Colorado Department of Public Health and Environment
Radioactive Materials License 1102-01
Renewal Application

Volume 3 of 7

Contents:

Browning-Ferris Industries, Inc. (BFI). 1981. *Chemical Waste Treatment/Solidification & Disposal Facility Plan.* Volume 1 – Technical Report. Highway 36 Land Development Company, Adams County, Colorado, Draft for Review and Comment.

February 2010

Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, CO 80105-9611

Log Book Entry #134

HIGHWAY 36 LAND DEVELOPMENT COMPANY
P.O. BOX 207 • BYERS, COLORADO 80103 • (303)386-2212

April 6, 1981

Mr. Jim L. Considine
Assistant Planning Director
Board of County Commissioners
450 South 4th Avenue
Brighton, Colorado 80601

Re: Highway 36 Land Development Company;
Application for Certificate of Designation;
Facility Plan Report

Dear Mr. Considine:

On behalf of Highway 36 Land Development Company, we are pleased to present the Adams County Planning Department with the Chemical Waste Treatment/Solidification and Disposal Facility Plan for our facility in Adams County. As requested, 85 copies of the report (in two volumes) have been transmitted for your distribution to various agencies and citizens groups (listed in Chapter 10). Please note the following:

- As requested, a list of property owners within six miles of the site has been included under separate cover from H.N.T.B.

- To aid in summarizing specific requirements for the facility plan, Table 1.1 in Chapter 1 was prepared. This table serves to index these requirements, the respective requirements of the regulatory agencies, and locations where they are found in the facility report.

- All reports have been numbered to facilitate distribution of subsequent information/addendums. To assure all copies which the Adams County Planning Department receives for distribution are kept up to date and complete, it is preferred that addendums be mailed to the appropriate agencies/citizens groups via registered mail, return receipt requested.

- All comments/questions on the report should be written and submitted direct to:

  Mr. Robert W. Anzia
  H.N.T.B.
  7500 West Mississippi, Suite 41
  Lakewood, Colorado 80226

It would be greatly appreciated if written comments were received within 30 days. We look forward to serving Colorado with a properly managed waste treatment/solidification and disposal facility.

Sincerely,

R. A. Johnson

R. A. Johnson
President

Steve Custer

Steve Custer
District Manager

RAJ/SC/lr

CHEMICAL WASTE TREATMENT/SOLIDIFICATION & DISPOSAL FACILITY PLAN

VOLUME I - TECHNICAL REPORT

HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO

A WHOLLY-OWNED SUBSIDIARY OF
BROWNING-FERRIS INDUSTRIES, INC.

APRIL, 1981

PREPARED BY:

HOWARD NEEDLES TAMMEN & BERGENDOFF
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LIST OF EXHIBITS

LIST OF ABBREVIATIONS

A	- area of drainage basin in acres
AA	- atomic absorption spectroscopy
ADT	- average daily traffic
BFI	- Browning-Ferris Industries, Inc.
BPI	- buying power index
C	- rainfall runoff coefficient
CC	- continuously cored
CFR	- Code of the Federal Regulations
cfs	- cubic feet per second
cm/sec.	- centimeters per second
CO	- carbon monoxide
COD	- chemical oxygen demand
cu.ft./min.	- cubic feet per minute
dBA	- decibels
DOT	- U.S. Department of Transportation
EBI	- effective buying income
EPA	- U.S. Environmental Protection Agency
ft./min.	- feet per minute
GC	- gas chromatography
HC	- hydrocarbons
HPLC	- high pressure liquid chromatography
Hwy 36	- U.S. Highway 36
I	- rainfall intensity
$lb./ft.^2$	- pounds per square foot
$lb./ft.^3$	- pounds per cubic foot
Leq	- equivalent sound level
MG	- million gallons
mg/kg	- milligram per kilogram
mg/l	- milligram per liter
mg/m^3	- milligram per cubic meter
MSL	- mean sea level
MW	- monitoring well
NAAOS	- National Ambient Air Quality Standards
NEPA	- National Environmental Policy Act
NFPA	- National Fire Prevention Association
NHPA	- National Historic Preservation Act
NO_2	- nitrogen dioxide
O_3	- ozone
OSHA	- Occupational Safety & Health Act
pCi/l	- picocuries per liter
PL	- Public Law
ppm	- parts per million
PSC	- Public Service Company of Colorado
Q	- maximum rate of runoff
R	- range
RCRA	- Resource Conservation & Recovery Act
S.H.	- State Highway
SO_2	- sulfur dioxide
SPCC	- Spill Prevention Control and Countermeasures
SWDSFA	- Solid Waste Disposal Siting and Facilities Act
T	- township
t_c	- time of concentration

List of Abbreviations
(Continued)

TLV	- threshold limit values
TSD	- treatment/storage/disposal facilities
TSP	- total suspended particulates
TOC	- total organic carbon
TOX	- total organic chlorides
ug/m^3	- micrograms per cubic meter
USDA	- U.S. Department of Agriculture
USGS	- United States Geological Survey
v/c	- velocity to capacity ratio
vph	- vehicles per hour
WW	- water well

LIST OF PREPARERS

Name	Company	Responsibility
Robert A. Johnson	Browning-Ferris Industries, Inc. and Highway 36 Land Development Co.	Vice President of Chemical Waste Operations; President
Steven G. Custer	Highway 36 Land Development Co.	District Manager
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Ralph E. Roper, Jr., PhD., P.E.	Howard Needles Tammen & Bergendoff	Facility Plan Project Manager
Regan A. Heath, CPGS	F. M. Fox & Associates	Geology and Hydrogeology
Victor R. Johnson, Jr., P.E.	Harding-Lawson Associates	Operations Monitoring Plans and Waste Inventory
Keith C. Price	Howard Needles Tammen & Bergendoff	Environmental Inventory and Assessment
John R. Jaeckel, P.E.	Howard Needles Tammen & Bergendoff	Air Pollution and Noise

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Regan A. Heath, CPGS

CHAPTER 1

SUMMARY

1.1 BACKGROUND

In 1980, the Highway 36 Land Development Company, a wholly-owned subsidiary of Browning-Ferris Industries of Colorado, Inc., herein referred to as BFI, acquired nine sections of land in Adams County, Colorado. A portion of the land is to be used for development of a chemical waste treatment, solidification, and disposal facility. The particular location was selected on the basis of a number of favorable factors, and in accordance with existing and anticipated environmental protection regulations. These factors are summarized below.

1.2 SITE SELECTION

When BFI selected the Adams County site, its geologic strengths were considered to be of prime importance. As shown in Figure 1.1, the site is indeed within the area defined by the Colorado State Department of Health as being most suitable for development of hazardous waste disposal facilities. This map was prepared by the Colorado Department of Health to depict favorable areas for the development of hazardous waste disposal sites(1).

Important considerations and requirements for site selection which are all satisfied at the Highway 36 Land Development Company Adams County site include:

- o suitable geologic conditions;
- o conveniently located near waste sources;
- o sparcely populated area;
- o good transportation access;
- o no adverse environmental impact anticipated;
- o availability of utilities;
- o land availability and site size requirements;

- o no nearby airports;
- o favorable topography;
- o soils suitable for liner material;
- o not located within a corridor of growth (as a site near Colorado Springs or Pueblo might be);
- o not within fault zone;
- o not within flood plain of 100 year flood;
- o not located within wetland area;
- o no impact on endangered or threatened species and critical habitats;
- o extensive buffer zone;
- o not located in aquifer recharge zone;
- o favorable evaporation rates with minimal rainfall.

BFI is constructing a facility complex for the management and disposal of hazardous wastes at the Adams County site. Construction of this facility commenced on November 4, 1980 and is continuing. The facility consists of two levels of operation. In the initial level of operation, herein after referred to as Phase I, BFI will utilize state-of-the-art techniques for chemical waste disposal consisting of clay-lined earthen cells for waste solidification. In the second level of operation, herein after referred to as Phase II, BFI will utilize concrete tanks for treatment and solidification, enclosing the entire operation in a building. Both phases will utilize clay-lined secure disposal cells for solidified product disposal.

The facility will be operated and maintained under enforcement and regulatory authorities exercised by the Colorado Department of Health and the U.S. Environmental Protection Agency (EPA), according to the requirements established for such facilities under the Resource Conservation and Recovery Act (RCRA). The technology being utilized is based on prior experience and proven capability of Browning-Ferris Industries, Inc.

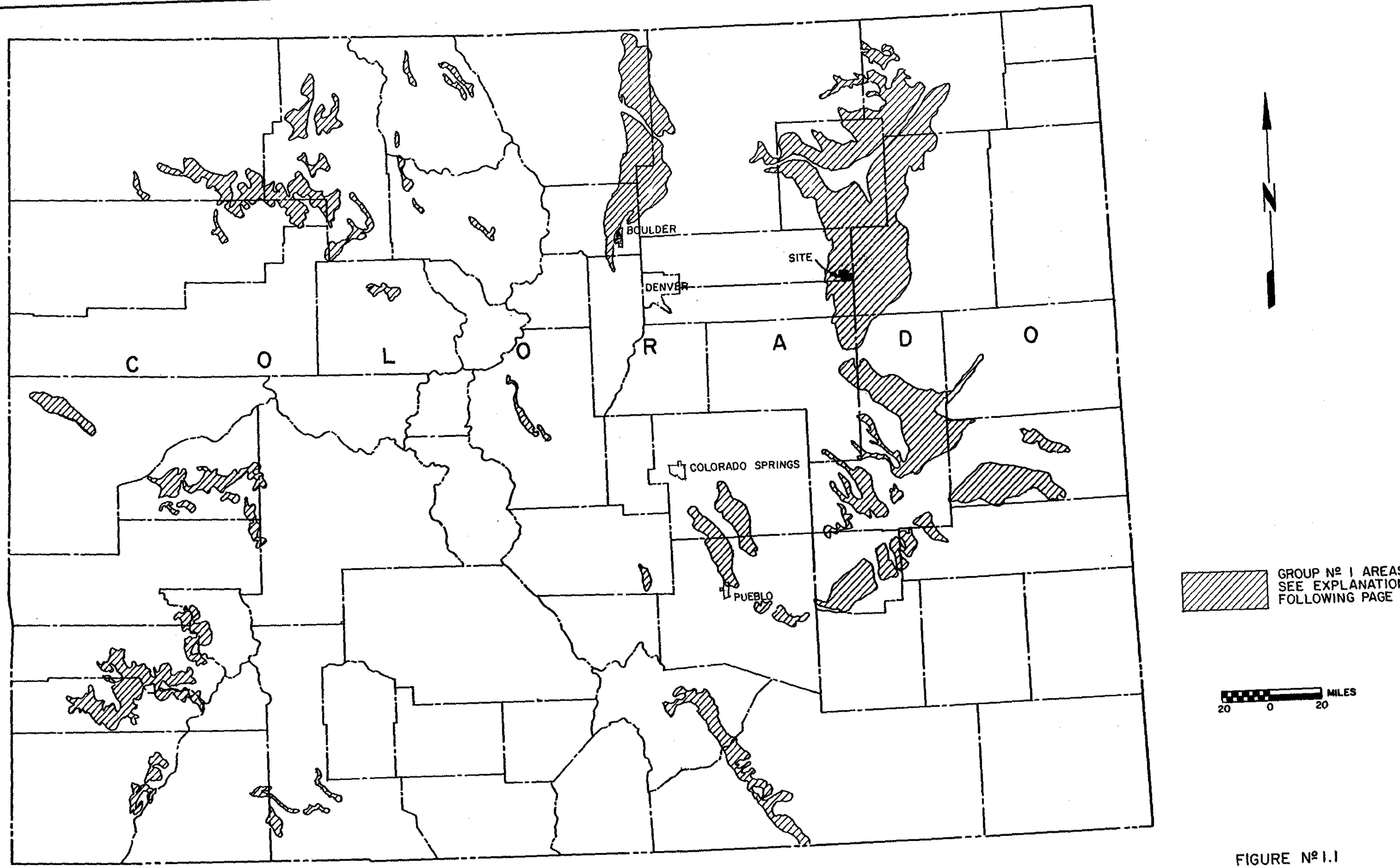


FIGURE Nº 1.1
OPTIMUM AREAS FOR
HAZARDOUS WASTE DISPOSAL
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

SOURCE: REFERENCE 1

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

In the Fall of 1980, the facility qualified for "interim status" under the EPA's hazardous waste management regulatory program. The U.S. EPA identification number assigned for the facility is COTO90010620. Interim status notification from the EPA is given in Appendix C.

1.3 NEED FOR THE FACILITY

Industrial wastes are an integral and inevitable part of our economy. In supplying America with the abundance of goods and services that contribute to our nation's exceptionally high standard of living, some 750,000 businesses--representing all types of industrial and commercial enterprises--generate by-products which are wastes that can be hazardous. Some of the products whose manufacturing processes result in potentially hazardous wastes are themselves lifegiving--artifical limbs, heart pacemakers, surgical implants, and membranes. Others are so much a part of the American scene--blue jeans, televisions, cars, telephones, leather--it is hard to imagine a world without them.

The types of industrial wastes which are to be received and treated at this facility include solid and liquid waste which, if mismanaged, can be harmful to human, animal, aquatic, or plant life. Such industrial wastes include spent acid solutions, sludges, tank bottoms containing heavy metal ions, aqueous solutions of inorganic chemicals, and materials such as paper, metal, cloth, or wood contaminated with industrial waste. In the general public's mind, these wastes are often referred to as "hazardous wastes." However, these wastes are only truly hazardous when they are mismanaged--that is, dumped in an uncontrolled manner, often illegally, into sewers, open dumps, and other unregulated locations. Fortunately, these wastes can be handled in a safe, environmentally sound manner.

The proper management of hazardous wastes has become a focal point of great concern throughout the nation. EPA has documented over 400 cases of health or environmental damages due to improper hazardous waste management resulting from one of the following(2):

- direct contact with toxic wastes;
- fire and explosions;
- groundwater contamination via leachate;
- surface water contamination via runoff or overflow;
- air pollution via open burning, evaporation, and wind erosion;
- poison via the food chain (biomagnification).

EPA has estimated that 90% of the 35-50 million metric tons of hazardous chemical wastes generated annually in the United States are handled by practices that will not meet stringent new Federal standards(2). Currently, these wastes are being disposed of in non-secure ponds, lagoons, or landfills or are incinerated without proper controls.

The State of Colorado has an equally urgent need for proper hazardous waste management, as revealed by Colorado's Department of Health survey of current industrial chemical waste disposal practices. Conclusions made from this survey stress the immediate need for proper hazardous waste management facilities(1):

- Hazardous wastes are now and have been going to inadequately designed landfills, and the potential exists for serious groundwater and other environmental pollution.

- There are no existing facilities designed for the disposal and "permanent containment" of the hazardous wastes generated in the State of Colorado. The large majority of such wastes are presently going to substandard facilities not designed to handle these wastes and, therefore, the potential exists for widespread contamination of groundwater and the environment throughout the State.

- A hazardous waste disposal site is needed immediately in Colorado to properly dispose of the large volumes of hazardous materials without creating a serious hazard.

- Unless a site is approved and made available, these wastes will have to be shipped out-of-state to acceptable disposal facilities and this would impose considerable costs on industry in Colorado for transportation, packaging, and disposal.

- Geographically the site(s) should be located along the Front Range urban corridor where 99.7% of these wastes are generated. A site should be located somewhere reasonably close to the Denver metropolitan area where almost 40% of the total hazardous waste is generated.

Colorado generates approximately 855,000 tons of potentially hazardous wastes annually(1). It is the intent of BFI to provide a facility for the treatment, solidification, and disposal of a portion of these wastes in a fashion that meets or exceeds the requirements of Federal, State, and local governments. A facility of this type would afford the following advantages to the State of Colorado:

- provide environmental protection for disposed wastes;

- reduce the amount of hazardous wastes going to unsuitable landfills and other inadequate facilities;

- provide incentives for industrial growth due to the availability of adequate, secure, hazardous waste disposal facilities;

- reduce costs of hazardous waste disposal to industries in Colorado which must now transport wastes long distances out of state to get to approved disposal facilities.

- provide Colorado with a suitable site for hazardous waste disposal in accordance with the Federal Comprehensive Environmental Release Compensation and Liability Act of 1980 ("Superfund Bill"). The EPA requires that a suitable site be available to qualify for and obtain superfund monies which allow for the clean-up of areas contaminated by hazardous wastes.

Numerous reports and studies have acknowledged the need for properly designed and operated chemical waste disposal facilities, particularly in the Colorado area. Indeed the Governor, in his "State of the State" address, has cited hazardous wastes as one of Colorado's critical stewardship issues(3).

1.4 CHEMICAL WASTE TREATMENT MANAGEMENT PHILOSOPHY

BFI has supported RCRA and EPA's strategy in implementing the Congressional mandates of the Act. BFI worked with the National Association of Solid Waste Management, the U.S. EPA, the American Association of State and Territorial Solid Waste Management Officials, the U.S. Congress, and others prior to the passage of RCRA in order to support development of comprehensive legislation for proper hazardous waste management. With respect to the overall hazardous waste control program being developed by the U.S. EPA, BFI has supported, and continues to support, the objectives of RCRA; particularly, to promote the protection of health and the environment and to conserve valuable material and energy resources. These objectives have been reached by regulating the treatment, storage, transportation, and disposal of hazardous wastes which can have adverse effects on health and the environment. BFI believes there is a national need for the proper management of hazardous wastes and that such management can be safely assured in the public's interest by establishing a cooperative effort among Federal, State, and local governments and private enterprise. Furthermore, BFI recognizes the importance and necessity to consider and balance the economic impact and/or benefit which may result from improved protection of our environment.

1.5 FACILITY OVERVIEW

1.5.1 General

Chemical wastes are received in one of three forms: solid, liquid, or an intermediate sludge, and may be in bulk quantities or containerized in drums. Solids normally present the fewest management problems. Liquid wastes can transmit hydraulic forces and, if merely buried, cannot readily be rendered immobile. BFI's management philosophy is to treat the wastes in such a manner that they become inert or physically immobile to the greatest extent possible. Consequently, each waste stream is custom engineered to ascertain the best treatment and disposal methods.

Before BFI contracts for the treatment and disposal of an industrial waste, a sample of the material is sent to the BFI corporate central laboratory in Houston, Texas. There the materials are evaluated and classified by trained chemists, using tests recognized by scientific authorities and the U.S. EPA. The results of these tests are used to determine the best, most environmentally acceptable treatment and disposal method. The wastes are then re-checked when received at the facility to ensure that the material being received is indeed the material expected.

The primary treatment methods to be used are neutralization, oxidation, reduction, and stabilization. The neutralization process is particularly applicable to spent pickle liquors and industrial waste acids. Lime or other alkaline additives, including compatible waste caustics are used to bring about the neutralization. Elevation of the pH allows heavy metals to precipitate from the neutralized wastes. The remaining neutralized sludges are then solidified and deposited in secure disposal cells.

More advanced treatment may involve oxidation-reduction reactions such as the reduction of hexavalent chromium, which is water soluble, with ferrous iron. In this reaction, the chromium is reduced to trivalent chromium which is essentially insoluble at an alkaline pH. Final treatment consists of neutralization and solidification.

Many industrial chemical wastes are of a semisolid nature. They are too high in solids content to treat and discharge to surface waters, yet are not sufficiently immobilized to allow burial in even a properly designed, secure disposal cell. BFI's policy is to use both chemical and physical stabilization for such wastes where this action promotes long-term security in the final disposal environment.

Chemical stabilization consists of neutralization, lime stabilization, or some other "chemical" treatment. Physical stabilization may be accomplished by solidification using moisture absorption with a dry alkaline material such as waste kiln dust or Portland cement. The purpose of the kiln dust or Portland cement is to convert a potentially mobile semisolid waste to an immobile solid waste. BFI utilizes a proprietary chemical fixation process called LIOWACON®, which combines both chemical and physical stabilization. This state-of-the-art process consists of mixing chemical reagents with certain inorganic waste streams which transforms the waste material from a pumpable semisolid to a relatively inert solid.

Because the preferred solidifying agents are themselves waste by-products, the operation has the added benefit of conserving natural resources. In addition, where appropriate, further conservation of natural resources will be accomplished by recycling waste acids and caustics for waste-to-waste pH neutralization.

1.5.2 Adams County Treatment/Solidification and Disposal Site Facility Overview

As illustrated in Figure 1.2, the facility is located on a portion of nine sections of land in southeast Adams County, adjoining Washington and Arapahoe Counties. Although the entire parcel is owned by BFI, only the

FIGURE №. 1.1 EXPLANATION

INFORMATION SERIES 14
PLATE 1
1980

EXPLANATION

HOST ROCK SUITABILITY CLASSIFICATION SCHEME

The formations ranked below are divided into most suitable and marginally suitable host media for storage of hazardous waste. This selection is based on the following criteria (further discussed in the explanation and accompanying text):

- Contain a minimum thickness of 150 feet of impermeable shale or clay with in-place permeabilities less than 1×10^{-7} cm/sec. (0.1 ft/yr)
- Outside of ground water recharge/discharge areas.
- Outside of floodplain-Quaternary-Tertiary valley fill basins/drainage.
- Tectonically stable, structurally simple.
- Not within close proximity of igneous or geothermal activity.
- Areas with lowest sediment yield ranging from 0 < 0.2 acre ft/sq mi/yr are ranked "a" and those with sediment yield ranges from 0.2 to 0.5 acre ft/sq mi/yr are ranked "b" to reflect susceptibility to erosion. Covered areas are not ranked with respect to erosion susceptibility.

Group 1 Optimum conditions for potential storage of non-nuclear hazardous industrial waste, include the following argillaceous formations (except where highly fractured):

Pierre Shale of eastern Colorado (includes upper and lower sections)

Mancos Shale of western Colorado

Lewis Formation of northwestern and west central Colorado

San Jose Formation of southwestern Colorado

Group 2 Marginal suitability potential storage of non-nuclear hazardous industrial waste including the following argillaceous formations:

Pierre Formation - Middle Section of eastern Colorado.

Dawson Arkose, including Denver Formation of east-central Colorado.

Laramie Formation of east-central Colorado

Niobrara Formation of southeastern Colorado

Benton Shale, including Carlile and Graneros Shale members, of southeastern Colorado

Wasatch Formation of northwestern Colorado

Lance Formation of northwestern Colorado

Contact

Covered formation contact

DISCUSSION

Introduction

One of the more common methods employed to achieve long-term isolation of hazardous wastes from the environment is secure burial at a carefully selected and managed hazardous waste disposal site. The purpose of this map is to identify and rank generalized areas within the State of Colorado which, based upon reconnaissance studies, appear to be favorable for storage of non-nuclear, industrial wastes. This map has been generated from sources of information best characterized as regional in nature and therefore is not intended to provide site-specific information pertaining to the suitability of a particular locality for storage of such waste.

The suitability classifications presented here are based on evaluation of geologic, hydrologic, and physiographic conditions only. Other factors, such as access or population density were not considered. Many geologically suitable areas will be eliminated from final consideration on the basis of other such factors.

The map shows the areas where the physical conditions fall into a given category. Suitable sites can be found within these areas. However, detailed analysis may reveal local exceptions where conditions do not conform to the stated criteria. Conversely, there may be suitable locations outside the indicated areas. However, the likelihood of finding and developing such sites is much lower and the expense will probably be significantly greater than in the specified areas. In the great majority of cases, the map will prove accurate as determined by the stated criteria. This map is intended to be an effective tool for generalized hazardous waste planning and should serve as a guide for site selection. It should not be used as a substitute for detailed analysis of specific sites.

Numerous physical characteristics must be considered in the evaluation of potential hazardous waste disposal sites. These include hydrology, geology, geochemistry, structural geology, geomorphology, climatology, and mineral resources. Pertinent aspects of each of the above criteria and the areal classification scheme for suitable areas within Colorado are summarized here and are discussed in greater detail in the accompanying text.

HYDROLOGY

The single most important consideration in the development of suitability criteria for hazardous waste disposal sites is the protection of ground and surface water from contamination by leaking wastes or secondary byproducts. Surface water can be contaminated by runoff or introduction through recharge of ground water which has been polluted and vice versa. Protection of aquifers--geologic rock units which contain water and are, or can be utilized by man--is extremely important.

General Criteria

- A minimum thickness of 150 ft of impermeable material between the site and any aquifer (or potential aquifer).
- The actual disposal excavation should be below the interface between bedrock and the overlying surficial material. The landfilled waste material should lie entirely within the containing medium below the top of the bedrock.
- A thorough evaluation of specific sites should include:
  1. the direction and rate of groundwater flow,
  2. depth to the water table,
  3. presence of aquifers should be ascertained and their relationship to the site, the surrounding area, and its hydrology should be evaluated.
- A minimum distance of 100 ft of impermeable material must be maintained between the bottom of any proposed excavation and historical high water table.
- A minimum distance of one mile to any perennial stream channel or positive isolation from the stream by local topography.
- Avoidance of physiographic floodplain and low terraces.

GEOLOGY

Geologic conditions in the vicinity of a proposed waste disposal facility must be thoroughly analyzed. The lithology, permeability, thickness, and areal extent of the formation(s) present must be well understood and determined to be well suited for hazardous waste disposal.

Minimum permeability and thickness for suitability as a hostrock on this map are 10^{-7} cm/sec (10^{-3} gallons/day/ft^2-0.1 ft/year) and 150 feet of homogeneous shale or clay.

Geologic hazards such as avalanches, landslides, rockfalls, mudflows, debris fans, unstable slopes, excessive erosion, seismic activity, and ground subsidence must be avoided.

Suitable Host Rock Formations

Group I - Formations with highest potential for safe, long term containment of hazardous waste

1. Pierre Shale - (upper and lower sections) eastern plains area, eastern Colorado
2. Mancos Shale - northwestern, southwestern Colorado
3. Lewis Shale - northwestern Colorado
4. San Jose Formation - southwestern Colorado

Group II - Formations with marginal potential for safe storage of hazardous waste

1. Pierre Shale - (middle section) eastern plains area, eastern Colorado
2. Niobrara Fm.- eastern, southeastern Colorado
3. Wasatch-Lance Formations - northwestern Colorado
4. Benton Group - eastern Colorado
5. Laramie Formation - eastern plains area, eastern Colorado
6. Denver-Dawson Formation - eastern plains area, eastern Colorado

GEOCHEMISTRY

The chemical and physical compatibility of the host medium and waste material must be such that long term suitability within the closed system can be achieved and maintained. Detailed geochemical, mineralogical, and physical investigations must be conducted by empirical methods in order to precisely demonstrate the exact nature of the compatibility between the waste material and selected formations.

Recommendations

1. Perform detailed mineralogical, physical, and chemical studies on the selected clay mineral(s) in order to determine their exact suitability or compatibility with the various types of pollutants (organic and/or inorganic).
2. Determine the chemical-physical relationship between the clay mineral(s) and the specific wastes to be disposed of by conducting laboratory studies coupled with in situ (on the site) observations. Various physical and chemical parameters to consider include: pH, Eh ion exchange capacities, precipitation products, etc., of the clay mineral and the type(s) of pollutant.
3. Frequent field inspections, such as soil and water sampling, should take place during operation of the facility in order to assure that a closed system between the waste disposal site and the surrounding media is constantly maintained and to verify or modify the assumptions and interpretations utilized in the original suitability studies.

STRUCTURAL GEOLOGY

Structural geology is the study of the deformation of rocks, including folding and faulting. Structural or tectonic activity usually tends to modify the bulk characteristics of rock units in a manner that is deleterious to suitability of the rock as a hazardous waste disposal site.

Faults, joints, and fractures can serve as a conduit for the passage of fluids within a rock mass. Known faults should be avoided because of their possible deleterious affects on a site.

General Criteria

- The geologic structure of the area should be simple enough to be well understood and evaluated with respect to site suitability.
- Thorough site investigation to reveal the presence of faulting and jointing within the general study area.
- A minimum of one mile to any major fault/tectonic feature.
- Select areas that are devoid of moderate to severe structural deformation.
- Avoid areas in close proximity to igneous or geothermal activity.
- Avoid areas of anomalous heat flow gradients.

GEOMORPHOLOGY

Topography and slope characteristics should be evaluated to insure long term protection from excessive surface erosion. Low slopes, less than 2%, generally do not provide positive drainage, resulting in surface retention, ponding, and possible high rates of infiltration. Slopes greater than 5% are subject to relatively high rates of erosion which can cause eventual breaching of the repository cells and escape of hazardous materials.

Local topographic highs, such as buttes and mesas, will erode at a faster rate than surrounding areas. Streams tend to dissect these areas and provide a means of transporting hazardous wastes from the disposal site.

Recommendations

- Stable surface, such as low drainage divides, not subject to erosion greater than 0.5 $\frac{\text{acre ft}}{\text{mi}^2/\text{yr}}$
- Areas with base levels which are appreciably higher than surrounding areas should be avoided.
- Natural slope should be between 2% and 5%.

CLIMATOLOGY

Climatic considerations for hazardous waste disposal sites include precipitation, evaporation, wind, and attendant erosion. Areas prone to frequent severe thunderstorm activity and flooding should be avoided because of the deleterious effects on a hazardous waste disposal site. Wind velocity and duration should be major factors involved in the analysis of a potential site. Severe winds (greater than 50 mph) can cause containment and handling problems during operation of a landfill, and wind erosion can seriously reduce the integrity of the facility after closure.

Recommendations

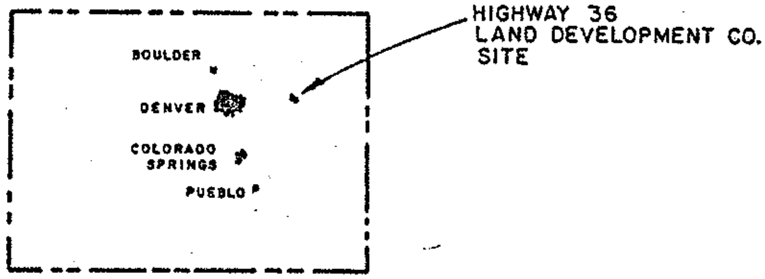
- The mean annual evaporation should exceed the mean annual precipitation by 20 in/yr.
- The maximum 24-hour storm should be no greater than 6 inches.

MINERAL RESOURCES

The potential burial site and vicinity should be evaluated for the presence of various potentially commercial or critical mineral commodities. These include uranium, thorium, other trace metals, coal, oil, oil shale, gas, precious and base metals, geothermal localities,

Presence of potentially commercial mineral resources are not necessarily preemptive, but should be carefully described so that it can be used in site-search evaluations at all stages.

