services.) High groundwater conditions, prevalent in most of the county, could create contamination and possible health problems in areas where septic systems and domestic water wells are in close proximity (i.e., high density nonsewered residential areas). Any additional flow to the existing system would only aggravate an already serious overloaded condition at the treatment facility and further endanger the water quality of Flat Creek. Therefore significant growth and expansion in Teton County is dependent upon the availability of new or expanded wastewater services.

Flat Creek Water Quality

Water quality information for Flat Creek has been available on a continuing basis only since the initiation of the Teton County 208 Project in the fall of 1975. This is areawide water quality planning funded by EPA under Section 208 of the Federal Water Pollution Control Act Amendments of 1972. The State has, through their 303(e) basin planning process, classified all major streams (including Flat Creek) in Teton County as Class 1 (suitable for a cold water game fishery), the highest possible designation. As stated in the Snake River Basin Water Quality Management Plan, "Flat Creek ... is the most critical stream segment in the Snake River Basin in terms of possible impairment of water quality." A number of potentially degrading point (direct discharges) and nonpoint source (diverse, indiscrete discharges) discharges threaten the stream quality from the National Elk Refuge north of Town throughout its entire length to the confluence with the Snake River along the southern edge of South Park. It was concluded in the State's analysis that at present the water quality of Flat Creek is quite high except directly below the sewage treatment plant, and that water quality throughout the immediate study area is exceptional.

The ongoing 208 project water quality monitoring activities have shown that the in-stream standards assigned to Flat Creek are being maintained with the exception of the coliform bacteria requirement which has exceeded the 1000 colonies/100 ml limitation at a South Park sampling point immediately below the treatment plant.

Flat Creek is considered by the Wyoming Department of Game and Fish as a stable cold water fishery. Little information is available as to its value, carrying capacity, or fisherman use, and since major access is limited by private land bordering the Creek, the Department does not try to manage its fishery resources as they would on waters open to the public.

It should also be noted that while available water quality records do not indicate any major degradation except below the treatment plant, studies now in progress on agricultural and urban nonpoint problems may provide evidence of sporadic increases in pollutants from storm runoff and spring overland flow. A more detailed discussion of Flat Creek water quality is presented in Section II.

Snake River Water Quality

The water quality of the Snake River, according to the State's basin management plan summary, is excellent in all streams within the Snake River Basin and meets or exceeds Wyoming's water quality standards. The main stem of the Snake River appears, from the limited data, to suffer some "slight deterioration" in a downstream direction. A combination of both natural and man oriented or at least aggravated activities have been pointed to as being the source of this degradation. In particular, the Water Quality Division of the Wyoming Department of Environmental Quality has recorded a number of water quality violations of the fecal coliform requirement (200 colonies/100 ml) below the confluence of Flat Creek. The overloaded condition of the Jackson wastewater treatment plant and its nondisinfected effluent discharging into Flat Creek are cited as the probable cause for these sporadic summer violations.

The Snake River, along its Wyoming course, has been nominated for inclusion in the National Wild and Scenic River System (P.L.90-542). The U.S. Forest Service, as lead agency, is initiating studies to determine if the Snake qualifies and what, if any, designation will be applied (i.e., wild, scenic, or recreational). If the river were to be classified under this system, a number of requirements and controls would be applied, including establishment of water quality standards that may exceed those of the State's, and restriction of construction projects (including municipal) that would impact on the scenic resources. It will be necessary that any wastewater facility (structures, outfalls, etc.), proposed by the Town of Jackson, be carefully reviewed by the USFS in order to determine if it would affect the potential classification and use of the Snake River as defined by P.L. 90-542. Their study is scheduled to be completed in 1979.

PROPOSED PROJECT BY THE TOWN OF JACKSON

The existing wastewater treatment facilities for the Town of Jackson were constructed in 1969 for a peak design population of 5,000. Excess summer infiltration, the addition of new service areas, and the popularity of Jackson as a vacation resort area have all contributed in exceeding design capacity in early 1971. Aggravating this situation was the lack of solids and sludge handling units, which were proposed for the existing facility but never completed. A 1973 report (R. D. Connell) was prepared for the Town detailing what modifications could be made to bring the system

into proper operating order for a proposed 1985 population equivalent. This report recommended that the Town install aeration equipment in the existing polishing pond, reduce infiltration, overhaul the raw sewage pumps, install skimmers and construct sludge beds. While several sludge bed modifications and a small mechanical aerator were installed subsequent to these recommendations, they really only compounded an already difficult problem. Funds were expended by the Town, but no significant improvement to the operation or treatment efficiency of the system was realized. The sludge beds were incapable of handling raw primary sludge at the necessary rate and the polishing pond aeration unit was too small and ineffective to do anything but disperse the solids accumulating in the pond.

In 1974, the Town, in seeking funding assistance from the U.S. Environmental Protection Agency, prepared a Facility Plan detailing the improvements necessary for the wastewater systems. Two significant actions resulted from this study. EPA agreed to fund a study of the inflow/infiltration problems of the collection system. This study was completed in 1975 and resulted in a federal grant to modify and improve the system which should eliminate up to 75% of the known infiltration. The second major action resulting from this report was the town council's rejection of the consulting engineers' recommendations to revise and upgrade the existing plant, and the preference of the council for a more capital expensive (e.g., 1975 Supplemental Report to the Facility Plan) alternative of an aerated lagoon in the South Park Elk Feedground.

As a result of this decision by the Town and the subsequent controversy this has created, the U.S. Environmental Protection Agency has found it necessary to prepare an Environmental Impact Statement on the proposed project and its alternatives. The major controversies which have arisen include:

1. Use of the South Park Elk Feedground site and the probable impacts this may create.

2. The secondary growth that the interceptor running through South Park may facilitate.

3. The impact the proposed project would have on the county comprehensive planning effort now being prepared.

4. The validity of the cost of the proposed project presented in the 1975 supplement to the facility plan and the cost effectiveness of a lagoon at the South Park Elk Feedground.

This document examines the proposed project and the likely and feasible alternatives in terms of their environmental, social, cultural and economic impacts on the Jackson area. It presents the necessary information required by the National Environmental Policy Act through which a decision can be made as to whether the federal government can assist in funding the proposed facility. The Environmental Impact Statement process, and the assessment of

environmental impacts must not be an end in themselves, but a logical and reasonable step in the planning and deliberation leading to a final decision to protect water quality and public health in the Jackson area.

EPA DECISION AND RESPONSIBILITY

EPA and State of Wyoming Authority

EPA approval of the facility plan and this EIS will mean that 75% of all eligible costs will be made available to the Town of Jackson under provision of the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500. The State of Wyoming Department of Environmental Quality (WDEQ) must approve of the discharge limitations and issue a permit under the National Pollution Discharge Elimination System (NPDES) to assure compliance with such limitations and with a compliance schedule for completing construction. The Wyoming DEQ must also certify the facility plan and transmit it to EPA for funding. Therefore, both EPA and the state DEQ will have to concur on the decision in order to fund Jackson's sewage treatment facility.

History of Events Regarding The Jackson Facility Plan

This section outlines the state, local, and EPA actions regarding this facility plan and the decision to prepare an environmental impact statement.

A Step I grant to the Town of Jackson authorizing the development of a facility plan was approved by EPA in March, 1974, in the amount of $46,500. The firm of Nelson, Haley, Patterson and Quirk, Inc., (NHPQ) was hired by the town to complete this function. Their initial studies indicated the need for an extensive inflow and infiltration (I/I) study to analyze sewer line problems. An additional $47,250 was authorized by EPA for this purpose--total Step I funds were $87,750.

By October, 1974, the plan was completed and delivered to the city. The plan, which only analyzed treatment needs to 1985, recommended as the most cost-effective alternative an extended aeration treatment plant at the present plant site, approximate capital cost of $1.5 million. The plan recommended as the second preferred option a similar plant west of the town near Boyle's Hill, approximate cost $2.9 million. As a third option, the plan stated a waste stabilization lagoon could be built 4.5 miles south of town which would allow gravity service to all of the undeveloped South Park, approximate cost $1.8 million. This site is located in the Snake River floodplain on the Wyoming State Elk Feedground. The plan by NHPQ fully recognized the disadvantages of this South Park site. Among these are: 1) adverse impact to the elk feeding area and the controversy of securing Wyoming Game and Fish property; and

2) interceptor placement in the undeveloped, uniquely scenic South Park, creating growth pressure.

After the city's November, 1974 hearing on the plan, the city requested NHPQ to re-evaluate the comparative costs of the treatment plant at the present site versus the South Park lagoon. NHPQ's January 5, 1975 facility plan supplement stated the South Park site would suffer a 17% inflation cost because it would be constructed at a later date than other alternatives. The supplement concluded that the total annual equivalent costs (all operation and maintenance costs plus debt retirement) of upgrading the existing treatment plant were less expensive than the South Park lagoon.

A letter to the city from EPA in October, 1974 indicated that an EIS would probably be required if the decision were to use the South Park Elk Feedground location. The city received the January, 1975 supplement but was unable to make an immediate decision concerning alternative selection.

An NPDES wastewater discharge permit was issued to the Town of Jackson on April 30, 1974 by the Wyoming DEQ. One of the requirements of the permit was the submittal of a compliance schedule which outlined steps to be taken to meet permit effluent limitations which are the attainment of secondary treatment by July 1, 1977 as mandated by P.L. 92-500.

Jackson's compliance schedule was approved by the State of Wyoming on March 24, 1975 as follows:

(1) Preliminary Plans - June 1975;
(2) Final Plans - September 1975;
(3) Award Contract - October 1975;
(4) Commence Construction (on/or before) - April 1976;
(5) Complete Major Construction - June 1976;
(6) Complete All Construction - August 1976; and
(7) Operational Status - September 1976.

Following delays in submittal by the city, the State of Wyoming Department of Environmental Quality issued a Notice of Violation to Jackson on November 4, 1975 requiring the submittal of items (1) and (2) of the above schedule within thirty (30) days.

The Town of Jackson replied to the State-issued Notice in a letter dated November 18, 1975. Jackson's reply indicated that the Town Council did not agree with the Step I Facility Plan prepared by their consulting engineer, NHPQ, and that the Town Council had approved the South Park location on or near the State Elk Feedground.

EPA officially received the facility plan and the city's recommended alternative on January 3, 1976. EPA's Operation and Maintenance staff completed an inspection of the facility on January 15, 1976. On January 30, 1976, EPA's Regional Administrator, Mr. John A. Green, gave his approval to prepare an environmental impact statement

based on the expected public controversy and expected adverse environmental impacts regarding the approval of the South Park Elk Feedground site.

In February, 1976 during consideration as to when an EIS for the Jackson facility plan should begin, EPA was informed that a county-wide comprehensive plan was currently under preparation. In July, 1975 EPA authorized a grant to Teton County under Section 208 of P.L. 92-500 for the purpose of developing areawide wastewater control plans. Since these two studies were currently underway and a decision of new or expanded facilities partly depended upon the results of these studies, EPA decided to delay the EIS so that data from the 208 Study and Comprehensive Plan would be available. Consequently, on July 23, 1976, EPA hired the firm of James M. Montgomery Engineers of Boise, Idaho to assist the agency in preparing the EIS. The total contract cost to Montgomery Engineers for this EIS was $38,500. A "Notice of Intent to Prepare an EIS" was issued by EPA on August 26, 1976 and mailed to all interested individuals and agencies.

EPA and the State agreed to separate the approval of funds for the rehabilitation of Jackson's sewers (i.e., the correction of infiltration-inflow problems) from the EIS. This was done since the sewer rehabilitation portion of the project was not controversial and was necessary regardless of the final selected alternative. Consequently, on June 9, 1976, EPA issued a negative declaration on the sewer rehabilitation portion of the project and a Step II grant was awarded on June 30, 1976, in the amount of $28,125.

Determination of Site Selection and Treatment Capacity

The Town of Jackson has asked EPA to approve its site selection in the State Elk Feedground at a capacity sufficient to handle expected 1985 flows. Based on the known environmental and public controversy associated with this site, EPA determined that an environmental impact statement was needed. This draft EIS is issued to facilitate public views on the project, to update engineering cost data from the out-of-date 1974 facility plan, and to include several other site alternatives. It is the intention of EPA to obtain a concensus decision on the treatment alternative from the majority of the public, the city, the Wyoming Department of Environmental Quality, and concerned local, state, and federal agencies.

Options Available to the Town of Jackson

A. Maintain choice of South Park Elk Feedground site but update design capacity to either 1990 or 1995 flows and request EPA funding.

B. Select another of the five alternative site options at either the 1990 or 1995 flow design capacity and request EPA funding.

C. Decide only on interim upgrading of the existing site to meet 1977 permit conditions and request EPA funding.

D. Decide to build or expand a wastewater treatment plant at their own expense.

E. Decide to take no action to expand or upgrade the facility.

Options Available to the State of Wyoming

A. Approve the Town's proposed plant site and reissue compliance schedule and new NPDES permit.

B. Deny approval of the Town's proposed plant site based on adverse environmental impacts or unsound engineering but still issue new NPDES permit with new compliance schedule.

C. Approve one of the five alternatives or interim upgrading and reissue NPDES permit with new compliance schedule.

D. If the Town cannot or will not meet new NPDES permit and compliance schedules, issue a tap ban on new construction and/or daily fines until the Town does so comply.

Options Available to EPA

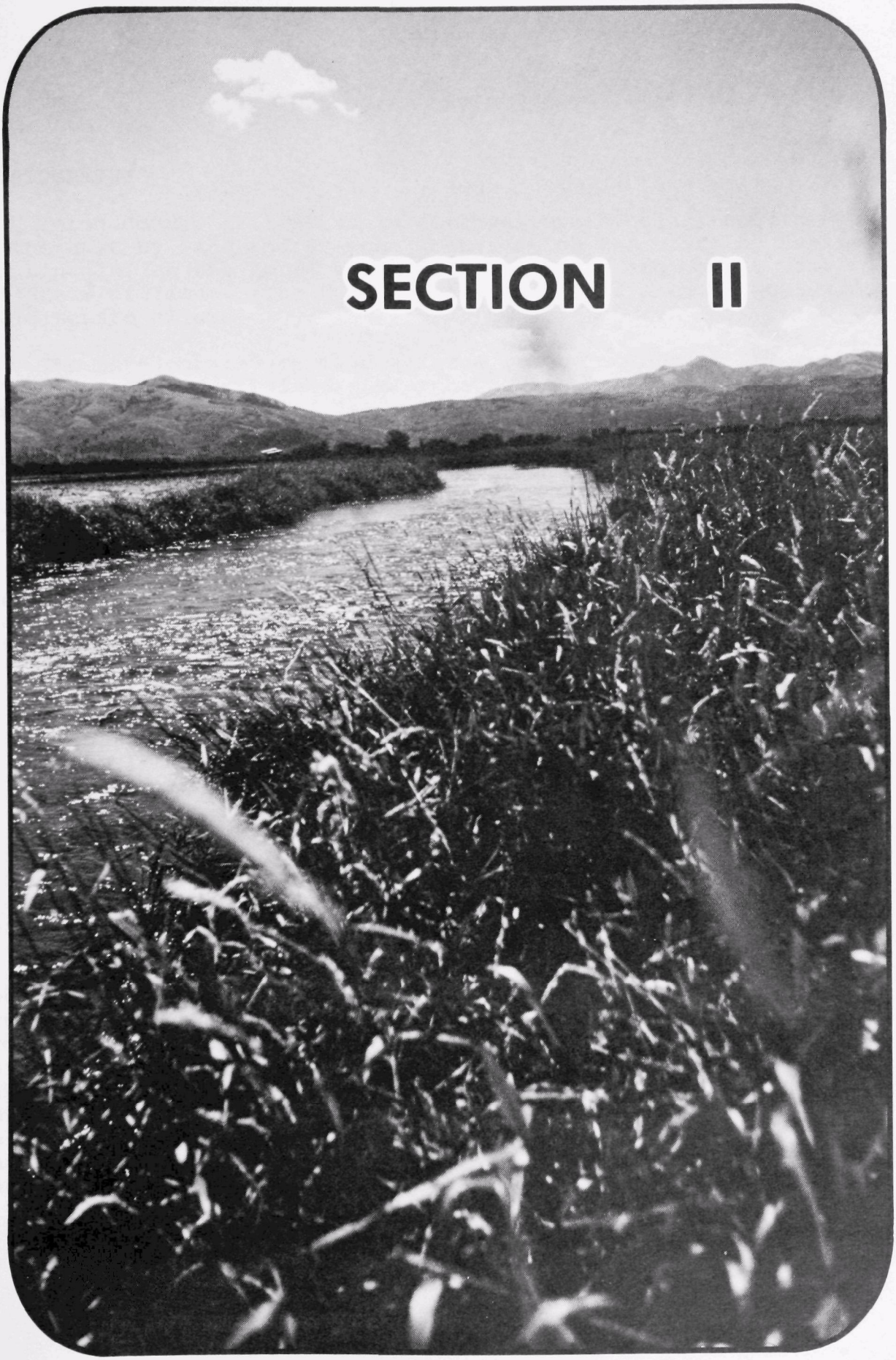
A. Approve the South Park Elk Feedground site. Approval of this site would mean some adverse impact to the elk herd wintered there, requiring a complicated and controversial land exchange, require construction in the 100-year flood plain and has the secondary effect of facilitating growth in the scenic South Park area. EPA does not intend to approve this site location at this time.

B. Approve another of the five alternative site options at 1990 or 1995 capacity. If there were still a significant amount of adverse secondary impacts due to residential growth associated with the site selection following evaluation of agreed-to mitigation measures, EPA could suggest re-evaluation of the site. If EPA agreed that mitigation measures were sufficient to protect from adverse growth effects, EPA could approve the site. If EPA determined that proposed mitigating measures by the community are insufficient, then EPA could impose grant restrictions (such as limiting residential taps along the interceptor) and then approve the site.

C. EPA could approve funding for population projections for 1990, 1995, or some other year. These population projections are based on an historically very rapid rate of growth of 6% per year. If EPA determined that the city's request was for unjustified excess capacity, EPA could set the design year flow.

D. If the preceding options were not acceptable to the Town of Jackson, EPA could deny funding. If there were still substantial adverse impacts following an evaluation of all agreed-to mitigation measures and none of the preceding options were acceptable to the Town of Jackson, EPA could deny funding of the project. Since the Wyoming DEQ is likely to pursue permit compliance, such an action would possibly force 100% local funding. If 100% funding were unavailable and no action were taken, the community would not meet water quality objectives.

If EPA is unable to achieve a concensus, EPA will make it known what treatment options are environmentally, engineeringly, and economically feasible. The Wyoming DEQ will then be able to reissue the notice of schedule of compliance, and the city will have to select one of the approved alternatives. If the city is unable to make a selection, EPA will notify them which solution is preferable to EPA and the town will be asked to respond. EPA would only approve the facility plan following at a minimum of 30 days after issuance of the final EIS, provided that the city agrees to one of the feasible alternatives. This action will allow the city to request funds to design the facility. Following EPA and State approval of design work, the city will be authorized to let construction bids. Seventy-five percent of costs eligible items will be paid to the city for both design and construction of the sewage treatment facilities. If current schedules are met, construction could start the spring of 1978 and the plant could begin operations by late 1979 or early 1980.


SECTION II

SECTION II

EXISTING ENVIRONMENT

PHYSIOGRAPHY

Teton County is located in northwestern Wyoming, and is bounded on the east by Park and Fremont Counties, on the south by Sublette and Lincoln, on the north by Yellowstone Park, and on the west by the State of Idaho. The County contains a land area of approximately 2,873 square miles.

The physiography or land surface of the County is the result of geologically controlled phenomena, which continue to shape the land even today (Love and Reed, 1968). The Teton Range which lies on the western side of the County, is a product of four geologic factors: a) hard granitic rocks; b) vertical uplift; c) recent mountain-making movement; and d) the dynamic forces of wind, water and temperature. The Range is short, narrow and jagged, forming the western rim of Jackson Hole.

Other mountainous areas include the Yellowstone Plateau to the north, Pinyon Peak and Mount Leidy Highlands to the northeast, the Gros Ventre Range to the south and east, and the Hoback and Snake River Ranges to the south.

Jackson Hole lies in the center of Teton County. Surrounded by mountains, the basin was formed by land movements along faults such as the Teton Fault (Love and Reed, 1968). The basin is oriented in a north-south direction, sloping from 7,000 feet in the north to 6,000 feet in the south.

Most of the valley floor in Jackson Hole, because it is surrounded by mountains, was formed by deposition of gravel from alluvial outwash. Other lands like the low terraces near Wilson and the Snake River flood plain are relatively recent flood plains still being modified by the Snake River.

The town of Jackson is located in the southeast corner of Jackson Hole. Most of the population and activity of the County are located here. The valley floor is crossed by the Snake and Gros Ventre Rivers near Jackson. The valley also contains the largest, and some of the most scenic lakes found in the state. Jackson Lake, located just north of Jackson, is the third largest lake in the state with a capacity of some 846,000 acre feet. Jenny Lake, Leigh Lake, Taggart Lake and Phelps Lake, are all within Grand Teton National Park and all are the result of glacial activity, and enhance the area's scenic attributes.

GEOLOGY

The geologic background of the Jackson Hole area, although relatively new, is diverse and complex. The Tetons were probably formed between eight and ten million years ago, carved from a segment of the earth's crust that had been uplifted along the Teton Fault. Numerous active faults traverse the Jackson Hole area, as evidenced by frequent small earthquakes in the Teton region. These mountains border the west side of the study area, rising to elevations in excess of 13,770 feet.

The Teton Range is composed mainly of crystalline and metasedimentary rocks of Precambrian age (hard metamorphic and igneous rocks), flanked by Palezoic and Carboniferous sedimentary rocks including limestones, shales and sandstone (Love and Reed, 1968). Younger Mesozoic sedimentary rocks occur in the Buffalo and Gros Ventre River drainages which form the mountains and highlands to the east of Jackson Hole, including the Mount Leidy Highlands and the Gros Ventre Mountains, while the East and West Gros Ventre Buttes are remnants of the older Teton-Gros Ventre Mountain range which was fractured and destroyed by the faulting of the more recent Teton Mountains.

Glaciers sculptured all sides of Jackson Hole. The glacial features and the evidence of glacial remains are still prominent in the area. Downfaulted Jackson Hole is floored with Cretaceous and Tertiary rocks, which are covered at the north end by glacial till and outwash. These glacial materials were deposited by at least two sets of glaciers: the alpine glaciers flowing from the Teton Mountains and the intermontane glaciers which moved south from the Yellowstone Plateau. The oldest glaciation was the most widespread, and the ice in many places was 2,000 feet thick. Later glaciations eroded or covered parts of the deposits of earlier ones. Even today, the "Hole" continues to drop and tilt; gravel covered surfaces that originally sloped southward are now tilting westward toward the mountains.

Hazardous Geological Conditions

Although geologic records indicate that the origin of the Tetons began about nine million years ago, the violent geologic processes which shaped the physiography of the Teton Range and Jackson Hole continue to exert their dynamic influence on the physical character of the area. Teton Glacier, for example, moves nearly 30 feet each year, scouring the valley bottom and walls. Water pours from melting ice near the lower end of the glacier, depositing outwash onto the valley floor. The Teton and other numerous faults which break the valley floor between the Gros Ventre River and the Town of Jackson remain active, as evidenced by frequent small earthquakes in the area. The Snake River west of Jackson continues to meander westwardly toward the town of Wilson. All of these processes exemplify the continuing geologic activity in the area. These

processes also present a constant reminder of the geological hazards which confront development in the Jackson Hole area.

Physical hazards that exist in the study area are generally of four types and include: 1) faults and associated seismic dangers; 2) slope stability; 3) high ground water problems; and 4) flooding.

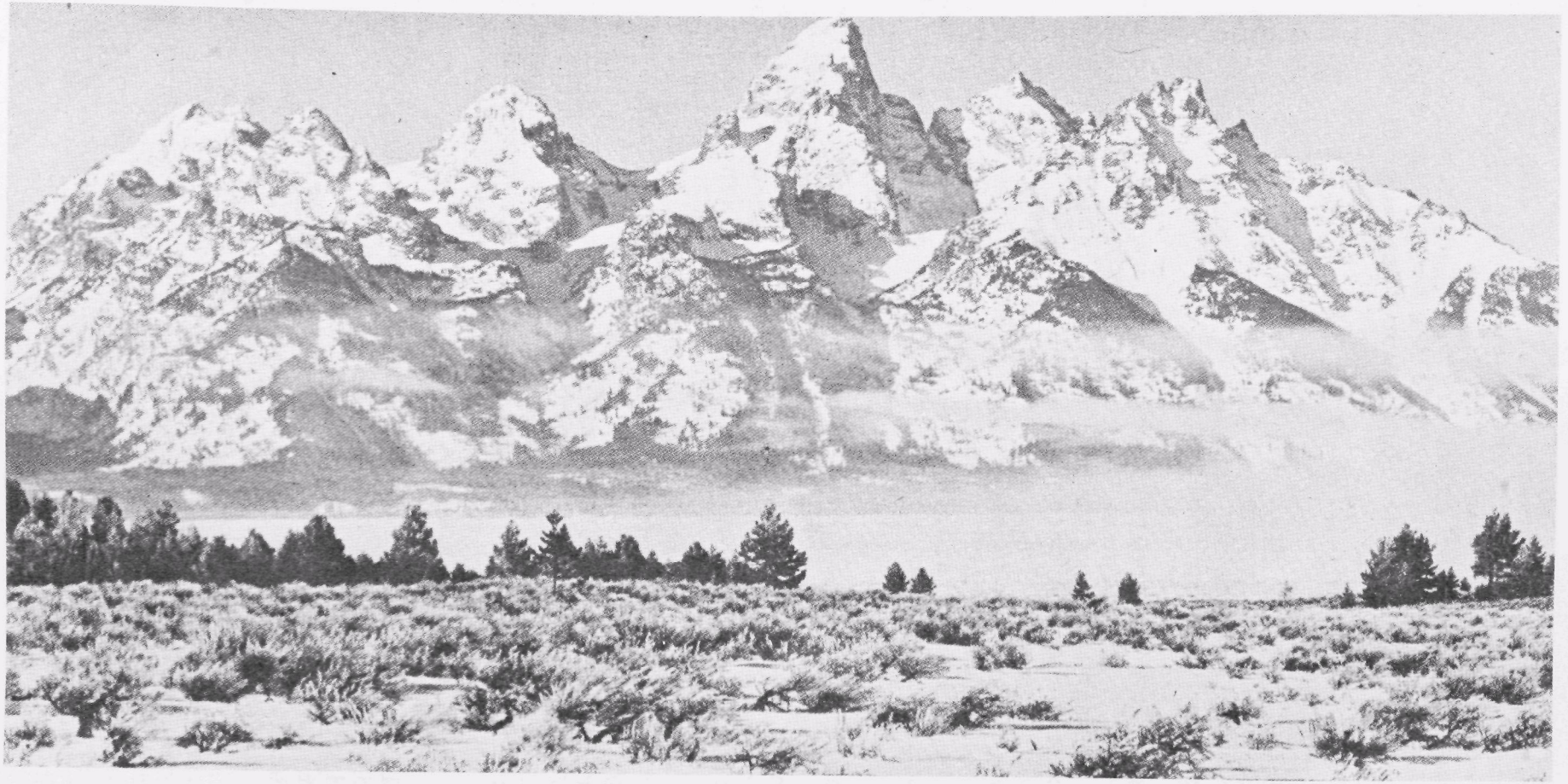
Fault Zones and Seismic Risk

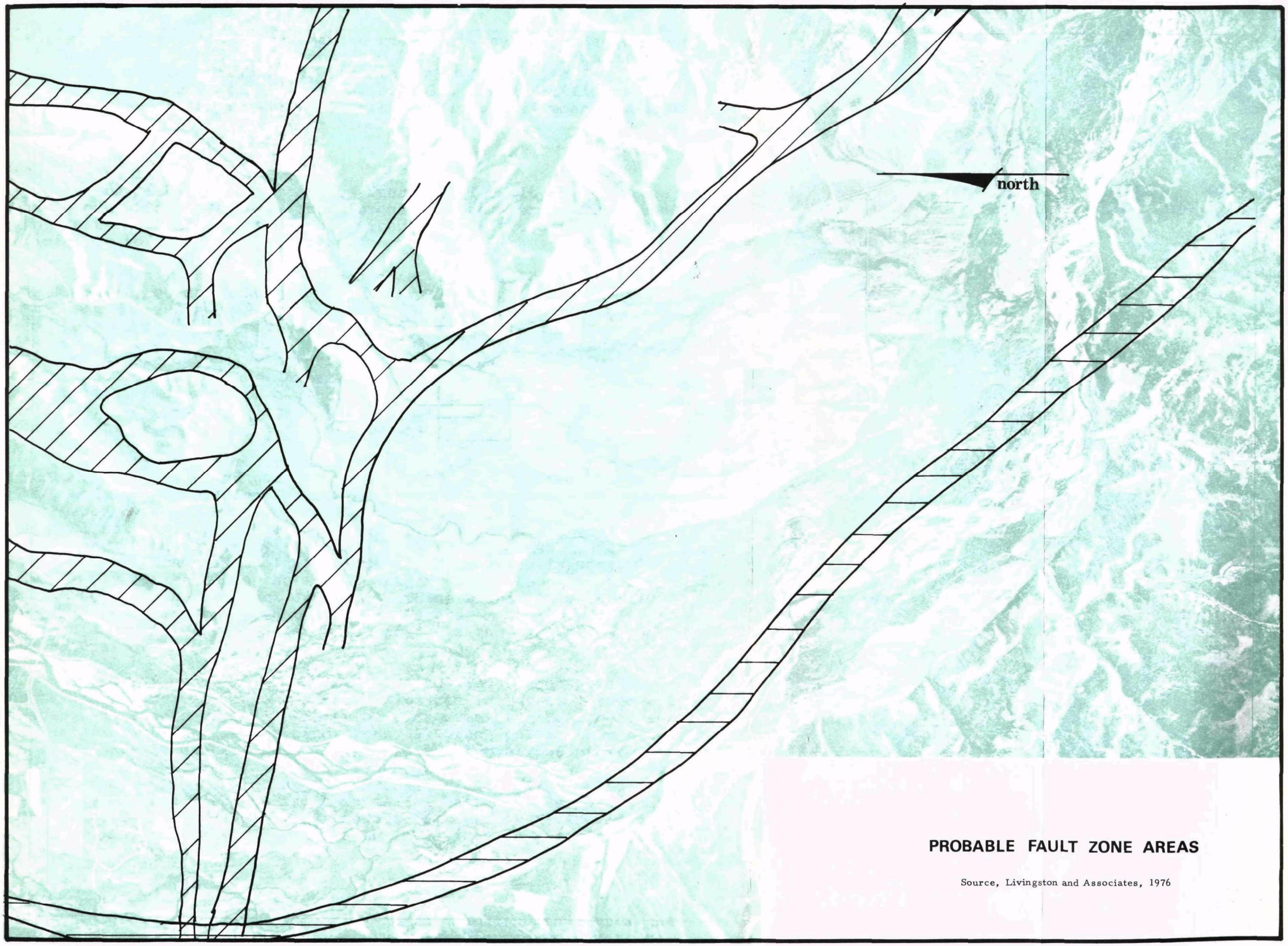
Seismic risk is the most difficult to evaluate of all the geologic hazards. Earthquakes cannot be prevented or predicted in terms of frequency or intensity.

The Jackson Hole area is considered among the most active regions in the United States in terms of seismic activity. The "Hole" was formed by land movements along faults such as the Teton Fault, which runs south from Jackson Lake along the Snake River flood plain. The area is also characterized by a number of active and inactive faults which criss-cross the valley floor, including the Flat Creek Fault which runs in a southwesterly direction along the Flat Creek flood plain through the town of Jackson, and the Buck Mountain Fault which lies west of the main peaks of the Teton Range.

The Jackson area has been subjected to numerous minor quakes, along with several major activities. These include the 1927 event which centered near Kelly resulting in six deaths and total destruction of the town by flooding and the 1959 Yellowstone disaster which inflicted major damage and caused 28 deaths. According to U.S. Geological Survey data supplied by the NOAA Environmental Data Service in Boulder, Colorado the area within a 100 mile (160 km) radius of Jackson has been subjected to 28 earthquakes of the magnitude of V or greater (Modified Mercalli Scale) in the past 70 years. Earthquakes of this magnitude, although depending on a number of factors including distance from the epicenter and distance to the surface, can generate ground motions sufficiently severe to be potentially damaging to structures. For magnitudes less than V the ground motion is unlikely to be damaging because of very short duration and moderate acceleration.

Leopold and Twiss (1975) in compiling information for the comprehensive land use plan have identified the major fault zones occurring in the study area to be considered in future land use/development decisions (Figure 3). In general, faults in the Jackson area are usually located adjacent to slopes, as shown in the mapping. Zone widths of 1000 feet have been identified as areas where damage can be expected should there be movement along an existing fault. Expected losses along these zones include direct damage to structures, utilities and roads, structural collapse and settlement, and most importantly high danger to occupants. Although the map is somewhat general, the information should be considered in any planning, design and development in the Jackson Study Area.





PROBABLE FAULT ZONE AREAS

Source, Livingston and Associates, 1976

Figure 3

For example, seismic damage can be reduced by avoiding development on fault zones and steep slopes, and by requiring minimum materials standards for foundations and structures as identified in the 1976 Uniform Building Code. Hospitals, schools, public utilities, fire stations, and bulk storage facilities for liquid flammable substances should be designed to exceed minimum standards.

Slope Stability

Slope stability is a complex function of geologic structure and geomorphic processes. These processes can exert an influence so great that the inherent properties of rocks are altered sufficiently to cause slope failure.

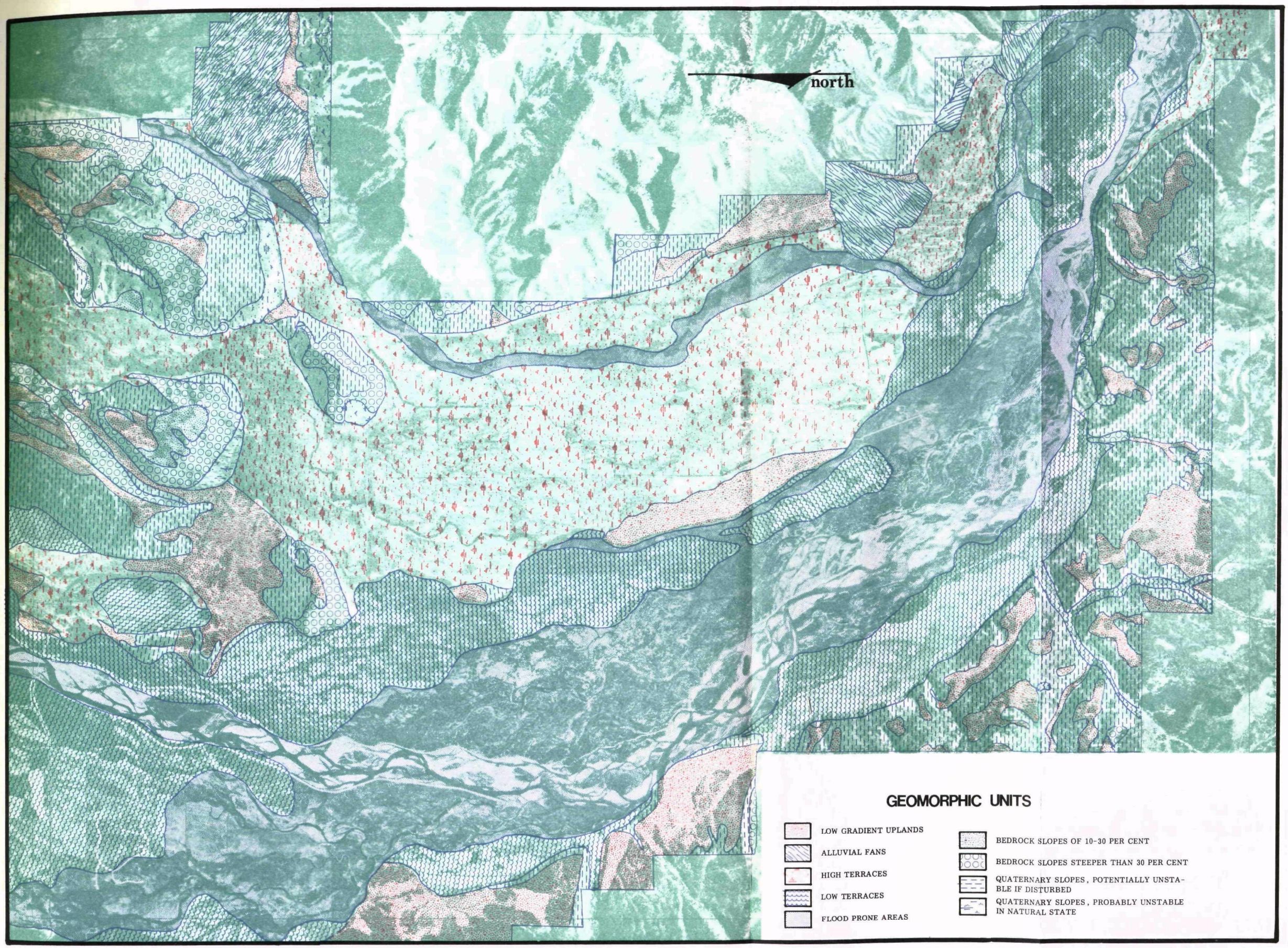
Slope failures in the Jackson area, not related to earthquakes or flooding, occur in response to internal and external factors that can act separately or in combination with sufficient magnitude to overcome the cohesional strength of the material. Internal factors include the inherent strength of the rock type and volume percent of swelling clay materials present, and degree of saturation and consolidation of the material. External factors include effects of erosion, amount of precipitation and infiltration, natural or artificial over-steepening or heightening of slopes, and removal of support at the base or toe of slopes.

Problems in the study area caused by action of these factors include rock falls and avalanching of bedrock on slopes steeper than 30%, and massive erosion in similar areas where vegetation has been disturbed by roads constructed without taking proper measures to control soil erosion and localize slope failure (Haible, 1976). These areas lie primarily west and southwest of Jackson, near Boyles Hill and the bench east of Flat Creek. Many naturally unstable slopes also exist along the east flank of the Snake River below South Park and near Hoback Junction. These slopes have been identified in mapping prepared by Haible (Figure 4) and generally are not suitable for any land use which disrupts the vegetation, soil, or natural drainage system.

Slope failures in the Jackson area induced by earthquakes, as previously mentioned, are commonly initiated in direct response to earthquake shocks of an intensity of V or greater. Failures caused by seismic activity in the study area, although potentially widespread, have in general been limited to bedrock slopes greater than 30% and Quaternary alluvial slopes which run along the bench south of Jackson and east of Flat Creek (Haible, 1976). These areas correspond with the fault zones delineated by Leopold and Twiss (1975). Any development proposed for the areas should be limited and subject to detailed site investigation prior to establishing firm design criteria.

High Groundwater

The geologic hazards occurring in the Jackson Study area that relate to groundwater exist primarily in the form of moderate to



Source, Livingston and Associates, 1976

Figure 4

poorly drained soils in the lowland areas south of Jackson where groundwater levels are less than five feet below the ground surface. Saturated or near-saturated soil conditions in those areas immediately adjacent to and within the Flat Creek and Snake River flood plains have created some water quality problems due to malfunctioning septic tanks. Individual waste disposal in those areas serviced by conventional septic tanks with soil absorption systems or leach fields can create two kinds of environmental problems. First, if wastewater is added to the local groundwater at a rate faster than the groundwater is naturally drained out of the drainfields by subsurface flow, the local groundwater level will rise and prevent proper treatment of the wastewater. Second, if wastewater disposed of in these systems is not completely treated biologically and chemically before it joins the groundwater, contamination of the shallow groundwater aquifer, adjacent surface water and possibly even the regional groundwater reservoir could result.

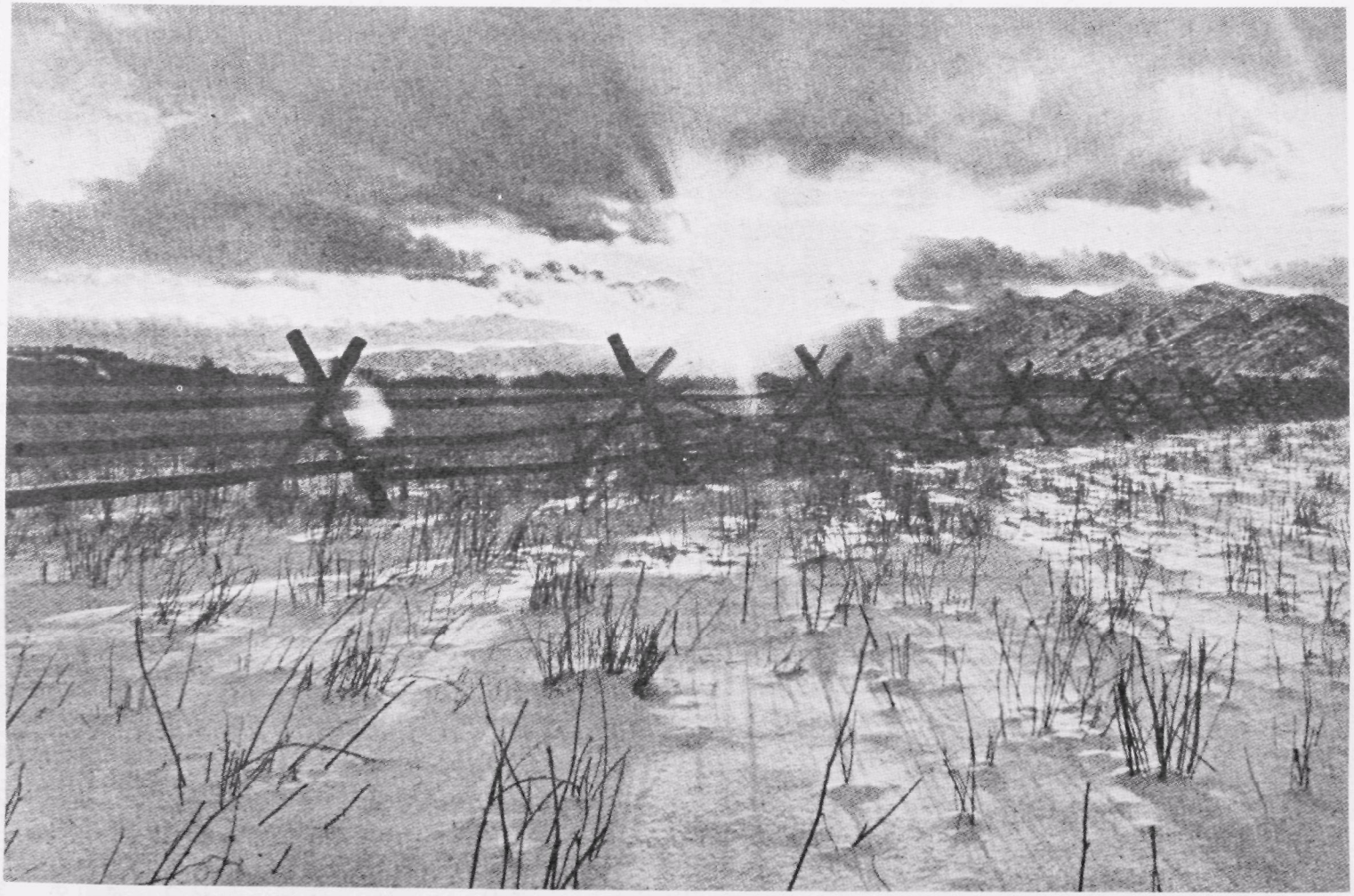
Haible (1976), utilizing data from the U.S. Soil Conservation Service and the U.S. Geological Survey, has mapped the Jackson Study area (Figure 5). He classified four categories of groundwater levels existing at or near the surface and differentiated suitable from unsuitable areas for septic tank operation. Much of the area designated as poorly drained lowlands with ground water levels generally less than three feet below the surface is located in the study area. Haible indicates that in addition to the shallow ground water in these areas, the physical features of the region including thin, poorly drained soils and inadequately low soil percolation rates may preclude these areas from consideration in developing high concentration of individual soil absorption systems. It should also be noted that officials from the U.S. Soil Conservation Service and the Wyoming Department of Environmental Quality (WDEQ) have indicated some concern over locating pipelines in these areas without taking into consideration frost problems and potential breakage associated with "wet zones" in these poorly drained soils.

Flooding

Floods are a natural and normal occurrence. Typically, a stream will occupy some portion of its flood plain area about once every two or three years, while greater floods occur on less frequent intervals.

Increasing urbanization throughout the United States has continued to result in urban development being allowed to pre-empt the natural floodways and flood plains of streams and rivers, often without regard to flood hazards and concomitant dangers to property, health and life. This trend is evidenced by the fact that while over $25 billion have been spent on structural flood control measures since 1920, national losses have continued at an increasing pace.

The Snake River dominates the western portion of the Jackson study area. While its waters are important to the area for irrigation and recreation and provide an important element of the scenic



north

GROUND WATER CATEGORIES

WELL DRAINED HILLSLOPES WITH SLIGHTLY TO HIGHLY PERMEABLE SOILS AND WITH GROUND WATER LEVELS GENERALLY MORE THAN FIVE FEET BELOW THE SURFACE

WELL DRAINED LANDS UNDER 10 PER CENT SLOPE WITH MODERATELY TO HIGHLY PERMEABLE SOILS, AND WITH GROUND WATER LEVELS GENERALLY MORE THAN FIVE FEET BELOW THE SURFACE

MODERATELY DRAINED, NEARLY LEVEL LOWLANDS WITH MODERATELY PERMEABLE SOILS, AND WITH GROUND WATER LEVELS GENERALLY THREE TO FIVE FEET BELOW THE SURFACE

POORLY DRAINED, NEARLY LEVEL LOWLANDS WITH LOW SOIL PERMEABILITY, AND WITH GROUND WATER LEVELS GENERALLY LESS THAN THREE FEET BELOW THE SURFACE

Source, Livingston and Associates, 1976

Figure 5

qualities of Jackson Hole, a major portion of the land west and a relatively wide area east of the River are subject to flooding. Portions of Flat Creek which runs south through the Town of Jackson are also subject to less frequent but periodic winter flooding caused by ice blockages. Because of the frequency and severity of flooding in portions of the Jackson Study Area the flooding situation and flood hazards will be discussed in detail later in this report.

Geohydrology

Groundwater is used in the Jackson area for irrigation, domestic and industrial supplies. Most of the irrigated area lies east of the Snake River and southwest of Jackson. Although most of the Jackson area farmland is irrigated by surface waters, irrigation water is also pumped from two irrigation wells near Jackson (Cox, 1975). Domestic water is pumped from three wells northeast of the Town of Jackson. Rural residences divert water from springs and pump water from wells. Water for the Jackson Fish Hatchery is pumped from wells and piped from nearby springs.

Aquifers in the Jackson area are recharged by precipitation and by waters from streams. Snowmelt and precipitation percolate to the water table and during periods of high runoff recharge the aquifer. As streamflow declines, the hydraulic gradient reverses adjacent to gaining streams but remains toward the aquifer adjacent to losing streams. Recharge to the groundwater systems is greatest in late spring and summer, owing to the combination of melting snow, rainfall and high streamflow. Recharge also occurs in the southern portion of the Jackson study area in the form of percolation from irrigated lands, canal and ditch leakage. Aquifers in the Jackson area are also recharged from discharge of one aquifer to another, particularly in faulted areas.

Groundwater movement in the Jackson area is downgradient from areas of recharge to areas of discharge, according to Cox (1974). Groundwater in alluvium and glacial deposits in the Jackson Study Area moves toward the Snake River, but parallel to or away from Cottonwood and Fish Creeks and the Gros Ventre River. Stream gains generally occur upstream of Jackson, gradually decreasing as surface elevations decrease and the valley floor narrows in the lower South Park area.

Although the alluvial groundwater deposits are over several hundred feet in many portions of Jackson Hole, as mentioned earlier in this discussion, an important consideration relative to groundwater as it pertains to planning and design projects is the high groundwater levels in the poorly drained soils and lowland areas southwest of Jackson. Shallow groundwater areas of levels less than 3 feet near and around Jackson have been identified by Haible (1976). Consideration of groundwater conditions is essential for protection of water supplies and water quality in providing for municipal wastewater disposal.

SOILS

General

The Jackson Hole area is a geologically young area. Soil types are diverse and immature. Although numerous soil types are found in the study area, they can be grouped and studied according to their geologic origin to assess development constraints and to determine appropriate land uses. Soil factors which should be considered in planning have been identified from U.S. Soil Conservation Service data by Livingston and Associates (1976). These factors include: vulnerability to erosion, suitability for septic tanks, value for agricultural production and potential for revegetation.

The soil of the Jackson Hole floor is sand, gravel, and talus, including glacial outwash and materials deposited by existing stream flow. These soils range from well- to poorly-drained, depending on elevation and groundwater conditions. Some wind swept deposits of silt carried in from the west are also present. These soils are common on hill slopes along the west side of Jackson Hole and on lower butte slopes.

The predominant soil type in the area of fine loamy to loamy-skeletal mixed soils. These soils are found on low mountains, alluvial fans and uplands where elevations range from 6,000 to 12,000 feet, according to the Wyoming Department of Environmental Quality (1976). Parent materials are alluvium sedimentary and igneous rocks and volcanic material. Soils range in depth from 10 to 60 inches. Natural water tables fluctuate in depth causing some soils to be beneficially subirrigated and others to be somewhat poorly drained.

Much of the study area is irrigated, adding to the problem of poor drainage.

Soils and Development Considerations

Shallow soils are located on steep hillsides which form the southeast border of the study area along U.S. Highway 189, and the butte slopes near Boyles Hill west of Jackson. These soils are derived from hard bedrock (i.e., granite and limestone), are generally less than ten inches in depth and are usually sandy and poorly consolidated. On the steeper slopes (those exceeding 30%), vegetation is sparse and soils are easily eroded. Where slopes have been cut for roads or building sites in these soil types, such as along the east face of East Gros Ventre Butte, soil cuts are eroding and revegetation is difficult. Conditions for septic tanks in these soil types are limited, and erosion control measures should be incorporated in development designs.

Soils on the gentle sloping hillsides south and west of South Park and the Gros Ventre Range are fine-textured with low to high water-holding capacities, and support a wide range of vegetation

types. Septic tank conditions in these areas are generally favorable, and development can be accommodated if reasonable erosion control practices are utilized. These soils, however, can erode rapidly if vegetation is removed, particularly on steeper slopes.

Most of the cropland in the study area is found southwest of Jackson on alluvial fans, glacial outwash plains, and floodplains at elevations ranging from 6,000 to 6,200 feet. Soils consist of fine to coarse loams and fine to coarse silts and mixed soils, and are developed to depths of 60 inches. The alluvial fan areas on the east side of Jackson Hole are generally well-drained because of the topography, while fans in the study area are wetter because of snowmelt and support grassland vegetation. The major limitation to development for soils on alluvial fans is their permeability which should be investigated prior to development. Septic tank conditions on the glacial outwash areas of the valley floor are generally satisfactory, but can become marginal or require relatively large leach fields when near the head of the outwash in coarser soils. Construction in these areas can also be hindered by coarse rock and boulders, according to Livingston (1976). The floodplains around Jackson are characterized by fine-grained material lying on top of or mixed with gravel and sand deposits. Soils are gravelly, but valuable as pasture land and for hay production because they also have a significant portion of clay and silt. These soils range from poorly to well-drained, and a relatively low annual precipitation (approximately 15 inches) dictates that most crops require irrigation. The major soil problems in portions of the agriculture area are related to water saturation in areas of high groundwater. Poorly drained lowlands with soils of low permeability and high groundwater have been identified by Livingston (1976). Although these soils preclude the use of septic tank leach fields for residential development, the areas are some of the most productive ranch lands in Teton County.

CLIMATOLOGY

The climate in Teton County and the Jackson Study Area is a combined product of latitude, elevation and topography. The area is predominately mountainous and characterized by comparatively harsh, long winters and cool, dry and short summers. The basin is in the latitudes of prevailing westerlies, with a predominance of maritime Pacific air which has generally been modified by passage over several mountain ranges between the Pacific Ocean and the Wyoming Snake River Basin. The Teton Range, on the western side of the County, has perhaps the most predominant influence on Jackson climate. Altitudes vary from 9,000 to above 13,000 feet, with Grand Teton being the highest peak at 13,770 feet. Precipitation in the mountainous areas of Teton County often exceeds 70 inches annually, the Teton range causing most of this precipitation coming from the west to fall on the western side of the basin. Winters are long and cold, with over 60% of the annual precipitation that occurs in

the region occurring as snow. On the average, it snows 80 to 120 days per year.

The elevation at Jackson is approximately 6,244 feet. The climate is characterized by cool summers and cold winters, although extremely cold temperatures are generally blocked by the mountains to the north and west. The average annual temperature in Jackson is 37.7°F. July is the warmest month of the year with temperatures averaging 60.9°F, according to information supplied by the National Park Service and the U.S. Department of Commerce (1975). January is the coldest month with temperatures averaging 14.2°F. The highest recorded temperature of 101°F occurred in Jackson in 1934. The record low of -48°F occurred in 1933.

Precipitation patterns throughout the region vary dramatically with elevation and topography. Average annual precipitation in Jackson is 15.22 inches according to data from the National Weather Service (1976), with an average of 75 inches of snow per year accounting for nearly three-fourths of this precipitation. In Moose, located 12 miles north of Jackson, annual precipitation averages 21 inches. Average monthly precipitation for Jackson is highest during the winter months of January and February and the spring months of May and June (Figure 6).

Sunshine is abundant throughout the Wyoming Snake River Basin and the Jackson Study Area, especially during the summer. It is estimated that sunshine averages about 60% on an annual basis, ranging from 40% in the winter to 80% in the summer.

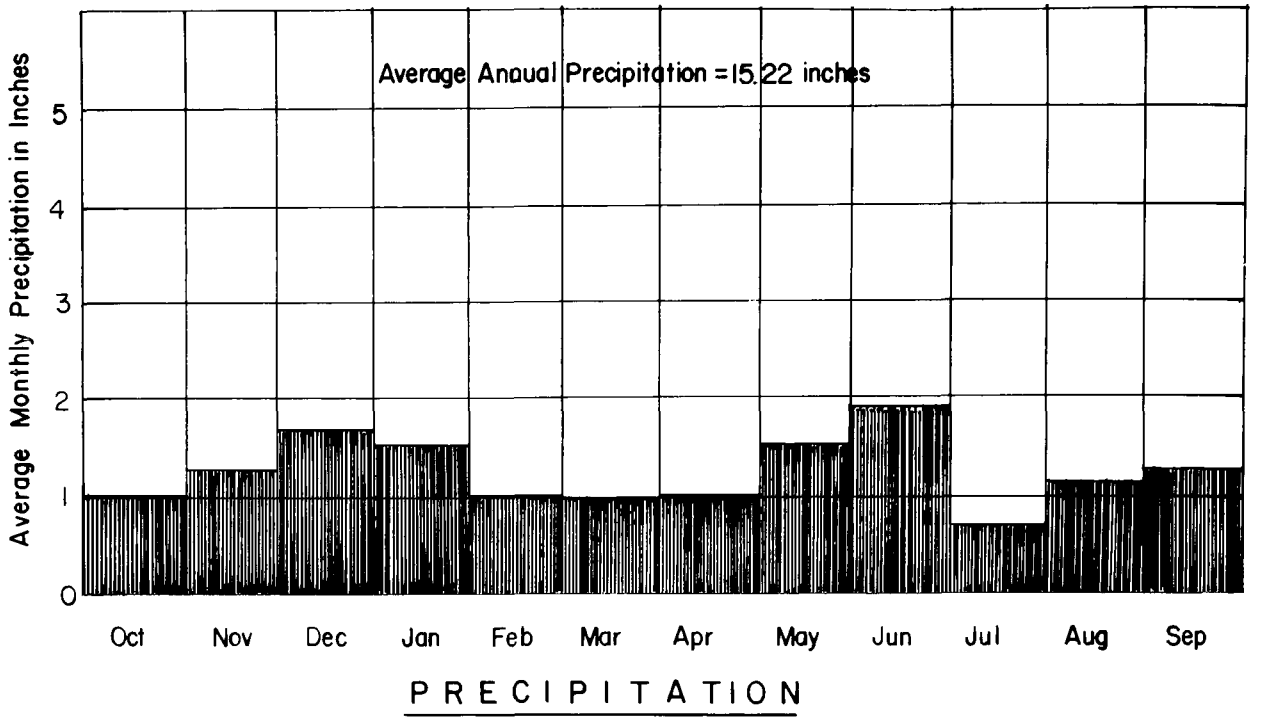
Average relative humidity for Jackson ranges from 55% to 60% annually, the highs occurring in the winter (65%-75%), and the lows occurring during the summer months of July and August (34%-45%).

Wind patterns in the Jackson area prevail from the southwest. Daytime winds are generally stronger than nocturnal winds. Although strong gusts may occur during severe summer thunderstorms, damaging winds are rare with wind speeds generally falling below 15 miles per hour on the valley floor. Stronger winds characterize the surrounding mountains, with gusts exceeding 100 miles per hour recorded on numerous occasions.

ACOUSTIC CONDITIONS

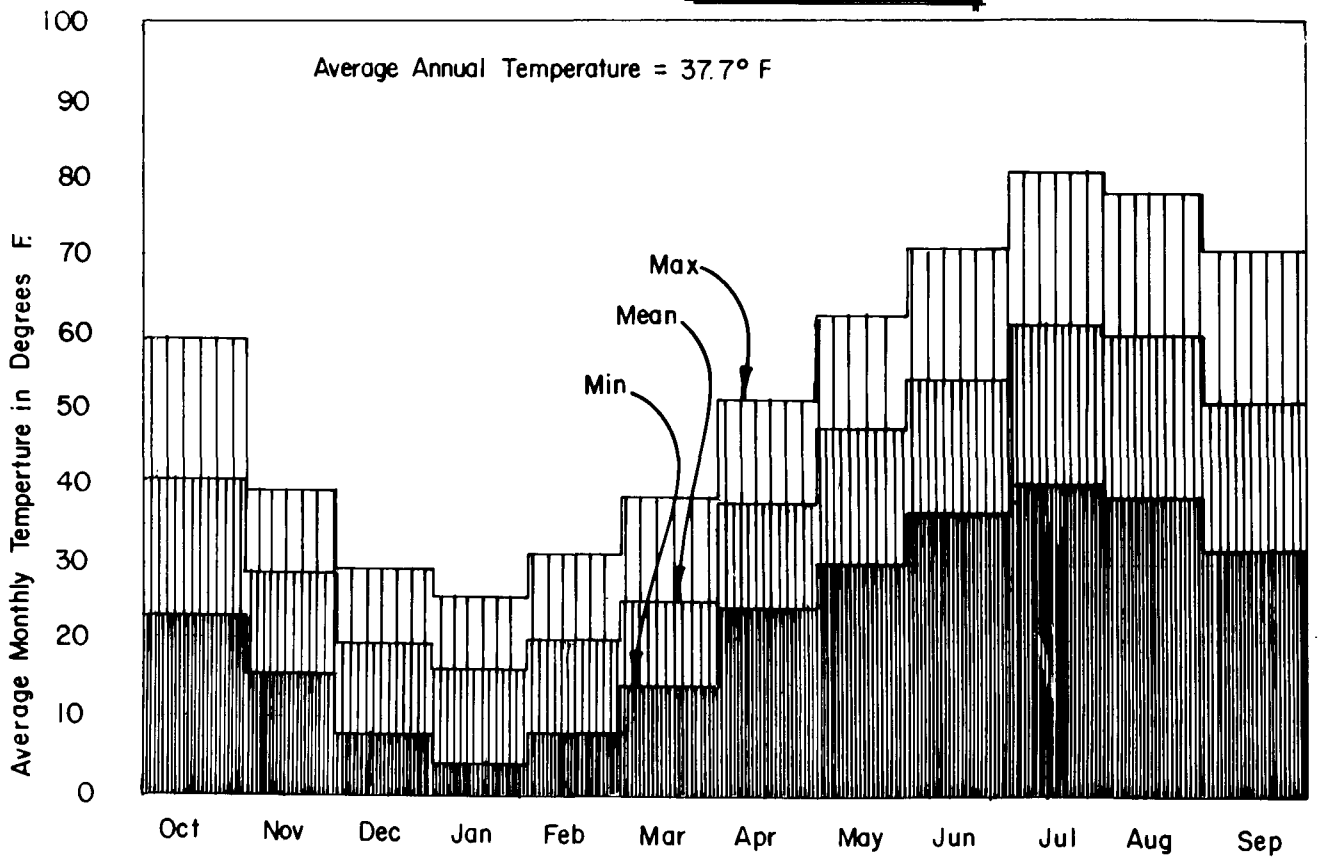
The Jackson area is characterized by several small communities and sparse development. Ambient noise levels are generally low, but increase over natural levels along the South Park Highway (U.S. Highway 26-89-187), State Route 22, and the Town of Jackson. Highway-road vehicles are considered the major noise source in the study area. The Jackson Hole Airport in Grand Teton National Park is perhaps the most intense intermittent noise source in the study area.