SOURCE: REFERENCE 1



COLORADO

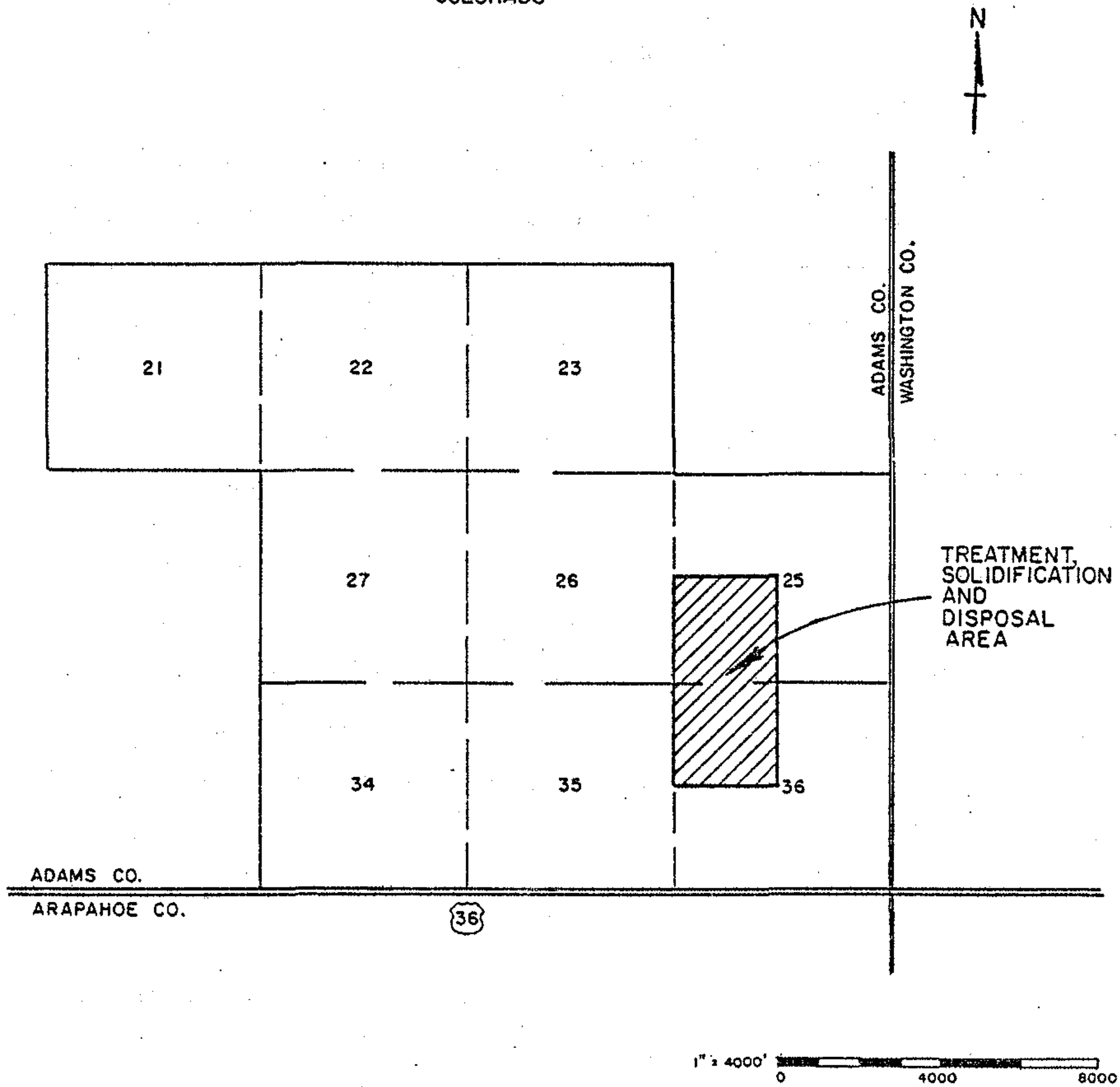


FIGURE № 1.2

SITE LOCATION

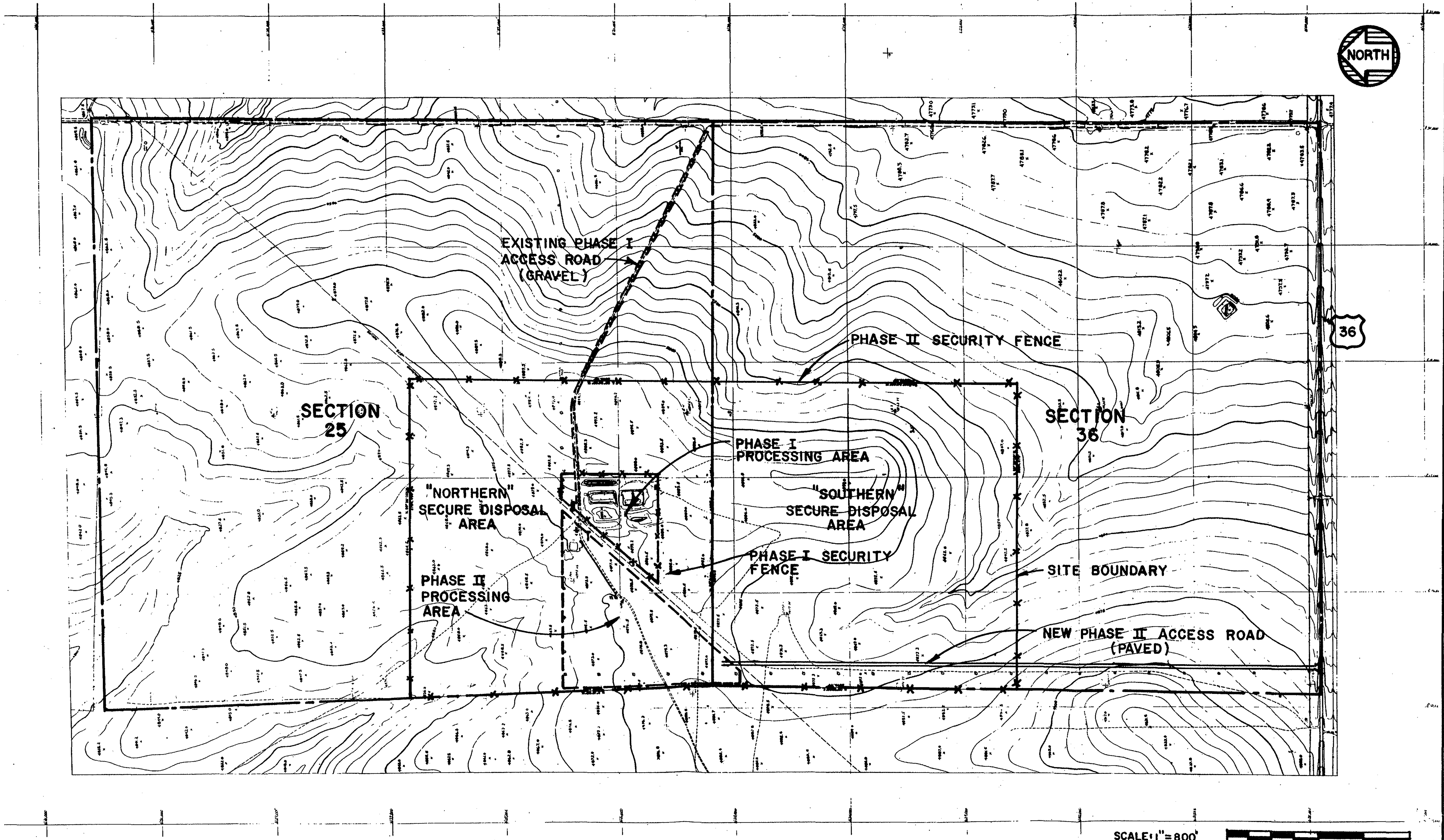
HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

quarter sections indicated in Sections 25 and 36 will be utilized for waste processing and disposal. Use of the other seven sections (which were purchased as part of a package) is not planned or anticipated.

The facility concept consists of two basic operations. The first is treatment and solidification whereby liquid or semi-liquid chemical wastes are neutralized or otherwise treated as required and converted to a solid product by the addition of a dry reagent such as cement kiln dust or fly ash. The resultant treated/solidified product can be handled more easily and is very resistant to formation of leachate. The second operation is disposal of the treated/solidified product by burial in a secure disposal cell designed so as to prevent any release of contaminants to the environment. It is to be emphasized that only solid waste or solidified product (as opposed to liquids, containers of liquids, or intermediate sludges) will be placed in the secure disposal cell.

Operation of the facility is anticipated to be conducted in two phases. Within the Phase I processing area, shown in Figure 1.3, the solidification operations would be conducted in clay-lined earthen cells. This "first generation" technique is presently and effectively utilized at the BFI Calcasieu Parish hazardous waste site near Willow Springs, Louisiana. For Phase II (also shown on Figure 1.3), treatment and solidification would be conducted in concrete tanks like those employed at the BFI Livingston, Louisiana site. The Phase II facilities are regarded as "third generation" because in addition to the use of concrete tanks, the operation would be totally enclosed in a building. The Phase I facilities would be placed into operation following approval from the Adams County



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DESIGNER
DRAFTING
PROJ. ENGR.
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BY
DATE

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JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

SHEET NO.
FIG. 1.3
OF

Board of County Commissioners. Also upon approval, the detailed design and construction of the Phase II facilities will continue and be completed within about 15 months. Phase I operations would cease as soon as operation of the Phase II facility commences.

Waste processing during either phase will proceed in essentially the same manner, as illustrated in Figure 1.4. All materials will arrive at the facility by truck. Wastes will be unloaded into one of a series of reception chambers, to which the treatment and solidification reagents will be added and then mixed with a hydraulic back hoe. During Phase I, the solidification reagents will be fed to the waste reception chambers from portable storage trailers; whereas for Phase II operations, reagents will be fed from storage silos. The hydraulic back hoe or a front end loader will be used to load the off-road dump truck which will be used to transport the finished product to the secure disposal cell. Final disposal operations will be suspended during periods of inclement weather.

The Phase I facility is designed to handle 8,000,000 gallons of waste annually, while the Phase II facility is designed to handle 12,000,000 gallons of waste initially with the capability of up to 48,000,000 gallons per year, as required. Assuming an average processing rate of 24,000,000 gallons per year, the projected life of the site would be approximately 20 to 25 years.

1.6 SCOPE OF REPORT

This report has been prepared to provide the Adams County Board of County Commissioners, the State of Colorado Department of Health, the U.S. Environmental Protection Agency, and interested persons a detailed and comprehensive description of the Phase I and Phase II Facility Plan. The

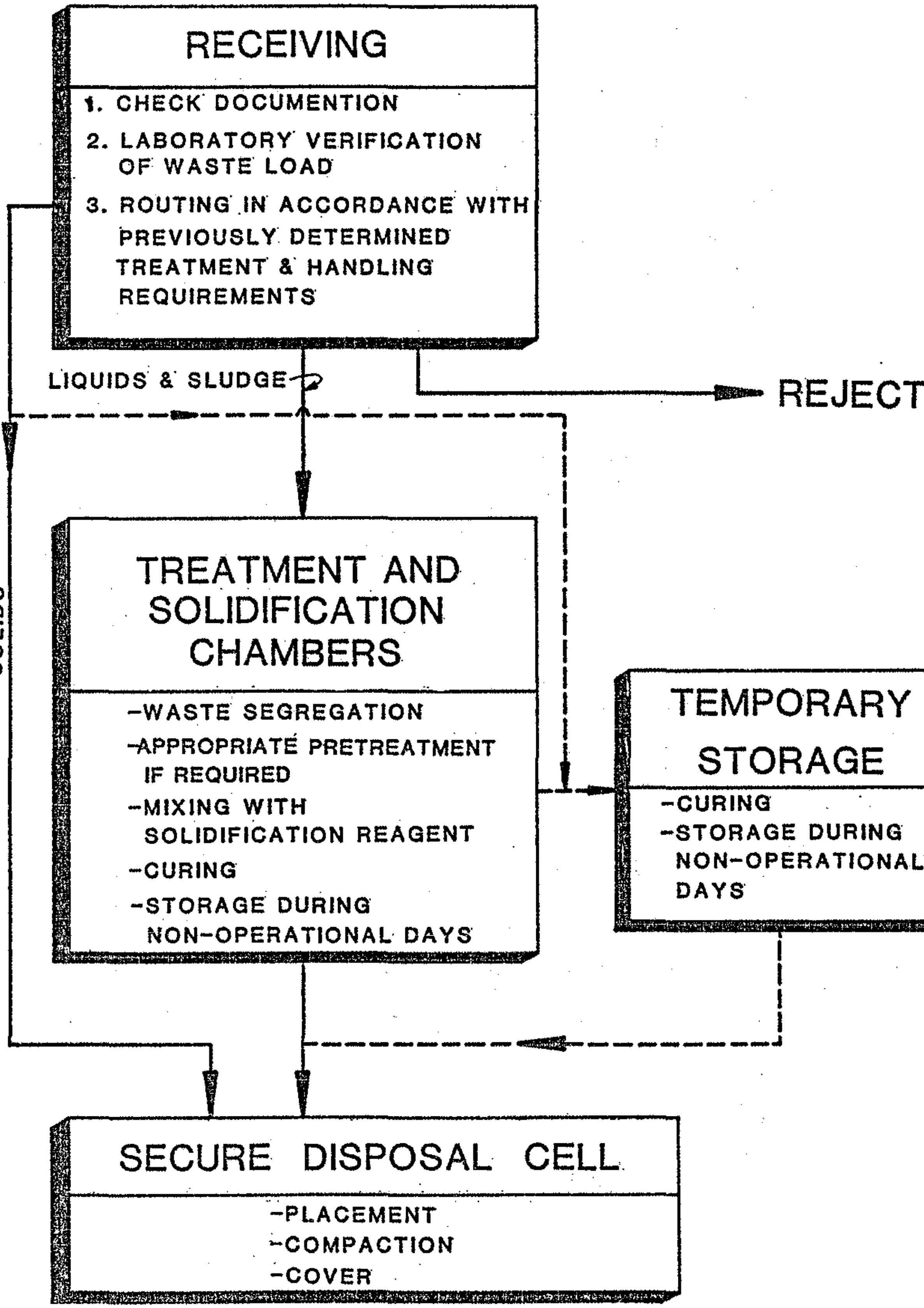

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FIGURE Nº 1.4
GENERAL WASTE PROCESSING FLOW CHART
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

Facility Plan presented herein is intended to meet or exceed the applicable Federal requirements under the Resource Conservation and Recovery Act for hazardous waste treatment and disposal facilities. Accordingly, many of the subsequent chapters have been organized to directly address considerations required by these Federal regulations. Further, this report addresses the manner in which it is proposed to develop the facility, how decisions were arrived at, and how environmental considerations were taken into account in arriving at those decisions. Major topics developed and discussed herein include the following:

- o Chemical Waste Inventory Analysis (Chapter 3);
- o Transportation Analysis (Chapter 4);
- o Existing On-Site and Off-Site Conditions (Chapter 5);
- o Description of Facility (Chapter 6);
- o Operational Controls and Monitoring (Chapter 7);
- o Environmental Impact Assessment (Chapter 8);
- o Qualifications of Proposer (Chapter 9);
- o Response to Comments from Reviewing Agencies (Chapter 10).

In a similar vein, this Facility Plan is intended to meet or exceed the Adams County regulations and the Colorado Department of Health regulations (Appendices J and I, respectively). An index summary of how the facility will be consistent with these regulations is presented in Table 1.1. Included in this table are the locations in the report where additional information (see Appendix K) requested by County and State agencies may be found.

1.7 REFERENCES

1. Hynes, Jeffrey L. and Sutton, Christopher J., "Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal," Colorado Department of Health and Colorado Geologic Survey, Denver, CO., 1980.

2. "Hazardous Waste Fact Sheet," EPA Journal, 5(2) 12 (February, 1979).

3. Governor Richard D. Lamm, "State of the State," Jan. 13, 1981.

TABLE 1.1

INDEX TO INFORMATION REQUESTED AND/OR REQUIRED BY STATE AND COUNTY

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Adams County (4)	1. site selection process	Sections 1.1, 1.2, 6.1, 6.2.1
" "	2. qualifications of parent co.	Chapter 9; Appendix A
" "	3. assessment of impacts on migratory bird life	Section 8.6.2.2
" "	4. projected market areas	Sections 3.1, 3.3
" "	5. housing and population within 10 miles	Section 5.8.3.1
" "	6. projected impacts on air quality	Sections 5.7.1, 8.5.1
" "	7. leachate control	Sections 6.5.2.4, 6.6.1, 7.6, 7.7.2.8.3, 8.4.2
" "	8. waste analysis list of materials expected to be received at the facility	Sections 3.2.4, 3.3; Appendix B
" "	9. plan for reporting monitoring results to Adams County	Sections 7.5.5, 7.6.12
" "	10. summary of how proposed facility is consistent with local ordinances and plans	Sections 1.6, 8.6.3.1; Chapter 7
" "	11. resource recovery potential	Section 1.5.1
Adams County (5)	4.410 development drainage design	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.2.1, 6.6
" "	4.420 areas subject to flooding	Sections 5.5.3, 8.4.1
" "	4.510 (2) site location	Sections 1.2, 1.5.2, 5.3, 6.1
	type of facility	Sections 1.1, 1.5.2, 3.2.1
	hours of operation	Sections 3.3, 6.4.1.2, 7.2.3
	method of supervision	Section 6.3.3
	rates to be charged	Section 6.7
	other information requested	Section 1.6
	engineering, geological, hydrological, operational data	Chapters 5, 6, 7, 8
" "	4.510 (3) names and addresses of nearby property owners	submitted under separate cover
" "	4.510 (4) site plan	Sections 6.2, 6.3
" "	4.510 (6) certified boundary survey	Section 5.3
" "	4.510 (7) drainage and drainage facilities	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.2.1, 6.6

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Adams County (5)	4.510 (8) additional information	Section 1.6
" "	4.530 (1) effect on surrounding property	Sections 8.6.3, 8.6.4
" "	4.530 (2) site access from potential users	Chapter 4
" "	4.530 (3) ability to comply with health standards, etc.	Chpater 7; Appendix A
" "	4.600 (3) legal description of property	Section 5.3.1
" "	4.600 (4) description of area	Section 5.8
" "	4.600 (5) description of operation	Chapters 6, 7, 8
" "	4.600 (6) description of site after use	Sections 6.2.2, 7.1, 8.6.2.1
Col.Dept.of Health(6)	1. feasibility of alternative sites	Sections 1.1, 1.2, 6.1, 6.2.1
" " " "	2. size and anticipated life of site	Sections 6.1, 6.2.5, 6.2.6
" " " "	3. geotechnical evaluation of site	Section 5.4
" " " "	4. final location and design of all improvements proposed at the site	Chapter 6; Section 7.6.1
" " " "	5. construction reports for all improvements	to be submitted under separate cover
" " " "	6. equipment/area inspection schedules	Section 7.2.4
" " " "	7. sample manifest form	Sections 7.2.2, 7.5
" " " "	8. contractual agreements	Section 1.1; Appendix M
" " " "	9. description of operational procedures	Chapter 7
" " " "	10. list of types of wastes anticipated	Sections 3.2.4, 3.3; Appendix B
" " " "	11. location of and procedures for monitoring of air, surface water, and groundwater quality	Sections 5.6, 5.7, 7.6
" " " "	12. corporate structure charts	Section 6.3.3
" " " "	13. qualifications and training of key site personnel	Sections 6.3.3, 7.2.5
" " " "	14. ability and intentions to re-spond to accidental chemical spills	Sections 4.2, 7.4
" " " "	15. provisions to contain and ex-tinguish fires	Sections 7.3, 7.4
" " " "	16. plans for closure of the site	Section 7.7
" " " "	17. present zoning and land use of adjacent areas and impacts on surrounding properties	Sections 5.8.3, 8.6.3, 8.6.4

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Col.Dept.of Health(6)	18. provisions to restrict site access	Sections 7.2.3, 7.7.1.7
" " " "	19. inclement weather operating contingencies	Sections 1.5.2, 6.4.1.4, 6.4.3
Col.Dept.of Health(7)	1. potential waste sources and estimated quantities	Sections 3.2.4, 3.3; Appendix B
" " " "	2. potential air contaminants and control measures	Sections 5.7.1, 6.4.3.2.4, 6.4.3.2.5, 7.6.3, 8.5.1, 8.6.2.1.1
" " " "	3. base line hi-vol monitoring data	Section 5.7.1.3
" " " "	4. information relevant to fugitive dust emissions	Section 8.5.1
" " " "	5. site specific meteorological data	Sectioin 5.7.1.4
S.W.D.S.F.A. (8)	3.b. nuisance vector control	Section 8.6.7.1
"	3.c. compliance with laws, standards, etc.	Section 1.6; Chapter 7
"	3.d. radioactive wastes	Section 3.2.4
"	3.f. fencing	Sections 7.2.3, 7.7.1.7
"	3.g. prevention of waste burning	Section 7.2.6
"	4.a. protection of surface and subsurface waters from contamination	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.2.1, 6.3.2.5, 6.3.2.6, 6.4.3.1, 6.4.3.2.1, 6.5.1.2, 6.5.2, 6.6, 8.2.3, 8.3, 8.4
"	4.b. protection of water quality in nearby wells	Section 8.4
"	4.c. location of site relative to waste sources	Section 4.3
"	4.d. access routes to and from site and on site	Sections 4.3, 4.6.2, 6.3
"	4.e. compaction and cover of waste materials to prevent nuisance vectors	Sections 6.5.2, 8.6.7.1
"	4.f. compaction of waste materials	Section 6.5.2
"	4.g. windblown debris	Section 8.6.7
"	4.h. recycling operations	Section 1.5.1
"	4.i. prevention of waste burning; extinguishing of fires	Sections 7.2.6, 7.4
"	4.j. final closure	Section 7.7
"	4.k. flood protection	Section 5.5.3
"	6.a. person in charge of facility	List of Preparers

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
S.W.D.S.F.A. (8)	6.b. list of equipment to be used	Section 6.3
"	6.c. hours of operation	Sections 3.3, 6.4.1.2, 7.2.3
"	6.d. fire fighting equipment	Sections 7.4.9, 7.4.10
"	6.e. frequency of cover in disposal cells	Section 6.5.2.1
"	6.f. windblown debris	Section 8.6.7
"	6.g. plan for eradication of rodents and insects	Section 8.6.2.2
"	6.h. procedures for implementing other aspects of design	Chapters 6, 7, 8

4. Mr. Jim L. Considine, Asst. Planning Director, Adams County Colorado, Letter of Correspondence to Mr. Robert Anzia, HNTB, Feb. 17, 1981.

5. 1980 Zoning Regulations of Adams County, Colorado.

6. Mr. Kenneth L. Waesche, Geologist, Radiation and Hazardous Wastes Control, Colorado. Dept. of Health, Letter of Correspondence to Mr. Fritz Easterberg, Highway 36 Land Development Co., Jan. 14, 1981.

7. Dr. James M. Lents, Director, Air Pollution Control Div., Colorado Dept. of Health, Letter of Correspondence to Mr. Fritz Easterberg, Feb. 13, 1981.

8. Solid Wastes Disposal Sites and Facilities Act, 30-20, 101 *et seq*. C.R.S. 1973, as amended.

CHAPTER 2

OBJECTIVES AND METHODOLOGY

2.1 STUDY OBJECTIVES

The overall goal of this project is to develop an environmentally safe, technically feasible, cost-effective facility to treat, solidify, and dispose of liquid and semi-liquid chemical wastes and to dispose of solid chemical wastes on the selected site in specially constructed secure cells. To accomplish this goal, criteria are necessary to establish basic design requirements, to compare alternatives, and to evaluate the effects of the undertaking. The first step in the process was the identification of objectives which could subsequently be used as the basis for such criteria. As discussed below, these objectives are of two major types: objectives which refer to the procedure for undertaking the study, and objectives to be used for designing the facility.

2.1.1 Procedural Objectives

Procedural objectives are those which serve to ensure that the facility plan addresses the full range of environmental and technical issues. Specifically, these objectives are as follows:

- Obtain and review all relevant local, State, and Federal regulations and guidelines.
- Ensure broadly based technical participation by County, State, and Federal governments.
- Discuss preliminary facility plan concepts with governmental agencies to aid in identifying all applicable concerns.
- Ensure that the study process facilitates the preparation of an environmental assessment in accordance with the requirements of the Resource Conservation and Recovery Act and requests made by State and local agencies. (See Appendix K).

- Ensure that the facility plan is documented in a form which is suitable for review and detailed evaluation by local, State, and Federal authorities and for presentation at a formal public hearing.

To assist in achieving these objectives, informal preliminary meetings and discussions have been held with governmental agencies as well as interested local persons, as summarized below:

- January 7, 1981 Meeting with Adams County Planning Department staff, representatives of EPA, Colorado Department of Health, Tri-County District Health Department, and members of the design team to discuss the nature of the project, permitting procedures, and issues to be addressed in the facility planning report.

- January 14, 1981 Presentation by representatives of BFI to the Governmental Refuse Collection and Disposal Association (GRCDA) regarding the hazardous waste solidification process. Members of GRCDA include private haulers, various county planning department officials, EPA officials, and public officials in the solid waste field.

- January 15, 1981 Meeting with Adams County Planning Department staff and design team representatives to outline the facility planning information under development.

- February 17, 1981 Presentation by representatives of BFI, Highway 36 Land Development Company, and design team members regarding the specific nature of the facility to representatives of State and local government, State and local agencies, and interested persons.

In addition to the above, site visits were conducted by representatives of BFI or the design team on the following occasions:

October 31, 1980 - Colorado Department of Health and Colorado Geological Survey: Pre-construction meeting.

Janaury 7, 1981 - Representatives from the EPA, Tri-County District Health Department, and the Colorado Department of Health.

January 22, 1981 - Colorado Department of Health.

February 13, 1981 - Colorado Division of Wildlife.

More extensive public participation will take place during the formal public hearing stage after this facility plan report has been submitted to the various reviewing authorities.

2.1.2 Design Objectives

The design objectives were divided into six major categories: risk, service, acceptability, uncertainty, flexibility, and costs. Particular emphasis has been placed upon the development of a facility design which eliminates the risk to human health and safety, both in the work place and in the general environment.

Service objectives were considered important because a waste handling system that is efficient in terms of its operating procedures, monitoring programs, and remedial action plans has a greater likelihood that:

- o the potential for accidental release of waste materials at the site will be minimized;
- o accidental releases will be detected and the necessary remedial action taken to prevent off-site effects.

Both of these service considerations relate directly to the need to eliminate risk to human health.

The acceptability objective was considered in the sense that the facility and associated handling systems must conform with all appropriate Federal, State, and local regulations. Similarly, it was considered that the project must recognize all appropriate Federal, State, and local guidelines, policies, and programs.

The uncertainty objective or reliability of the process was mitigated through the use of proven technologies.

The flexibility objective was considered so that the viability of the facility can be continually reassessed to assure that the needs of the State of Colorado are being met as far as hazardous waste management is concerned. Therefore, the need exists to incorporate sufficient flexibility into the facility design such that it will be feasible to increase the throughput of chemical wastes. Further, the need also exists to reserve on-site space for alternative methods of chemical waste handling procedures, such as resource recovery or incineration, so that a greater diversity of wastes can be accommodated if desired.

Despite the importance of the cost objective, costs cannot be traded off for risk to human health. Consequently, only when alternatives remained after consideration of the other objectives were cost constraints a factor in the decision.

In summary, the study objectives were as follows:

- Risk
  - Eliminate risk to human health
  - Eliminate risk to natural environment
  - Avoid risk of community disruption

- Service
  - Maximize efficiency in operation of waste handling system
  - Maximize efficiency of monitoring of facility and environmental conditions
  - Maximize efficiency of remedial actions

- Acceptability
  - Ensure compliance with Federal, State, and local regulations
  - Recognize Federal, State, and local guidelines, policies, and programs

- Uncertainty
  - Ensure use of proven technologies in waste handling and processing systems

- Flexibility
  - Provide flexibility for alternate future disposal options for chemical wastes, if necessary
  - Provide flexibility to accommodate variations in waste quantity and quality

- o Cost
  - Minimize development and operational costs for disposal facility consistent with other objectives outlined above

2.2 STUDY METHODOLOGY

2.2.1 Introduction

The study methodology involved six major thrusts of activity:

- o inventory of chemical wastes within the State of Colorado that are compatible with the solidification process;
- o assessment of the adequacy of transportation routes;
- o characterization of existing on-site and off-site conditions;
- o design and layout of the facility complex and the selected site;
- o development of operational plans, monitoring plans, contingency plans, and closure plans;
- o assessment of effects that the facility would have on existing on-site and off-site conditions.

Although these activities are described in separate sections of the report, they are closely interrelated. Because of the iterative nature of the decision-making process, the flow of information from one activity to another was of paramount importance during the entire facility planning effort. In general, the facility plan evolved in the following manner:

- o Initial consideration given to the functional requirements of the facility and to existing site conditions resulted in various alternatives for facility layout, design, and operation.
- o Evaluation of these alternatives in terms of their engineering and environmental suitability formed the basis for selecting a preferred concept.
- o Detailed evaluation of the operational requirements and environmental impacts then served to refine and optimize the facility design.

2.2.2 Study Process

As discussed previously, the initial step in the study process was to establish the study objectives so as to provide overall direction to the study. Concurrent with the formulation of these objectives, the waste inventory analysis, transportation analysis, site characterization, and preliminary design activities were initiated, as discussed below.

Estimates of waste types and quantities that might be received at the facility were derived from the hazardous waste inventory report prepared by the Colorado Departments of Health and Natural Resources(1). Technical data regarding the treatment and solidification process to be used was supplied by BFI. A review of comparable projects was undertaken including visits to existing BFI facilities.

Based on the anticipated range of waste volumes to be processed and the related quantities of reagents required, estimates could then be made regarding the amount of traffic that would be generated by the site and the adequacy of existing transportation routes.

Extensive field studies were performed to characterize the existing on-site and off-site conditions. These included the following:

- o general and site specific geological and hydrogeological investigations;
- o boundary surveys;
- o aerial photography (detailed site topography);
- o sampling and analysis (baseline water qualities);
- o biological reconnaissance;
- o historical and archaeological surveys;
- o land use and population surveys;

- o surface drainage studies;
- o other baseline environmental data (e.g., climate, noise levels, etc.).

The base line data for the site and its environs together with preliminary design concepts were used to develop alternative facility layouts. Consideration given to on-site traffic patterns, secure disposal cell development, space utilization, cut and fill requirements, etc., provided the basis for selecting the optimum site plan layout.

With the conceptual layout of the facilities completed, the facility operational plans, monitoring plans, contingency plans, etc., could be developed. These, in turn, resulted in refinements made to the facility layout.

A detailed evaluation of the effects of the project was then undertaken, based on:

- o the likely characteristics of the facility and access to it;
- o the potential effects the facility could have on people and the environment;
- o the experience of the study team members.

Where required, mitigative measures were formulated and the residual effects identified.

2.3 REFERENCES

1. Hynes, Jeffrey L. and Sutton, Christopher J., " Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal," Colorado Department of Health and Colorado Geologic Survey, Denver, Co., 1980.

CHAPTER 3

CHEMICAL WASTE INVENTORY AND COMPATIBILITY ANALYSIS

3.1 CHEMICAL WASTE INVENTORY IN COLORADO

Estimates of waste types and quantities that would be received at the facility were made from Colorado hazardous waste inventory data. The inventory of industrial wastes in Colorado was jointly compiled by the Colorado Geological Survey's Department of Natural Resources and the Colorado Department of Health and was published in a 1980 report entitled "Hazardous Wastes in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal"(1). For that report, the University of Colorado Business Research Division was contracted to provide a list, by county, of all companies registered in Colorado that are potential generators of hazardous wastes. The State canvassed additional potential hazardous waste sources, including hospitals, universities, and State and Federal facilities.

The hazardous waste inventory was accomplished through a questionnaire which served to characterize the wastes in terms of waste type (using a code system), composition, concentration, and present and projected volumes for the next five years. Of the 1,562 questionnaires that were sent out statewide, 61.5% responded. It is important to point out that 92% of the largest firms (greater than 250 employees) responded. Thus it is felt that the inventory provides a reasonable assessment of hazardous wastes in Colorado. The results are presented and discussed below.