AVERAGE MONTHLY PRECIPITATION & TEMPERTURE, JACKSON Wyo.



PRECIPITATION

SOURCE: NATIONAL WEATHER SERVICE RECORDS (1941-1970 AVERAGE VALUES)



TEMPERATURE

FIGURE 6

Heavy equipment and accompanying construction activities will undoubtedly generate the major increases in noise levels during the construction phase of the proposed project. The impact of construction noise will vary with the proposed alternatives in relation to proximity to population centers and wildlife habitat areas. Numerous studies indicate that where construction activities might be carried out within 500 feet of houses or other buildings, noise impact of protracted operations could reach unacceptable levels. Noise impact on wildlife is probably more acute. These impacts will be collectively evaluated in the "Environmental Impacts of Alternatives" section of this report.

AIR QUALITY

Local topography and meteorological conditions have a major influence upon air quality patterns in any region. In general, deep valleys similar to the Jackson Hole area are characterized by channeling wind flow along the valley axis, and development of stable drainage winds during calm night time conditions, resulting in higher pollutant concentrations along the valley floor.

When compared with cities having a higher population density and emission generating industries, the Jackson area, although it does experience substantial seasonal influxes of automobiles due to the tourism, has relatively clear air. This statement must, however, be tempered by the fact that monitoring data for the area is very limited and is available only for particulate concentrations. Information is not available for carbon monoxide (CO), the primary constituent of incomplete combustion and carbonaceous fuels burned in the automobile (approximately 90% of all CO emissions come from transportation sources). There is no data available for nitrogen oxides (NO_x) or hydrocarbon (HC) concentrations. Both nitrogen oxide and hydrocarbon levels are closely related to automobile use and power production. Sulfur dioxides (SO_2), a primary by-product of the combustion of sulfur-containing fuel in stationary sources, also has not been monitored in the Jackson area.

Existing air quality sampling and analyses for the Jackson Study Area have been collected by the Wyoming Department of Environmental Quality. Monitoring data is limited to particulate concentrations sampled by the WDEQ, Air Quality Section. According to WDEQ officials, air samples were collected at the town of Kelly located ten miles northeast of Jackson over a five month period (8/10/75 - 12/26/75). These samples are thought to be indicative of conditions which would be experienced in Jackson. Samples were collected using a Hi-Vol sampler on a six day schedule. All samples were 24-hour composites. The average values for the sampling period (approximately 25 samples) showed a geometric mean of 11.0 mg/m^3, with a high value of 33 mg/m^3 and a low of 4 mg/m^3. These values fall well below Wyoming State Standards and EPA's National Ambient Air Quality Standards for particulate concentrations which are 60 mg per cubic meter (annual geometric mean) and 150 mg per cubic

meter (maximum 24 hour concentration not to be exceeded more than once per year).

Although information on inversion frequency was not available through the National Climatic Center (Jackson has no upper air observing capability), personnel at the Center and the Wyoming DEQ indicated the area is subject to frequent inversion. However, WDEQ officials did emphasize that air quality conditions in the area were generally good. WDEQ also stated that the main concern for the area in terms of air quality maintenance as related to the proposed Jackson wastewater facility would be the control of fugitive dust caused by construction. Compliance with State particulate standards will undoubtedly require that reasonable precautions are taken to inhibit dust from becoming airborne during the construction phase of any approved project.

An additional source of air pollution is the noxious odors that emanate from the existing wastewater facilities during the warmer months. The polishing pond and the sludge drying beds are the primary sources of these odors that are generated from the decay of organic material under anaerobic conditions. While these are somewhat confined to the areas adjacent to South Park, they do present a definite problem in the proposed residential/commercial growth areas.

AESTHETIC AND VISUAL CHARACTERISTICS

General

The Jackson Hole area is world reknown for its spectacular scenic beauty. This is attested to by the vast number of people who flock to the area each year to enjoy the relatively unspoiled outdoor experience the region offers. While such landmarks as the Teton Mountains, Grand Teton National Park, Jackson Lake, Snake River excursions, and Yellowstone National Park are the primary destinations for this yearly influx of visitors, it is the valley's overall composition that creates the setting through which these attributes can be experienced.

While the secondary impact of expanded wastewater facilities can be widespread in allowing growth in numerous areas, the primary geographic unit that may be affected by the proposed project and solution-oriented alternative is South Park. This is because of two main constraints: the majority of the developable private land in the county is in South Park, and the direction of the comprehensive planning effort is to funnel growth into those areas that can be serviced by Jackson's municipal facilities.

Preserving the aesthetic and visual characteristics of Jackson is a prime concern for most of the area's residents along with the federal and state agencies operating in the area. The questionnaire distributed through the Comprehensive Planning Study to

survey desires and needs of the resident population concerning the major land use and development issues in the County revealed that over eighty percent of those responding felt that the preservation of scenic values should take precedence over private development rights. While the results of this inventory may be subject to a great deal of rebuttal and criticism, it is basically true that for various personal and economic reasons (tourist industry forms a dominant portion of the area's economy), maintaining this existing refined but outdoor oriented philosophy and life style through the area's scenic grandeur is important to the people of Jackson, and one of the main attractions that holds and draws individuals to the area. The results of the Comprehensive Plan questionnaire provide not only a documentation of this thesis, but a rather overwhelming public declaration supporting it.

A number of recent planning and scenic preservation efforts are being pursued in the immediate study area including Teton National Park Expansion Study and Master Plan, the Scenic Corridor and Reserve Concept of the Nature Conservacy, the Town/County Comprehensive Plan, and the Wild and Scenic River Study on the Snake River. While each of these is important, the two that may directly effect a decision on the Jackson Wastewater Project are the Comprehensive Planning Study and the Wild and Scenic River classification investigation.

Comprehensive Planning Study

One of the outputs of the Comprehensive Planning and 208 Study contract was the development of a Report on Visual Analysis for Teton County. This study conducted by the U.S. Forest Service classified the nonfederal land in the County in terms of its scenic and visual values and proposed planning guidelines to mitigate and reduce the visual impact of development. Figure 7, Landscape Units and Vegetation, presents the results of the report. The study characterizes the County into landscape units and comments on types of introduced elements which may be appropriate and what aesthetic impacts various types of development generally have on people. It presents the results in terms of a unit's Visual Absorption Capability (VAC), which is an index that results "from rating five factors which are responsible for a landscape's ability to accept change while remaining visually strong." The factor includes slope, diversity, screening, revegetation potential, and color contrast. Based on this study, three different landscape units have been described for the area of primary impact resulting from the wastewater project. The unit classifications are presented in Table 1. However, a complete description is found in Appendix K of the Teton County Growth and Development Alternatives (Livingston and Associates, 1976). The VAC rating measures an area's ability to accept changes in the landscape. A high VAC indicates an area can absorb change better than one with a low VAC. Generally, with the exception of the Boyles Hill area, South Park has an average VAC.

TABLE 1

VISUAL ABSORPTION CAPABILITY RATINGS

Landscape Unit Number	Slope	Diversity	Screening	Revegetation Potential	Soil Color Contrast	Total Index
3	1	3	2	2	2	10
4	1	1	3	3	2	10
5	1	1	1	1	1	5
6	2	1	2	1	1	7
7	2	1	2	1	1	7
8	3	2	1	2	2	10
9	3	1	1	2	2	9

Individual Items

1 = Low VAC
2 = Average VAC
3 = High VAC

Total Index

5-7 = Low VAC
8-12 = Average VAC
13-15 = High VAC

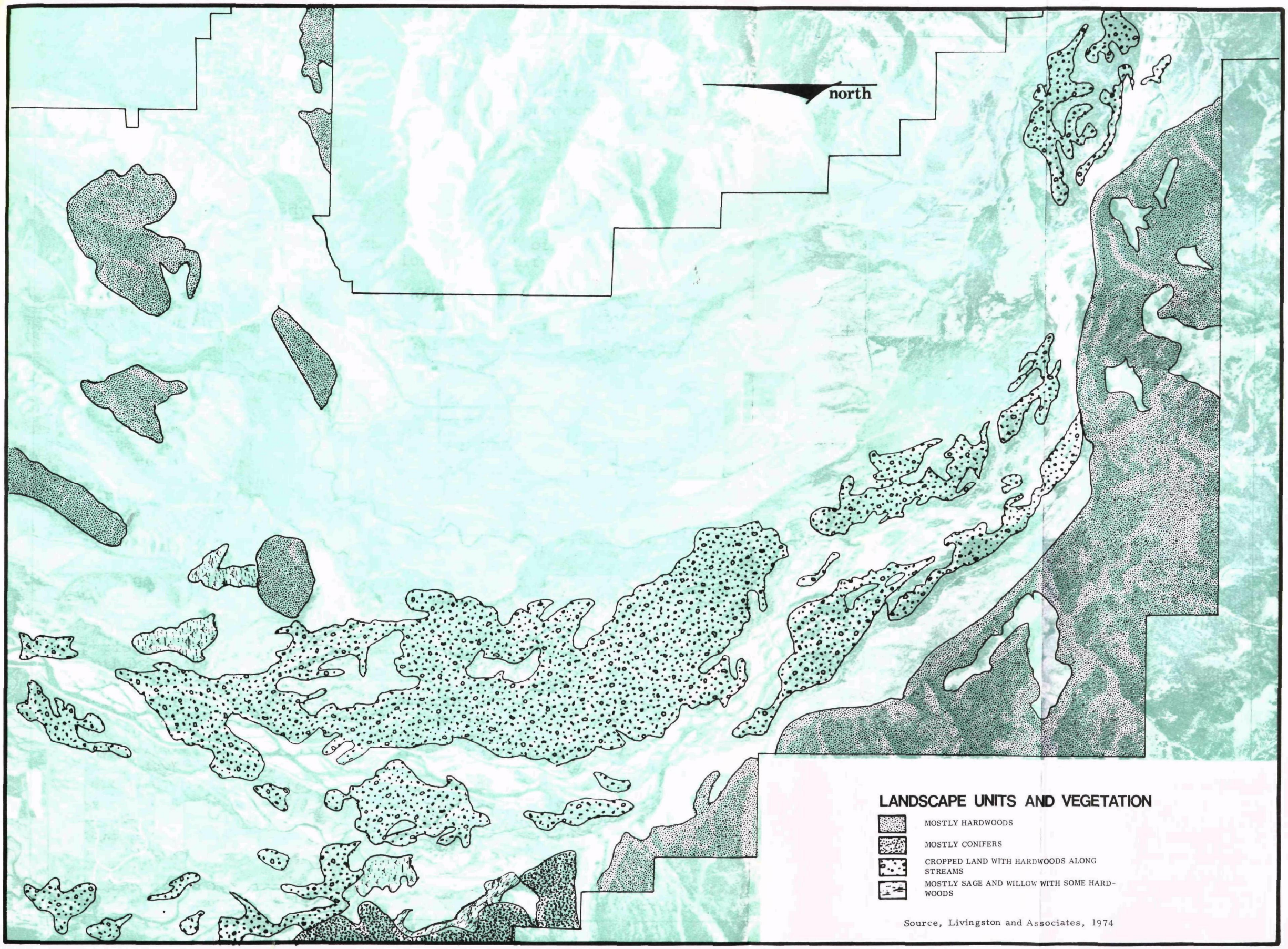

north
LANDSCAPE UNITS AND VEGETATION
MOSTLY HARDWOODS
MOSTLY CONIFERS
CROPPED LAND WITH HARDWOODS ALONG STREAMS
MOSTLY SAGE AND WILLOW WITH SOME HARDWOODS
Source, Livingston and Associates, 1974
SCALE 1:24 000
1 MILE
1000 FEET

Figure 7

While this may provide a useful diagnostic tool for planners, it must be pointed out that even in areas with a high VAC, the type and extent of the development is the major influencing factor. Urban sprawl across the flat bottom land of South Park would have significant scenic and visual impact for those approaching Jackson from the south. Any treatment facility would require landscaping and architectural mitigation in order to be unobtrusive on the landscape.

Wild and Scenic River Study

The Wild and Scenic River Act (P.L. 90-542) of October 1968 directed the Department of the Interior to classify and preserve:

> "Certain selected rivers of the nation which, with their immediate environment, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic cultural or other similar values."

The section of the Snake River flowing from Teton National Park to Palisades Reservoir is a candidate for classification, and is the subject of a current study with the U.S. Forest Service acting as lead agency. The results and recommendations of the classification investigation are not expected to be complete until 1979. In the meantime, one of the responsibilities of the lead agency, according to the Teton Forest Supervisor, is "to assure that during the interim of the study, and eventual determination, that federal and federally assisted projects that could have a direct or adverse effect on the river's special values are properly evaluated as required by the Wild and Scenic Rivers Act."

In regard to federally funded projects, such as the proposed wastewater facilities, the act states that:

> "No department or agency of the U.S. shall, during the periods hereandbefore specified [Section 7(i)] , recommend authorization of any water resources project on any such river, or request appropriations to begin construction of any such project, whether heretofor or hereafter authorized, without advising the Secretary of the Interior and, where National Forest lands are involved, the Secretary of Agriculture, in writing of its intention so to do at least sixty days in advance of doing so, and without specifically reporting to the Congress in writing, at the time it makes its recommendation or request, in what respect construction of such project would be in conflict with the purposes of this Act and would affect the component and the values to be protected by it under this Act."

It therefore remains the lead agency's responsibility, as agent for the Secretaries of the Interior and Agriculture, to evaluate

TABLE 2

Attributes and management objectives of the three river classifications for inclusion in the National Wild and Scenic River System

	Wild	Scenic	Recreation
Attributes	1. Free-flowing. Low dams, diversion works or other minor structures which do not inundate the natural riverbank may not bar consideration as wild. Future construction restricted.	1. Free-flowing. Low dams, diversion works or other minor structures which do not inundate the natural riverbank may not bar consideration. Future construction restricted.	1. May have undergone some impoundment or diversion in the past. Water should not have characteristics of an impoundment for any significant distance. Future construction restricted.
	2. Generally inaccessible by road. One or two inconspicuous roads to the area may be permissible.	2. Accessible by roads which may occasionally bridge the river area. Short stretches of conspicuous or longer stretches of inconspicuous and well-screened roads or railroads paralleling river area may be permitted.	2. Readily accessible, with likelihood of paralleling roads or railroads along river banks and bridge crossings.
	3. Shorelines essentially primitive. One or two inconspicuous dwellings and land devoted to production of hay may be permitted. Watershed natural-like in appearance.	3. Shoreline largely primitive. Small communities limited to short reaches of total area. Agricultural practices which do not adversely affect river area may be permitted.	3. Shoreline may be extensively developed.
	4. Water quality meets minimum criteria for primary contact recreation except where such criteria would be exceeded by natural background conditions and esthetics 2/ and capable of supporting propagation of aquatic life normally adapted to habitat of the stream.	4. Water quality should meet minimum criteria for desired types of recreation except where such criteria would be exceeded by natural background conditions and esthetics 2/ and capable of supporting propagation of aquatic life normally adapted to habitat of the stream, or is capable of and is being restored to that quality.	4. Water quality should meet minimum criteria for desired types of recreation except where such criteria would be exceeded by natural background conditions and esthetics 2/ and capable of supporting propagation of aquatic life normally adapted to habitat of the stream or is capable of and is being restored to that quality.
Management objectives	1. Limited motorized land travel in area.	1. Motorized vehicles allowed on land area.	1. Optimum accessibility by motorized vehicle.
	2. No unharmonious or new habitations or improvements permitted.	2. No unharmonious improvements and few habitations permitted.	2. May be densely settled in places.
	3. Only primitive-type public use provided.	3. Limited modern screened public use facilities permitted, i.e. campgrounds, visitor centers, etc.	3. Public use areas may be in close proximity to river.
	4. New structures and improvement of old ones prohibited if not in keeping with overall objectives.	4. Some new facilities allowed, such as unobtrusive marinas.	4. New structures allowed for both habitation and for intensive recreation use.
	5. Unobtrusive fences, gauging stations and other management facilities may be permitted if no significant adverse effect on natural character of area.	5. Unobtrusive fences, gauging stations and other management facilities may be permitted if no significant adverse effect on natural character of area.	5. Management practice facilities permitted.
	6. Limited range of agriculture and other resource uses permitted.	6. Wide range of agriculture and other resource uses may be permitted.	6. Full range of agriculture and other resource uses may be permitted.

2/ Federal Water Pollution Control Administration's Water Quality Criteria, April 1, 1968.

For a complete explanation see Guidelines for Evaluation Wild, Scenic and Recreational River Areas Proposed for Inclusion in the National Wild and Scenic River System under Section 2, Public Law 90-542 (1970).

what impacts a project may have on the eventual classification for the river. The agency can then, through the Secretary recommend what mitigation measures may be necessary or even if a project should be allowed to proceed.

Water resource and wastewater projects have, under the conditions of the Act, been shown to be compatible. This has in instances required the incorporation of both design and regulatory mitigation to offset the impacts of construction and operation of a facility.

It would be anticipated that any proposed wastewater construction activities along the course of the Snake River would be subject to the approval of the Secretaries of the Interior and Agriculture. Table 2 presents a summary of the general criteria utilized in the Wild and Scenic Classification System. These criteria would need to be evaluated on a case-by-case basis to determine their applicability in each application, and may be altered to suit a particular river. Regarding the proposed project and all its practical alternatives, with the exception of maintaining the existing site, an outfall line to the Snake River would be required for effluent disposal. The impacts this line would have during construction and on long term aesthetic values and water quality would require review in terms of the Wild and Scenic Rivers Act.

CULTURAL AND HISTORIC/ARCHEOLOGIC RESOURCES

Sometime around 1829, the valley of Jackson Hole was named for the trapper, David E. Jackson. Although the fur trading business played a major role in the eventual settling of the Jackson area, trappers were by no means the first inhabitants of the area, according to Haden (1969). Many years earlier, the Shoshone Indians looking up from the valley floor on one of their annual hunting pilgrimages had called the majestic Tetons "Teewinot", or pinnacles. Traces of the camps made by these Indians can be found throughout Jackson Hole, and excavations for ditches and dwellings are turning up additional information.

Permanent settlement of Jackson Hole began about 1878 as trappers decided to settle in the area instead of trapping intermittently. Through the 1880's a number of families came into the valley as homesteading began to replace trapping as the main livelihood, and in 1890 Wyoming became a state. Many remnants of these activities can still be found throughout the area.

About 1900, cattle ranching became the chief industry. This surge, however, was short-lived with a sudden growth in the tourist business. Increased tourist activity remains the chief industry for the Jackson area today.

Based on existing records and reports and correspondence with various state agencies and groups, including the Wyoming Recreation

Commission and the Wyoming State Archives and Historical Department and State Archeologist, there are no historic sites currently enrolled in the National Register of Historic Places or currently in nomination for such enrollment that would be located on the proposed treatment plant sites or pipeline routes. Similarly, no sites are affected which appear on the Wyoming Inventory of Historic Places.

Discussions with the Wyoming Recreation Commission and the University of Wyoming Department of Anthropology indicate that no known archeologic sites would be affected by the proposed alternatives for the new wastewater treatment facility for the Town of Jackson. However, it should be noted that a number of significant archeological findings have been uncovered in the general study area. The South Park area (west and south of Jackson) has not been subjected to extensive archeological survey. Since a primary portion of the proposed project will involve ditching, the State Archeologist recommends that a field survey be initiated prior to construction, and that a member of his staff be available during ditching, should the survey indicate potential finds. EPA has determined that, while a pre-construction field survey will be done, EPA does not believe that the cost of an on-site archeologist is warranted unless the field survey shows a high potential for archeological finds. Any newly discovered sites will be reported to the State Archeologist for further evaluation.

WATER QUALITY

Water Quality Standards

The assessment of current water quality conditions in the study area and the evaluation of the proposed alternatives in terms of impacts on local water quality in the study area are dependent on the classification of specific waters, and the development of criteria based on downstream use. This information provides a basis for the subsequent assessment of existing water quality conditions in Flat Creek and the Snake River. The information also provides the foundation for evaluation of the proposed Jackson Wastewater Treatment Plant alternatives in terms of compliance with present and future treatment needs, discharge requirements, and potential impacts on Flat Creek, surrounding tributaries, and the Snake River.

Water quality standards applicable to the streams in the Jackson Study Area are set forth by the Wyoming Department of Game and Fish and the Wyoming Department of Environmental Quality. The standards are divided into two main categories which include a water use classification (based on fish supporting capabilities) and specific water quality parameter standards.

Chapter I of "Water Quality Standards for Wyoming" designates all Wyoming waters as belonging to one of the following three classes:

Class I - Those waters which, based on information supplied by the Wyoming Game and Fish Department, are determined to

be presently supporting game fish or have the hydrologic and natural quality potential to support game fish.

Class II - Those waters which, based on information supplied by the Wyoming Game and Fish Department, are determined to be presently supporting non-game fish, or have the hydrologic and natural water quality potential to support non-game fish.

Class III - Those waters which, based on information supplied by the Wyoming Game and Fish Department, are determined as not having the hydrologic or natural water quality potential to support fish.

The Standards also indicate that the actual classification of specific waters will be updated every three years and presented to the public.

All major streams in Teton County and the Jackson Study Area have been assigned the highest quality classification (Class I) according to information supplied by the Wyoming Game and Fish Department. The State of Wyoming Department of Environmental Quality has also established standards based on the type of water use, existing water quality, and the source of pollutants for fifteen physical, chemical, biological, radiological and general parameters. Quality standards for Class I waters in the study area are divided into physical, chemical, biological, radiological and general parameters, and are presented below, as outlined by Ablondi (1976):

Physical:

1. Settleable Solids. Waters shall be free from substances of other than natural origin that will settle to form sludge, bank or bottom deposits.

2. Floating Solids. Waters shall be free from floating debris, scum and other floating materials of other than natural origin in amounts sufficient to be unsightly.

3. Taste, odor, color. Waters shall be free from substances of other than natural origin which produce taste, odor, and color.

4. Turbidity. In all waters, wastes of other than natural origin shall not cause the natural turbidity of the water to be increased by more than ten (10) Jackson Turbidity Units. In addition, waters designated for full body contact recreation (swimming, water skiing, etc.), wastes of other than natural origin shall not be discharged in amounts which will increase turbidity to the extent that a Secchi disc is not visible at a depth of one (1) meter.

5. Temperature. In all waters, wastes of other than natural origin shall not be discharged in amounts which raise

natural ambient water temperatures to levels which are deemed to be harmful to existing aquatic life. As most natural stream temperatures in the Jackson area do not exceed 68°F (20°C), wastes of other than natural origin shall not be discharged in amounts which will result in a change of more than 2°F (1.1°C) over the maximum daily stream temperature. No induced temperature change will be allowed over fish spawning areas except for experimental purposes.

Chemical:

1. Dissolved Oxygen. In all waters, wastes of other than natural origin shall not be discharged in amounts which will result in death or injury to existing aquatic life and which will result in a dissolved oxygen content of less than 6.0 mg/l (ppm) at any time.

2. pH. For all waters, wastes of other than natural origin shall not cause the pH to be less than 6.5 or greater than 8.5.

3. Oil and Grease. In all waters, wastes of other than natural origin shall not be discharged which will cause the oil and grease content to exceed 10.0 mg/l, formation of visible oil film or globules, discoloration of the surface, or a formation of visible deposits on the bottom or shoreline.

4. Total Gas Pressure. Discharges from impoundments or other sources shall not cause the total dissolved gas pressure to exceed 110 percent of existing atmospheric pressure.

5. Salinity. High salinity (Total Dissolved Solids) is recognized as an important water quality parameter which may in some cases cause adverse physical and economic impact on water users. Emphasis will be given to management methods which improve salinity and control the accumulation of dissolved solids in water. However no upper limit of salinity exists for waters in Teton County.

Biological:

1. Coliform Bacteria. The following limitation applies to still water bodies (lakes, impoundments, etc.) which lie at an altitude of less than 7,000 feet above sea level and the waters of the Snake River commencing at the south boundary of Yellowstone Park downstream to the Wyoming-Idaho state line.

   During the recreation season, (May 1 through September 30), wastes of other than natural origin shall not be discharged in amounts which will cause fecal coliform concentrations to exceed a geometric mean of 200 fecal coliform

groups per 100 milliliters based on a minimum of five samples obtained during separate 24-hour periods for any 30-day period. Ten percent of the samples shall not exceed 400 groups per 100 milliliters during any 30-day period.

The following limit applies to all other waters in the Jackson area. During the recreation season (May 1 through September 30), fecal coliform concentrations shall not exceed a geometric mean of 1,000 fecal coliform groups per 100 milliliters based on a minimum of five samples obtained during separate 24-hour periods for any 30-day period. Ten percent of the samples shall not exceed 2,000 groups per 100 milliliters during any 30-day period.

2. Undesirable Aquatic Life. All waters shall be free from substances and conditions which are attributable to municipal, industrial, or other discharges or agricultural practices which produce undesirable aquatic life.

Radiological:

1. Radioactive Material. In all waters, radioactive material of other than natural origin shall not exceed a concentration of 3 pCi/l* of Radium 226, 10 pCi/l of Strontium 90 or the limits established in the most recent Federal Drinking Water Standards. Radiological material shall not be present in any amount which reflects failure in any case to apply all controls which are physically and economically feasible.

General:

1. Public Water Supply. When public water supply is a designated use, water quality will be such that after conventional water treatment, the treated water will meet the most recent Federal Drinking Water Standards.

2. Toxic Material. All waters shall be free from toxic, corrosive, or other deleterious substances of other than natural origin in concentrations or combinations which are toxic to human, animal, plant, or aquatic life.

Monitoring Data

Water quality data for the study area has been collected by four agencies. The U.S. Geological Survey Water Resources Division, the Wyoming Game and Fish Department, the Bridger-Teton National Forest, and the Wyoming Department of Environmental Quality maintain 96 monitoring stations located throughout Teton County. The monitoring

*pCi-picrocurie-10^{-12} curies where a curie is defined as 3.7×10^{10} disintegrations per second.

network includes permanent trend stations and "problem oriented" stations. Additional monitoring stations have also been established by the Teton County 208 Planning Agency, in cooperation with the WDEQ. Data from this network forms the basis for the discussion on Flat Creek and Snake River water quality that follows.

TETON COUNTY WATER QUALITY

Teton County constitutes the major portion of land area for the Snake River Basin of Wyoming, encompassing some 5,139 square miles in the western portion of the State. The County ranks fourth statewide in terms of surface water acreage, with the Snake River and Jackson Lake Reservoir accounting for the majority of this area. Jackson Lake Reservoir alone accounts for approximately 25,500 acres of the 43,300 surface water acres in Teton County.

Relatively high amounts of precipitation and extensive snowpacks in the mountains, coupled with a gradual release of water from snowmelt continuing through the summer support continuing perennial stream flows for all the major streams within the Snake River Basin. The Basin provides sufficient water quality for municipal, recreational, agricultural and industrial uses, with the average annual flow originating in the Wyoming portion of the Basin estimated at 4,721,650 acre-feet. Although a significant quantity of this supply is used for irrigation in the Basin (approximately 83,700 acre feet), the Wyoming Department of Environmental Quality has estimated that some 4,632,500 acre-feet of water leaves the Wyoming Snake River Basin each year.

The major hydrologic systems, located in the immediate study area likely to be affected by the proposed project, include the Snake River and Flat Creek. Existing water quality conditions for these water courses will be discussed in detail. The discussion will form the basis for evaluating water quality impacts of the proposed alternatives in the "Environmental Impacts of Alternatives" section of the report. Other tributaries to the Snake for which data are available include (by downstream order): Gros Ventre River, Fish Creek, Cache Creek, and Hoback River. Water quality conditions for these tributaries will also be discussed collectively in general terms where existing information allows.

Existing data indicate that water quality for most streams in Teton County is generally good. Exceptions are watercourses adjacent to higher density population centers including Flat Creek near Jackson where the stream receives treated effluent from the Jackson sewage treatment plant and stormwater runoff from the urbanized area; and Fish Creek between Teton Village and Wilson where rapid growth of homesites, gravel mining operations and occasional and intermittent poorer quality effluent from the Teton Village sewage treatment plant can seriously degrade water quality. The Hoback River, which lies immediately south of the study area, also experiences increases in conductivity, salinity, turbidity and pH due primarily to natural erosion and mineral spring discharges.

In general, the flow regimes for most of the streams in the study area follow a general pattern of high flows in the spring and early summer with increased snowmelt and releases from Jackson Reservoir, gradually decreasing over the summer and early fall. Total dissolved solids (TDS) range between 100 milligrams per liter (mg/l) and 250 mg/l for most streams, with concentrations increasing downstream from Jackson Lake (Ablondi, 1976).

Water temperatures remain relatively constant for most of the streams throughout the County, increasing slightly in a downstream direction with increases in ambient air temperatures and water use, and decreases in elevation. This is important as temperature is a prime regulator of natural processes within the water environment, particularly as related to the physiological functions of organisms.

Dissolved oxygen (D.O.) content, perhaps the most important indicator of the water's condition, is generally high ranging from 9.0 to 13.0 mg/l for most of the streams where data is available. The parameter consistently exceeds the minimum standard of 6.0 mg/l established for Class I waters.

pH values range between 6.5 and 8.5, the range for most productive natural fresh waters. Higher values are attributed to areas of limestone deposit in the underlying geology. Such is the case for Cache Creek, where the mean pH is 8.3 (WDEQ, 1976).

Chloride (Cl) and sulfate (SO_4) concentrations measured by the U.S. Geological Survey, U.S. Forest Service and the Wyoming Game and Fish Department range between 0.0 and 21.0 mg/l, and 5.0 and 50 mg/l, respectively in most streams in Teton County. Exceptions include the Hoback River, where SO_4 levels exceeding 240 mg/l have been observed (Ablondi, 1976).

Nitrate nitrogen (NO_3) concentrations, an important limiting factor in the growth of all plants, reached a high of 0.18 mg/l below the Jackson treatment plant, but generally did not exceed 0.1 mg/l according to information gathered by the 208 agency. Total phosphate levels are also relatively low throughout Teton County. Flat Creek phosphate values range from a high of 1.8 mg/l (expressed as total P) below the treatment plant on Flat Creek to less than 0.01 mg/l above Jackson near the National Fish Hatchery during the sampling conducted by the 208 agency in 1976.

Coliform bacteria forms the basis for indirect bacteriologic water quality examination. The presence of coliform bacteria indicates recent discharges from warm blooded animals. Absence implies the water is free of pathogens. Monitoring information on fecal coliform bacteria is limited for Teton County. Geometric mean concentrations for the major watercourses, however, generally fall below 50 colonies/100 ml and rarely exceed the 200 fecal coliform groups/100 ml standard in extreme cases. Highest concentrations

occur in the summer months at the peak of tourist activity immediately downstream from the Jackson sewage treatment plant.

Flat Creek

Flat Creek originates in the Gros Ventre Range, flows through the National Elk Refuge where approximately 8,000 head of elk are wintered annually, then turns south flowing through the Town of Jackson. Below Jackson, the river receives effluent from the Jackson sewage treatment plant. The river is also impacted by discharge from the Jackson National Fish Hatchery, septic tank seepage, and urban storm and runoff from corrals. Based upon only one year of data the average annual flow is approximately 110 cfs, and the low flow is approximately 50 cfs.

Flat Creek is considered a stable cold water fishery by the Wyoming Department of Game and Fish. Little information is available as to its value, carrying capacity, or fisherman use in the South Park Area. Since major access is limited by private land bordering the Creek, the Department does not try to manage the fishery as they would for waters open to the public.

Water quality information for Flat Creek has been available on a continuing basis since the initiation of the Teton County 208 Study in the fall of 1975. As a result of information and additional data collected under the "Snake River Basin Water Quality Management Plan," Flat Creek has been designated "the most critical stream segment in the Snake River Basin in terms of possible impairment of water quality." Because of this designation, a stream segment profile was performed by the WDEQ in November, 1975 (Table 3).

Table 3 shows Flat Creek water quality as generally good throughout the upper portion of the study area. Dissolved oxygen concentrations are high ranging from 11.0 to 12.4 mg/l. Turbidity and total dissolved solids range between 1.5 and 3.4 JTU, and 130 and 187 mg/l, respectively. Nitrate nitrogen levels average about 0.5 mg/l; and total phosphate levels average 0.03 mg/l, both well below U.S.P.H.S. recommended Drinking Water Standards, and those levels thought to facilitate nuisance algae growths (Water Quality Criteria, 1963). Below the sewage treatment outfall south of Jackson, however, BOD and COD levels increase appreciably, demonstrating the effects of the Jackson sewage treatment outfall and nearby cattle grazing operations. Nitrate nitrogen levels double from 0.5 to 1.0 mg/l at this sampling station. Likewise, total phosphate levels increase by a factor of eight, from 0.03 to 0.26 mg/l. Turbidity and total dissolved solids show a substantial two-fold increase. These increases do not exceed State standards. Fecal coliform numbers also show a substantial increase jumping from a mean value of less than one (1) colony/100 ml to 120 colonies/100 ml.

TABLE 3. FLAT CREEK STREAM PROFILE (November 3-7, 1975)*

STATION	Dissolved Oxygen (mg/l)	Fecal Coliform (#/100 ml)	BOD (mg/l)	COD (mg/l)	pH (S.U.)	Temperature (°C)	Nitrate-N (mg/l)	Total Phosphate (mg/l)	Turbidity (JTU)	Total Dissolved Solids (mg/l)	Specific Conductivity (umho/cmC 25°C)
Above Fish Hatchery Discharge	11.0	0	1.7	13	7.5	7.0	0.5	0.03	1.5	130	218
At U.S. Highway 26 Crossing, north of Jackson	11.8	1	1.7	13	7.2	6.0	0.5	0.03	2.4	155	295
Wooden Access Bridge behind Indep. Oil Co.	12.4	0	3.5	13	7.8	6.0	0.2	0.03	2.1	177	295
Wooden Access Bridge near Millward St.	12.0	2	1.5	12	7.8	6.0	0.5	0.03	3.4	168	295
Wooden Access Bridge near Gill St.	11.2	0	1.5	12	7.9	6.0	0.5	0.03	2.8	168	295
U.S. Highway 26 near Jackson Food Market	11.3	1	1.3	11	7.9	7.0	0.5	0.03	3.6	187	289
Wooden Access Bridge behind Virginian	12.4	0	1.8	11	8.0	7.0	0.5	0.03	3.4	186	283
U.S. Highway 26 south of Jackson	12.0	2	1.3	11	8.4	7.0	0.5	0.03	3.1	176	354
South Park Bridge 3.5 miles below sewer discharge	14.1	120	3.5	20	8.7	7.0	1.0	0.26	6.2	489	332

*Information from Ablondi (1976)

Ongoing water quality monitoring activities presently being performed for the Teton County 208 Study further indicate that instream standards assigned to Flat Creek are being maintained, except for coliform bacteria (recommended standard by the 208 Agency is 200 colonies/100 ml) which has been exceeded immediately below the treatment plant. Samples collected above and below the treatment plant on 7/6/76, for example, show high D.O. concentrations of 9.3 mg/l (standard is 6.0 mg/l). COD and BOD elevate slighly below the treatment plant, increasing from 13.0 and 2.0 to 15.0 and 2.7 mg/l, respectively. Ammonia nitrogen levels show a dramatic increase, jumping from 0.002 to .286 mg/l. Although relatively low in terms of toxic unionized ammonia, this elevation is indicative of effluent discharge from sewage treatment plants. Total phosphate levels also demonstrate an increase from 0.05 mg/l at Flat Creek Bridge crossing south of Jackson above the treatment plant to 0.15 mg/l at Flat Creek 1000 feet below the outfall. With ideal physical conditions (temperature, streamflow, sunlight, etc.), algal blooms have been observed at concentrations as low as 0.001 mg/l (Water Quality Criteria, 1963). Fecal coliform counts showed the most substantial elevation between the two sampling stations, increasing from 30 colonies/100 ml above the plant to over 1800 colonies at the site below the outfall. It should be noted that this data represents only one sampling. Although the Wyoming Water Quality Standards applicable to Flat Creek dictate that the geometric mean of 1000 fecal coliform groups per 100 ml based on five (5) samples obtained during separate 24-hour periods for any 30-day period shall not be exceeded, the sampling is indicative of degraded water quality.

In summary, Flat Creek maintains generally good water quality, except below the outfall of the Jackson municipal wastewater treatment facility. A number of potentially degrading point (direct discharge) and nonpoint (diverse, indiscreet discharges) pollution sources threaten the stream quality from the National Elk Refuge north of town to the confluence with the Snake. Studies now in progress on the Elk Refuge and agricultural and urban nonpoint problems will better identify the significance of these sources.

Snake River

The Snake River flows westward along the southern portion of Yellowstone National Park, turns southward crossing the Park boundary, and enters Jackson Lake Reservoir. Below the reservoir the river flows southerly through Jackson Hole out of Teton County into Palisades Reservoir in southeast Idaho.

Snake River water quality in the Wyoming Snake River Basin is good, due to relatively sparse development and the occurrence of a more natural watershed. The main stem of the Snake does, however, appear from limited data to suffer "slight deterioration" in a downstream direction with increasing urban development.

The Wyoming Department of Environmental Quality maintains a monitoring station on the Snake River above Flat Creek. The purpose of the station is to provide natural background data for the river before it receives flow from Flat Creek. As previously mentioned, Flat Creek receives effluent from the Jackson sewage treatment plant. Samples are obtained on a quarterly basis and analyzed for fecal coliform, total dissolved solids, nutrients, radiochemical constituents, and standard field determinations including pH, dissolved oxygen, water temperature, specific conductance and turbidity.

At this station water quality is good, with no violations of Wyoming Water Quality Standards observed during a six-month sampling period performed by the WDEQ (Table 4). Dissolved oxygen values range from 8.0 to 13.2 mg/l, averaging 9.7 mg/l, (standard is 6.0 mg/l). Fecal coliform counts do not exceed 172 colonies/100 ml, below State standards of 1000 colonies per 100 ml. Subsequent sampling performed under the Teton County 208 Study at the same site over a six (6) month period (3/15/76 - 9/9/76) further substantiate these findings. COD and BOD measurements fall well below levels established by public health officials. Nitrate nitrogen and total phosphate concentrations also fall below State standards, with respective maximum values of 0.18 and 0.14 mg/l measured on 6/1/76. Fecal coliform counts are also consistently below State standards.

The impact of the overloaded Jackson sewage treatment facility on Snake River water quality is apparent below the confluence of Flat Creek and the Snake River from fecal coliform data collected between August, 1968 and December, 1971. Approximately 38 samples were collected and analyzed for fecal coliform by the WDEQ. During the study period, the mean recorded value for fecal coliform was 195 colonies/100 ml. A maximum concentration of 5,420 colonies/100 ml was recorded on 7/28/69 (WDEQ, 1976), exceeding State Water Quality Standards.

Four (4) similar violations were also registered during the period of record. It should be noted, however, that it is extremely difficult to determine whether these violations are due to effluent from the Jackson treatment plant, or in part to natural background pollutants and numerous diverse, nonpoint pollution sources.

Additional information on Snake River water quality also indicates that conditions continue to deteriorate slightly in a downstream direction, particularly in terms of increased sediment loading. Much of this increased load is attributed to the Hoback River which confluences with the Snake River, approximately 12 miles below the Flat Creek/Snake River Station.

Existing water quality conditions in the main stem of the Snake River through the study area can generally be summed up as good. Quality slightly deteriorates in a downstream direction, due primarily to inadequately treated effluent from the Jackson wastewater treatment plant, agricultural activities and extreme

TABLE 4

SNAKE RIVER WATER QUALITY

(November, 1973 - November, 1975)

Parameter	Mean	Maximum	Minimum
Dissolved oxygen (mg/l)	9.70	13.20	8.00
Specific conductivity (umhos)	148.00	231.00	110.00
Turbidity (JTU)	7.70	27.00	0.40
pH (S.U.)	8.10	8.40	7.60
Fecal coliform (colonies/100 ml)	40.50	172.00	0.00
NO_3 (mg/l)*	0.20	0.40	0.10
PO_4 (mg/l)**	0.04	0.06	0.03

* 1972-1973 only

**1976

sedimentation in the Hoback River. In a few isolated cases, standards are violated. Additional monitoring conducted by the ongoing Teton County 208 Study is specific problem-oriented. This data will provide a more representative data base for future waste load determinations and stream segment analyses.

An additional consideration in analyzing the overall water quality of the Snake River is the operation and management of Jackson Lake Dam. Since irrigation diversions often deplete the flow of the Gros Ventre River, the releases from Jackson Lake are essential in maintaining the environmental condition of the Snake River. The 1976 Snake River Management Plan identified almost 200 instances when flows in the Upper Snake have been reduced to less than 100 cfs (range 0.30 - 97 cfs) due to the dam's operation. If the Snake River was to be considered as a potential site for the disposal of treated effluent, the maintenance of an adequate flow for dilution would have to be assured in order to protect the River and the aquatic habitat. The duration of these reduced flow periods is unknown.

Palisades Reservoir, which is fed by the Snake River, is currently under consideration for lake restoration. The EPA's Lake and Reservoir Assessment (1976) classifies Palisades as being mesotrophic (in the earlier stages of the eutrophication) and as a "lake cleanup" candidate as determined by the study. Since phosphate concentrations and phosphorus to nitrogen ratios are normally the limiting nutrient in Western water bodies, any increases in point and non-point source to the Snake need to be analyzed in terms of its eventual impact on Palisades. A preliminary survey of nutrient loading on Palisades Reservoir conducted jointly by EPA laboratories at Corvallis, Oregon, and Las Vegas, Nevada, concludes that nonpoint sources contributed essentially all the known phosphorus and nitrogen loading (see Appendix 4). Jackson's current wastewater treatment plant produces less than three percent of the total annual phosphorus and nitrogen loading on the reservoir.

GENERAL HYDROLOGIC CONDITION

In the Snake River Basin, which encompasses approximately 5,139 square miles in western Wyoming, streamflow discharge is directly related to spring and early summer snowmelt. On unregulated streams, an excess of 50 percent of the runoff occurs during periods of peak snowpack melt in May and June. Flows during the remainder of the year are augmented by precipitation, inflow through soil, and groundwater from aquifer systems.

Aquifers in alluvium and glacial deposits in the study area are recharged by precipitation and surface water percolation. Although precipitation is greatest in winter and spring, recharge is greatest in spring and summer when snow is melting, precipitation is occurring as rain, and streamflow is highest. Recharge also occurs during this period from irrigated lands and canal and ditch leakage. Aquifers in other than alluvium and glacial deposits are

also recharged by precipitation. Recharge in these types of rock may also occur by discharge from one aquifer to another, particularly in faulted areas. Groundwater in the study area moves from areas of recharge to areas of discharge. The flow of surface waters may be increased significantly where groundwater discharges to streams (Cox, 1974).

Surface Water

The study area is drained by the Snake River system, which heads into Teton County above Jackson Lake Reservoir, flows south across the county through Jackson Hole just west of the Town of Jackson and into Idaho at Alpine. Most of the streams in the Jackson area originate in the uplands surrounding Jackson Hole and flow to the Snake River. Major tributaries to the Snake River in the study area in terms of discharge by downstream order include: Pacific Creek, Buffalo Fork, Spread Creek, Cottonwood Creek, Gros Ventre, Fish Creek, Flat Creek and Hoback River.

Streamflow characteristics for the surface waters in the Jackson Study Area vary in a wide range because of climate, topographic and geologic features discussed in other sections of this report. Since precipitation is relatively light in the immediate study area (approximately 15 inches annually), these features have great impact on streamflow. Practically all streamflow is associated with snowmelt. In general, reaches of streams in Jackson Hole that are topographically high lose water and those that are topographically low gain water. Rainfall on snowpack and intense rainfall during summer thunderstorms further contribute to stream flows. In some streams like Mosquito and Spring Creeks, flow may be augmented from groundwater during certain times of the year. In other streams, such as the Gros Ventre River, flow may be dramatically reduced in the summer by irrigation diversions.

Streamflow data has been collected by several agencies for several streams in the study area. Although most of the data are on larger streams, generalizations can be made on streamflow characteristics for most of the streams in the Jackson area from information supplied in reports by Cox (1974, 1975) and the Wyoming Department of Environmental Quality (1976).

Approximately 4,632,500 acre-feet of surface water flow leave the Snake River Basin annually, according to the Wyoming Department of Environmental Quality (1976). Jackson Lake Reservoir is the key storage reservoir. It is estimated that some 83,700 acre-feet of surface water are consumed by irrigation, 50 acre-feet per year by the timber industry, 700 acre-feet per year by municipal, domestic and stock water uses, and 4,700 acre-feet per year by reservoir evaporation.

Surface water quality in the Snake River Basin is generally good. Surface water quality in the immediate study area is discussed in detail in the preceeding section of this report.

Groundwater

Groundwater conditions in the Snake River Basin are the result of climate, topography, geology and the activities of man. The primary sources of groundwater in the Jackson Study Area are precipitation and infiltration from surface streams, lakes and irrigated lands, with depth to groundwater varying from zero in swampy areas to nearly 200 feet along the front of the Gros Ventre Range. Depth to groundwater in the Snake River flood plain is extremely variable, with reported well fluctuations of from one to sixteen feet occurring in response to changes in river stages.

Groundwater, mostly from wells in alluvium and glacial deposits, provides water for municipal, domestic, fish-rearing, commercial and recreation uses. Very little groundwater is pumped for irrigation because surface water supplies are more economically available. Groundwater depletions for the Snake River Basin in 1970 were estimated at 1,430 acre-feet for municipal, domestic, commercial and recreation uses, and 680 acre-feet for irrigation. Irrigated lands were largely within Star Valley, according to the WDEQ (1976). It is anticipated that groundwater development will continue to grow with tourism and population growth. Although supply is generally considered adequate, some drawdown may be evidenced as the number of wells and groundwater withdrawals increase.

Although monitoring data is limited for the deep aquifer systems in the study area (particularly for biological parameters), existing information indicates that groundwater quality in the Snake River Basin is generally good. Water is of a calcium bicarbonate type; moderately hard to very hard varying with geologic and hydrologic processes. Yields of wells range from a few gallons per minute for many private domestic wells to 2,000 gallons per minute for three large municipal wells near Jackson. According to permits issued by the State Engineer's office, approximately 600 wells have been drilled in Teton County (Ablondi, 1976). It is estimated that at least this many more were drilled prior to requiring permits.

The chemical quality of groundwater in Jackson Hole is affected by the quality of water in nearby streams, according to Cox (1974). In general, groundwater is of excellent quality on the west side of the valley as is the quality of the streams flowing from the Teton Range. On the east side of the valley near Jackson and the Gros Ventre River, groundwater is higher in dissolved solids. Groundwater systems near the Snake River are generally of good quality.

Table 5 presents a comparison of selected chemical parameters from two fairly representative sampling stations in Teton County with recommended U.S. Public Health Service Drinking Water Standards (1962). This comparison provides a general indication of existing groundwater quality in the study area.

TABLE 5

GROUNDWATER QUALITY

A Comparison of Selected Chemical Parameters Monitored at the Jackson Well (October 31, 1973) and Buffalo Fork Station (November 17, 1971) with Recommended U.S. Public Health Service Standards.*

Constituent	Level Observed		Recommended U.S. Public Health Service Standards mg/l
	Buffalo Fork	Jackson	
Chloride (Cl)	10.000	-	250.0
Floride (F)	0.270	0.3	1.7 - 2.4
Iron (Fe)	0.019	-	0.3
Nitrate (NO_3)	1.000	2.4	45.0
Sulfate (SO_4)	25.000	55.0	250.0
Dissolved Solids	136.000	247.0	500.0

*Information from Ablondi (1976) and Cox (1974).

Levels observed for all six of the selected parameters fall well below recommended U.S. Public Health Service Standards. It should be noted, however, that this comparison is general in nature. Wells throughout the study area, and particularly in densely populated shallow groundwater areas near Jackson and Wilson, have shown the presence of coliform bacteria as the result of septic tank contamination. Chemical and biological constituents in groundwater samples collected throughout the study area will vary with aquifer systems and hydrologic and geologic processes.

Relatively few known problems of well contamination have occurred in Teton County. Contamination of domestic wells in Jackson Hole, however, has become increasingly prevalent in the past five years. In one study conducted by the County Sanitarian, approximately 30 wells have been classified as "unsafe" and nearly 50 as "atypical." A later well sampling program conducted by the 208 agency (1976) failed to reveal contamination of domestic wells, but these programs were conducted in different areas, at a different time of year, utilizing modified techniques. Factors contributing to these findings are somewhat localized and include contamination from improperly functioning septic tank systems, poorly sealed well casings, drilling wells into unsafe aquifers, and the fluctuating level of localized aquifers.

NONPOINT SOURCES

Information on nonpoint source pollution in the Jackson Study Area is limited, although it is anticipated that additional data will be collected through several of the Teton County areawide 208 waste treatment management studies presently underway. These studies include an evaluation of the effect of elk and cattle wastes on Flat Creek and Spring Creek, an extensive investigation of the effects of silviculture activities on the area's water quality, and a study to determine the effects of urban runoff on Jackson and vicinity water quality.

The "Snake River Basin Water Quality Management Plan" prepared by the WDEQ in February 1976 identifies erosion as the most serious potential nonpoint pollution source in the Jackson area. Although many of the erosion problems in the study area are attributed to natural causes, human activities (including land development, construction, irrigation, livestock grazing and recreational activities) contribute somewhat to increased sedimentation of local streams.

The high natural erosion rates in the Gros Ventre River drainage and the practice of discharging irrigation water from the Gros Ventre

to Flat Creek can, during spring runoff, add substantial amounts of sediment to Flat Creek. Levee construction and maintenance on the Snake River have also resulted in sporadic increases in turbidity and sediment loading to these water courses. These activities will undoubtedly continue to affect water quality in the drainages until such time as existing water use and water quality protection practices are improved.

Grazing and farming can also contribute to water degradation in Teton County and the study area. It has been estimated by the U.S. Soil Conservation Service that erosion losses associated with improper application of water to farmlands in the study area may exceed 20 tons of soil per acre per year in the Snake River Basin. Soil erosion maps have been prepared for the basin by the S.C.S. Highest erosion rates are found in the drainage of the upper Hoback and Salt Rivers. Dry cropland farming is considered the most erosive practice. Grazing, because it is better administered and less intensive, is generally considered least erosive. Pasturing stock along streams in meadows and irrigated grassland has been indicated as a possible source of increased turbidity in the study area. Runoff from corrals and grazing areas has been considered as a source of increased nutrient loading, but no definitive evidence has been developed.

Another minor nonpoint pollution source identified in the report is the National Elk Refuge located in the Flat Creek Drainage. The Refuge occupies approximately 24,000 acres of land adjacent to the Town of Jackson. The Refuge feeds some 60 percent (8,000 head) of the Jackson Hole elk herd during the winter months. As part of the 208 agency's work plan, data on the relationship between the winter elk herd and water quality was collected. Very little increase in degradation was shown to be directly attributable to the elk herd. The State of Wyoming owned South Park Elk Feedground lies approximately eight miles south of Jackson along the north bank of the Snake River. The site occupies 636 acres of land and feeds approximately 800 - 1,000 elk through five months of winter. The unit is being considered for the location of sewerage lagoons in the Jackson Facilities Plan alternatives. Most of the unit is situated in the flood plain of Flat Creek and the Snake River. Along with possible elk-generated bacterial, nutrient and sediment pollutants, the unit is also thought to contribute, though not significantly, to the area's water pollution problems in terms of recreational use and activities. During the past five years, the unit has averaged 13,705 visitor days annually. The impact of the National Elk Refuge on local water quality is undergoing extensive study under the Teton County 208 program, as mentioned earlier.

Ground and surface water contamination from individual waste disposal systems has also been shown in the study area. Numerous shallow wells in the densely populated Jackson area have demonstrated coliform bacteria levels exceeding U.S. Public Health Service Drinking Water Standards. This problem is magnified in areas of high groundwater where a continuous aquifer receives septic tank effluents and also supplies domestic water from wells (Ablondi, 1976).

A number of nonpoint source water quality problems exist in the 310,443 acre Grand Teton National Park. During the past seven years the number of visitors to the park has ranged from 2.8 - 3.3 million, according to the National Park Service (1976). This number is expected to increase to 5.5 million by 1979, representing a population of some sixteen times the total of Wyoming. Tourist activities include float trips, boating, hiking, fishing and camping. All of these activities can contribute to water quality degradation in the form of increased nutrients, coliform bacteria, oils and grease, and sedimentation in lakes and streams. Indirect activities including construction of additional park facilities, roads and parking facilities, accelerated erosion from fire control, and revegetation projects also affect water quality in the Jackson area.

Silviculture is another important nonpoint pollution source in the Wyoming Snake River Basin. Approximately 76 percent of the acreage in the basin is managed by the U.S. Forest Service. Physical processes including surface erosion, mass soil movement, channel erosion, organic composition and stream temperature are all affected by timber management practices. These processes in turn affect water quality in the Jackson area in terms of additional sediment loads and organic matter; increased levels of forest chemicals including pesticides, fertilizers and fire retardants; increased nutrient and pathogen levels; and temperature regime fluctuations caused by reduction of shade by streamside vegetation removal. The magnitude of the effects of silviculture on water quality in the Jackson area have not been fully determined. The Teton County 208 Program will be studying this potential impact.

FLOOD HAZARDS

Floods are a natural and recurring process. Streams and rivers periodically overflow their banks taking possession of some portion of their natural flood plains and floodways about once every two or three years. Greater floods which occupy larger portions of the flood plain occur less frequently.

Inundation of natural floodlands occurs when the amount of water entering the stream channel is greater than the hydraulic capacity of the channel. Floods will vary in area inundated, suddenness, duration, and frequency with natural and certain man-made conditions. The natural conditions include the total amount of rainfall and snowmelt, the intensity and geographic distribution of that rainfall and snowmelt, storm patterns, preceeding moisture conditions, temperature and season of the year. Physical features such as watershed configuration, topography, soils, geology and drainage patterns also influence flood conditions. The man-made conditions include land use changes, alteration of drainage patterns and various other factors that affect storm-water runoff. As urbanization has proceeded, encroachment on the flood plain of many incompatible land uses has occurred. While many of the original settlements were located on high ground near rivers and

creeks, settlements soon spread to nearby areas including low-lying floodlands; and urban development occurred either to take advantage of level lands or to capitalize on close-in sites.

Flooding in the Jackson Study Area occurs annually, primarily as the result of spring snowmelt. The extent of this flooding depends on the quantity of snow cover and rate of melting which is directly affected by spring temperatures. Spring snow or rainstorms can also augment snowmelt and compound the flooding situation.

The Snake River originates in the high plateaus of Yellowstone Park and flows south through Jackson Hole west of the Town of Jackson. The river drains some 1,878 square miles above the mouth of the Gros Ventre River and 2,500 square miles at the Wilson Bridge near Wilson, Wyoming (Corps of Engineers, 1976). The mean basic elevation upstream from the Wilson Bridge is about 6,200 feet above sea level with an average stream slope of about 19 feet per mile through the study area.

The history of flooding through the study area is well known to local residents. Annual flood damage is sufficient to require construction of the Jackson Hole Flood Control Project, completed by the U.S. Army Corps of Engineers in 1964. The Project consists of operating the Jackson Lake Dam and Reservoir for flood control and irrigation and a series of levees which contain the Snake River from river mile 974.4 (11.2 miles above the Wilson Bridge) to river mile 959.0 about four miles below the Wilson Bridge. In addition, the Wyoming Game and Fish Department constructed 800 feet of levees to protect the South Park Elk Feedground.

Jackson Lake was originally a natural lake. Prior to the Jackson Hole Flood Control Project, the control structure was operated primarily for irrigation. The Lake now contains approximately 25 percent of the flood control storage for Palisades Reservoir and will regulate the 100-Year Flood. The 100-Year Flood is that flood which has an average frequency occurrence of once every 100 years, or a one percent chance of occurring in a given year. However, it is important to note that this flood may occur more than once in 100 years, on successive years, and more than once in a given year.

The National Flood Insurance Program (NFIP) has established the 100-Year Flood as the basis for determining minimum land use measures for new construction or substantial improvements to existing development in flood hazard areas. The NFIP requires that communities notified of potential flood hazard and participating in the program impose minimum land use/construction requirements on development in the flood plain, insuring that the proposed development is "reasonably safe" from flooding. The program also requires purchase of flood insurance for all acquisition and new construction in special flood hazard areas that are federally financed. Federal financing restrictions include restrictions on all federal programs involving building (i.e., SBA, Hill Burton Act, EDA, EPA, etc.), housing financing (i.e., VA, BIA, etc.),

mortgage insurance programs (i.e., FHA, VA, FmHA, etc.), and all conventional lending backed by FDIC, FSLIC, etc. The Town of Jackson is presently participating in the program, while Teton County and Wilson are not. The implications of the NFIP are discussed in more detail in the land use section of this report.

The 100-Year Flood discharge for the Snake River is 23,300 cfs. Boundaries of the 100- and 500-Year flood plain are shown in Figure 8. Since 1890, there have been seven years in which major floods (flows of 22,000 cfs or more) have occurred. The peak discharges at the Wilson Bridge for these floods as estimated by the Corps of Engineers are shown in Table 6.

Velocities in the river channel through the Jackson Study Area range up to 14 feet per second. Low velocities occur in shallow depths and in ponding areas, while higher velocities occur in the main channel. Velocities over three feet per second combined with flood depths of three feet or more are generally considered potentially hazardous in terms of flood damage.

Flood duration in the reach of the Snake River flowing through the study area is approximately 30 days, according to the Corps of Engineers (1976). Flood stages characteristically rise and recede slowly in the study area.

The levee portion of the project, since completion in 1964, has provided some protection against annual flooding to the Town of Wilson. Although originally designed to accommodate flows of the 500-Year Flood (45,000 cfs), annual maintenance and repair have been necessary to contain flows of the 50-Year Flood. Costs for annual maintenance of the system presently amount to approximately $70,000 according to information supplied by the Corps of Engineers. These costs apply to the mean annual flood flow of 13,000 cfs (Haible, 1976). The local/federal contributions for annual maintenance are approximately $25,000/$45,000 respectively. These estimates compare to an average annual loss of some $26,000 for the portion of the Snake River flood plain from the Park to the lower highway bridge.