For the purposes of reporting the inventory results, the State was broken down into the 13 regions illustrated in Figure 3.1. Table 3.1 presents a regional breakdown of the hazardous wastes quantities generated throughout the regions. As can be seen, the study indicated that 99.7% of the

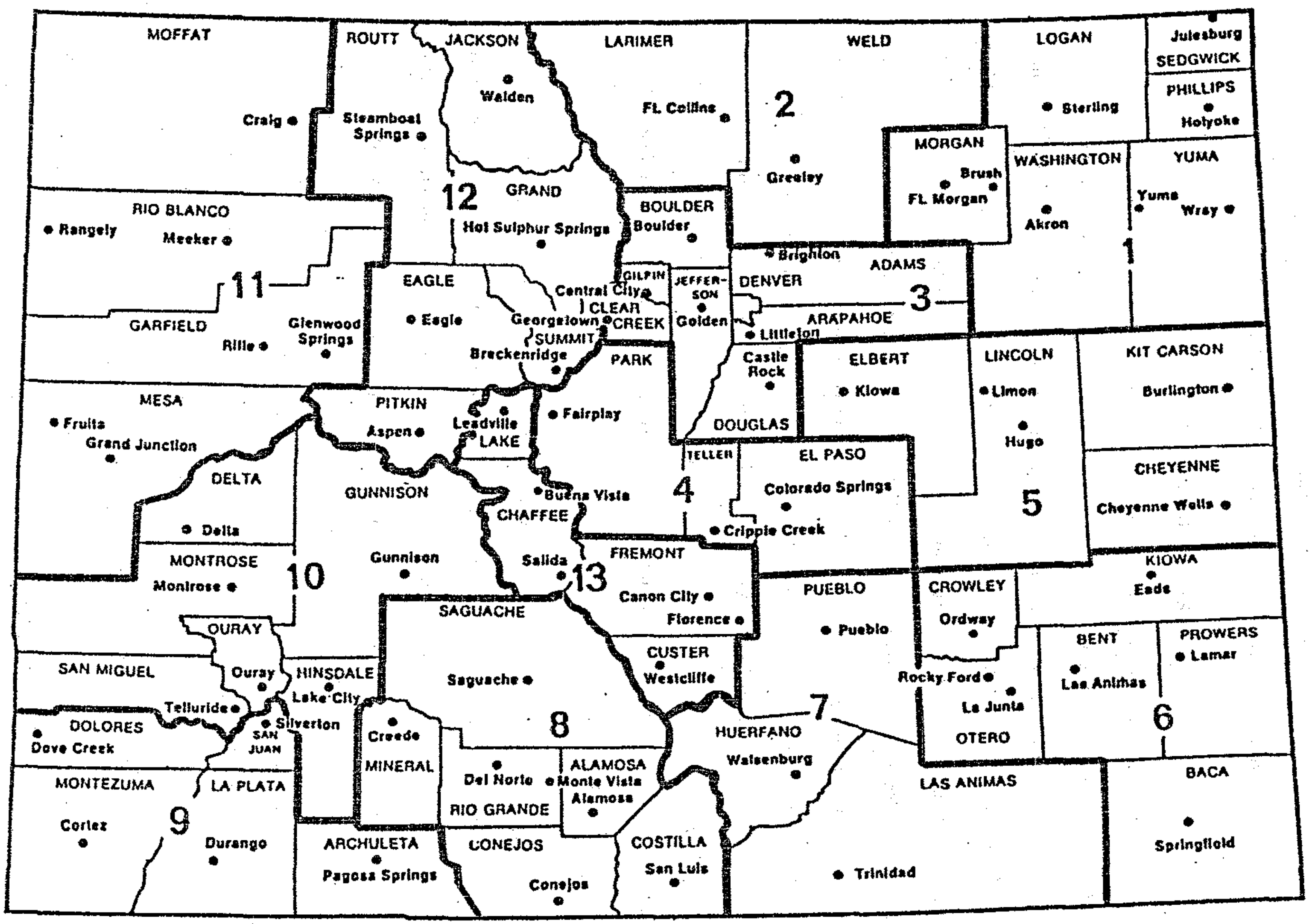

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FIGURE Nº 3.1
COLORADO PLANNING & MANAGEMENT REGIONS
HIGHWAY 36 LAND DEVEL[illegible]MENT CO.
ADAMS CO., COLOR[illegible]

TABLE 3.1

REGIONAL BREAKDOWN OF HAZARDOUS WASTES GENERATION IN THE STATE OF COLORADO(1)

Colorado Region	Hazardous Gallons	Hazardous Tons	Extremely Hazardous Gallons	Extremely Hazardous Tons	Total Tonnage**	% of Colorado Annual Waste Inventory
1	40	-	-	3	3	-
2*	4,578,247	1,266	45,513	92	24,477	2.86
3*	25,589,483	150,831	1,361,519	47,541	333,127	38.94
4*	45,240,105	482	6,143,755	308	257,710	30.13
5	-	-	-	-	-	-
6	131,610	69	600	-	730	0.08
7*	521,367	236,028	600	-	238,636	27.94
8	-	-	-	-	-	-
9	3,300	226	-	-	243	0.03
10	150	93	-	15	109	0.01
11	300	29	-	-	31	.004
12	-	-	-	-	-	-
13	-	20	-	-	20	.002
TOTAL	76,064,602	389,044	7,551,987	47,959	855,086	100.0%

*Front Range Regions 2, 3, 4, and 7 account for 99.7% of hazardous waste generated statewide.

**A factor of 10 pounds per gallon was used for converting gallons to tons.

hazardous wastes in Colorado are generated in the Front Range regions 2, 3, 4, and 7. Detailed breakdowns of the waste types from these four regions are presented in Tables 3.2 through 3.5, respectively. The data presented in these tables were employed to estimate the anticipated waste load to the facility, as subsequently discussed in Section 3.3.

3.2 WASTE COMPATIBILITY WITH THE TREATMENT/SOLIDIFICATION PROCESS

3.2.1 Description of Treatment/Solidification Process

The main function of the facility will be the treatment and solidification of liquid and semi-liquid chemical wastes with reagents for subsequent burial in a secure disposal cell and the direct landfill burial of solid chemical wastes. There is no liquid effluent produced from this process, and, therefore no need for surface discharge. Solidification of the wastes produces a product that is easier and safer to handle and is very resistant to the formation of leachate.

As mentioned in Chapter 1, the Phase I solidification process will take place in clay-lined earthen cells. Liquid and semi-liquid wastes will be mixed with reagents from portable bulk storage vehicles. The Phase II process will take place in a large metal building which will contain several large mixing tanks and solidified product storage areas with outdoor reagent storage silos. The liquid and semi-liquid wastes will be mixed in the tanks with the reagent from the silos.

The resultant product will be a solid of relatively low permeability. This solidified product will be buried in specially constructed secure disposal cells at adjacent portions of the site. Areas will be provided for temporary storage in the solidification building during inclement weather. A more complete description of the facility is presented in Chapter 6.

TABLE 3.2

COLORADO REGION 2 HAZARDOUS WASTE GENERATION BY TYPE(1)

	Gallons	Tons
Acids	75,292	0.1
Alkalies	280,150	10.0
Inorganic Liquids & Solids	-	2.9
Organic Liquids & Solids	214,761	88.0
Sludges	4,018,295	690.0
Baghouse Waste	-	6.0
Alum/Tin Dross	-	12.0
Misc. Contaminated Items	-	2.0
Spill Residues & Production Wastes	-	545.0
Solder, Flux, Wave Oil	1,650	2.6
Rinse and Other Wastewaters	23,000	-
Mixed Oils	8,000	-

TABLE 3.3

COLORADO REGION 3 HAZARDOUS WASTE GENERATION BY TYPE(1)

	Gallons	Tons
Acids	8,384,743	0.1
Alkalies	187,763	152.5
Inorganic Liquids & Solids	5,016,050	25,504.0
Organic Liquids & Solids	1,644,745	4,800.0
PCB Solids & Sludges	5,811	-
Sludges	7,705,281	9,202.0
Alum/Tin Dross	-	80.6
Baghouse Waste	-	11.5
Boiler Wash	1,000	-
Brine Solutions	-	130,462.2
Fluorescent Tubes	-	7.7
Misc. Contaminated Items	-	3,278.9
Non-Emulsified Waste Oil	54,140	-
Emulsified Oil	57,550	-
Epoxy/Resin Waste	1,000	-
Explosives	-	11.0
Halogenated Still Bottoms	1,500	209.0
Low Level Radioactive Waste	5,000	5,000.0
Misc. Package Chemicals	-	31.1
Non-Halogenated Still Bottoms	-	66.0
Photographic Chemical Waste	1,870	-
Spill Residues	-	48.8
Sewage Sludge	-	2.0
Spent Activated Carbon	-	50.0
Spent Cartridge Filters	-	315.0
Spent Catalyst	-	221.5
Waste Tars	-	540.0
Rinse & Other Wastewaters	3,725,300	-
Other Mixed Oils	158,060	-
Other Mixed Waste	7,000	88.0
Other Rejected Goods	3,300	11,000.0

TABLE 3.4

COLORADO REGION 4 HAZARDOUS WASTE GENERATION BY TYPE(1)

	Gallons	Tons
Acids	36,168,030	-
Alkalies	181,600	-
Inorganic Liquids & Solids	9,043,200	1.0
Organic Liquids & Solids	50,525	-
Sludges	183,500	741.0
Baghouse Waste	-	4.2
Misc. Contaminated Items	-	2.0
Low Level Radioactive Wastes	-	-
Off Spec. Pesticides	655	0.3
Polyester Resins	-	36.0
Solder, Flux, Wave Oil	300	2.5
Spent Cartridge Filters	-	1.3
Rinse & Other Wastewaters	5,750,000	-
Other Mixed Oils	5,400	-

TABLE 3.5

COLORADO REGION 7 HAZARDOUS WASTE GENERATION BY TYPE(1)

	Gallons	Tons
Acids	-	18,384
Alkalies	60,000	-
Inorganic Liquid & Solids	-	-
Organic Liquids & Solids	-	-
PCB Solids & Sludges	550	-
Sludges	6,050	51,785
Alum/Tin Dross	-	234
Asbestos	-	4
Baghouse Waste	-	10
Non-Emulsified Oil	207,081	-
Grease	30,000	-
Scrap Batteries	-	9.5
Sewage Sludge	-	30
Waste Lime	-	5,484
Waste Tars	-	348
Rinse & Other Wastewaters	49,686	-
Other Mixed Oils	168,000	-
Other Mixed Waste	-	160,092

3.2.2 Types of Reagents

The two primary reagents to be used in the treatment/solidification process are cement kiln dust and/or fly ash. Typical leachate characteristics of these reagents are given in Table 3.6. Also given are characteristics of Portland cement, which could also be employed in the event of shortages of the other materials.

Kiln dust is a waste product from the manufacture of Portland cement and is the preferred reagent. Generally, it takes about two volumes of kiln dust to one volume of liquid waste to carry out the solidification process. The solidified product has a volume about twice that of the original waste. Fly ash is a waste product from the generation of electricity at coal fired power plants. This reagent is normally less effective than the kiln dust and its use would generally be restricted to those instances where either the kiln dust would react adversely with the wastes or inadequate volumes of other reagents were available. Generally, about three volumes of fly ash per unit volume of waste is required for the solidification process.

This operation conserves natural resources because the solidifying reagents are themselves waste by-products.

Different reagent and waste combinations will be used at the site because the chemistry of the solidification process varies somewhat. Solidification involves the following physical or chemical reactions:

- o hydration of cementitious materials in the reagents;
- o absorption of the liquid by the solid reagent;
- o precipitation of metal hydroxides;
- o neutralization of acidic wastes by the excess alkalinity of the reagents.

TABLE 3.6

LEACHATE CHARACTERISTICS OF SOLIDIFICATION REAGENTS(2)

Parameters	Kiln Dust	Cement	Fly Ash
pH	12.8	12.0	4.7
Total Solids Wt. (%)	1.06	0.33	2.40
Chloride	585	76	<15
Sulfate	3,000	1,500	1,450
Color (Alpha Units)	<20	<20	<20
Barium	0.5	0.3	0.1
Manganese	<0.10	<0.10	0.23
Boron	<0.5	<0.50	11
Arsenic	<0.010	<0.010	<0.010
Cadmium	<0.010	<0.010	0.028
Copper	<0.10	<0.10	0.28
Chromium	<0.1	<0.10	<0.1
Mercury	<0.0005	<0.0005	<0.0005
Nickel	<0.10	<0.10	0.13
Silver	<0.10	<0.10	<0.10
Zinc	<0.10	<0.10	0.44
Lead	<0.1	<0.10	0.1
Selenium	<0.010	<0.01	<0.010
Total Organic Carbon	24	9	<5

NOTE: Units are mg/l unless otherwise stated. The leaching tests were performed using a shake test based on the ASTM proposed procedure, Method "A".

There are major cement plants in Colorado that generate waste kiln dust. Also, there are major coal fired power plants in the Front Range with an adequate supply of fly ash. On the basis of potential reagent sources surveyed, it appears that adequate volumes of reagents will be available for the treatment/solidification facility. Should these reagent sources become inadequate, commercial absorbents or Portland cement would be employed.

3.2.3 Product Characteristics

3.2.3.1 Appearance

When the chemical wastes are mixed with the reagents, the resultant product is a moist solid that will not flow. Over the next 24 to 72 hours, the product "cures" and becomes a soil-like product. The time required for curing is a function of the temperature and type of wastes and reagents used.

3.2.3.2 Leaching

Solidified wastes are very resistant to the formation of leachate. The characteristics of the leachate from solidified wastes are substantially improved over the characteristics of the original waste material. Selected samples from typical industrial wastes have been solidified both with kiln dust and fly ash. The leachate test results are presented in Appendix E(2).

3.2.3.3 Permeability

Permeability tests have been performed on industrial wastes solidified with kiln dust, fly ash, and cement powder. The results, presented in Table 3.7, show the fly ash samples have permeabilities of 2.5×10^{-5} to 8×10^{-5} centimeter per second (cm/sec). The kiln dust ranges between

TABLE 3.7

PERMEABILITY TESTS ON SOLIDIFIED WASTE SAMPLES(2)

Sample Identification	Moisture Content Beginning of Test %	Dry Density ($lb./ft.^3$)	Permeability at 20°C (cm/sec.)
7149 kiln dust	44.7	71.1	1.8×10^{-6}
7150 kiln dust	48.3	72.7	4.4×10^{-6}
7151 kiln dust	44.4	74.4	2.5×10^{-7}
7152 kiln dust	33.9	77.0	1.2×10^{-7}
7153 kiln dust	40.0	75.9	9.3×10^{-7}
7093 fly ash	28.6	68.2	8.0×10^{-5}
7150 fly ash	31.7	81.2	2.6×10^{-5}
7151 fly ash	30.4	83.5	2.5×10^{-5}
7927 fly ash	31.4	78.9	4.1×10^{-5}

Permeabilities of samples solidified with Portland Cement were so low that difficulty was experienced in running the tests. For example, the results for sample 7151 indicated a permeability of 2.1×10^{-10} cm/sec. It was estimated that all the samples had a permeability of less than 10^{-8} cm/sec.

1×10^{-7} and 2×10^{-6} cm/sec., while the cement powder permeabilities are estimated to be in excess of 1×10^{-8} cm/sec. For comparison, the kiln dust samples have a permeability 1,000 (10^3) to 10,000 (10^4) times less than a fine sand.

3.2.3.4 Strength

Another advantage of the solidified wastes is that they are strong enough to support conventional construction equipment during moving and disposal operations. To verify this, unconfined compressive strength tests have been conducted on solidified wastes(2). The results are presented in Table 3.8. This compressive strength has been further verified by experience at existing BFI treatment/solidification facilities.

3.2.4 Waste Acceptability

Prior to accepting each waste stream at the facility, it will be subjected to rigorous chemical analysis and testing to ensure that it is compatible with the method of treatment and disposal proposed herein (see Chapters 6 and 7). Although the site will be capable of accepting a great variety of waste streams, those listed below will not be accepted.

- Hydrophoric Reactives
- Pyrophoric Reactives
- Class A Explosives
- Shock Sensitive
- PCBs
- Dioxin (Agent Orange)
- Hexachlorocyclopentadiene (C 56)
- Radioactive Waste

TABLE 3.8

UNCONFINED COMPRESSION TESTS ON SOLIDIFIED WASTE SAMPLES(2)

Sample Identification	Moisture Content Beginning of Test %	Dry Density ($lb./ft.^3$)	Strain (%)	Unconfined Compressive Strength ($lb./ft^2.$)
7149 kiln dust	49.0	68.7	13.0	516
7150 kiln dust	40.2	73.8	4.4	1,655
7151 kiln dust	45.2	71.7	11.0	1,784
7152 kiln dust	37.5	73.8	6.8	1,667
7153 kiln dust	44.2	72.5	11.1	2,007
7149 cement	22.6	103.1	0.8	21,946
7150 cement	24.6	82.2	1.4	67,392
7151 cement	19.2	92.9	1.5	187,258
7152 cement	26.2	74.4	0.9	15,293
7153 cement	17.8	93.6	1.1	160,963
7149 fly ash	31.0	78.3	3.9	1,483
7150 fly ash	-	-	2.9	2,534
7151 fly ash	32.3	80.7	4.6	2,938
7152 fly ash	21.3	81.3	2.3	1,728
7153 fly ash	27.9	82.1	1.8	2,736

3.3 ANTICIPATED WASTE LOAD

In order to estimate the waste load that might be expected at the site, the data presented in Tables 3.2 through 3.5 were studied and modified. Organic wastes, dilute wastewater liquids, and several lesser categories listed on the tables were omitted as it was felt these would most likely be treated or disposed of on-site by the generator. The second major modification was to use a conversion factor of about 8.3 pounds of liquid per gallon (lb./gal.) (instead of the 10 lbs./gal. used in the Colorado waste inventory report) as being more representative of chemical wastes.

As can be seen in Table 3.9, the above modifications and assumptions yielded a total of about 138 million gallons of waste or about 75% of the total hazardous waste load generated in Colorado annually. Therefore, approximately 75% of Colorado's hazardous waste load is compatible with the facility, the majority of which comes from Region 3 (Denver area), Region 4 (Colorado Springs area), and Region 7 (Pueblo area).

Although the above quantity represents a reasonable estimate of the total annual amount of hazardous wastes generated in Colorado which would be compatible with the treatment/solidification and disposal facilities, the range of waste loadings selected for the facility is significantly less. This is due to a variety of factors including:

- the percentage of wastes already disposed of in an environmentally safe manner (10%, based on national averages);
- anticipated efforts by Colorado generators to minimize the amount of waste generated (e.g., via process modifications, by-product recovery, product substitution, etc.);
- development of area-wide waste exchange programs; and
- future on-site generator treatment and disposal facilities within the state.

TABLE 3.9

ESTIMATED QUANTITIES OF WASTES COMPATIBLE WITH SOLIDIFICATION PROCESS*

	Colorado Region 2**	Colorado Region 3**	Colorado Region 4**	Colorado Region 7**	Subtotals
Acids	75,316	8,384,767	36,168,030	4,408,633	49,036,746
Alkalies	282,548	224,333	181,600	60,000	748,481
Inorganic Liquids & Sludges	695	11,132,117	9,043,440	-0-	20,176,252
Sludges	4,183,762	9,911,995	361,199	12,424,515	26,881,470
Spill Residuals	130,695	11,702	-0-	-0-	142,397
Misc. Contaminated Items	480	786,307	480	-0-	787,267
Spent Catalyst	-0-	53,118	-0-	-0-	53,118
Waste Lime	-0-	-0-	-0-	1,315,108	1,315,108
Other Misc. Inorganic Wastes	-0-	205,277	8,951	38,450,719	38,664,947
TOTAL (GALLONS)	4,673,496	30,709,616	45,763,699	56,658,975	137,805,786

*Based on data presented in Reference 1.
**Refer to Figure 3.1 for regional definitions.

Additional factors would tend to increase waste generation rates. These include:

- the fact that not all industrial waste sources responded to the survey questionnaires; and
- recent and upcoming promulgation of EPA industrial wastewater pretreatment guidelines which will inevitably result in an increase in industrial sludges to be disposed of.

In view of these factors, the anticipated waste load to the facility was estimated to range from 12,000,000 gallons per year to 48,000,000 gallons per year. The wastes would be composed primarily of those categories indicated in Table 3.9. Representative compositions of some of these wastes are presented in Table 3.10(2).

TABLE 3.10
CHARACTERISTICS OF RAW WASTES FROM SEVERAL INDUSTRIAL CATEGORIES

Parameter	Metal Finishing-Plating 1	Metal Finishing-Plating 2	Metal Finishing	Metal Finishing-Spent Alkaline Degreaser	Automotive Oily Water	Petrochemical-Spent Alkaline Cleaner	Metal Fabrication-Detergent Cleaner	Aluminum Parts Manufacture-Plating
Flash Point (COC)° F	200	200	200	-	200	-	200	-
pH	2.2	8.6	9.5	14.2	8.4	13.9	9.6	6.0
Total Solids Wt. (%)	25.6	6.3	8.0	-	21.1	-	1.1	37.3
Chloride	-	-	-	533	-	82	-	-
Sulfate	-	-	-	2,250	-	100	-	-
Barium	4.2	0.1	0.1	0.5	0.5	0.1	0.2	22.5
Iron	880	1.0	0.36	-	19	1.80	140	7,111
Manganese	24	0.1	0.10	0.1	0.4	0.10	0.1	12.7
Boron	0.3	80	60	-	19	0.8	58	-
Arsenic	0.26	0.01	0.01	0.5	0.01	0.73	0.066	-
Cadmium	0.8	0.01	0.024	0.01	0.02	0.010	0.01	11.2
Copper	26	0.2	0.48	0.01	0.8	0.65	0.8	64.3
Chromium	200	0.4	0.40	0.4	0.6	10.0	2.1	1,693
Mercury	0.005	0.02	0.04	0.018	0.001	0.0060	0.0050	12.7
Nickel	210	12	3.28	0.1	4.3	0.10	410	11.2
Silver	0.1	0.1	0.1	0.1	0.1	0.10	0.1	12.4
Zinc	2,300	0.5	0.1	52	13	32	2.0	191.9
Lead	5.9	0.1	0.1	17	0.6	0.2	0.1	146.7
Selenium	0.6	0.3	0.3	1.5	0.1	3.0	0.1	-
Total Organic Carbon	1,360	748	185	4,500	7,925	495	1,450	-
Cyanide	-	-	-	-	-	0.180	-	-
Phenol	-	-	-	0.200	-	1.08	-	-

NOTE: Units are mg/l unless otherwise stated.

Phase I operation will process approximately 8,000,000 gallons per year, consistent with the Part A application (included in Appendix B) submitted to the EPA to qualify for interim status. The anticipated basis of operation will be a one shift per day, five day per week schedule.

For Phase II, to accommodate the estimated range of waste loadings in Colorado, the facility must be able to process about 12,000,000 gallons per year when operated on a one shift per day, five day per week basis; and 48,000,000 gallons per year when operated three shifts per day and six to seven days per week. Appropriate amendments to the EPA Part A permit will be made for Phase II operation in accordance with RCRA requirements.

3.4 REFERENCES

1. Hynes, Jeffrey L. and Sutton, Christopher J., Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geological Criteria for Disposal, "Colorado Department of Health and Colorado Geological Survey," Denver, Co., (1980).

2. Dillon, Consulting Engineers and Planners, Solidification Facilities for Liquid Industrial Wastes, Environmental Assessment Report, Vol. II (May, 1980).

CHAPTER 4

TRANSPORTATION ANALYSIS

The chemical wastes and solidification reagents will be transported to the site by truck. A transportation analysis was, therefore, performed to assess the adequacy of existing roads within the regional network. The scope of this analysis included the following tasks:

- Identify regulations governing the transportation of chemical wastes;
- Determine existing access routes to the site;
- Estimate traffic volumes generated by the site;
- Determine existing traffic volumes associated with the access routes;
- Compare site generated traffic volumes to existing traffic volumes.

4.1 TRANSPORTATION MANAGEMENT PHILOSOPHY

Chemical wastes will be received at the facility in one of three forms: solid, liquid, or an intermediate sludge, and will be either in bulk quantities or containerized in drums. Solidification reagents, such as cement kiln dust or fly ash, will be delivered to the facility in bulk. In general, four types of specialized vehicles will be utilized for collection and transport of these materials: vacuum type tank trucks (liquids), roll-off container trucks (solids and sludges), flat-bed trucks (drums), and pneumatic-type bulk material trucks (dry reagents). These vehicles are shown in Figures 4.1 through 4.4.

BFI's specialized fleet of collection vehicles and/or subcontract vehicles, or their equivalent, will be utilized for transportation. These vehicles are classified according to U.S. Department of Transportation (DOT) specifications. Trucks receive this DOT approval only when every step in their construction and operation--from the way in which the welding was done to the installation of all safety devices--has met Federal standards. Inspection and operation of subcontract vehicles will be monitored by BFI.

4.2 TRANSPORTATION REGULATIONS AND PRECAUTIONS

Transporters of hazardous wastes are required to comply with the applicable regulations of the Department of Transportation, Environmental Protection Agency, and the State of Colorado governing the transportation of hazardous wastes(1). All waste transporters will be required to obtain an EPA identification number in accordance with 40 CFR Part 263.11, as well as maintain and comply with the manifest system in accordance with 40 CFR Part 263, Subpart B(2).

The Department of Transportation regulations under 49 CFR Part 172, Subpart F, require labeling of hazardous material transports. All BFI vehicles and subcontract vehicles carrying hazardous wastes will be appropriately labeled or placarded. All vehicles are maintained in secure and roadworthy condition and are equipped with two-way radios.

40 CFR Part 263, Subpart C, requires the transporter of a pollutant which has spilled to take immediate action to protect the environment and to give notice of the discharge, if required by 49 CFR 171(2). Subpart C places the responsibility of discharge clean-up on the transporter. There is also a provision for an appropriate agency or municipality to direct the transporter to take action to prevent or limit the effects of a spill. In the event of a road accident resulting in a spill, a response team will be sent from the site to assist in clean-up. This response team is described in Section 7.4.

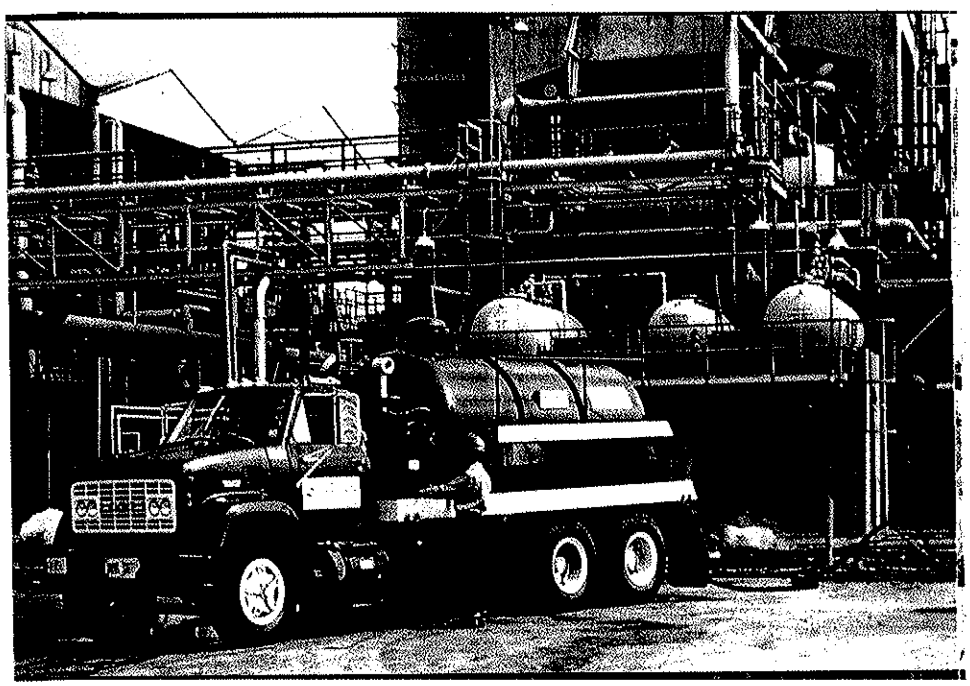

FIGURE Nº. 4.1

TYPICAL VACUUM TYPE TANK TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

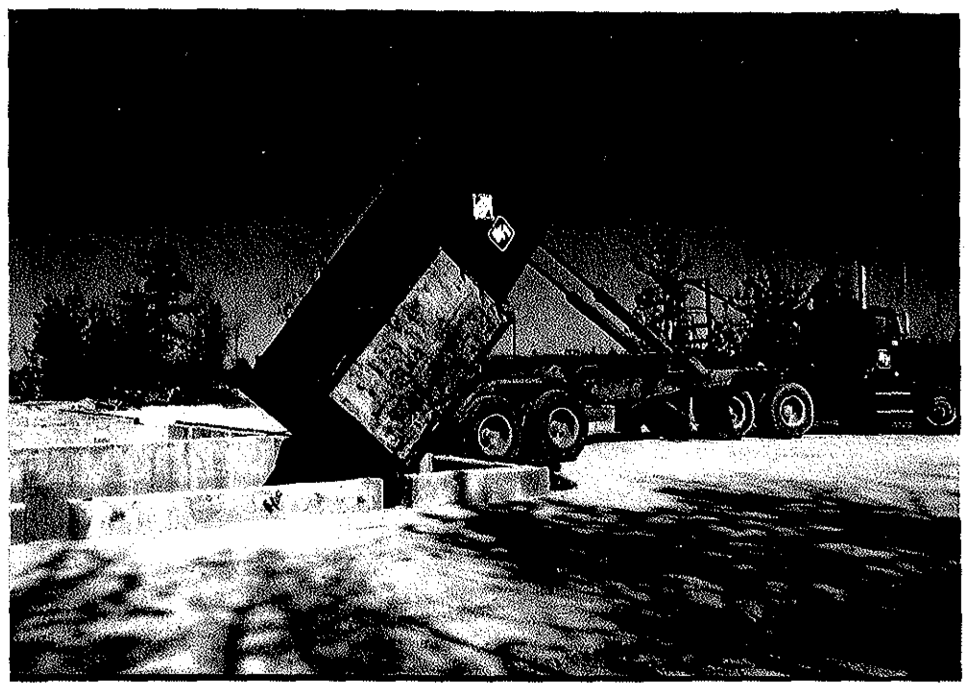

FIGURE Nº. 4.2

ROLL-OFF CONTAINER TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

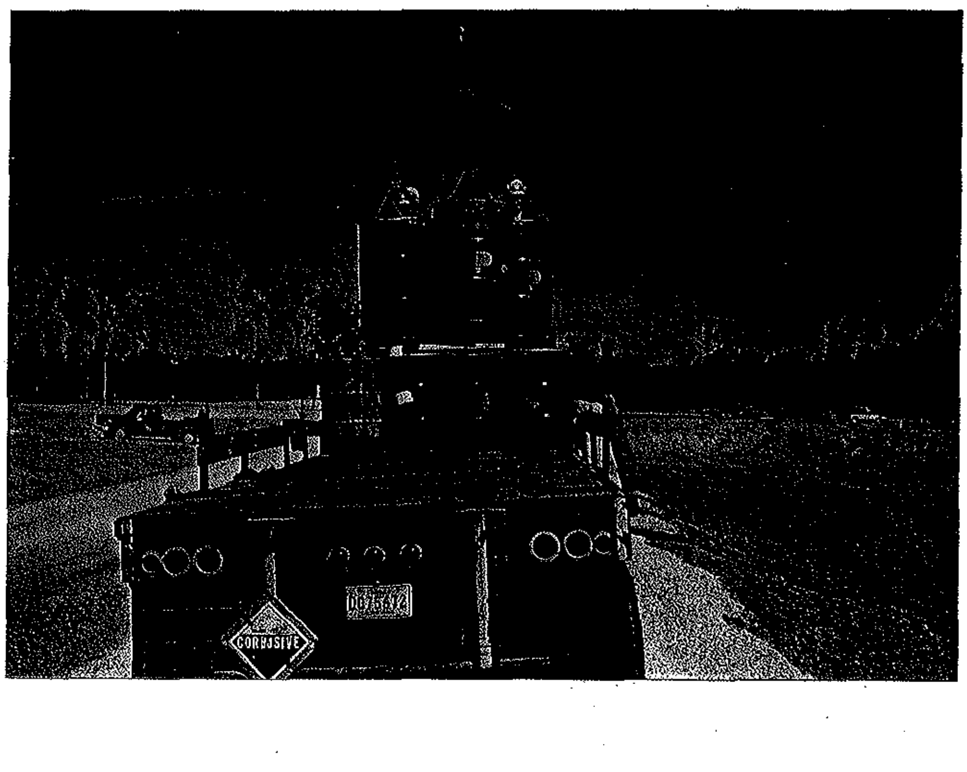

FIGURE №. 4.3

FLAT-BED TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
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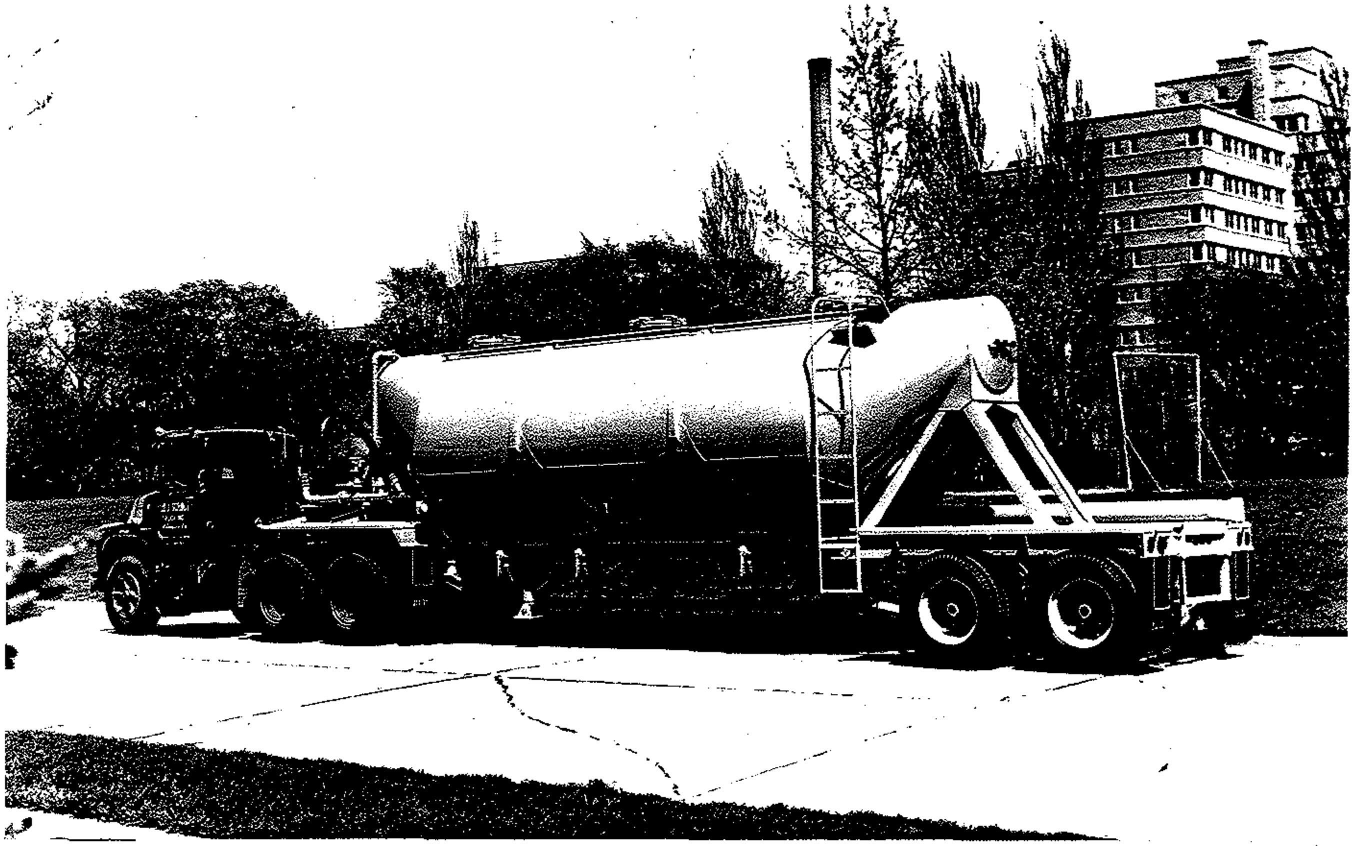

FIGURE Nº. 4.4

PNEUMATIC – TYPE BULK MATERIAL TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
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In addition to the above Federal regulations, Colorado regulations governing transport and shipping of hazardous materials will be complied with, where applicable. The Colorado Public Utilities Commission regulations are contained in HMS 1-9 and HMT 1-15(1,3). These are presented in Appendix I.

4.3 ACCESS ROUTES

The Colorado Department of Health and Colorado Geological Survey have determined that 99.7% of the State's hazardous waste is generated in Regions 2, 3, 4, and 7 which are shown in Figure 4.5(4). Consequently, only the traffic from cities within these regions was considered as having a potential impact on transportation facilities. The routes regarded as most reasonable for access are also illustrated in Figure 4.5. The major traffic sources include the cities of Denver, Greeley, Fort Collins, Boulder, Colorado Springs, and Pueblo. The major routes to be affected by increased traffic associated with the facility are U.S. Highway 36 (U.S. 36), State Highway 71 (S.H. 71), U.S. Highway 85 (U.S. 85), and Interstate Highways 25 and 70 (I-25 and I-70). Probable routes to the site are summarized in Table 4.1.

TABLE 4.1

PROBABLE TRANSPORTATION ROUTES

City	Probable Route	Distance (Miles)
Denver	I-70 to U.S. 36	75
Colorado Springs	I-25 to I-70 to U.S. 36	145
Pueblo	I-25 to I-70 to U.S. 36	185
Fort Collins	I-25 to I-70 to U.S. 36	150
Greeley	U.S. 85 to I-70 to U.S. 36	120
Boulder	U.S. 36 to I-70 to U.S. 36	110

All existing bridges on the routes indicated in Table 4.1 were found to conform to standard Colorado structural loadings(5). The State of Colorado legal weights and sizes can be found in Appendix I.

4.4 TRIP GENERATION

For the purpose of estimating daily truck traffic generated by the proposed facility, the following assumptions were made:

- o truck capacities

liquid tanks	- 4200 gallons
roll-off containers	- 20 cubic yards
drums	- 80 per truck
reagents	- 50 cubic yards

- o waste volume split

liquid tanks	- 60%*
roll-off containers	- 35%*
drums	- 5%

*This conservative split results in maximum reagent usage, although actual liquid percentage could probably be less.

- o waste and reagent arrivals

Monday through Friday	- 90%
Saturday and Sunday	- 10%

- o reagent to waste ratios

liquids	- 2.5:1*
semi-solids	- 1:1
solids	- direct burial

*The 2.5:1 ratio was chosen to liberally estimate reagent usage as an average of reagent ratios for cement kiln dust (2:1) and fly ash (3:1). Because kiln dust is the preferred reagent, the average will probably be closer to 2:1.

As was discussed in the previous chapter, the waste loading for the facility is anticipated to range from 12 to 48 million gallons per year. For the purposes of the transportation analysis presented herein, the maximum rate was assumed. Based upon a maximum waste throughput of 48

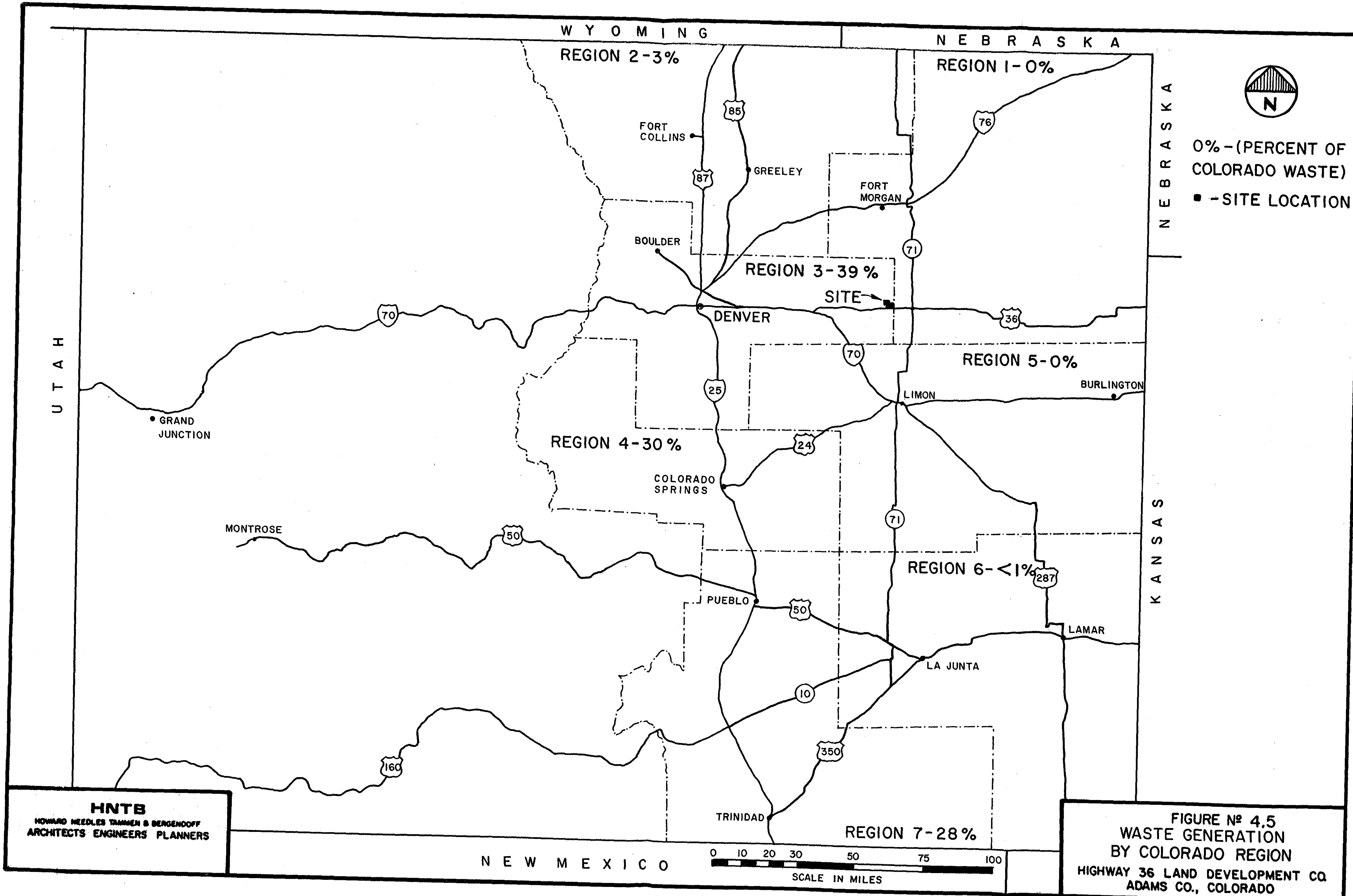

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FIGURE Nº 4.5
WASTE GENERATION
BY COLORADO REGION
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

million gallons per year and the quantity of reagents required, the average number of one-way truck trips per weekday is estimated to be 70. Assuming 80% will arrive between 7:00 A.M. and 7:00 P.M. and a total processing time of one and one-half hours, the hourly variations of two-way weekday truck traffic were estimated. This is illustrated in Figure 4.6. Figure 4.6 also illustrates the hourly variations in two-way weekday employee traffic(6). The assumptions used to generate the curve were as follows:

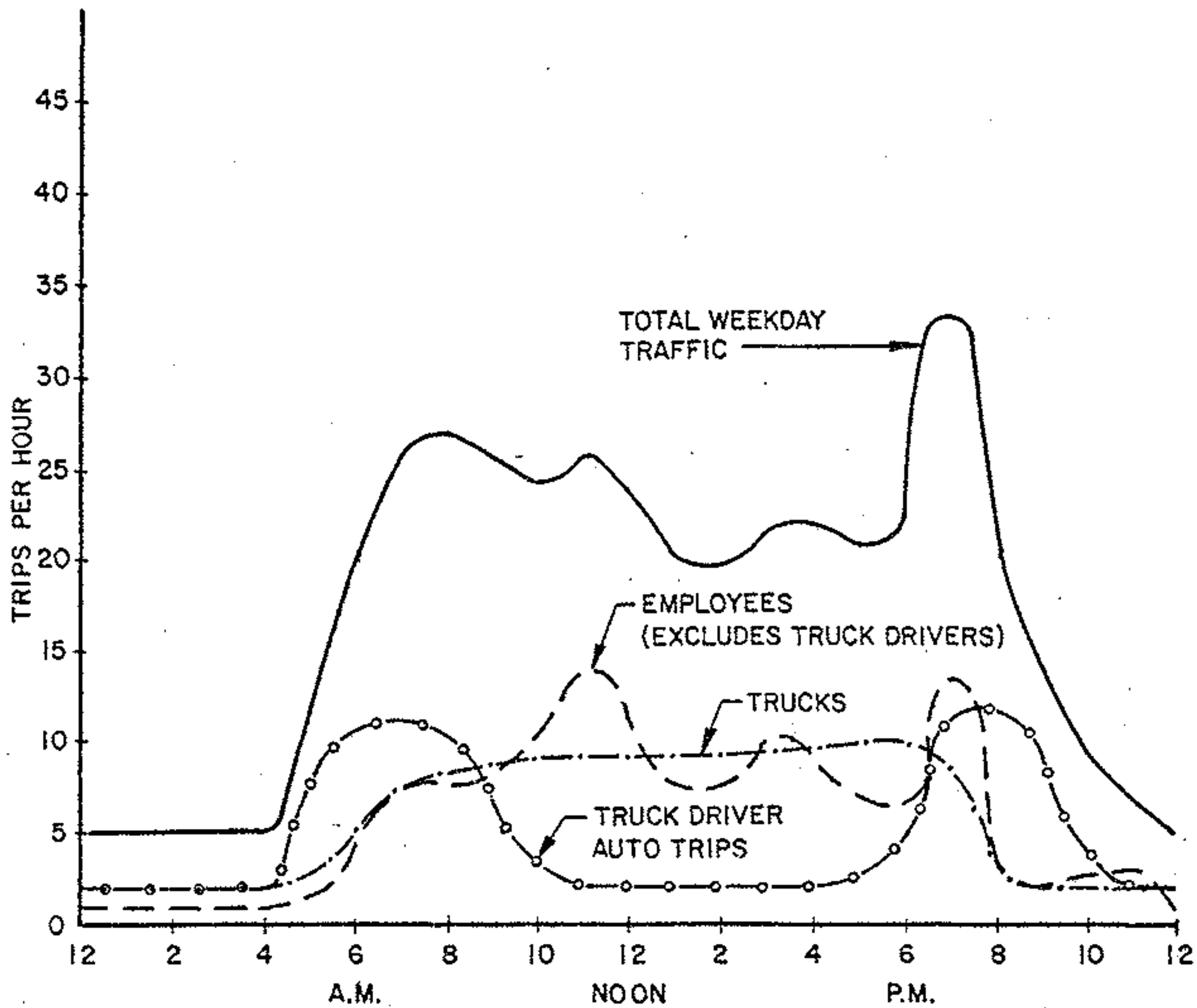
- o a minimum operation staff of five (1.2 round-trips each per day);
- o a managerial staff of five during the day (8.8 round-trips each per day);
- o a waste processing staff of 25 during the period of maximum activity (1.2 round-trips each per day);
- o a truck driving staff of 58 for peak loadings (1 round-trip each per day).

The average number of two-way weekday employee trips is forecasted to be 236 and truck trips will be approximately 140. Thus, the total site-generated two-way average weekday trips will be 376.

A factor of 2.0 was applied to the hourly waste truck volumes to determine the peak hour two-way volume. The total two-way peak hour volume (trucks and employees) generated by the site will be 43.

4.5 TRAFFIC VOLUMES AND DISTRIBUTION

Table 4.2 shows existing routes expected to be used as access to the site. Included in this table are the average traffic growth rates per year, the 1978 average daily traffic (ADT), the ADT in 1982 with and without traffic generated by the site, and the percentage of 1982 ADT that are waste delivery trips(7).



WEEKDAY TRAFFIC VARIATION AT THE SITE (TWO-WAY)

FIGURE Nº 4.6

SITE GENERATED TRAFFIC

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

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TABLE 4.2

FUTURE ROAD TRAFFIC VOLUMES

Route	Avg. Growth per Year(8)	Existing 1978 ADT(7)	1982 ADT W/O Site	Daily Employee Trips	Daily Waste Trips	Daily Reagent Trips	1982 ADT W/Site	% of Total 1982 ADT Generated by Waste Trips Only
U.S. 36 W. of Adams-Washington County Line	3-1/2%	810	920	94	81	57	1152	7
U.S. 36 W. of Last Chance	3-1/2%	780	890	142	2	0	1034	<1
S.H. 71 S. of Last Chance	3%	570	630	71	0	0	701	<1
S.H. 71 N. of Last Chance	2-1/2%	800	880	47	1	0	928	<1
U.S. 36 E. of Last Chance	3%	820	920	24	1	0	945	<1
I-70 W. of Byers	3-1/2%	7650	8720	94	81	57	8952	1
I-25 S. of Denver	3%	21,500	25,200	0	47	33	25,280	<1

Future volumes on the road systems were derived using traffic counts and growth rates established by the Colorado Department of Highways. Assumptions made for this study are that 40% of the employees will commute from communities west of the site, 10% from the east, 20% from the north, and 30% from the south. Figure 4.7 illustrates the 1982 ADT volumes with and without traffic generated by the site.

4.6 ANALYSIS AND REQUIREMENTS

4.6.1 Level of Service

The anticipated impact of the facility on the adjacent and area road system is measured by changes in level of service attributable to additional vehicular volumes generated by the site. Level of service is a qualitative measure used to describe general operating conditions on a specific roadway segment(9). Factors included in evaluating level of service are speed, vehicle types, roadway conditions, and roadway geometrics. A major factor in identifying level of service is the v/c ratio--the ratio of demand volume to capacity. Level of service indexes correlate to certain v/c ratios and range from A to F, with A being a free flow condition. Level of service is generally determined on the basis of traffic occurring during a period of one hour over a specified section of road. The maximum rate of flow in vehicles per hour which can be accommodated on a section of roadway and still provide service A level of operation is called the service volume at level of service A. The service volume at level of service A for U.S. Highway 36 is 280 vehicles per hour. This assumes 30% trucks and passing sight distance greater than 1500 feet over at least 80% of the roadway.

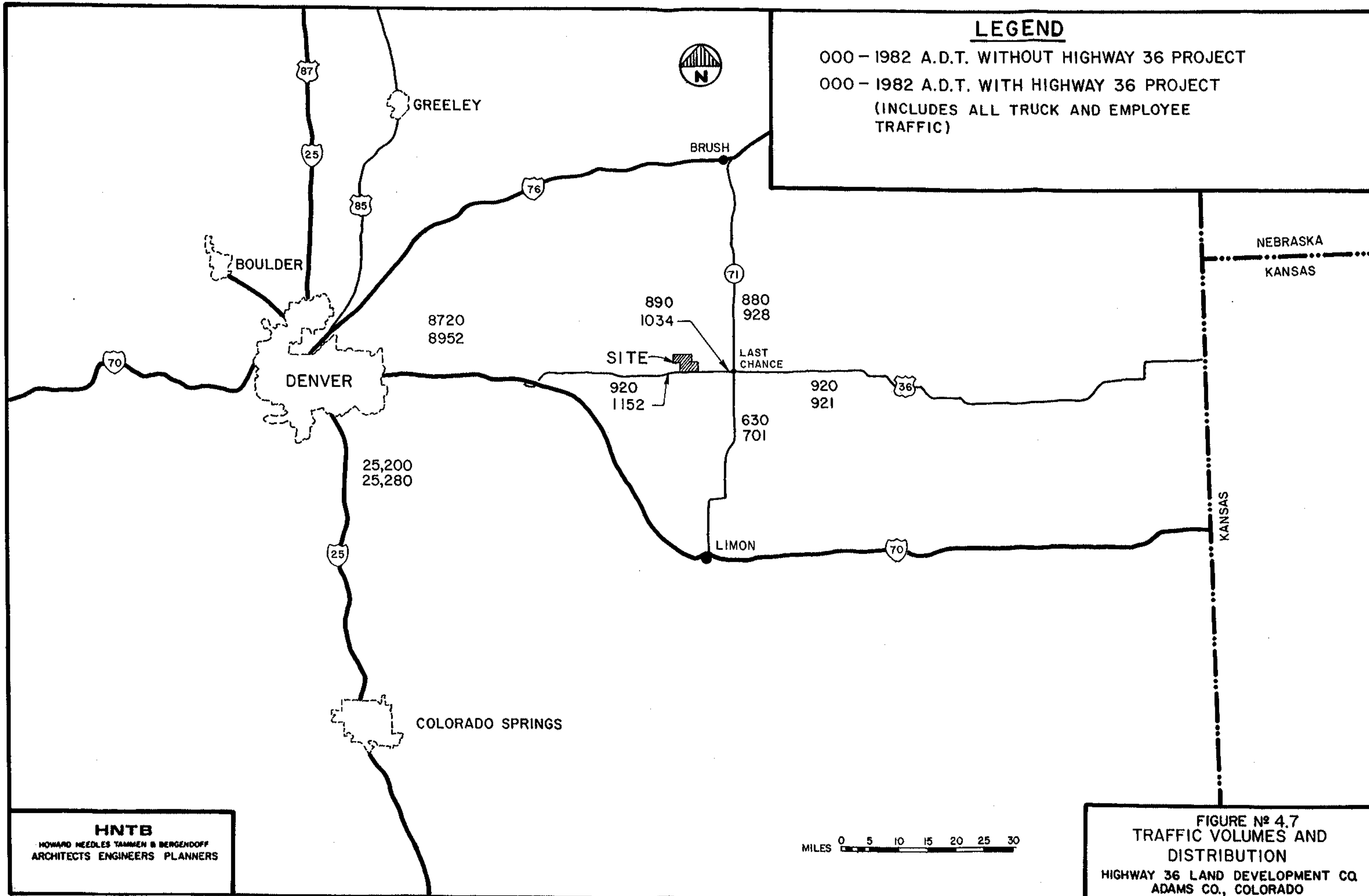


FIGURE Nº 4.7
TRAFFIC VOLUMES AND DISTRIBUTION
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

This analysis assumes concurrent peak hours for U.S. 36 and site-generated traffic. Figure 4.8 shows the peak hour traffic volumes associated with the roadways in the site area. These 1982 values indicate the volumes at the start of full operation of the site. The impact of site-related traffic will be most critical at that time.

The anticipated maximum 1982 volume in the vicinity of the site is 194 vehicles per hour (v.p.h.), which is well within the level of service A range. Therefore, no change in level of service on these roads is expected to result from site-generated traffic. Other roadways along routes to the site have large enough volumes of traffic to make the increases due to site-generated traffic insignificant. Therefore, the traffic impacts related to the site do not require significant mitigating measures.

4.6.2 Access Road Analysis

It is recommended that access to the active site be provided by a road connecting to U.S. 36. Prior to construction of this access road, vehicles will utilize two existing roadways, as follows. The Phase I route would follow the existing road on the Adams/ Washington county line north from U.S. 36 approximately one mile, then west into the site area along the existing access road.

The Phase II route from U.S. 36 to the southern site boundary is expected to be operational in 1982. Located approximately one mile west of the Adams/Washington county line, this route parallels an existing power line on the site. This main access road would be asphalt pavement on a granular base, capable of handling the intended traffic.

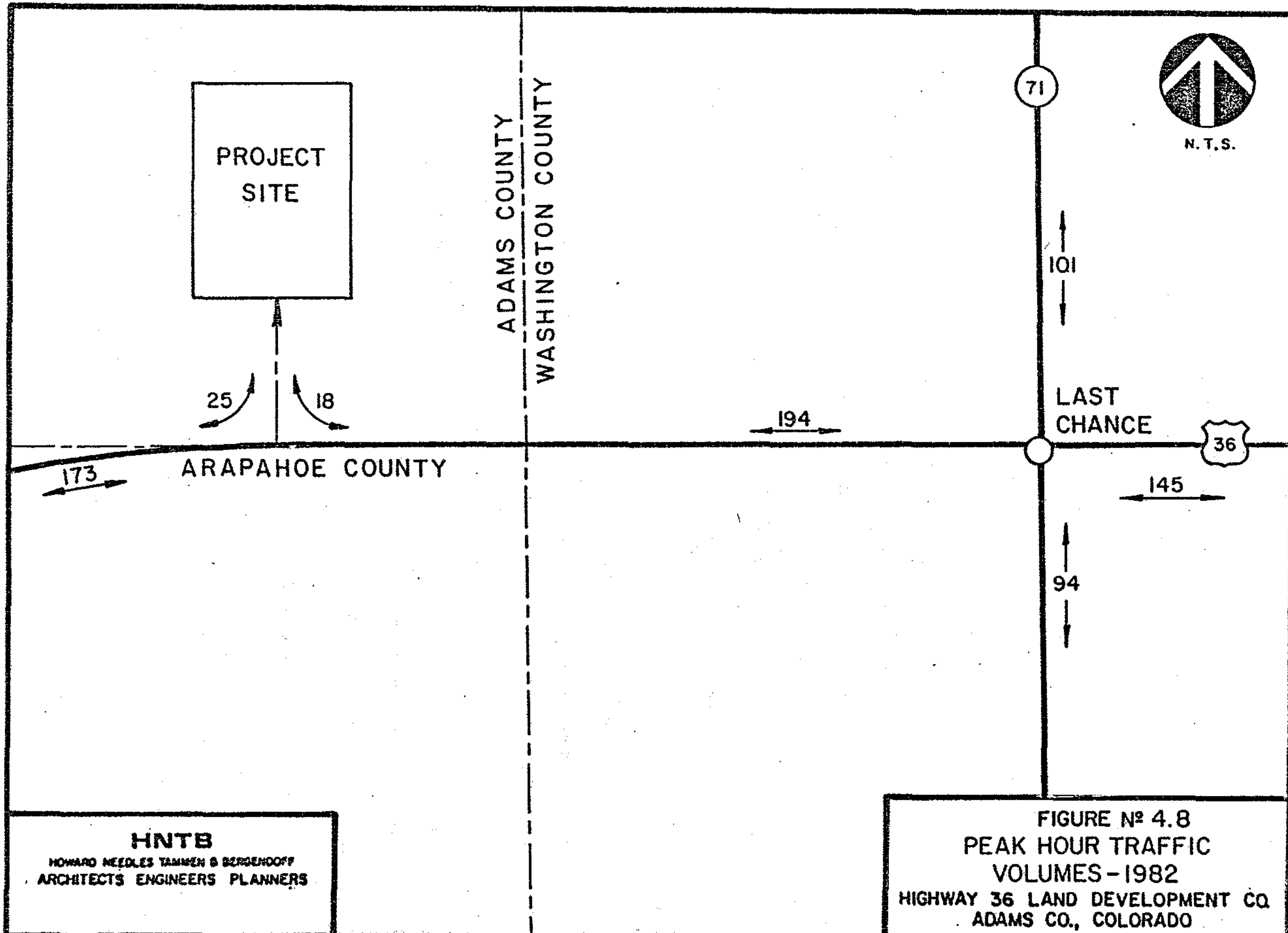


FIGURE Nº 4.8
PEAK HOUR TRAFFIC
VOLUMES-1982
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

The location of the site access connection to U.S. 36 provides adequate stopping site distance for traffic on the highway. Approach roadway features on Highway 36 leading to the southern access road for Phase II will be provided consistent with Colorado Department of Highway requirements.

4.7 REFERENCES

1. Public Utilities Commission of the State of Colorado, Department of Regulatory Agencies, Rules and Regulations Governing the Transportation of Hazardous Materials within Colorado.

2. "Environmental Protection Agency - Hazardous Waste and Consolidated Permit Regulations," Federal Register, 45 (98), Book 2 (May 19, 1980).

3. Public Utilities Commission of the State of Colorado, Department of Regulatory Agencies, Rules and Regulations Governing the Shipping of Hazardous Materials within Colorado.

4. Hynes, J. L., Sutton, C. J., Hazardous Wastes in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal, Colorado Department of Health and Colorado Geologic Survey, State of Colorado (1980).

5. Personnel Communication, Bridge Inspection Engineer, Colorado Department of Highways.

6. Buttke, C. H., et al., Trip Generation, Institute of Transportation Engineers, Arlington, Virginia (1979).

7. 1978 Traffic Volume Map - Colorado State Highway System, Division of Planning, State Department of Highways - State of Colorado.

8. Colorado Department of Highways, Division of Transportation Planning, Traffic Counts and Growth Factors.

9. Kemp, B. K., et. al., Highway Capacity Manual, Highway Research Board, Washington, D.C. (1965).

CHAPTER 5

EXISTING ON-SITE AND OFF-SITE CONDITIONS

5.1 INTRODUCTION

The purpose of this chapter is to provide a detailed summary of existing regional and site-specific conditions. This information provided essential input to the design and operational plan, to be discussed in Chapters 6 and 7. It also served as a basis from which potential environmental impacts could be assessed, as discussed in Chapter 8. The conditions characterized in this chapter include the following:

- boundary survey;
- geology and hydrogeology;
- topography and surface drainage;
- baseline water quality;
- air quality and noise;
- environmental inventory;
  - climate;
  - natural ecosystems;
  - land use and population;
  - economic activities;
  - heritage and cultural resources.

5.2 METHODS OF CHARACTERIZATION

Several methods of characterization were utilized in order to accurately describe the regional and site-specific base line conditions. These included:

- legal surveys of property;
- aerial reconnaissance;
- site borings and soils testing;
- field reconnaissance;
- water sample collection and analysis;
- collection, review, and analysis of existing information;
- computer modeling;
- biological reconnaissance.