Because of the concern that the levees will not contain the 50- or 100- and perhaps even the 25-Year Flood, the U.S. Army Corps of Engineers is presently preparing a "Levee System Design Deficiency Report, Snake River, Jackson, Wyoming." Although not complete, discussions with the Corps of Engineers indicate that the study is considering a number of alternative actions for the levee system ranging from present partial rehabilitation and annual maintenance to complete rehabilitation to original design standards at an estimated cost of some $15,000,000. High costs for total renovation are escalated because of the problem of lateral erosion which is characteristic of levees built on braided or wide, shallow sandbed streams. In these situations, levees fail due to the undercutting action of the shallow flows rather than from overtopping. The problem of maintenance is also compounded by lack of,

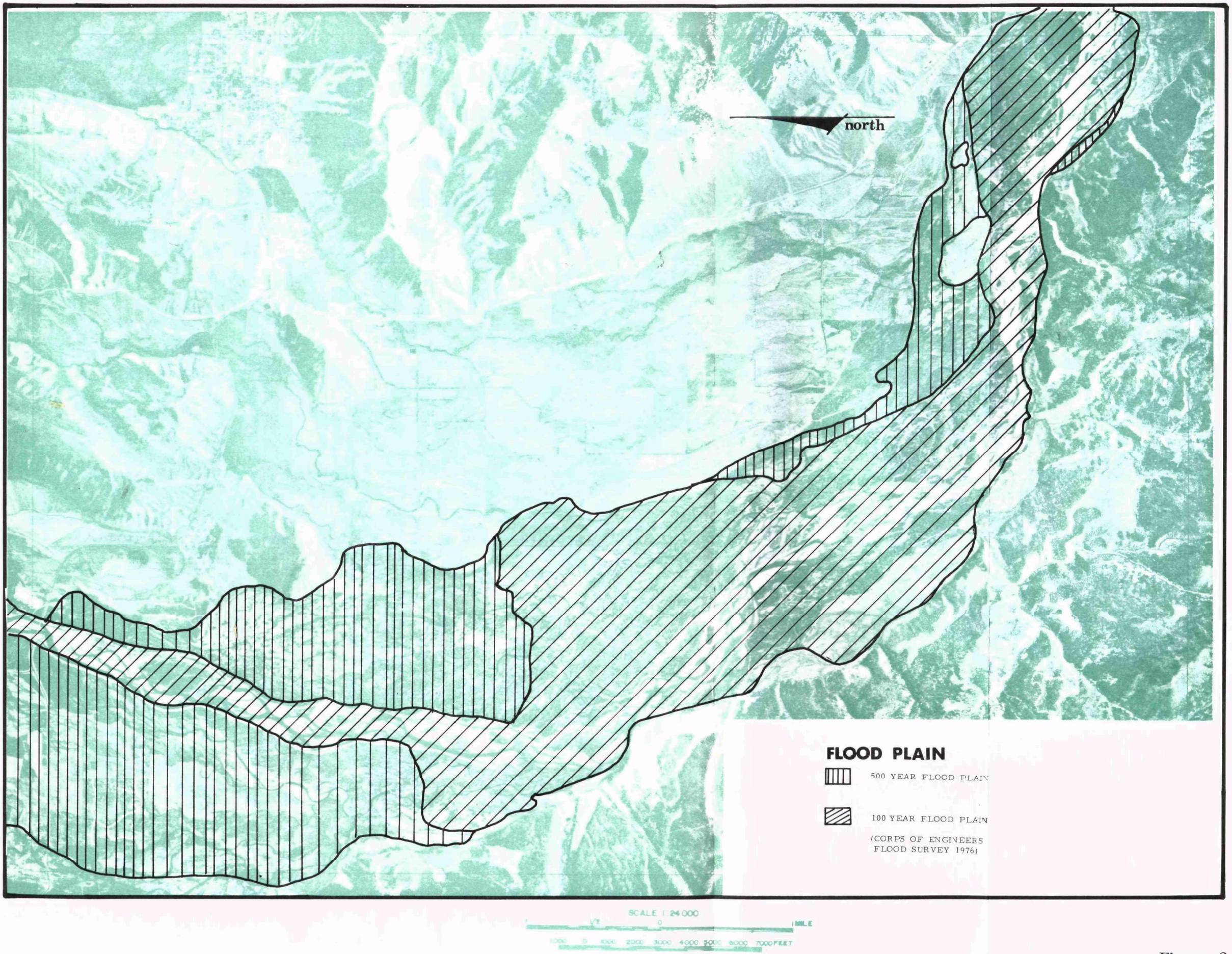

north
FLOOD PLAIN
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
(CORPS OF ENGINEERS
FLOOD SURVEY 1976)
SCALE 1:24 000
0
1 MILE
0
1000
2000
3000
4000
5000
6000
7000 FEET

Figure 8

TABLE 6

ESTIMATED PEAK DISCHARGES

FOR THE SNAKE RIVER AT WILSON BRIDGE*

Year	Peak Discharge (cfs)
1894	41,000
1918	32,500
1904	28,500
1909	25,900
1917	23,400
1927	22,900
1943	22,800

*Information from Special Flood Hazard Information, Snake River, Wilson, Wyoming and Vicinity, February, 1976, U.S. Army Corps of Engineers.

and costs for maintaining access roads. The high costs are most directly associated with the costs of providing high grade rip-rap.

As previously mentioned, the Jackson Hole area is an area of high seismic activity. Another important consideration related to flood hazard along the Snake River is the possibility of severe flooding downstream from Jackson Lake Dam in the event of a severe earthquake and dam failure. The U.S. Geological Survey has analyzed the potential impacts of such an event in their recent report: "Hydrologic Effects of Hypothetical Earthquake-Caused Floods Below Jackson Lake, Northwestern Wyoming" (1976). In this report, variations of dam and outlet structure failure were examined, peak discharges were calculated and an inundation map prepared. Effects of the most extensive flooding (that experienced with instantaneous destruction of the entire dam) included extensive scour, fill and re-position of the channel, destruction of buildings (particularly in the Town of Wilson) and flood plain vegetation, and possible contamination of domestic wells. Areas subject to innundation by flooding which would result from this catastrophic event, similar to the 500-Year Flood, are shown on Figure 8.

The reach of Flat Creek from the Town of Jackson to South Park Road (Figure 9) is also subject to periodic flooding during the winter months. Flat Creek presently receives treated effluent from the Jackson sewage treatment plant. Localized flooding caused by ice blockage can occur, with water depths varying from ten (10) to two (2) feet or less on the flat lands. Flooding generally occurs between December and March, presenting hazard to livestock and agricultural facilities in the area.

Flooding along Flat Creek, because of its nature, is not subject to the same analysis as flooding caused by runoff in stream channels. Flat Creek is the only stream in the region known to flood in this manner, according to Haible (1976). According to information supplied by the Corps of Engineers, however, detailed data does exist for a portion of Flat Creek in the form of a special flood hazard survey performed in October, 1976. This survey includes a portion of the creek through the Town of Jackson. A Flood Hazard Boundary Map (revised 4/16/76) has also been prepared for the Town of Jackson by the Department of Housing and Urban Development, delineating the limits of the 100-Year Flood. This map is presently utilized by lenders to determine flood insurance requirements for new construction in Jackson.

EPA policy, as directed by Executive Order 11296, indicates treatment facilities funded by the government will be evaluated for flood hazard. The regulatory principle used for the evaluation is the flood having a 100-year recurrence interval. It is therefore likely that any alternative site for the Jackson sewage treatment facility located in the 100-Year flood plain would be required to incorporate flood-proofing and/or elevation provisions in design which minimize flood hazards. (Costs associated with flood-proofing the Jackson facility to the level of the 100-Year Flood have not been included in cost evaluation analysis of the alternatives.)

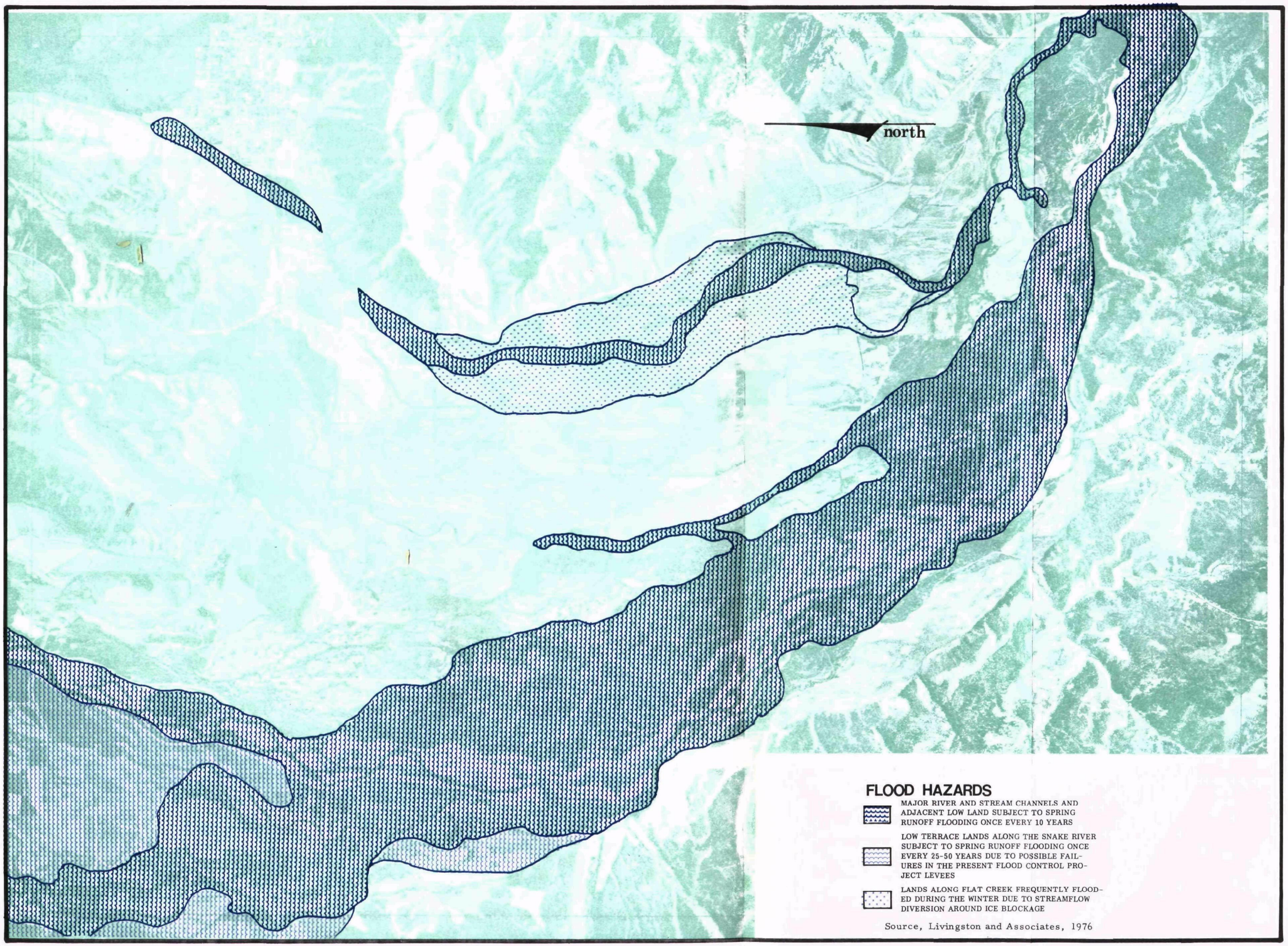

north
FLOOD HAZARDS
MAJOR RIVER AND STREAM CHANNELS AND ADJACENT LOW LAND SUBJECT TO SPRING RUNOFF FLOODING ONCE EVERY 10 YEARS
LOW TERRACE LANDS ALONG THE SNAKE RIVER SUBJECT TO SPRING RUNOFF FLOODING ONCE EVERY 25-50 YEARS DUE TO POSSIBLE FAILURES IN THE PRESENT FLOOD CONTROL PROJECT LEVEES
LANDS ALONG FLAT CREEK FREQUENTLY FLOODED DURING THE WINTER DUE TO STREAMFLOW DIVERSION AROUND ICE BLOCKAGE
Source, Livingston and Associates, 1976
SCALE 1:24 000
MILE
4000 5000 6000 7000 FEET

Figure 9

These costs will vary considerably with location and are dependent on elevation information presently being developed by the Corps of Engineers.

The final EPA grant regulations concerning evaluation of flood hazard for wastewater treatment construction grants were published in the Federal Register on May 8, 1974 (40CRF 30.405-10), and are also included in EPA Program Requirements Memorandum (PRM) No. 75-28. Effective July 1, 1975 (or one year after a community's notification as a flood-prone community, whichever is later), EPA is prohibited by law from making any grant for acquisition or construction purposes in a flood hazard area unless the community in which the project is located is participating in the flood insurance program, and flood insurance is purchased by the grantee. Participation must begin with construction and continue for the entire useful life of the project. The amount of insurance required is the total project cost, excluding facilities which are uninsurable under the NFIP (in the case of sewage treatment works, eligible facilities are generally restricted to building structures, as defined by HUD) and the cost of land; or the maximum limit of coverage made available to the grantee under the program, whichever is less. The required insurance premium for the period of construction, whether assumed by the grantee or the contractor, is an allowable project cost. The list of communities determined as "flood prone" is published on a monthly basis by HUD.

The maximum insurance coverage for all types of buildings other than residential under the Emergency Program of the NFIP is $100,000 per building, at a federally subsidized rate of 40¢/$100 coverage per year. Once Flood Hazard Rate Maps have been prepared and the community has entered the Regular Program of the NFIP, maximum insurance coverage of $200,000 per building for actuarial rates (proportionate to the flood hazard) is available.

In the case of the Jackson wastewater treatment facility, the Town of Jackson is participating in the Emergency Program of the NFIP. However, flood-prone areas for Teton County have not been identified by HUD, and the county is not participating in the program. Although EPA regulations prohibit making any grant for acquisition or construction in a flood hazard area unless the community in which the project is located is participating in the NFIP and flood insurance is purchased, these regulations would not mandate purchase of flood insurance for the proposed Jackson treatment facility prior to making a grant because Teton County has not been notified by HUD of flood hazard. EPA cannot require a community by virtue of funding regulations, as in the case of Jackson, to enter the NFIP in order to receive a grant. If, however, Teton County were in the program, the Town of Jackson would be required to purchase flood insurance as a provision of grant approval. Under the Emergency Program, the Town would be required to purchase $100,000 coverage at the subsidized rate of 40¢/$100 and annual cost of $400. Once Teton County entered the Regular Program, the amount of available and required coverage would increase to

$200,000. However, the actuarial rate (based on discussions with HUD) would probably decrease to about 20¢/$100 coverage.

It should be noted that although Teton County is not presently participating in the NFIP, the county will undoubtedly be notified of flood prone areas by HUD in the near future. As mentioned earlier in the discussion, the Snake River and Flat Creek through the study area are subject to annual flooding, and flood hazard areas have been identified by the Corps of Engineers. Presently, individuals living outside the corporate limits of Jackson cannot purchase flood insurance because the county is not participating in the program. Participation will not only make insurance available to county residents, but also protect life and properties by limiting development in flood prone areas and requiring that new construction located in flood prone areas is reasonably safe from flooding.

Additional considerations in terms of Snake River and Flat Creek flooding and the Jackson Facilities Plan alternatives include: physical damages and related costs to the treatment plant, pipeline and sewage outfall; emergency costs and indirect business losses resulting from flooding; water quality degradation resulting from physical damage to the facilities; and outfall location for Snake River effluent discharge as related to reposition of the channel resulting from substantial flood flows. For example, physical damage, emergency costs and indirect business losses can be reduced by locating facilities in areas not subject to flooding. Water quality can also be protected by locating a treatment facility in an area which would not be subjected to flood hazard. Location out of the 100-Year flood plain minimizes sewer service disruption during flooding, which can result in hazards to public health through backup of sanitary sewer systems and contaminated public water systems as well as damage to fisheries and wildlife support systems. These considerations will be described in more detail for respective alternatives in the Environmental Impacts of Alternatives section of this report.

NATURAL COMMUNITIES

Vegetation

The Jackson Hole area has a wide spectrum of climatic and topographic features and a corresponding diversity of vegetation. This vegetation plays an important part in the dynamic characteristics of the regional ecosystem. The importance of vegetation in stabilizing slopes against erosion in an area characterized by seismic activity, periodic flooding and slope instability cannot be over-stated.

Vegetation in the Jackson Study Area is transitional between Great Basin and Rocky Mountain types, with total production of vegetation generally greater above 7,000 feet in elevation. The

predominant species in the valley floor are the big sagebrush (Artemisia tridentata) and crested wheat grass (Ayropyron spicatum) according to Shaw (1974). This cover type, when undisturbed, has a moderate capacity for intercepting rainfall and decreasing surface runoff and erosion.

The South Park Study Area is characterized by agricultural cover types including grass and alfalfa hay and pasture. The greatest percentage of these agricultural lands were once riparian, marshland and sagebrush-grass types. This change to an agriculture ground cover provides only a low interception capacity and a low impedance to surface runoff.

The area is also characterized by riparian vegetative types including cottonwoods (Populus deltoides) and dwarf maple (Acer sp.) along the Gros Ventre and Snake Rivers and the marshland cover types (cattails, rushes and sedges) which emerge along Flat Creek. Aspen also occurs along the transitional slopes of the study area, although a recent decline has been observed in the region (Lower Valley Power and Light, Inc., 1974). Riparian vegetative types usually provide high erosion protection and capacity for filtering out sediment from overland flows. Maintenance of the cover is naturally important for sediment control and streambank protection.

A conifer type cover characterizes the upper hillslopes and steeper sloping topography which surrounds the study area. Lodgepole pine (Pinus contorta) and Douglas fir (Pseudotsuga menziesii) are the predominant forest types in the area. Douglas fir may reach an age of 400 to 600 years, with maximum diameters of four to five feet according to Shaw (1974). Limber pine (Pinus flexilus) are also found on these hillslopes and in the lower valley area. Dominant understory plants in the higher elevations include pinegrass (Calamagrostis rubescens), wild rye (Elymus glauca) and big whortleberry (Vaccinium sp.). This cover type has a high capacity for intercepting precipitation and retarding surface flow. In most cases, the conifer type cover protects the ground from erosion. However, water concentrated by construction activities may develop enough force to destroy this protective cover.

The impact of development on the Jackson Study Area vegetation is an important consideration for the proposed project. Perhaps the most important aspect of this consideration in terms of the project is the loss of vegetation on the valley floor and the increase in areas covered by impervious surfaces associated with urban development (parking areas, rooftops, roads, etc.) made possible by the availability of the proposed facility. This activity can cause a decrease in the overall watershed capacity of the watershed soils, as stated by Livingston (1976), which in turn lead to increased flows in stream channels and increased stream channel erosion. Increased storm runoff to stream channels with resultant erosion and bank slippage has occurred in portions of the study area, particularly on Mosquito, Cottonwood, and Crane Creeks. The streams are characterized by gentle sloping and steep sides, streambank vegetation not only stabilizing the streambank,

but also providing a buffer to trap sediment washing downslope and affording shade for game fish rearing. This potential to degrade water and stream channel quality should be considered in any future development of the area.

Wildlife and Terrestrial Habitat

Within the South Park Study Area and the neighboring lands several outstanding wildlife habitats exist. While the majority of this region, as one looks across the flat valley bottom, has been placed in agriculture, the fence row bordering flood plains and forested hillsides all provide a stable and supporting environment for a number of seasonal and resident species. Two areas of particular wildlife significance, in terms of their carrying capacity and importance during the critical winter months, are the Snake River flood plain and channel meanders and the State's South Park Elk Feedground. Both areas provide a wintering area for the predominant big game species of the region, elk, moose, and deer (Figure 10).

In general not a great deal of information is available on the species diversity or habitat conditions within the project area. A number of studies and articles have been published covering the flora and fauna of Jackson Hole, but these (discussing the area in question) pertain to the entire valley. The Wyoming Department of Game and Fish has detailed records on the types and numbers of game species and has classified the general ranges of these animals and their critical and winter habitat. A habitat analysis for the South Park Elk Feedground and adjacent South Park lands was initiated but has not been finalized for distribution at the time of this printing.

Within Jackson Hole it is possible to encounter a number of non-game mammalian and avian species including black bear, mountain lion, bobcat, Canadian lynx, wolverine, and beaver. Other smaller species include otter, raccoon, marmot, chipmunk, red squirrel, badger, weasel, ground squirrel, and skunk.

A variety of avian species migrate through the region each year. Geese, trumpeter swan, a variety of ducks (teal, mallards, goldeneye, etc.) and wading birds inhabit the lakes and rivers during their yearly migrations. Raptors including osprey and bald eagles nest and fish along the Snake River. The peregrine falcon and other more common hawks and falcons can be observed hunting in the area along with a number of other interesting species including the gray jay, horned owl, magpie, tanager, and mountain blue bird.

While all the wildlife species are important in terms of the general environmental balance of the region, the effects that any proposed development would have on big game of the region are particularly significant. Historically a good portion of the economy of the Jackson area has been dependent upon the local

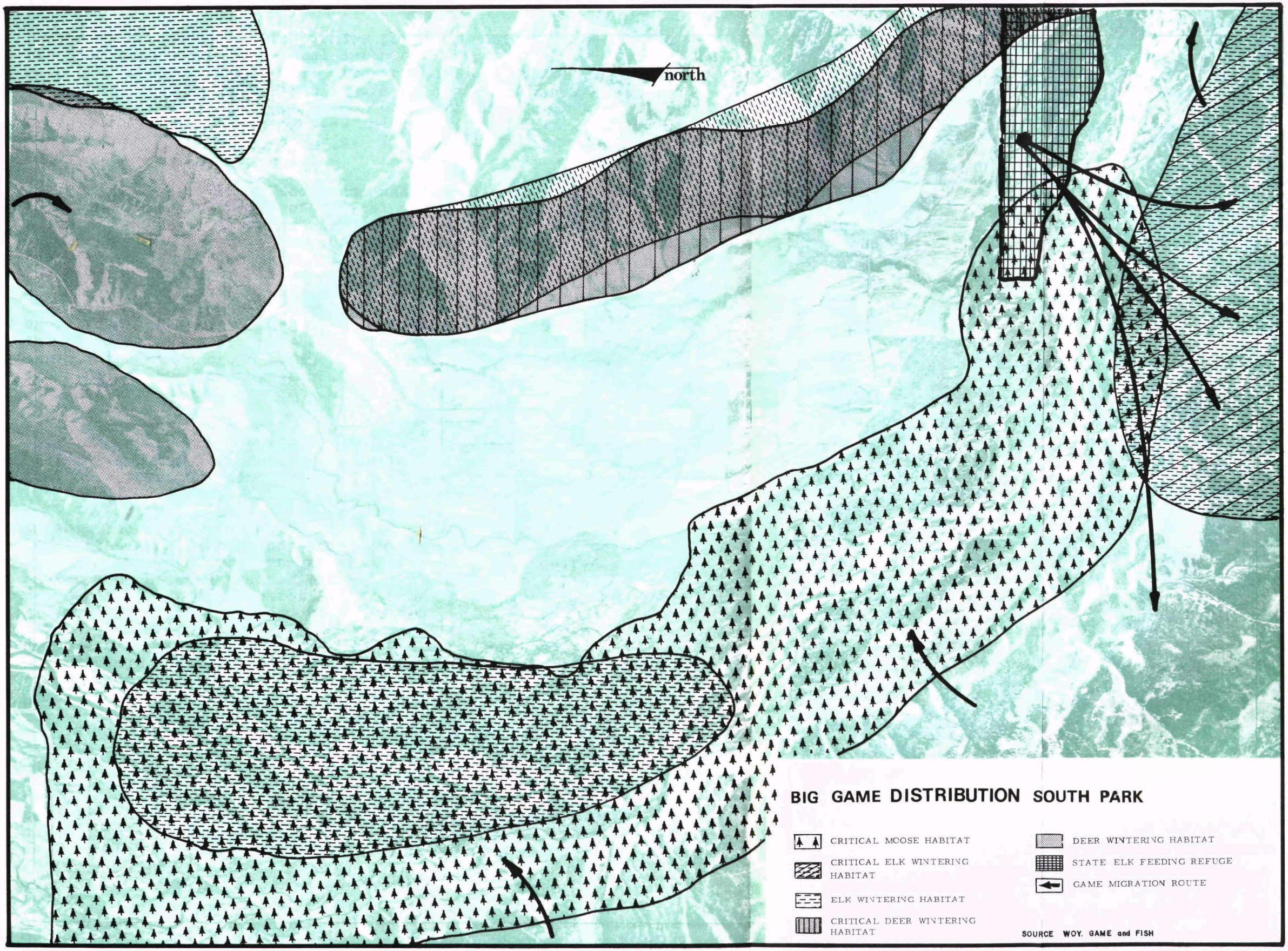

north
BIG GAME DISTRIBUTION SOUTH PARK
CRITICAL MOOSE HABITAT
CRITICAL ELK WINTERING HABITAT
ELK WINTERING HABITAT
CRITICAL DEER WINTERING HABITAT
DEER WINTERING HABITAT
STATE ELK FEEDING REFUGE
GAME MIGRATION ROUTE
SOURCE WOY. GAME and FISH
SCALE 1:24000
1 MILE
0 1000 2000 3000 4000 5000 6000 7000 FEET

Figure 10

residents acting as hunting guides for out-of-state hunters. It has also been noted by several authors that the wintering elk herds have been a special emotional tie for the local residents since the turn of the century. The acquisition of land for the present National Elk Refuge (not to be confused with the South Park Elk Feedground) north of Jackson was initiated in 1911 to protect and manage the Yellowstone elk herds. It annually winters over 8,000-10,000 head.

The South Park Elk Feedground was established in 1939 and, following the acquisition of several additional land parcels, contains 636 acres at the narrow end of the valley. Appendix 1 contains a comprehensive summary and description of the site prepared for the Wyoming Game and Fish Commission pursuant to the request by the Town of Jackson for a long term lease.

The basic purpose of the South Park Elk Feedground is to provide for the maintenance of approximately 800-1,000 head of elk. Animals that would either starve during hard winters or damage surrounding ranch property in their search for winter forage are fed first on the natural vegetation on the unit and later on imported hay as the winter snow builds up.

On the average an elk spends 149 days on the Feedground at a cost to the State of Wyoming of $41.50 per season. The purchase of local supplemental feed accounts for a large portion of the $38,000 a year operating budget.

The site serves as an ideal habitat for the animals that inhabit the unit. The combination of open grass/meadows and the dense stands of cottonwoods provides both food and protection. A necessary amount of open-space is available as required as a buffer zone between the elk and adjacent human activities. The flood plain corridor created by the Snake River enables animals to migrate on and off the Feedground without undue harassment. According to the Department of Game and Fish, without feeding grounds of this nature the elk herd would not have sufficient winter range to survive since historical winter ranges and migration routes have been used for other purposes or blocked by the progress of civilization.

Since most of the unit is situated in the known flood plains of Flat Creek and the Snake River, the Department of Game and Fish built over 800 feet of dike in 1957-1958 to keep the Snake from flooding into Flat Creek and inundating the unit. Even though the area is protected from human intrusion during the winter, it provides a great deal of recreational opportunities the other seven months of the year. Over 1,727 hunter days are sustained as a result of management goals for the herd; between 500-1,200 fishermen used Flat Creek during 1974; and the unit has averaged over 13,705 visitor days and 1,000 camper days per season.

In addition to the elk, other species of wildlife such as moose, deer, raptor, water fowl, and upland game birds are also present.

Aquatic Habitat

Both Flat Creek and the Snake River are known to support an active self-sustaining cold water fishery. The Snake River is a trophy stream known to sportsmen throughout the country. A number of guides and river boatmen work out of Jackson during the summer and early fall offering scenic trips and fishing expeditions. The Wyoming Department of Game and Fish manages the fishery of the Snake River in terms of establishing and regulating bag limits.

Very little is known about the fishery potential of the lower reaches of Flat Creek below the Town of Jackson. The area in question is exclusively private with the only public access at the South Park Elk Feedground. Fishing in town is usually limited to children and the elderly, and fishing access to Flat Creek as it crosses the National Elk Refuge is controlled and limited to late summer. Within the South Park Study Area, Flat Creek is not considered to be of particular importance as a public fish resource due to the lack of access points and availability of other high quality streams in the area. The discharges from the existing wastewater treatment facility, according to recent data (see Section on Water Quality), do not present a fishery limiting problem as a result of either oxygen depletion or ammonia toxicity.

Rare and Endangered Species

The Endangered Species Act of 1973 authorized the Secretary of the Interior to designate threatened as well as endangered animals and plants. The Act officially recognizes two categories: 1) Endangered Species and 2) Threatened Species. The endangered list has been completed but no official list of threatened species has been promulgated. According to information published by the U.S. Fish and Wildlife Service, both the American peregrine falcon and the blackfoot ferret may be found as either transient or resident in the South Park area. In addition, both the Canadian lynx and wolverine, considered threatened in the Western United States by most experts, have been seen in the study area.

No plant species have yet been declared threatened or endangered under the terms of the 1973 Act. In 1974, the Smithsonian Institute submitted a list of 2,099 plants in the Continental United States for consideration as provided by the Act. No plant species on this list or the 57 additional plants added later are known to occur in the study area.

LAND USE PLANNING

The use of land is perhaps the most basic of all environmental issues. Sound land use is fundamental both to preserving stable ecosystems and to controlling pollution.

As with highways, the construction of sewers can have a major effect on local land use. Impacts represent real costs to the community--costs that may be reduced by proper land use controls and public facilities planning.

Because of the scenic grandeur and environmental sensitivity of the Jackson area, the link between sound land use and public facilities planning is particularly important. The environmental impacts for the proposed Town of Jackson sewage treatment plant will vary according to how much development occurs, the spatial pattern and density in which it emerges, the speed at which it progresses and the natural characteristics of the site. This section investigates this relationship by reviewing existing land use and the status of current land use planning in the Jackson Study Area and analyzing the proposed "Teton County Comprehensive Plan" and its relationships to wastewater facilities planning.

Existing Land Use

Teton County is sparsely settled. The existing population is largely concentrated in a few areas and fluctuates seasonally. The county contains a land area of approximately 2,873 square miles. Land is of two general types: mountainous areas and the central Jackson Hole valley floor. Teton County contains approximately 1,838,720 acres, including some 1,795,328 acres of land surface and about 43,392 acres of water surface. About 97 percent of the land area in the county is government owned. Approximately 75,000 acres are privately owned. Most of this land is located in the Jackson Hole area. This scarcity of private land dictates that what land is available must be used wisely. Table 7 provides a general breakdown of this ownership.

The land use of private lands in Teton County in 1968 is shown in Table 8. In 1969 there were about 64,403 acres of farmland in the county, an increase of some 1,000 acres over the 1968 estimate (U.S. Census of Agriculture, 1969). As indicated from the data, agriculture accounts for nearly 85 percent of the private land uses in the county. About half of the agricultural land is rangeland. The remaining agricultural lands are primarily irrigated and cultivated farmland (Teton County Soil and Water Conservation District, 1970).

The 1970 population of Teton County was approximately 6,000 people. This population represents a 77 percent increase (1,583 people) over the 1960 census. The 1975 population was estimated at about 7,300. The Town of Jackson's estimated population for 1975 was 4,150 (Livingston, 1976).

The four basic categories of development in Teton County include the relatively urbanized areas centered around the towns of Jackson and Moose, mixed urban/agricultural areas of Alta and Wilson, predominant agricultural and rural residential areas of Jackson Hole, and scattered commercial uses at highway junctions

TABLE 7

TETON COUNTY LAND OWNERSHIP AND MANAGEMENT*

Ownership	Percent
U.S. Forest Service	77.0
U.S. Park Service	16.5
U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management and State of Wyoming	4.0
Private	2.5
	100.0

*Information from Lower Valley Power and Light (1974)

TABLE 8

LAND USE OF PRIVATE LANDS (1968)

Land Use	Acres	Percent
Urban - Developed	980	1.3
Agriculture	63,369	84.4
Woodland	1,175	1.6
Vacant - Undeveloped	9,534	12.7
TOTAL	75,058	100.0

and strip commercial development along highway frontages. Residential uses are generally of relatively high quality, while commercial uses often violate sound planning concepts (Planning and Research Associates, Inc., 1970).

Current economic information is not presently available for Teton County. The County has, however, recently contracted with the University of Wyoming to prepare a regional economic base study.

Existing information indicates that tourism-recreation is the dominant industry in the study area. This industry has been the primary impetus to population growth. Agriculture is second to tourism and recreation in its influence on the economy of the area. Both of these economies have shown stabilizing increases in both population and personal incomes during the past five years, despite a continuing decrease in acreage available to private agricultural operators (Lower Valley Power and Light, Inc., 1974). It is anticipated that much of the existing agricultural land will be converted to other uses as development pressures increase. Another important source of the local economy in the study area is government employment and expenditures. In 1969, for example, the government sector of the economy was more than $5,000,000. This income is expected to continue to increase.

Transportation circulation in the study area is channeled through the long valley floor by U.S. Highway 26, 89 and 187. In 1970 this major roadway averaged between 1,500 and 3,800 vehicles per day at Hoback Junction (Master Plan for Teton County, 1970). Counts taken outside Jackson indicate this daily average is exceeded frequently, as evidenced by congestion on Highway 26, 89 and 187. State Highway 22 has been improved in recent years and provides major access from Jackson to Idaho cities to the west. Internal circulation in the study area is provided by a fairly adequate system of federal, state and county roads. The Jackson Airport also plays a continually increasing and important role in accommodating commercial and private air traffic.

Legal and Political Considerations

As in many parts of the western United States, the questions of land use and land use planning are in the legal/political arena in Teton County. Views on the benefits of land use planning for the area appear to be polarized, with many of the larger land owners opposing land use regulation for the land they own. However, the results of recent public opinion surveys by Livingston & Associates, the planning consultant working for Teton County, indicate that a surprisingly large majority of the public in the County favor what many would consider strong land use controls to protect the various resources of the County. Eighty to 84 percent of the respondents favored limiting development of private lands because of natural hazards including areas of high water table unsuitable for septic tanks; protecting terrain, vegetation and wildlife;

and protecting scenic values. Eighty-one percent favored land use regulations to preserve water quality even if the business or ranching operation or lifestyle at home would be affected. Over two-thirds favored limiting the pace of growth in the years ahead.

Results from a second questionnaire developed by Livingston & Associates and the University of Wyoming Water Resources Institute, "Proposed County Plan and Action Program," further substantiated these findings (Livingston & Associates, 1977). In summary, over 80 percent of the respondents strongly supported the retention of the "essential character" and environmental quality of the Jackson Hole area. Strong support for protection of outstanding sensitive environmental and scenic resources including wildlife habitats was also expressed; with mixed support for preservation of agricultural lands for ranching and providing land and supporting public services to accommodate new residential development. In terms of land use/water quality questions, respondents (86 percent) favored concentrating future residential development around presently developed areas and 86 percent favored discouraging strip commercial development along highway routes to Jackson. First priority for scenic preservation was given to private lands in the Snake River and Gros Ventre River flood plains. Potential high density development area preferences included the existing towns of Jackson and Wilson and the Skyline Ranch, Snake River-Fish Creek, and Moose-Wilson Road suburban residential areas. Indications from the initial survey that conventional zoning is largely unacceptable to Teton County residents were not verified. However, a majority of the residents responding did indicate support of enactment of environmental protection regulations.

Although the County does have a planning commission, created in 1968 to develop a master plan, it does not currently have an updated set of planning and zoning provisions. The County is currently operating on a master plan developed in 1970 by Planning and Research Associates, Inc., Salt Lake City, Utah. The plan is considered law where specific. The County also enforces subdivision regulation and neighborhood density guidelines. To prevent inappropriate development from occurring while the "Comprehensive Plan and Implementation Program" are being prepared and adopted, the County has also enacted interim "Development Regulations" which require permits for most new developments. The regulations call for positive findings to be made on 25 different factors including environmental and visual impacts, water supply, waste disposal, access, public services, agriculture, and nuisances before a permit can be granted. Decisions are made on a project-by-project basis.

Status of Current Planning

The consulting planning firm of Livingston & Associates is currently under contract with Teton County to develop alternatives for a county land use plan, as directed by state legislation enacted in 1975. This legislation requires counties to develop

comprehensive plans. The legislation does not require implementation of the plans. It is anticipated that final adoption of the Teton County plan will occur during the next eight to ten months. It is not likely, however, that the plan will be adopted prior to completion of the final EIS and approval by EPA of the facilities plan for a new wastewater treatment plant.

Livingston & Associates is also developing a land use element for the Town of Jackson. Concurrently, Jackson is updating its zoning ordinance. Jackson currently has jurisdiction for development occurring within a one (1) mile radius of the corporate limits of the town.

Under the Teton County 208 Study, the firm of Nelson, Haley, Patterson and Quirk, Inc. (NHPQ) is evaluating alternative wastewater treatment systems for the Jackson-Wilson-Teton Village area. This evaluation concentrates on the concept of cost-effective wastewater treatment systems. To date, two working papers have been completed. The study considers individual waste disposal, aerated lagoons, land application systems for the Jackson-Wilson-Teton Village area and compares these systems to central wastewater treatment facilities in terms of costs and operation. Among the alternatives originally considered was to connect these scattered communities to the proposed Jackson plant. A preliminary study of the economic feasibility of centralizing these facilities is underway through the 208 program. This study has not been considered further in this analysis.

Because the relationships between wastewater systems and land use planning for the County and the Town of Jackson are intimately related, an assumption must be made that the general theme of the proposed comprehensive plan, or something very similar, will be adopted in the near future. However, it should be emphasized that this EIS primarily concerns only the proposed wastewater systems and not the land use in general.

Proposed Comprehensive Plan

In general, the comprehensive plan presently being formulated consists of a land use element assumed to be implemented primarily by regulation and a scenic preservation element assumed to be achieved primarily by purchase. Although the proposed plan could easily be adapted to implementation by conventional zoning, the County has directed the consultant to emphasize implementation approaches that do not deal with this type of regulation. The plan, as presently proposed, also does not deal with development location or growth rate controls. Certain basic physical land use constraints are used to determine maximum development densities.

The environmental protection element of the proposed plan would classify all private lands in Teton County in one or more of eight districts including: Flood Protection Districts; Watercourse Protection Districts; Groundwater Protection Districts; Hillside

Protection Districts; Suburban Development Districts; Low Density Cluster Districts; Medium Density Cluster Districts; and Urban Development Districts. A land parcel could fall within several of these districts, and in this case presumably would be subject to the most stringent regulation. Compensation to land owners adversely affected by environmental regulation is also proposed in the form of "development rights transfer." Development rights transfer, or "density transfer," involves assignment by local government of rights to landowners of land which is regulated. Owners can then transfer these rights to other lands or sell them to owners of land designated for more intensive development.

The scenic preservation element of the proposed plan assumes that it will be necessary to establish preservation priorities according to the degree of impact inharmonious development would create. The element establishes four priority levels for the purchase of scenic easements on the basis of environmental sensitivity of the various lacations, the degree of control necessary to achieve the aims of the program, and the best timing strategy.

Factors Considered

In summary, the comprehensive plan as presently formulated considers the 10-Year and 25- to 50-Year flood plains, slope stability due to vegetation and geology, and water table considerations particularly as they affect septic tank utilization. Specifically, the proposed plan considers the following factors.

Geomorphic units. This category primarily deals with the stability of various land units due to soil and geologic considerations.

Groundwater categories. This category deals with the permeability drainage characteristics and groundwater levels.

Flood hazards. Primary consideration is given to the 10-Year Flood, where development is proposed to be prohibited, and to the 25- to 50-Year flood plain where certain residential developments are allowed, but high-density residential commercial development prohibited.

Landscape units and vegetation maps. This category primarily deals with the type of vegetation cover as related to the particular type of landscape unit (e.g., river, terraces and flood plains).

It is also important for the purposes of this EIS to understand the significance of factors not directly considered in the proposed plan. Wildlife habitat units, migration routes and fisheries, for example, are not directly considered in the planning approach, but are said to be "implicit" in the plan. Although many wildlife considerations are addressed in the protection of steep slopes and flood plains, the Wyoming Department of Game and Fish maintains there are certain wildlife considerations not

integrated into the proposed comprehensive plan (i.e., protection of migration routes and buffer areas).

A scenic study element of the plan was prepared by the U.S. Forest Service. However, this study is based on the general description of units, rather than a specific mapping of important scenic vistas.

Although special attention was given to prevention of bacterial contamination of groundwater, nonpathogenic water quality considerations (nutrients) were not considered in the plan. Since nitrates, for example, are not generally absorbed by the soil media, they will move from the septic tanks with the groundwater until they emerge in a surface water body and are eventually taken up as part of the biomass. Such nitrates can act as biostimulants. In some cases this might be beneficial if the population of desirable forms of aquatic life including certain macroinvertebrates and fish species are increased. However, the more common situation is for water degrading forms such as algae to be stimulated in the form of nuisance algal blooms.

An important factor to consider in comprehensive planning is the economic feasibility of wastewater collection, treatment and disposal systems; transportation systems; educational facilities; domestic water systems and police and fire protection. Assuming various growth levels, the cost of the needed utilities and facilities greatly depends on the location of development and the configuration and density of the growth pattern. This aspect is not included in the proposed plan as presently formulated.

Prohibiting development in the 10-Year flood plain is a good, but somewhat outdated approach. Ultimately, Teton County may decide, as the Town of Jackson, to enter the National Flood Insurance Program. Land use and construction control measures under this program equate to the "floodway" and the 100-Year flood plain and prohibit construction of structures in delineated floodways. The 100-year criteria are also consistent with the levee studies presently being performed by the U.S. Army Corps of Engineers. It should also be noted that while the proposed plan would prohibit locating sewage treatment facilities in the 10- and 25- to 50-Year flood plain areas, EPA policy requires flood-proofing and/or elevation of sewage treatment plants to the level of the 100-Year flood plain, as discussed earlier in this report.

Finally, the proposed comprehensive plan does not include a transportation element. Considering the potential impacts of transportation systems on wastewater treatment planning, and conversely the impacts of wastewater treatment facilities on growth and transportation needs, the factor should be considered significant.

Land Use Element

The portion of the proposed "Teton County Comprehensive Plan" for the study area is shown in Figure 11. The plan, in effect, assumes that some form of residential, commercial or industrial development is possible for the entire 75,000 acres of private land, with the exception of the 10-Year flood plain areas.

The residential area densities proposed for the Town of Jackson and vicinity vary from ten units per acre to one unit per ten acres (Figure 12). Residential dwelling types include single and multi-family, townhouses and low rise apartments. In total, the proposed plan shows residential areas including approximately 650 acres with a total saturation capacity of some 17,875 people. Proposed residential densities for Teton Village located approximately nine miles northwest of Jackson range up to 20 units per acre.

Areas are also established for commercial development in both the Teton County and Town of Jackson land use elements. These areas occur adjacent to existing commercial development. The plans suggest continuing existing types of commercial development along the major highways. These businesses are highly dependent on and related to tourism and recreation.

A limited amount of land south of Jackson is designated for industrial growth. Industrial growth is defined as light industrial/distribution (warehousing). In general, industrial land use is designated adjacent to existing industrial uses and along U.S. Highway 89-18-126 South.

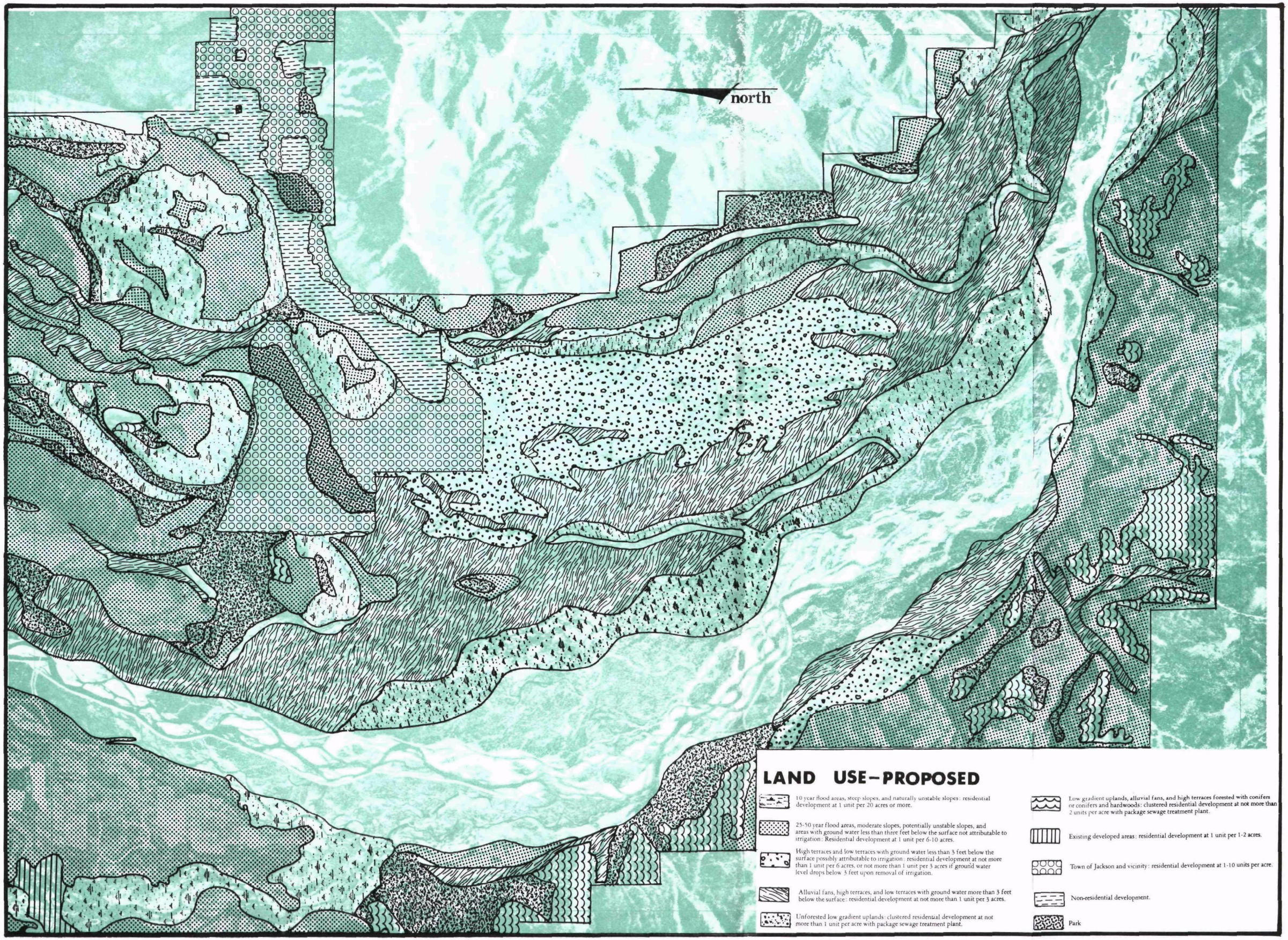
Relationships to Wastewater Facilities

As previously mentioned, there are no locational controls in the proposed comprehensive plan. Although residential development densities are specified, almost every acre of land in the county could conceivably be developed for residential purposes on central wastewater treatment facilities or specially designed individual systems.

Under these planning and control provisions, a number of development situations can occur. Several potential situations include:

1. The development may disperse throughout the county so randomly that if a problem did occur (i.e., groundwater contamination) a central collection and treatment system would not be feasible.

2. Development may occur randomly outside the areas logically serviceable by a given wastewater treatment plant location. In the event a central system was determined



Source, Livingston and Associates, 1976

Figure 11

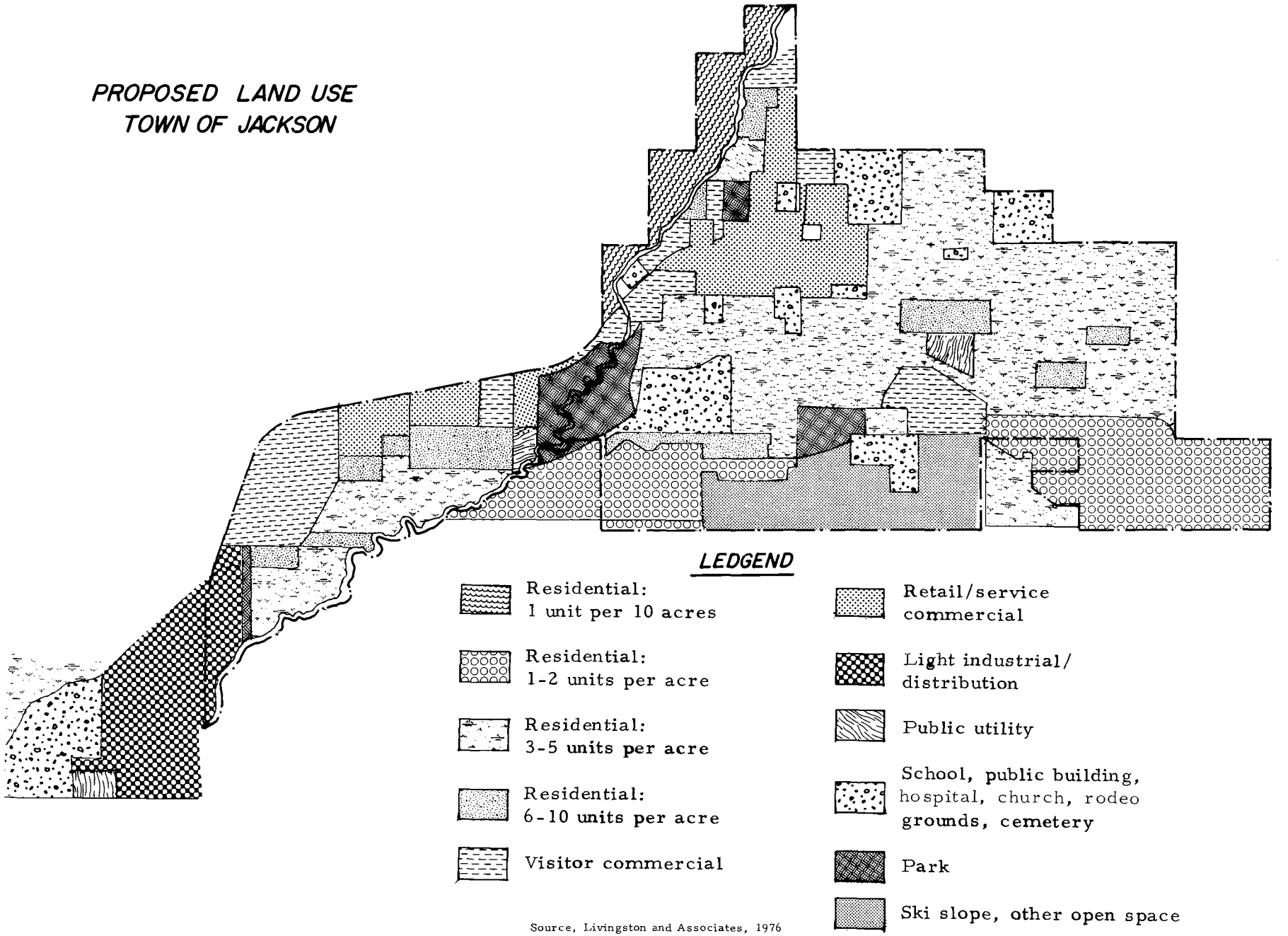

PROPOSED LAND USE
TOWN OF JACKSON
LEDGEND
Residential:
1 unit per 10 acres
Residential:
1-2 units per acre
Residential:
3-5 units per acre
Residential:
6-10 units per acre
Visitor commercial
Retail/service
commercial
Light industrial/
distribution
Public utility
School, public building,
hospital, church, rodeo
grounds, cemetery
Park
Ski slope, other open space
Source, Livingston and Associates, 1976

Figure 12

necessary (for public health or environmental reasons) the location of this development would greatly increase the cost of wastewater collection systems for users within the facility's use area (the wastewater collection system area).

3. Development may occur in a few pockets, but outside the areas that could be served economically by the more logical locations for wastewater treatment systems.

4. Development may occur adjacent to the Town in areas designated for high density in an orderly manner and be economically served by a properly located wastewater treatment system.

Adding to the difficulty is the fact that with certain wastewater treatment plant sites, it may be erroneously implied that a certain service area upstream, or upgradient from the treatment plant, would be economically serviceable with a sewer system. While a system of this type might be physically possible, the economics of such servicing depend on the density and actual amount of development as well as the configuration of the collection system.

Another important relationship between the wastewater facilities and land use is that locating a treatment facility in certain areas may induce development in that direction. This type of a situation may not be compatible with other planning considerations including the location of existing and proposed public facilities and services, wildlife migration, or aesthetics.

POPULATION

The population of the areas to be serviced by the proposed wastewater treatment facility may, for planning purposes, be considered as being composed of two discreet units. The resident population, which while reasonably stable in terms of total maximum numbers, is in a constant state of flux due to seasonal in and out migration, and the tourist or migrant population. While these two elements will be considered separately in determining the contribution of each to the wastewater flows to the Jackson plant, they are in reality closely related to a town, such as Jackson, with an economy as highly dependent upon providing tourist and vacation oriented services. According to the U.S. Department of Commerce's 1973 figures on employment in Teton County, nearly 55 percent of the total employment involved some form of trade and service occupations, which in Jackson's case centers around seasonal tourism. Two definite patterns of seasonal activities have evolved in Teton County: the summer to early fall family sightseeing or wilderness experience vacationing, followed by a limited amount of big game hunting in late fall; and the winter sport oriented visitors from December to early spring. This differential is pointed out for several reasons that will become

important in analyzing use factors and are critical in estimating the required size of the waste treatment facility. The summer use of the Jackson area far exceeds that of the winter activities. Thus, in developing and projecting a peak or maximum expected population and consequently the wastewater generated in the Jackson service area, the existing and potential summer tourist seasons will be used as an indication of maximum expected flow.

Historic Population

Past resident population for the Jackson service area is given in Figure 13. This figure indicates a steady increase in the population of the Town between 1940 and 1976. In the last five years, the Town's population increased at a rate of 6 percent annually, from 3,196 to 4,150 people. Livingston's 1976 report listed 979 single-family units, 245 multi-family units and 265 mobile homes within the confines of the town.

Population Projections

As stated earlier, there are two separate elements that must be dealt with in preparing population projections in order to determine the necessary size of wastewater facilities. The trend established for resident population change, in most situations, is driven by the availability of employment in communities of the size of Jackson. The Teton County area provides several exceptions to this assumption. The area's scenic grandeur and recreational opportunities attract a number of people who, because of financial independence or adoption of alternative life styles, come into the region regardless of the opportunity for traditional employment. A second complicating factor in trying to use available employment and economic development as a stimulating factor spurring population growth is the number of seasonal and part-time jobs the area's vacation-oriented businesses offer. This creates a situation where high summer tourist use requires an increase in seasonal resident employment. While much of the seasonal work will obviously be picked up by the area's more permanent residents, it also has the potential of drawing a large number of short-term residents. Regardless of their employment status, these individuals must, in the final analysis, be considered residents in terms of generated wastewater and use of public facilities.

A detailed economic analysis of the Jackson area is not presently available. The County has recently entered into a contract through the University of Wyoming to develop an economic study that will investigate the effects of the various development alternatives to be considered by the county Comprehensive Plan. The results of this study are not expected until April, 1977. There appears from our investigation to be no economic growth plan or evaluation of the phasing of regional commercial or industrial expansion. Livingston, in developing the county's Comprehensive Plan, has made an employment forecast of a 5.0 - 7.5 percent

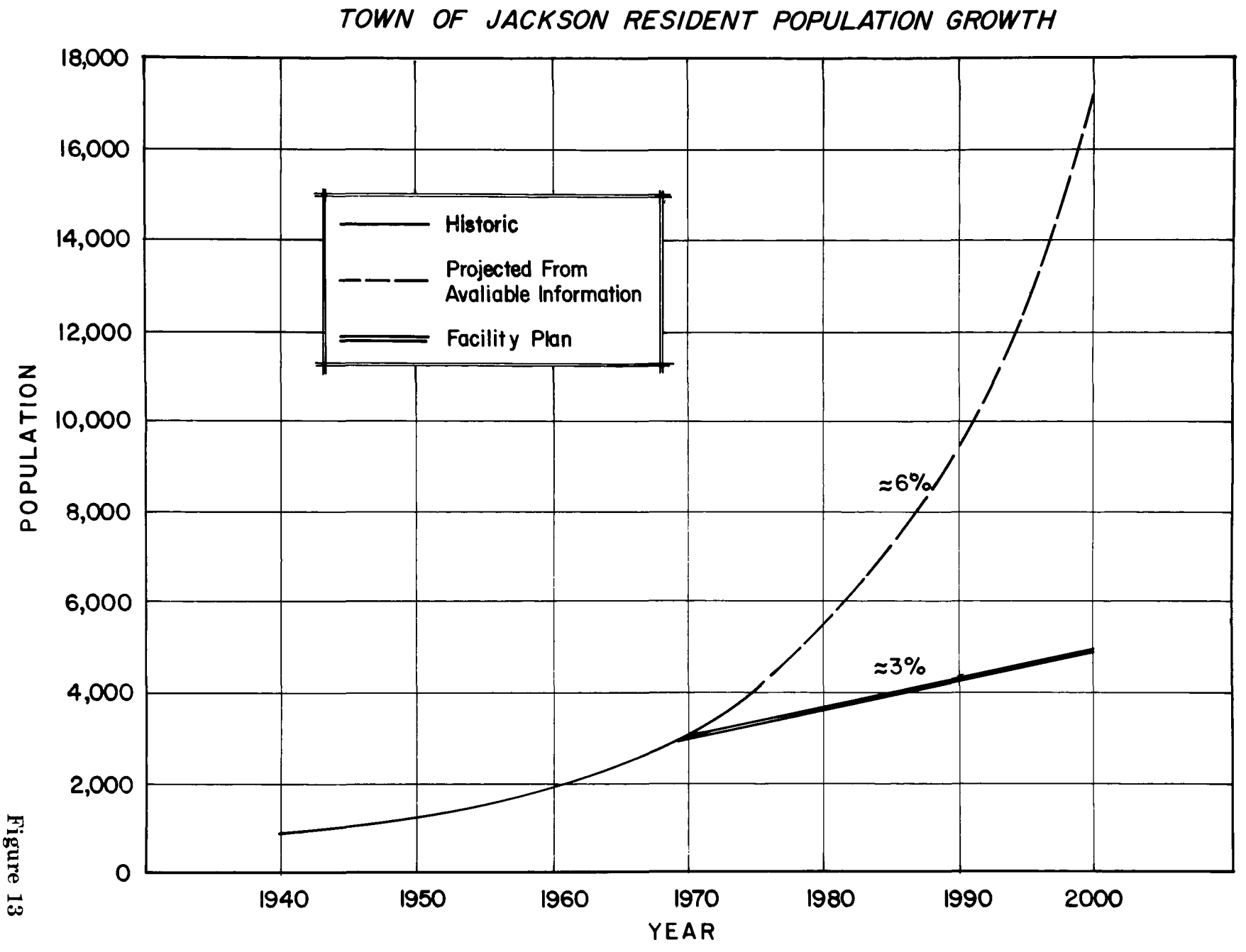
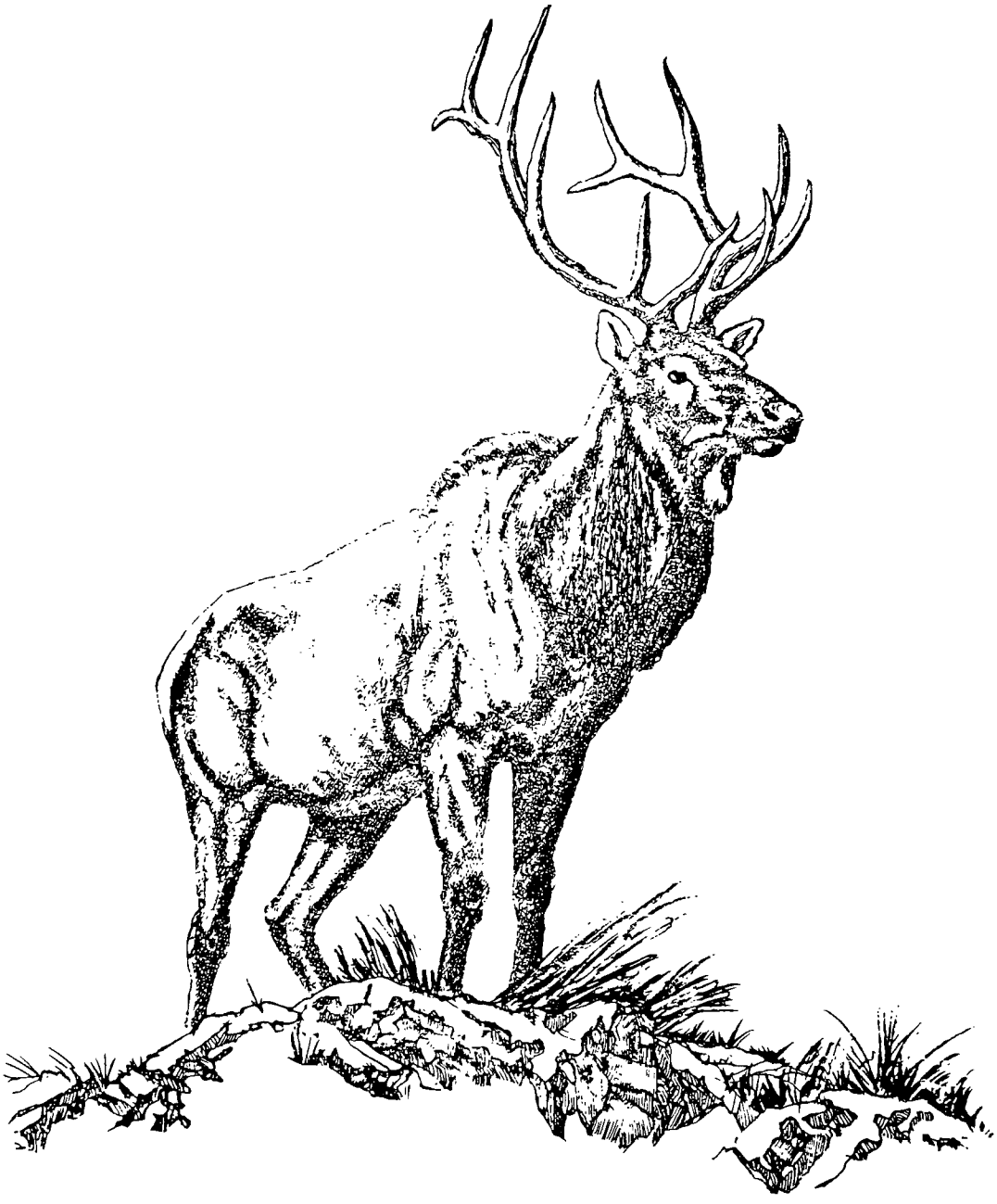

TOWN OF JACKSON RESIDENT POPULATION GROWTH
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
POPULATION
Historic
Projected From Avaliable Information
Facility Plan
≈6%
≈3%
1940
1950
1960
1970
1980
1990
2000
YEAR

Figure 13



increase in county employment over the next fifteen years. The majority of any increase would, in the opinion of the local agencies and residents queried, be primarily in the trade and service field.

Livingston (1976) has prepared two projections of population growth in Teton County based upon expected impact of general national economic prosperity (Table 9). A three percent increase assumes a tight economy, while the five percent "would be about as high as could reasonably be expected."

In order to determine the population increase in the Jackson wastewater service area, it was necessary for facility planning purposes to determine the maximum reasonable population that could be expected in the planning period. In order to disaggregate the Town of Jackson's resident population from the County's, several assumptions were made based on the existing information:

- The majority of the proposed development will continue to occur in an area that could be serviced by the proposed facility.
- Without any evidence to the contrary, Jackson's wastewater service area growth will continue at 6% and the County at 3.1%
- No major area, outside of that proposed by the Preliminary Comprehensive Plan, will be included in the system prior to 1990 (i.e., no other communities such as Wilson-Teton Village, etc. will be serviced by the proposed plant expansion).

Table 10 presents the disaggregation of the Town of Jackson and Teton County resident population from 1976 to 1995. Projections were based on the known existing populations as presented in the Teton County Growth and Development Alternative.

The population projections in the facility plan prepared in 1975 by Nelson, Haley, Patterson & Quirk, Inc. were based on a substantially lower 3% growth rate based on U.S. Census data. They projected a 1990 resident population of 4,700, based upon what appears to be a 1970 census base (2,101). Figure 13 presents the historic, proposed, and 1975 Facility Plan population projected through 1990. From our evaluation of the available data, Livingston's (1976) information offers a more up to date base, while facility plans disagree with the growth experienced within the last five years. For planning and cost estimating purposes this study has adopted a 1990 population of 9,600 individuals to be serviced by the proposed facilities. This corresponds closely to the figures developed independently by Nelson, Haley, Patterson & Quirk, Inc. in their analysis of the Wilson-Teton Village Alternative Wastewater Management Systems (Working Paper No. 2, 1976). They projected a 1995 high and low population for the existing Jackson service area (disaggregated from the County) of 11,593 and 8,045,

TABLE 9

PROJECTED POPULATION

TETON COUNTY

	@ 3% Increase	@ 5% Increase
1977	7,622	7,770
1978	7,851	8,159
1979	8,086	8,566
1980	8,329	8,995
1981	8,579	9,444
1982	8,836	9,917
1983	9,101	10,413
1984	9,374	10,933
1985	9,655	11,480
1986	9,945	12,054
1987	10,243	12,657
1988	10,551	13,289
1989	10,867	13,954
1990	11,193	14,651

Source: Livingston & Associates

TABLE 10

TOWN OF JACKSON POPULATION PROJECTIONS

	Town @ 6%*	County @ 3.1%	Total
1976	4,250	3,137	7,387
1977	4,505	3,237	7,742
1978	4,775	3,341	8,116
1979	5,062	3,448	8,510
1980	5,365	3,558	8,223
1981	5,687	3,672	9,352
1982	6,028	3,790	9,818
1983	6,390	3,911	10,301
1984	6,773	4,036	10,809
1985	7,180	4,165	11,345
1986	7,610	4,299	11,909
1987	8,064	4,436	12,500
1988	8,552	4,578	13,130
1989	9,065	4,724	13,789
1990	9,608	4,876	14,484
1991	10,184	5,027	15,211
1992	10,796	5,183	15,979
1993	11,443	5,344	16,787
1994	12,129	5,510	17,639
1995	12,857	5,680	18,537

* This includes future population that would reside on the fringe areas of Jackson (those areas slated for high density under the proposed land use plan).

respectively; based upon the availability of developable land as presented in the preliminary land use plan.

The non-resident or migrant population trends in an area such as Jackson are difficult to evaluate given the unstable and somewhat tenuous position of the national economy. The 1974 facility plan analyzed the problem in terms of available overnight accommodations, national park visitations, and traffic flow within the town. They concluded that very little increase in seasonal visitation could be expected and that the "increase in permanent residents will cause a more rapid increase in P.E. demand loading on the system than would an increase in seasonal visitors." This was based on the decrease in tourism experienced in Grand Teton National Park between 1969 and 1972, the probable impact of the then highly publicized "energy crisis," the sharply increasing cost of automobile travel, and the overall difficulty in reaching the area by other methods of transportation. They estimate, using data from the Wyoming Highway Department's traffic figures, that up to 14,000 people per day were presently (1969 data) visiting Jackson during the summer.

This study approached the problem of estimating the non-resident population by analyzing the present contribution this element of the population makes to the total amount of wastewater generated. 1976 flow data showed that the peak day flow received at the plant was in July, approximately 1.84 mgd (July 6th) over the July 4th holiday week. To determine what portion of this load was generated by non-residents it was necessary to subtract out the known resident population contribution and the known amount of infiltration.

The Sewer System Analysis and Evaluation prepared for the town in December of 1975 documented 853,220 gpd of infiltration during periods of high ground water (high runoff and irrigation). The existing resident population serviced by the Jackson system was given as 4,250. If it is assumed a per capita daily flow of 120 gallons (Section III) this accounts for 510,000 gallons of wastewater. Therefore:

1,840,000 gallons total peak daily flow
- 850,000 gallons documented infiltration
- 510,000 gallons resident flow

480,000 gallons non-resident flow

The non-resident flow contributes 26 percent of the flow or 49 percent of the wastewater entering the system.

In order to convert non-resident flow to the actual number of people, several assumptions need to be made. It is assumed that each visitor spends the night and has at least two restaurant meals in town. From standard USPHS statistics the total contribution percapita would be approximately 50 gallons per day. This calculates out to almost 9,600 individuals that used the facilities

of Jackson on that particular peak day. While this figure does not agree with the estimated gallons percapita provided for in the recently completed Water Facilities Investigation (1976) for The Town of Jackson (100 gpcd - non-resident), it provides a better approximation of actual sewage generated for facility planning purposes. The Jackson Chamber of Commerce estimates that the present available hotel/motel rooms have an overnight carrying capacity of approximately 6,000 guests while the current 450 commercial trailer and camp sites could accommodate another 1,200 people. At full occupancy the town could provide a total overnight capacity of 7,200 individuals. This figure is up 40 percent from that estimated in the 1974 report (5,140 individuals).

Expansion of tourist services and the expected impact on municipal facilities is difficult to predict. Both national and regional economic factors tend to control vacation spending. Analysis of Teton National Park gate information (Figure 14) shows a decline in visitation over the last few years but a sharp increase during the summer of 1976. The reason for the decline and recent resurgence of interest is speculative; the waning of the energy crisis, economic stability, the Bicentennial, any number or combination of factors could be responsible for the increase in area visits. The Park's Master Plan (1976) has established a number of management initiatives including holding the level of overnight visitor accommodations, visitor conveniences, and wilderness trail developments to that established in 1971.

This will, in effect, force the development of any additional visitor oriented service elsewhere, logically a good portion of which could locate in the Jackson service area given the proximity of existing facilities and the transportation system.

Livingston & Associates (1976) projected a 5.0 - 7.5% increase in employment in Teton County over the next 15 years. If the present trends in categories of employment continue and 55 percent (1973) of any new jobs were in those areas heavily dependent upon tourist activity, a steady increase in tourist activity would be expected. Based upon the available information and assuming that employment trends continue, a 2 - 3 percent increase in tourist and visitor activity could be forecasted. Due to the economic uncertainties and the almost assured continued increase in the price of gasoline, a 2 percent annual increase in summer tourism was selected for planning purposes. While this figure may be challenged by groups favoring or opposed to any further development of the Jackson area, based on existing information, it represents a conservative approach for planning the necessary facilities. Table 11 shows the projected increase in peak visitor or non-resident population utilizing the Jackson wastewater facilities could reach nearly 13,000 in 1990 and 14,000 in 1995.

It should be emphasized that these figures are based upon the 1976 contribution this segment of the population had on the total amount of wastewater generated, and not estimates of actual people in town. Extrapolation of future use was made on the basis of the 1976 peak flow.

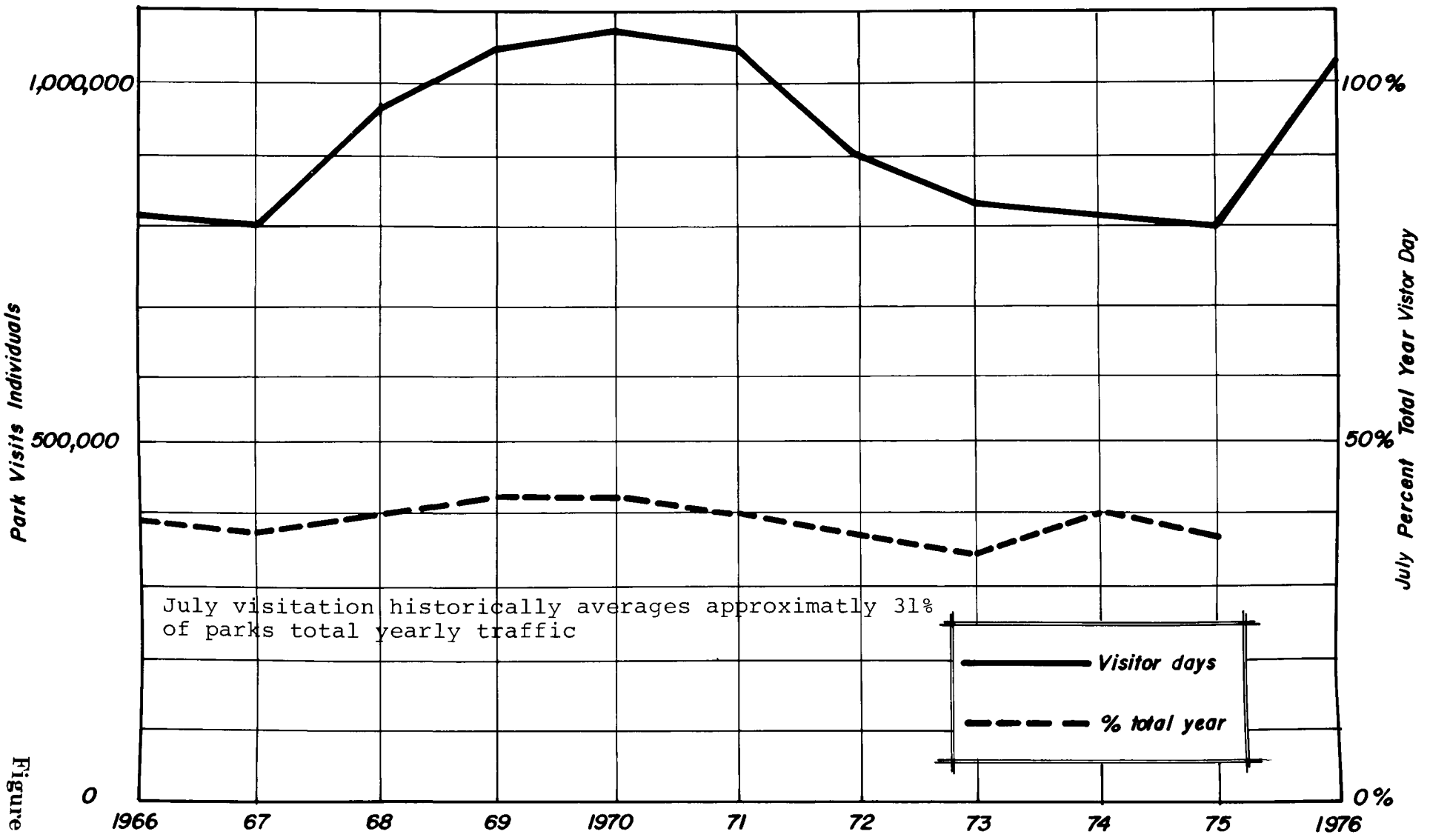

TOTAL VISITS GRAND TETON NATIONAL PARK
JULY 1966-1976
1,000,000
500,000
0
Park Visits Individuals
100%
50%
0%
July Percent Total Year Vistor Day
1966
67
68
69
1970
71
72
73
74
75
1976
July visitation historically averages approximatly 31%
of parks total yearly traffic
Visitor days
% total year

Figure 14

TABLE 11

PEAK NON-RESIDENT POPULATION

1976	9,600
1980	10,391
1985	11,473
1990	12,920
1995	13,985

EXISTING WASTEWATER TREATMENT FACILITIES

General

The existing wastewater treatment facility discharges unchlorinated effluent from an activated sludge stabilization system into Flat Creek, south of the Town of Jackson. The present system includes the collection lines, an 18" interceptor flowing south out of town, the treatment plant, and the outfall line.

The existing plant (Figure 15) was constructed in 1969, but was never completed. The extended aeration activated sludge process includes: the headworks with a manually racked bar screen, a triplex primary lift station, two aeration basins, two clarifiers (operated in parallel), a sludge recycle pump, a polishing pond to which a small surface aerator was added and a covered and heated sludge drying bed. The original construction drawings show that only the facilities necessary to accommodate the 0.8 mgd design flow, according to the design engineer, were constructed in 1969. This equates to a calculated population equivalent (P.E.) of 5,000. Notes on the original drawing stated that to increase the capacity of the system in order to handle a P.E. of 7,500, greater aeration would be required and that by adding aerobic sludge digestion a P.E. of 10,000 could be accommodated.

The present collection system is composed primarily of 6, 8, 10, 12, 15 and 18 inch vetrified clay sewer mains, manholes and appurtenant equipment. The system services the entire Town of Jackson including a small area southwest of the city limits.

Operation

In a report prepared for the Town of Jackson in 1973 by R.D. Connell and Associates, Inc. the average flow to the plant was shown to be in excess of the maximum design peak of 1.2 mgd.

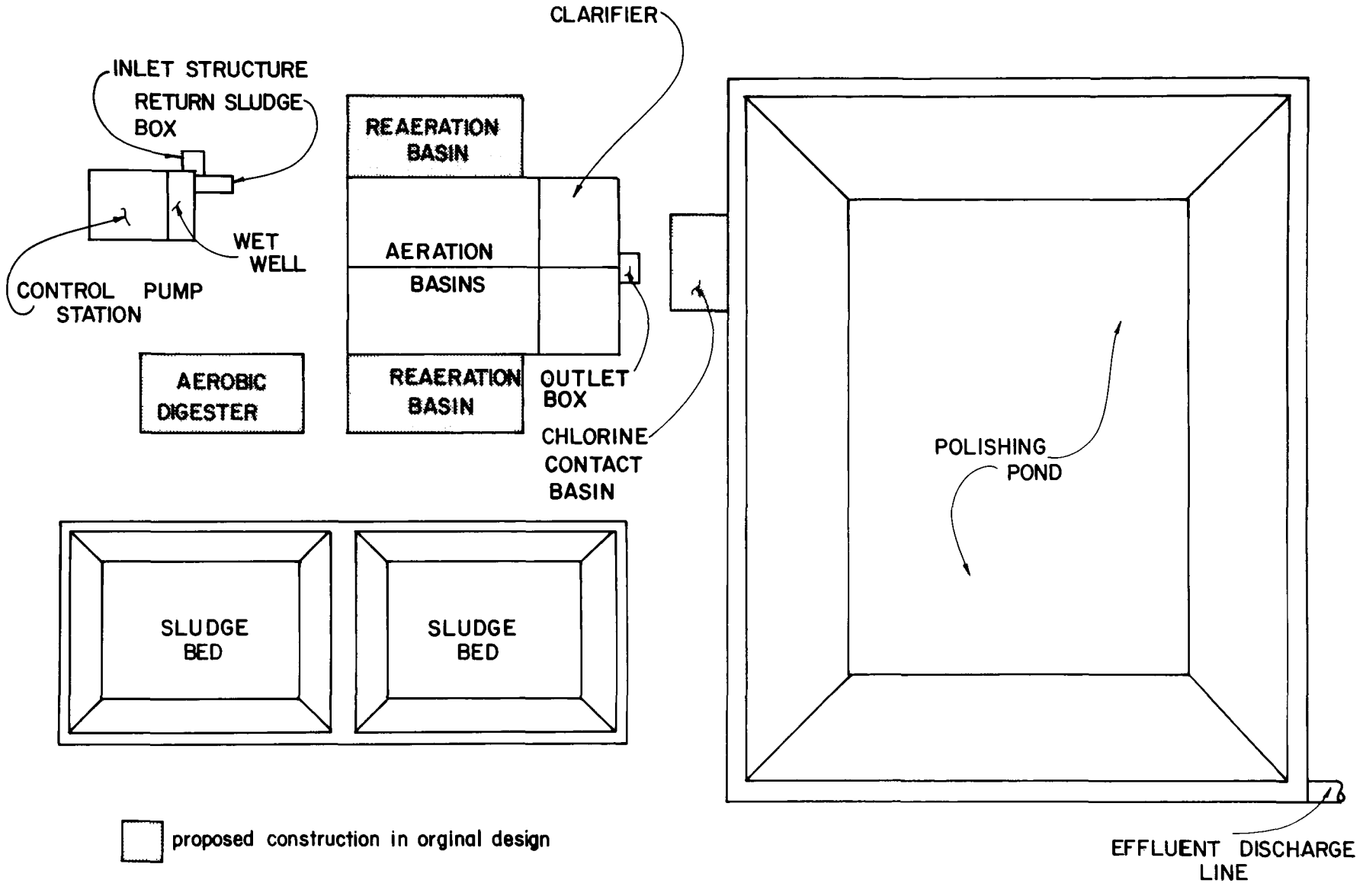
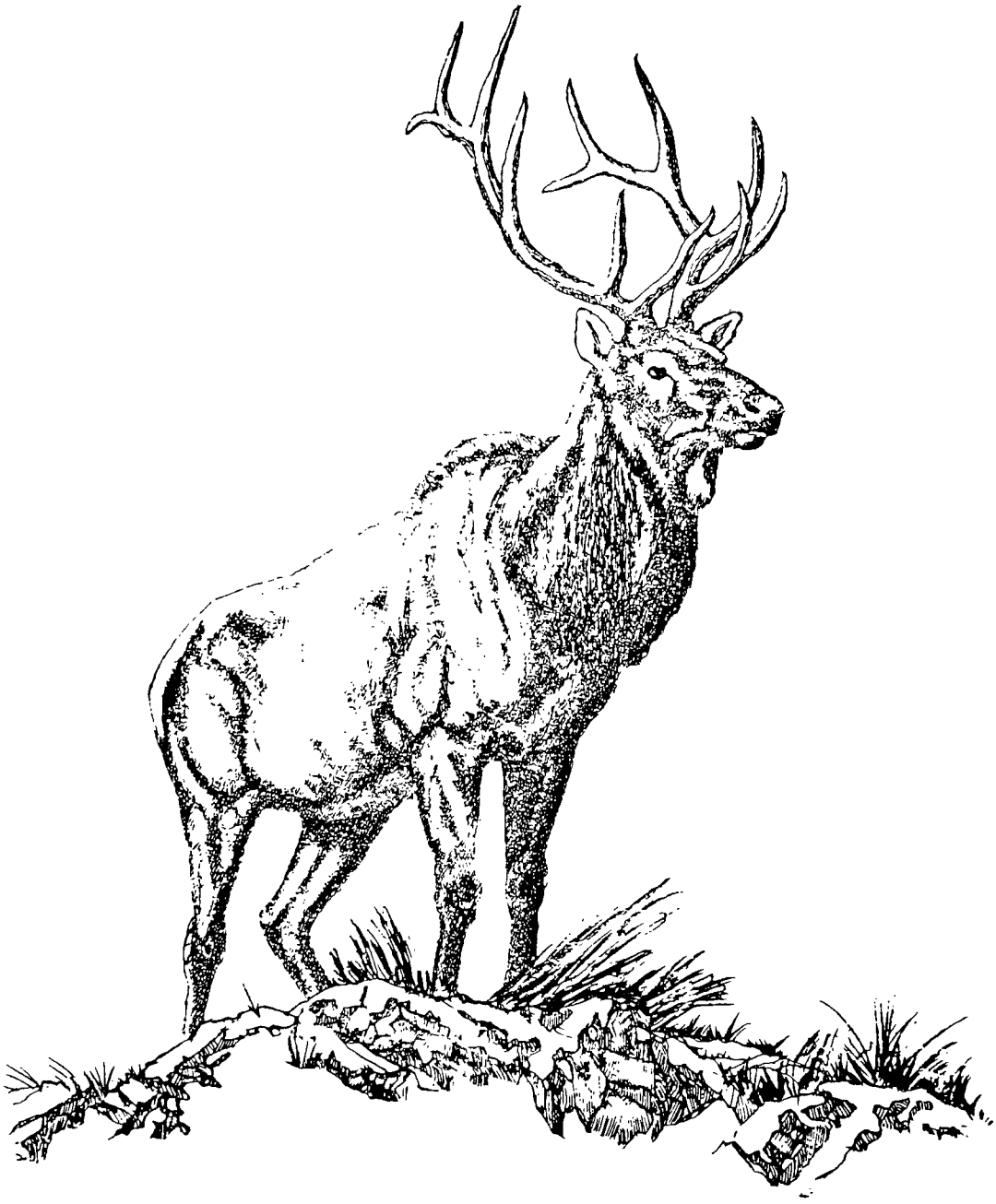

EXISTING WASTEWATER TREATMENT PLANT TOWN OF JACKSON
CLARIFIER
INLET STRUCTURE
RETURN SLUDGE BOX
REAERATION BASIN
WET WELL
AERATION BASINS
CONTROL PUMP STATION
AEROBIC DIGESTER
REAERATION BASIN
OUTLET BOX
CHLORINE CONTACT BASIN
POLISHING POND
SLUDGE BED
SLUDGE BED
proposed construction in orginal design
EFFLUENT DISCHARGE LINE

Figure 15



	1971 - 1972	
	Winter	Summer
Average	0.850 mgd	1.34 mgd
Peak	0.951 mgd	1.59 mgd
Minimum	0.543 mgd	1.11 mgd

In the same report organic loading was calculated at over 2.2 times that for which it was originally designed (1000 lb. BOD/ 24 hr.). While no design or facility report was available to verify the criteria to which the plant was constructed, it would appear that the existing system was badly overloaded less than three years after completion.

A major problem that has plagued the operation of the facility in the last several years is inability of the system to adequately process grit and sludge. A portion of sludge material (organic and inorganic) produced by the biological unit of the plant is, under ideal operating conditions, recycled to the incoming sewage which increases the effectiveness of the operation. The remainder is "wasted" and disposed of by various means. This normally entails a digestion process which will stabilize the biologically active element of the material in order that it can be dried and safely disposed of as either land fill or an agricultural soil aid. Unless the wasted sludge is digested, it is very difficult to de-water and dry. This is particularly so, given Jackson's climate. With the available equipment the plant operator may require as much as two months to adequately dry the wasted sludge. Because the dried material has not been stabilized, only dried, it still presents a public health hazard and cannot be disposed of at land-fill sites or on agricultural land. At present, dried sludge is stockpiled at the treatment plant site, which has created a number of odor and storage problems. The local and state health authorities have refused to allow the Town to dispose of the material by conventional methods. Because drying of unstabilized sludge is so slow and difficult, the operator has not been able to waste sludge at a rate which provides proper operation of the plant. To compensate, sludge which builds up in the clarifier is recycled to the headworks at a rate far beyond that normally desired. The material that cannot be recycled is lost over the clarifier weirs and accounts for the high suspended solids in the effluent. Clarifier inefficiency, due to this overloading, has resulted in heavy silting of the polishing pond and the carryover of solids into the Flat Creek discharge line.

In addition to the fact that the system is already serving a larger population equivalent than it was designed for (as great as 17 percent during the peak summer months), infiltration problems have a significant impact on the hydraulic capacity of the system. A December 1975 sewer system evaluation prepared for the

Town of Jackson, pursuant to an EPA Step II Grant, concluded, through the use of a television inspection, that during the summer months over 853,000 gpd enter the system as infiltration. The majority of this infiltration is from leaking service connections, sewer pipe joints, and manholes. The Town has received approval of its grant application to EPA to correct approximately 600,000 gpd of this infiltration by repairing particularly poor sections throughout the service area. This construction will be completed in 1977. The Town is presently forcing new connections and pipelines to abide by more restrictive construction practices by an aggressive construction inspection policy.

Figure 16 shows the average monthly characteristics of the plant influent for the last three years. This indicates that the peak summer flow in July is approximately double that received during the spring, fall and winter months. This increase is attributable in part to the tourist influx during the summer, but also to a great degree by the increase in infiltration promoted by heavy irrigation coinciding with snowpack melt and runoff during the spring and early summer growing season. The correlation between the rise in groundwater levels and the seasonal application of irrigation water has been well documented in the area. These correspond to the wastewater plant operator's observation that a marked increase in flow to the facility occurs shortly after the beginning of the irrigation season. Figure 16 also indicates an extremely variable influent waste strength. Characteristics varied as much as 50 mg/l in BOD_5 and Suspended Solids in 1976. On August 26 the treatment plant operator took a suspended solids measurement and flow reading at about 6 a.m., the historic daily low flow period for Jackson (Figure 17). The results of this spot analysis showed that while the influent flow rate was 1.22 mgd, the total suspended solids were only 15 mg/l. Later in the day the flow increased to nearly 1.8 mgd and the solids concentration was well over 100 mg/l.

While the summer infiltration may be helpful in the sense that it provides some dilution, it disrupts the hydraulic flow of the plant and increases the flushing of solids through the system and into the effluent discharge. Figure 16 presents the effluent discharge information compiled through the Town's self-monitoring program. During the summer months the system is achieving total suspended solids removal rates as low as 43 percent and BOD removal of about 75 percent. Over the last few years, the plant is regularly operating in violation of its National Pollution Discharge Elimination Permit. The State of Wyoming, Department of Environmental Quality, has indicated that this situation will not be allowed to continue. The State and EPA will require the following discharge limits:

Total Suspended Solids	30 mg/l
BOD_5	30 mg/l
Fecal Coliform	200 organisms/100 ml

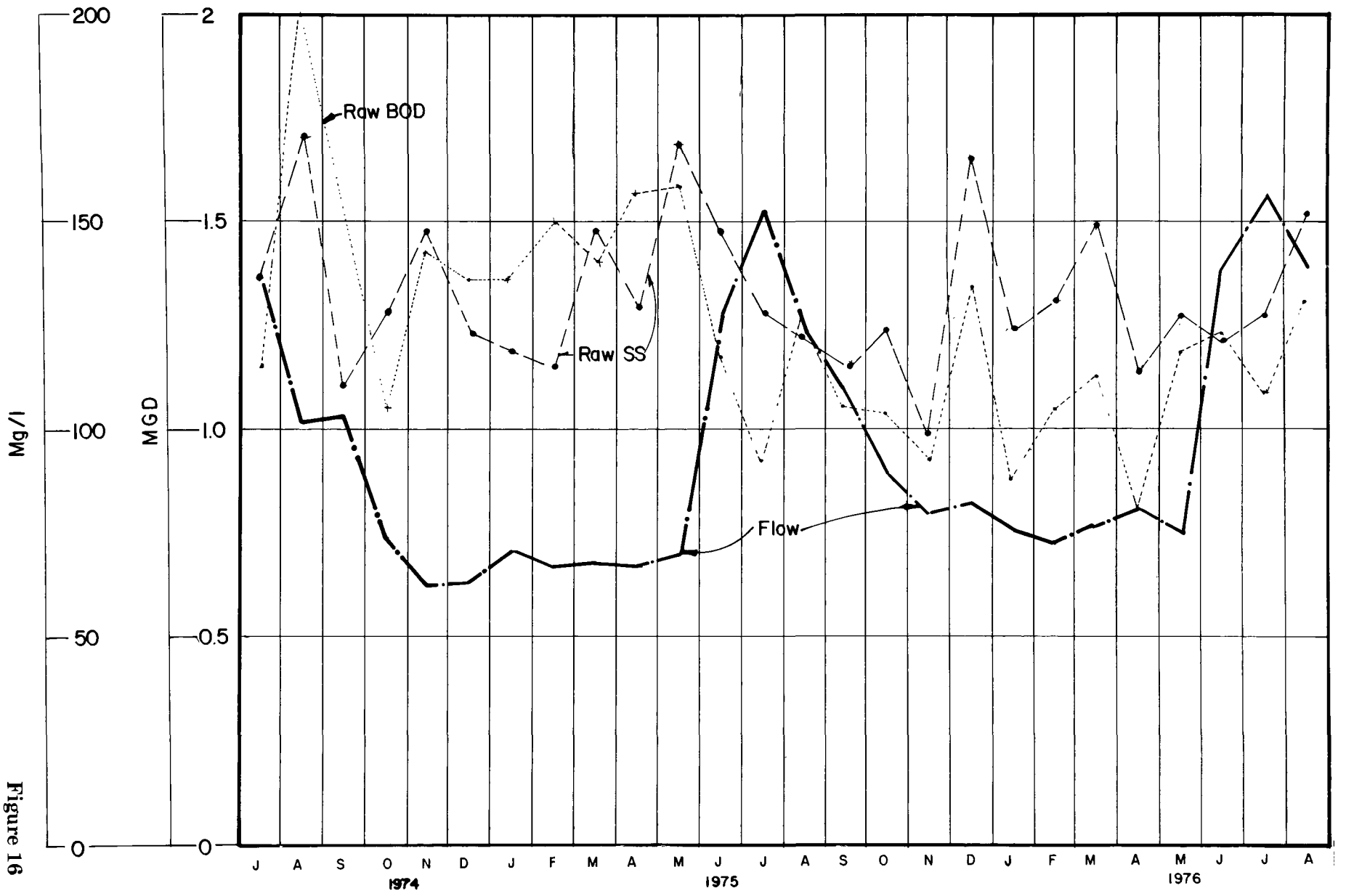

JACKSON WASTEWATER TREATMENT PLANT INFLUENT QUALITY
Mg/l
MGD
200
150
100
50
0
2
1.5
1.0
0.5
0
Raw BOD
Raw SS
Flow
J A S O N D J F M A M J J A S O N D J F M A M J J A
1974
1975
1976

Figure 16

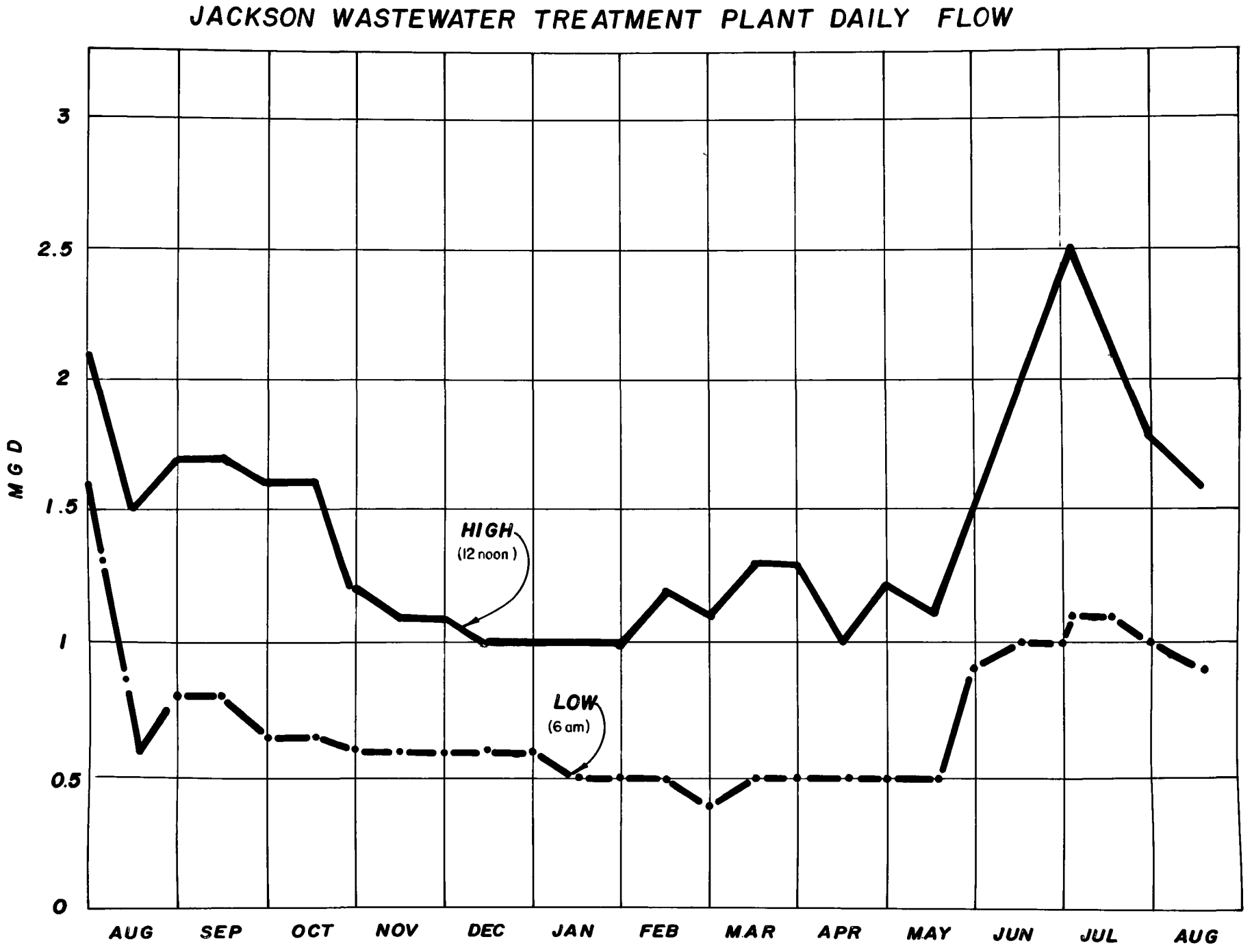

JACKSON WASTEWATER TREATMENT PLANT DAILY FLOW
MGD
3
2.5
2
1.5
1
0.5
0
HIGH
(12 noon)
LOW
(6 am)
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG

Figure 17

In addition, residual chlorine, ammonia and/or phosphate requirements could be imposed if the State determines, based on the final receiving water, that these are necessary. As seen in Figure 18 this level of treatment will require significant modifications in solids processing and improvements of the organic stabilization efficiency. In addition, disinfection will be required in order to meet bacterial contamination requirements.

The existing treatment system is generally inadequate. The system is unable to efficiently treat the biological or solids load received at the plant. In addition, primary and secondary solids generated within the process cannot, at present, be safely and efficiently treated and disposed. The existing sludge drying bed and polishing pond are ineffective and are a primary source of odors, which residents have reported to be quite noticeable over past years during the summer.

In addition to the problems endemic to the existing system design and operation, power outages in the Jackson area can have a disastrous impact on treatment reliability. Lower Valley Power and Light, the power utility for the Jackson area, listed 14 power outages totalling 16 hours and 15 minutes without service from 1972 through 1975. The Town is currently exploring measures that will either reset the necessary electrical equipment in the event of a power failure automatically or alert the operator at home that the plant requires assistance. Any new EPA funded mechanical treatment facility or pump station will require the installation of standby power. This can be either separate line source or onsite generating capacity.

Effect on Receiving Water

The Teton County 208 Planning Agency is currently developing information on the water quality of Flat Creek and the impacts the wastewater treatment plant has on the aquatic environment. In-stream water quality standards for Flat Creek stipulate specific criteria on five parameters:

Dissolved Oxygen - 6.0 ppm
Total Residual Chlorine - 0.002
Ammonia (Unionized) - 0.02 ppm
Bacteria - 1,000 colonies/100 ml
pH - 6.0 - 9.0

According to the information provided by the 208 agency, only fecal coliform bacteria are presently an immediate potential problem. Suspended solids, while not at an alarming level, are generally higher below the treatment plant as are ammonia and nutrients.

While monitoring data for the existing plant is complete for BOD and suspended solids, other water quality parameters, which 1) can leave a detrimental effect on water quality, 2) be controlled

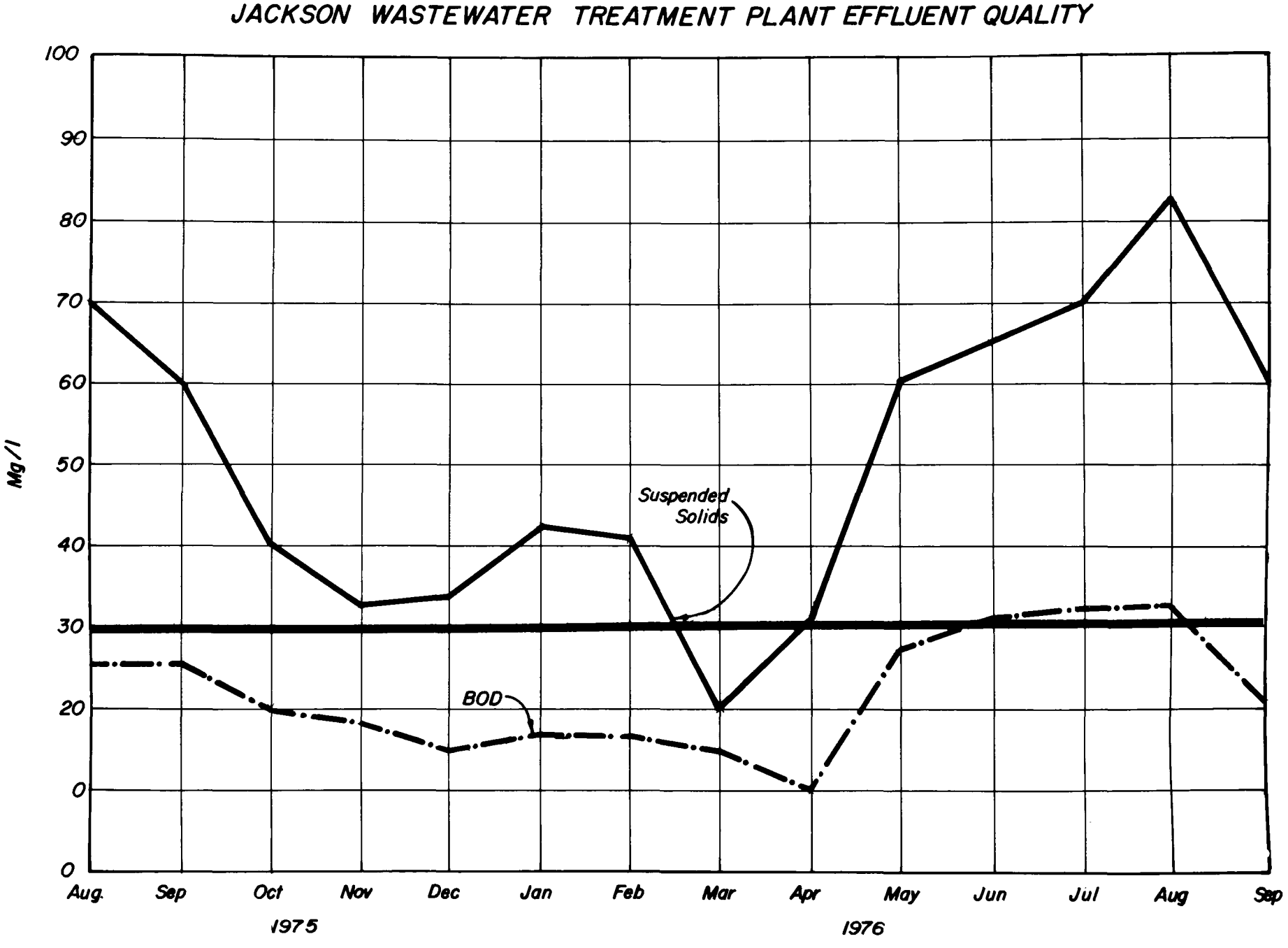

JACKSON WASTEWATER TREATMENT PLANT EFFLUENT QUALITY
100
90
80
70
60
50
40
30
20
0
0
Mg/l
Suspended Solids
BOD
Aug.
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
1975
1976

Figure 18

TABLE 12

FLAT CREEK WATER QUALITY

Flat Creek Instream	Date	NO_3-N	Total P	NH_3-N
Above the Town of Jackson	4/14/76	0.030*	0.053	0.022
	5/12/76	0.018	0.041	0.006
	6/09/76	0.012	0.052	0.008
	6/30/76	0.010	0.060	0.007
Below Treatment Plant	4/14/76	0.038	0.119	0.125
	5/12/76	0.026	0.140	0.093
	6/09/76	0.062	0.085	0.016
	6/30/76	0.023	0.134	0.011

*All concentrations in mg/l.

by wastewater facilities, and 3) are costly to remove, must be considered. These include the nutrients phosphorous and nitrogen and the toxic effect of ammonia nitrogen. The only water quality data that would provide a direct indication of what concentrations of these materials the existing plant is generating was collected through the efforts of the 208 agency. The 208 agency sampling program was not designed specifically to analyze the impacts of the plant on Flat Creek so the only sampling stations that include the plant also include the Town of Jackson and some of the South Park agricultural land. It is thought that a number of non-point sources as well as some clandestine point discharges may be included in this data (Table 12). The 208 agency collected the only known nutrient and ammonia data on quality of the treatment plant effluent. This data is presented below.

Effluent Discharges. Jackson WWTP

	Flow	pH	Temp	NO_3-N	Total-P	NH_3-N
One sample (7/6/76)	1.84 mgd	7.4	14°C	0.1 mg/l	2.8 mg/l	10 mg/l

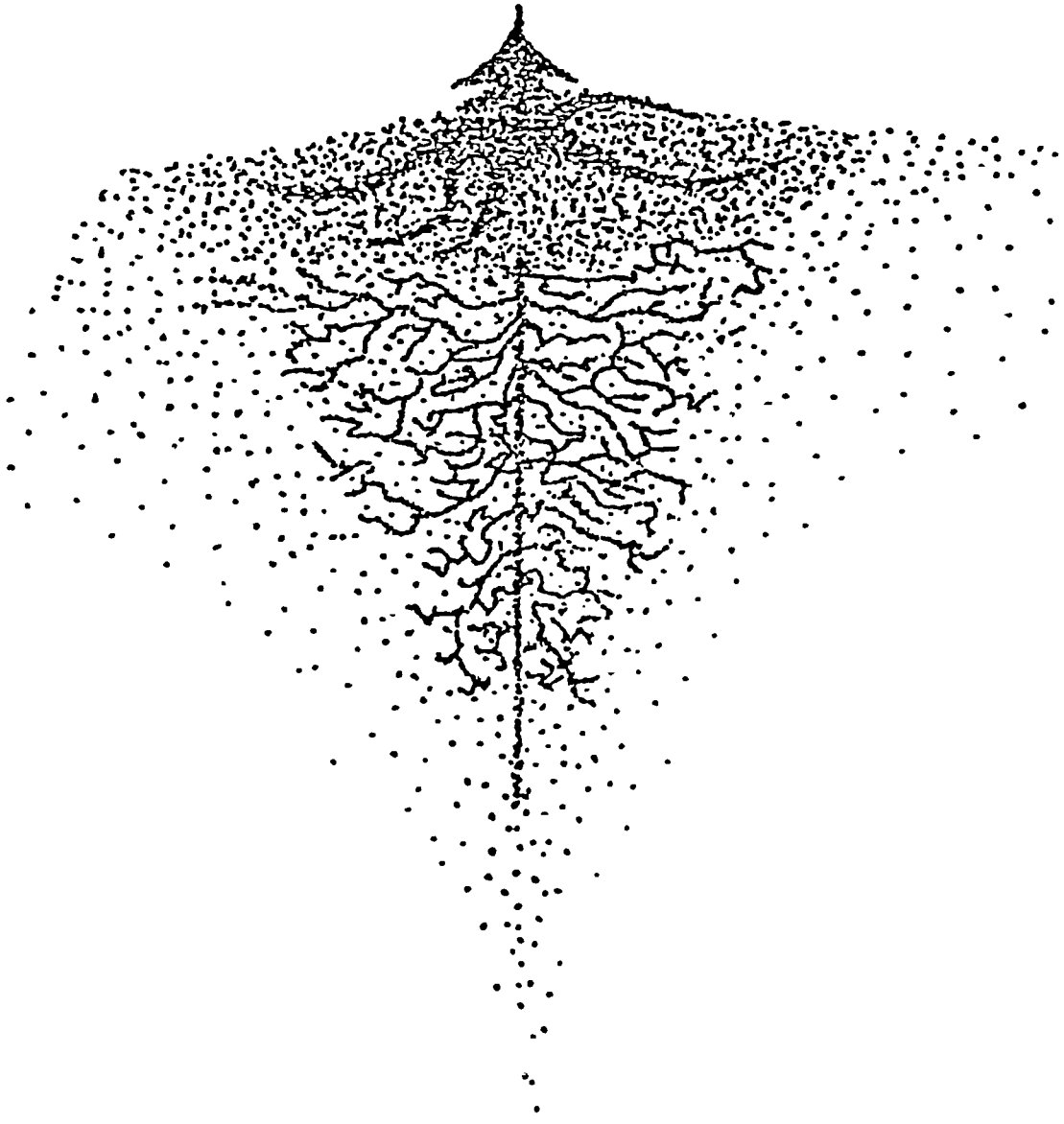
The Snake River Water Quality Management Plan (1976) performed limited water quality sampling on Flat Creek and determined that the only significant nutrient degradation occured as a result of the Treatment Plant. Flat Creek nitrate concentrations doubled and phosphate increased 8.5 times after confluence with the plant effluent.

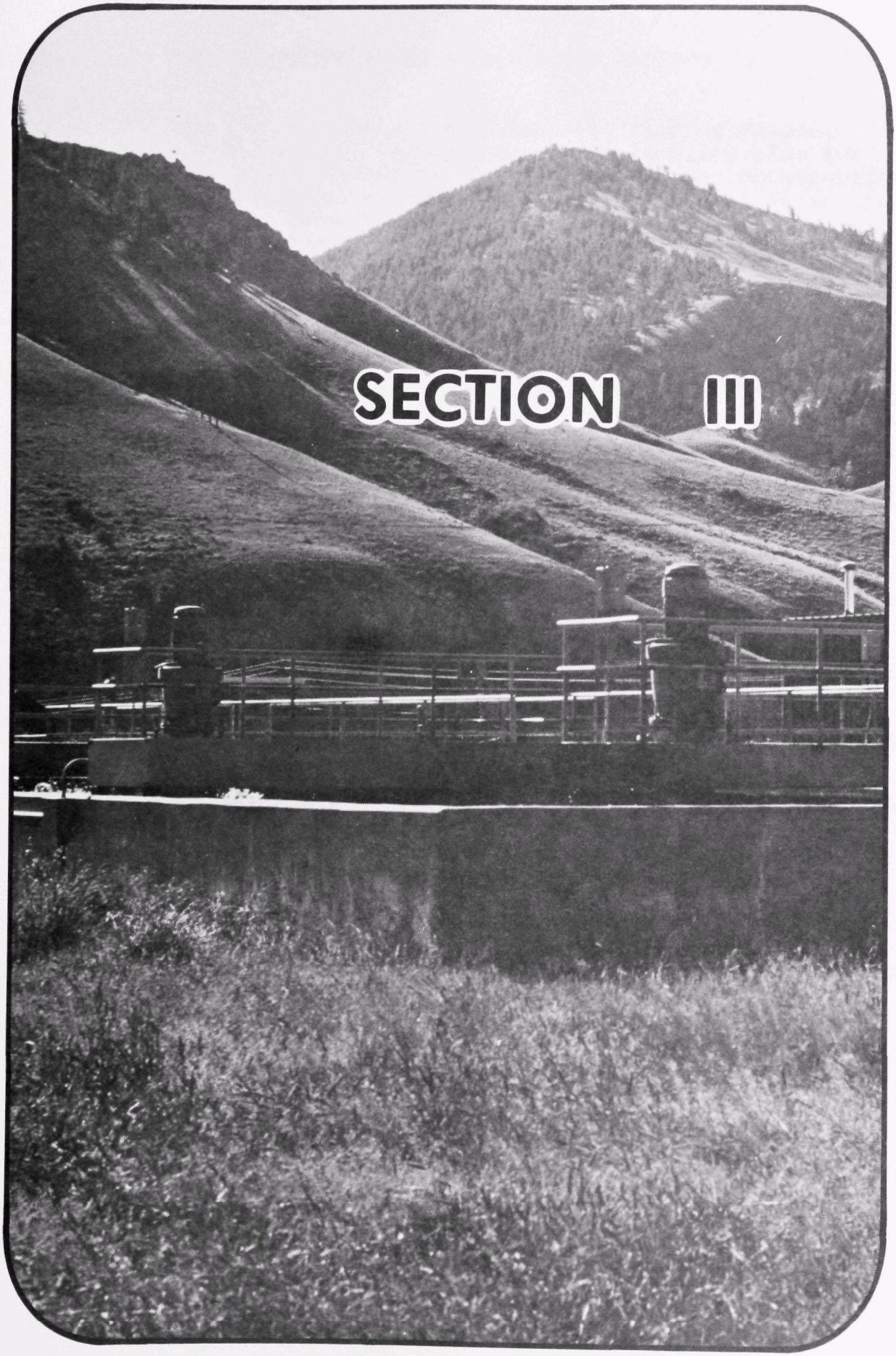
As indicated, water quality between the Town and below the plant diminishes. Nitrate concentrations increase on an average of 250 percent, total phosphate 235 percent and ammonia nitrogen 6.20 percent. Based upon this single effluent sample, taken after one of the highest loading period experiences (July 4th weekend), the mass loading for nutrients and ammonia was estimated at NO_3-N 1.54 lb/day, total phosphate 43.1 lb/day and ammonia nitrogen 155 lb/day.

Since January of 1977 the Jackson treatment plant operator has been required to monitor ammonia nitrogen in the effluent to Flat Creek. Results of this monitoring activity to date indicate concentrations range from 15 to 20 mg/l. A full report will be in the final EIS.

The potential for biostimulation of aquatic plants as a result of nutrient enriched wastewater effluent has been raised by land owners below the plant along Flat Creek. Field observations of the area for this study, including low level aerial flights, indicate that while there was a proliferation of vascular aquatic plants along several stretches of the Creek and at times floating algal mats could be seen on the surface, Flat Creek would not generally be considered a highly eutrophic watercourse. Nitrate and phosphate (two of the most important nutrients found in water) concentrations in Flat Creek below the treatment plant were low,

ranging from 0.023 to 0.07 mg/l for nitrate and 0.04 to 0.15 mg/l for phosphate. These concentration levels indicate that a major problem with algal stimulation is unlikely. Still it should be noted that even a small increase in available nutrients (especially phosphate in many waters) has been shown to be stimulatory.




SECTION III

JACKSON'S EXISTING WASTEWATER TREATMENT FACILITY

SECTION III

PROJECT PROPOSED BY THE TOWN OF JACKSON

In 1974 the Town of Jackson retained the firm of Nelson, Haley, Patterson and Quirk, Inc. to prepare a facility plan for wastewater management pursuant to a federal grant for construction of the required facilities as prescribed by the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) and EPA regulations. In November of that year the results of the study were presented to the Town Council for consideration. The engineer addressed a number of alternatives including:

1. No action

2. A lagoon treatment system on the State of Wyoming South Park Elk Feedground

3. A lagoon treatment system at the county land-fill site

4. A mechanical treatment plant on State owned school land near Boyles Hill

5. Expansion at the existing site to provide complete secondary treatment.

Upon evaluating the considered alternatives, the engineer recommended that the Town apply to EPA for a grant for the design of a complete secondary biological treatment facility to be constructed at the site of the existing plant. The recommendation was based upon cost, acceptability, and environmental considerations.

The Town Council, after reviewing the engineer's recommendation, decided to ask the engineer to prepare a summary supplemental report identifying and comparing in detail the cost effectiveness of both the recommended plan and the alternative lagoon on the South Park Elk Feedground at the southern extent of South Park.

In January of 1975 Nelson, Haley, Patterson and Quirk, Inc. submitted to the Town a Supplemental Report to the Facilities Plan. This report considered capital and operation and maintenance expenses, as well as public acceptability and the potential for delay due to conflicts involved in acquiring the South Park Elk Feedground land. As a result of this investigation the Town Council opted to seek a Step II design grant for the construction of a lagoon on the South Park Elk Feedground. This decision was based primarily on three issues.

1. The lower operation and maintenance cost for a lagoon.

2. The ultimate and unlimited service capacity of a plant located at the South Park Elk Feedground site.

3. The Council's assumption that being public lands, the South Park Elk Feedground site would be available for the Town's use.

As a result of this decision, EPA in compliance with the goal of the National Environmental Policy Act and internal regulations required this Environmental Impact Statement to be prepared on the proposed project and alternatives before any further financial assistance could be considered. The EIS requirement was based on the potential for public controversy and unknown environmental problems of disturbance of the elk and secondary effects of growth along the five to six mile long interceptor.

DESIGN CRITERIA AND CONSIDERATION

The project proposed by the Town, as addressed by the facility plan, envisioned a treatment facility designed to accommodate the projected 1985 population equivalent of 15,000. The expected flows and organic loading were based on normal domestic wastes. Since industry of any kind is almost nonexistent, no industrial waste contributions were anticipated. The design criteria utilized in the preparation of the facility plan included:

Design Data

Population	15,000
Flow	1.5 mgd
BOD_5 (Summer)	3,450 lb/day @ 15°C
BOD_5 (Winter)	1,725 lb/day @ 5°C
Peak Flow	3.0 mgd
Expected Removal	90%

Since the preparation of the facility plan, the Town and County have initiated an update of their comprehensive land use plan. This revision and the fact that the 1985 planning period adopted for the original facility report is now insufficient to adequately plan for future needs prompted EPA to utilize the EIS to update the design and cost criteria in the facility plan for treatment design years of 1990 and 1995. Interceptor lines were uniformly sized for the year 2000. Table 13 presents a summary of population and flow data utilized in preparing the necessary revisions based upon information developed subsequent to the 1974 Facility Plan.

Organic and solids loading for 1976 (peak tourist months of the summer), assuming 75 percent correction in known infiltration, were estimated at approximately 180 mg/l each. This calculates out to a maximum day mass loading of 3,300 lb/day in 1990 and 3,987 lb/day in 1995. These summer loading rates reflect the large amount of water utilized for washing and cleaning connected with the commercial tourist business.

TABLE 13

POPULATION AND FLOW ESTIMATES

	1990	1995	2000
*Resident	9,600	12,850	17,200
Nonresident	12,900	14,200	15,700
Total	22,500	27,050	32,900
**Resident Flow mgd (@ 120 gpc)	1.15	1.54	2.06
Nonresident Flow mgd (@ 50 gpc)	0.65	0.71	0.78
Noncorrectible Infiltration mgd (25% existing or 50 g/c 1976)	0.21	0.21	0.21
Expected New Infiltration (300 g/ac/d @ 380 acres total)	0.12	0.16	0.20
Total Flow mgd (maximum day)	2.20	2.65	3.25
Peak Factor mgd	1.62	1.65	1.68
Peak Flow on Max-day mgd	3.60	4.30	5.50

*See discussion on population.

**120 g/c based upon survey of surrounding communities, N.H.P.Q., Inc., Personal Communication.

Jackson's isolated location and the difficulty and expense in transporting raw and manufactured goods excludes the area from ever becoming a significant industrial center. The wastewater flows presently experienced and those expected should not normally contain any refractory or exotic constituents. It must be noted, however, that because of the prevalent economic activities in the area, certain waste problems could occur. County-wide septic tank and sanitary vault waste pumping and private discharges of pesticides, oils and other material may occur and should be anticipated in any design.

The project proposed by the Town would entail the construction of a 21 inch interceptor line from the existing wastewater treatment plant running south to the site selected on the South Park Elk Feedground. The alignment proposed in Figure 19 follows South Park Road starting just west of the existing facility and cuts overland southeasterly to the facility site at the lower end of the road as it turns east. Two potential sites were identified approximately 7,000 feet apart but both located within the South Park Elk Feedground. A 21 inch discharge line would be provided to the mainstream of the Snake River.

The favored treatment process, according to the facility engineers, is a deep (10 feet) three cell stabilization pond. The first two cells would be partial mix systems providing enough aeration to stabilize the organic load in the upper layers, while the lower portion would remain anaerobic facilitating solids digestion in the warmer months. The third pond provides final polishing and, according to the facility engineer, algal removal.

Systems of the type envisioned typically provide 80 - 90 percent BOD_5 (organic) conversion, but may without further processing be sporadically high in suspended solids. Since there is little information on the type of pond operation system proposed by the facility consultant, EPA concludes that while the system should, if operated properly, meet the proposed 30 mg/l BOD standard, it may require additional treatment in order to consistently meet the anticipated 30 mg/l suspended solids requirement. The decision as to whether chlorination and possibly dechlorination would be required for any discharge to the Snake River would need to be determined by State water quality officials in association with the Scenic and Wild River Study task force headed by the Forest Service.