5.3 BOUNDARY SURVEY

5.3.1 Legal Description

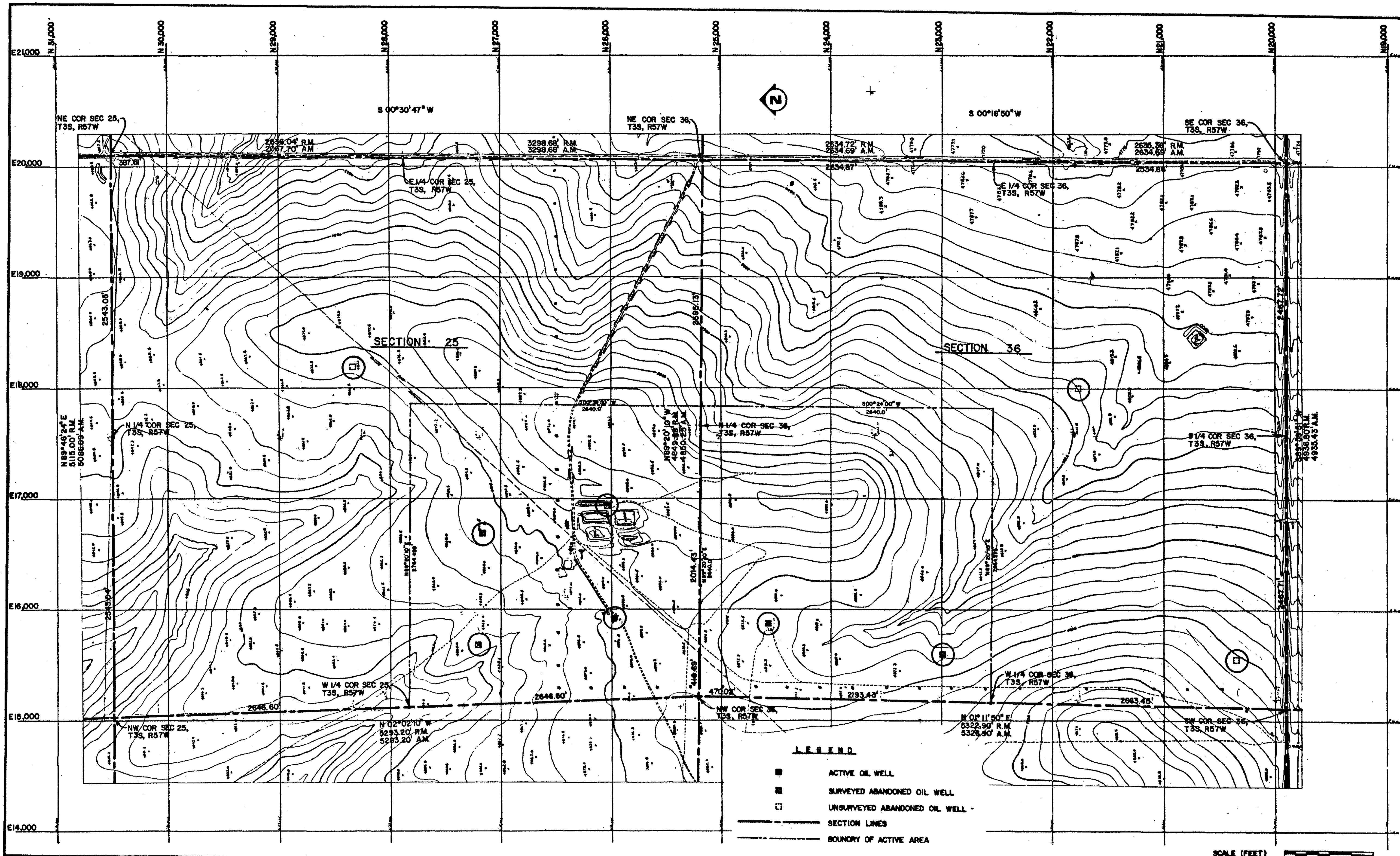
As shown in Figure 5.3.1, the legal description of the two sections, within which the site is located, reads as follows:

> All of Sections 25 and 36, Township 3 South, Range 57 west of the sixth prime meridian, Adams County, Colorado; except an apparent utility easement across Sections 25 and 36 and except an easement and right-of-way for the purpose of constructing, reconstructing, operating, and maintaining a 6 inch oil pipeline, granted to Arapahoe Pipeline Company by the State of Colorado, acting by and through the State Board of Land Commissioners, affecting Sections 25 and 36, excepting right-of-way for ditches or canals, reserved in United States patents recorded in Book 106, page 201, affecting the north half of Section 25; also Book 99, page 201, affecting the south half of Section 25; and excepting the east 30.00 feet of Section 25; also excepting the east 30.00 feet of Section 36 to be dedicated to Adams County for road, and except the south 100.00 feet of Section 36.

A certified copy of the boundary survey is given as Exhibit 5.3.1.

Section 25 contains approximately 603.93 acres; Section 36 contains approximately 580.18 acres. Acreages include an easement and rights-of-way for the pipeline recorded in Book 1356, page 288, and an apparent utility (electrical power line). Figure 5.3.2 is an aerial photograph of Sections 25 and 36 taken in December of 1980.

The portion of the two sections to be used for the processing and disposal facility complex (the site) is indicated on Figure 5.3.1. It contains approximately 325 acres. All recorded abandoned oil wells within this area were physically located and surveyed. These are shown in Figure 5.3.1 along with the historically recorded locations of other abandoned oil wells on the two sections.



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HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB

ARCHITECTS ENGINEERS PLANNERS

JOB NO.

DATE 18 MAR 81

BFI BROWNING-FERRIS INDUSTRIES

HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO

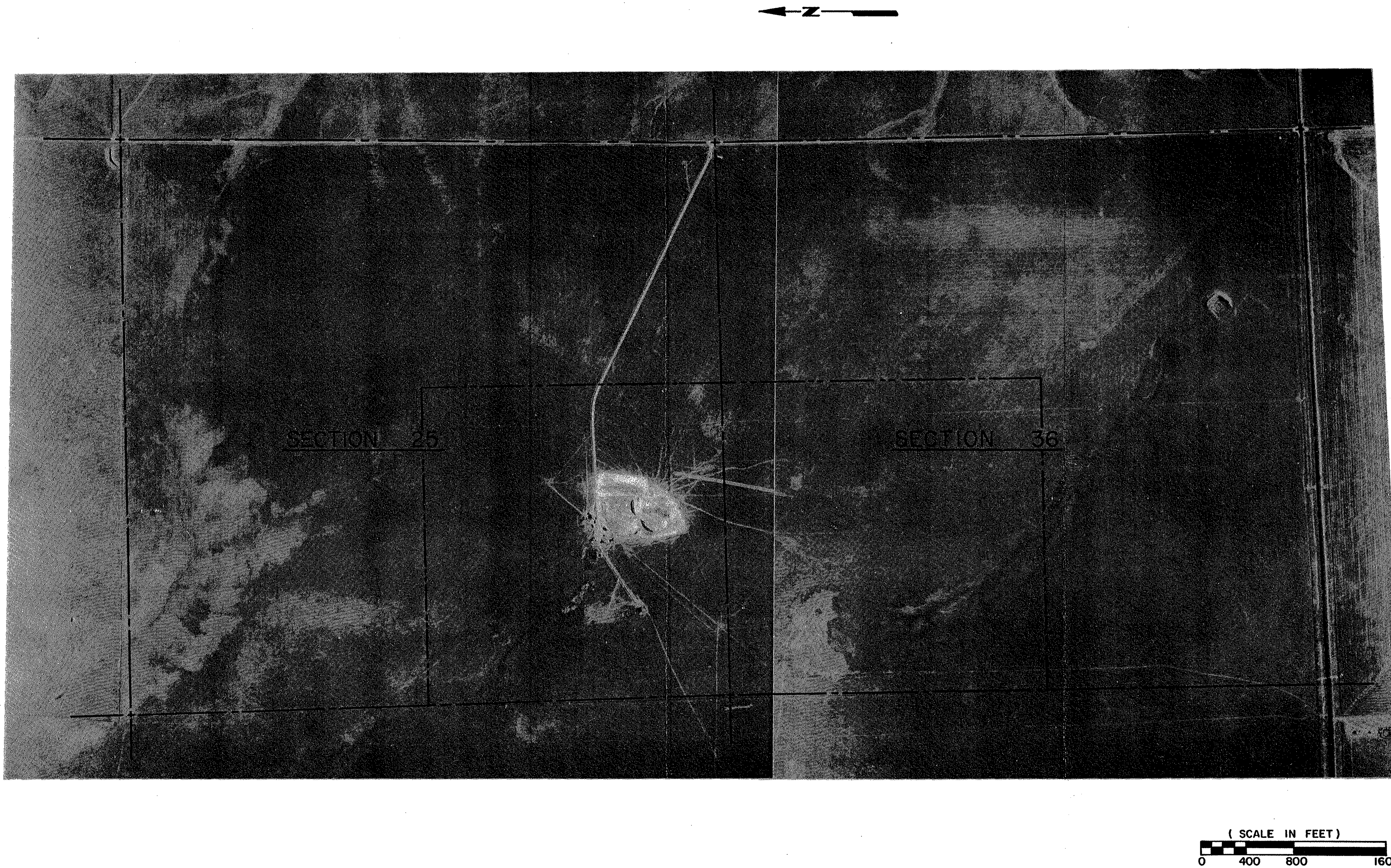
CHEMICAL WASTE DISPOSAL FACILITY

BOUNDARY SURVEY OF SECTIONS 25 & 36 AND ACTIVE AREA

SHEET NO.

FIG 5.3.1

OF



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ARCHITECTS ENGINEERS PLANNERS

JOB NO.

DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES

HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO

CHEMICAL WASTE DISPOSAL FACILITY

AERIAL PHOTOGRAPH OF SECTIONS 25 & 36

SHEET NO

FIG 5.3.2

5.3.2 History of Ownership

The history of ownership of Sections 25 and 36 since Adams County was formed in 1902 is provided below:

- Section 36
  - Acquired by patent from the State of Colorado by Gene and Shirley Linnebur in 1979.
  - Sold to Highway 36 Land Development Company in 1980.
- Section 25
  - S 1/2 owned by John and Ethel Fleming when the county was formed in 1902.
  - N 1/2 acquired by patent from U.S. Government in 1920 by Lucy Pierce.
  - S 1/2 acquired by George and Mary Patterson from Fleming in 1920.
  - N 1/2 sold to Viola Ledgerwood in 1920.
  - S 1/2 acquired by Colorado Farm Company from Patterson in 1922.
  - N 1/2 sold to Wanda Lieske in 1929 from Ledgerwood.
  - S 1/2 sold to Ina Dudley from Colorado Farm Company in 1930.
  - S 1/2 sold to William Jolly in 1941 from Dudley.
  - N 1/2 sold to John Jolly from Lieske in 1943.
  - N 1/2 conveyed to William Jolly from John Jolly in 1947.
  - Section 25 conveyed to Wanda Jolly upon the death of William Jolly in 1964.
  - Section 25 sold by Wanda Jolly in 1969 to Linnebur.
  - Sold by Linnebur to Highway 36 Land Development Company in 1980.

5.4 GEOLOGY AND HYDROGEOLOGY

5.4.1 Introduction

Geologic and hydrogeologic investigations of the site and the surrounding region were performed by F. M. Fox & Associates, Inc., of Denver, Colorado. The purpose of these studies was to assess and determine the site's geological and hydrogeological suitability for a chemical waste treatment, solidification, and disposal facility.

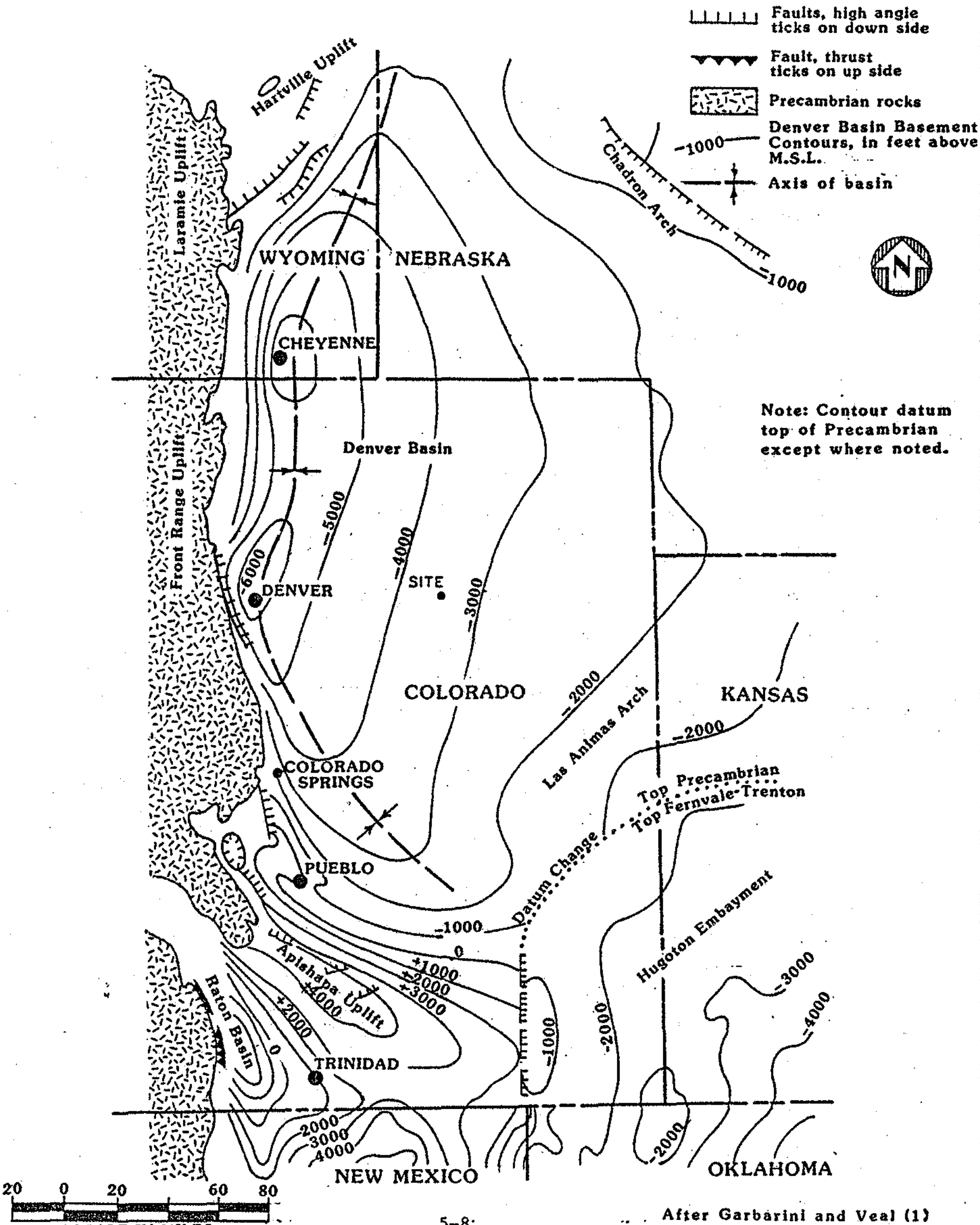
5.4.2 Geologic Conditions

5.4.2.1 Regional

The Denver Basin in northeastern Colorado, east of the Front Range and north of Colorado Springs, was evaluated in this regional analysis. The Denver basin is in the Great Plains physiographic province, a region primarily of rolling grasslands. These plains slope generally eastward across the Denver basin. Elevations range from 7,000 feet near the mountains to 4,000 feet along the Kansas border.

A generalized tectonic map of the Denver basin and surrounding area is presented in Figure 5.4.1(1). As indicated by the contour lines, the Precambrian basement east of the mountains is at a depth of 2,000 to 6,000 feet below mean sea level. Furthermore, these contours illustrate that the Denver basin is a broad asymetrical structure with the axis very close to the western margin of the basin. The eastern flank dips gently west at about 30 to 50 feet per mile, and the western flank dips very steeply to the east, with beds locally overturned(1). Very few faults have been found, except along the boundary of the Front Range.

Few wells have been drilled to basement in the Denver basin. Where observed, the basement material consists of Precambrian igneous and metamorphic rocks, primarily gneiss and granite. Overlying sedimentary rocks



After Garbarini and Veal (1)

GENERALIZED TECTONIC MAP OF THE DENVER BASIN

FOX Consulting Engineers and Geologists

Job No:	1-2543-3233
Date:	12/11/80
Figure	5.4.1

range in age from Cambrian to Tertiary, as illustrated in the regional composite stratigraphic section presented in Figure 5.4.2(1). East of the basin axis, only Cretaceous age and younger rocks are exposed. Surficial deposits of Quaternary dune sand, silt, and Peoria loess blanket much of the surface. Figure 5.4.3 is a generalized regional geologic map of the basin area(2), and Figure 5.4.4 is a generalized regional east-west cross-section. The significance of these figures will be discussed in Section 5.4.4.

Coal, oil, and gas have been produced from the Denver basin. Coal has been mined from seams in the Laramie Formation just east of the Front Range. Oil and gas production has come from the Dakota "D" and "J" sandstones, the Niobrara Formation chalk, the Hygiene Sequence sandstones of the Pierre Shale, and the Lyons Sandstone. Within the Pierre Shale are the Richard, Larimer, Rocky Ridge, Terry, and Hygiene Sandstones, collectively called the Hygiene Sequence. These units thin eastward from the Front Range. The oil and gas accumulations are localized in stratigraphic traps of lenticular sandstone bodies pinching laterally into shale or sandy shale.

5.4.2.2 <u>Site Specific</u>

Bedrock below the site is the Pierre Shale. The Colorado Department of Health has evaluated geologic formations in the State for potential use as hazardous waste disposal sites(3). Their evaluation indicated that the Pierre Shale has the highest probability of developing a safe storage facility. Other formations in the Denver basin, i.e., the Denver Formation, Dawson Arkose, Laramie Formation, Niobrara Formation, and Benton

Era	Period	Formation	
	TERTIARY	W OGALLALA ARICKAREE WHITE RIVER	NON MARINE
MESOZOIC	CRETACEOUS UPPER	W DAWSON FM. W LARAMIE FM. W FOX HILLS SS.	
MESOZOIC	CRETACEOUS UPPER	● PIERRE SH. NIOBRARA FM. BENTON SH.	MARINE
MESOZOIC	CRETACEOUS LOWER	● W DAKOTA GROUP	
MESOZOIC	JURASSIC	MORRISON FM. ENTRADA SS.	
MESOZOIC	TRIASSIC	LYKINS FM.	DOCKUM SS.
PALEOZOIC	PERMIAN	● LYONS SS.	
PALEOZOIC	PENNSYLVANIAN	FOUNTAIN FM. ARKOSE	EVAPORITES MARINE CARBONATES AND CLASTICS
PALEOZOIC	MISSISSIPPIAN	MARINE CARBONATES	
PALEOZOIC	DEVONIAN	AND CLASTICS	
PALEOZOIC	SILURIAN	ABSENT?	
PALEOZOIC	ORDOVICIAN	MARINE CARBONATES	
PALEOZOIC	CAMBRIAN	AND CLASTICS	
PRECAMBRIAN BASEMENT		IGNEOUS AND METAMORPHIC ROCKS	

W Aquifer

● Designates major oil objectives

After Garbarini and Veal (1)

COMPOSITE STRATIGRAPHIC SECTION OF DENVER BASIN

FOX Consulting Engineers and Geologists

Job No: 1-2543-3233

Date: 12/11/80

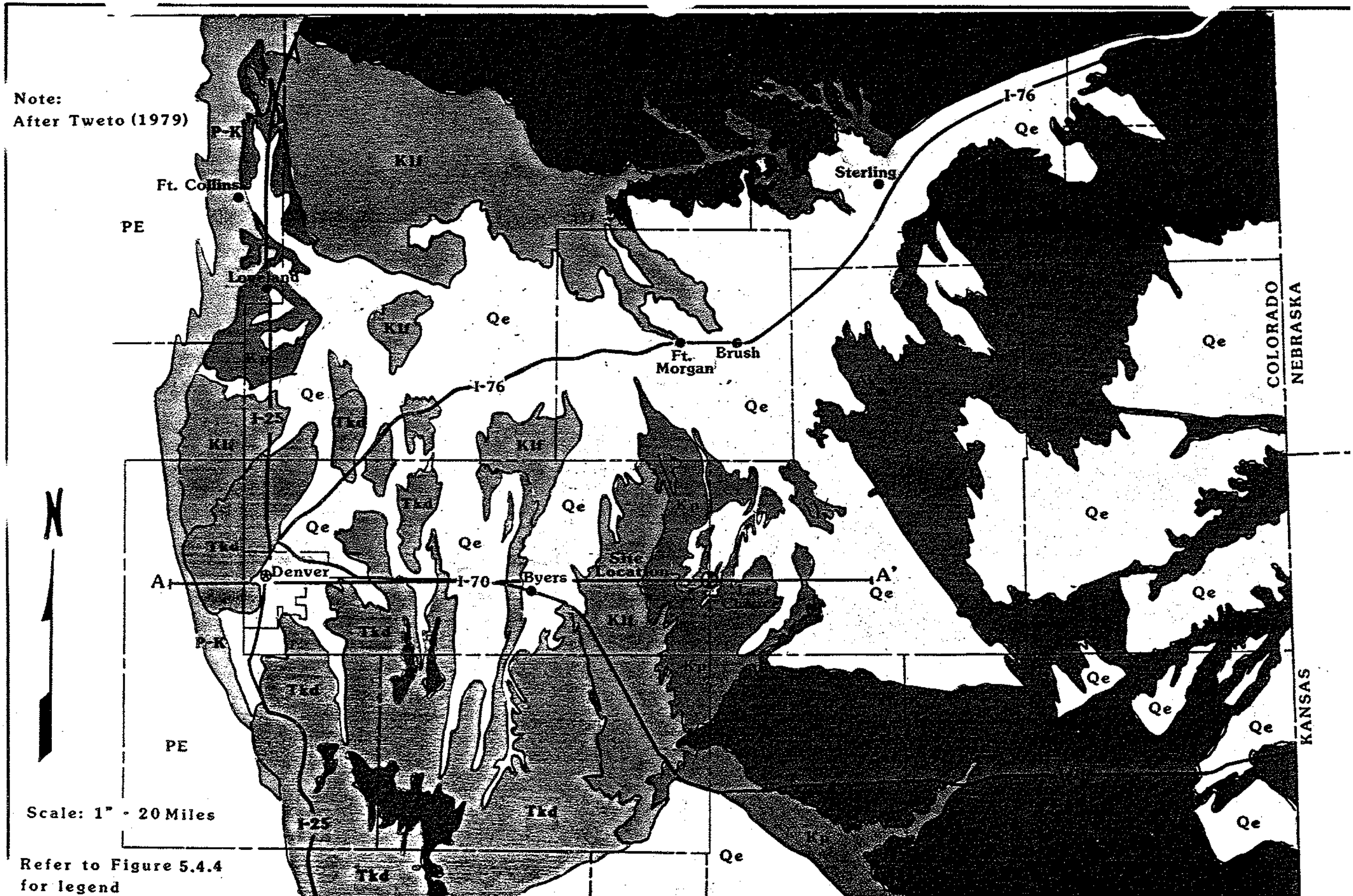
Figure 5.4.2

Group were evaluated as having marginal probability for safe storage. These conclusions are summarized in Table 5.4.1. Figures 5.4.3 and 5.4.4 illustrate that the site is located within this favorable formation.

The Pierre Shale is a gray to black, silty, fossiliferous, marine shale. Oil well information indicates the sandstones of the Hygiene Sequence of the Pierre Shale pinch out west of the site(1,4,5). If the sequence were below the site, it would be expected at an approximate depth of 1,000 feet. No evidence of this sequence was found in the available geophysical logs from wells at the site. The total thickness of the Pierre Shale at the site is approximately 4,300 feet, as illustrated in the generalized site stratigraphic section presented in Figure 5.4.5(5) and the general cross section in Figure 5.4.6(5). In-situ permeability test results near the surface of the unweathered Pierre Shale indicate that the shale is impervious (refer to Section 5.4.3).

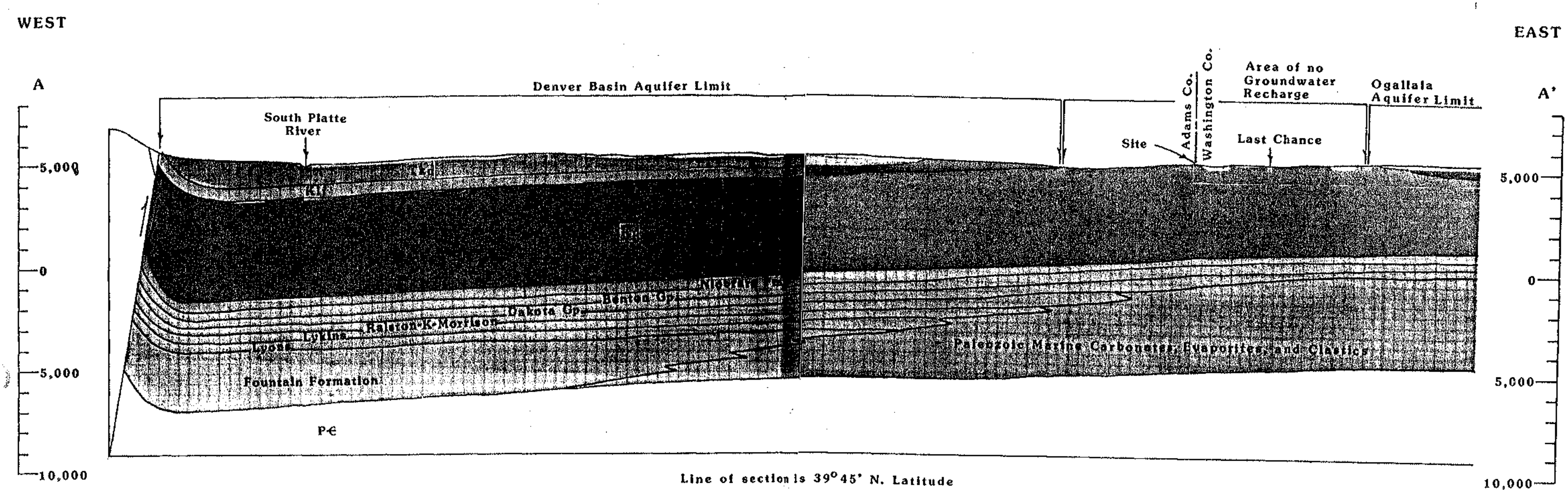
The Pierre Shale is underlain by the Niobrara Formation. This formation is light to yellowish gray, calcareous shale, with thin interbedded limestone and bentonite. The Niobrara Formation is approximately 500 feet thick and contains two members, the Smokey Hill Shale and the Fort Hays Limestone. The Fort Hays Limestone is a shaley chalk in the lower 50 feet of the formation. This member has been drilled for gas in parts of northeastern Colorado(6).

The Benton Group underlies the Niobrara Formation. The Group is composed of the Carlile Shale, the Greenhorn Limestone, and the Graneros Shale. The Carlile Shale is approximately 80 feet of medium to dark gray, noncalcareous siltstone, with some interbedded limestone. The Greenhorn



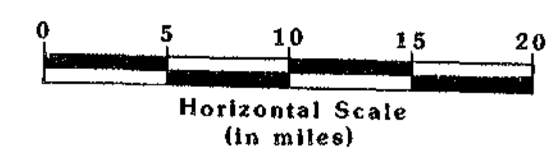
Refer to Figure 5.4.4 for legend

GENERALIZED REGIONAL GEOLOGIC MAP	Job No: 1-2543-3233
FOX Consulting Engineers and Geologists	Date: 1/15/81
	Figure 5.4.3



LEGEND

Qe	Quaternary loess, eolian sand, and alluvium
	Tertiary Ogallala and White River Formations
Tkd	Tertiary / Cretaceous Denver Formation and Dawson Arkose
Kp	Cretaceous Pierre Shale
Klf	Cretaceous Laramie and Fox Hills Formations
P-K	Pennsylvanian through Cretaceous rocks, undifferentiated
P€	Precambrian rocks



GENERALIZED REGIONAL CROSS SECTION

FOX Consulting Engineers and Geologists

Job No: 1-2543-3233 | Date: 1/15/81 | Figure 5.4

TABLE 5.4.1

GEOLOGIC SUITABILITY RANKING FOR WASTE DISPOSAL

Formations with highest probability of developing a safe storage facility for hazardous waste:

<u>Formation</u>

Pierre Shale - eastern Colorado (includes upper and lower sections)*

Mancos Shale - northwestern, southwestern Colorado

Lewis Formation - northwestern, west central Colorado

San Jose Formation - southwestern Colorado

Formations with marginal probability of developing a safe storage facility for hazardous waste:

<u>Formation</u>

Pierre Formation - middle section, eastern Colorado

Dawson Arkose - eastern Colorado

Laramie Formation - east central Colorado

Niobrara Formation - southeastern Colorado

Benton Shale - southeastern Colorado

Wasatch Formation - northwestern Colorado

Lance Formation - northwestern Colorado

(From Colorado Department of Health(3)).

*The site is located on top of this upper section of the Pierre Shale.

FORMATION	THICKNESS (feet)	DESCRIPTION
Pierre Shale	4300	Gray to black, silty, fossiliferous, marine shale, weathered in top 25 feet
Niobrara Formation	450	Smokey Hill Shale Member - light to yellowish gray, calcareous, fissile shale, with thin interbedded chalk and bentonite
	50	Fort Hays Limestone Member - Medium to yellowish gray, hard, dense, fossilifereous limestone with interbedded medium to dark gray, calcareous shale
Benton Group	80	Carlile Shale Member - medium to dark gray, noncalcareous siltstone with some interbedded limestone
	80	Greenhorn Limestone Member - yellowish gray limestone and light gray to black, fissile, clayey shale
	220	Graneros Shale Member - dark gray, clayey shale with interbedded brown to gray siltstone
Dakota Group	10	"D" Sandstone - buff to yellow, medium grained, quartzose sandstone
	40	Huntsman Shale - gray to black, fissile, marine shale, with interbedded dark gray to brown, fine grained, poorly sorted, bioturbated, quartz-poor sandstone
	130	"J" Sandstone - white, very fine to fine grained, fairly well sorted, quartzose sandstone

Note: Data generalized from the review of approximately fifty electric logs and a review of pertinent U.S.G.S. literature.