Several problems are anticipated during the construction phase of the project. The entire South Park area has extremely high groundwater. Reviewing the Soil Conservation Service's unpublished information on groundwater levels on and near the proposed plant site indicates that water may be expected one to three feet below the surface. Two major problems are anticipated as a result of this extremely high groundwater condition. The first involves the construction and final integrity of the interceptor line. The second concerns the construction of a subsurface pond system at the South Park Elk Feedground site. Trench dewatering, in the

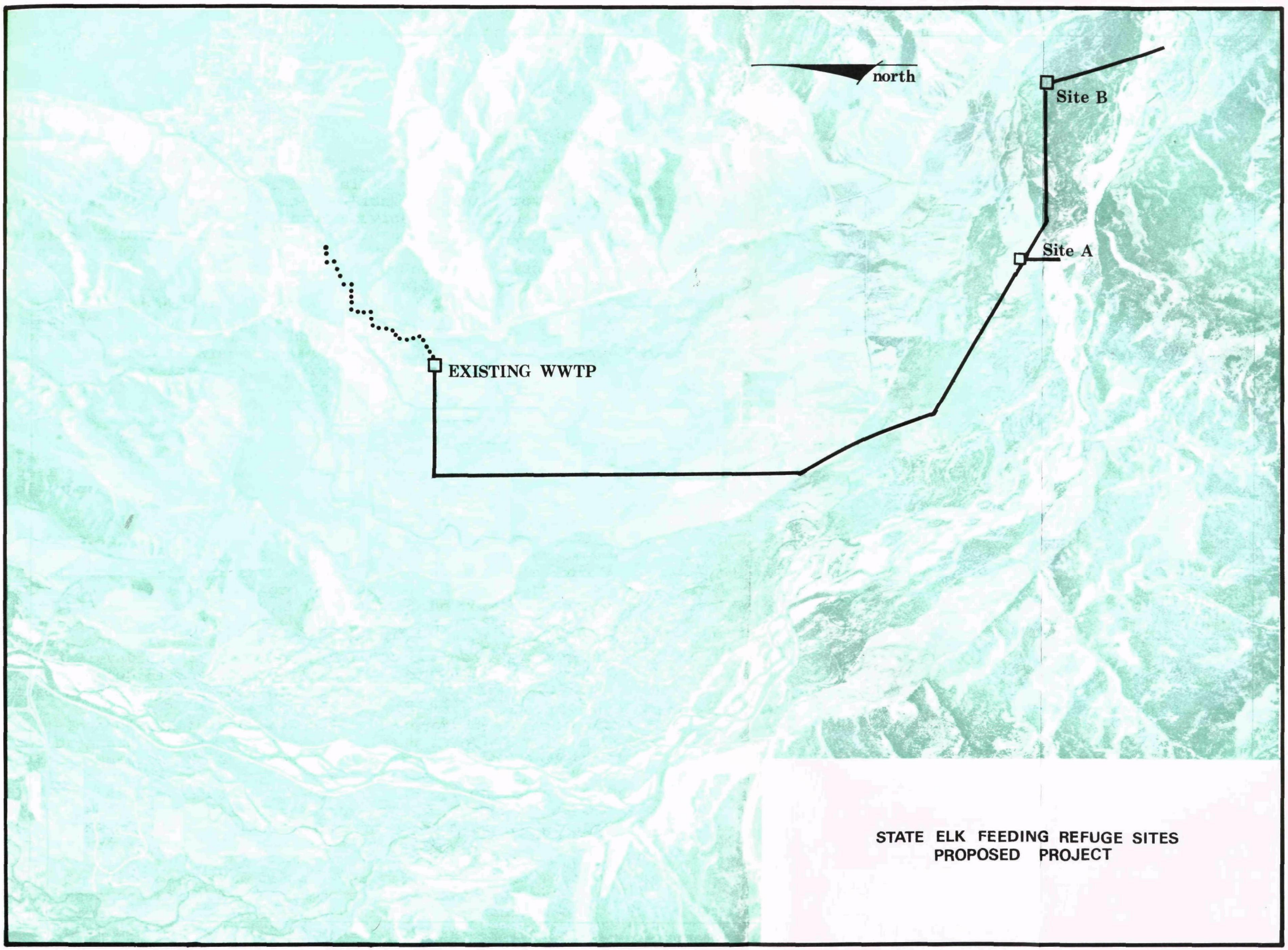

north
Site B
Site A
EXISTING WWTP
STATE ELK FEEDING REFUGE SITES
PROPOSED PROJECT

Figure 19

lower reaches of the pipeline alignment could prove extremely expensive and time consuming. It should also be remembered that unless extreme care is taken and very tight construction inspection is employed, infiltration could become a significant problem. The approximately 6.5 miles of pipeline, if constructed similar to much of the existing Jackson system, could be responsible for extremely high infiltration with the large diameter pipe anticipated.

Construction of a deep, sealed pond system at the South Park Elk Feedground site may be impossible given the known groundwater problems. Based on soils information available from the Jackson office of the Soil Conservation Service and in the absence of any onsite field data, raised (above ground) or mounded ponds may be the only way to successfully construct and seal the proposed facilities. The close proximity of the Snake River and the porous cobble and gravel soils in the area would make dewatering of any open excavation very difficult and economically impractical. It likewise could create problems in sealing or lining to assure containment. It is likely that similar groundwater problems would be encountered at almost any sites within the study area west of the South Park Road. To verify this assumption would require a detailed soil survey of the area which is outside the scope of this investigation. The cost estimates in Section IV are, as described, based upon normal construction practices. If it were necessary to import fill and construct an above ground pond system, the construction cost for the earthwork portion of the system could be increased as much as six times, depending upon the availability of imported fill.

In addition to the probable groundwater problems, the proposed plant site may be subject to flooding during the 50- and 100-Year Floods. The U.S. Army Corps of Engineers studies (Special Flood Hazard Information Snake River, Wilson, Wyoming and Vicinity, February 1976) show that proposed site A is out of both the 500- and 100-Year Floods while, according to the Corps of Engineers' information, site B is in the 50- and estimated 10-Year Flood hazard zone. Cost estimates for flood-proofing to the 100-Year Flood elevation have not been included because such costs are dependent on site specific elevation information yet to be developed by the Corps of Engineers.

In addition to the physical considerations in installing the proposed system, a number of procedural political and regulatory questions have arisen. The most significant of these is the availability of the South Park Elk Feedground land. A November 24, 1976 letter (Appendix 2) to Mr. Bill Ashley, Chairman of the Teton County Board of Commissioners from Earl M. Thomas, Director of the Wyoming Game and Fish Department, presented the position of the agency in regard to the lands in question:

> "In view of the amount and type of information we now have and after a careful consideration of it, the Commission and the Department feels that decisions must be made and time is of the essence. We must,

therefore, in fairness to all concerned, conclude and notify you that the Wyoming Game and Fish Commission and Department does object to and will oppose fully any attempts to place sewerage lagoons or other sewerage facilities on the South Park Elk Feedground."

The Department based its objection on four categorical issues: biological and habitat impacts, the legality of any land transfer, sociological and recreational effects, and the public controversy that has been generated by the Town's proposal. The Wyoming Game and Fish Department has summarized its position on these issues in the following portion of the aforementioned letter:

"1. Biological: We have serious reservations about placing any municipal sewerage facility on a flood plain, particularly one on a river with the potential and consequence of the Snake. The South Park Elk Feedground was initiated in 1939 on a site selected because of its unique and highly desirable biological features. There are high producing grass meadows along Flat Creek and on the Snake River bottoms where the elk are fed. Immediately adjacent to these meadow areas are large stands of mature cottonwood trees with an understory of shrubs and herbacious plants which provide cover and protection from weather. The elk can be fed, graze and rest relatively free of any harassment and never need to leave the Unit to benefit from these features. Although every portion of the Unit is not used for the feedground or for cover, a measurable amount of open space is required to provide a buffer zone between the elk and adjacent human activities. Although the Unit was acquired originally primarily for elk, other wildlife species inhabit the area in numbers. These species include moose, deer, waterfowl, raptors, upland game birds, furbearers and song birds.

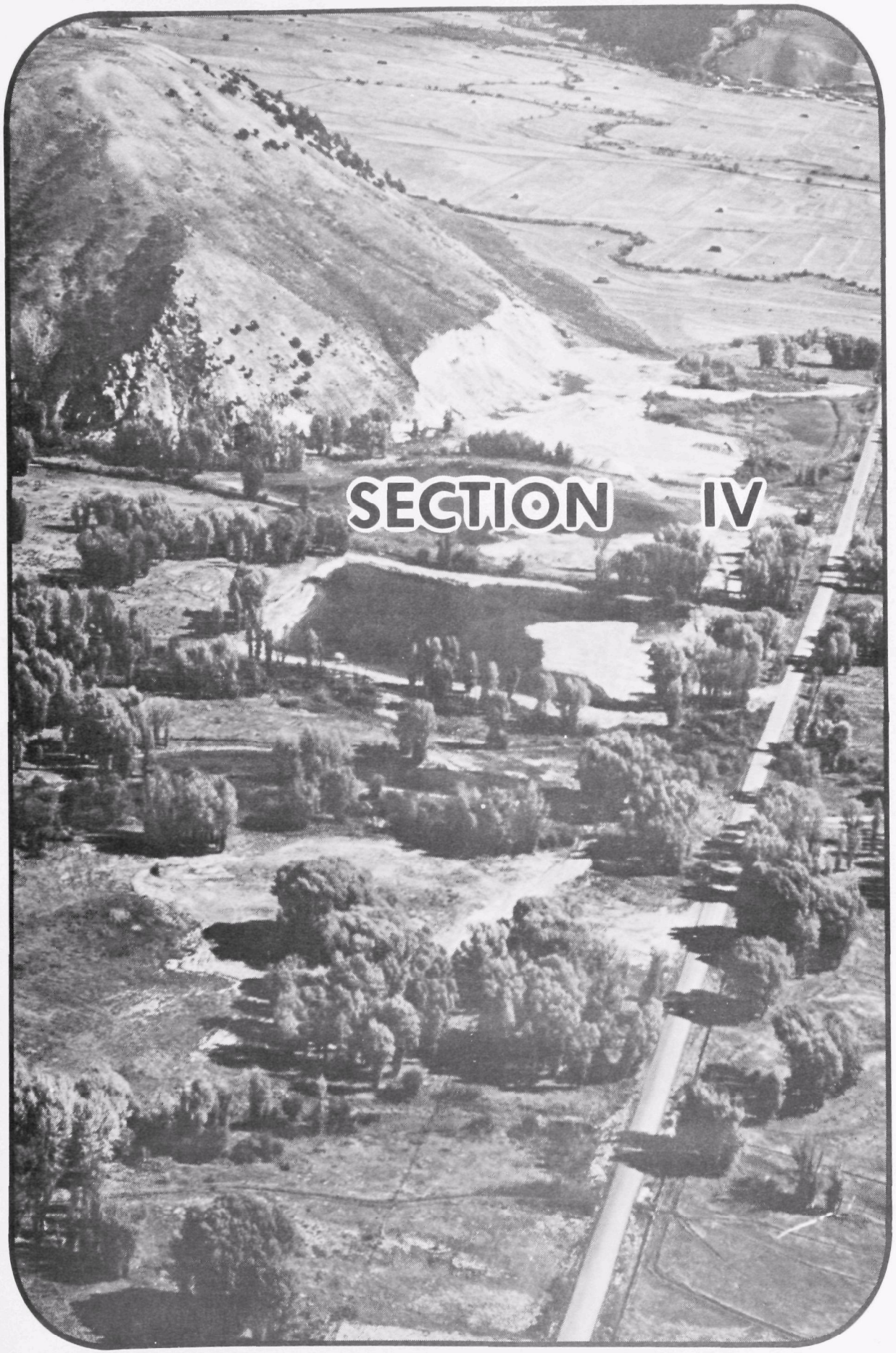
2. Legal: The enclosed letters from Area Manager Rounds, 1973; Assistant Regional Director Lane, March and August 1976, are self-explanatory. The feedground was purchased with Federal Aid money. The Commission very definitely cannot declare the property surplus to our needs and to simply transfer the land to Jackson would constitute a "diversion of funds" and would thereby jeopardize the Department's future and continued eligibility to receive Federal Aid Funds.

3. Sociological: The subject property is not only serving the original purpose for which it was primarily purchased, but also now serves a much greater public need. Camping, boating, dog trials, hunting, fishing and horse backing are among the public uses which constitute an average use of 13,705 visitor days for a six month period (June through November) for the past five years.

4. Political: The report of Nelson, Haley, Patterson and Quirk, Inc., lists several negative impacts of placing sewerage facilities at south Park. Among these statements is found the following:

> 'Any attempt by the Town of Jackson, even with County support, to take away land on the elk feeding area without the consent of wildlife officials will result in controversy. Vocal and powerful conservation and environmental groups, both local and national, might enter such a battle and delay any such action.'

Our files contain many letters from interested citizens from the Jackson area and elsewhere. Some are rather emotional, some are very practical and some are personal; but, without exception, they are all in opposition to placing sewerage lagoons on the South Park Feedground. A review of all the 'public input' made to us leads us to question; Who really wants or insists on the facility being at South Park?"


SECTION IV

BOYLES HILL ALTERNATIVE
SITE

SECTION IV

ALTERNATIVES

DESCRIPTION OF ALTERNATIVES

The alternatives which were evaluated in detail included several developed in the original facility plan, as well as new options not previously considered. The potential alternative sites and process methods were discussed on several occasions with local officials and government personnel, and six realistic alternatives were developed. These include:

A-1 Construction of a new mechanical plant at the site of the existing wastewater treatment plant.

A-2 Construction of a mechanical plant on the Boyles Hill school property.

A-3 A stabilization pond constructed on the Boyles Hill school property.

A-4 A stabilization pond constructed at a central mid-South Park location.

A-5 A stabilization pond constructed at a South Park location adjacent to Lower South Park Road.

A-6 Interim upgrading of the existing site to provide adequate waste treatment for the existing serviceable population.

A-7 No further action on the Town's part to improve wastewater treatment.

While these seven options will not address every possible combination of actions or specific potential sites, they reasonably represent the types of solutions or actions that are engineeringly, economically and environmentally feasible. Other options such as land disposal of effluent or advanced biological and/or chemical treatment were considered; but because of severe climatological and groundwater problems encountered in the area, and the prohibitive financial demands that would be placed upon the community, they were not considered further as being practical in meeting expected discharge standards for the region.

Alternative A-1

The existing treatment facility would be expanded and improved to meet the projected demand in the year 1990 or 1995. The major

improvement (NHPQ 1974) would entail the addition of a flow equalization basin conversion or the present extended aeration system to contact stabilization, secondary clarifiers, aerobic digesters, sludge handling facilities, disinfection and a number of electrical pumping, piping and weather protection modifications. As shown in Figure 20, only the existing headworks, pump structure, basins, and ancillary equipment would be salvaged. In addition, it may be necessary to provide stand-by power and dechlorination of the effluent discharged to Flat Creek.

The existing aeration basins and clarifiers are of the sufficient capacity to allow conversion to the contact stabilization mode. The required retention time for both the contact and stabilization phases of the operation would be in excess of those normally required for the projected 1990 flows. It is also unlikely that refractory industrial organic wastes, which would interfere with the contact stabilization process, would regularly be encountered in the Jackson area.

A properly operated contact stabilization system should be able to provide removal rates of organic contaminants of 80-90% with a desirable degree of future flexibility. The facility consultant has proposed to utilize aerobic digestion thickening and vacuum filtration for stabilization of the approximately 40,000 gallons/day of raw sludge that would be expected at 1990 flows. Ultimate disposal of digested and stabilized waste sludge would be to either a solid waste site or agricultural land disposal.

The existing polishing pond would be abandoned, but the present outfall line discharging to the west side of Flat Creek should be repaired and maintained. It will be necessary to replace or rebuild the existing pump's motors and drives, and a fourth stand-by unit will be needed at ultimate capacity. The revised cost estimate in Table 16 utilizes the existing wet well, major influent piping and laboratory and maintenance buildup. No additional land requirements are anticipated, and following construction, the site would be graded and landscaped to conform with the land uses of the area.

Alternative A-2

This alternative would entail the construction of an activated sludge plant located on State school land at the south end of Boyles Hill (Figure 21). This facility would utilize a minimum of space (approximately 3 acres) and could be landscaped and concealed to blend into the existing topography and vegetative cover. The land has been utilized within the last year as a gravel quarry and has undergone extensive surface disruption. Several quarry ponds are present on site, verifying the presence of high groundwater in the area.

This site would necessitate a transmission line from the Town to Boyles Hill. Several alternative configurations are possible

PROPOSED EXPANDED PLANT LAYOUT

ALTERNATIVE A1

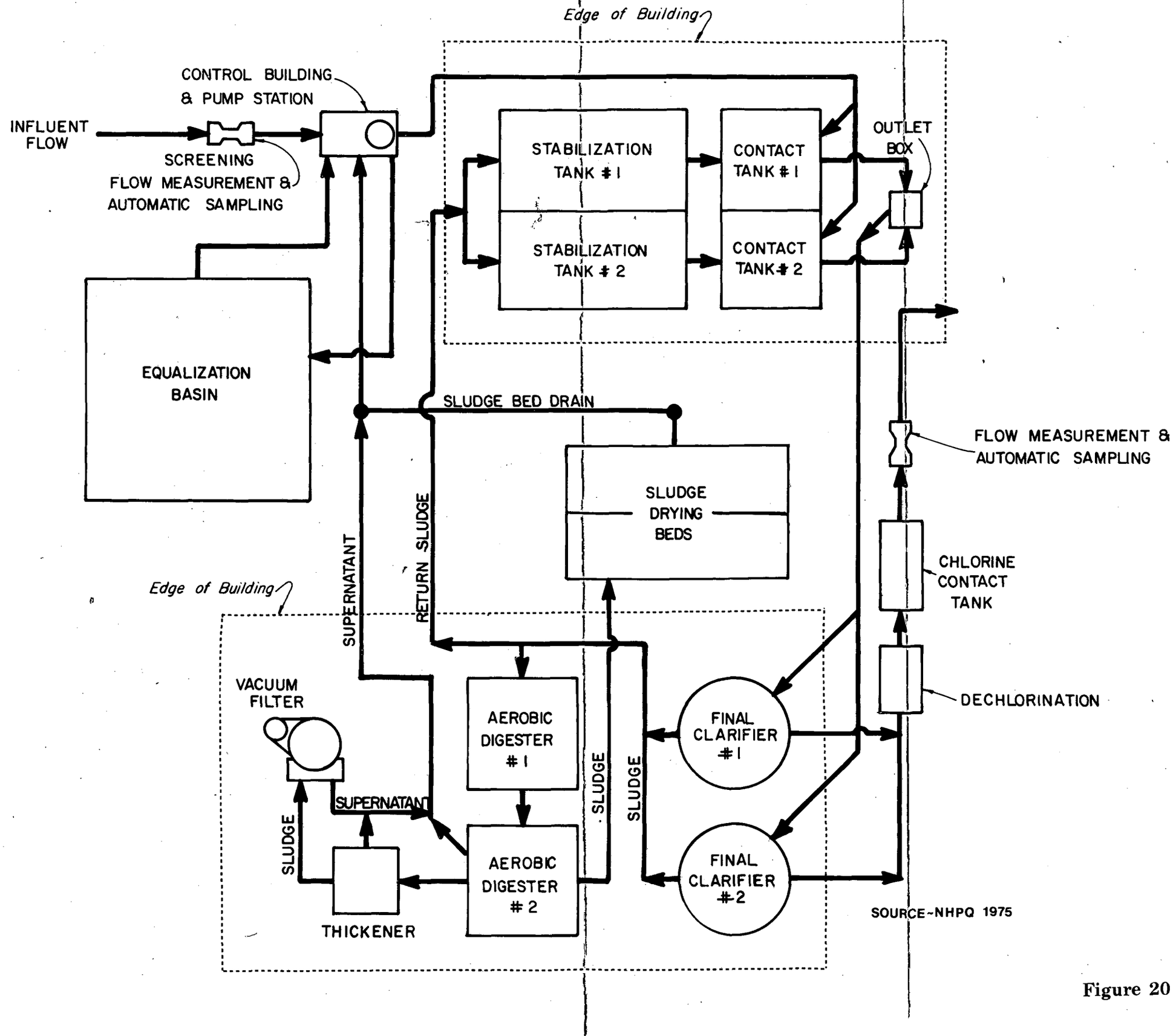


Figure 20

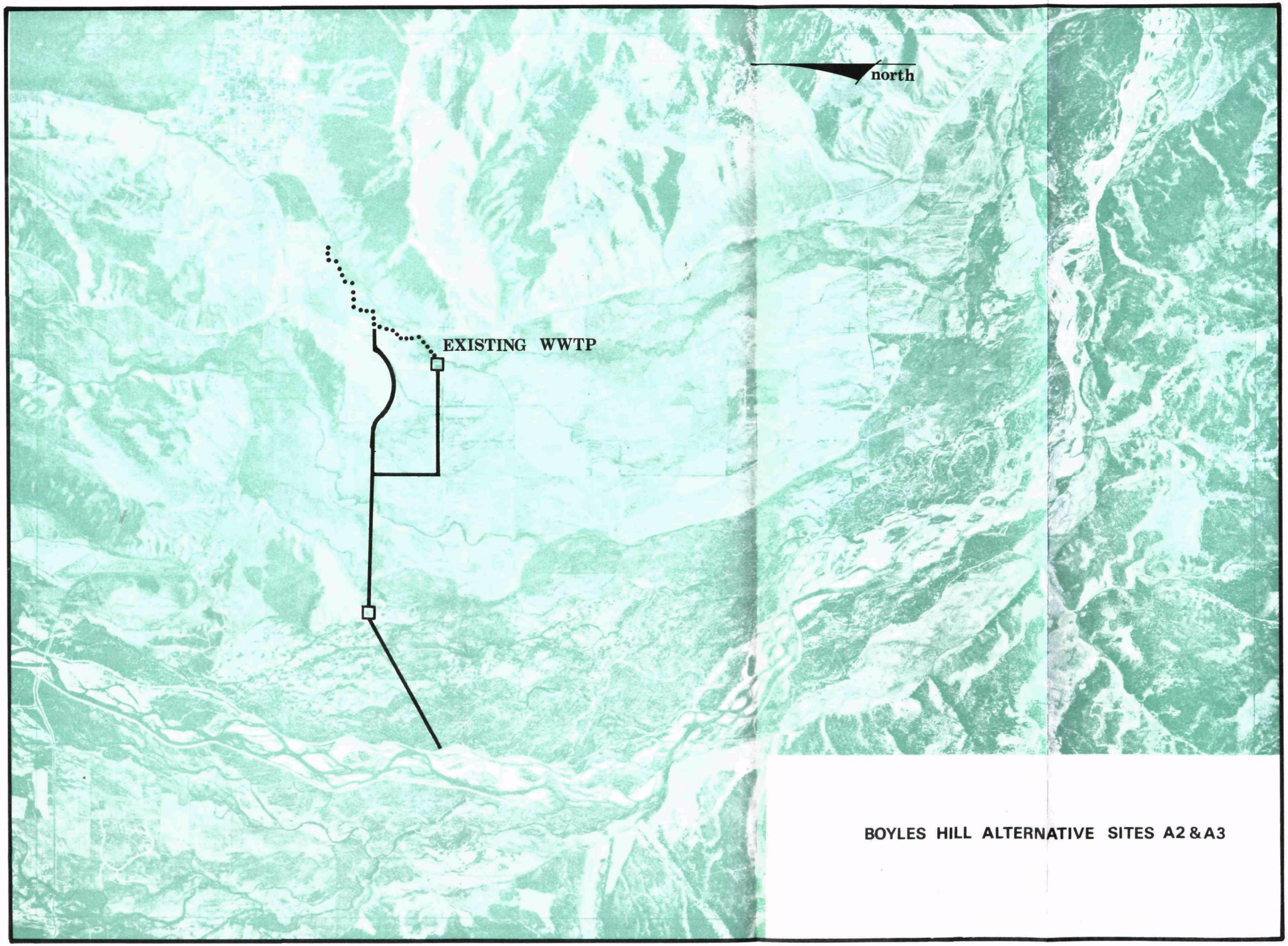

north
EXISTING WWTP
BOYLES HILL ALTERNATIVE SITES A2 & A3
SCALE 1:24 000
½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

Figure 21

and presented along with capital cost in Table 17. A suitable access road is available from Highway 189 to the gravel complex which should in its present form be adequate for both construction and operation purposes.

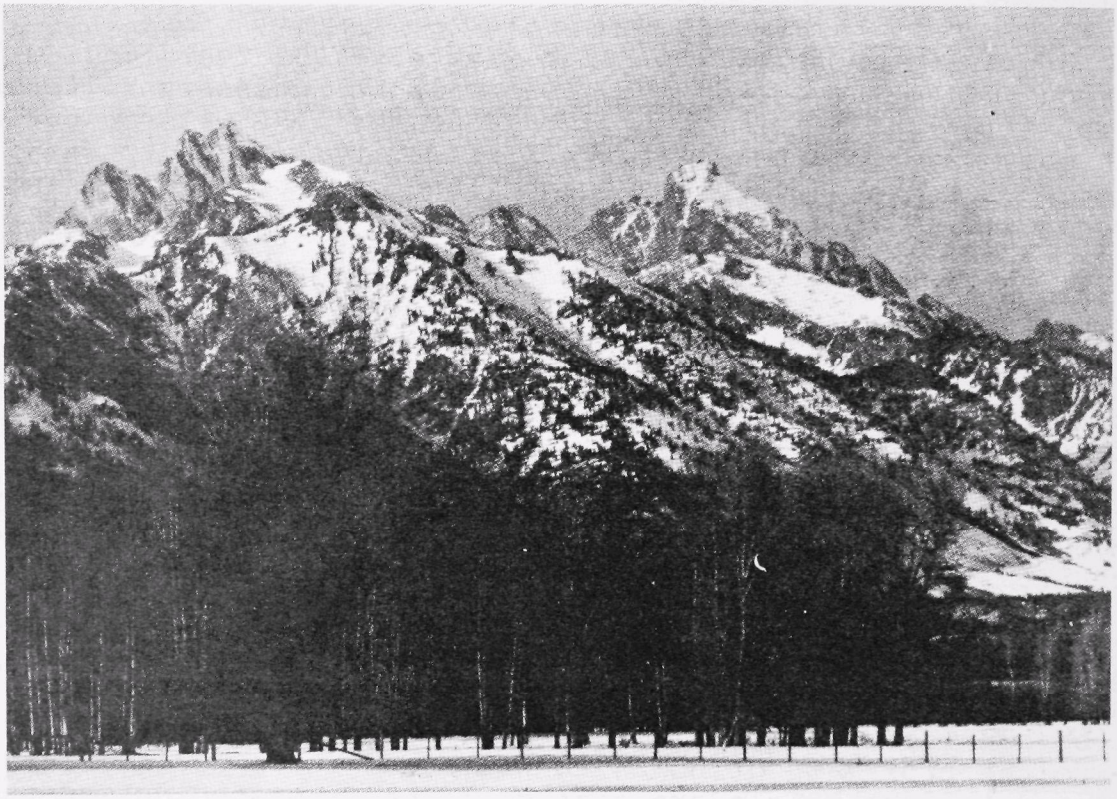
Alternative A-2 will allow the plant to be built on a section of land with sufficient expansion capabilities to meet any future requirements with regard to water quality standards and/or growth in Jackson (or Teton County) that may be necessary. While the facility plan does not go into any detail on process design, it would be anticipated that aerobic sludge digestion and land disposal of stabilized material would be incorporated. The biologically active portion of the system and any open water channels would need to be enclosed to prevent freezing and decreased efficiency.

A gravity outfall line, approximately 7000 feet long, will be required to the Snake River. It will be necessary to secure an outfall right of way; but given that the line will be buried with only access manholes on the surface, this should pose no major environmental problems as the land can be reclaimed and revegetated.

Alternative A-3

A stabilization pond could be constructed on the Boyles Hill site. It has, in the absence of onsite soils and groundwater information, been assumed that a deep lagoon will be constructed in order to reduce land requirement. This would require surface aerators with higher aeration efficiencies (i.e. increased H.P. demand) than indicated in the project report. While low energy mechanical surface aerators work well in the more temperate climates, it is doubtful that they could operate effectively during Jackson's severe winter climate conditions. This would likely require an injector or diffusor type apparatus to sustain treatment under winter ice accumulation. The Boyles Hill site would not be considered for facilitative or anaerobic winter operation due to the proximity of homes in the subdivision north of Boyles Hill and the probable odors that could be generated during the spring and fall.

This site (Figure 22) would require an outfall to the Snake River, disinfection and the flexibility to add additional treatment processes or capacity at a latter date if effluent discharge requirements were increased, or if the system required expansion. The alternative interceptor lines to the plant would follow the same alignment presented in Alternative A-2. The alternative costs are presented in Tables 18, 19 and 20. The groundwater depth in the Boyles Hill area is approximately 3 to 5 feet. Any deep lagoon, for that matter any lagoon in the Jackson area, would require a weighted liner or solid sealant to prevent infiltration and exfiltration. The development of any structure in this area



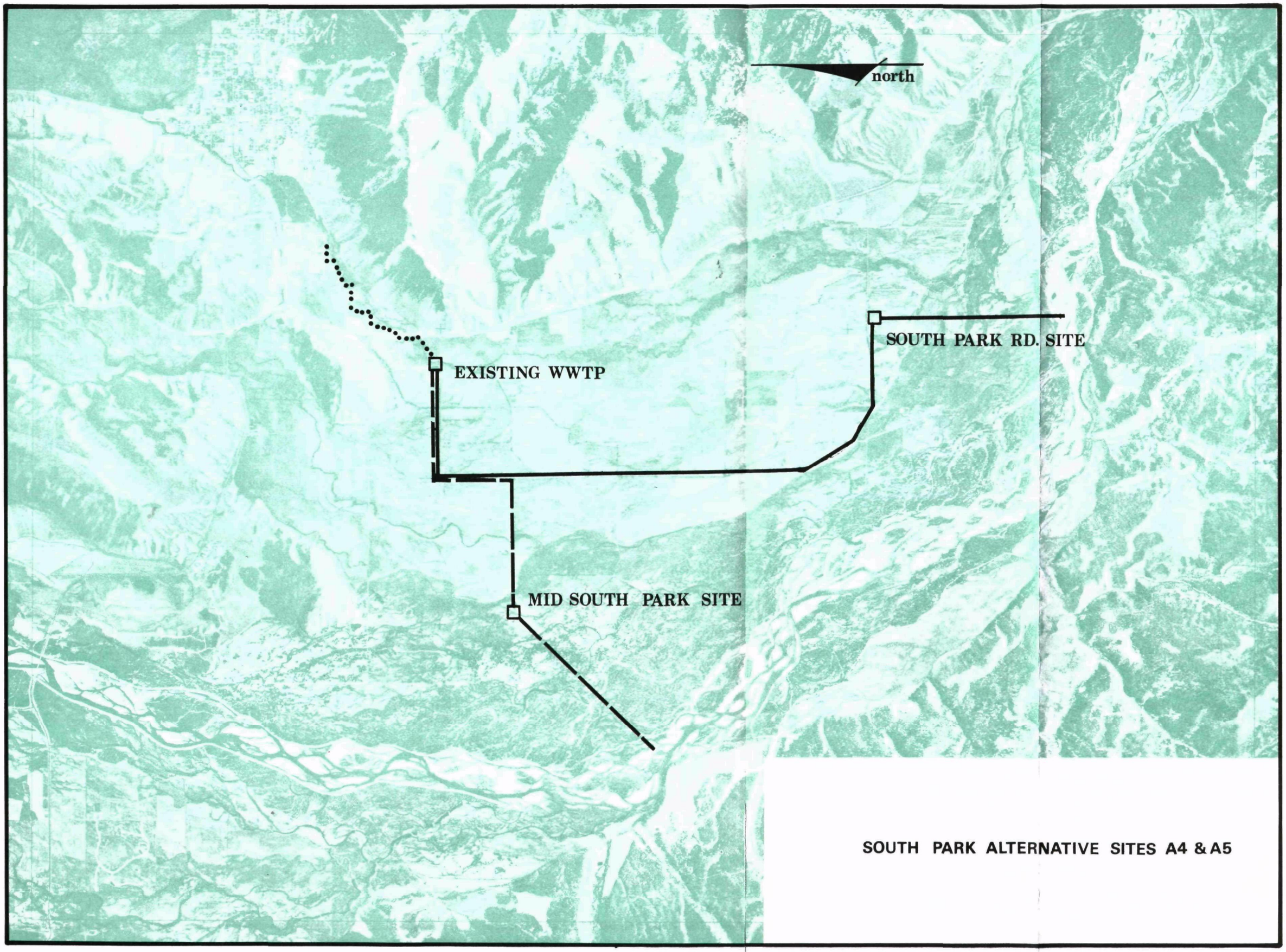

north
EXISTING WWTP
SOUTH PARK RD. SITE
MID SOUTH PARK SITE
SOUTH PARK ALTERNATIVE SITES A4 & A5
SCALE 1:24 000
1/2
0
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

Figure 22

would require grading, landscaping and reclamation of the damage caused by the gravel operation. This could be accomplished by proper landscaping.

Alternative A-4

Alternative A-4 would be a stabilization pond system located at a site midway in the South Park area. The proposed location shown in Figure 22 was selected for planning purposes only. Initial study of this site shows, on the basis of field investigation, the necessary requirements as far as space and cover are concerned, but many other locations could provide the same attributes. This study did not investigate the availability of land in this area, nor does it propose that this site be pursued over other similar tracts of land. It will service the area of proposed development with a much shorter pipeline than would be required to go to the Elk Feedground location. The site would be located in an area of high groundwater, but this is a condition common throughout South Park.

The controlling cost factor associated with this system is the length of the interceptor line and the cost of land (approximately 25 acres). This study has assumed a deep mechanically aerated lagoon system to reduce the surface area and land requirements. The climatic problems and restraints discussed under Alternative A-3 will also apply to this site, as would the requirements for an outfall to the Snake River.

Alternative A-5

Alternative A-5 is similar to A-4 in that it would entail the construction of a deep aerated stabilization pond system in the South Park area. This proposed location (Figure 22) of this alternative, contingent upon available land and geologic and hydrogeologic conditions, is along the lower end of South Park Road west of the Jackson Polo Club. The facility would require an outfall line running south to the main channel of the Snake River. The siting of a plant at this location would have several construction advantages in terms of available access and pipeline alignments, and would immediately open up a substantially greater amount of land to be serviced by gravity flow than Alternative A-4. Alternative A-5 could service by gravity flow almost as much undeveloped land as the proposed South Park Elk Feedground site.

Alternative A-6

In order to bring the system up to a higher degree of operation, without having to rely upon the availability of federal funding for a complete new system, the State of Wyoming, Department of Environmental Quality, has recommended an interim upgrading of the existing system. It would be possible under current EPA regulations to break out federal funds to complete the design and construction of these modifications immediately. This would require essentially finishing the plant as it was originally designed

along with the addition of chlorination facilities, and a general maintenance and overhaul. It has been suggested that this upgrading be designed to handle the expected flow from the Town for the next 5 years (1981). This is an arbitrary time frame, but it would allow the phasing of digester construction if the existing treatment plant site was eventually selected.

If this option was selected it would be necessary to bypass the polishing pond and repair the existing outfall to Flat Creek. The WDEQ has indicated that it would probably not be necessary to provide dechlorination for interim improvements. The addition of the digesters along with the other mechanical improvements would make it possible for the plant to adequately process secondary sludge and meet secondary standards for organics and suspended solids. These improvements could only be considered temporary. Unless the city adopted a concerted program of growth control, the facility would require expansion to accommodate the expected growth of the region. This latter expansion could be quite expensive for the Town since P.L. 92-500 funds will, in all probability, not be available and inflation will increase the necessary capital expenditure.

Alternative A-7

Under Alternative A-7 the Town would do nothing further to improve the condition of their wastewater system and reduce odor problems and the water quality degradation that is occurring. Inaction in finding and developing a solution to the overall problem of providing adequate wastewater facilities for the Town will only complicate the existing situations as the area continues to grow and expand. Each year's delay has and will continue to increase the eventual cost of construction at a rate that is parallel to the annual inflation experienced in the region. While the national inflation rate appears to be leveling off, increases in the construction industry have not responded as well. Between 1974 and 1976 there has been a real 17 percent increase in costs for the projects proposed in the 1974 facility plan, and another 10-12 percent can be expected prior to any construction.

Beyond the escalation of project cost that would certainly occur as a result of further delays, a deliberate no action stand could put the Town of Jackson in violation of state and federal laws and make it subject to court action. While EPA has only been forced to resort to this type of procedure on several occasions nationwide, the precedents have been set making flagrant violators of the water quality laws subject to stiff fines and other penalties. While a no action approach may seem to some members of the community a safe and inexpensive method of delay with the problem at hand, in reality, it cannot be considered an acceptable alternative. The lack of a positive result oriented plan for providing the needed wastewater facilities will only lead to continued environmental problems and water quality degradation. It is also possible that the WDEQ could institute a connection ban restricting new development in the area. This would have the secondary effect of creating an economic hardship in the community due to a lack of incoming and available capital development funds.

ECONOMIC EVALUATION OF PROPOSED PROJECT AND ALTERNATIVES

Eight possible plant locations and/or pipeline alignments were considered as to their engineering and economic feasibility. Five specific sites were investigated, including the existing wastewater treatment plant, the South Park Elk Feedground, two South Park sites and a site at Boyles Hill. Treatment processes analyzed included renovating the existing treatment plant to provide contact stabilization and improved sludge handling facilities, and at the other sites, treatment processes analyzed were aerated stabilization ponds and mechanical activated sludge systems.

In addition to these eight major variations of the alternative new treatment facilities, the interim improvements necessary to bring the existing wastewater treatment plant to an acceptable operational level were evaluated.

Pipeline estimates for the various alternatives assume a minimum surface cover of five feet for frost protection. Sizing and slopes of all gravity sewers allow a minimum velocity of two feet per second at design flow. Normal construction techniques are assumed for pipelines in the Jackson area, except for gravity outfall lines to the Snake River, where allowance for extreme wet and marshy conditions was made. Sheeting, shoring and other types of bracing methods for the pipeline trenches were also assumed in order to comply with Occupational Safety and Health Act (OSHA) and other requirements. The pipelines were designed for a peak daily flow rate of 5.5 mgd, which is the maximum peak instantaneous flow rate projected for the year 2000.

The wastewater treatment plant process alternatives were investigated for summer maximum daily flow rates of 2.2 mgd in 1990 and 2.6 mgd in 1995. Adequate operation and maintenance practice for both wastewater treatment plants and pipelines was assumed to maximize the useful life of the facilities.

Except for Alternatives A-1 and A-5, all effluent would be discharged to the Snake River for disposal. The lower reach of Flat Creek on the South Park Elk Feedground was initially considered as a possible disposal point for the discharge of effluent from the Town's proposed project. This was later dismissed from further consideration due to the slow-moving, backwatered condition of the stream at this point and the potential of nutrient and ammonia toxicity problems.

Costs for the various alternatives studied were obtained from economic curves for the Jackson area, and other data supplied by either the facility consultant or developed by the EIS consultant for similar construction projects. Cost data were then updated to the date of anticipated design and the start of construction (1978-1979) by using the Engineering News Record (ENR) method. For the purpose of this study, the ENR value for the present (late 1976) was assumed as 2,810, and for the earliest possible construction period in late 1978, the ENR was assumed to be 3,100.

Land costs for the Elk Refuge (exchange) and South Park alternatives were assumed to be $7,000 per acre, and land at the Boyles Hill site on State school land was assumed to be obtainable by either direct purchase of an easement or a sublease agreement with the present lease holder. The standard lease cost according to the State Land Officer is five percent of the appraised purchase price per year. Easement costs would be a one time payment at the appraised market value. The cost of the Boyles Hill land was assumed to be $5,000 per acre. Pipeline costs were based upon normal construction costs for the conditions anticipated within the Jackson area. While these costs include excavation, normal pipe bedding, reasonable trench dewatering, sheeting and shoring, etc., they do not take into consideration such items as cutting and replacing of pavement, repair to private property, and unknown field construction problems such as unstable soils or deep rock. Pipeline rights-of-way or easements were uniformly excluded from analysis of all the alternatives. Right-of-way and easement costs, if included, would have the effect of increasing the cost of all alternatives except the renovation of the existing wastewater treatment plant.

A present worth analysis was performed on each of the alternatives using both a 15 and a 20 year period with an eight percent compound interest factor.

Proposed Project - South Park Elk Feedground

Two locations on the South Park Elk Feedground (Section 28, Township 40 North, Range 116 West) were investigated as alternate treatment plant sites, as shown in Figure 20. A 21-inch gravity sewer was routed from the existing wastewater treatment plant to the proposed sites. The wastewater treatment process was assumed to be aerated stabilization ponds designed for cold weather operation and utilizing a land area of approximately 25 acres in 1990. An additional 5 acres of ponds is required to treat the anticipated flow rate in 1995. The treated wastewater would discharge into the Snake River via a 21-inch gravity outfall line. The estimated cost for the South Park Elk Feedground alternative for both 1990 and 1995 is shown in Tables 14 and 15.

Alternative A-1 - Construction of a New Wastewater Treatment Plant at the Existing Site

Various major revisions and modifications at the existing wastewater treatment plant can bring it up to the desirable level of operation that has been envisioned for the next several years. The cost of the revisions required to bring the facility up to secondary standards for 1990 and 1995 flows were estimated using several sources (i.e., 1974 Facility Plan, Cost Curves and Estimating Manuals and updated to an ENR of 3,100 for late 1978). Major revisions, as indicated in the facility plan include installation of a flow equalization basin, new or reconditioned sewage lift pumps, modification of the secondary treatment process to allow for contact stabilization, the construction of a secondary

TABLE 14

COST ESTIMATE

PROPOSED PROJECT - SITE A

SOUTH PARK ELK FEEDGROUND

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21" (28,600')	$2,216,000	$13,150	$2,216,000	$13,150
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	175,000	-	210,000	-
Outfall, 21" (1,000')	86,000	1,100	86,000	1,100
Subtotal	3,356,000	64,250	3,436,000	69,250
Admin., Engr., etc. @ 25%	83,900	-	859,000	-
Subtotal	4,195,000	64,250	4,295,000	69,250
Escalation to 1978	419,500	6,425	429,500	6,925
TOTAL	$4,614,500	$70,675	$4,724,500	$76,175

TABLE 15

COST ESTIMATE

PROPOSED PROJECT - SITE B

SOUTH PARK ELK FEEDGROUND

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21" (35,600')	$2,629,000	$13,150	$2,629,000	$13,150
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	175,000	-	210,000	-
Outfall, 21" (3,000')	216,000	1,100	216,000	1,100
Subtotal	3,856,000	64,250	3,979,000	69,250
Admin., Engr., etc. @ 25%	964,000	-	995,000	-
Subtotal	4,820,000	64,250	4,974,000	69,250
Escalation to 1978	482,000	6,425	497,000	6,925
TOTAL	$5,302,000	$70,675	$5,471,000	$76,175

clarifier, aerobic digester, and other solids handling facilities including an air flotation thickener and vacuum filtration and final effluent chlorination. In addition, it is quite likely that both standby power and dechlorination would be required, which would add approximately $50,000 to $60,000 to the capital cost. These costs are presented in Table 16 and were modified from the preliminary figures presented within the 1974 Facility Plan.

Alternatives A-2 and A-3 - Boyles Hill

An alternative treatment plant site at Boyles Hill (Section 36, Township 41 North, Range 117 West) was investigated with several subalternates.

Alternative A-2

This alternative would require construction of an activated sludge treatment plant for 1990 or 1995 wastewater flow at the Boyles Hill site. Wastewater was assumed to be intercepted upstream of the existing W.W.T.P. and transported to the site via a 21-inch gravity sewer. Effluent from the treatment plant would be discharged to the Snake River via a 24-inch outfall. The estimated costs for this alternative are shown in Table 17.

Alternative A-3a

This alternative again assumes a 21-inch gravity sewer intercepting the Town of Jackson trunk line upstream of the existing wastewater treatment plant and running westerly for 10,500 feet along a county road, as shown in Figure 21. At the site of the existing wastewater treatment plant a small lift station would be maintained to serve the area downstream from the intercepted trunk line. This wastewater would be transported to the Boyles Hill site via a four-inch force main for a distance of 11,000 feet. At the Boyles Hill site, this alternative calls for aerated stabilization ponds and a 24-inch gravity sewer outfall to the Snake River, a distance of 7,000 feet. The estimated cost for Alternative A-3 is presented in Table 18.

Alternative A-3b

This alternative presents the costs for a 27-inch gravity sewer routed from the existing wastewater treatment plant to the Boyles Hill treatment site, a distance of 11,000 feet and shown in Figure 21. The treatment plant process would be aerated stabilization ponds for both 1990 and 1995 wastewater flows, with a 24-inch gravity sewer outfall to the Snake. A summary of these costs is presented in Table 19.

Alternative A-3c

This alternative investigated the installation of a lift station at the existing wastewater treatment plant site, and an 18-inch force main to the Boyles Hill site. Other conditions are the same as for those presented above. A summary of the costs for this alternative is presented in Table 20.

Figure 23 shows the three alignments for these interceptor alternatives.

TABLE 16

COST ESTIMATE

ALTERNATIVE A-1

EXPANSION OF EXISTING PLANT SITE
TO CONTACT STABILIZATION

Unit Processes	1990 Capital	1990 Annual O & M	1995 Capital	1995 Annual O & M
Flow Equalization Basin	$ 580,000		$ 684,000	
By-pass and Abandon Comminutor	19,000		19,000	
Renovate Sewage Pumps	71,000		71,000	
Conversion of Aeration Tanks and Clarifiers to Contact Stabilization Process	58,000		58,000	
Addition of Secondary Clarifiers	233,000		325,000	
Addition of Aerobic Digesters	137,000		191,000	
Plant Enclosures	226,000		226,000	
Chlorination Facilities	72,000		101,000	
Thickener	58,000		63,000	
Vacuum Filter	122,000		130,000	
Excavation, piping, etc.	393,000		410,000	
Electrical	129,000		140,000	
Landscaping	19,000		19,000	
	$2,117,000		$2,457,000	
Contingencies, Engineering, admin., legal and inspection	508,000		516,000	
TOTAL	$2,625,000	$143,000	$2,973,000	$155,000

TABLE 17

COST ESTIMATE

ALTERNATIVE A-2

BOYLES HILL

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21"	$ 621,500	$ 3,100	$ 621,500	$ 3,100
Lift Station	36,000	2,000	36,000	2,000
Force Main, 4"	99,900	500	99,900	500
W.W.T.P., Activated Sludge	2,000,000	143,000	2,200,000	155,000
Land	50,000	-	50,000	-
Outfall, 24"	553,000	2,800	553,000	2,800
Subtotal	3,360,400	151,400	3,560,400	163,400
Admin., Engr., etc. @ 25%	840,600	-	890,100	-
Subtotal	4,200,000	151,400	4,451,000	163,400
Escalation to 1978	420,000	15,100	445,000	16,300
TOTAL	$4,620,000	$166,500	$4,896,000	$179,700

TABLE 18

COST ESTIMATE

ALTERNATIVE A-3a

BOYLES HILL

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21"	$ 621,500	$ 3,100	$ 621,500	$ 3,100
Lift Station (0.1 mgd)	36,000	2,000	36,000	2,000
Force Main, 4"	99,900	500	99,900	500
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	125,000	-	150,000	-
Outfall, 24"	553,000	2,800	553,000	2,800
Subtotal	2,271,400	58,400	2,384,400	63,400
Admin., Engr., etc. @ 25%	568,000	-	596,000	-
Subtotal	2,839,000	58,400	2,980,000	63,400
Escalation to 1978	284,000	5,800	298,000	6,300
TOTAL	$3,123,000	$64,200	$3,278,000	$69,700

TABLE 19

COST ESTIMATE

ALTERNATIVE A-3b

BOYLES HILL

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 27"	$ 988,000	$10,000	$ 988,000	$10,000
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	125,000	-	150,000	-
Outfall, 24"	553,000	2,800	553,000	2,800
Subtotal	2,502,000	62,800	2,615,000	67,800
Admin., Engr., etc. @ 25%	626,000	-	654,000	-
Subtotal	3,128,000	62,800	3,269,000	67,800
Escalation to 1978	313,000	6,300	327,000	6,800
TOTAL	$3,441,000	$69,100	$3,596,000	$74,600

TABLE 20

COST ESTIMATE

ALTERNATIVE A-3c

BOYLES HILL

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Force Main, 18"	$ 433,000	$ 2,200	$ 433,000	$ 2,200
Pump Station, (5.5 mgd)	526,000	14,000	526,000	14,000
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	125,000	-	150,000	-
Outfall, 24"	553,000	2,800	553,000	2,800
Subtotal	2,463,000	69,000	2,586,000	74,000
Admin., Engr., etc. @ 25%	616,000	-	647,000	-
Subtotal	3,079,000	69,000	3,233,000	74,000
Escalation to 1978	308,000	6,900	323,000	7,400
TOTAL	$3,387,000	$75,900	$3,556,000	$81,400

Alternatives A-4 and A-5 - South Park

Two alternative sites were evaluated in the South Park area, and results are given below.

Alternative A-4

The first alternative investigated in South Park was a treatment plant located in Section 1, Township 40 North, Range 117 West in the South Park area, as shown in Figure 22. A 21-inch pipeline is routed from the existing wastewater treatment plant for 10,900 feet to the site, which includes stabilization ponds for both 1990 and 1995 wastewater flows. From the South Park site a 24-inch gravity outfall line is required to run the 8,000 feet to the Snake River. A summary of these costs is presented as Table 21.

Alternative A-5

The second South Park site evaluated is located in Section 20, Township 40 North, Range 116 West, as shown in Figure 22. A 21-inch gravity sewer runs 24,000 feet from the existing wastewater treatment plant to the site, where treatment via stabilization ponds is assumed. An 18-inch outfall runs for 6,000 feet in a southerly direction to the Snake River. The estimated costs for this alternative are presented in Table 22.

Summary of Alternative New Systems

The estimated cost of the eight alternatives studied at the five potential treatment sites is summarized in Table 23. The alternatives for 1990 wastewater flows range in capital cost from $2.6 million to $5.3 million, with the existing wastewater treatment plant (Alternative A-1) having the lowest capital cost. Operation and maintenance costs range from $62,800 to $166,500, with the Boyles Hill plant stabilization pond (Alternative A-3a) lowest. The large O & M values shown for Alternative A-1 and A-2, as compared to the other alternatives studied, is the result of utilizing an activated sludge process demanding higher energy needs instead of aerated stabilization ponds.

The present worth of the alternatives ranges from $3.5 to $6.0 million for 1990 and $5.2 to $10.4 million for the 1995 alternatives. The Boyles Hill pond site (A-3a) has the lowest overall cost. It should be noted from the present worth analysis, the total project costs for the mid-South Park site (Alternative A-4), the Boyles Hill site utilizing lagoons and gravity line (Alternative A-3b), the Boyles Hill site utilizing pump station and force main (Alternative A-3c), and the revisions to the existing plant (Alternative A-1), all can be assumed to have essentially the same total project cost, given the inherent uncertainties of the estimating process. The present worth analysis of the alternatives shows that an activated sludge plant, at a site other than the existing wastewater treatment plant, is probably an economically unfeasible solution in terms of local financing of capital and O & M costs. Likewise a site far removed from the existing

TABLE 21

COST ESTIMATE

ALTERNATIVE A-4

MID-SOUTH PARK

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21"	$ 776,000	$ 3,900	$ 776,000	$ 3,900
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	175,000	-	210,000	-
Outfall, 24"	632,000	3,200	632,000	3,200
Subtotal	2,419,000	57,100	2,542,000	62,100
Admin., Engr., etc. @ 25%	605,000	-	636,000	-
Subtotal	3,024,000	57,100	3,178,000	62,100
Escalation to 1978	302,000	5,700	318,000	6,200
TOTAL	$3,326,000	$62,800	$3,496,000	$68,300

TABLE 22

COST ESTIMATE

ALTERNATIVE A-5

SOUTH PARK ROAD

	1990		1995	
	Capital	Annual O & M	Capital	Annual O & M
Pipeline, 21"	$1,757,000	$ 8,800	$1,757,000	$ 8,800
W.W.T.P., Lagoons	836,000	50,000	924,000	55,000
Land	175,000	-	210,000	-
Outfall, 18"	372,000	1,900	372,000	1,900
Subtotal	3,140,000	60,700	3,263,000	65,700
Admin., Engr., etc. @ 25%	785,000	-	816,000	-
Subtotal	3,925,000	6,700	4,079,000	65,700
Escalation to 1978	392,000	6,100	408,000	6,600
TOTAL	$4,317,000	$66,800	$4,487,000	$72,300

TABLE 23

COST ESTIMATE SUMMARY OF ALTERNATIVES

Alt. No.	Site	1990 Treatment, thousands Capital	Annual O & M	Present* Worth	Ranking	1995 Treatment, thousands Capital	Annual O & M	Present* Worth	Ranking
Proposed Project	Elk Range-A	$4,615	70.7	$6,535		$4,725		$ 8,212	6
	Elk Range-B	5,302	70.7	7,222	7	5,471	76.2	8,958	
A-1	Existing WWTP	2,625	143.0	6,508	6	2,973	155.0	10,066	7
A-2	Boyles Hill	4,620	166.5	9,141	8	4,896	179.7	13,119	8
A-3a	Boyles Hill	3,123	64.2	4,866	1	3,278	69.7	6,468	1
A-3b	Boyles Hill	3,441	69.1	5,317	3	3,596	74.6	7,010	4
A-3c	Boyles Hill	3,387	75.9	5,448	4	3,556	81.4	6,991	3
A-4	South Park #1	3,326	62.8	5,031	2	3,496	68.3	6,622	2
A-5	South Park #2	4,317	66.8	6,131	5	4,487	72.3	8,029	5

*Capital plus anticipated O & M (@ 8% annual) for the life of the project (assume full 15 and 20 year design).

treatment plant site (i.e., South Park Elk Feedground) is also extremely expensive due to the large capital cost of the required pipeline.

Alternative A-6 - Interim Improvements

As an alternate to the major capital projects discussed above, or as a method for staging the major construction of a mechanical plant at the existing site, a series of interim improvements at the existing wastewater treatment plant were investigated. This includes all the necessary interim improvements that would be required to bring the system to an efficient operational level for at least the next five years. Major items included in the interim improvements included addition of solids handling via aerobic digestion, and thickening/filtration, installation of standby power, and provision for chlorination/dechlorination facilities. Facilities were designed for an average daily flow rate of 1.5 mgd, the value estimated for 1981. A summary of the costs and major assumptions for these interim facilities is presented in Table 24.

If the existing sludge drying beds were considered sufficient to provide adequate solids drying for the interim period, approximately $130,000 (thickening and filtration) could be reduced from this estimated capital and $9,000 from the operation and maintenance. This would reduce the capital outlay to approximately $240,000 and the annual operation and maintenance to about $6,500 above the existing costs. As in other agricultural areas, dried and stabilized sludge could be sold or given to farmers and ranchers in the area for ultimate disposal if the necessary restrictions were developed. This material can be stockpiled until spring and summer when it could be utilized as soil builder.

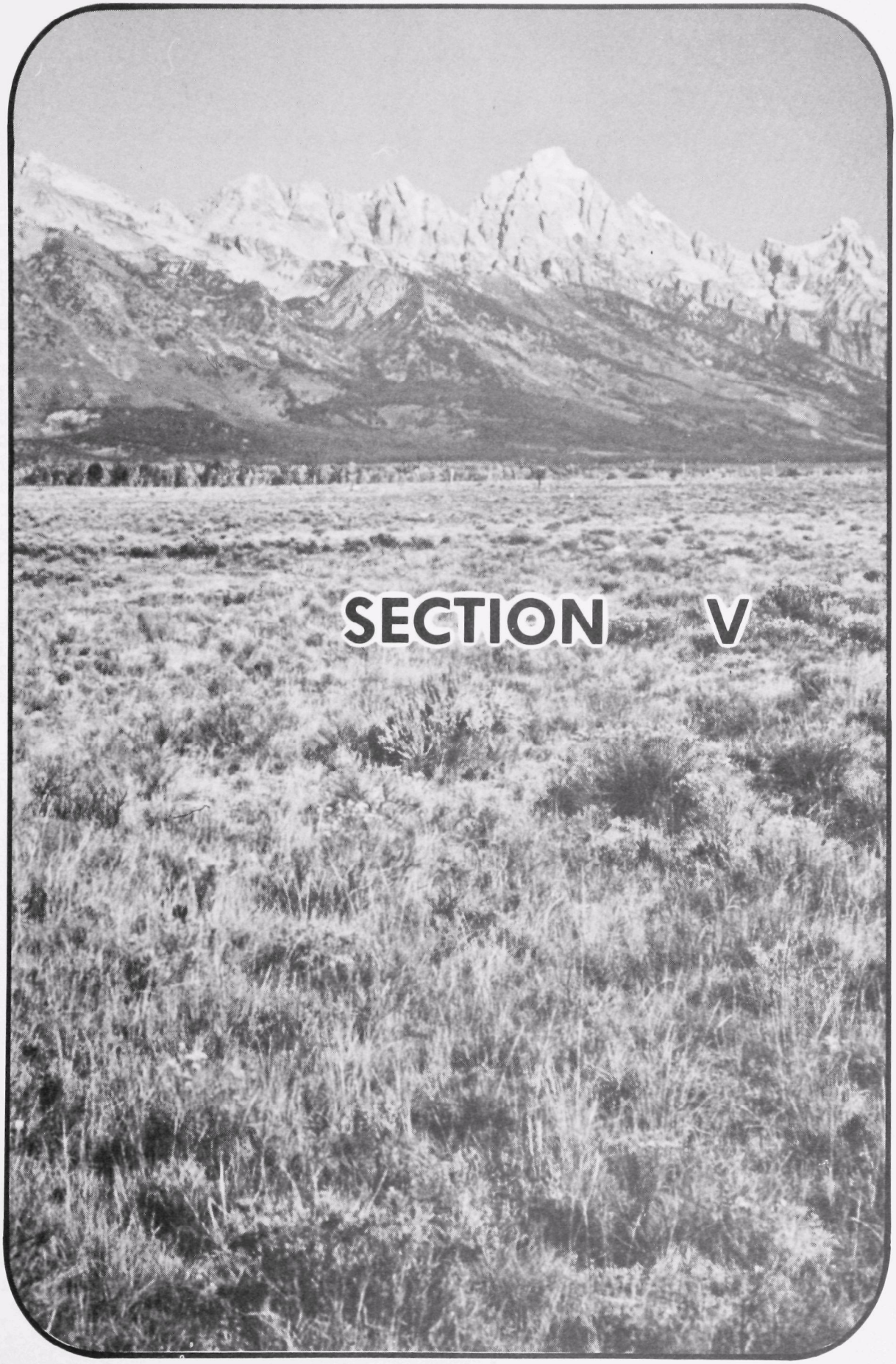
TABLE 24

*COST ESTIMATE - ALTERNATIVE A-6

INTERIM (5 year) IMPROVEMENTS

	Capital	O & M
Aerobic Digestion	$118,000	$ 3,500
Air Flotation Thickening	64,000	3,400
Vacuum Filtration	68,000	5,600
Standby Power	30,000	Negligible
Chlorination	45,000	3,000
Subtotal	$325,000	$15,500
Administration and Contingencies @ 15%	49,000	--
TOTAL	$373,000	$15,500

*All costs - ENR for early 1978 2,800


SECTION V

TETON MOUNTAIN

SECTION V

IMPACTS OF THE PROPOSED PROJECT AND ALTERNATIVES

The following section analyzes the impacts of the proposed project and the seven basic alternatives that were described in detail in preceding sections. The impact analysis weighs both the positive and negative characteristics inherent in each alternative, and presents these first in a narrative description, and summarized in a later section by a matrix which compares the attributes and weaknesses of each alternative within several basic categories. The narrative description discusses the characteristics of each option in terms of four impact categories which correspond to the major topical headings in the background section of this document (Section II) within the framework of the existing information. These include the Natural Environment Impacts, Socio-Cultural Impacts, Economic Impacts, and Land Use Impacts. The matrix summary analyzes both objective and subjective impact areas utilizing a weighting factor to distinguish between the more significant aspects or values effected by each alternative.

The evaluation of impacts are directed to those issues which were considered of major importance, or have become highly controversial. While the document is comprehensive in terms of its analysis of the Town's wastewater problem, it is oriented toward providing a comparative evaluation of these critical issues.

Primary impacts are considered at the beginning of the section followed by a summary analysis of the secondary impacts of each alternative.

NATURAL ENVIRONMENT IMPACTS

Environmental problems seldom stem from simple causes. Rather, they usually rise out of the interplay of many contributing circumstances. Changes in one part of the environment inevitably trigger changes in other parts. For this reason, the complex interactions of environmental processes must be looked at as a "whole system."

The following section analyzes the impacts of the proposed action and the seven basic alternatives on the natural environment in the Jackson study area. The discussion considers both primary and secondary impacts in terms of short term and long term environmental relationships. While the primary impacts are generally straightforward, the secondary impacts likely to be facilitated by implementation of an alternative are extremely difficult to forecast. Construction of a wastewater treatment facility, for example, can have a direct primary impact of improving water quality

(groundwater or surface water) by providing better treatment efficiency than existing individual septic tank systems in an area. The long range secondary impacts of providing central sewer to the area, however, may include increased air pollution generated by the increased population serviced by that centralized system.

For this reason, the narrative discusses both the positive and negative characteristics of the alternatives in terms of their potential impacts on four major areas; ir quality, water quality, wildlife habitats, and natural hazards. The no-action alternative is included within the evaluation framework where specific impacts are anticipated.

WATER QUALITY IMPACTS

Impacts of the Proposed Action (South Park Elk Feedground)

The primary impacts of construction of a lagoon treatment system at the South Park Elk Feedground on Flat Creek water quality include significant decreases in fecal coliform, ammonia, nitrate nitrogen, total phosphate, total dissolved solids and turbidity due to removal of the Jackson treatment plant discharge to the creek. With the construction and operation of the proposed treatment facility and discharge to the Snake River, increases in these water quality parameters can be expected for the Snake River downstream from the sewage outfall. Nutrient levels will likely demonstrate the most significant increases because of increased flows facilitated by additional treatment capacity and the low nutrient removal efficiency provided by the lagoon system.

Although Flat Creek is presently classified as a Class I stream, existing data indicates that water quality is impaired in the segment of the creek below the Jackson treatment plant. Snake River water quality through the Wyoming Snake River Basin is excellent.

Construction of the proposed project will involve installation of the 21 inch interceptor, construction of a new outfall, and discharge to the Snake River.

In the absence of a detailed analysis of the existing characteristics of Jackson's wastewater and the alternative treatment plant design removal efficiencies, several assumptions were prepared in order to predict the discharge concentration expected from the 1995 flows for total phosphorus, total nitrogen and ammonia. These were developed for both the Snake River and Flat Creek and are presented at this point in order to facilitate comparison.

Assuming a medium sewage strength, the influent characteristics of Jackson's wastewater were assumed (Metcalf & Eddy 1972) at 1995 design flow as follows:

Total Nitrogen	40 mg/l	886 lb/day
Total Phosphorus	10 mg/l	221 lb/day
Ammonia Nitrogen	25 mg/l	553 lb/day

A conventional activated sludge system without nutrient removal, ammonia removal, or a biological polishing pond and algal removal could be expected to remove only about 40 percent of the influent nitrogen concentration and 20 percent of the phosphate through bacterial assimilation and sludge removal.

This will provide an estimated effluent quality of:

Total Nitrogen	24 mg/l	531 lb/day
Total Phosphorus	8 mg/l	177 lb/day
Ammonia Nitrogen	15 mg/l	331.8 lb/day

A stabilization pond, as proposed by the design engineer, may reach higher nutrient removal rates but be subject to more fluctuation. Removal for some nutrients as high as 75-80 percent (EPA Lagoon Upgrading 1973) may be experienced in the summer, but a more conservative estimate of 60 percent for nitrogen and 20 percent for phosphorus was used in this analysis. Utilizing a simple effluent mass loading this would indicate effluent characteristics as follows:

Total Nitrogen	16 mg/l	531 lb/day
Total Phosphorus	8 mg/l	177 lb/day
Ammonia Nitrogen	6 mg/l	132 lb/day

In evaluating what effects these discharges would have on either Flat Creek or the Snake River, low flows of 50 cfs on Flat Creek and 1200 cfs (Wyoming Water Planning Program Report, No. 14, 1975, Discharge Measurements) on the Snake River were assumed. The following nutrient and ammonia concentrations were calculated based upon these flows.

TABLE 25

Calculated Instream Concentration

Discharge	Total N mg/l	Total P mg/l	Total Ammonia N mg/l
Flat Creek Mechanical	1.6	0.5	1.0
Snake River Mechanical	0.07	0.02	0.04
Stabilization Pond	0.05	0.01	0.03

Toxic ammonia (unionized ammonia) concentration, based upon the known temperature and pH characteristics at low flow were calculated at:

Discharge	Toxic NH_3 (unionized)
Flat Creek Mechanical	0.012
Snake River Mechanical	0.0015
Stabilization Pond	0.0001

If, as indicated in the Snake River Basin Water Quality Management Plan (1976), Snake River flows below Wilson could reach as low as 100 cfs for limited periods, when Jackson Dam releases were suppressed, the following concentration could be expected in the Snake River at maximum design flow:

	Total N	Total P	NH_3-N	Toxic NH_3 (unionized)
Mechanical	0.80	0.25	0.50	0.016
Stabilization Pond	0.50	0.17	0.33	0.011

Water quality standards for instream nutrient concentrations (EPA Quality Criteria for Water 1976) state that in order to prevent the development of biological growth and eutrophocation, phosphorus (normally considered the limiting nutrient in western waters) concentration in any stream entering any lake should not exceed 0.05 mg/l. Since the Snake River enters Palisades Reservoir, these extremely low flows could exceed the desired quality of the river. A number of nonpoint sources enter the Snake River between Jackson and Palisades Reservoir making the loading of nutrients on Palisades primarily a nonpoint problem (see Appendix 4).

It appears from these estimates that the recommended phosphorus concentration for Flat Creek instream water quality would be exceeded by a conventional activated sludge facility at the design flow. The phosphorus concentration generated by either of the proposed treatment facilities discharging to the Snake River would not exceed either instream or impoundment protection criteria unless extreme low flows (e.g. 100 cfs or less) were experienced.

According to the calculated concentrations it does not appear that instream toxic ammonia levels for cold water fisheries (0.02 mg/l unionized NH_3 Ammonia Toxicity 1976) would be reached at either site at design flow.

It should also be noted that by removing the Jackson treatment plant effluent discharge to Flat Creek, 1995 flows will be reduced by as much as 4.0 cfs during certain periods of the year. Flat Creek presently has an annual average flow of approximately 100 cfs, with low flows of 50 cfs measured during February 1976. A somewhat less significant but important impact of the proposed action, particularly for site B in view of its close proximity to the Snake River, is the increased sediment loadings and turbidity to the river caused by surface disturbance and disruption during the construction phase of the proposed project. A large area will require excavation for construction of the lagoon system, and placement of the outfall line. These increased concentrations can be minimized through utilization of temporary erosion control practices during construction, and maintenance of a permanent buffer between the lagoon area and the Snake River.

Dewatering will be required during pipeline construction and alignment in areas of high groundwater. This action will likely create local turbidity problems in groundwater, and wastewater which must be removed from the trench. Proper controls would be exercised in disposal of this wastewater to prevent adverse effects on nearby surface waters. Raised mounded lagoons will require sealing or lining to insure containment and prevent groundwater contamination.

Infiltration of groundwater into the interceptor should have an insignificant effect on the volumes of water which require treatment if proper materials and methods are used in the construction phase of the interceptor. Exfiltration should pose no significant problems in terms of groundwater contamination if proper design and testing are utilized.

Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

The primary impacts of construction of a new mechanical plant at the existing treatment plant site will be to improve the Flat Creek water quality. At present, the existing plant is hydraulicly overloaded. Existing monitoring data indicate the facility is contributing to the bacteria, sediment and nutrient levels of Flat Creek, making this stream segment the most critical in Wyoming's Snake River Basin in terms of water quality impairment. Expansion and improvement of the Jackson plant to meet the projected waste treatment demand for the year 1990 will reduce high fecal coliform, turbidity and total dissolved solid concentrations presently contributed by the plant. Nitrate, ammonia and phosphate not removed by secondary treatment will continue to elevate with population growth and increased flows.

Snake River water quality should also show a general improvement in bacteria and sediment concentrations at the confluence with Flat Creek as a result of improved operation of the Jackson treatment plant. The existing interceptor is scheduled to undergo improvements to correct the existing infiltration program under an EPA grant. No major adverse water quality impacts are anticipated during this project which should be completed during the summer 1977.

Increased sediment levels and turbidity resulting from runoff from the site during construction will probably be minimal due to the small amount of land area disturbed. Proper grading and landscaping with a stream buffer zone following construction would reduce on-site runoff.

Alternative A-2 (Boyles Hill Mechanical Plant)

The primary impacts of construction of a new mechanical plant at the Boyles Hill site in the short term/long term would be significant decreases in fecal coliform, ammonia, nitrate nitrogen, total phosphate, total dissolved solids and turbidity water quality parameters for Flat Creek due to removal of the Jackson treatment plant effluent discharge. A corresponding increase can be expected for the Snake River downstream from the newly located outfall. These impacts, however, will not be as acute due to the substantially higher flows and dilution provided by the Snake River throughout the year.

The primary impacts of this alternative during the construction phase would be similar to those for Alternative A-1, and include increased sedimentation to the small tributaries in the area (Spring and Crane Creeks) caused by runoff from the site. These impacts are short term, and are not expected to be significant. Dewatering will be required during pipeline alignment in areas of high groundwater. Infiltration and exfiltration problems will be similar to those discussed for the proposed action, and will require similar mitigation measures.

Alternative A-3 (Boyles Hill Stabilization Pond)

The primary and secondary water quality impacts involving construction of a stabilization pond at the Boyles Hill site would be similar to those discussed for Alternative A-2. A significant improvement in Flat Creek water quality and a corresponding minor decrease in Snake River water quality below the realigned sewage outfall would be expected.

The primary short term adverse impacts on groundwater and surface water quality could be complicated somewhat by the increased surface area disturbance required for a lagoon treatment system. Dewatering of the pipeline trench and raising and sealing of the lagoons to insure containment of wastewater would be required.

Alternative A-4 (Mid-South Park Stabilization Pond)

The primary impacts on Jackson area water quality associated with this alternative are similar to those discussed for the Boyles Hill stabilization pond alternative. Short term surface water and groundwater quality may be adversely effected by soil disruption during construction. Sedimentation and turbidity problems can be minimized through the use of construction techniques which reduce soil erosion, ditch bank slumping and control on-site runoff. Crossing Spring Creek and Crane Creek with the interceptor alignment may also create some short term adverse impacts. These impacts can also be reduced through existing regulations and construction mitigation procedures.

Flat Creek water quality will undoubtedly be improved through implementation of this alternative. Snake River water quality will receive no beneficial impacts for reasons discussed under the other alternatives involving effluent discharge to the river.

Alternative A-5 (South Park Road Stabilization Pond)

The primary water quality impacts of construction of a stabilization pond system in lower South Park are very similar to those for the proposed South Park Elk Feedground alternative. A general improvement in Flat Creek water quality can be expected. Conversely, water quality conditions in the Snake River below the sewage treatment plant outfall can be expected to show some minor deterioration.

Primary short term construction impacts will also be similar to the proposed action. Site planning which includes provisions for effective erosion and sediment control and storm water management will minimize these impacts during the construction phase of the project. Proper design and testing of the interceptor will reduce infiltration/exfiltration problems.

Alternative A-6 (Interim Upgrading of Existing Treatment Plant)

The primary short term impacts of this alternative would be similar to those discussed for Alternative A-1, and would include temporary correction of existing hydraulic overload at the plant and reductions in fecal coliform, turbidity and total solid concentrations in Flat Creek. This improvement, however, is only a short term solution as the action does not provide sufficient additional treatment capacity to serve the long term needs of the area.

Alternative A-7 (No Action Alternative)

Impacts on water quality of the "no action" alternative are dependent on the population growth. The "no action" alternative would create no additional primary short term adverse or beneficial impacts on water quality beyond those currently being experienced in the Jackson area, providing no extensions or additional hookups were allowed on the existing system. Wyoming water quality standards would continue to be exceeded periodically for fecal coliform in Flat Creek below the treatment plant outfall, and the plant would continue to exceed the proposed (July 1, 1977) discharge standards. This could result in the Town of Jackson violating their secondary treatment requirements and being subjected to enforcement sanctions by the Wyoming DEQ.

If present population growth continues and the projected population is realized, Flat Creek water quality conditions will begin to deteriorate at an increasing rate. Violations of additional water quality parameters including oxygen demanding waste, nutrients and sediment will occur downstream from the sewage treatment outfall. Increased nutrient and sediment levels are also likely to occur further downstream at the confluence of Flat Creek and the Snake River.

AIR QUALITY

Impact of the Proposed Action (South Park Elk Feedground)

The primary impacts on air quality in the Jackson, Wyoming study area for the proposed action would be from the actual construction and operation of the facilities. Alignment of the pipeline and construction of the wastewater treatment plant will result in increased particulate levels for ambient air quality. Construction of a lagoon treatment system alternative will likely result in some seasonal odor problems.

Limited monitoring data indicates that existing air quality in the study area is good. Construction of the proposed project will necessitate the removal of vegetation and disruption of soils and ground area with resultant dust generation during excavation for the pipeline. These effects are proportional to the interceptor length and the land area required for construction of a lagoon treatment system. On-site construction impacts will largely be from fugitive dust as a result of construction equipment operation and construction activities. Maximum particulate concentrations will likely occur during the dry summer months. These concentrations can be minimized but not eliminated by restricting the size of construction easements in critical areas, through dust abatement practices during construction, and by starting restoration as soon as possible following construction.

The overloaded condition of the existing treatment facility and the fact that the plant was not finished as intended, compounded by prevailing wind patterns, has resulted in a significant odor problem for the Town of Jackson. Although extremely difficult to quantify, the direct impacts of the proposed system also included a more pronounced but localized potential for seasonal odor problems due to the operational mode of the lagoon system. Because the proposed treatment system is located in a relatively remote and sparsely populated area, however, major odor problems are not anticipated. Manholes along the proposed interceptor line could also create periodic localized odor problems.

Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

A primary impact of construction of a new mechanical facility at the existing treatment plant site will be increased particulate levels in the immediate construction area resulting from fugitive dust generated during construction of the plant.
Dust problems will be short term, and dependent on dust abatement procedures implemented during the construction phase.

The most significant primary beneficial affect of the alternative will be the long term reduction of odor problems resulting from hydraulic overloading and inadequate sludge handling at the existing treatment plant.

Alternative A-2 (Boyles Hill Mechanical Plant)

During construction phase of the project, the primary adverse short term impacts of the alternative would be similar to those for Alternative A-1. This alternative will involve additional disruption of soils and vegetation for pipeline construction (proportionate to interceptor and outfall pipe length). The project will also create more extensive fugitive dust which would be concentrated in the immediate vicinity of construction at intermittent intervals. Site location and adjacent topography will essentially eliminate odor problems for the Town of Jackson. Suburban residential development in close proximity to the treatment facility (particularly the subdivision to the north Skyline Ranch Development) or along the pipeline alignment will probably be subjected to some increase in odors.

Alternative A-3 (Boyles Hill Stabilization Pond)

The primary impacts for the alternative involving construction of a stabilization pond at the Boyles Hill site would be similar to those summarized for Alternative A-2 except that the primary odor problems from a pond system are more serious than those generated by a mechanical facility. Additional land area requirements and corresponding disruption during construction for the stabilization pond system, however, will result in higher localized particulate concentrations (fugitive dust).

Alternative A-4 (Mid-South Park Stabilization Pond)

Short term primary impacts associated with this alternative are similar to those for the Boyles Hill stabilization pond alternative and include dust emmission created by earth moving equipment and vehicles, and exhaust from construction equipment and motor vehicles. An additional source of particulate concentrations for this alternative will be the clearing and construction of a necessary maintenance road. These pollutants will probably be confined to the immediate vicinity of the construction site, and occur during intermittent intervals of the construction phase. Potential odor emissions will also be similar to the Boyles Hill stabilization pond alternative, although existing residential development in the area is more scattered, and not located in the vicinity of the proposed site.

Prevailing wind patterns could create occasional minor odor problems for the Town of Jackson during spring and fall. These problems, however, should not be of major consequence.

Alternative A-5 (South Park Road Stabilization Pond)

During the construction phase, the primary short term impacts of the project will be attributable to increased particulate concentrations resulting from soils and vegetation disturbance at the site of the stabilization pond and along the interceptor route. These impacts will be very similar to those discussed under Alternative A-4. Immediate odor problems resulting from operating the system are not anticipated to be of major consequence, because of the low density residential development in the area, but could become more significant if residential growth were to occur in close proximity to the plant.

Alternative A-6 (Interim Upgrading of Existing Treatment Plant)

The short term primary impacts associated with interim upgrading of the existing treatment plant include increased localized dust problems related to construction of additional facilities. These impacts also include elimination of current nuisance odor problems currently experienced by local residents. It is probable, however, that in five years the system would be operating at an efficiency similar to the present system, unless growth controls were adopted.

Alternative A-7 (No Action Alternative)

The "no action" alternative impacts on existing air quality in the Jackson study area would depend on the growth policy finally adopted by the Town of Jackson and Teton County. Assuming a policy is adopted similar to the policy being proposed by the draft Comprehensive Plan, it is likely that population growth will continue, but at a somewhat slower rate because of a lack of sewer capacity and the implications of non-compliance with the Town's NPDES permit. No significant short term deterioration of existing air quality is anticipated in the immediate future. Short term increases in particulate concentrations resulting from removal of vegetation and activity would not occur.

Taking no action would result in the primary impact of continuing and increasing the odor problems caused by the present overloading and sludge disposal problems experienced at the Jackson treatment plant. These would be compounded as the population increased.

WILDLIFE HABITAT

Impacts of the Proposed Project (South Park Elk Feedground Stabilization Pond)

The major primary impact that would result from construction of aerated stabilization ponds on the Elk Feedground would be the loss of 20 plus acres of winter wildlife habitat. Of the two Elk Feedground specific sites investigated, Site B, the less expensive of the two, is located in a large open area. The site serves as a hay production area during the summer and a browsing habitat for elk during the late fall and early winter. Elimination of the 20 acres would reduce the carrying capacity of the refuge and possibly force Department of Game and Fish personnel to purchase more supplemental winter feed.

While it is unlikely that the construction operation of facilities themselves (ponds, aerators, fencing, etc.) would adversely affect the condition of the wintering elk herd, the increase in human activity (operation and maintenance personnel) and the high probability that at some time in the future additional land and facilities would be required, may be a significant adverse affect on the elk, and could lead to the eventual abandonment of the area by the herd. A stabilization pond system requires little continuous maintenance, but if chlorination facilities and the flow

recording devices were at the lagoon site, several trips a day through the feedground would be necessary to administer the facility. While the Wyoming Game and Fish personnel feel that the lagoon could "totally eliminate the purpose the land was originally acquired for" to maintain a thousand head of elk, it appears more probable that the long term impacts, barring other secondary effects, would be to reduce the carrying capacity of the area as the elk build up a buffer zone between themselves and the fenced pond area. This reduction in carrying capacity would apply to other species (deer, small mammals, etc.) which inhabit the area during the winter.

If Site B were selected, there would not be a need to remove any significant amount of trees. Interceptor and outfall lines would require only limited soil disturbance, and it would be necessary to restore and revegetate those lands impacted. Construction of the ponds would necessitate the instillation of an improved road.

While the American peregrine falcon which is on the Rare and Endangered Species List, has been reported as occuring in the area, little information is available as to its frequency, use of the area, or number. Without any information it is difficult to make an assumption as to the impact on this species.

Impacts on the local fishery would, in the long term, be positive, regardless of the alternative selected. A facility designed and operated to meet Wyoming Class I Water Quality Standards for the projected 1995 flows would protect the fishery resources of the Snake River.

Alternative A-1 (New Mechanical Plant at Existing Site)

The only significant impact to the natural community resulting from this alternative would be the improvement of water quality in Flat Creek. This would over the year help protect and maintain the fishery values and prevent any barrier to fish movement that may be generated by increasing low quality effluent discharges.

Alternative A-2 (Mechanical Plant Boyles Hill)

Alternative A-2 would eliminate a portion of the local environment surrounding Boyles Hill and displace those species dependent upon this area. Since this is not a particularly critical area in terms of wildlife habitat, and has in the past been subject to severe land alteration, this impact would be minimal given the extensive amounts of available high quality habitat.

If the system were designed and operated to meet Wyoming Class 1 Water Quality Standards as expected, no deterioration in the fishing potential of the Snake River is expected. This alternative would protect Flat Creek from any point source degradation.

Alternative A-3 (Stabilization Pond Boyles Hill)

The expected impact would be similar to those discussed in Alternative A-2.

Alternative A-4 (Mid-South Park Stabilization Pond)

The impacts from Alternative A-4 would be similar to those at the Boyles Hill or existing site in terms of its secondary growth inducing factors. Primary impact on wildlife would be minor. With the application of architectural finishing and landscaping utilizing trees and other small shrubs, the available habitat for a number of smaller species would be enhanced.

Alternative A-5 (South Park Road Stabilization Pond)

The wildlife and habitat impacts of this alternative are basically the same as those in the Proposed Project, with the exception that the Elk Feedgrounds are preserved intact and the elk herd would remain uneffected by the facilities.

Alternative A-6 (Interim Upgrading at the Existing Treatment Plant)

An increase in Flat Creek water quality and protection of the fishery potential of the stream would be realized by the implementation of this alternative. Of course the plant would have to be expanded to take care of additional flows due to growth, or water quality would not be protected in the long term.

Alternative 7 (No Action)

This alternative fails to protect the long term water quality of Flat Creek and could be expected to lead to the eventual deterioration of the fishing resources on Flat Creek, due to the expected increase of the pollutant loading.

NATURAL HAZARDS

Impact of the Proposed Action (South Park Elk Feedground)

The major natural hazards are related to flooding and earthquake hazard. According to information supplies by the Corps of Engineers, both South Park Elk Feedground sites are located in the 100-Year Flood plain of the Snake River. Flooding at these sites probably exceeds the 100-Year Flood in terms of frequency. Flood-related impacts for this alternative are further complicated by the uncertainties regarding the degree of flood protection provided by the levee system and periodic winter flooding of Flat Creek caused by ice blockage. The sites are not located over known fault zones.

The primary short term impacts of construction of a stabilization pond treatment system at either of the South Park Elk Feedground sites include the potential for periodic inundation by floodwaters from the Snake River. During a flood episode, operation of the facility could be impaired if flood waters overtopped a low profile lagoon causing a subsequent backup with potential health hazards and adverse water quality impacts. Access to the plant may also be temporarily interrupted if the flood waters reach sufficient velocities to wash out sections of the service road. Damage to the outfall may also occur during flooding. A "Special Flood Hazard Information Report" has been prepared by the Corps. This report discusses Snake River

flooding problems in Teton County, and provides elevation information for 500, 100, 50 and 10-Year Floods. Flood-proofing the proposed facility to the level of the 100-Year Flood will largely reduce flood damage potential. Participation in the National Flood Insurance Program by Teton County would enable the Town of Jackson to purchase flood insurance covering any structure damage due to flooding.

Secondary long range impacts of flooding related to the proposed project include additional potential for flooding and damage to new residential and other types of development in areas where development did not exist prior to sewer availability. Teton County presently experiences average annual flood damages in the Snake River flood plain exceeding $26,000.

Impacts of Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

No major primary natural hazard impacts are anticipated with construction of a new mechanical plant at the present site. The existing waste treatment plant is located in close proximity to a probable earthquake fault zone which runs east across the valley floor and south along Highway 26, 89, 187. Although information on the exact location of the fault is limited, minimum building materials and design standards should be utilized in planning the facility considering the Jackson area is one of the most seismically active regions in the United States.

Flooding and high water table conditions do not appear to be major problems for construction of a new mechanical plant at the site. However, adequate flood-proofing measures should be included in design of the facility to insure protection from flooding should Flat Creek experience abnormally high flows. These measures should include an auxillary generating system flood-proofed to the level of the 100-Year Flood to reduce shut down time in the event a flood episode did occur. Additional flows from the treatment plant will alter the hydrologic regime of Flat Creek. Winter flooding could be increased as a larger population is served by the facility.

Alternative A-2 (Boyles Hill Mechanical Plant)

The major primary impacts associated with implementation of this alternative are very similar to those discussed for Alternative A-1. The proposed construction site is located adjacent to a probable earth quake fault zone. Groundwater levels are generally three to five feet below the surface in the area, and excavation for pipeline alignment and treatment plant construction may create temporary turbidity problems in local groundwater aquifers (discussed in a previous section). The project site is not subject to the 100-Year Flood according to available information, although it is located in the 500-Year Flood plain of the Snake River. Construction would not require flood-proofing measures. However, placement of the outfall to the Snake River will need to include flood-proofing considerations.

Alternative A-3 (Boyles Hill Stabilization Pond)

The primary and secondary impacts associated with construction and operation of a stabilization pond system at the Boyles Hill site are very similar to those discussed for Alternative A-2. Additional excavation required for construction of a lagoon system will probably have a larger short term effect on groundwater in the area. The mounded, sealed lagoon system should be flood-proofed to maintain operation through the 100-Year Flood.

Alternative A-4 (Mid-South Park Stabilization Pond)

The mid-South Park site is not located over any known earthquake fault zones. Depth to groundwater at the site generally ranges between three and five feet. The site is located in the 100-Year Flood plain of the Snake River according to information supplies by the Corps of Engineers. The primary short term impacts of flooding on this alternative are similar to those discussed for the proposed action, and include the potential for periodic flooding and damage, service disruption and health hazards. Flood insurance is not presently available for the facility structures because Teton County is not participating in the National Flood Insurance Program. Participation would require adoption of standard resolutions which assure the Flood Insurance Administration that applications for all new development or substantial improvements to existing development in the County are reviewed to insure such development is "reasonably safe" from flooding.

Alternative A-5 (South Park Road Stabilization Pond)

The primary and secondary short term/long term impacts associated with implementation of this alternative are similar to those summarized for the South Park Elk Feedground alternative. Earthquake hazard will probably be minimal as the site is not located over a known fault zone. The site also is not located in the 100-Year Flood plains of the Snake River or Flat Creek; and the facility would not require flood-proofing.

Alternative A-6 (Interim Upgrading of Existing Treatment Plant)

No major primary natural hazard impacts are expected with interim upgrading of the existing treatment plant, although the site is located in close proximity to a probable earthquake zone. Additional flow from the upgraded plant may have a minor impact on the flooding potential for Flat Creek.

ECONOMIC IMPACTS

The economic burden or value a particular project either imposes or indirectly bestows upon a community is one of the primary controlling factors that determines what direction that community may take in solving a particular municipal problem. A significant consideration in making a commitment to one alternative over another is the immediate capital that the residents of an area will need to generate in order to finance design and construction. The second major expenditure is the yearly operation and maintenance costs that are

necessary to maintain the facility at its designed level of efficiency. While capital construction costs may represent a large initial investment for a community, and may require either bonded indebtedness or commitment of accumulated municipal funds, the operation and maintenance of a system may, after utilizing the assistance available through the EPA Construction Grant Program, be a longterm and equally significant burden on the residents of the service area.

A third factor that must be considered in evaluating the economic impacts of any proposed project are the indirect or secondary costs that are created or facilitated by that project. This includes the cost of other municipal facilities and services that must be supplied when a wastewater project serves to accelerate growth and development in areas that lack or have inadequate existing services. Such items as schools, transportation, road improvements, police and fire protection, health services, and recreation must be provided to new residents of an area. Since the Comprehensive Plan being developed by the county relies heavily upon natural hazards (i.e., high groundwater requiring widely spaced individual disposal systems) to direct and control the density of development, removing this hazard by providing a centralized wastewater facility may facilitate major changes in the proposed development plan depending upon the site and interceptor alignment selected. The EPA's Construction Grant Program will fund 75% of the eligible costs for the design and construction of a municipal wastewater system. While eligible costs need to be evaluated on a case by case basis, such things as land, demolition of abandoned facilities, and providing excess capacity and a higher degree of treatment than is necessary are generally excluded. The direct costs that the Town of Jackson would have to assume including both capital and operation and maintenance, are reflected on Table 26 for each alternative site.

It is important to note that the EPA portion of any funding is based upon the availability of federal grant funds. While Jackson is presently at the top of the priority funding list, if the Town cannot decide on a system acceptable to the State and Federal Government, then money which was designated for the Jackson project will go to other municipalities. While the "no action" alternative may appear economically attractive, it should be pointed out that the Town will eventually be required to deal with its water quality problems. The inability on the part of EPA and the Town of Jackson to arrive at an equitable and environmentally sound solution at the time the facility plan was prepared has increased the estimated 1978-1979 construction cost a minimum of 25-30%, due to inflation. If after the issuing of the final EIS a recommended project cannot be developed, these inflation factors can be expected to continue to increase the eventual cost of construction. This may impose both severe economic and water quality impacts on the Jackson area, at some future date.

In order to simplify the analysis, only the seven major alternatives were evaluated. It was assumed that the least expensive pipeline alignment and specific site (where there was a choice

TABLE 26

1995 CAPITAL COST *COMPARISON OF ALTERNATIVES

Alternative	Capitol Cost (million$)	EPA Share (Fundable Under 75% PL 92-500) (million$)	Local Share (Non-grant Fundable) (million$)	Present Worth O & M (million$)	Total Present Worth Town (million$)	Peak Design P.E. **	Life of Project Cost Per Design P.E. (dollars)	Ranking (Present Worth to the Town of Jackson)
South Park Elk Feedground (Proposed Project)	4.724	3.386	1.339	3.487	4.826	18700	258	3
Expansion at Existing Site Alt. A-1	2.973	2.230	0.743	7.093	7.836	18700	419	4
Boyles Hill Activated Sludge Alt. A-2	4.896	3.620	1.276	8.223	9.498	18700	508	5
Boyles Hill Stabilization Pond Alt. A-3	3.278	2.304	0.974	3.190	4.168	18700	223	2
Mid South Park Stabilization Pond Alt. A-4	3.496	2.465	1.032	3.126	4.158	18700	222	1
South Park Road Site Stabilization Pond Alt. A-5	4.487	3.208	1.280	3.542	4.822	18700	258	3
Interim Improvements (5 years) Alt. A-6	0.373	0.280	0.093	0.091	0.184	10100***	18	

*Outright cost no debt service or later connection fee assumptions possible at this level of study

**The lower the cost per design population equivalent (P.E.), the lower the monthly cost to the taxpayer. A revenue plan is currently being generated which will translate these costs into average residential costs.

***Assume no growth restrictions.

between alternatives) would be recommended on the basis of cost effectiveness, and these would be utilized in the evaluation of economic impacts.

Impacts of the Proposed Project (South Park Elk Feedground)

Table 26 presents the cost information for the Proposed Project and the alternatives for a 1995 design flow. In terms of actual cost per Population Equivalent (P.E.)(not differentiated between residential, commercial or tourist) in the Town of Jackson, the least expensive of the two proposed South Park Elk Feedground sites ranks tied for third, as the third least costly of the six alternatives providing complete treatment. This includes $1.339 million in non-grant fundable capital costs and $3.487 million in operation and maintenance charges over the 20 year life of the project. These figures do not include such items as debt service on the locally funded capital, salvage values on the existing plant and land, and other variable costs and credits that would need to be identified through a local revenue plan once a project was approved for construction. Based upon the 1995 design P.E. (over the 20 year life of the facility), $258 per P.E. would need to be generated locally to fund and maintain the facility. It should be re-emphasized that the $1.339 million would need to be made available prior to or during construction, but the remaining $3.487 million would be prorated over the design life of the facility.

The costs associated with the tourist or seasonal portion of the facility could be generated through the use of a local hotel/ motel or restaurant tax or the current sales tax designated for sewage facility capital expansion, but the resident share would still require an eventual increase in the residential service charge.

The operation of an aerated stabilization pond is, when compared to a mechanical plant, less expensive due to lower energy requirements. There is also generally less repair and preventive maintenance associated with a pond system. The proposed gravity interceptor line would require a certain amount of additional maintenance until the flow to the plant was large enough to sustain a self flushing action. In the years following any construction, and during the off tourist season it may be necessary to occasionally flush the line to resuspend settled material. Interceptor O & M costs are normally considered to be one-half to one percent of the capital cost annually depending upon the design and construction.

Under proper operation sludge disposal is not a problem in a facultative (aerobic/anaerobic) stabilization pond. Sludge (primarily inorganic solids, and cellular material) settles to the anaerobic layer of the pond and the organic portion is decomposed and stabilized. A certain amount of stabilized solids and algae material wash through the system and may in some cases require the addition of advanced treatment (coagulation and settling or filters) if it must be removed.

Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

The immediate capital that would need to be generated locally if this alternative were implemented is approximately $750,000 (Table 26) making it the least expensive alternative in terms of construction and design. However, the O & M costs for the life of the project are the second highest of the six complete alternatives (approximately 7 million dollars over the next 20 years) and give a combined ranking as the fourth least expensive in terms of locally generated funds.

Alternative A-2 (Mechanical Plant at Boyles Hill)

This alternative is the most expensive of those considered, both in terms of capital and O & M costs. The Boyles Hill site, while in some ways ideal for a WWTP, would require the installation of additional sewer lines (or force mains) and an outfall to the Snake River. The Boyles Hill State School section of land has sufficient room for any future expansion and provides a site isolated from the Town but capable of servicing the presently anticipated growth area by gravity sewers and a low volume pump station and force main.

Alternative A-3 (Boyles Hill Stabilization Pond)

In terms of necessary local capital and O & M costs this alternative or alternative A-5 would be the least expensive option the Town could adopt (Table 26). The capital cost of constructing deep ponds at the Boyles Hill location could increase if severe ground water problems were encountered, but it is not to be anticipated that they would pose the same degree of difficulty as expected at the South Park Elk Feedground site. Detailed on-site soils and ground water analysis would be necessary to establish the severity of any construction problems at Boyles Hill.

Alternative A-4 (Mid-South Park Stabilization Pond)

An aerated stabilization pond at a Mid-South Park location would be one of the two least costly in terms of local capital and operating and maintenance expenses (Table 26). The site would be located at the southwest peripherial edge of the anticipated higher density area being proposed by the Comprehensive Plan, and would service this area through a gravity collection and interceptor system.

Alternative A-5 (South Park Road Stabilization Pond)

The South Park Road site and the Elk Feedground site have essentially the same local capital and O & M cost (Table 26). While A-5 requires a significantly shorter interceptor line, its outfall to the Snake is longer, providing a combined pipeline cost which is approximately the same for both sites.

Alternative A-6 (Interim Upgrading of the Existing Treatment Plant)

Alternative A-6 provides only a temporary or stop gap solution to Jackson's wastewater problems. When the excess infiltration is corrected in Summer of 1977, the plant will still exceed its original 0.80 mgd design capacity during the peak summer tourist season. As explained earlier, original design notes have indicated that a

hydraulic loading of 1.6 mgd could be accommodated if an adequate sludge handling system were installed. While this may be somewhat optimistic, the system if improved as indicated should be able to treat an expected peak summer P.E. up to approximately 10,000. Once the hydraulic capacity of the system is reached and treatment effectiveness declines a new facility will be required. While the initial cost of this alternative is low (less than $18 per design P.E.), when the ultimate capacity is reached the Town will have to make a financial commitment to construct a new plant. A new plant constructed 5 to 8 years from now would be significantly more expensive because of expected inflationary trends.

When the infiltration is corrected and the plant is improved with an efficient sludge handling system, the facility should be capable of treating the maximum amount of waste generated by an additional P.E. of approximately 1500. This is not enough to handle the expected growth from the proposed expansion area, or provide for any significant increase in tourist activity. If the Town were to impose a policy of growth control in order to maintain the capacity of the system, and prolong its usefulness, this may create a number of economic problems and hardships in the local business community.

The interim improvements suggested could, if properly planned, be incorporated into a complete expansion of the Jackson treatment plant. This would require that the Town make a commitment to remain at the present location. By doing this the salvage value of the proposed treatment units are greater and the financial impacts of having to abandon them some time in the future is reduced. Mechanical equipment of the type anticipated, if properly maintained, has a functional life of at least 20 years.

SOCIO-CULTURAL IMPACTS

Socio-Cultural impacts are much more difficult to identify and quantify than those in any other area. The impacts a particular project has on the life style, aesthetic values, and the intrinsic historic and cultural sites of a particular area will differ between individuals or groups within the community. While any ranking or weighing factor used to differentiate between the potential positive or negative socio-cultural impacts will be open to controversy, it is important to attach some relative level of significance in developing a comprehensive issue-oriented evaluation of the various options. Three general areas were considered under this section: social (i.e., psychological, legal and regulatory) impacts, aesthetic impacts, and the historic-cultural impacts.

Based upon the information supplied by the State Archeologist and Recreation Commission there appears to be little difference in the historic-cultural impacts between any of the alternatives requiring pipeline work. The present indication is that a field archeologic

survey will be required once a site and pipeline alignment is selected and that the construction specification must require that the contractor notify the State Archeologist if any artifacts or items of cultural significance are unearthed during construction. Obviously, anytime a project entails extensive earthwork or digging there is a potential for disturbing a cultural site. The extent of this potential, in the absence of other information, roughly is related to the amount of necessary earthwork. In the absence of any definitive information, it was impossible to consider historic-cultural impact in further detail. They are not expected to be a significant deciding factor in the final development of this project.

Impacts of the Proposed Project (South Park Elk Feedground Stabilization Pond)

The primary Socio-Cultural impacts associated with the proposed project would involve the aesthetic losses associated with construction. While no major disruption in or widespread hardships or inconvenience is anticipated as a result of pipeline construction, the loss of approximately 20 acres of Elk Feedground would have an impact on the scenic and recreational values of the State lands. People that have come to regard this area as a natural or reacreational area would probably find the presence of a 20 acre fenced treatment facility incompatible with their needs.

The position taken by the Wyoming Game and Fish Commission and indirectly the regualtions of the U.S. Department of the Interior (Fish and Wildlife Service) in opposing the construction of a treatment plant on the Elk Feedground location, puts the practical availability of these lands in question. Even if the Department of Game and Fish (WDG&F) were to decide to relinquish control of all or part of the Feedground it may constitute a "diversion of funds" and hence an infraction of Federal Aid Regulations. Because there are no adjacent exchange lands with (in the opinion of the WDG&F) the same wildlife values, it is unlikely that the land exchange proposed by the Town would be approved by the Fish and Wildlife Service. It is quite probable that any attempt by the Town to secure these lands over the objections of the WDG&F would have to be resolved by the Courts. This would further delay the project and possibly jeopardize Jackson's opportunity to receive Federal Grant assistance.

The scenic impacts a treatment plant at either of the proposed Elk Feedground sites would have on the Wild and Scenic River Study would be dependent upon the final design and placement of the system. The outfall to the Snake is the only structure that would enter the river corridor. While the River's final classification is dependent upon the outcome of the Forest Service Study, the outfall structure would require extension to the main channel and an architectural treatment to reduce its visibility and intrusiveness.

Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

Alternative A-1 would eliminate the majority of the noxious odor

problems that have plagued plant operation in the past, but the plant would remain in its present location adjacent to the proposed light industrial and commercial development area. While the improvement in the odor problem would have a positive social impact, the presence of the treatment plant and the attached psychological stigma may effect the communities interest in developing lands in proximity to the facility. The present facility is unsightly, but with the proper landscaping and architectural mitigation these impacts could be relieved.

Construction activities would be expected to have only a minor impact since residential and commercial activity in the area is limited.

Alternative A-2 (Mechanical Plant at Boyles Hill)

This alternative has impacts similar to these associated with the expansion of the existing facility. The Boyles Hill site is more isolated from the expected residential growth areas, but an existing developed area on the north side of Boyles Hill would be exposed to any odors, noise, dust generated during construction and long-term operation. While a properly designed and operated activated sludge plant would create only very localized impacts of this nature, the presence of a facility at this location would be expected to generate a certain amount of apprehension and anxiety making the local residents more aware of any change in their environment which could be associated with the plant.

Alternative A-3 (Stabilization Pond Boyles Hill)

The social impacts of Alternative A-3 are essentially the same as A-2 with the exception that the potential for odors from ponds are much greater than from an efficient mechanical system. Psychological stress and even physical discomfort could result in those areas subject to constant exposure to the prevailing winds. This may be a particular problem when treatment effectiveness is lowest and anaerobic activity may occur during the early fall and spring.

Alternative A-4 (Mid-South Park Stabilization Pond)

The only significant difference in social impacts between this alternative and A-1 through A-3 is that the location is farther removed and not centered in the projected high density development area. While there is almost no existing residents in this area of South Park that could be effected by construction activity, the operation of the pond could create problems similar to those identified for Alternative A-3 as the area developed. The area that could theoretically be serviced by gravity sewers generally conforms to the high density growth areas identified in the proposed comprehensive plan.

Alternative A-5 (South Park Road Stabilization Pond)

Alternative A-5 has almost the same social cultural impacts as the Proposed Project. A slightly smaller (10%) area is provided potential service, but the overall growth pattern would be practically identical. This alternative does however preserve the South Park Elk Feedground in its entirety. The regulatory opposition, presented by those agencies with an interest in the feedground, should be eliminated by this alternative.

Alternative A-6 (Interim Upgrading of the Existing TREATMENT PLANT

This alternative has the same general impacts as Alternative A-1 except that unless the Town takes an aggressive approach to solving its wastewater problems, Jackson will find itself in the same situation it is in now within the next five years. The alternative to providing improved facilities would be to make the necessary interim improvement and disallow any additional hookups, in essence, adopt a no growth policy.

Alternative A-7 (No Action)

The "no action" alternative has really only two significant socio-cultural impacts. The first is that without a new facility the Town will remain in violation of its water quality discharge permit. This could put the Town in jeopardy of being assessed a fine up to $25,000 a day under State and Federal Law.

The second impact includes a variety of generally unaesthic characteristics that would be allowed to continue and get worse if nothing is done. These include such things as the odors emitting from the sludge beds, and polishing ponds during the warmer months, the insect and health problems from the accumulating mound of dried but undigested sludge which cannot be disposed of, and the general unsightliness of the present plant owning to the land area occupied, and lack of landscaping and community interest in improving the visual appearance.

LAND USE IMPACTS

Numerous studies have demonstrated that changes in land use do occur as extensive and advanced sewerage systems replace septic tanks or inadequate existing systems. New development may be attracted to areas served by sewers for a number of reasons. In the Jackson area, the primary reason is probably the increasing environmental concern for groundwater contamination which has focused with recent findings of possible coliform-contaminated wells. Second, residents generally prefer houses with sewer in terms of maintenance responsibilities. Third, communities often find themselves in a position where they must deliberately attract new development to new sewer service areas in order to pay construction expenses through user charges and connection fees.

Interceptors also influence and even direct land use changes. The amount of vacant land served by an interceptor, and the excess capacity of the trunk sewer and treatment plant are important determinants of the amount and pattern of development occurring in an area.

In this respect, the Town of Jackson's decision to implement and EPA's decision not to fund the proposed action may be viewed a significant "land use" decision. The provision of sewers, coupled with the lack of a well-defined growth policy can lead to land development patterns which may, in the long term, adversely affect environmental quality.

Impacts of the Proposed Project (South Park Elk Feedground Stabilization Pond)

In general, the most extensive impact of sewers on development patterns throughout the country has been the trend to develop larger areas of vacant land into single family residential housing. The "Town of Jackson and Vicinity Land Use Element" identifies 670 acres of developable land east of Boyles Hill. This area, combined with the presently undeveloped available land in Jackson, constitutes a continuous urban growth area capable of accommodating up to 3,300 residential units (Livingston and Associates, 1976).

The primary short term/long term land use impact of locating the proposed treatment facility at the South Park Elk Feedground would be the removal of approximately 20 acres of land as a wildlife refuge. As previously discussed in this report, the action has drawn significant criticism from the Wyoming Game and Fish Department, the U.S. Fish and Wildlife Service and a number of interested citizens. Concensus from a majority of citizens at the second public workshop on the Jackson treatment facility reaffirmed this criticism (Appendix 3). The legality of locating the stabilization pond system on Elk Feedground property has not been determined. In addition, the Game and Fish Depratment is not aware of any local property available in the South Park area which could replace the land lost to the treatment facility.

The proposed interceptor corridor would avoid highly developed areas. No residential relocation is anticipated as a result of pipeline alignment. A minimal amount of transportation disruption and rerouting is anticipated during the construction phase of the project. Construction impacts of the interceptor should not exceed a four-month period.

Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

The primary impacts of construction of a new mechanical plant at the existing treatment plant site probably include a continuation of the existing land use development pattern in the study area, with additional emphasis for infilling within the Town of Jackson sewer service area. Construction related impacts on local land use will be reduced by utilizing the existing interceptor right-of-way and treatment plant location. No relocation of existing residential development would be required. Temporary transportation disruption or rerouting would be minimal.

No special land uses (i.e. South Park Elk Feedground) would be affected by construction of the project. Operation and maintenance of the facility would not significantly affect wildlife habitat.

Alternative A-2 (Boyles Hill Mechanical Plant)

This alternative would not have any significant primary effects on land use. The primary short term impact of locating a new

mechanical treatment plant at the Boyles Hill site would be restricted to temporary disruption of traffic during the construction phase of the project. The interceptor route generally avoids highly developed areas, minimizing the impact on residential development. The project would not immediately affect existing agriculture or special land uses (i.e., wildlife habitat).

Alternative A-3 (Boyles Hill Stabilization Pond)

The primary short term land use impacts involving construction of a lagoon system at the Boyles Hill site are similar to those discussed for Alternative A-2. The immediate impacts of construction, however, may be increased because the total land area which will be disturbed for the lagoon treatment system is somewhat larger (20 plus acres). Construction activities may also result in temporary disruption of grazing patterns in the immediate locality of the project. The site will avoid the conflict which would result from selection of Wyoming Game and Fish Department property at the South Park Elk Feedground. The alternative will not result in significant damage or conflict with other native biotic communities. Adverse visual impacts would be increased, somewhat, by the appearance of a lagoon system. Proper grading and landscaping procedures would mitigate these impacts.

Alternative A-4 (Mid-South Park Stabilization Pond)

The primary impacts on Jackson area land use associated with construction of a stabilization pond system at the Mid-South Park site are similar to those for Alternative A-3. The construction phase would probably result in some disruption of grazing activity and patterns, although these impacts should be insignificant. Housing relocation is not anticipated. Some temporary traffic rerouting may be required along South Park Road during interceptor alignment. This disruption will also be minor.

Alternative A-5 (South Park ROAD STABILIZATION POND)

The primary impacts of this alternative on existing land use are very similar to the proposed action alternative. The proposed location and interceptor alignment for this alternative, although not in conflict with the position of the Wyoming Game and Fish Department discussed earlier in the report, would probably involve other similar immediate construction-related impacts. The interceptor corridor would avoid highly developed areas, and no residential relocation is anticipated as a result of the project. Temporary transportation disruption is anticipated during interceptor alignment along portions of the South Park Road.

Alternative A-6 (Interim Upgrading of Existing Treatment Plant)

The primary land use impacts of this alternative will be short term, and are very similar to those for Alternative A-1. The action would not require any major disruption of the existing or special land uses (wildlife habitats) during upgrading or operation of the facility.

Alternative A-7 (No Action Alternative)

The "No Action" alternative will have no significant primary impacts on land use in the Jackson area. No significant short term changes in existing land use are anticipated with implementation of this alternative. The primary impacts associated with pipeline alignment and treatment plant construction or upgrading including the potential for residential relocation, transportation disruption and rerouting, and other construction-related impacts will not occur.

SECONDARY IMPACT ANALYSIS

Secondary or indirect impacts are those impacts resulting from or induced by a particular action independent of its construction or capital expenditure impacts. Such items as accelerated land use commitments, the cost of providing community services necessitated by the growth inducement of a project, and increased runoff or drainage into a surface water way following intensified subdivision activity are all examples of secondary impacts that may be associated with a municipal wastewater project.

The most significant secondary impacts associated with any of the proposed alternative actions result from their influence on land utilization and development. In this analysis only the major secondary impacts of each alternative were considered. While secondary impacts can effect all facets of the environment, some are of such minor or ephemeral nature as not to play a significant role in the decision making process to which the EPA Construction Grants Program must adhere. This section discusses the pertinent secondary impacts and effects of the Proposed Project and alternatives in terms of their general overall impacts and specific differences.

The Secondary Impacts of the Proposed Project (South Park Elk Feedground Stabilization Pond)

The secondary impacts of the Proposed Project are of a greater potential consequence than those imposed by construction of the facility. The secondary impacts on Jackson area water quality are mainly dependent upon the potential population increase which in turn is related to the amount of land area made developable by the availability of central sewer facilities. By removing the primary growth constraint (wastewater disposal), the entire South Park area would be "opened up" and a less intensive scattered growth pattern is likely to occur. Lower land costs and sewer capacity in the outlying areas of Teton County are also likely to make sites originally unsuitable for construction much more attractive. The existing agricultural land uses would largely be replaced by rural residential development.

If inadequate septic systems were allowed to be installed in anticipation of connecting to the central sewer at a later date, then groundwater quality in South Park may be adversely affected during this interim period.

Increased densities potentially served by the extended interceptor and central treatment plant and the associated construction and paving activity, will facilitate increased impervious surface and storm water flows. This alteration in the natural topography and drainage patterns can also effect the hydrologic regime and flooding problems along the Snake River throughout the study area.

Secondary impacts of the proposed action on the air and acoustic quality in the Jackson area result from the long-range effects of increased population and resultant development patterns on ambient environmental quality. Since sewers, like highways, can lead to the conversion of large areas of land to residential development, air and noise pollution will likely be aggravated by the additional trips generated and miles traveled to the Town of Jackson employment and commercial center as a result of widespread development acitivity.... The overall increase would be minor in terms of the general background levels in the summers, but they will be a substantial increase over the localized levels in South Park.

The most significant secondary impacts on wildlife would involve the gradual encroachment of residential development throughout South Park, and it's effect on the existing habitat. While it may take a number of years before any effects are noticed, the growth promoted by the plant and interceptor would cause an increase in development activity in the area, which tends to displace wildlife and alter migration and behavior patterns and critical habitats. It is also possible that the additional removal of Elk Feedground land for future expansion could, during a severe winter, force animals off the refuge and onto private lands in search of forage.

The major secondary social-cultural impacts would be those associated with the change in life styles and scenic values that would be forced upon the existing South Park residents and the area in general if the proposed interceptor line facilitated high density development throughout the area. Extension of the interceptor could in essence change the remaining agricultural land of the area into a sprawling residential subdivision if economic and development pressures were favorable.

In the absence of a detailed local economic study, a transportation plan, and other issue oriented studies, it is impossible to attach an absolute value to the major land use related secondary cost impacts associated with the Proposed Project. In estimating any secondary costs it is necessary to make a number of assumptions. In regard to the Proposed Project (and other alternatives) these would include:

1. The removal of South Park development constraints by constructing the interceptor line to the Elk Feedground. This would open up essentially the entire area for development.

2. Development in South Park would occur primarily as single family units at medium densities (1 unit per acre).

3. Cost of developing municipal services would be borne by the South Park residents through a local agency (Town or County).

In the publication "The Cost of Sprawl" (prepared for the Council on Environmental Quality and the Department of Housing and Urban Development, 1974) a detailed cost analysis was prepared for various development patterns. It was concluded that low to medium density sprawl type development, which has characterized the existing development in the South Park area, and which would be expected to continue if the interceptor line were available to remove wastewater restraints, is one of the most expensive forms of residential growth. Services are difficult and expensive to supply and total consumption of resources is highest when piece meal growth occurs. "Leap frog" development which tends to move residents farther and farther away from necessary central facilities is extremely costly for both the individual residents and the community as a municipal unit.

Of the various optional sites considered, the Elk Feedground opens up the most available land for development by providing gravity wastewater collection and treatment facilities and therefore would be expected to have the greatest associated secondary costs. The actual cost per acre or per development unit would be related to the amount, location and density to which the land was developed. Municipal capital development cost figures for the type of low density mixed sprawl development, which would be expected in the South Park area if wastewater facilities were available to allow unlimited growth, run as high as $165 million (The Cost of Sprawl, 1974) for a 10,000 unit residential development. Annual operating expenses for such facilities and services would require from $100,000 to $200,000 for the first 10 years. While one would not anticipate 10,000 units developing in South Park in the foreseeable future, sufficient land could be made available by providing access to a centralized treatment system, which the proposed plan would provide. If additional land is available for development outside the areas contemplated in the Comprehensive Plan, then the capacity of the system could be exhausted well before the design period (similar to what occured with the existing system) and the community would be forced into a premature expansion. Such an expansion would be at the Town's expense and could have considerable economic implications.

In addition to the obvious secondary economic impacts, the utilization of 20 plus acres of Elk Feedground land would remove it from forage and hay production, forcing the Department of Game and Fish to either purchase more winter hay or reduce the size of the wintering elk herd. It would also have a minor impact on the summer recreational value of the land and may reduce, to a small extent, the revenues brought into the community from hunting and fishing.

Secondary Impacts of the Alternatives

Alternative A-1 (New Mechanical Plant at Existing Site)

Maintaining Jackson's wastewater facility at the existing site will probably reduce the overall magnitude of its secondary impacts, as compared to the Proposed Project, by limiting the amount of land serviced by the new facility. The proposed land use element for the "Jackson and Vicinity Comprehensive Plan" has identified projected population growth, and developable land within the central sewer service area necessary to accommodate the growth. The proposed "Teton County Comprehensive Plan" has also identified the growth potential and environmental constraints for the county. Long term secondary land use impacts of construction of a new mechanical plant at the existing site will probably include more compact growth patterns. The extent of rural residential development will be reduced by existing environmental considerations including steep slopes, flood plains, and high groundwater tables. By discouraging development in these areas, additional public costs for flood protection and other public services will also be reduced. Other land uses including commercial and industrial will probably be encouraged to develop within or adjacent to the Town of Jackson due to sewer availability and customer proximity.

Existing farming and livestock operations would not be subjected to major long term impacts. Irrigated land area and grazing patterns probably will not be effected. Secondary impacts on elk migration routes and existing wildlife habitats will also be minimized.

Although precise impacts on land use and ownerhsip cannot be determined from existing information, land values within the sewer service area are likely to increase due to the reduced amount of land available for urban development. Values in the outlying non-contiguous areas will probably remain essentially unchanged, but increase as the population within the sewer service area increases and the service area expands.

The secondary long term water quality impacts on Flat Creek water quality are very difficult to identify because the impact of numerous diverse nonpoint sources in the study area have not been determined, and the Town of Jackson and Teton County have not adopted a well defined growth policy. Higher density growth will probably occur in and immediately contiguous to the sewer service area through implementation of this alternative. This type of growth pattern, if properly phased, is likely to improve area wide surface water quality over the long term by providing phased and cost effective wastewater treatment. The potential for health hazards from septic tanks will reduce as central facilities become available and these systems are phased out. Groundwater quality will probably be improved because of the higher treatment efficiency provided by a central treatment system.

Although it is probable that localized urban runoff will increase to Flat Creek with the additional population serviced by the facility, the alternative encourages development which is more easily adaptable to structural and non-structural storm runoff controls. Land

use measures, storm drains, special detention and treatment basins, proper street cleaning and regulation of construction activities all facilitated by phased growth, will reduce the potentially adverse impacts on water quality.

Long term secondary impacts on air quality, although dependent on the amount of growth realized, will likely create some increase in air polutant levels. Increases in SO_2 concentrations will probably be the most significant as a result of more compact growth patterns and the concurrent increase in stationary fuel combustion sources (i.e. residential heating systems). Particulate concentrations will also increase with projected increases in residential and commercial stationary sources. Increases in CO levels resulting from additional and concentrated automobile use will probably be offset by compact development which requires less vehicle miles traveled and is more easily adopted to urban transit modes.

The only significant impact to the natural community resulting from this alternative would be the improvement of water quality in Flat Creek. Improved Flat Creek water quality would protect and maintain the fishery values and prevent any barrier to fish movement that may be generated by increasing low quality effluent discharges.

The secondary economic impacts of this alternative are again related to the amount of land serviced by the facility. Alternative A-1 could provide gravity sewer service to the high density areas proposed by the draft Comprehensive Plan. Sewer service would not be available to much of the area south of the plant site without the addition of pump stations and force mains. This physical restraint would help to maintain and preserve the capacity of the system for those areas of planned development and restrict any extensive southward expansion. Implementation of this alternative has the practical effect of eliminating the necessity of expanding municipal services to areas outside the immediate vacinity of Jackson, but could create the need for an entirely new facility once the proposed growth area reaches saturation.

Alternative A-2 (Boyles Hill Mechanical Plant)

During the five year period (1970-1975) the Town of Jackson's population increased from 3,196 to 4,150 (Livingston and Associates, 1976). Projections indicate that this rate of growth will likely continue. The major secondary impacts of construction of a mechanical plant at Boyles Hill are similar to Alternative A-1 related to the moderate increase in land area made potentially serviceable by the facility. Land use changes are likely to occur more rapidly in this area with sewer avialability, the population growth potentially occurring at a faster rate. The most obvious long term land use change will probably be the gradual conversion of grazing and irrigated agriculture uses to a somewhat dispersed, rural residential-type development. Public costs associated with providing other urban or semi-urban services will probably increase owing to the moderately increased land area made serviceable by the

interceptor extension. Local residents may also be subjected to some change in life style due to increased urban development and population in the proposed service area.

The long term secondary impacts on water quality of this alternative in the Snake River, Spring Creek and Crane Creek are primarily related to construction activities, and increased storm runoff peak flows associated with additional paved areas, all facilitated by sewer availability. Secondary impacts of this alternative on local groundwater quality are also related to accompanying land use changes. Groundwater recharge in the area may be reduced, if the area is subjected to extensive suburban development and paving without consideration for necessary open space, resulting from sewer availability. The potential for health hazards, however, will be reduced with the replacement of individual waste disposal systems by central sewer facilities as long as no new development is allowed to proceed without being required to connect to a centralized wastewater system (wetline policy).

Long term secondary impacts on air quality and noise levels of this alternative will be similar to Alternative A-1, and include increased concentrations for most air quality parameters, and increases in background noise levels. This alternative will likely promote additional growth in areas not previously serviced by central sewers. The result will be slightly longer travel distances to the employment and trade center.

Alternative A-2 will eliminate a portion of the natural environment surrounding Boyles Hill and displace those species dependent upon this area. Since this is not a particularly ciritcal area in terms of wildlife habitat, and has in the past been subject to severe land alteration, this impact will probably be minimal, given the extensive amounts of available high quality habitat.

If the system is designed and operated to meet Wyoming Class 1 Water Quality Standards as expected, no deterioration in the fishing potential of the Snake River is expected. The alternative would protect Flat Creek from any point source degradation.

Alternative A-3 (Boyles Hill Stabilization Pond)

The secondary long term land use impacts involving construction of a lagoon system at the Boyles Hill site are similar to those discussed for Alternative A-2. Although the overall land requirement of this alternative is somewhat larger than the area needed for construction of a new mechanical plant, the total area is not that significant in terms of long range secondary impacts.