GENERALIZED SITE STRATIGRAPHIC SECTION

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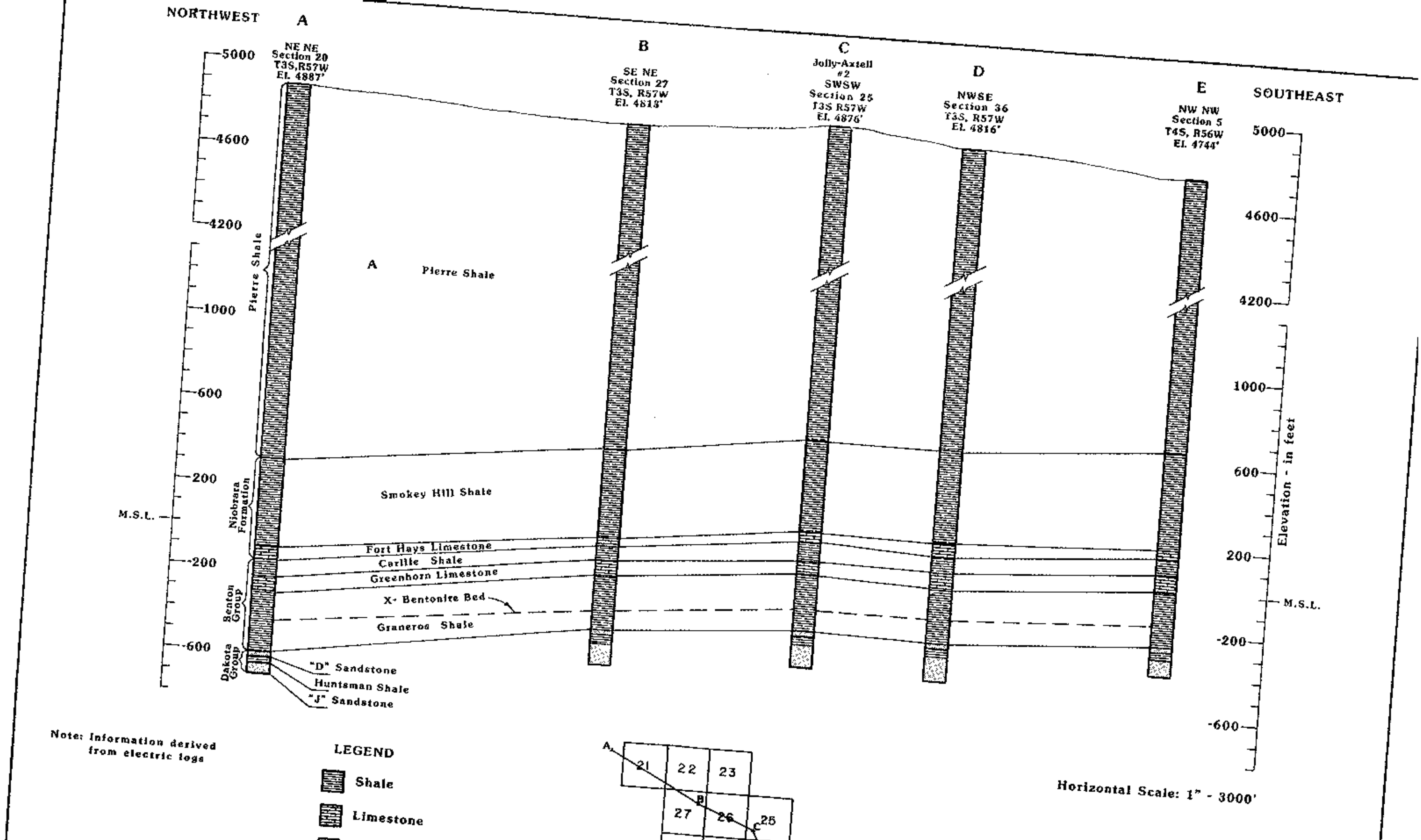
Job No: 1-2543-3233

Date: 12/8/80

Figure 5.4.5



GENERAL SITE CROSS SECTION

FOX Consulting Engineers and Geologists

Job No: 1-2543-

Limestone is yellowish gray limestone with light gray to black, fissile clayey, shale, approximately 80 feet thick. The bottom 220 feet of the Benton Group is the Graneros Shale, a dark gray, clayey shale with interbedded brown to gray siltstone.

The Dakota Group underlies the Benton Group. Below the site the upper "D" Sandstone of the Dakota Group is approximately 10 feet thick and consists of buff to yellow, medium grained quartzose sandstone. Approximately 40 feet of Huntsman Shale separates the "D" and "J" Sandstone.

Oil wells have been drilled in the area to the "D" and "J" Sandstones of the Dakota Group. The Niobrara chalk has produced natural gas, but the chalk is not known to contain natural gas at the site. No other economic minerals are known to exist beneath the site.

No evidence of faulting was observed at or near the site. The site is an area of low seismicity. Algermissen and Perkins(7) have mapped the region as having maximum probable acceleration of less than 4% of gravity (Modified Mercalli Intensity IV). This is sufficiently low that seismic shaking of structures should be of less importance than wind shaking.

5.4.3 Subsoil Conditions

The area referred to as the general site is shown on Figure 5.4.7. It is the entire area within Sections 21, 22, 23, 25, 26, 27, 34, 35, and 36, Township 3 South, Range 57 West, in Adams County, Colorado. Data from seven borings (CC1 through CC7) were collected from this area to provide an indication of general subsoil conditions. Upon completion of the general site characterization effort, a more concentrated subsoil investigation was conducted in Sections 25 and 36 (refer to Figure 5.4.8). All of the subsoil data collected for these evaluations were obtained from field and laboratory investigations. The field methodology employed is described below.

5.4.3.1 Field Methods

5.4.3.1.1 Test Boring Program

The test boring program consisted of the 46 borings illustrated in Figures 5.4.7 and 5.4.8. The test boring designations are assigned as follows:

Borings CC1 through CC7

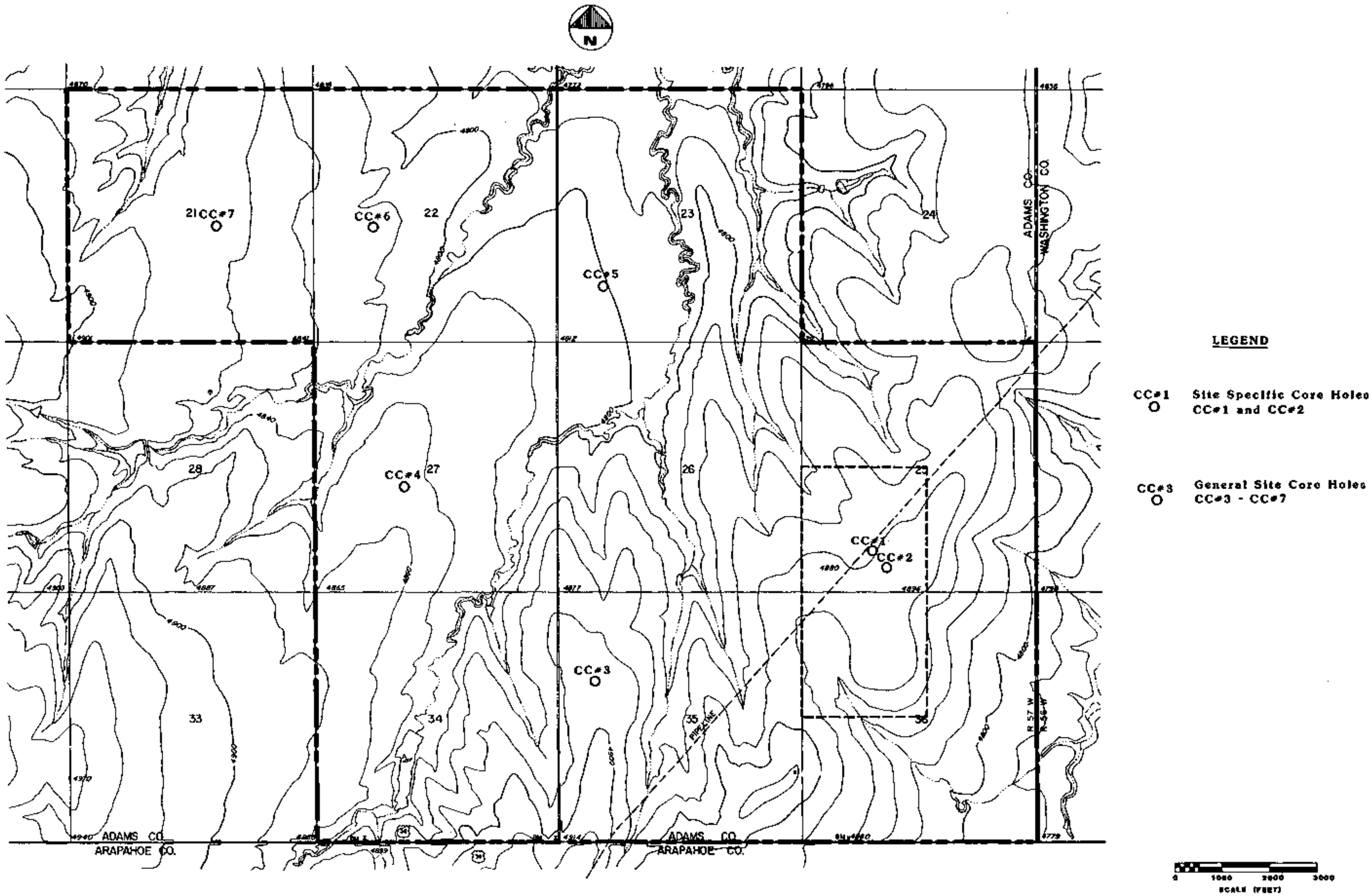
Borings CC1 through CC7 were drilled to provide subsoil information for the area described above as the general site. With the exception of boring CC1, these holes were drilled to a depth of approximately 30 feet with 6-inch diameter hollow stem augers and then continuously cored to their total depth. Boring CC1 was drilled with a combination of rotary and coring techniques. Each of these borings is now completely sealed with a very thick bentonite slurry mixture. The logs of these borings are presented in Appendix G.

Borings A1 through G4

Borings A1 through G4 were drilled at the nodes of a grid (see Figure 5.4.8) to generate detailed subsurface information in Sections 25 and 36 and more specifically the initial construction area. These borings were drilled with 4-inch diameter continuous flight solid augers. Soil and/or bedrock sampling was conducted with a 2-inch diameter modified California Barrel Sampler. Upon completion of drilling, each of these borings was sealed with a mixture containing 25% sand and 75% dry bentonite.

Borings MW1 through MW9

Borings MW1 through MW9 were drilled at locations which could later serve as monitoring wells to be used to characterize existing water quality and for groundwater monitoring during the operation and post-closure period. These borings were drilled with 6-inch diameter hollow stem continuous flight augers. Soils and/or bedrock samples were collected with a 2-inch modified California Barrel Sampler. Upon completion of drilling, each of these borings was cased with 3-inch diameter slotted, polyvinyl chloride (PVC) pipe with threaded couples, and sandpacked with filter sand. The logs for these borings, as well as those for borings A1 through G4, are presented in Figures 5.4.9 and 5.4.10.



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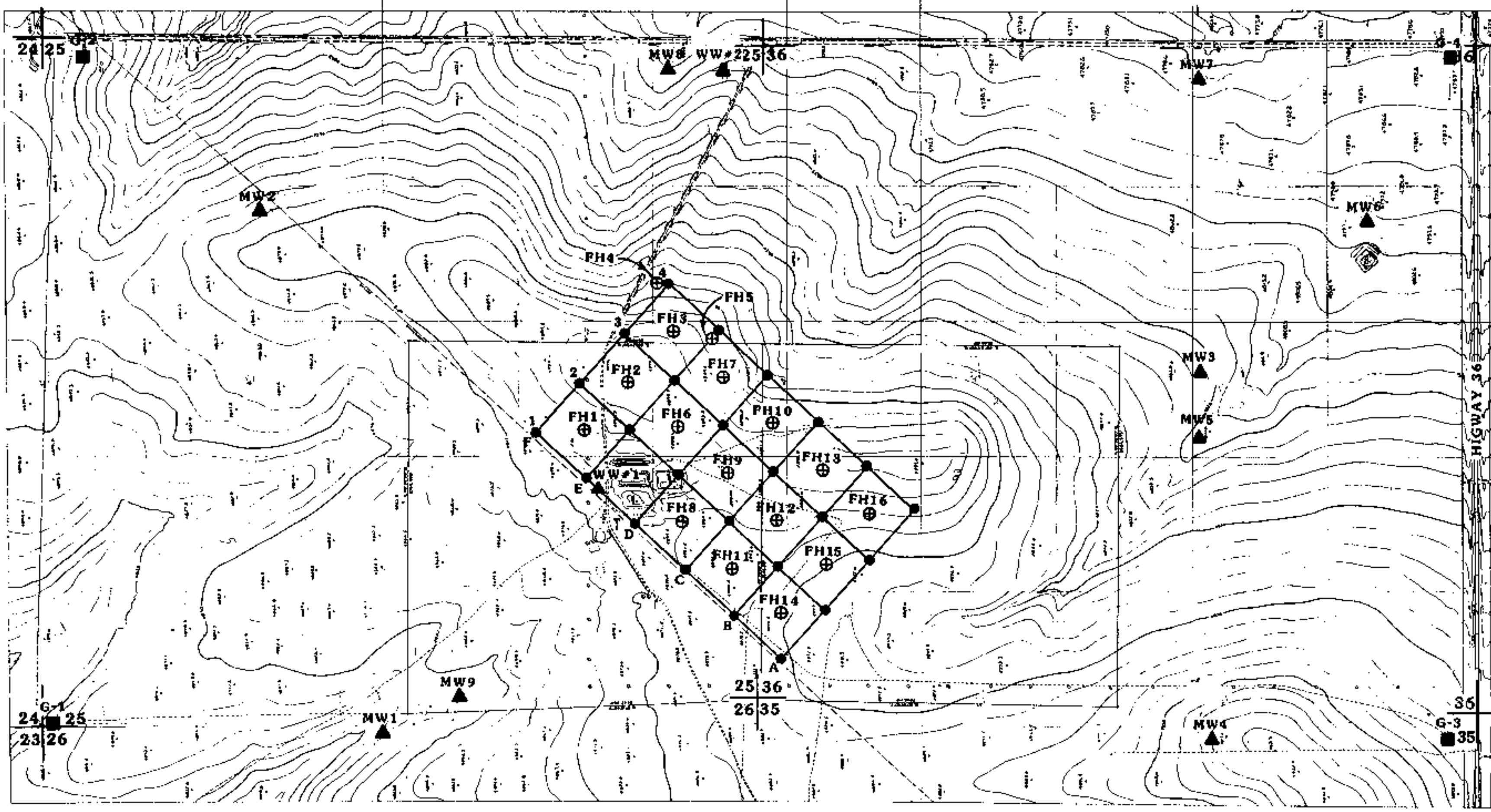
ARCHITECTS ENGINEERS PLANNERS

JOB NO.	BFI BROWNING-FERRIS INDUSTRIES	SHEET NO.
	HIGHWAY 36 LAND DEVELOPMENT COMPANY ADAMS COUNTY, COLORADO CHEMICAL WASTE DISPOSAL FACILITY	FIG 5.4.7
DATE 16 MAR 89	LOCATION OF CORE BORINGS	



⊕ Standpipe Permeability Location (FH Holes), 2 Tests at each location, except FH4 & FH5

● Grid Test Holes A1 through F4

▲ Monitor Well Location

■ G Test Hole Location, part of Grid Test Hole Program

SCALE IN FEET: 0 400 800 1600

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DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

TEST HOLES AND MONITORING WELLS LOCATION PLAN

SHEET NO. Figure 5.4.8 OF

Borings WW1 and WW2

Borings WW1 and WW2 were drilled to collect deep (500 feet) geological and geohydrological information about the site. These borings were drilled and completed as 500 foot deep water wells. The upper 100 feet of each well is cased with 8-5/8 inch steel casing cemented to the surface. Each well is cased for its full length with 4-inch diameter PVC pipe. The pipe is slotted and sandpacked below 100 feet. The logs for these borings are presented in Appendix G.

All the borings, with the exception of WW1 and WW2, were drilled with a CME 55 or CME 75 drilling rig. Borings WW1 and WW2 were drilled with a Speed Star water well drilling rig.

5.4.3.1.2 Seismic Refraction Investigation

A seismic refraction investigation was conducted on portions of the drilling grid to generate velocity profiles between boreholes. The investigation was conducted with a 12-channel Geometrics seismograph. Standard refraction seismic techniques were used. The resultant seismic profiles are presented in Figure 5.4.11.

5.4.3.1.3 In-situ Permeability Testing

Two types of in-situ permeability tests were conducted for this project: constant head stand pipe permeability tests, and packer type injection permeability tests.

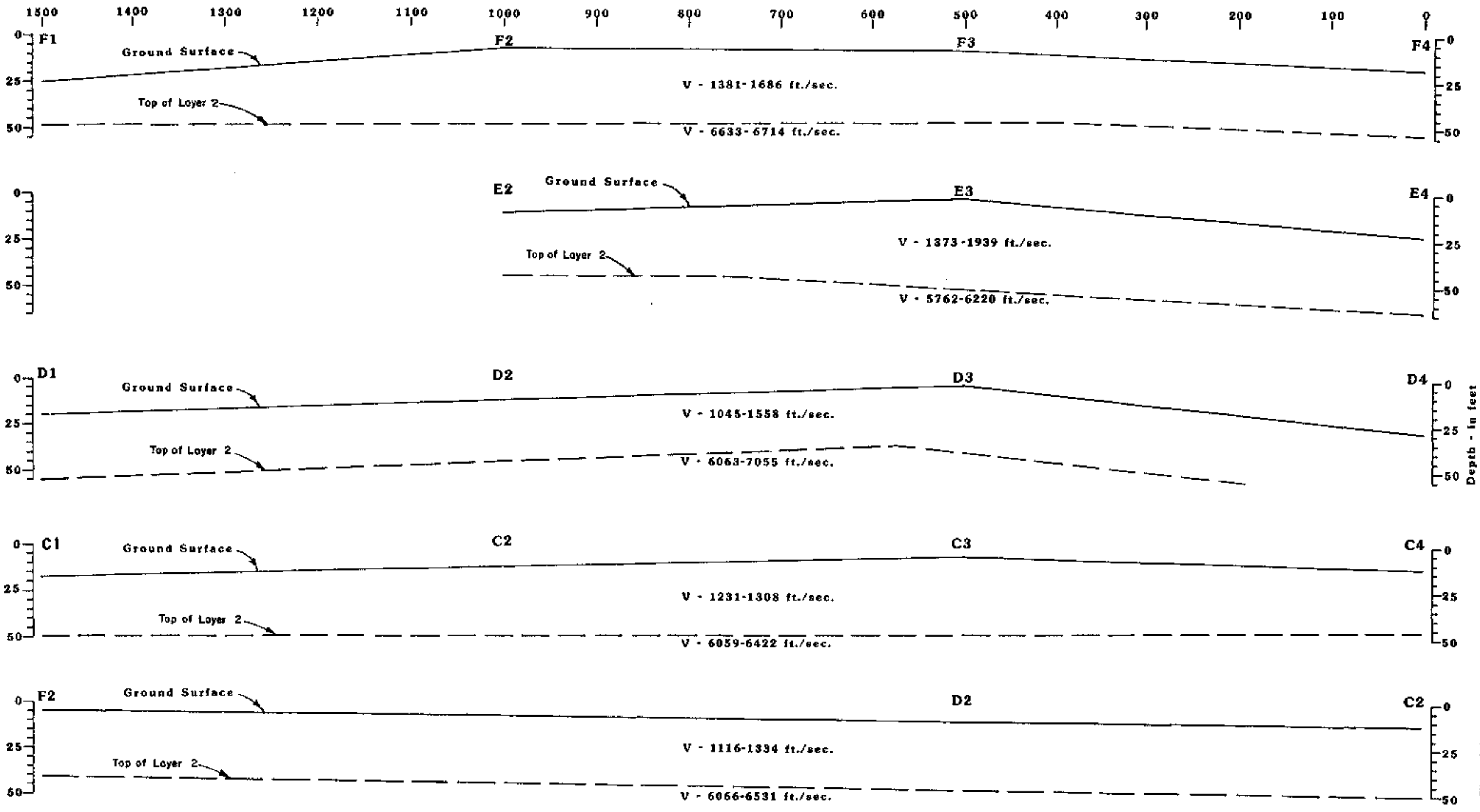
Due to the extreme depth of the water table at the site and the requirement for permeability data near the surface, the tests were conducted above the water table in unsaturated material.

The constant head stand pipe permeability tests were conducted by drilling a 6-inch diameter drill hole to the test depth desired. Six-inch diameter solid PVC casing was then installed in the boring. After the casing was installed, water was added to the casing until full and allowed to stand for a minimum of 24 hours. This procedure was used to allow the test zone below the bottom of the casing to develop a nearly saturated condition. Upon completion of the test zone saturation period, a constant head permeability test was conducted in the stand pipe. The locations of these tests were indicated in Figure 5.4.8. Test results are summarized in Table 5.4.2.

The packer type injection tests were conducted in bore holes. These were performed by isolating a section of the bore hole with inflatable rubber packers and injecting water between them at a constant pressure head. The tests were conducted for a period of approximately 30 minutes. The length of the bore hole test section was generally on the order of tens of feet. Packer type permeability tests were conducted for this project to determine the affect of secondary porosity (fracturing) on the overall mass permeability. When fracturing does exist, zone permeabilities are calculated to be higher than localized permeabilities measured by other methods. The packer test results generally indicate that this is the case in the weathered shale. Below the weathered shale, the shale is essentially impervious. Packer permeability test sections are indicated on the boring logs, and a summary of the packer permeability test results is presented in Tables 5.4.3 and 5.4.4.

5.4.3.2 Laboratory Investigation Methods

Upon completion of the field investigation, all soil and bedrock samples obtained during the drilling and sampling operations were returned to the F. M. Fox & Associates' Denver laboratory. The soil samples were then carefully opened, cataloged, and classified. Inspection of the samples followed the procedures outlined in ASTM D-2488, Standard Recommended Practice for Description of Soil (Visual-Manual Procedure). The number



Note: Refer to Figure 5.4.8 for locations

SITE SPECIFIC SEISMIC PROFILES		
FOX Consulting Engineers and Geologists		
Job No: 1-2543-3233	Date: 1/15/81	Figure 5.4.11

TABLE 5.4.2

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Standpipe Test Vertical Permeability (cm./sec.)
FH-1A	19	(CL-CH) - Group I	1.0×10^{-7}
FH-1B	29	CLAYSTONE - Group II	5.0×10^{-8}
FH-2A	19	(CL-CH) - Group I	2.3×10^{-7}
FH-2B	29	CLAYSTONE - Group II	6.4×10^{-8}
FH-3A	19	(CL-CH) - Group I	4.2×10^{-8}
FH-3B	29	CLAYSTONE - Group II	1.6×10^{-7}
FH-4	4	(CL to CL-ML) - Group I	2.3×10^{-7}
FH-5	4	(CL to CL-ML) - Group I	3.9×10^{-7}
FH-6A	19	(CL-CH) - Group I	2.3×10^{-8}
FH-6B	29	CLAYSTONE - Group II	5.1×10^{-8}
FH-7A	19	(CL-CH) - Group I	1.2×10^{-7}
FH-7B	29	CLAYSTONE - Group II	3.3×10^{-8}
FH-8A	19	CLAYSTONE - Group II	6.9×10^{-8}
FH-8B	29	CLAYSTONE - Group II	6.2×10^{-8}
FH-9A	19	CLAYSTONE - Group II	1.1×10^{-7}
FH-9B	30	CLAYSTONE - Group II	8.3×10^{-8}
FH-10A	19	CLAYSTONE - Group II	1.4×10^{-7}
FH-10B	29	CLAYSTONE - Group II	1.1×10^{-7}
FH-11A	19	CLAYSTONE - Group II	4.8×10^{-8}
FH-11B	29	CLAYSTONE - Group II	3.2×10^{-8}
FH-12A	19	CLAYSTONE - Group II	3.5×10^{-8}
FH-12B	29	CLAYSTONE - Group II	1.3×10^{-7}
FH-13A	19	CLAYSTONE - Group II	2.0×10^{-6}
FH-13A	29	CLAYSTONE - Group II	1.7×10^{-6}
FH-14A	19	CLAYSTONE - Group II	8.9×10^{-8}
FH-14B	29	CLAYSTONE - Group II	1.1×10^{-6}
FH-15A	19	CLAYSTONE - Group II	1.0×10^{-7}
FH-15B	29	CLAYSTONE - Group II	1.8×10^{-7}
FH-16A	19	CLAYSTONE - Group II	8.0×10^{-8}
FH-16B	29	CLAYSTONE - Group II	9.6×10^{-8}

TABLE 5.4.3

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Packer Type Test Horizontal Permeability (cm./sec.)
CC #3	134-200	SHALE - Group III	8.6×10^{-8}
CC #4	148-200	SHALE - Group III	No Flow
CC #5	148-200	SHALE - Group III	1.4×10^{-7}
CC #6	145-202	SHALE - Group III	3.0×10^{-7}
CC #7	40-72	CLAYSTONE - Group II	2.2×10^{-7}
CC #7	145-200	SHALE - Group III	No Flow

TABLE 5.4.4

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Packer Type Test Horizontal Permeability (cm./sec.)
A2	85-99	CLAYSTONE - Group II	$6.6x10^{-6}$
B1	85-99	CLAYSTONE - Group II	$2.2X10^{-6}$
B2	13-19	(CL-CH) - Group I	$9.5x10^{-5}$
B3	85-99	CLAYSTONE - Group II	$5.0x10^{-6}$
C1	35-49.5	CLAYSTONE - Group II	$6.0x10^{-5}$
C2	85-99	CLAYSTONE - Group II	$5.1x10^{-6}$
C4	85-99	CLAYSTONE - Group II	$2.0x10^{-5}$
D1	15-19.5	CLAYSTONE - Group II	$4.6x10^{-5}$
D2	35-49.5	CLAYSTONE - Group II	$1.4x10^{-4}$
D3	85-99	CLAYSTONE - Group II	$1.0x10^{-5}$
E1	25-49.3	CLAYSTONE - Group II	$2.1x10^{-4}$
E2	55-99.3	CLAYSTONE - Group II	$7.6x10^{-6}$
E3	16-25.5	(SC-SM) - Group I	$5.1x10^{-4}$
E4	3-8	(CL to ML-CL) - Group I	$1.5x10^{-5}$
E4	84-99.5	CLAYSTONE - Group II	$2.5x10^{-5}$
F1	13-19.5	(CL-CH) - Group I	$2.4x10^{-4}$
F1	83-99	CLAYSTONE - Group II	$3.2x10^{-6}$
F2	8-19	(CL-CH) - Group I	$1.1x10^{-5}$
F3	85-99.5	CLAYSTONE - Group II	$8.7x10^{-6}$
G1	16-24	CLAYSTONE - Group II	$9.1x10^{-5}$
G1	90-118	CLAYSTONE - Group II	$4.0x10^{-6}$
G2	104-119	CLAYSTONE - Group II	$6.6x10^{-6}$
G3	25-39	CLAYSTONE - Group II	$2.5x10^{-5}$

of specific tests, the test types, and appropriate ASTM designations were as follows:

Type of Tests	No. of Tests Conducted	ASTM Test Designation
Dry Density Determination	53	D2937
Natural Moisture Content Determination	57	D2216
Atterburg Limits	63	D423 & D424
Mechanical Analysis	51	D422
Hydrometer Analysis	13	D422
Consolidation	11	D2435
Unconfined Compressive Strength	5	D2166
Specific Gravity	11	D854
Undisturbed Constant Head Permeability	3	D2434
Remolded Constant Head Triaxial Compression Permeability	6	D2850
Cation-Exchange Capacity	3	None

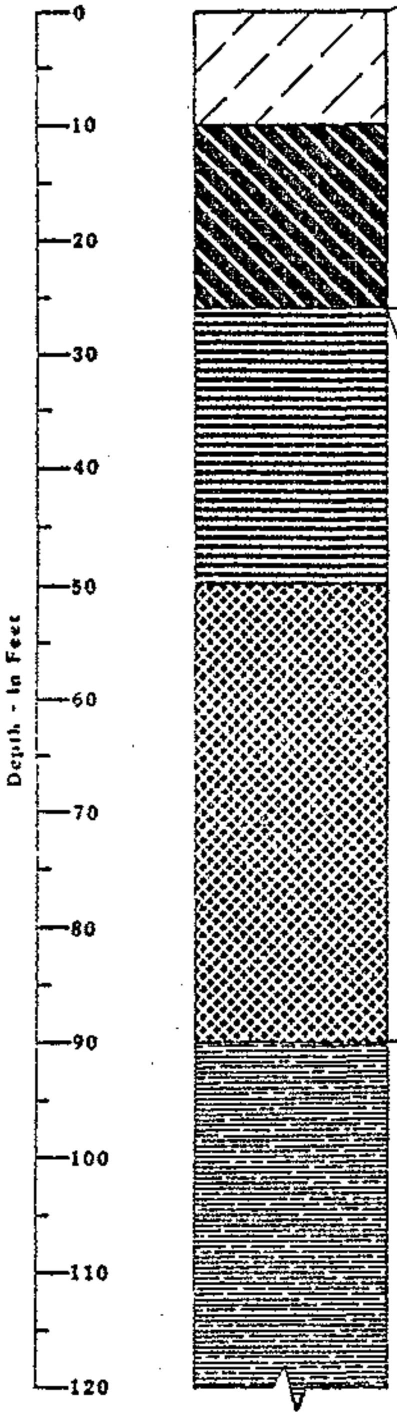
The testing data obtained during the laboratory investigation are presented in Appendix G. The laboratory permeability test results were verified by the University of Colorado Soils Laboratory.

5.4.3.3 Results of Subsoil Condition Investigation

The results indicate that subsoil conditions across the processing/disposal area are very well suited for a waste facility. They are generally uniform in areal distribution but vary with depth. The subsoils across the site can generally be divided into three major groups of similar physical characteristics. These groups are indicated in Figure 5.4.12 and are described below:

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The clay content, moisture content, and dry density generally increase with depth, and in most borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2. Based on the cation-exchange capacity values (See Appendix G) and the geologic



Group I Material

Approx. 11 to 38 feet of slightly silty to very silty CLAY (CL to CL-ML) or silty to sandy CLAY with CLAYSTONE (CL-CH)

w = 7.6 to 22.8%
γ_d = 87 to 120 pcf
LL = 19 to 63
PI = 4 to 42
56.4% to 99.9% passing the #200 sieve
S.G. = 2.61 to 2.78
Qu = 12,440 psf (one sample tested)
K(mean) = 2 x 10^{-6} cm/sec

NOTE: Soil samples swelled up to 12.8% with 1 ksf surcharge when wetted. Some samples consolidated up to 1.2% under the same laboratory conditions.

NOTE: The above material is discontinuously underlain by a generally thin layer of silty to clayey SAND (in 22% of the test holes.)

w = 2.8 to 3.1%
γ_d = 119 pcf
LL = 22 to 30
PI = 9 to 11
18.5 to 23.5% passing the #200 sieve
Kv = 9 x 10^{-5} cm/sec (from laboratory test)
Kh = 5 x 10^{-4} cm/sec (from packer test)

Group II Material

Approx. 25 to 84 feet of CLAYSTONE, (weathered SHALE) (CL-CH), fractured with sulfates and iron staining (less fractured with depth.)

w = 8.7 to 22.8
γ_d = 91 to 124
LL = 39 to 83
PI = 15 to 53
96.6 to 99.9% passing the #200 sieve
S.G. = 2.56 to 2.80
Qu = 13,333 to 20,853 psf
Kh(mean) = 1 x 10^{-5} cm/sec (from Packer Tests)
Kv(mean) = 1 x 10^{-7} cm/sec (from Standpipe Tests)

NOTE: Soil samples swelled up to 8.8% with 1 ksf surcharge when wetted.

Group III Material

Very Hard SHALE (unweathered PIERRE SHALE) underlies the weathered SHALE at a depth of 59 to 102 feet below the ground surface.

Kh = 3 x 10^{-7} cm/sec to impervious
(No flow could be induced)
(From Packer Tests)

LEGEND

w = natural moisture content
γ_d = dry density
LL = Liquid Limit
PI = Plasticity Index
S.G. = Specific Gravity
Qu = Unconfined Compressive Strength
K = Permeability
Kh = Horizontal Permeability
Kv = Vertical permeability

TYPICAL LITHOLOGICAL LOG AND SUBSOIL CONDITIONS	Job No:	1-2543-3233
FOX Consulting Engineers and Geologists	Date:	1/8/81
	Figure	5.4.12

environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec. range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1×10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4×10^{-7} cm/sec. and a low of "completely impervious" (no flow could be induced).

Correlation between the boring logs and the seismic layers was not exact, due to the nature of the seismic method and the gradation changes in lithology encountered at the site. The contact between the weathered claystone and the hard shale at the site is gradational. "Layer 2" in the seismic profiles, presented in Figure 5.4.11, may be thought of as the subweathered layer and has a velocity generally from four to five times higher than the weathered surficial materials. It is above the fresh unweathered bedrock. The fresh unweathered bedrock layer has been identified from visual inspection of the core and auger samples. The value of the seismic work is that it demonstrates the lateral consistency of the subsurface materials.

5.4.4 Groundwater Conditions

5.4.4.1 Regional

The principal aquifers of the eastern Denver basin are the Pliocene Ogallala Formation and Recent unconsolidated alluvial sand and gravel in the major river drainages. In the Denver metropolitan area, the principal aquifers are the sandstones and conglomerates of the Fox Hills Sandstone, the Arapahoe and Denver Formations, and the Dawson Arkose. Sandstones of the Dakota Group are aquifers south of the Arkansas River. North of that river, the Dakota sandstones contain saline water and are major oil objectives.

Figure 5.4.3 (presented earlier) is a generalized geologic map, and Figure 5.4.4 (also presented earlier) is an east-west cross section showing stratigraphic relationships. These figures show the relationship of the disposal site to the major aquifers of the area. The aquifers used as domestic supplies in the Denver metropolitan area are recharged in the western part of the Denver basin. Because the site is located east of these exposures and west of the Ogallala exposures on the eastern flank of the basin, it is in an ideal area where runoff and infiltration do not directly recharge these aquifers.

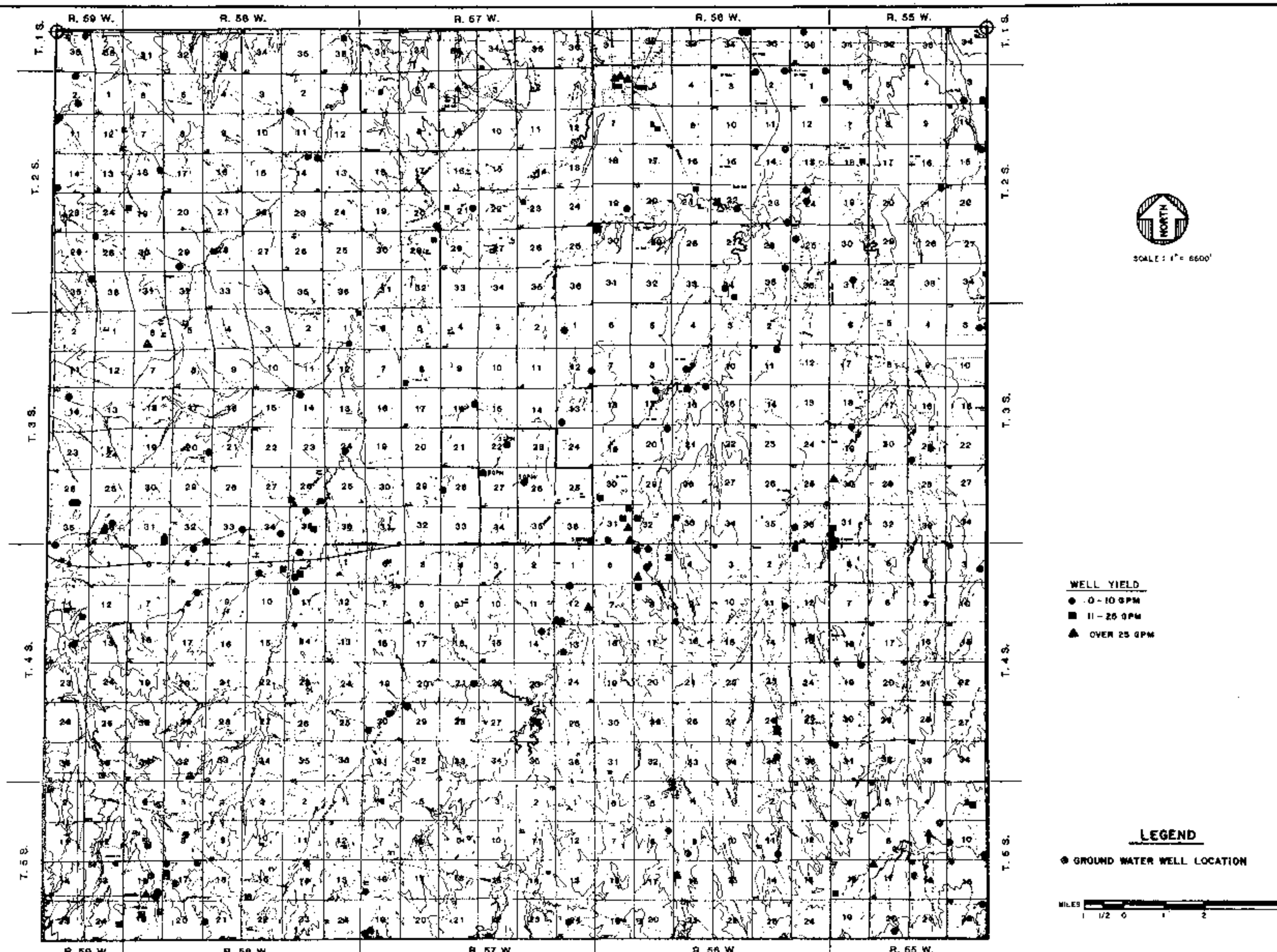
5.4.4.2 Site Specific

No major groundwater aquifers underlie the site, nor are any exposed at the surface; however, due to the very low permeability of the Pierre Shale, perched water tables typically occur in alluvial fill in drainage swales.

Perched water tables were encountered during boring operations in sandy alluvial materials within surface drainages near the site. Recharge to these areas comes from vertical infiltration in the immediate drainage area. Recharge amounts are dependent upon degree of slope and the shallow material permeabilities. Groundwater of this type was encountered in four borings at depths ranging between 35.7 and 45 feet, as illustrated in Figure 5.4.10. The Colorado State Engineers Office confirmed that shallow water exists within some drainages in the area, but indicated that production rates are very low. The chemical quality of the perched water is discussed in Section 5.6.

Examination of the well permit records at the Colorado State Engineers Office showed a maximum well yield of 5.0 gallons per minute within a one mile radius of the site. Maximum depth of production from these wells was 50 feet. The wells of the maximum yield typically supply single residences with drinking water. Figure 5.4.13 illustrates actual locations of these and other wells within a ten mile radius of the nine section parcel of land. The nearest residential well in use is over one mile from the active portion of the site.

A minor amount of deep groundwater exists at the site in the Pierre Shale bedrock. Groundwater of this type was encountered in the two deep borings (WW1 and WW2) at depths of 182 and 99 feet, both corresponding to an



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JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

GROUND WATER WELL LOCATION
WITHIN TEN MILE RADIUS OF SITE

SHEET NO.
FIG. 5.4.13
OF

elevation of about 4,700 feet. Pumping tests in these two deep wells indicated nearly dry conditions in the Pierre Shale. Assuming long-term recharge rates to be similar to the observed short-term (48 hours) recharge rates, the estimated production rate is approximately 0.16 gallons per minute. This rate is considerably less than that required by a single residence. These results indicate essentially dry well conditions. The Colorado State Engineers Office indicated that no water is produced in domestically useable quantities from Pierre Shale in the vicinity of the site.

5.4.5 Summary and Conclusions

A detailed geological and hydrogeological site characterization study was conducted east of Denver at the site of the Highway 36 Land Development Company chemical waste treatment/solidification and disposal facility. The results of this analysis show the site to be within the best geological and hydrogeological environment of the Denver basin for such a facility. This conclusion is based upon the following findings:

- the site is located over an extreme thickness (4,300 feet) of non-fractured impervious shale;
- the site is not located over any major aquifers;
- the site is not in an area that contributes to recharge of any major aquifer;
- the surficial materials are generally of low permeability and, when densified, are well suited for use as impervious liner materials;
- groundwater exists only in sands of adjacent surface drainages (perched) and to a very minor extent in the Pierre Shale below a mean sea level elevation of about 4,700 feet (i.e., from 130 to 200 feet below the surface of the site);
- the site is in an area of extremely low seismicity.

5.4.6 References

1. Garbarini, G. S., and Veal, H. K., "Potential of Denver Basin for Disposal of Liquid Wastes," Am. Assoc. Petroleum Geologists Mem. 10, p. 165-185 (1968).

2. Tweto, Ogden, "Geologic Map of Colorado," U.S. Geological Survey (1979).

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4. Moredock and Williams, 1976.

5. Petroleum Information Corporation, Denver, Colorado.

6. Root, M. R., "Developments in Eastern and Northeastern Colorado in 1979," Am. Assoc. Petroleum Geologists Bull., 64, (9) 1484-1489 (1980).

7. Algermissen, S. T., and Perkins, D. M., "A Probabilistic Estimate of Maximum Acceleration in Rock in the Contiguous United States," U.S. Geological Survey, Open File Report 76-416 (1980).

8. Rocky Mountain Association of Geologists, Subsurface Cross Sections of Colorado: Special Publication No. 2 (1976).

5.5 TOPOGRAPHY AND SURFACE DRAINAGE

5.5.1 Topography

The study area is characterized by broadly rolling topography. Small creeks in the vicinity are in relatively wide flat areas. As can be seen in Figures 5.5.1 and 5.5.2, the project site (i.e, the two quarter-sections within Sections 25 and 36) is drained by a tributary to Beaver Creek on the east and Wetzel Creek to the west. Beaver Creek and Wetzel Creek are ephemeral in nature and are composed of highly erodible clay-loam soils. In the undeveloped portions of the drainage basins, the ground cover is predominantly native grassland.

Also illustrated in Figure 5.5.1 are the various drainage basins (areas A through F) of the project site. The project site is well drained with

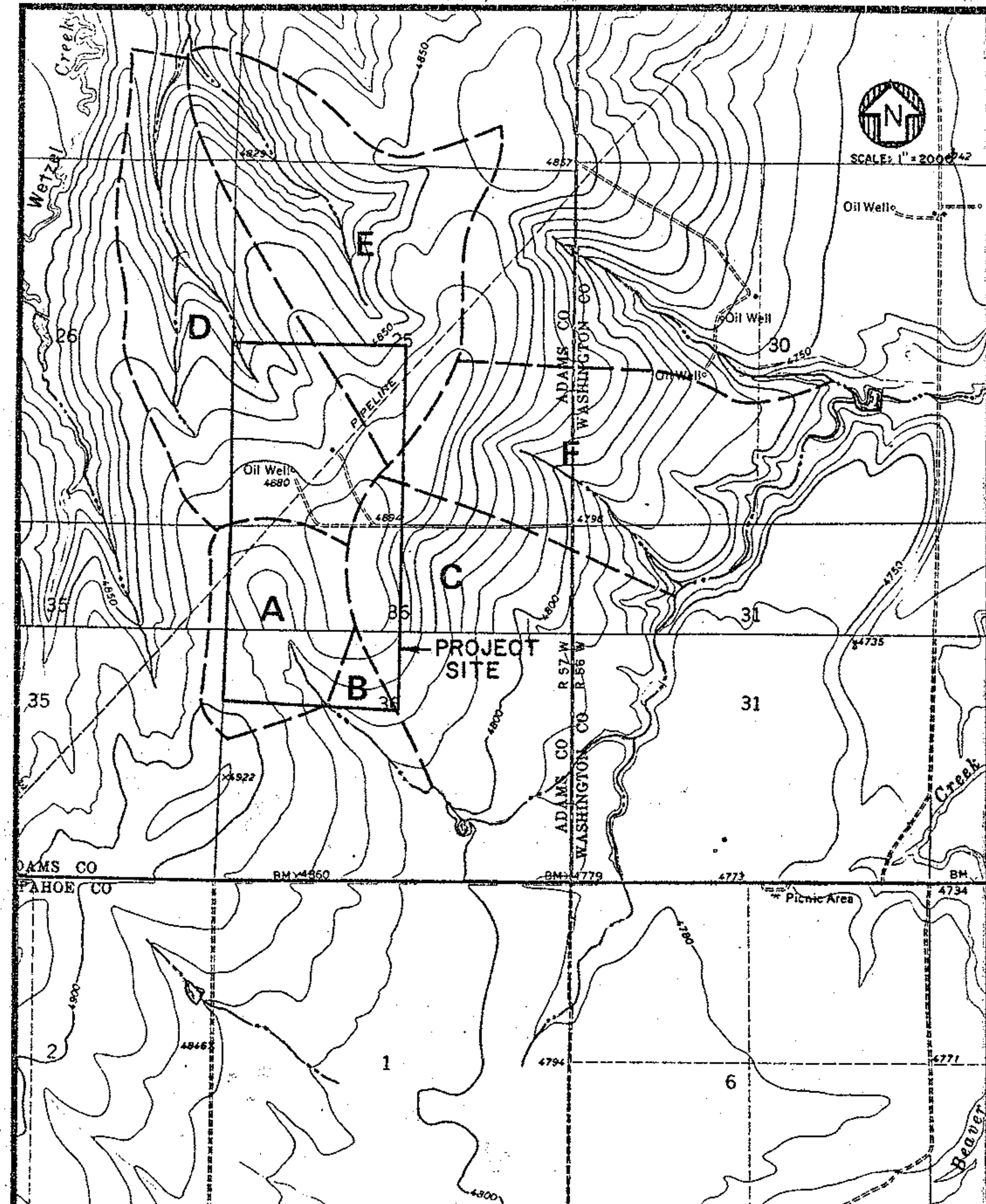

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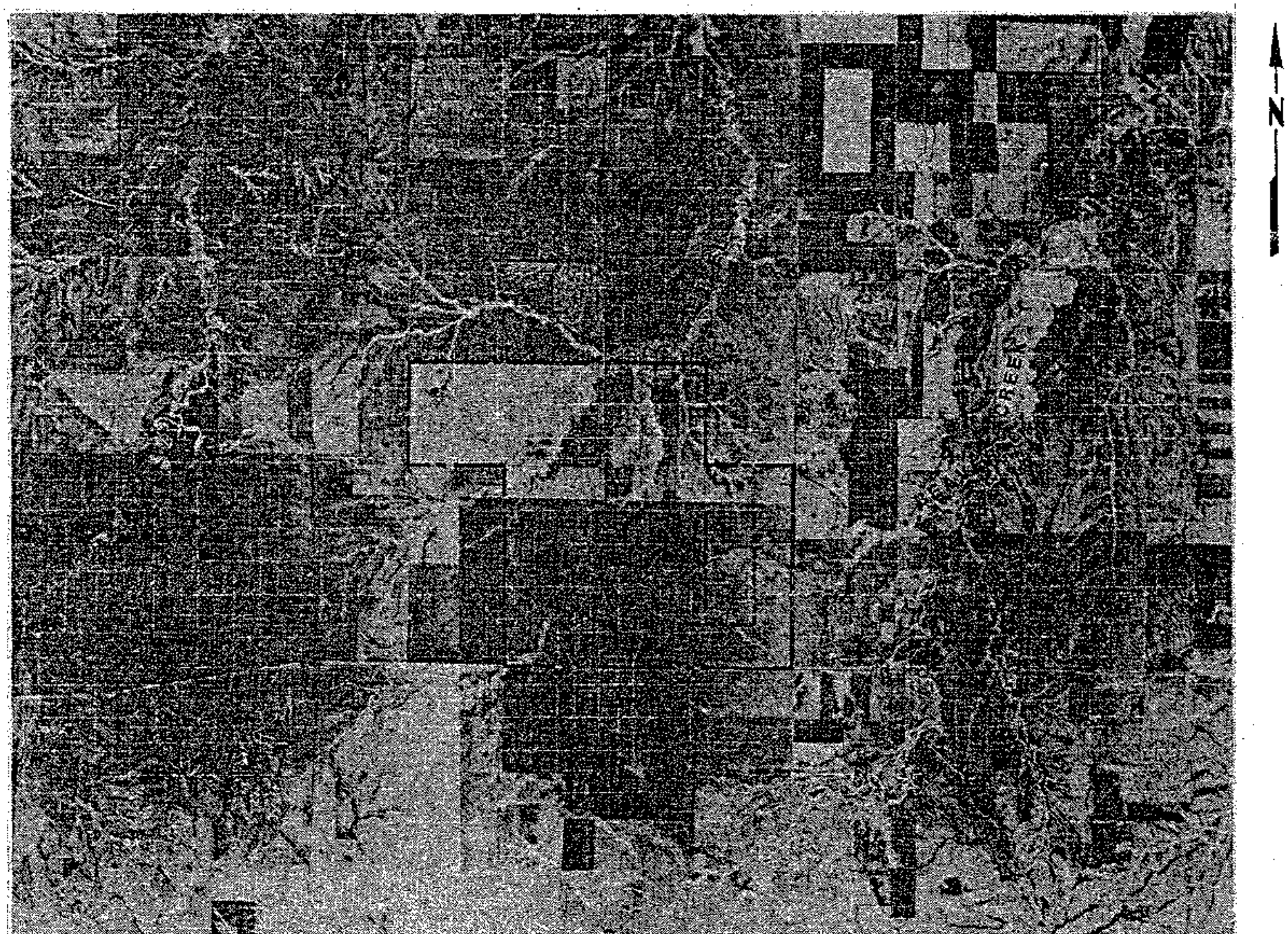
FIGURE Nº 5.5.1
STUDY AREA AND
DRAINAGE BOUNDARIES
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO



(SCALE IN MILES)
0 1 2 3

PROPERTY BOUNDRY

SITE BOUNDRY

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FIGURE Nº 5.5.2
AERIAL PHOTOGRAPH OF SITE AND SURROUNDING AREA
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

little rainfall run-on. Consequently, of primary concern is the quantity of runoff from the project site. The surface slope of the project site ranges from flat to about 6%.

5.5.2 Surface Runoff

A hydrological analysis was carried out to estimate the rate and quantity of rainfall runoff from the project site for a variety of rainfall conditions. Because of the simplicity of the study area, the Rational Method was used to compute the 10-year and 100-year peak surface runoff discharges from the project site. For this analysis, it was assumed that the project site would be bermed so that site run-on would be zero.

The Rational Method is based on the formula $Q = CIA$, where:

Q = the maximum rate of runoff in cubic feet per second (cfs)

C = rainfall runoff coefficient

I = rainfall intensity in inches per hour for a given frequency storm

A = area of project site drainage basin in acres

Values of the rainfall runoff coefficient, C, used in this study were derived from the Soil Survey of Adams County, Colorado(1) and the Drainage Criteria Manual(2). The runoff coefficients were determined to be 0.15 for a 10-year storm and 0.19 for a 100-year storm. The rainfall intensity data presented in Figures 5.5.3 and 5.5.4 were obtained from a precipitation-frequency atlas(3).

As can be seen in Figure 5.5.4, the rainfall depths for a 10-year, 24-hour maximum and a 100-year, 24-hour maximum rainfall are approximately 2.8 inches and 4.2 inches, respectively. These depths of rainfall were used to estimate the maximum volume of runoff from the project site.

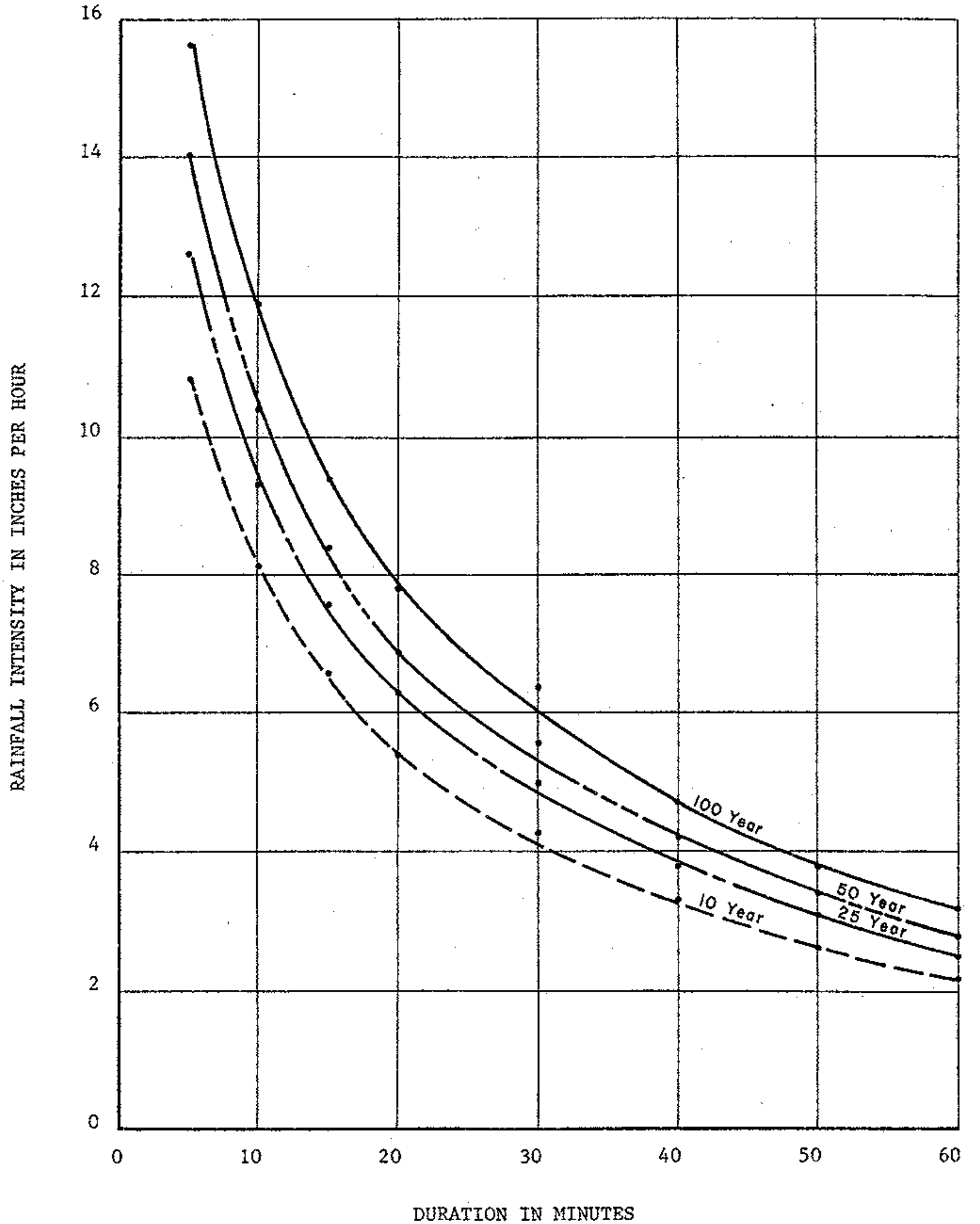

FIGURE Nº 5.5.3

TIME INTENSITY FREQUENCY CURVES

HIGHWAY 36 LAND DEVELOPMENT CO.
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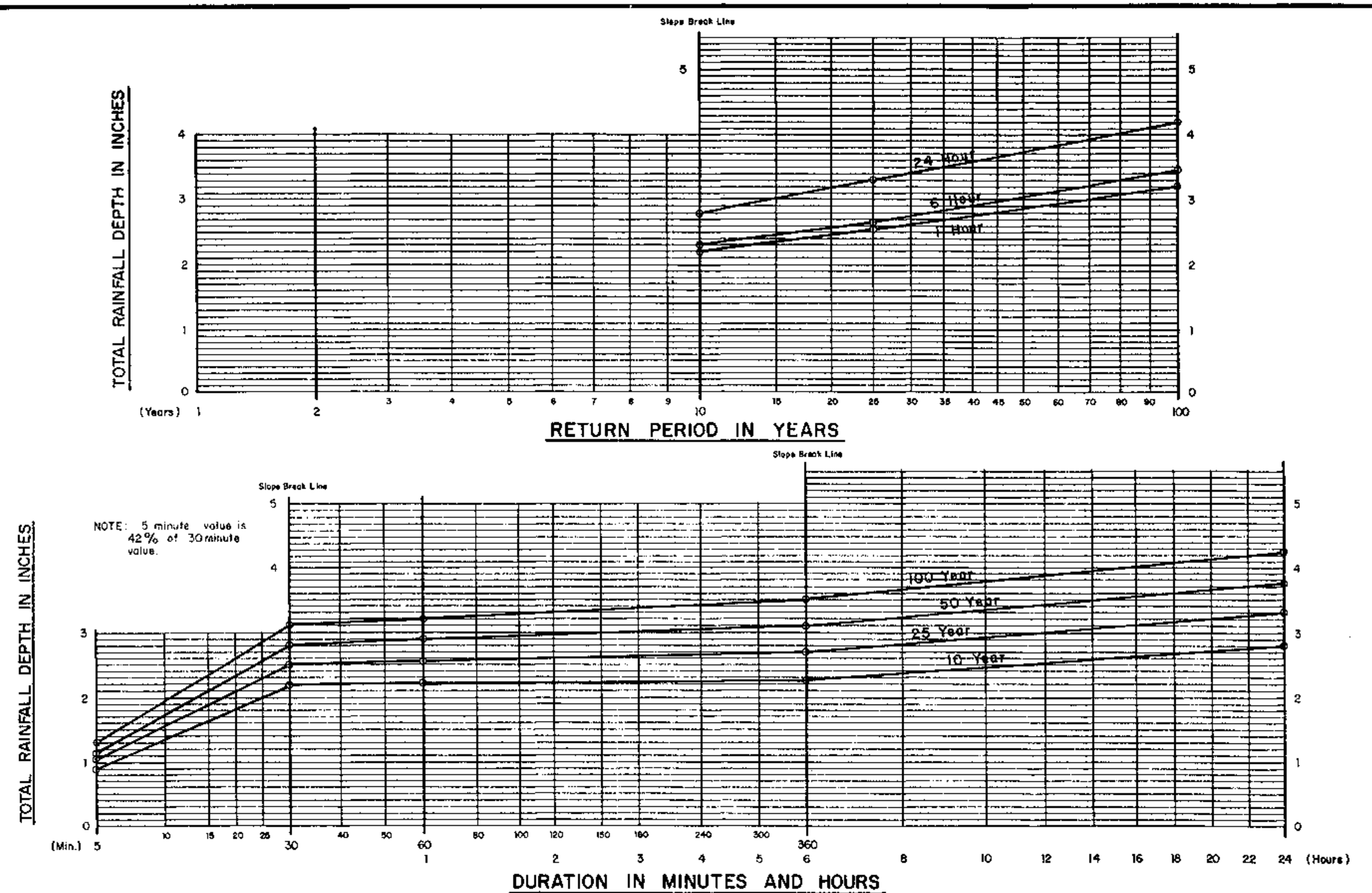

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FIGURE Nº 5.5.4
RAINFALL
DEPTH - DURATION - FREQUENCY GRAPHS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

The maximum rates of rainfall runoff for the 10- and 100-year recurrance intervals were calculated by estimating the "time of concentration" T_c, for the respective drainage basins and using the corresponding intensities illustrated in Figure 5.5.3. The results of the analyses are summarized in Tables 5.5.1 and 5.5.2.

5.5.3 Flood Plain Analysis

The project site is located on a rise with runoff flowing to the northwest into Wetzel Creek and to the southeast into Beaver Creek. Above the confluence with Wetzel Creek, Beaver Creek flows northerly from its source through Elbert, Arapahoe, Adams, and Washington Counties. The Wetzel Creek drainage area is approximately 48 square miles while the Beaver Creek drainage (above the confluence with Wetzel Creek) is about 317 square miles as shown in Figure 5.5.5. There are no active gaging stations located on Beaver Creek or its tributaries.

Because there are no completed or on-going flood studies available for Beaver Creek, a hydrological study was conducted to establish the Beaver Creek flood plain and verify that the project site did not lie within it. The investigation utilized a mathematical model developed by the Colorado Water Conservation Board in cooperation with the U. S. Geological Survey. The model was derived by applying a Log-Pearson Type III statistical analysis to historical gaging station data(4).

For the statistical analysis, the state was divided into several regions of similar topographical conditions. The Beaver Creek drainage area is located in the central portion of the Plains Region. The Plains Region includes all of the Front Range up to an elevation of 7,500 feet above sea level.

TABLE 5.5.1

PEAK RATES OF RUNOFF FROM PROJECT SITE

1. 10-Year, 24-Hour Rainfall

Basin	T_c (Minutes)	C	I (In./Hr.)	A (Acres)	Peak Discharge (Q) (cfs)
A	36.0	0.15	3.6	113	61
B	10.0	0.15	8.2	13	16
C	8.3	0.15	8.8	44	58
D	36.9	0.15	3.5	125	66
E	20.7	0.15	5.3	35	28
F	5.0	0.15	10.8	2	3

2. 100-Year, 24-Hour Rainfall

Basin	T_c (Minutes)	C_f	I (In./Hr.)	A (Acres)	Peak Discharge (Q) (cfs)
A	36.0	0.19	5.2	113	112
B	10.0	0.19	11.8	13	29
C	8.3	0.19	12.8	44	107
D	36.9	0.19	5.1	125	121
E	20.7	0.19	7.7	35	51
F	5.0	0.19	15.6	2	6

Note: The acreage, A, refers to the number of acres within the project site (i.e., the two quarter-sections) for the respective drainage basins defined in Figure 5.5.1.

TABLE 5.5.2

VOLUMES OF RUNOFF FROM PROJECT SITE

1. 10-Year, 24-Hour Rainfall

Basin	C	I (Inches)	A (Acres)	V (Million Gallons)
A	0.15	2.8	113	1.29
B	0.15	2.8	13	0.15
C	0.15	2.8	44	0.50
D	0.15	2.8	125	1.43
E	0.15	2.8	35	0.40
F	0.15	2.8	2	0.20
				Total = 3.97

2. 100-Year, 24-Hour Rainfall

Basin	C	I (Inches)	A (Acres)	V (Million Gallons)
A	0.19	4.2	113	2.45
B	0.19	4.2	13	0.28
C	0.19	4.2	44	0.95
D	0.19	4.2	125	2.71
E	0.19	4.2	35	0.76
F	0.19	4.2	2	0.04
				Total = 7.19

3. Annual Average

Basin	C	I (Inches)	A (Acres)	V (Million Gallons)
A	0.15	14	113	6.44
B	0.15	14	13	0.74
C	0.15	14	44	2.51
D	0.15	14	125	7.13
E	0.15	14	35	2.00
F	0.15	14	2	0.11
				Total = 18.93

4. Minimum & Maximum Annual Averages (90 Percentile Values)(3)

Basin	C	I (Inches)	A (Acres)	V (Million Gallons)
A	0.15	8-20	113	3.68-9.20
B	0.15	8-20	13	0.42-1.00
C	0.15	8-20	44	1.43-3.58
D	0.15	8-20	125	4.07-10.18
E	0.15	8-20	35	1.14-2.85
F	0.15	8-20	2	0.07-0.16
				Total = 10.81-26.97

Note: The acreage, A, refers to the number of acres within the project site (i.e., the two quarter-sections) for the respective drainage basins defined in Figure 5.5.1.