Alternative A-4 (Mid-South Park Stabiiazation Pond)

The secondary long term impacts on Jackson area land use associated with construction of a stabilization pond system at the Mid-South Park site are similar to but not as extensive as those for the Proposed Project. A substantial land area north of the treatment plant location along the Snake River flood plain will

become potentially developable with the extension of a gravity sewer system. A major portion of this area is subject to periodic inundation by flood waters. The proposed "Teton County Comprehensive Plan" does not eliminate low density development in the 25 and 50-Year Flood plains. Sewer extension to these areas could, in effect negate the limited development constraints proposed for the flood plain hazard areas. Flood damages in Teton County presently amount to some $26,000 annually. Losses are likely to increase if additional development is allowed in these areas. Federal funding assistance for levee maintenance may also be jeopardized by allowing development in areas subject to extensive flood damage.

Secondary impacts resulting from implementation of this alternative are also related to the amount of vacant land area made available by providing central sewer service. In the absence of conventional regulatory mechanisms (i.e., zoning), a realtively large area of land will become available for residential development with implementation of this alternative. Land use changes from primarily agriculture-related to low density residential are likely to occur. The demand for additional public services will follow. Over the long term, costs for providing these facilities and services may not be justifiable. In terms of total investment costs, for example, numerous studies have shown that while the amount of land used for schools and other public facilities is essentially the same for all development densities, a higher density more compact growth pattern uses about half as much land for transportation as lower density sprawl-type development. From a sociological standpoint, increased densities also generally reduce the amount of time that family members spend traveling to work, school, etc.

Long term secondary impacts of this alternative on the study area's surface and groundwater quality and hydrology are related to the additional land area made serviceable through implementation of the alternative. Impacts are similar, but of less magnitude than those discussed for the proposed action. Increased flooding may be experienced in the lower South Park area as new developments and additional paved surface area occur. Peak runoffs can be reduced by maintaining planned open space areas and providing adequate drainage facilities for any new development. The impacts on wildlife and habitat for Alternative A-4 are similar to those for the Boyles Hill or existing site in terms of secondary growth inducing factors. With the application of architectural finishing and landscaping utilizing trees and other small shrubs the available habitat for a number of small species could be improved over the limited available grassland habitat which currently characterizes the area.

The major difference in social impacts between this alternative and A-1 through A-3 is that the location is further removed and not centered in the projected high density development area. While there are almost no existing residential developments in this area of South Park which would be effected by construction activity, the

operation of the pond may create minor air and noise problems similar to those identified for Alternative A-3 as the area developed

Alternative A-5 (South Park Road Stabiliaztion Pond)

Long term secondary impacts of Alternative A-5 in the Jackson study area are similar to those for the proposed action, and include increased residential development, a gradual reduction in grazing and irrigated agriculture land, and additional development in the flood plain areas of the Snake River and Flat Creek. This type of development is likely to result in long range environmental problems. The secondary economic impacts of A-5 are almost identical to the Proposed Project. The amount of private land in South Park which is made available for higher density development is approximately 90 percent of that opened up by the Elk Feedground site. That additional 10 percent (roughly 1000 acres) lies at the southern most portion of South Park, boardering the Elk Feedground. Because of its relatively isolated location and general topographic features, this 1000 acres is least likely to be put into residential development. The economic impacts to local agriculture and recreation associated with the loss of Elk Feedground potential would not be a factor if the A-5 site were selected.

The secondary wildlife and habitat impacts of this alternative are basically the same as those for the Proposed Project, with the exception that the Elk Feedgrounds are preserved intact. Effects on elk migration routes and behavior patterns can also probably be measured in terms of new residential development facilitated by the project. Since the private polo-grounds are close to this site, some adverse impact on this recreational activity could also be expected due to odor or aesthetic appearance.

Alternative A-6 (Interim Upgrading of Existing Treatment Plant)

Although interim upgrading of the existing facility would initially provide sufficient capacity to accommodate current development trends, population growth within the Jackson sewer service area will undoubtedly continue until such time as treatment capacities are again exceeded. When this capacity is reached, additional development will probably have to be accommodated outside the service area on individual waste disposal systems. The situation is further complicated by the fact that, once the Town of Jackson has exercised its priority in terms of EPA funding to upgrade the existing plant, it is unlikely that additional federal funding assistance will become immediately available to construct a new facility. Thus, additional pressures for suburban "sprawl type" development are likely to result.

If the projected 1990 high range population of 14,700 for Teton County is realized, the associated long range environmental and economic impacts of accommodating a significant amount of the population on septic tanks and providing the necessary public services and facilities will be far-reaching. There is presently no reason to believe development in the Jackson area will not continue. Additional sewers and services will be necessary to sustain local population, tourist, and commercial growth. The possibility of the

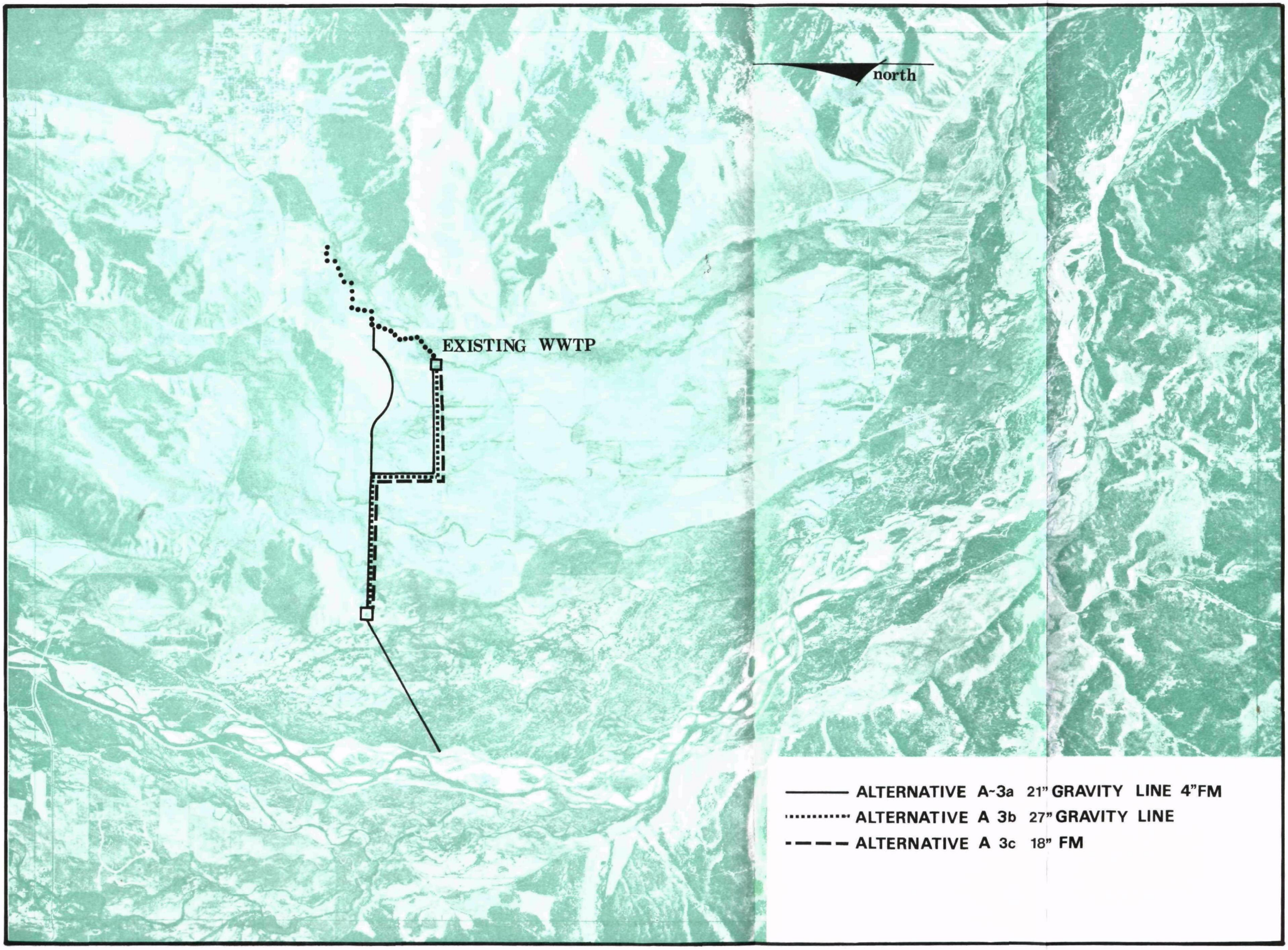
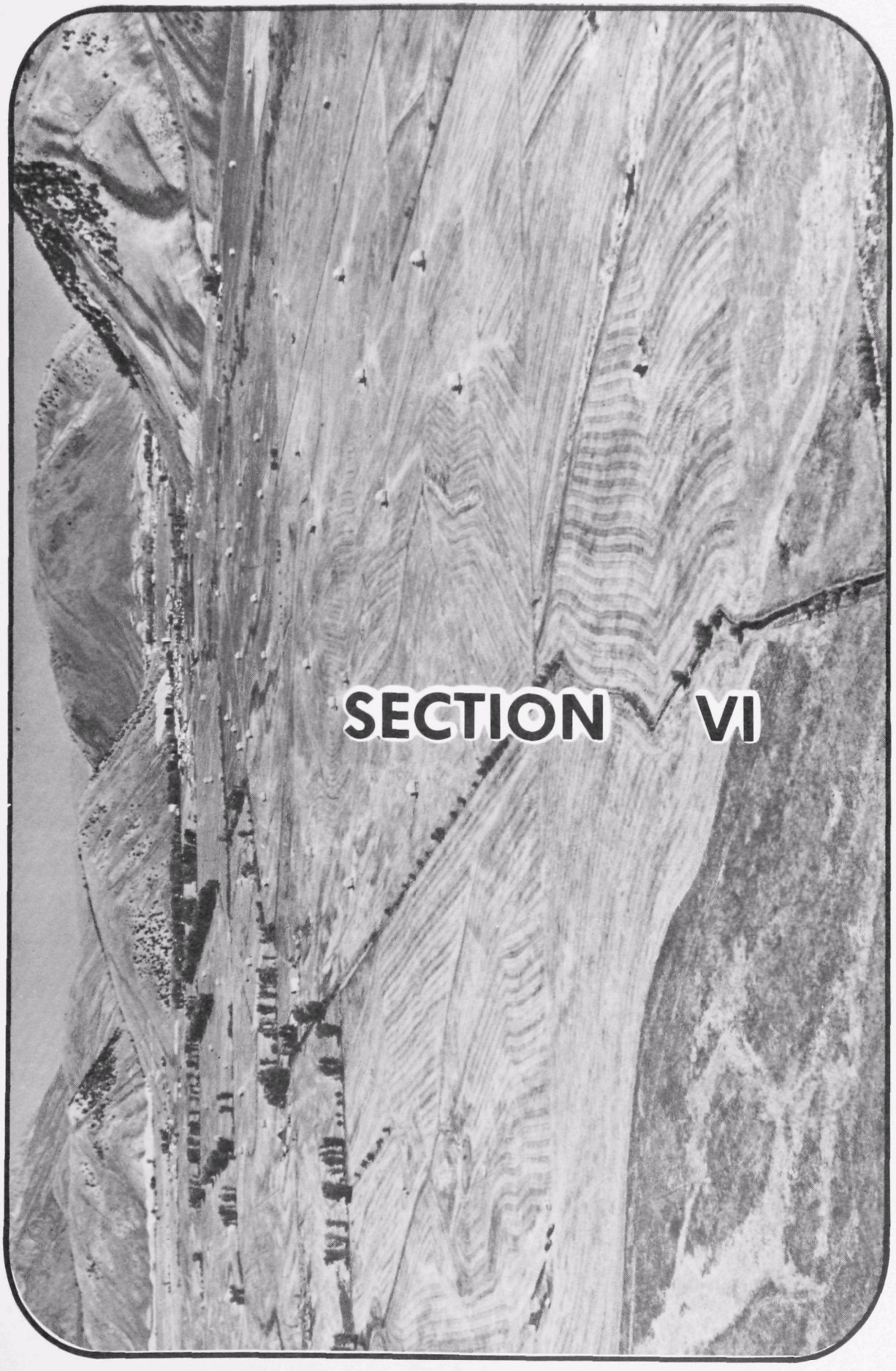

north
EXISTING WWTP
ALTERNATIVE A-3a 21" GRAVITY LINE 4"FM
ALTERNATIVE A 3b 27" GRAVITY LINE
ALTERNATIVE A 3c 18" FM
SCALE 1:24 000
1/2 0 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

Figure 23

State requiring the imposition of growth controls in order to maintain the plant within its capabilities may be another major secondary impact resulting from this alternative. When the plants capacity is again exceeded, the Town will find itself with Flat Creek water quality problems, and will undoubtedly be forced by the State of Wyoming to seek another solution in order to maintain instream water quality.

Alternative A-7 (No Action)

Secondary impacts resulting from the implementation of the "no action" alternative are dependent on the growth policy adopted by the Town of Jackson and Teton County. While growth will undoubtedly continue throughout the study area, inadequate sewer capacity within the Town of Jackson sewer service area and implications of non-compliance with Town's NPDES permit may direct new residential development to outlying areas of the County. It is estimated that between 1,600 and 2,800 new housing units will be needed to meet the projected 1980 Jackson population. This development would occur at lower densities serviced by individual waste disposal systems, as defined in the proposed "Teton County Comprehensive Plan" because of environmental constraints already discussed. This low density sprawl type development, besides increasing the potential for ground and surface water contamination, also promotes higher costs for the eventual servicing with public facilities and utilities including sewer, water, schools, transportation and police and fire protection. Although a moratorium on new construction in the Town of Jackson is unlikely, some communities have been forced into similar moratoria actions until additional sewer capacity is built.


SECTION VI

SOUTH PARK

SECTION VI

UNAVOIDABLE ADVERSE IMPACTS AND POTENTIAL MITIGATION MEASURES

GENERAL

This discussion of Unavoidable Adverse Impacts and Potential Mitigation Measures is divided into three broad categories: Short Term Construction, Long Term Construction and Operational. This will provide an overview of the significant impacts and some possible mitigation measures that could be taken to reduce the impacts of the Proposed Project and its alternatives.

Short Term Construction refers to those impacts involving actual construction of any facilities. Long Term Construction includes those residual or chronic impacts that result from the initial construction but persist after completion of construction. Operational are impacts resulting from the operation and use of the facilities. Since these are essentially the same for most of the alternatives, they will be discussed under the topic categories pointing out impacts and important differences.

SHORT TERM CONSTRUCTION

The Short Term Construction impacts would be generally the same for all of the projects considered. Such things as dust, noise, and increased traffic congestion from pipeline installation and movement of construction materials would be a minor problem connected with any alternative selected. These impacts are normally controlled through provisions in the construction specifications which delineate when and how construction will take place. When specifications are properly written and enforced, these impacts are held to a minimum.

The installation of an outfall line to the Snake River will require careful coordination with both the Wyoming Department of Game and Fish and the U.S. Forest Service. Any vegetation disturbed or removed during the installation of either the interceptor or outfall line will require revegetation with native shrubs and grasses. Construction should take place after the irrigation season when flow in the Snake should be at a minimum. It may be necessary to seek a flow alteration from the Bureau of Reclamation to minimize the water quality impacts and bottom disturbance from the placement and securing of a deep channel outfall. It is inevitable that some silt and detritus will be discharged as a result of this construction, but proper timing and care with instream construction should help reduce its impacts. Any instream dredging or other hydrologic modifications will require a Corps of Engineers 404 permit before work could proceed.

Any expansion of the existing facility could create some short term water quality problems if it were necessary to interrupt service during construction. Bypassing to the polishing pond or directly to Flat Creek would require the prior approval of the Wyoming Department of Environmental Quality and could only be considered on a limited basis during interfacing of the new facilities with the old.

LONG TERM CONSTRUCTION

Long Term Construction impacts differ on a project-by-project basis. While it is difficult to assess the overall impact a wastewater facility has upon a community or groups within the community, the long term visual impacts of the plant and its appurtenances are related to its proximity and landscaping. Generally, one would assume that the more visual a facility is and the closer it is to a residential area, the greater the impact.

A major problem that must be resolved during the design phase of this project will be the proper locating of any Snake River outfall in a reliable channel. Since the river meanders during periods of flow fluctuation, the placing of the outfall line to receive consistently high effluent dilution will assist in maintaining localized water quality.

The most significant specific long term construction impacts involve the loss of land and habitat at the South Park Elk Feedground, the potential impacts an outfall from any of the alternatives may have on the Snake River and its potential classification in the Wild and Scenic River System, and the secondary impacts of facilitated growth that the two most southern South Park sites would entail. The magnitude of any long term impacts the proposed outfalls would have on the Snake River could be mitigated greatly by the implementation of construction methods and material conforming to the local terrain. Unfortunately, any construction on the South Park Elk Feedground represents a loss in habitat which cannot be readily replaced. The development of a treatment facility and interceptor lines at either the South Park Elk Feedground site or the South Park Road site will relieve the physical growth restrictions on large areas of land outside the high density residential areas proposed in the draft Comprehensive Plan. This action represents a very real negative impact on the Town/County planning process and goals developed for comprehensive land use planning.

OPERATIONAL

While both the proposed project and each of the alternatives have their individual operation impacts, these are generally related to the type of treatment process and efficiency of the transmission facilities.

The Proposed Project and the South Park Road alternative both utilize aerated stabilization ponds and require long interceptor lines. An aerated stabilization pond has the general characteristic of requiring little operator attention, lower energy demands than a full mechanical plant, and is much less expensive to operate. These are positive attributes, and where land and sufficient buffer areas are available and climatic factors are right, the selection of this type of system is favored. The operation of a stabilization pond system has the disadvantages of low winter efficiency, freezing problems, possible spring and summer odor problems, and a wide variability in the quality of the effluent produced depending upon loading, design and climatic conditions. Systems that require excessively long pipelines with initial flows much less than the ultimate design flow have a number of operational impacts. These include the potential for odors escaping from manholes as a result of low velocities and corresponding long detention times, the problem of solids settling out in the line, and the eventual need for flushing and cleaning. As a general rule, a shorter interceptor line in an area with Jackson's characteristics has fewer associated operating and maintenance problems.

A complete mechanical plant, as proposed in Alternatives A-1, A-2 and the proposed interim improvement A-6, will normally function on a consistently higher level of efficiency. A mechanical plant, however, has operating expenses approximately 2.5 times that of an aerated stabilization pond. It also has a significantly high energy demand and may generate some localized odors. While much of the energy needed in space heating can be reduced by enclosing and insulating the critical areas, the mechanical process is highly energy dependent.

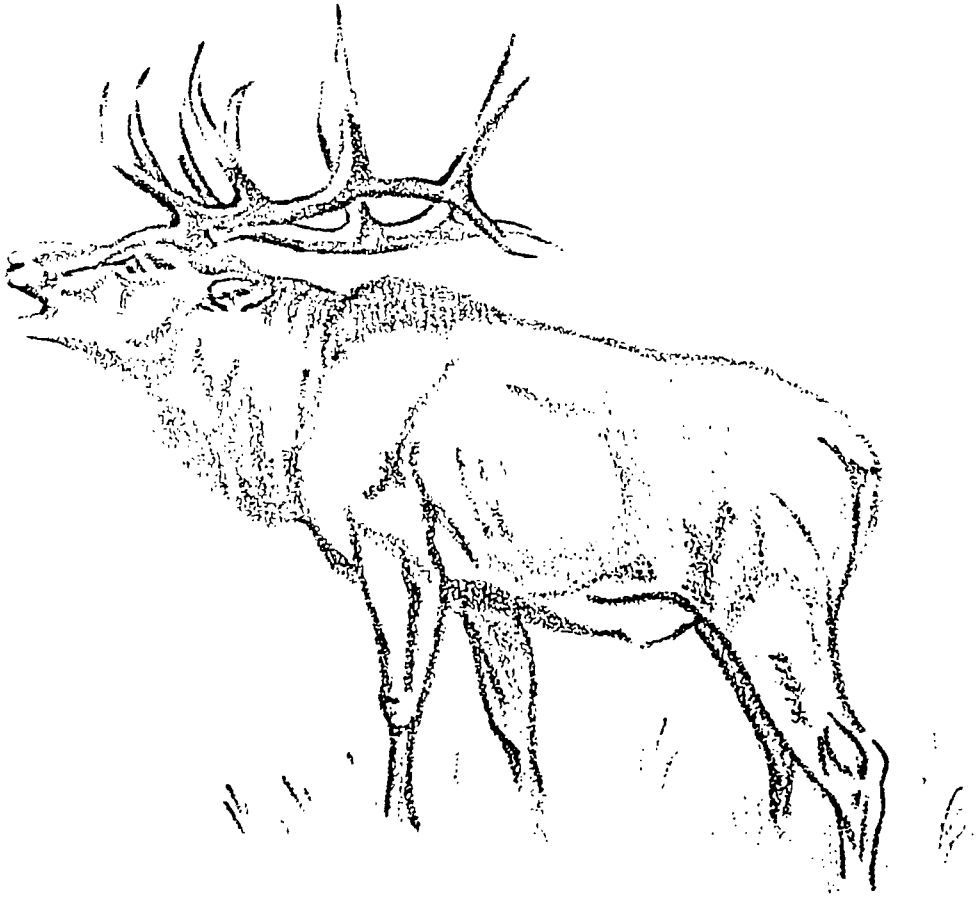
The availability of electrical energy has become a critical issue in Teton County. Lower Valley Power and Light, Inc., has stated that without additional transmission capabilities it can no longer supply the demands of new development. The existing treatment plant has difficulty operating reliably during the cold winter months when residential electrical heating demand is highest. Electrical power is reduced to a level where the mechanical equipment with a high power demand (aerators and pumps) will not operate effectively.

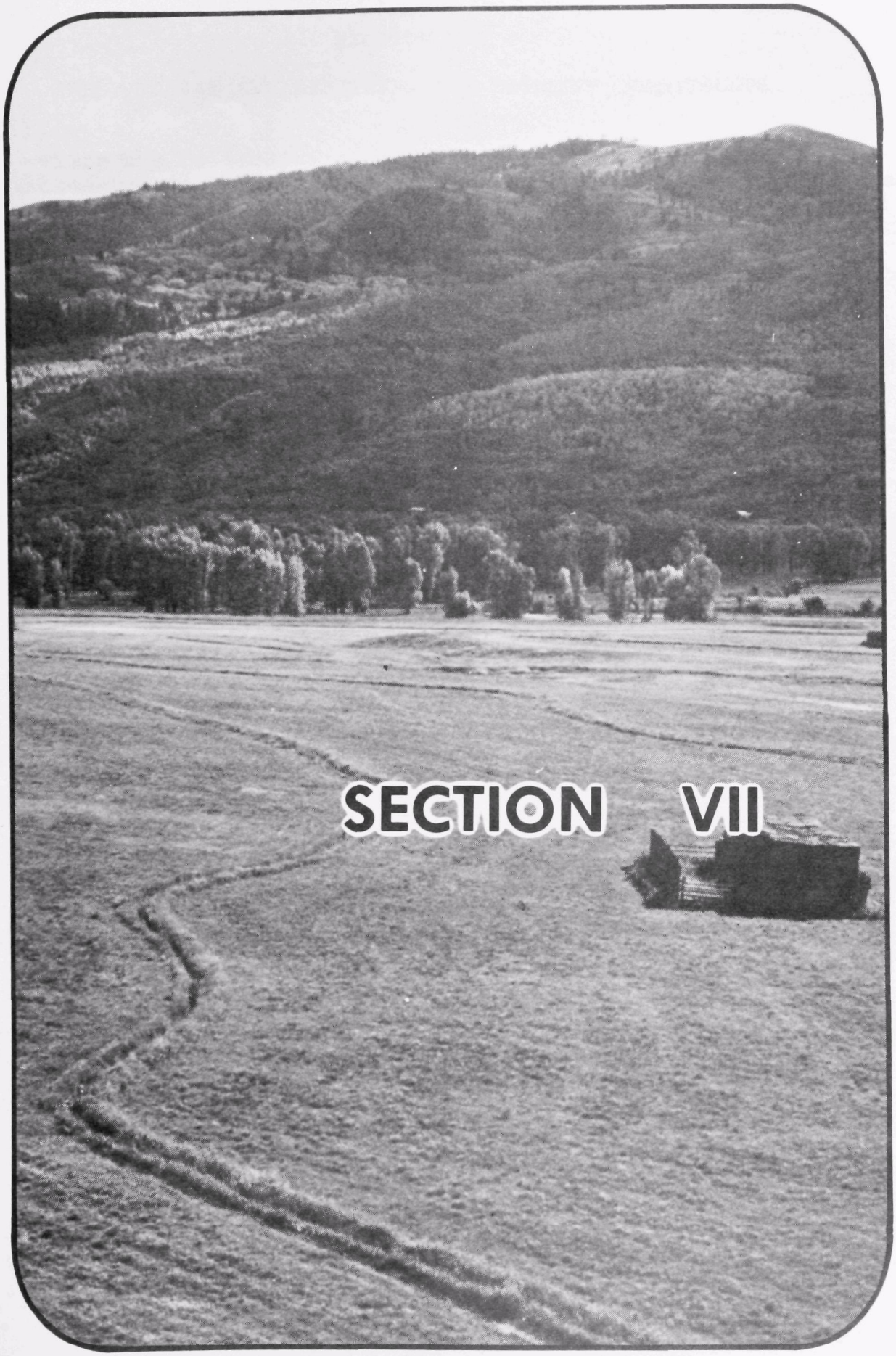
In order to reduce the energy demands and make the system more energy efficient, several options should be investigated during the design phase of the project. Such items as the proper installation of work areas, local temperature control, and site selection and orientation for highest solar efficiency should be incorporated into any design as a standard feature. The EPA will also require that consideration of other more innovative energy solutions be considered. Energy alternatives such as solar power for heating and future energy production may or may not be feasible in the Jackson area at this time. But regardless of the present technology, provision should be included in order that these can be added if perfected at a later date. The energy alternatives

such as methane generation through anaerobic sludge digestion, while technically feasible, cannot be considered a practical solution from an operations and reliability of treatment efficiency standpoint. Anaerobic digesters can be difficult to maintain for a small community and demand precise temperature control, which could require the addition of energy from an outside source.

The County is currently investigating alternative methods of disposing of solid waste. One option which has been suggested by the County's engineers is to incinerate the combustible portion at a site adjacent to the wastewater treatment plant. Heat generated during the process could be recycled for space heating and sludge drying. This implementation of the plan would depend upon a number of regulatory and institution agreements along with the solution to the technical and operations problems.

If the Town of Jackson wished to pursue an aggressive energy conservation program which employed exotic or untested technology, the EPA may not be in a position to fund those portions of the project under the normal P.L. 92-500 funding process. The Town may have to seek research and development funding and present the plant as a demonstration project. A final decision on this would need to be developed by the EPA Regional Administrator.




SECTION VII

SECTION VII

IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

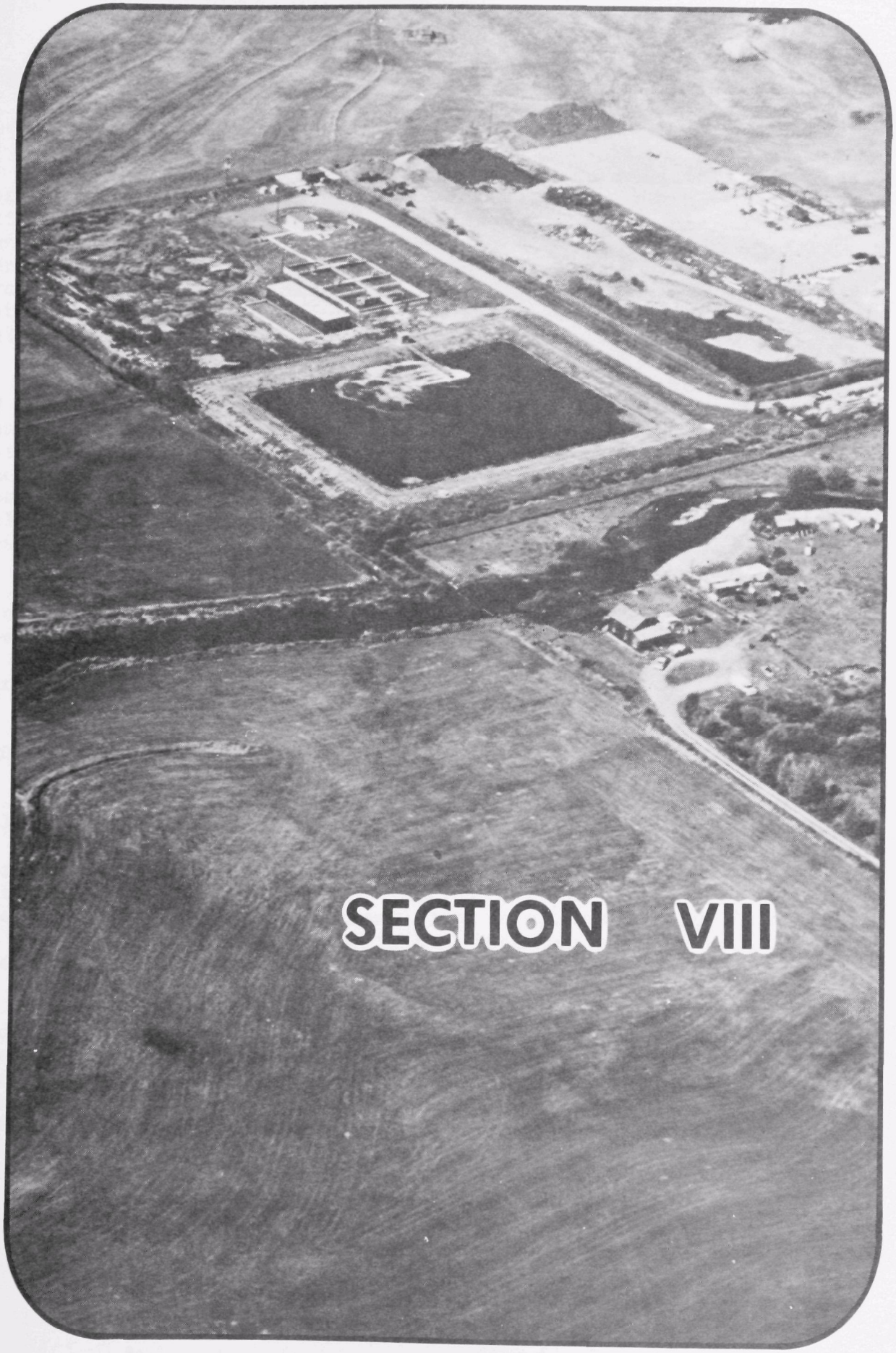
There are no truly irreversible or irretrievable primary environmental impacts or significant resource commitments generated by either the Proposed Project or its alternatives. While the construction of a wastewater treatment facility will utilize and commit a certain amount of land and building material, any of the options considered could be demolished or abandoned and returned to their near original condition at a later date if necessary.

A buried pipeline of the type proposed utilizes negligible land area, exerts little restriction on surface development (located in an existing highway right-of-way), has little, if any, effect on natural habitat, and involves no appurtenant structures that could not be abandoned and removed should the need arise.

The secondary irreversible impacts are of more significance and of a less definitive nature. Commercial and residential development, other changes in existing land use and habitat structure and secondary pollution could all be essentially irreversible and result in long term effects within the region. The pattern and degree of impact exerted within the area would depend upon the impetus for Jackson's expansion. If, after the installation of wastewater facilities, the expected growth did not occur in the area (due to a variety of previously discussed possibilities), then the total impact would be minor. The changes in population density patterns and land use are the major irreversible commitments that could occur as a result of any of the projects discussed.

The Proposed Project or its alternatives are of such small scale that any material resource commitment attributable to it would be slight. The use of steel, concrete and other construction materials may be assumed irreversible given the present state of recycling technology. Energy commitments are significant for the operational needs. The project would also require relatively minor amounts of fuel during the construction period.

The "No Action" alternative could have an impact on the water quality of Flat Creek if the present system were allowed to continue with the expected population growth. The fishery in Flat Creek could be permanently destroyed if the degradation were allowed to continue.


SECTION VIII

JACKSON'S EXISTING WASTEWATER
TREATMENT FACILITY

SECTION VIII

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE OR ENHANCEMENT OF LONG-TERM PRODUCTIVITY OF THE PROPOSED ACTION AND THE ALTERNATIVES

The short term uses of the study area in relation to the long term productivity of the region for the Proposed Project and the alternatives are described in this section. In terms of the general short term uses, both the Proposed Project and its alternative, with the exception of the "no action" option, will provide the necessary degree of protection to the overall future water quality of the region, given the expected growth and development.

The long and short term productivity within the study area is closely related to community and tourist services and residential development. Since other land resource potentials are not of a major importance (agriculture, timber, mining, etc.), the uses which can be applied to the region are limited for the most part to its recreational, agricultural and residential holding capabilities, life styles and aesthetic values and are evaluated under this assumption.

Basically, the availability of wastewater facilities would increase the potential for immediate commitment to additional residential and commercial development, while a lack or delay in acquiring these facilities would maintain the current characteristics of the area.

PROPOSED PROJECT (SOUTH PARK ELK FEEDGROUND STABILIZATION POND)

The Proposed Project will provide the potential for complete collection and interception of wastewater throughout South Park. It will eliminate the continued reliance on individual septic tank systems in the lower South Park area and help protect the ground water quality of the region. The project could (if legal under the present federal regulations) remove approximately 20 acres of elk feedground from its original intended purpose and set a precedent for the appropriation of additional land.

This proposal would also facilitate suburban development and commercial growth and could alter present characteristics of the area and future uses. As a result of this associated growth, wastewater loads would increase, and drainage and storm water runoff could be accelerated due to the removal of existing vegetation. While the project in itself would not significantly limit the existing or potential uses of the area's resources, the secondary consequences will allow for additional unplanned growth within the study area, which could conceivably affect future land resource uses within the region. Some individual hardships would result due to the assessments required to finance the project.

Land owners contemplating development of their property would benefit from the availability of services. Much of this development would not be in accord with the expected local planning goals and objectives and would occur in areas not anticipated or designated for residential/commercial activities.

ALTERNATIVE A-1 (NEW MECHANICAL PLANT AT EXISTING SITE)

The expansion of the existing facility would limit gravity interception of wastewater to approximately those areas proposed for higher density growth in the draft comprehensive plan. Since this area is presently more impacted by residential and commercial development than the rest of South Park, no significant effect on the long term productivity of the study area is anticipated.

ALTERNATIVES A-2, A-3, AND A-4 (BOYLES HILL MECHANICAL PLANT, BOYLES HILL STABILIZATION POND, MID-SOUTH PARK STABILIZATION POND)

These alternatives would result in essentially the same long term productivity impacts as the expansion of the existing system. The same general area can be serviced which corresponds closely to the proposed residential development area. Approximately the same amount of growth can be facilitated. The existing proposed growth pattern would be preserved and no commitment to any additional growth be made.

ALTERNATIVE A-5 (SOUTH PARK ROAD STABILIZATION POND)

Alternative A-5 has the same type and magnitude of impacts on long-term productivity as the Proposed Project. As discussed in a previous section, slightly less land can be serviced by this alternative as opposed to the Proposed Project. However, in general, the same area would be expected to be placed into residential or high density development. This site preserves the long term values of the Elk Feedground and isolates the sewerable areas to a region above the South Park Road. This alternative could remove the development constraint imposed by individual waste disposal systems throughout most of South Park.

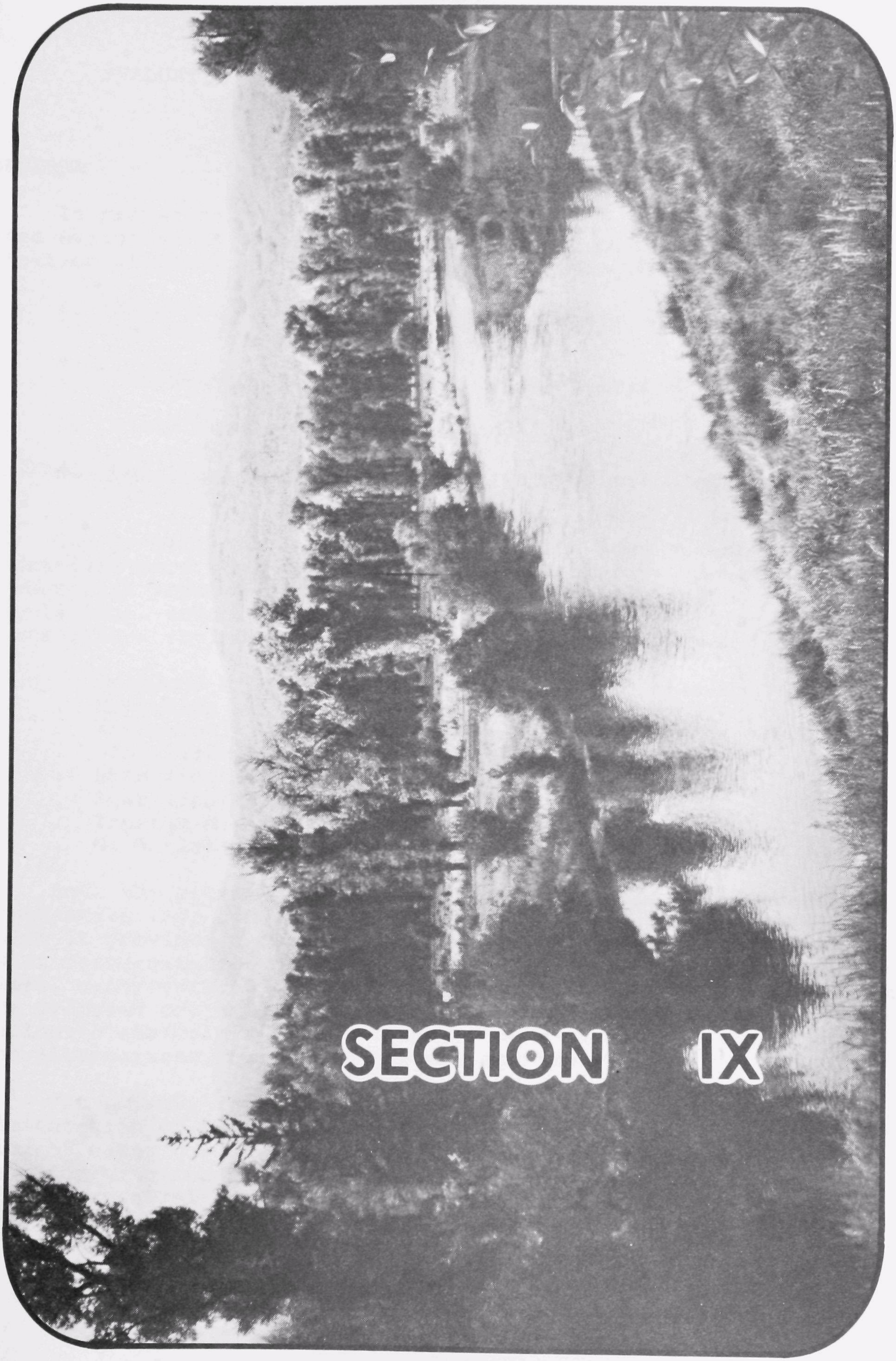
ALTERNATIVE A-6 (INTERIM UPGRADING OF EXISTING TREATMENT PLANT)

Alternative A-6 would serve only in a temporary role, providing only a minimum of increase capacity after the correction of the infiltration/inflow problem. The productivity of the study area will not be affected by the implementation of this alternative provided that the city restricts the number of connections until additional facilities are available.

ALTERNATIVE A-7 (NO ACTION)

If a "No Action" alternative was adopted and the Town of Jackson was to continue in its present pattern, the long term values and productivity of Flat Creek would eventually be destroyed. The cumulative impacts of point and nonpoint discharges may require a number of years to become noticeable, but the existing treatment facility cannot continue to process the expected wastewater flow at a level necessary to protect public health.

SECTION IX



FLAT CREEK AT THE SOUTH PARK
ELK FEEDGROUNDS

SECTION IX

EVALUATION OF THE IMPACT OF THE PROPOSED ACTION AND ALTERNATIVES

GENERAL

In preparing this document, all feasible and legal options were evaluated along with a "No Action" alternative. The determination of possible alternatives was based upon:

1. Existing studies and the existing facility plan for the Town of Jackson.

2. Discussion with pertinent agency personnel.

3. Field review of the study area.

4. Consideration of the issues which necessitated the writing of this EIS.

The project originally proposed by the Town and seven alternatives were considered and evaluated relative to natural environmental resources, social-cultural aesthetic values and regulations, economic requirements and land use planning. These alternatives include:

- Proposed Project - Elk Feedground Stabilization Pond
- Expansion of the existing facility (A-1)
- Mechanical facility at Boyles Hill (A-2)
- Stabilization Pond Boyles Hill (A-3)
- Stabilization Pond Mid South Park Site (A-4)
- Stabilization Pond South Park Road Site (A-5)
- Interim Modification to the existing facility (A-6)
- No Action (A-7)

Both the primary and secondary impacts resulting from each alternative were considered during the preparation of this EIS. While it provides a comprehensive evaluation of the subject, this is an issue-oriented document intended to focus on the key problems, controversies and considerations that have arisen regarding the proposed project. The document was not intended to be an all-inclusive analysis of Teton County, but a succinct discussion of the alternatives, pertinent issues, and impacts.

The primary impacts are those resulting directly from implementation of one of the possible alternatives (e.g., elimination of water quality problems, construction costs, odors, etc.). Secondary impacts are those arising or resulting from concomitant or consequential actions (e.g., facilitation of growth in areas outside a proposed development area, cost of community services as a result of growth, etc.).

Since the existing wastewater facility is not capable of meeting the proposed discharge requirements, it is considered critical by both the EPA and Wyoming Department of Environmental Quality that additional treatment capacity be provided. Because of a variety of natural environmental constraints (i.e., shallow groundwater), individual septic tanks and leach field disposal systems cannot accommodate the type and density of development anticipated.

The project proposed by the Town of Jackson, a South Park Elk Feedground stabilization pond, has created a great deal of controversy and opposition. This opposition has arisen not only from organizations and agencies involved in wildlife protection and management, but from the local citizenry. It was because of this opposition and controversy that the EPA decided to prepare this EIS.

SUMMARY EVALUATION

A summary of the impact assessment is presented in the following matrix. The matrix evaluation is restricted to the consideration of significant environmental, economic, social-cultural and land use impacts which are anticipated from each of the alternatives. Impacts of little general importance, or of negligible difference between the alternatives, were excluded from this summary to avoid unnecessary confusion. The numbers (positive and negative) on the left side of the column or above the slash represent primary impacts. Those on the right-hand side, below the slash, represent secondary impacts.

The relative importance of the specific assessment category to the project area evaluated is assigned a weighting factor from 1 to 3 and is shown in the right-hand column entitled "Weighting Factors."

These weighting factors are explained as follows:

1. Little, if any, extraordinary significance in the project area (e.g., no significant wilderness resource per se exists in the project area or is effected by the proposed project).

2. A significant consideration in the project area (e.g., the South Park Elk Feedground).

3. Of extraordinary significance in the project area (e.g., treated effluent discharges).

The number in the center of each rectangle is the product of the weighting factor times the primary plus secondary impact rating.

The matrix is of greatest value in comparing the impacts of the various alternatives on a given assessment category (e.g., "Wildlife") and in comparing the impacts on general-value categories (e.g., "Natural Environmental Values"). Its usefulness is limited for measuring the total numerical impacts of an alternative, and is not intended to provide a collective summary of the overall impacts.

Several alternatives were so close in their impact that an evaluation based solely on the numerical totals would be unjustified. The differences in numerical totals are within the error inherent in this subjective evaluation procedure. However, the matrix is quite useful in exposing the logic and values assigned by the assessment team, thereby encouraging a candid discussion of the impacts. It also tends to force the individual to consider all the dimensions in assessing environmental impacts.

The evaluation ratings and weighting factors are described as follows:

Rating Assignment System for Evaluation Matrix

+5 Major long term, extensive benefit (highest possible rating).

+4 Major benefit, but characterized as either short term or of limited extent.

+3 Significant benefit; either long term covering a limited area, or short term covering an extensive area.

+2 Minor benefit, but of a long term or extensive nature.

+1 Minor benefit over a limited area.

0 No impact.

-1 Minor adverse effects over a limited area.

-2 Minor adverse effects, but of a long term or extensive nature.

-3 Significant adverse effects; either long term covering a limited area, or short term covering an extensive area.

-4 Major adverse effects but characterized as either short term or of limited extent.

-5 Major long term, extensive adverse effects (lowest possible rating).

TABLE 27

Environmental Evaluation Matrix

Significant Assessment Categories	Proposed Project	Alternative A-1	Alternative A-2	Alternative A-3	Alternative A-4	Alternative A-5	Alternative A-6	Alternative A-7	Weighting Factor
NATURAL ENVIRONMENTAL VALUES									
Air Quality (localized)	-1 0 1	-2 -1 1	-1 -2 -1	-1 -3 -2	-1 -3 -2	-1 -2 -1	-1 0 1	0 -3 -2	1
Water Quality (surface)	3 3 -2	3 6 -1	3 6 -1	3 6 -1	3 6 -1	3 3 -2	3 6 -1	-2 -6 -1	3
Water Quality (ground)	0 4 2	0 2 1	0 2 1	0 2 1	0 2 1	0 4 2	0 0 0	0 -4 -2	2
Wildlife	-3 -10 -2	0 0 0	-1 -4 -1	-1 -4 -1	-1 -4 -1	-1 -4 -1	0 0 0	0 0 0	2
Fisheries	-1 0 -1	1 4 1	1 4 1	1 4 1	1 4 1	1 0 -1	1 4 1	2 6 -1	2
Vegetation and Habitat	-1 -6 -2	0 0 0	-1 -4 -1	-1 -4 -1	-1 -4 -1	-1 -4 -1	0 0 0	0 0 0	2
Rare and Endangered Species	-1 -1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1
Natural Hazards	-1 -3 -2	-1 -1 0	-1 -2 -1	-1 -2 -1	-1 -2 -1	0 -2 -2	-1 1 0	0 0 0	1
TOTAL	-13	10	0	3	3	-5	9	-19	
ECONOMIC									
Local Capital Cost	-2 -4 0	-1 -2 0	-3 -6 0	-2 -4 0	-2 -4 0	-2 -4 0	-1 -6 -2	0 -6 -3	2
O & M Cost	-1 -2 0	-3 -6 0	-3 -6 0	-1 -2 0	-1 -2 0	-1 -2 0	0 0 0	0 0 0	2
Induced Development Costs	0 -6 -3	0 -2 -1	0 -2 -1	0 -2 -1	0 -2 -1	0 -6 -3	0 0 0	0 0 0	2
Individual Cost	-1 -2 0	-2 -2 0	-3 -6 0	-1 -2 0	-1 -2 0	-1 -2 0	0 -4 -2	0 -6 -3	2
Loss of Ag. Productivity	0 -8 -4	0 0 0	0 -2 -1	0 -2 -1	-1 -6 -2	-1 -8 -3	0 0 0	0 0 0	2
	-22	-12	-22	-12	-16	-22	-10	-12	
SOCIAL-CULTURAL									
Historic-Archaeological	-1 -3 -2	0 -1 -1	0 -1 -1	0 -1 -1	0 -1 -1	-1 -3 -2	0 0 0	0 0 0	1
Public Acceptability	-2 -3 -1	-1 -1 0	-2 -2 0	-1 -1 0	1 1 0	-1 -2 -1	0 -1 -1	-2 -4 -2	1
Regulatory/Legal	-1 -6 -2	1 4 1	1 4 1	1 4 1	1 4 1	1 -2 -2	1 2 0	2 6 -1	2
Cultural Pattern (life style)	0 -4 -2	0 2 1	0 2 1	0 2 1	0 2 1	0 -4 -2	0 0 0	-1 -2 0	2
Aesthetics Values	-1 -6 -2	-1 0 1	0 2 1	0 2 1	0 2 1	0 -4 -2	-1 -2 0	-2 -4 0	2
Recreational Values	-1 -2 -1	1 1 0	1 1 0	1 1 0	1 1 0	1 0 -1	1 0 -1	0 -1 -1	1
TOTAL	-24	6	6	7	9	-16	-1	-17	
LAND USE PLANNING									
Adherence to the Planning Proc.	0 -6 -3	0 6 3	0 -4 -2	0 -4 -2	0 -4 -2	0 -6 -3	0 -6 -3	0 -6 -3	2
Growth Inducement	0 -6 -3	0 6 3	0 -4 -2	0 -4 -2	0 -4 -2	0 -6 -3	0 -1 -1	0 0 0	2
Growth Regulation	0 -6 -3	0 6 3	0 6 3	0 6 3	0 4 2	0 -6 -3	0 4 2	0 -1 -1	2
	-18	18	-2	-2	-4	-18	-3	-7	

EXAMPLE OF HOW TO READ THE ENVIRONMENTAL EVALUATION MATRIX

Consider, for example, the differences under the category "Wildlife" for the proposed project at the Elk Feedground site and Alternative A-1, expansion at the existing site. Under the proposed project the number -10 appears, while under Alternative A-1 the number 0 is in the "wildlife box." These numbers were obtained in the following manner:

The upper left hand corner (in the case of the proposed project, -3) is an evaluation of the primary impacts. Since a facility located at the Elk Feedground site would have a significant adverse effect on the elk herd, a minus 3 was assigned to this impact (see previous page on rating system). The lower right hand corner (in this case, -2) is an evaluation of the secondary impacts. Since the Elk Feedground site would facilitate induced development upon existing wildife habitat, not just elk but other species, notably water fowl, this category received a minus 2 indicating minor adverse impacts of extensive nature. Now the total rating, the larger number in each box, is arrived at with the following formula:

Total rating = sum of primary impacts and secondary impacts times the weighting factor. In this case:

Total Wildlife Rating
for the proposed alternative = $\pm(-3) + (-2)1 \times 2$

Total Rating = -10

Also, in this example for the wildlife rating of Alternative A-1, both primary and secondary impacts on wildlife were considered to be zero. That is, this alternative has no effect on wildlife since expansion at the existing site does not affect wildlife, either during construction or by "opening up" additional land to development that could displace wildlife. Then, obviously, the total rating for wildlife for Alternative A-1 equals (0 + 0) x 2, which equals zero.

The reader should note that both the estimate of numerical values for the primary and secondary impacts and the weighting factors are very subjective, and the reader is invited to reassign these numbers in order to make his or her own evaluation. For example, it has been suggested to EPA that the following categories should have higher weighting factors: Public Acceptability, Cultural Pattern, Aesthetics, Recreational Values, Fisheries, and Wildlife. If this were done, it would increase the negative values for those alternatives with poor showings in these categories (the proposed project, South Park Road, and no action), while increasing those with high positive values (Expansion at the Existing Site, the Boyle's Hill alternatives, and Mid South Park). EPA hopes the matrix is useful in summarizing the numerous impacts.

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APPENDIX 1

REPORT BY WYOMING GAME
AND FISH REGARDING LAND
TRANSFER TO THE TOWN
OF JACKSON

The following information is contained in a report dated February 24, 1976 to the Wyoming Game and Fish Commission from Webster B. Jones with reference to proposed sewerage lagoons on the South Park Feedground near Jackson, Teton County, Wyoming.

Pursuant to a request by the Staff of the Wyoming Game and Fish Department at a special Staff Meeting on February 2, 1976, I have compiled this report regarding the proposal of the Town of Jackson, Wyoming to construct two sewage disposal lagoons on the Department's South Park Feedground near Jackson.

The purpose of this investigation is to evaluate the impact of the sewage installation on the South Park Unit to aid the Department in making an informed, fair and legal decision.

To better understand the situation, a basic understanding of the Units history and purpose is required.

The South Park Unit lies eight miles south of Jackson along the north bank of the Snake River. The first land purchased by the Department was 450 acres in 1939 and the second major acquisition was 194 acres in 1941. Acquisition of additional small tracts through purchase and exchange have occurred since that time bringing the total to 636 acres. In 1965, 561 acres of federal lands administered by the Bureau of Land Management were leased by the Department under the Recreation and Public Purposes Act within the meander lines of the Snake River. Fee lands owned by the Department are shown in pink on the map in Appendix A. Federal leased lands are shown in yellow.

The purchase of this property was accomplished through the Federal Aid in Wildlife Restoration Act. This program allows federal participation up to 75 percent of the purchase price of lands valuable to wildlife. In order to receive these funds, the Wyoming Game and Fish Department was required by the Act to enter into a Project Agreement (Appendix B) stating that the State would use the acquired lands for the wildlife purposes as outlined in the Project Statement and the Plans and Specifications. In this case the Department stated that it planned to enclose the South Park Feeding Ground with an elk-proof fence which would conserve the pasture for early winter feed and prevent the elk from damaging surrounding ranch property during the winter feeding period.

Since the time of acquisition the feedground has proved to be a wise acquisition. At the present time, approximately 1,000 elk spend five months of the winter on the Unit. Without feedgrounds of this nature the elk herds would not have sufficient winter range to survive since historical winter ranges and migration routes have been used for other purposes or blocked by the progress of civilization.

Most of the Unit is situated on the flood plain of Flat Creek and the Snake River. In 1957-58 the Department built an 800 foot dike to keep the Snake River from flooding into Flat Creek and thus inundating much of the Unit. As may be expected on an area possessing a high water table, there are high producing grass meadows along Flat Creek and on the Snake River bottoms where the elk are fed. Adjacent to these areas are stands of cottonwood trees with an understory of shrubs and herbaceous species which provide cover from weather and harassment without the elk needing to leave the Unit. Although every portion of the Unit is not used for the feeding ground or for cover, a certain amount of open-space is required to provide a buffer zone between the elk and adjacent human activities.

The elk-proof fence around the perimeter prevents game damage to adjacent private lands. Although the Unit is primarily used for elk, other species of wildlife such as moose, deer, raptors, waterfowl and upland game birds are also present.

During the summer months when the elk are on their summer range at higher elevations, the Unit sustains a high degree of use for public recreation. Use by the general public between June 6th and November 30th has averaged 13,705 visitor days per year for the last five years. This does not include persons who walk from the highway on to the Unit. Camps and campers average 1,000 per season.

The Boy Scouts of America use the area for ten weeks with an average of 80 boys per week or 800 boys per season.

The Feedground has been used for training for the National Field Dog Trials for the past ten years.

It is the only free camping area in Jackson Hole and is used regularly by tourists, residents and various organizations for picnics and overnight camping.

This is one of the few areas boaters can gain access from the highway to the Snake River.

Approximately three hundred sixty two elk are harvested from this herd each year providing 1,727 hunter days of recreation, as well as the economic contribution to the State by these hunters. Five to ten deer are harvested from the Unit each year and the Unit provides one of the only areas open for waterfowl hunters. During the 1975 Waterfowl Hunting Season there was an average of 5-10 hunters per day.

In 1975 there was an estimated 397 bank fishermen and 953 boat fishermen using the Feedground as access to the Snake River during the summer months. In addition to this an estimated 500-1,200 fishermen used Flat Creek with two thousand, nine to sixteen inch cutthroat trout being stocked during the 1974 season.

On January 11, 1973, the Commission received a letter from Mayor Lester May (Appendix C) proposing that the City of Jackson enter into a long term lease with the Wyoming Game and Fish Department to construct two sewage lagoons on fifteen acres of the South Park Elk Feedground.

A committee of three staff members of the Department was appointed to investigate the proposal. They were Rex Corsi, Chief Game Warden; Cliff Bosley, Assistant Chief Fish Warden; and Jon Ogden, Chief Engineer. Their findings (Appendix D) were presented to the Commission on January 17, 1973 where the Commission voted to deny the request (Appendix E). A letter (Appendix F) was sent to the City of Jackson on February 17, 1973 which summarized the findings of the Committee and notified them of the Commission's action.

On March 21, 1973, President Crowell advised (Appendix G) the new members of the Commission concerning the previous action of the Commission toward the City of Jackson proposal.

On April 11, 1973, members of the Wyoming Game and Fish Commission met with Mayor Lester I. May and Councilman Howard Walters (Appendix H) to clarify the reasons for the Commission's actions so that there was no misunderstanding. At that time, it was explained that Federal Aid Funds had been used to acquire the South Park

Feedground. Mr. White was directed to contact officials of the U.S. Fish and Wildlife Service to ascertain if the Commission could legally sell or lease the property and, if so, would it be necessary to appraise the property.

On April 16, 1973, a letter of inquiry was written to the Area Manager of the Bureau of Sport Fisheries and Wildlife, Mr. Burton W. Rounds (Appendix I). A reply was received on April 20, 1973 (Appendix J). The letter said that:

"We believe the proposed land transfer to the City of Jackson, Wyoming would indeed constitute a 'diversion of funds' within the meaning of Section 80.5 of the Federal Aid Manual, unless conditions outlined below could be met. Such diversion would jeopardize your agency's continued eligibility to receive Federal Aid funds, as described in Subsection (b) of Section 80.5.

"As you are aware, it would be necessary for you to submit an amendment to project documentation requesting permission to dispose of the land parcel in question. Final approval would need to come from the Regional Director, Region 6, Bureau of Sport Fisheries and Wildlife. Your request would need to be predicated on one of two precepts:

(1) the land involved is no longer serving the purpose for which it was originally acquired;

(2) the entity proposing to acquire the parcel is prepared to replace it 'in kind.

"Regarding the first of these alternatives, it is our understanding that the land in question is indeed serving the purpose for which it was acquired. We seriously doubt that our Bureau could approve of disposal as surplus to Management Unit needs. Even if this could be established, it would be necessary to conduct a competent land appraisal and to fully reimburse the project at current market value. Appraisal and reimbursement costs would need to be borne by a non-Federal interest.

"Concerning the second alternative, we doubt that suitable replacement lands are available in the area. The burden of locating and obtaining control of any replacement lands should properly rest with the City of Jackson. The proposed replacement tract would need to meet your agency's criteria for the use intended. It would, of course, be necessary to obtain this Bureau's concurrence in your assessment of wildlife values for proposed replacement lands. It would also be necessary to provide proof of adequate legal control by you over the replacement tract itself.

"Under these circumstances, we feel the City of Jackson should be encouraged to seek alternative lands as a site for construction of the sewage lagoon."

On April 30, 1973 the letter from Mr. Rounds was read to the Commission (Appendix K) after which Commissioner Hull moved that the Commission reiterate its refusal to the Town of Jackson to place a sewage lagoon on the South Park Feedground for the reasons previously stated and the additional reason as expressed in the letter from the BSFW to the effect that such a lease or grant would be contrary to the purpose for which the lands were acquired and would constitute a jeopardy to further P-R Funds to the State of Wyoming. Motion seconded by Commissioner Mankin and carried.

On May 4, 1973, Mr. White sent a letter to the Town Council advising them of the position taken by the U.S.F.W.S. in regard to their request.

In October of 1974, Nelson, Haley, Patterson and Quirk, Inc., an Engineering Consulting Firm in Greeley, Colorado, completed and transmitted to the Mayor and Town Council a Facilities Plan for the proposed sewage disposal system at Jackson. The plan considers three sites including the South Park Feedground. The following discussion of that site is taken from the report.

> "Only one site in the South Park area, the Elk Winter Feeding area, appeared especially suitable for use of lagoon treatment methods. At this site, lagoons could be concealed from view and would be isolated from developing areas in South Park so that if odor problems occurred, for example, they would not be offensive to local residents."

Odor

> "The lagoon site is located on the edge of a stand of mature cottonwoods between the trees and the Snake River. The proposed lagoon site is in an old abandoned ox-bow of the river. This system would entail the construction of an aerated lagoon, polishing pond and effluent outfall line to the Snake River. The entire treatment area would be fenced to prevent access. An improved access road would have to be constructed to the area as at present only a cutbed, fishermen road exists to the area. Access to the site would require trespass across approximately 1.4 miles of the Wyoming Game Commission property and use of the site would remove approximately 15 to 20 acres from use as a wildlife refuge. The Wyoming Game and Fish Commission strongly objects to use of this area as a treatment plant. The Bureau of Sport Fisheries and Wildlife also concurs with the Game Commission on opposing the use of the site. This is, however, the site previously favored by the Town Council and by the Town Manager. The main arguments for the use of this site centers around the concept that the land is "Public Property," and therefore should be available to the "Jackson Public" for use as a treatment site. Secondly, the site would allow for construction of treatment lagoons rather than a treatment plant, saving on initial construction costs as well as reducing operation and maintenance costs. Third, the outfall line from the Town of Jackson would be able to utilize gravity flow the entire distance through South Park. Finally, the site, since it is located at the extreme end of South Park, would theoretically be capable of handling all future growth and waste-water demands in the area."

The plan also goes into the probable impact on the environment which is shown in its complete form in Appendix L. Listed below are some of the negative effects from that treatment which refer specifically to the South Park Feedground.

(a) It appears that a political and quite probably an emotional and environmental conflict will arise if the Town of Jackson attempts to obtain the Elk area for use as a treatment site. As indicated to the City Council on May 4, 1973 in a letter from the Wyoming Game Commission Director, Mr. James White, this property was purchased with Federal Aid to Wildlife Restoration funds. Any request for a change in use of these lands from their original intent (elk winter range) must be justified as to need or indicate that the property no longer serves the purpose for which it was originally acquired. The State Wildlife Agency and the

Federal Bureau of Sport Fisheries and Wildlife are the final agencies deciding on the merits of any proposed change of use. To date neither of these agencies have approved the proposed change and do not intend to change their opinions on this matter. Their reasons are as follows:

1. The request for a change in use of approximately 20 acres of the feeding site from range to a sewage treatment plant site would constitute a diversion of use and diversion of funds from the original intent.

2. Any taking of such land for use as a lagoon treatment site would require reimbursement to both the federal government and to the Game Commission. Reimbursement would have to be in the form of direct purchase and/or replacement in kind of similar land lost by the diversion of use. The federal government and the Game Commission would have to approve any such transaction with costs of land appraisals and land purchase borne by the Town of Jackson.

3. The present feeding ground supports up to 2,000 elk during the winter months on approximately 636 acres of Game Commission land and 561 acres of leased Bureau of Land Management property. Game Commission biologists consider that the site is already crowded and that they cannot afford the loss of 20 acres.

4. The Game Commission knows of no local property available in the South Park area which could replace land lost to the treatment facility. Any such land would have to be along established elk migration routes, and an isolated 20 acre site would hardly appear to be a manageable size for elk feeding purposes.

5. The Wyoming Game and Fish Commission must look at the proposed Jackson request from the standpoint that approval of such action would set a possible precedent for future "taking" of their lands. This would weaken Commission control and regulation of all of their lands within the state and complicate sound, long-range management and planning for such property

(b) Any attempt by the Town of Jackson, even with County support, to take away land on the elk feeding area without the consent of wildlife officials will result in controversy. Vocal and powerful conservation and environmental groups, both local and national, might enter such a battle and delay any such action.

In conclusion, the plan states that:

"In view of the problems which Alternate 2 (South Park Site) would pose in terms of land use and planning for the South Park Area, it appears that a better site should be found which will minimize some of these problems. Many of the negative effects could be solved with proper

planning and regulations, but as such action does not appear to be soon forthcoming, a less controversial site would be considered which will serve the Town's needs..... The alternate is the less expensive of the two alternates using lagoons as treatment processes. Its cost of $1,564,000 (See Exhibit M) is the second lowest and would rate consideration as a viable alternate or even most desirable of all alternates on strictly a cost basis. However, environmental and political problems that would be encountered placed this alternate third in ranking. Due to the possibility of the lagoon effluent not meeting future effluent standards without additional equipment, this alternate would be questionable to accomplishing contributions to future goals."

The results of the plan were presented to the Town Council on November 19, 1974 which recommended expansion of the present facility rather than the South Park Feedground Site (Exhibit N). The Town Council, however, chose the South Park plan over the advice of their consultants.

The proposal was discussed by the Commission again on January 19, 1976 at which time Governor Herschler informed the Commission that a group from Jackson had asked to meet with him that week concerning the acquisition of the South Park Site (Exhibit O).

At this time it is apparent that the Town of Jackson is continuing its quest to acquire a site on the South Park Unit from the Department.

There are not too many more points that can be added to those made by Rex Corsi, Cliff Bosley and Jon Ogden (Exhibit D); Nelson, Haley, Patterson & Quirk, Inc., (Exhibit L); Garvice Roby, Game Biologist (Exhibit P); or Max D. Rollefson, Area Fisheries Biologist (Exhibit Q), however, some of their more salient points concerning the impact of the sewage lagoons on the feedground as well as some of my own observations are discussed hereinafter.

Legal Aspects

From a legal standpoint it is impossible for the Department to sell or lease the twenty acre site to the Town of Jackson without the Commission declaring the land surplus to the needs of the Department, advertising it for sale for three consecutive weeks in a newspaper in Teton County and then selling it to the highest bidder over the appraised value. This is the procedure for disposing of surplus property as outlined by an interpretation of the State Statute by the Attorney General. Obviously a twenty acre tract in the middle of a 636 acre feedground cannot be declared surplus to the Department's needs.

Closely coupled to this, is the fact that the feedground was purchased with 75 percent participation by the Federal Government through the Federal Aid to Wildlife Restoration Act. As interpreted by the U.S. Fish and Wildlife Service (Exhibit J), a transfer of land to the Town of Jackson would constitute a "diversion of funds." Such diversion would jeopardize the Department's continued eligibility to receive Federal Aid Funds. Only two circumstances exist whereby a "diversion of funds" could be avoided; (1) if the Department could prove that the land is no longer serving the purpose for which it was originally acquired; or (2) if the Town of Jackson would be prepared to replace it "in kind."

The first alternative is impossible to meet because there is no question that the twenty acre site is being used for the purpose for which it was acquired and is not surplus to the Department's needs.

The second alternative is not so "clear cut", however, from a practical standpoint it is impossible to find suitable replacement lands in an area around the perimeter of the feedground which would have the same utility or benefits as twenty acres in the middle of a well "blocked up" unit. Any lands around the perimeter would tend to project out or be isolated from the present boundary and receive little elk use yet it would require a higher maintenance cost because of the added perimeter fence. It would also tend to create undesirable corners and pockets to trap elk.

It should be remembered that the Department once owned two forty acre tracts on the north and west boundaries of the present feedground. Both were traded for more desirable lands within the present unit.

From a legal standpoint, it is my opinion that no further negotiations are required with the Town of Jackson. Even if we wanted to sell the tract, legally we cannot.

Biological Aspects

The twenty acre tract desired by the Town of Jackson for the lagoons lies in the middle of an old ox-bow of the Snake River. It is completely surrounded by cottonwood trees and other shrubs. This area, although not used for feeding, is extremely important for cover from bad weather and harassment of all kinds. The elk are seen frequently in this area after feeding. It is this cover that tends to create a quiet setting, a place of refuge for the elk without requiring them to leave the unit to seek shelter. When elk leave a Unit of this nature, a high probability exists that they may go onto private lands and damage hay stacks, etc.

The location of the lagoons in this area would not only eliminate the 20 acres from use but would have an effect on the elk use of an additional 148 acres because of the strange appearance, odor, noise and human activity. This essentially destroys the use of much of the cottonwood cover.

Although it has been said that a daily visit is the only activity which will be required, this must be assumed to be under ideal conditions. What about unforeseen breakdowns, construction and reconstruction during the winter feeding period. The proposed pipeline not only traverses the cover area but through the feedground for almost the full length of the Unit. What about unforeseen problems with the pipeline. Any one of these problems could move the elk off of the Unit and keep them off if it occurred for a considerable length of time. It may be noted in Exhibit N that the EPA official said, "that if the town expects funds from his agency access to the sewer site is an absolute requirement. If it is the decision of the town to select the South Park site we must have assurances of free undisturbed access to the site in our report." This unrestricted access could be devastating to the South Park elk feeding program.

Another point which is mentioned on page 46 of the Facilities Plan by Nelson, Haley, Patterson & Quirk, Inc. reads as follows: "Additional space would also have been available for such equipment as clarifiers, microstrainers, chorination units or even a tertiary treatment facility if such units were needed to meet future effluent standards."

This statement would lead me to believe that future requests for more land could be expected and after granting the initial request how could we find justification to refuse additional demands.

This leads into another important point. If the Department approves this request from the Town of Jackson it would undoubtedly set a precedent for future taking of

its lands. This would weaken Department control and regulation of all of their lands within the State and complicate sound, long-range management and planning for such property (see Exhibit R for an example).

Another observation concerning the biological impact is that if the lagoons are placed on the South Park Unit it will tend to encourage development of the lands near the Unit. This is pointed out in Exhibit L. Needless to say human activities along the perimeter would be detrimental to the use of the feedground.

Construction of the lagoons will require considerable fill dirt and top soil. If it is planned to remove this from the adjacent unit lands this will have an adverse effect on forage and hay production.

There is some concern that the proposed site is located on the flood plain of the Snake River and will be susceptible to flooding which could flood the area with sewage making it undesirable for wildlife and human use as well as polluting Flat Creek and the Snake River. The lagoons are definitely near the water table of the Snake and probably below the water table of Flat Creek. If the system did not function properly, because of icing for example, pollution of the streams and damage to the fisheries could occur.

Although not a primary purpose of the Unit, summer recreation is certainly one of its principle uses. The existence of the sewage lagoons would have an effect on this use through appearance, odors and most definitely an undesirable psychological stigma would be attached to the location.

An Approach to Real Estate Appraisal

The following is a discussion of an appraisal approach based on rough unconfirmed appraisal data and is not a real estate appraisal although it may give a rough idea of the values involved.

The most equitable approach due to the extensive damages to the remaining property for elk feedground purposes would be the Before and After Appraisal Technique, the difference between the two appraisals being the Value of the Taking and the Damages to the Remainder.

From rough unconfirmed appraisal data it appears that the present South Park Feedground is worth approximately $1,748,000.00. The value of the land requested by the Town of Jackson is $60,000, however, the greatest part of just compensation is the damages to the remaining land if it is to have continued use as an elk feedground.

There will be a zone around the lagoons, estimated to be 500 feet wide and containing 65 acres which will have a 50 percent reduction in utility to the elk because of appearance, odor, noise and the related human activity. This results in damages to this zone in an estimated amount of $97,500. There is another zone estimated to be 500 feet wide and containing 83 acres around the first zone which will have an estimated 25 percent reduction in utility by the elk. The amount of damages to this area is estimated to be $62,250.00.

Because of approximately 49 percent of the 150 acres of forest cover has been taken or suffered a loss in utility an imbalance of 49 percent to the excess is evident in the nonforested lands of the feedground. This excess is estimated to be worth $552,720. Total Just Compensation to the Department is estimated to be $772,470.00. Please refer to the following summary.

Market Value Before the Taking		
Lands: 526 Ac. at $3,000	$ 1,578,000.00	
80 Ac. at $1,500	120,000.00	
30 Ac. at no value	- 0 -	
Improvements	50,000.00	
Total		$ 1,748,000.00
Just Compensation		
Value of the Taking (20 Ac. X $3,000/Ac)	$ 60,000.00	
Damages to the Remainder		
Zone No. 1 - 50% reduced utility by elk in a 500 foot strip around the lagoons (65 Ac. X $3,000 X .50)---	$ 97,500.00	
Zone No. 2 - reduced utility by elk in a 500 foot strip around Zone No. 1 (83 Ac. X $3,000 X .25)---	$ 62,250.00	
Reduced utility on 49% of the forest cover creates an in-balance of 49% of the remaining unforested type (.49 X 376 X $3,000)---	$ 552,720.00	
TOTAL JUST COMPENSATION		$ 772,470.00
Market Value After the Taking		
Lands: 506 Ac. at $1,591.96	$ 805,530.00	
80 Ac. at $1,500.00	120,000.00	
30 Ac. at no value	- 0 -	
Improvements	$ 50,000.00	
Total		$ 975,530.00

Although I am part of the Wyoming Game and Fish Department, I can understand, at least in part, the problem that the Town of Jackson is facing in securing a site for their sewage facility. However, since it is the Department's statutory mandate to administer the wildlife of Wyoming for the people of Wyoming, there is no reason whatsoever to comply with the Town of Jackson's request for land since it is legally and biologically infeasible and will benefit a greater part of the public if the present use is retained.

APPENDIX 2

NOVEMBER 1976 LETTER
FROM WYOMING GAME AND
FISH REGARDING THE
SOUTH PARK ELK
FEEDGROUND SITE

State of Wyoming

GAME AND FISH DEPARTMENT
CHEYENNE 82002

November 24, 1976

Mr. Bill Ashley, Chairman
Teton County Board of Commissioners
181 King
Jackson, Wyoming 83001

Dear Mr. Ashley:

At their last meeting in Sundance on October 30th, the Game and Fish Commission and staff gave further consideration to the proposal to build an aerated sewer lagoon system at the South Park Elk Feedground. The November 1976 issue of the monthly planning newsletter of the Teton County Board of Commissioners lists the South Park site as one of five alternatives being considered to alleviate the difficult problem of Jackson's currently inadequate sewage disposal system. The Commission understands that the timetable for the EIS is a completion of the preliminary draft in January, 1977 with publication occurring shortly thereafter. Following public hearings in March, the final EIS is to be published in May, 1977. After the EIS process is completed, Jackson could be in a position to apply for and receive the "Step II" federal grant to design a new sewerage facility and construction could possibly commence in the spring of 1978.

The Boise, Idaho firm of James M. Montgomery, Consulting Engineers, Inc., has been retained to prepare the necessary Environmental Impact Statement and representatives of this firm have been in frequent contact with our Department. We have furnished quantities of biological, environmental, legal and managerial information which we hope will substantially assist in preparing a complete and sound assessment of all ramifications of the several proposals. It is the South Park Elk Feedground site (proposal) with which we are primarily concerned and would like to address ourselves at this time.

The Commission is now in possession of complete investigation reports and documents which have been generated as a result of the Commission meeting of January 20, 1976 and the appearance of the Jackson delegation which solicited our cooperation at that time. I enclose for your

review and consideration some of the more salient parts of this information. We are also in possession of considerable public and private comment with reference to the South Park site, much of which has received a wide distribution by the commenters.

In view of the amount and type of information we now have and after a careful consideration of it, the Commission and the Department feels that decisions must be made and time is of the essence. We must, therefore, in fairness to all concerned, conclude and notify you that the Wyoming Game and Fish Commission and Department does object to and will oppose fully any attempts to place sewerage lagoons or other sewerage facilities on the South Park Elk Feedground. Our opposition is based on four categorical considerations:

1. Biological: We have serious reservations about placing any municipal sewerage facility on a flood plain, particularly one on a river with the potential and consequence of the Snake. The South Park Elk Feedground was initiated in 1939 on a site selected because of its unique and highly desirable biological features. There are high producing grass meadows along Flat Creek and on the Snake River bottoms where the elk are fed. Immediately adjacent to these meadow areas are large stands of mature cottonwood trees with an understory of shrubs and herbacious plants which provide cover and protection from weather. The elk can be fed, graze and rest relatively free of any harassment and never need to leave the Unit to benefit from these features. Although every portion of the Unit is not used for the feedground or for cover, a measurable amount of open space is required to provide a buffer zone between the elk and adjacent human activities. Although the Unit was acquired originally primarily for elk, other wildlife species inhabit the area in numbers. These species include moose, deer, waterfowl, raptors, upland game birds, furbearers and song birds.

2. Legal: The enclosed letters from Area Manager Rounds, 1973; Assistant Regional Director Lane, March and August 1976, are self-explanatory. The feedground was purchased with Federal Aid money. The Commission very definitely cannot declare the property surplus to our needs and to simply transfer the land to Jackson would constitute a "diversion of funds" and would thereby jeopardize the Department's future and continued eligibility to receive both P.R. and D.J. Federal Aid Funds.

3. Sociological: The subject property is not only serving the original purpose for which it was primarily purchased, but also now serves a much greater public need. Camping, boating, dog trials, hunting, fishing and horse backing are among the public uses which constitute an average use of 13,705 visitor days for a six month period (June through November) for the past five years.

4. Political: The report of Nelson, Haley, Patterson and Quirk, Inc., lists several negative impacts of placing sewerage facilities at South Park. Among these statements is found the following:

> "Any attempt by the Town of Jackson, even with County support, to take away land on the elk feeding area without the consent of wildlife officials will result in controversy. Vocal and powerful conservation and environmental groups, both local and national, might enter such a battle and delay any such action."

Our files contain many letters from interested citizens from the Jackson area and elsewhere. Some are rather emotional, some are very practical and some are personal; but, without exception, they are all in opposition to placing sewerage lagoons on the South Park Feedground. A review of all the "public input" made to us leads us to a question; Who really wants or insists on the facility being at South Park?

We sincerely hope the foregoing will assist those responsible in evaluating all planning options available and we appreciate your consideration of our official position with reference to them.

Sincerely,

Earl M. Thomas

EARL M. THOMAS, DIRECTOR
WYOMING GAME AND FISH DEPARTMENT

EMT:saw
Enclosures
cc: Governor Ed Herschler
Mr. Ralph Gill, Jackson Mayor-Elect
Jack Hull, Commission President
Darwin Creek, Game and Fish Department
bcc Edwin T. Cryer

APPENDIX 3

SUMMARY OF PUBLIC
WORKSHOP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80203

Tabulation of Public Responses

Workshop Number 2

January 11, 1977

Jackson Sewage Treatment System
Draft Environmental Impact Statement
Jackson, Wyoming

Note: Numbered responses were received from individuals and lettered responses were received from one of the eight groups that completed the questionnaire. An individual or group has the same designation for all their responses.

Jackson Wastewater Treatment System
Environmental Impact Statement
Summary of Public Workshop

On January 11, 1977, the second of two public workshops was held in connection with preparation of the draft environmental impact statement on Jackson's wastewater treatment system. Following an hour-long presentation on the alternative sewage treatment sites and systems, the economic costs, and environmental impacts, those attending received a pamphlet outlining this information and a six-sheet questionnaire. Eight groups of six to eight people were formed as those attending randomly seated themselves at different tables. All eight groups submitted a summary of their discussions. In addition, fifteen persons submitted their own individual responses to the questionnaire. This summary presents an analysis of both the groups' and individuals' responses that were received at the workshop. A copy of all the responses is attached.

Attendance

Total attendance at the beginning of the workshop was 76 people of which 68 were community residents. 62 Teton County citizens were present during the group discussion phase.

Content Analysis of Public Opinion

A. Group Results

Seven of eight groups participating in the workshop rejected the South Park Elk Feedground Site from further consideration. Six of the groups also rejected the South Park Road Site (A-5) and the Mid-South Park Site (A-4). Reasons given were the adverse effects of development created by extending sewers to these sites and the unavailability of land or high costs of private land.

Six of the groups also reached a concensus regarding the preferred solution. All six groups' recommendations include expansion at the existing Site (A-1), some in combination with Interim Improvements (A-6). Four of the groups also wish to retain a Boyle's Hill site alternative (A-2 & A-3a) as an option. Of the two remaining groups, one split between recommending a lagoon at Boyle's Hill (A-3a) and expansion at the existing site (A-1); the other group split between recommending expansion at the existing site (A-1) and selecting the Elk Feedground Site.

Six of the groups considered the question of alternative plant size and all agreed that the 1995 design capacity was preferable to a smaller (1990) size.

A majority of the groups expressed reservations as to the acceptance of lagoons as the method of treatment. Reasons given emphasized odor problems, but also included amount of land required and aesthetics. Two groups felt that the much lower annual operating costs of lagoons justified selecting a lagoon system.

Regardless of plant location or method of treatment, a plurality of the groups also expressed a desire for energy conservation and a reduction if not elimination of odors.

Conclusion on group responses: The concensus of those attending is to reject the southernmost sites (South Park Road Site and South Park Elk Feedground Site) in favor of either Expansion at the Existing Site or locating a plant at the Boyle's Hill Site.

B. Individual Results

Fifteen individuals submitted responses separate from their group responses. All but one felt there was some significant problem with the Elk Feedground Site with reasons including stimulation of growth throughout South Park, interference with the elk, unavailability of the land and conflict with both established use and the proposed land use plan. Ten of eleven persons responding believed the South Park Elk Feedground Site was not compatible with the proposed land use plan.

These individuals also felt there were problems associated with Expansion at the Proposed Site (A-1). These problems included high operating costs, proximity to the proposed high school and the settled community, odor problems, and flooding and aquatic life growth on Flat Creek. Several individuals expressed strong doubts about lagoon systems, particularly their odor problems, and others requested energy conservation regardless of the selected alternative. The individuals who responded to the question on whether the estimated growth rate of six percent per year was reasonable were split evenly, with half believing this was accurate and the other half claiming this was too high. All but one individual felt that having reserve capacity beyond the design year was a good idea (that is if the rate of growth is not as rapid as projected there would be reserve capacity beyond the design year). Only one individual felt that the "ability to serve growth dangles as an incentive to have growth...".

Conclusion on individual responses. The concensus of individuals submitting questionnaires is to reject the South Park Elk Feedground Site, but they were split as to their preferred site although a plurality preferred Expansion at the Existing Site (A-1); others preferred a Mechanical Plant at Boyle's Hill Site (A-2) or the Mid South Park Lagoon (A-4).

Summary

Is there a concensus of opinion that certain sites should not be further considered? Which ones?

1. If Flat Creek empties into the river at elk feedground as an open sewer line, it is doubtful that the proposed system would pollute the river any more.

5. Elk refuge; South Park road site.

6. Elk refuge; South Park road site; mid South Park.

8. South Park feedground; South Park road.

9. Anything below South Park line; no lagoons.

11. All but the existing!

A. Elk refuge; South Park.

B. Elk refuge site; mid South Park site.

C. Three southernmost.

D. South Park elk refuge; South Park road site.

E. South Park elk refuge; South Park road site.

F. A-5; A-4; A-3a; proposed site.

G. Boyle's Hill; mid South Park.

H. Elk feedground (due to creating high density); mid South Park; Boyle's Hill; polo grounds.

Summary

Do you have a group's concensus for a preferred site?

5. No; personally felt mechanical at Boyle's Hill or existing site.

6. No; personally prefer mechanical at Boyle's Hill or existing site.

8. Mid South Park.

9. A-1; mechanical plant or at Boyle's Heights; no ponds.

11. Yes; existing.

A. A-1 and A-6 combined; Boyle's Hill.

B. A-1 and A-6 combined; Boyle's Hill; mechanical or aerated lagoon.

C. Not quite; Boyle's Hill-mechanical; existing site-mechanical; heavy commitment to alternative energy.

D. A-1, A-6 combined; Boyle's Hill; should be tied together instead of treated separately.

E. No; some mechanical; some like lagoon; Boyle's Hill; existing plant using aeration improvements followed by expansion.

F. Yes: A-2, A-1, A-6 No: A-5, A-4, A-3.

G. *Seven in group: three prefer present site; three prefer elk feedground; one prefers Boyle's Hill or present site.*

H. A-1; expansion at existing site to 1995.

Summary

Do you have a concensus of opinion regarding the plant size? What size does the group prefer?

8. 1995 or larger; alternative energy.

9. 1995.

11. Stupid question to ask lay people at a meeting like this.

A. Full size as projected with flexibility to go higher with population growth.

B. Full size, plus lots of flexibility for enlargement.

C. 1995.

D. Full size as projected and future expansion; relate sewage growth rate to water usage; expressed interest in mechanical; alternative energy; cooperation: city and county.

E. Not considered.

G. 1995 size.

H. As large as possible to effectively take us to the target date.

The Proposed Alternative
South Park Elk Feedground Site
Aerated Stabilization Lagoon

What problems do you see in constructing a sewage treatment plant at this site?

1. Very small compared to others.

2. Stimulate growth through South Park; that we don't need high cost and high water table; uncertain reliability; this is an elk refuge--leave it this way.

4. Elk habitat.

5. State interference; sportsmen; elk hunters; fish and game; high H_2O table.

6. *Can we get the land? Interference from G & F & State; high water table;* opens up South Park for growth.

7. Facilitates growth in South Park, which I personally do not favor; not good for the elk or as a precedent for future wildlife-related value choices.

8. Scenic impact; elk disturbance; increased growth impact in South Park; site not available; flood danger.

9. Expansion for South Park.

10. Elk; increase growth and density; Game and Fish opposed.

11. The land is not, and will not be, available.

12. Stimulation of growth; flood plain, high water, etc.

13. Conflict with established use, i.e., detriment to natural wildlife; would open South Park to high density development; high groundwater would require elevated lagoons and expensive liners.

D. State, Game and Fish, National opposition; water table; raised lagoon.

E. State interference; Fish & Game interference; unknown cost of raised lagoon; opening South Park area, along South Park road, to certain development in open untried area; opposed to comprehensive plan.

F. Land acquisition/State F & G doesn't want it; preempts county planning options/incentive to growth in South Park; high water table problems; smell at least 9 months of year; potential problem for Scenic River status; lagoons don't work well in Jackson Hole.

The Proposed Alternative

15. Extremely expensive and potentially disruptive to an area already recognized as wildlife habitat, agriculturally productive; and scenically valuable.

The Proposed Alternative

What benefits?

1 All lagoon sights will have to have above ground treatment of similar cost.

2. Gravity flow to plant; no sludge removal.

4. No benefits.

5. Growth stimulation; cost; gravity flow.

6. Stimulates growth, if that's a benefit; cost is low for operation and maintenance; gravity flow.

7. If development of South Park is inevitable, then a plant site in South Park is foresighted.

8. None not available with other sites.

9. Out of sight; handle it all.

10. Maybe lower land cost.

11. None.

12. None at all, except for landowners, who'll develop South Park and get rich.

D. Stimulates growth; gravity flow, no pumping.

E. Gravity flow; low operational cost.

F. Outside further limits of developable area; out of sight.

15. Far away from main population base; "out of sight, out of mind"; perhaps easier to acquire the land than lengthy condemnation procedures at other sites, but I doubt it.

The Proposed Alternative

Do you believe this site is compatible with the proposed comprehensive land use plan?

1. Yes.

5. No, not as presented by them.

6. No.

7. If the goal of the plan is to limit growth in South Park, no. If, however, the goal is simply to insure that growth does not harm the environment (e.g. water), yes, it is compatible.

8. Absolutely not.

9. No.

10. No, more development.

11. No, urban density is not desired except in town of Jackson -- see Master Plan adopted.

12. Not in the slightest.

13. No.

D. No.

E. No.

F. No.

15. Not as I understand the overall guiding principles.

The Proposed Alternative

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc.?

1. Least.

2. 20 acres of fencing.

5. Fencing;landscaping.

6. Fencing or landscaping.

7. Alternative energy sources.

8. Remove the plant.

9. Little.

10. Landscaping.

11. Does not apply.

12. Drop the idea.

13. Fencing to keep out elk or other wildlife; should be aesthetically pleasing to be compatible with surroundings.

D. Not hard to conceal.

E. Raising lagoon.

F. No.

15. Unique architecture, perhaps; at best, it would still interfere with a wildlife habitat.

The Prooosed Alternative

Do you prefer this alternative? Why?

1. Serves the most people.
2. No.
4. No. Elk habitat feed grounds.
5. No. Too much population increase (high density); aesthetic value.
6. No. Allows for too much growth; "flavor" of Jackson will not be preserved.
7. No. Encourages growth in South Park.
8. Absolutely no.
9. No.
10. No.
11. No. It is not an alternative.
12. I think it is so bad it should no longer be considered.
13. No. For the above-mentioned reasons.
D. No. *Prefer lower density; reduced visual impact.*
E. No. Invitation to high density development in open area; visual impact; diminishing effect on ranching.
F. No.
15. As a last resort.

Alternative A-1
Expand at the Existing Site
Expansion of the existing mechanical plant

What problems do you see in constructing a sewage treatment plant at this site?

1. No consideration.
2. None; just complete what was begun and left unfinished.
2. High M & O cost; too close to high school and settled community.
3. Problem with dumping into flat creek may be gravity feed to make up date right away to bring sewage treatment up to date to at least handle the problem for five years while new one is being built.
4. Costly.
5. Affluence into Flat Creek; high cost of maintenance; proximity of town; expanding community.
6. High O & M cost; effluent into Flat Creek more concentrated; handle just the town.
7. Only problem is that expansion potential is limited and service from South Park would require energy input; however, I regard those advantages rather than disadvantages. Also, I dislike energy consumption of a mechanical plant.
8. Town Council; higher operating cost.
9. None.
10. Odor nearer development.
11. Only problems of effluent into Flat Creek can be handled and additional acreage, which also can be handled -- even acreage for lagoon(s).
12. Is site large enough?
13. Requires discharge into Flat Creek; does not allow for a gravity feed to the plant from South Park residents.
15. Compounds problem in Flat Creek with accelerated aquatic life growth, flooding potential, and water quality degradation.
D. Effluents into Flat Creek, unless piped to Snake; high O & M; lots of energy used; proximity to town and expanding community; proximity to school site.

Alternative A-1

E. Empties into Flat Creek; high cost of O & M; next to new school site.
F. Additional load to Flat Creek; maintenance high energy demand high.

Alternative A-1

What benefits?

2. Make use of the investment now there.
2. Can utilize some of existing facility.
3. Use of present pipes in old plant; would only have to build lagoons to handle problem; could use the present pumps and pipes that are there already; this plant was never finished; no wonder it doesn't work now!
5. Low initial cost; no odor; effluent better treated; already own land.
6. Low initial cost; effluent better treated; no odor; already own land.
7. Makes good use of present capital investment; does not encourage growth, but will accomodate it.
8. Short interceptor; supportive of master plan; low capital cost.
9. Low cost.
10. Limits growth; density.
11. Stop the urbanization of the rural countryside south of this site, and effectively contain the city in its present limits.
12. Jax owns land.
13. Conforms with established use; incorporates existing system; mechanical system has proven reliability when properly sized.
15. Protects original and substantial investment that has already been made; effectively limits growth into scenic South Park area (density of development).
D. Gravity flow; no pumping (ten foot existing lift now?); short-term option if site is kept long-term.
E. Low initial cost; better treatment; no odors; gravity flow.
F. J owns property; already there; people used to it there; K cost cheapest; can adjust for shifts in loading (shock loading); fits with land use plan; avoids scattered growth; minimal odor problem.

Alternative A-1

Do you believe this site is compatible with the proposed comprehensive land use plan?

2. Yes.

2. Yes.

3. Yes; according to plan, this would be the most effective because other places would be limited by growth by the problem of sewage disposal.

5. Yes, if it can be pumped.

6. Yes, if it can be pumped.

7. Yes.

8. Yes.

9. Yes.

10. Yes.

11. Yes, it is good to remember the work used is; I do not believe Teton County will buy the plan.

12. Yes.

13. Yes.

15. It is a prior existing use and, as such, is compatible under the "grandfather" clause.

D. Yes, would serve the expanded town.

E. Yes.

F. Yes.

Alternative A-1

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc.?

2. To some extent.

2. Lots of landscaping.

3. Trees and shrubs to do away with some visual destruction.

5. All, especially if school is built.

6. All, especially if school is built.

7. Alternative energy sources.

8. As much as possible.

9. Little.

10. Landscaping, odor.

11. Screening will be necessary (as in other areas of the town and county).

12. All of them -- disguise it.

13. Nothing out of the usual; fencing.

15. All of the above and more.

D. In an industrial area, but also in town and in a high density area.

E. Few.

F. Taking effluent to Snake River.

Alternative A-1

Do you prefer this alternative? Why?

2. Yes, mostly because it exists already; there is a large investment in it already.

3. Because they would use part of the present facility in the new system and save on building cost. I think if they use this site, there has to be strict regulations on septic tank systems below it in order to insure good underground drinking water.

4. No.

5. Yes, site located/benefits above.

6. This is an O.K. alternative; would limit growth and treat the effluent better. Perhaps effluent pipe to Snake?

7. This or Boyle's Hill lagoon.

8. Yes.

9. Yes, mainly for land use planning.

10. Yes.

11. See benefits.

12. Vaguely.

13. Yes, the mechanical system is reliable when properly designed and the present site has proven compatible with the community. This alternative allows the town to incorporate the existing system.

15. While greater O & M costs would eradicate any capital savings between this and other alternatives, it is preferable to pass increased costs onto consumers as they consume. That is, users should pay as they use; capital improvements benefit everyone and are funded by ad valorem taxes; those who use should pay the freight when they use. The property owner should only have to stand for a cost that is reasonably minimal and yet still adequate.

D. No. High cost of maintenance; prefer flow into Snake.

E. No. High cost of O & M; flows into Flat Creek.

F. Yes.

Alternative A-2
Boyle's Hill Site
Activated Sludge
Mechanical Plant

What problems do you see in constructing a sewage treatment plant at this site?

1. No.

2. High cost of M&O.

4. Best location.

5. High O&M costs and initial const. May be problem in getting land. Some pumping south plant.

6. High O&M costs and initial construction; may be problem in getting land; some pumping required.

7. Too expensive. Energy consumptive.

9. Pumping station.

10. Odor problem to skyline.

11. Bad (costly) sub water problem. Should not consider this site at all.

12. None.

13. None

D. Some pumping of south district; cost.

E. High cost of construction, O&M, some pumping from down south.

F. Most costly to operate and overall; land acquisition; possible opposition from neighboring landowners; loss of investment in present plant; true for not all but not at present site; on road.

15. High costs for capitalization; therefore high taxes; high O & M; therefore, high user costs.

Alternative A-2

What benefits?

1. None.
2. Reliable type of plant
4. Best location.
5. No odor; better dilution in Snake River; better treated effluent.
6. Better treated effluent; better dilution in Snake River, no odor.
7. No answer.
8. No answer.
9. It's above South Park; location fairly good.
10. Snake River receives effluent.
11. None.
12. It's a good position for Livingston's proposed high density area.
13. Permits gravity to site (from most of the area); located near anticipated high density growth area. Reliable system.
D. Outside town; will serve expanded community; odor free.
E. Encourage development in an area of least environmental impact, no odors, or interference with wildlife.
F. Minimal smell; fits w. plan; site already disturbed; convenient to town for maintenance people.
15. Perhaps easier to acquire land; limits growth potential to south and into scenic area.

Alternative A-2

Do you believe this site is compatible with the proposed comprehensive land use plan?

1. No.
2. Yes.
4. Yes.
5. Yes.
6. Yes.
7. Yes.
8. No answer.
9. Yes.
10. Yes.
11. No.
12. Yes.
13. Yes.
D. Yes.
E. Yes.
F. Yes.
15. Yes.

Alternative A-2

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc.?

1. No answer.
2. No answer.
4. No answer.
5. Well screened already...few if any.
6. Not sure.
7. Alt. energy sources.
8. No answer.
9. Cosmetics would be needed.
10. Landscaping.
11. D.N.A.
12. All of them.
13. No answer.
D. Well screened by terrain.
E. Few or none.
F. Screening necessary.
15. All of the above, plus .

Alternative A-2

Do you prefer this alternative: Why?

3. This location is protected.
5. No, very expensive.
6. No rather expensive.
7. No because of expenses.
8. No -- but preferable to South Park feed ground.
9. I find it better than most.
10. Yes.
11. No.
12. Yes -- this, or lagoon, above all others.
13. Yes, good location for mechanical plant, good system. I prefer expenasion at existing site but this is second favorite.
D. No -- expense; O&M.
E. No - High Costs - Best second alternative.
F. Yes, 5; No. 1
15. Conceivably, this alternative limits growth to the south, yet its costs are high. I am ambivalent about the trade-offs.

Alternative A-3a
Boyle's Hill Site
Aerated Stabilization Lagoon

What problems do you see in constructing a sewage treatment plant at this site?

1 No.

7. Odor from lagoon in residential area, part. new proposed expansion also.

9. Smell looks area needed.

10. Odor.

11. Bad (costly) subwater problem -- site should not even be considered.

12. Smell -- takes up a lot of space.

13. Compatibility with development (lagoons).

F. Odor - problem with surrounding landowners; land aquisition; in flood plain? extra engineering may be needed; ponds would need to be built up; location outfall in Snake River.

15. Large land requirements may impact area in a less than desirable way; some concern about odor and proximity to residential development.

Alternative A-3a

What benefits?

1. None.

7. location good.

9. Above So. Park (expansion).

10. Consistent with proposed density flows into Snake River.

11. None.

12. Same as A-2.

F. Fits with plan; cheap for O&M; cost effective to FPA.

15. Growth is limited to south; O & M is low, comparatively.

Alternative A-3a

Do you believe this site is compatible with the proposed comprehensive land use plan?

1. No.

7. Yes.

9. Yes.

10. Yes.

11. No.

12. Yes.

13. Yes.

F. Yes.

15. Yes, to the degree that scenic areas are preserved.

Alternative A-3a

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc.?

1 Conspicuous.

7. Alt. energy sources.

9. Smell alone makes this type sight poor for this sight.

10. Lansscaping.

11. D.N.A.

F. Build up and screen.

15. All of the above, plus.

Alternative A-3a

Do you prefer this alternative? Why?

1 No.

7. Yes, if odor problem can be resolved.

8. No, but preferable to South Park feedground.

9. No, would offend too many nearby residents.

10. Yes.

11. D.N.A.

12. Yes.

13. No, I don't feel it is a good location for lagoons.

F. Yes, 1. No. 5.

15. I am ambivalent about this as well.

Alternative A-4
Mid South Park Site
Aerated Stabilization Lagoon

What problems do you see in constructing a sewage treatment plant at this site?

1 Why spend this money when latteral transfer of property is possible.

4. Land owners.

7. Again, encourages growth further south.

8. Disturbing presently undeveloped areas.

9. Purchase of land.

10. Increases growth; 100-year flood plain.

11. Urbanization of rural country - should not happen.

12. Flood groundwater increase (development).

13. Groundwater?

15. Encourages and enables growth in an area better left untouched.

F. Land acquisition, probable opposition landowners. Too close to land under sceptic easement now; would encourage scattered growth; same problems in general as elk refuge site.

Alternative A-4

What benefits?

9. Gravitational theory.

10. None.

11. None.

12. Close to high density area but not close enough.

15. None readily identifiable.

F. One of cheapest for K & O&M.

Alternative A-4

Do you believe this site is compatible with the proposed comprehensive land use plan?

7. Probably.

8. No.

9. Semi.

10. No.

11. No.

12. Not enough to suit me.

13. Yes.

15. No.

F. Maybe or No.

Alternative A-4

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc?

7. Alt. Energy sources.

9. Again purchase and cosmetic.

11. D.N.A.

15. All of this and more besides.

F. Not enough.

Alternative A-4

Do you prefer this alternative? Why?

4. To open.

7. Third choice.

8. No.

9. No, but could accept it.

10. No.

11. D.N.A.

12. No. Would encourage development.

13. Not particularly.

15. No.

F. Yes, 1 No. 5.

Alternative A-5
South Park Road Site
(Near the Polo Club)
Aerated Stabilization Lagoon

What problems do you see in constructing a sewage treatment plant at this site?

1. No.

4. No.

7. Opens South Park to deer.

9. Not consistent with desired plan; very bad as far as vusual.

10. Increased development - sewer line in middle of South Park.

11. Urbanization of rural country -- should not be.

12. Encourage development.

13. Possible high groundwater table; would serve to open South Park to high density development and requires a humongous interceptor length.

15. Encourages undesirable growth pattern.

F. Same as Elk Feed ground site and Mid-South Park. Bad scenic impact.

Alternative A-5

What benefits?

1. No.

7. Paul Von Gontard ought to like it.

9. None.

10. None.

11. None.

12. Make some landowners rich when they develop.

15. Low O&M?

F. Less of ground water problem.

Alternative A-5

Do you believe this site is compatible with the proposed comprehensive land use plan?

7. Not particularly.

9. No.

10. No.

11. No.

12. No.

13. No.

15. No.

F. No.

Alternative A-5

What mitigation measures might be necessary here? Such as landscaping, fencing, unique architecture, etc.?

7. Alt. energy sources.

9. Visual effect - bad!

10. Landscaping fence.

11. D.N.A.

15. All of above plus....

F. Extensive landscaping.

Alternative A-5

Do you prefer this alternative? Why?

4. Too opened.

7. No. Some development problem.

8. No.

9. No bad location.

10. No.

11. No.

12. No. Development.

13. No. I do not feel the lagoon system is reliable and also the costs presented are substantially lower than the actual costs to be incurred with an aerated lagoon system.

15. No.

F. Yes, none, 6, No.

Alternative A-6
Interim Improvements
At the Existing Site

There is a short-term alternative of improving the existing plant to meet water quality standards. This would have capacity for the design year of 1980. In your opinion, would it be better to fund this inexpensive but short-term solution?

1 Last Resort.

2. Yes in view of the investment already expended and it would clarify matters right now.

7. Yes, it would give us more time to make the larger philosophical decision.

9. I'd rather build up the existing, but would except this.

10. No.

11. Yes, but work towards long-term solutions to keep Jackson plant here.

12. No.

13. No.

15. No, there is so little to be gained that it would be a useless exercise.

E. No.

Alternative A-6

If this option was chosen, what problems would arise when additional treatment capacity was needed?

2. That might not happen until 1990 and the whole situation might be changed.

7. Same old battle, but we might know more about the scenic area proposal and the future of S. Park.

9. $$$

10. Need to build another plant. Additional cost.

11. Site expansion is possible, difficult but possible.

12. More dull meetings to go to.

13. Commitment to present site rehash what we are doing tonight.

15. Simply a rehashing of problems currently being experienced. Same indecision, same options, only more expensive.

E. Higher costs - crash program.

Alternative Flow Capacity

Do you feel the estimated rate of growth is reasonable? Why?

1 Based on present growth percent and advertising on 1-1 basis.

7. No -- too high.

8. Yes.

9. Not entirely - fuel for cars in future might well decrease tourists, etc.

10. 6% too much. 3% or less is enough

12. I expect your figs. are accurate, altho like all newcomers, I'd prefer to see it less.

13. I feel it is slightly high but reasonable for design purposes.

15. No, there will be a level beyond which growth simply cannot continue as fast.

Alternative Flow Capacity

If the rate of growth is not as rapid as projected, the plant will have reserve capacity beyond the design year. What is your opinion on this?

1. Excellent.

7. That's great.

9. Better more than enough than not enough.

10. Fine.

12. It's an excellent idea.

13. Good.

15. The ability to serve growth dangles as an incentive to have growth whether it is advisable or not. If the capacity exists, someone will find an excuse to use it.

Alternative Flow Capacity

What percent increase in sewage plant capacity do you prefer, 275% (1990 design year), 330% (1995 design year) or some other percentage?

1 330%.

7. 1995 sounds cool to me.

8. Personal preference is for a reduction in capacity from present level-- and corresponding renovation in hookups. How about a 6% evacuation rate?

9. 1995 design year.

10. 330%.

12. 1995 design year.

13. 330%.

15. 20-year planning is reasonable in terms of reliable data and financial considerations, i.e, most municipal bonds mature on a 20-7ear cycle.

APPENDIX 4

PRELIMINARY REPORT
PALISADES RESERVOIR
NATIONAL EUTROPHICATION
SURVEY

PRELIMINARY REPORT

ON

PALISADES RESERVOIR

BONNEVILLE COUNTY, IDAHO

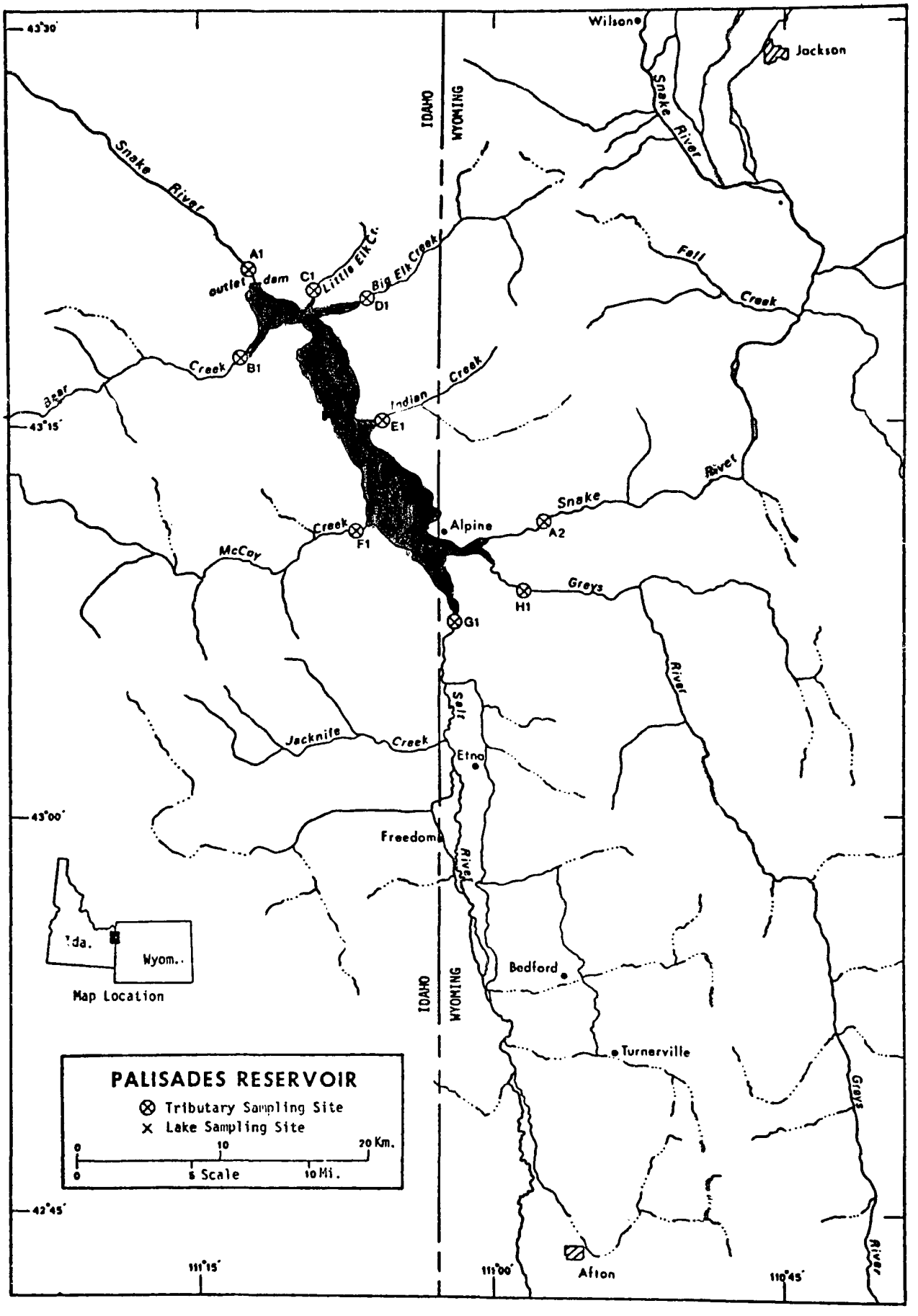
AND LINCOLN COUNTY, WYOMING

EPA REGION X

NOTICE

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

National Eutrophication Survey
CERL, Corvallis, Ore.
EMSL, Las Vegas, Nev.


43°30'
43°15'
43°00'
42°45'
111°15'
111°00'
110°45'
Wilson
Jackson
Snake River
IDAHO
WYOMING
Snake River
A1
outlet
dam
C1
Little Elk Cr.
Big Elk Creek
D1
Fall Creek
Creek
B1
Bear
Indian Creek
E1
Snake River
Alpine
A2
Creek
F1
McCoy
Greys
H1
G1
Salt River
Jacknife Creek
Etna
Freedom
Bedford
Turnerville
Afton
Greys River
Ida.
Wyom.
Map Location
PALISADES RESERVOIR
Tributary Sampling Site
Lake Sampling Site
0
10
20 Km.
0
5 Scale
10 Mi.

PRELIMINARY REPORT ON PALISADES RESERVOIR, IDAHO

STORET NO. 1610

I. CONCLUSIONS

A. Trophic Condition:*

On the basis of Survey data and field observations, Palisades Reservoir is considered mesotrophic. Of the 13 Idaho lakes sampled in 1975, 6 had higher median total phosphorus (0.024 mg/l) levels, 1 had higher median inorganic nitrogen values (0.080 mg/l) and 9 had higher median orthophosphorus (0.007 mg/l) levels than Palisades Reservoir. Chlorophyll a levels ranged from 0.8 µg/l to 5.6 µg/l with a mean of 2.1 µg/l. Potential for primary production as measured by algal assay control yields was generally low.

Survey limnologists did not observe any problem conditions during their visits to the lake. The Idaho Department of Water Resources, et al. (1975) reports the stretch of the Snake River above Heise which includes Palisades Reservoir is high quality water, and in stable condition.

*See Appendix E

B. Rate-Limiting Nutrient:

The algal assay results indicate that Palisades Reservoir was colimited during September sampling (09/18/75) and phosphorus limited during October (10/20/75). The reservoir data suggest nitrogen limitation at all three sampling times.

C. Nutrient Controllability:

1. Point sources -

There were no known point sources impacting Palisades Reservoir during the 1975 sampling year.

The calculated annual phosphorus loading of 6.25 g $P/m^2/yr$ is over three times that proposed by Vollenweider (1975) as "eutrophic" for a lake with such volume and retention time. If the present loading continues, increasingly undesirable responses to enrichment are likely to occur.

2. Nonpoint sources -

Nonpoint sources contributed all of the known nutrient loading to Palisades Reservoir during the sampling year. The Snake River contributed 68.9% of the total phosphorus load, the Greys River contributed 14.9%, and Salt River contributed 13.0%. Ungaged drainage areas were estimated to have contributed 0.9% of the total.

The phosphorus export rates of Greys River were substantially greater during the sampling year than the other tributaries

to Palisades Reservoir (Section IV-D). This inflation may be due to unidentified point sources rather than to nonpoint source inputs, but more extensive sampling is needed to determine the location and significance of these possible sources.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake surface area, mean depth and volume were provided by Martin and Hanson (1966). Tributary flow data were provided by the Idaho District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in NES Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 61.31 km^2.
2. Mean depth: 28.2 meters.
3. Maximum depth: ?
4. Volume: 1,732.560 x 10^6 m^3.
5. Mean hydraulic retention time: 108 days.

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area(km^2)	Mean flow (m^3/sec)
A-2 Snake River	8,984.7	128.99
B-1 Bear Creek	199.7	2.21
D-1 Big Elk Creek	153.3	1.96
E-1 Indian Creek	100.5	0.39
F-1 McCoy Creek	279.7	2.31
G-1 Salt River	2,198.9	21.42
H-1 Greys River	1,160.3	18.47
Minor tributaries and immediate drainage -	433.4	5.30
Total	13,510.5	181.05

2. Outlet - A-1 Snake River 13,571.6 185.83

C. Precipitation:

1. Year of sampling: 33.3 cm.
2. Mean annual: 27.4 cm.

III. LAKE WATER QUALITY SUMMARY

Palisades Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from five stations on the lake and from a number of depths at each station (see map, page i). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During September and October sampling, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 16.8 meters at Station 01, 8.5 meters at Station 02, 45.1 meters at Station 03, and 53.3 meters at Stations 04 and 05. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

PALISADES RESERVOIR
STORET CODE 1610

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER		(8/ 5/75) S*** = 4				(9/18/75) S*** = 4				(10/20/75) S*** = 4			
	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	
TEMPERATURE (DEG CENT)													
0.-1.5 M DEPTH	8	20.2- 21.1	20.9	0.0- 1.5	8	16.2- 17.2	17.1	0.0- 1.5	8	13.8- 14.2	14.0	0.0- 1.5	
MAX DEPTH**	4	10.0- 18.5	11.0	8.2- 53.3	4	12.2- 15.5	13.3	8.5- 53.3	4	11.9- 13.1	12.1	7.6- 51.8	
DISSOLVED OXYGEN (MG/L)													
0.-1.5 M DEPTH	8	5.4- 8.8	7.8	0.0- 1.5	8	6.8- 8.0	7.6	0.0- 1.5	8	7.9- 8.4	8.1	0.0- 1.5	
MAX DEPTH**	4	5.6- 7.6	7.5	8.2- 53.3	4	4.8- 7.4	6.0	8.5- 53.3	4	2.2- 8.6	8.1	7.6- 51.8	
CONDUCTIVITY (UMHOS)													
0.-1.5 M DEPTH	8	230.- 235.	231.	0.0- 1.5	8	227.- 232.	230.	0.0- 1.5	8	201.- 207.	205.	0.0- 1.5	
MAX DEPTH**	4	190.- 265.	208.	8.2- 53.3	4	200.- 248.	218.	8.5- 53.3	4	191.- 235.	214.	7.6- 51.8	
PH (STANDARD UNITS)													
0.-1.5 M DEPTH	8	8.3- 8.7	8.6	0.0- 1.5	8	8.3- 8.5	8.4	0.0- 1.5	8	8.3- 8.5	8.4	0.0- 1.5	
MAX DEPTH**	4	7.8- 8.7	8.3	8.2- 53.3	4	7.8- 8.3	7.9	8.5- 53.3	4	7.6- 8.4	8.1	7.6- 51.8	
TOTAL ALKALINITY (MG/L)													
0.-1.5 M DEPTH	8	98.- 112.	110.	0.0- 1.5	8	109.- 114.	110.	0.0- 1.5	8	115.- 203.	122.	0.0- 1.5	
MAX DEPTH**	4	111.- 117.	112.	8.2- 53.3	4	110.- 118.	113.	8.5- 53.3	4	115.- 144.	134.	7.6- 51.8	
TOTAL P (MG/L)													
0.-1.5 M DEPTH	8	0.011-0.082	0.018	0.0- 1.5	8	0.020-0.033	0.028	0.0- 1.5	8	0.012-0.027	0.015	0.0- 1.5	
MAX DEPTH**	4	0.013-0.127	0.020	8.2- 53.3	4	0.023-0.103	0.051	8.5- 53.3	4	0.012-0.044	0.025	7.6- 51.8	
DISSOLVED ORTHO P (MG/L)													
0.-1.5 M DEPTH	8	0.003-0.018	0.008	0.0- 1.5	8	0.002-0.010	0.003	0.0- 1.5	8	0.005-0.007	0.006	0.0- 1.5	
MAX DEPTH**	4	0.012-0.019	0.017	8.2- 53.3	4	0.002-0.023	0.015	8.5- 53.3	4	0.005-0.029	0.007	7.6- 51.8	
NO2+NO3 (MG/L)													
0.-1.5 M DEPTH	8	0.020-0.020	0.020	0.0- 1.5	8	0.020-0.040	0.020	0.0- 1.5	8	0.040-0.080	0.065	0.0- 1.5	
MAX DEPTH**	4	0.020-0.170	0.095	8.2- 53.3	4	0.040-0.180	0.135	8.5- 53.3	4	0.050-0.270	0.095	7.6- 51.8	
AMMONIA (MG/L)													
0.-1.5 M DEPTH	8	0.020-0.040	0.020	0.0- 1.5	8	0.020-0.020	0.020	0.0- 1.5	8	0.020-0.020	0.020	0.0- 1.5	
MAX DEPTH**	4	0.020-0.060	0.030	8.2- 53.3	4	0.020-0.050	0.020	8.5- 53.3	4	0.020-0.030	0.025	7.6- 51.8	
KJELDAHL N (MG/L)													
0.-1.5 M DEPTH	8	0.200-0.300	0.200	0.0- 1.5	8	0.200-0.200	0.200	0.0- 1.5	8	0.200-0.200	0.200	0.0- 1.5	
MAX DEPTH**	4	0.200-0.200	0.200	8.2- 53.3	4	0.200-0.200	0.200	8.5- 53.3	4	0.200-0.200	0.200	7.6- 51.8	
SECCHI DISC (METERS)													
	3	2.1- 4.8	2.7		4	4.0- 5.5	4.6		4	4.6- 6.1	5.1		

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton - Not available at this time.

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
08/05/75	01	0.8
	02	3.1
	03	1.4
	04	1.4
	05	1.0
09/18/75	01	5.6
	02	2.4
	03	1.7
	04	2.4
	05	1.6
10/20/75	01	4.2
	02	2.3
	03	1.3
	04	0.9
	05	0.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 09/18/75 Stations 01-03

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.015	0.075	1.8
0.05 P	0.065	0.075	2.4
0.05 P + 1.0 N	0.065	1.075	6.2
1.00 N	0.015	1.075	2.9

Stations 04-05

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.005	0.050	0.3
0.05 P	0.055	0.050	1.0
0.05 P + 1.0 N	0.055	1.050	16.8
1.00 N	0.005	1.050	0.2

b. 10/20/75 Stations 01-03

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.005	0.070	0.3
0.05 P	0.055	0.070	2.3
0.05 P + 1.0 N	0.055	1.070	25.5
1.00 N	0.005	1.070	0.3

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary production in Palisades Reservoir was low during September for sampling Stations 04, 05, and during October for Stations 01-03, but high in September for Stations 01-03. In the October and September (Stations 04, 05) assays, the addition of orthophosphorus alone produced a significant increase in yield over that of the control, indicating phosphorus limitation. The addition of nitrogen alone did not result in any increase in yield over that of the control in those samples. In the September (Stations 01-03) assay, a growth increase accompanied the addition of either phosphorus or nitrogen alone, suggesting colimitation by the two nutrients.

The mean inorganic nitrogen to orthophosphorus ratios (N/P) in the lake data were less than 13/1 on all sampling occasions, suggesting nitrogen limitation in the lake (a mean N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Idaho National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page i), except for the high runoff month of June when two samples were collected. Sampling was begun in October 1974, and was completed in September 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Idaho District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $kg/km^2/year$, in Big Elk Creek, Indian Creek and McCoy Creek at Stations D-1, E-1 and F-1 and multiplying the means by the ZZ area in km^2.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Snake River	263,880	68.9
B-1 Bear Creek	3,775	1.0
D-1 Big Elk Creek	1,705	0.4
E-1 Indian Creek	1,035	0.3
F-1 McCoy Creek	1,180	0.3
G-1 Salt River	49,860	13.0
H-1 Greys River	57,260	14.9
b. Minor tributaries and immediate drainage (nonpoint load) -	3,465	0.9
c. Known municipal STP's - None		
d. Septic tanks* -	10	<0.1
e. Known industrial - None		
f. Direct precipitation** -	1,075	0.3
Totals	383,245	100.0%

2. Output - A-1 Snake River 126,270

3. Net annual P accumulation - 256,975

*Estimate based on 30 lakeshore residences and 2 camps.
**Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source		kg N/yr	% of total
a.	Tributaries (nonpoint load) -		
	A-2 Snake River	2,351,245	65.5
	B-1 Bear Creek	24,435	0.7
	D-1 Big Elk Creek	26,350	0.7
	E-1 Indian Creek	13,160	0.4
	F-1 McCoy Creek	21,525	0.6
	G-1 Salt River	824,330	23.0
	H-1 Greys River	207,995	5.8
b.	Minor tributaries and immediate drainage (nonpoint load) -	55,040	1.5
c.	Known municipal STP's - None		
d.	Septic tanks* -	460	<0.1
e.	Known industrial - None		
f.	Direct precipitation** -	66,190	1.8
	Totals	3,590,730	100.0%

2. Outputs - A-1 Snake River 2,920,000

3. Net annual N accumulation - 670,730

*Estimate based on 30 lakeshore residences and 2 camps.
**Estimated (See NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Snake River	29	262
Bear Creek	19	122
Big Elk Creek	11	172
Indian Creek	10	131
McCoy Creek	4	77
Salt River	23	375
Greys River	49	179

E. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
C-1 Little Elk Creek	0.020	0.259

F. Yearly Loadings:

In the following table, the existing phosphorus loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" and "oligotrophic."

Note that Vollenwieder's model may not be applicable to water bodies with very short retention times or in which light penetration is severely restricted from high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading ($g/m^2/yr$)
Estimated loading for Palisades Reservoir	6.25
Vollenweider's "eutrophic" loading	1.84
Vollenweider's "oligotrophic" loading	0.92

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