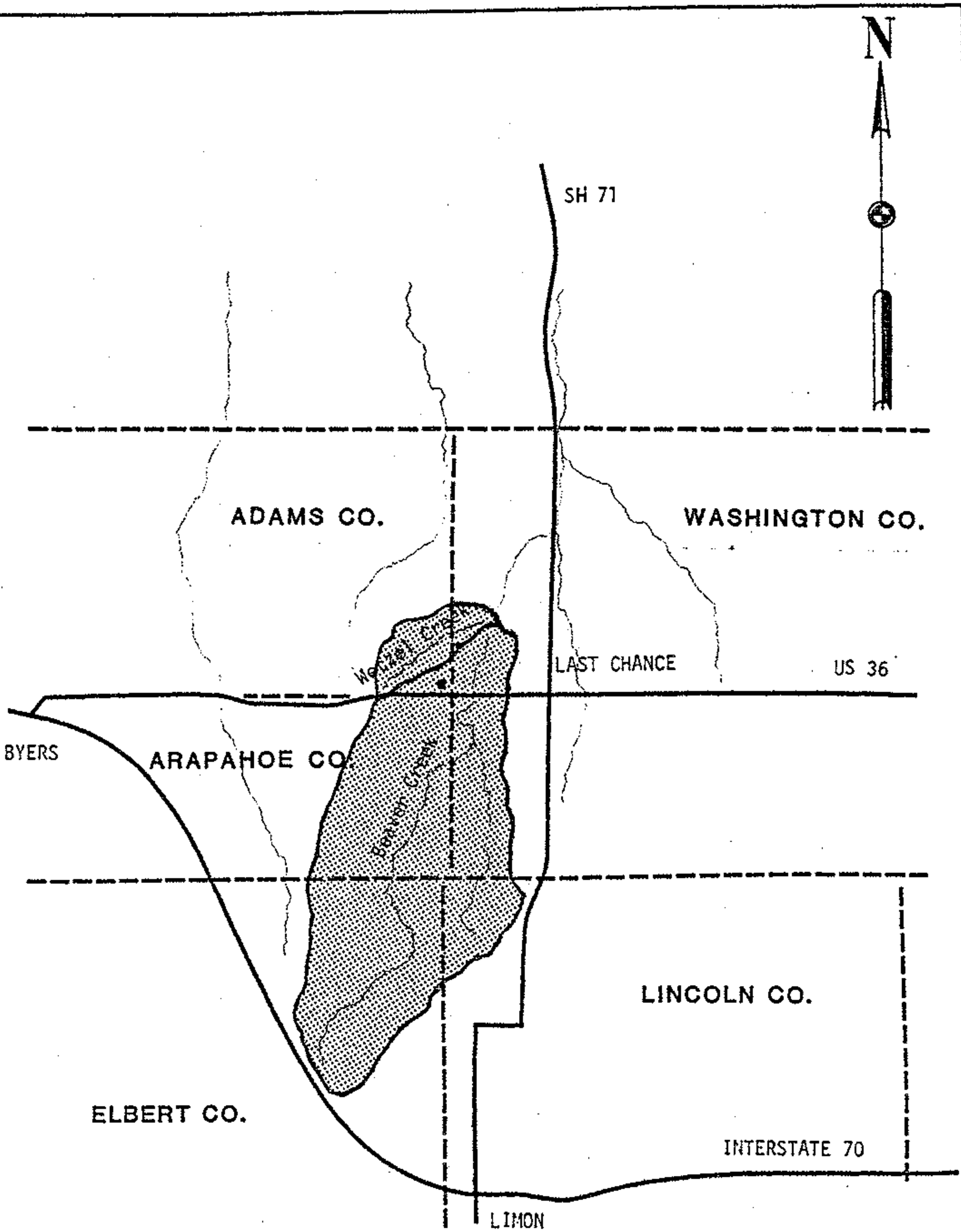

FIGURE №. 5.5.5
WETZEL AND BEAVER CREEKS DRAINAGE AREAS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

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The analysis correlated available gaging data to drainage area, mean annual precipitation, basin slope, and stream bed slope, to develop a mathematical model which describes 100-year flood conditions in ungaged basins of similar topography. The general form of the mathematical model employed was as follows:

$$Y = AX_1^{B_1} X_2^{B_2}$$

Where: Y = flood condition

$X_{1,2}$ = drainage basin characteristics

$B_{1,2}$ = respective coorelation exponent

A = proportionality constant

The analysis revealed the 100-year flood depth in the Plains Region was best predicted on the basis of the stream bed slope alone, in accordance with the following equation:

$$D_{100} = 59.3\ S_s^{-0.517}$$

where: D_{100} = 100-year flood depth in feet

S_s = Stream bed slope in feet per mile

As required in the methodology(4), stream bed slopes were calculated at the lower most point in the drainage area by determining the quotient of up and down stream contour differences and the length between these contours. For the case at hand, this was at the confluence of Wetzel and Beaver Creeks. The above relationship was then used to calculate the 100-year flood depth:

$$S_s = \frac{\text{difference in contours}}{\text{length between contours}}$$

$$= \frac{4{,}600 \text{ ft.} - 4{,}580 \text{ ft.}}{2.85 \text{ miles}} = 7.02 \text{ feet/mile}$$

$$\text{thus, } D_{100} = 59.3\ S_s^{-0.517}$$

$$= 59.3\ (7.02)^{-0.517} = 21.6 \text{ feet}$$

As indicated above, the 100-year flood depth is estimated to be nearly 22 feet above the average stream elevation at the confluence of Wetzel and Beaver Creeks. To relate this flood depth to the active site, a conservative assumption was made to calculate the flood plain elevation at the intersection of Beaver Creek and Highway 36 shown on Figure 5.5.5. Given the existing elevation at this intersection (4,720 feet), and assuming the same increased flood depth at that intersection as was calculated for confluence of Beaver and Wetzel Creeks, a flood elevation of 4,742 would be encountered. Comparing this elevation to the lowest elevation at the active site (4,835 in the southeastern corner of the site), reveals that the active site is at least 93 feet above the 100-year flood depth of Beaver Creek. Thus, it is concluded that the site is not subject to flooding.

5.5.4 References

1. U.S. Department of Agriculture, "Soil Survey of Adams County, Colorado," Soil Conservation Service, In Cooperation with Colorado Agricultural Experiment Station, October, 1974.

2. Urban Drainage and Flood Control District, Drainage Criteria Manual, Volume I, March, 1969.

3. U.S. Department of Commerce, Precipitation - Frequency Atlas of the Western United States, Volume III - Colorado, National Weather Service, 1973.

4. McCain, J. F., and Jarrett, R. D., Manual for Estimating Flood Characteristics of Natural Flow Streams in Colorado, Technical Manual No. 1, Colorado Water Conservation Board, Denver, Co., (1976).

5.6 BASE LINE WATER QUALITY

Extensive analytical testing of a variety of water and soil leachate samples was conducted so as to establish their background composition. The procedures and results of this program are summarized below.

5.6.1 Selection of Sampling Locations

Groundwater samples were collected from each of five new wells. These are indicated in Figure 5.6.1 as WW No. 1, MW 5, MW 9, MW 10, and WW 11. These samples provided a first round indication of groundwater quality in the vicinity of the facility.

An existing abandoned water well at the southeast corner of Section 36 was also sampled. However, the complete series of analyses was not performed on this sample because of obvious contamination resulting from deterioration of the well structure. The results for this sample (presented subsequently in Table 5.6.8) were not considered typical of actual groundwater quality and thus were not used in the base line study.

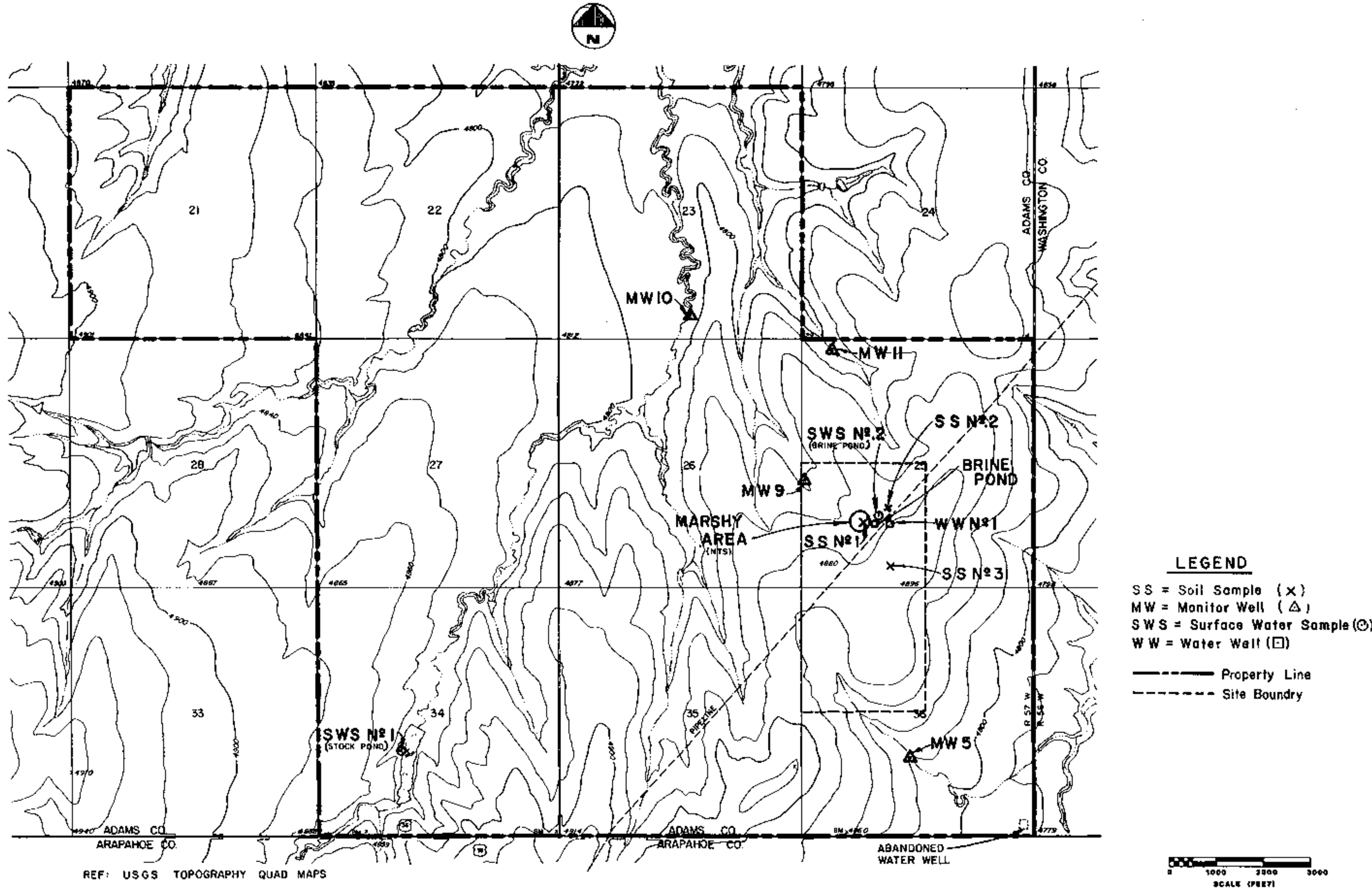
Several field inspections of Wetzel and Beaver Creeks were made in an attempt to locate surface water for sampling downstream from facility drainage. However, only dry creek beds were discovered, even as far north as Interstate 76 (about 37 miles). In lieu of creek samples, the stock pond (SWS No. 1), in Wetzel Creek was sampled. As can be seen in Figure 5.6.1, this pond is located to the west and upstream of the facility's drainage. This impoundment, which sometimes covers as much as ten acres, was much smaller in area and covered with ice at the time of sampling. The analytical results for this sample may be higher than normal because evaportion and ice formation tend to concentrate the various dissolved chemicals present.

The only other surface water available at the site during the sampling program was the oil field brine pond (see Figure 5.6.1) which stores water recovered from the operating oil production well. This brine pond was sampled to evaluate its potential for contaminating the shallow alluvium of the drainage swale which extends to the northwest. It appears that this pond continuously discharges to the surrounding area, forming approximately an acre of marsh-like ground between it and the swale leading toward monitoring well MW 9.

The points at which soil samples were collected are also illustrated in Figure 5.6.1. Soil Sample No. 1 was collected from the marshy area about 50 yards to the west of the overflow point from the brine pond. In order to evaluate the possible effects of the pond discharge on soil, Soil Sample No. 2 was collected upslope about 100 yards north of the pond. Soil Sample No. 3 was collected about 100 yards south of the Phase I solidification basins.

5.6.2 Sampling and Analytical Methodology

Seven water quality and three soil quality samples were collected and analyzed over the period of January 22 to January 26, 1981. The water samples collected from the five wells and two ponds were analyzed for 42 parameters carefully selected to characterize the water in terms of the requirements of 40 CFR 265.92. All analyses were made by Rocky Mountain Analytical Laboratory in Denver, Colorado(2). The depth and water table measurements of the five sampled wells are presented in Table 5.6.1. For the water sample collected from the abandoned water well, only five parameters were measured. This was because the sample was not considered to be representative of actual groundwater, as previously explained. Each of the three soil samples was analyzed for 16 trace metal and six organic pesticide parameters.



REF: USGS TOPOGRAPHY QUAD MAPS

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER / DRAFTING / PROJ. ENGR. / PROJ. MGR. / BY / DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF — HNTB

ARCHITECTS ENGINEERS PLANNERS

JOB NO.

DATE: 16 MAR 81

BFI — BROWNING-FERRIS INDUSTRIES

HIGHWAY 36 LAND DEVELOPMENT COMPANY

ADAMS COUNTY, COLORADO

CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF SAMPLING POINTS

BASELINE WATER QUALITY STUDY

SHEET NO. 5.6.1

TABLE 5.6.1

DEPTH OF SAMPLED WELLS

Well No.	Date Observed	Static Water Level, Feet above MSL	Water Depth, Feet Below Ground Surface	Well Head Elevation Feet Above MSL
WW 1	1/22/81	4689.3	190.1	4879.4
MW 5	1/22/81	4788.8	38.1	4826.9
MW 9	1/22/81	4802.4	39.5	4841.9
MW 10	2/17/81	4788.5	16.6	4805.1
MW 11	2/17/81	4774.3	10.7	4785.0

A Kemmerer water sampler was used to collect surface water samples from about three feet below the surface of the stock pond. Brine pond water was collected directly into sample bottles from near the surface. At each soil sample site, five subsamples from the top ten inches were composited in a glass dish and then transferred to a prewashed glass bottle with a teflon lined cap. Groundwater samples were collected by bailing each well until three or four casing volumes had been removed or until it was dry. After allowing the well to recharge (normally 24-48 hours), the samples were collected with a stainless steel bailer, poured directly into prepared sample bottles, and labeled.

All samples were preserved in the field at the time of collection in accordance with procedures defined by the Federal Register, 40 CFR 136, December 3 and December 18, 1979. Table 5.6.2 contains a summary of the methodology and references to the methodology used to analyze the water and soil samples. The metals analyses for the soil samples were determined by leaching the samples for one hour at 90°C in dilute hydrochloric and nitric acid (see reference 1 in Table 5.6.2). The results were calculated as the milligrams of leachable metals per dry kilogram of soil. The organics were extracted in Soxhlet extractors with organic solvents.

TABLE 5.6.2
METHODOLOGY USED FOR ANALYTICAL TESTING

Parameter	Method	Method Referenced Number	Reference Number
Arsenic	Furnace AA	Method 206.2	(1)
Barium	Flame AA	Method 208.1	(1)
Cadmium	Flame AA	Method 213.1	(1)
Chromium	Flame AA	Method 218.1	(1)
Fluoride	Electrode	Method 340.2	(1)
Lead	Flame AA	Method 239.1	(1)
Mercury	Flameless AA	Method 245.1	(1)
Nitrate (as N)	Colorimetric	Method 352.1	(1)
Selenium	Furnace AA	Method 270.2	(1)
Silver	Flame AA	Method 272.1	(1)
Endrin	GC	Method 608	(2)
Lindane	GC	Method 608	(2)
Methoxychlor	GC	Method 608	(2)
Toxaphene	GC	Method 608	(2)
2,4-D	HPLC		(3)
2,4,5-TP(Silvex)	HPLC		(3)
Radium	Alpha Spectometry	Method 705	(4)
Natural Uranium	Fluorimeter		(5)
Gross Alpha	Proportional Counter	Method 703	(4)
Gross Beta	Proportional Counter	Method 703	(4)
Coliform Bacteria	Membrane Filter	Method 909	(4)
Chloride	Titration	Method 325.3	(1)
Iron	Flame AA	Method 236.1	(1)
Manganese	Flame AA	Method 243.1	(1)
Phenolics	Distillation-Colorimetric	Method 420.1	(1)
Sodium	Flame Emission	Method 273.1	(1)
Sulfate	Turbidimetric	Method 375.4	(1)
pH	Electrode	Method 150.1	(1)
Specific Conductance	Wheatstone Bridge	Method 120.1	(1)
TOC	Combustion Infrared	Method 415.1	(1)
TOX	Dohrman TOX	Method 450.1	(1)
Color	Platinum-Cobalt	Method 110.2	(1)
COD	Titration	Method 410.1	(1)
Oil & Grease	Gravimetric	Method 413.1	(1)
Ammonia	Electrode	Method 350.3	(1)
Magnesium	Flame AA	Method 242.1	(1)
Zinc	Flame AA	Method 289.1	(1)
Copper	Flame AA	Method 220.1	(1)
Nickel	Flame AA	Method 249.1	(1)
Phosphate	Colorimetric	Method 365.2	(1)
Potassium	Flame Emission	Method 258.1	(1)
Cyanide	Distillation-Colorimetric	Method 335.2	(1)

[1] "Methods for Chemical Analysis of Water and Wastes", USEPA, EPA-600/4-79-020, March, 1979.

[2] Federal Register, Volume 44, Number 233, Monday, December 3, 1979.

[3] "Half Hour Determination Method for Chlorophenoxy Acids and Esters Using Liquid Chromatography", Water Associates, J22, May, 1978.

[4] "Standard Methods for the Examination of Water and Wastewater", 14th Edition American Public Health Association, 1015 Eighteenth Street, NW, Washington, DC 20036, 1975.

[5] U.S. Geological Survey.

[6] Available from the EPA, Environmental Monitoring & Support Laboratory, Cincinnati, Ohio.

5.6.3 Results and Discussion

The analytical results for the water samples are presented in Tables 5.6.3 through 5.6.6, and those for the soil samples are presented in Table 5.6.7. The results for the sample from the abandoned water well are given in Table 5.6.8. For comparison purposes, drinking water standards are listed in Table 5.6.9.

The EPA National Primary Interim Drinking Water Standards were exceeded for a number of the trace metal parameters of the water samples (Table 5.6.10). The EPA standard for cadmium was significantly exceeded for well MW 9 and slightly exceeded for the four other wells sampled and for the stock pond. Cadmium is a toxic metal which can be accumulated in various body tissues, especially the kidneys and the liver(3). However, chronic toxic effects of cadmium from ingestion is rarely encountered. Assuming that a person consumes between 1.6 and 2 liters of water a day, cadmium intake from the well of the highest concentration would be only 82 to 102 ug/day. A daily intake of 200 to 500 ug of cadmium significantly increases the probability of kidney damage(5).

The EPA standard for chromium was exceeded only for the water sample of well MW 9 (Table 5.6.10). The levels of chromium that may be taken over a long-term period without adverse effects have not been determined. However, it has been reported that a family of four consumed water with a hexavalent chromium concentration of 0.45 mg/l for 3 years without any known ill effects(6). The concentration of chromium in well MW 9 (0.064 mg/l) falls well below this value.

TABLE 5.6.3

MONITOR WELLS AND SURFACE WATER RESULTS (JANUARY, 1981) - I

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS DRINKING WATER SUPPLY

Parameter	Units	Brine Pond	MW9	Stock Pond	MW5	MW10	MW11	WW1
Arsenic	mg/l	ND*	ND	0.008	ND	ND	ND	0.008
Barium	mg/l	0.22	0.22	0.22	0.22	0.77	0.11	0.55
Cadmium	mg/l	0.008	0.051	0.011	0.014	0.011	0.011	0.011
Chromium	mg/l	0.022	0.064	0.043	0.022	0.022	0.043	0.022
Fluoride	mg/l	3.0	2.3	0.8	1.2	0.7	1.3	2.2
Lead	mg/l	ND	0.350	ND	ND	0.100	0.100	0.100
Mercury	mg/l	ND	ND	ND	ND	ND	ND	ND
Nitrate (as N)	mg/l	ND	1.2	ND	1.1	6.0	7.0	0.08
Selenium	mg/l	0.010	0.008	ND	ND	ND	0.012	0.011
Silver	mg/l	ND	0.03	ND	ND	0.01	ND	ND
Endrin	mg/l	ND	ND	ND	ND	ND	ND	ND
Lindane	mg/l	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	mg/l	ND	ND	ND	ND	ND	ND	ND
Toxaphene	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-D	mg/l	ND	ND	ND	ND	ND	ND	ND
Radium 226	pCi/l	0.6±0.9	0.9±1.3	ND	0.6±0.7	4.0±1.9	0.5±1.1	2.0±1.3
Natural Uranium	pCi/l	ND	179.	2.0	27.	6.1	5.4	15.6
Gross Alpha	pCi/l	6 ±21	1100 ±400	10 ±7	37 ±26	72 ±35	41 ±35	64 ±37
Gross Beta	pCi/l	30 ±27	1200 ±300	27 ±8	33 ±27	77 ±30	44 ±28	92 ±31
Coliform Bacteria	No./100ml	0	0	0	0	0	0	0
2,4,5-T (Silvex)	mg/l	ND	ND	ND	ND	ND	ND	ND

* None Detected

TABLE 5.6.4

MONITOR WELLS AND SURFACE WATER RESULTS (JANUARY, 1981) - II

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION

Parameter	Units	Brine Pond	MW9	Stock Pond	MW5	MW10	MW11	WW1
pH - A	pH units	7.5	7.7	8.6	7.3	7.5	7.4	7.9
B		7.5	7.6	8.6	7.4	7.5	7.3	7.9
C		7.6	7.7	8.5	7.5	7.6	7.4	8.0
D		7.4	7.5	8.6	7.4	7.5	7.3	7.9
Specific Conductance - A	umhos/cm	2600	17,000	390	1650	910	2100	4700
B		2600	16,400	380	1640	890	2200	4600
C		2700	16,900	390	1670	900	2150	4650
D		2650	17,100	400	1650	910	2200	4700
TOC - A	mg/1	21	11	10	4	3	14	10
B		9	16	24	9	7	6	13
C		12	25	14	9	6	6	16
D		10	16	20	6	4	10	9
TOX - A	ug C1-/1	28	59	9	67	28	78	45
B		19	29	19	49	22	60	25
C		24	49	17	41	36	55	37
D		7	31	15	55	26	67	33

TABLE 5.6.5

MONITOR WELLS AND SURFACE WATER RESULTS (JANUARY, 1981) - III

REQUIRED PARAMETERS ESTABLISHING GROUNDWATER QUALITY

Parameter	Units	Brine Pond	MW9	Stock Pond	MW5	MW10	MW11	WW1
Chloride	mg/l	203	524	11	23	18	40	1340
Iron	mg/l	0.63	9.54	0.47	2.50	17.3	6.60	22.3
Manganese	mg/l	0.60	0.59	ND*	0.29	1.31	0.50	0.41
Phenolics	mg/l	0.16	ND	0.007	0.008	0.008	0.008	0.006
Sodium	mg/l	58	390	2	12	3	11	89
Sulfate	mg/l	377	2150	32	810	223	1480	62

* None Detected

TABLE 5.6.6

MONITOR WELLS AND SURFACE WATER RESULTS (JANUARY, 1981) - IV

OTHER PARAMETERS RELATED TO GROUNDWATER QUALITY

Parameter	Units	Brine Pond	MW9	Stock Pond	MW5	MW10	MW11	WW1
Color	mg/l	10.	5.	3.	ND*	1.5	1.5	5.
COD	mg/l	132	62	49	34	180	66	92
Oil and Grease	mg/l	41	2	ND	ND	ND	ND	ND
Ammonia	mg/l	2.10	ND	1.90	ND	ND	ND	0.96
Magnesium	mg/l	ND	1080.	27.3	76.4	63.6	45.4	30.9
Zinc	mg/l	ND	0.26	ND	0.21	0.14	0.16	0.63
Copper	mg/l	ND	0.09	ND	0.05	0.05	0.04	0.11
Nickel	mg/l	ND	0.08	ND	ND	ND	ND	ND
Phosphate	mg/l	0.03	ND	ND	ND	0.02	ND	1.67
Potassium	mg/l	6.9	72.	15.3	7.1	14.5	9.1	14.7
Cyanide	mg/l	0.013	ND	ND	ND	ND	ND	ND

* None Detected

TABLE 5.6.7

RESULTS OF SOIL TESTING (JANUARY, 1981)

LEACHABLE METALS IN SOIL SAMPLES
(Values Based on Dry Weight of Sample)

Parameter	Detection Limit	Units	Soil #1	Soil #2	Soil #3
Arsenic	0.11	mg/kg	0.80	0.30	0.83
Barium	1	mg/kg	100	100	120
Cadmium	0.05	mg/kg	0.55	0.49	0.47
Chromium	0.1	mg/kg	8.1	7.8	8.0
Lead	0.5	mg/kg	15	14	14
Mercury	0.002	mg/kg	ND*	ND	ND
Selenium	0.065	mg/kg	ND	ND	ND
Silver	0.10	mg/kg	0.31	0.28	0.28
Iron	0.50	mg/kg	1200	1000	970
Manganese	0.25	mg/kg	330	340	320
Sodium	10	mg/kg	1200	250	180
Magnesium	10	mg/kg	2300	2700	2600
Zinc	0.2	mg/kg	47	42	42
Copper	0.3	mg/kg	9.2	9.0	9.0
Nickel	0.6	mg/kg	11	10	11
Potassium	10	mg/kg	720	570	570

ORGANIC PARAMETERS FOR SOIL SAMPLES
(Values Based on Dry Weight of Sample)

Parameter	Detection Limit	Units	Soil #1	Soil #2	Soil #3
Endrin	0.002	mg/kg	ND	0.012	0.006
Lindane	0.001	mg/kg	ND	0.002	ND
Methoxychlor	0.02	mg/kg	ND	ND	ND
Toxaphene	0.06	mg/kg	ND	ND	ND
2,4-D	0.03	mg/kg	ND	ND	ND
2,4,5-TP (Silvex)	0.03	mg/kg	ND	ND	ND

* Not Detectable

TABLE 5.6.8

RESULTS FROM ABANDONED WATER WELL

Parameters	Units	Results
pH	pH Units	8.3
TDS	mg/l	2400
TOC	mg/l	7
Fecal Coliform	Colonies/100 ml	0
Nitrate (as N)	mg/l	1.3

Note: Groundwater depth was measured to be 44.9 feet on February 9, 1981 corresponding to a mean sea level elevation of approximately 4,735 feet.

TABLE 5.6.9

DRINKING WATER STANDARDS

Parameter	Standard	Reference No.
Arsenic	0.05 mg/l	(1)
Barium	1.0 mg/l	(1)
Cadmium	0.01 mg/l	(1)
Chromium	0.05 mg/l	(1)
Fluoride	1.4-2.4 mg/l	(1)
Lead	0.05 mg/l	(1)
Mercury	0.002 mg/l	(1)
Nitrate (as N)	10.0 mg/l	(1)
Selenium	0.01 mg/l	(1)
Silver	0.05 mg/l	(1)
Endrin	0.0002 mg/l	(1)
Lindane	0.004 mg/l	(1)
Methoxychlor	0.1 mg/l	(1)
Toxaphene	0.005 mg/l	(1)
2,4-D	0.1 mg/l	(1)
2,4,5-T (Silvex)	0.01 mg/l	(1)
Radium 226	5 pCi/l	(2)
Gross Alpha	15 pCi/l	(2)
Gross Beta	50 pCi/l	(2)
Coliform Bacteria	1 #/100 ml	(1)
Chloride	250 mg/l	(3)
Iron	0.3 mg/l	(1)
Manganese	0.05 mg/l	(1)
Sulfate	250 mg/l	(3)
Color	15 mg/l	(3)
Zinc	5 mg/l	(1)
Copper	1 mg/l	(1)

References:

1. Federal Register, Volume 40, No. 248, Wednesday, December 24, 1975, Title 40, Part 141.

2. Federal Register, Volume 41, No. 133, Friday, July 9, 1976, Title 40, Part 141.

3. U.S. Public Health Service. 1962. Public Health Service Drinking Water Standards, 1962. U.S. Public Health Service Publication #956.

TABLE 5.6.10 WATER QUALITY VALUES EXCEEDING DRINKING WATER STANDARDS

Parameter	Units	EPA Standard	Brine Pond	MW9	Stock Pond	MW5	MW10	MW11	WW1
Cadmium	mg/1	0.010[1]		0.051	0.011	0.014	0.011	0.011	0.011
Chromium	mg/1	0.050[1]		0.064					
Fluoride	mg/1	1.4-2.4[1]	3.0						
Lead	mg/1	0.050[1]		0.350			0.100	0.100	0.100
Selenium	mg/1	0.010[1]						0.012	0.011
Chloride	mg/1	250[2]		524					1,340
Iron	mg/1	0.3[1]	0.63	9.54	0.47	2.50	17.3	6.60	22.3
Maganese	mg/1	0.050[1]	0.60	0.59		0.29	1.31	0.50	0.41
Sulfate	mg/1	250[2]	377	2,150		810		1,480	
Gross Alpha	pCi/1	15[3]		1,100±400		37±26	72±35	41±35	64±37
Gross Beta	pCi/1	50[3]		1,200±300			77±30		92±31

[1] EPA National Primary Interim Drinking Water Standards, 1975.
[2] U.S. Public Health Service Standards, 1962.
[3] EPA National Primary Interim Drinking Water Standards, 1976b.

The EPA standard for lead was exceeded for all of the sampled wells except well MW 5 (Table 5.6.10). Lead is a toxic metal which is accumulated in the tissues of man, and with long-term exposure, causes anemia, kidney damage, and neurologic dysfunction(3). Exposure of humans to lead through water is generally too low to cause poisoning. Two cases of lead poisoning from drinking municipal water containing 2.6 mg/l of lead have been reported. These levels were much higher than the greatest concentration of lead which was determined during the water sampling program (0.350 mg/l for well MW 9).

The EPA standard for selenium was only slightly exceeded for the water samples of wells WW 1 and MW 11 (Table 5.6.10). No adverse effects would be expected from the concentration of selenium in wells WW 1 and MW 11, which only slightly exceed the EPA standard.

The EPA standard for iron was exceeded for all the well water samples and the surface water samples (Table 5.6.10). The EPA standard for iron is set primarily for esthetic rather than toxicological purposes(3). Iron can stain plumbing fixtures and clothes during laundering operations and can affect the taste of water at levels above 1 or 2 mg/l(3,7). Iron overload in humans from dietary intake is rare. The highest iron concentration which was detected was 22.3 mg/l (well WW 1), as compared to 40 to 80 mg/l in beverages causing known iron overloads(6).

The EPA standard for manganese was exceeded for all the wells sampled and for the brine pond (Table 5.6.10). As with the case of iron, the EPA standard for manganese is set primarily for esthetic rather than toxicological purposes(3). Manganese poisoning from ingestion is not common. No adverse health effects would be expected from the concentrations of manganese in the wells sampled in the vicinity of the proposed waste facility.

The EPA standard for fluoride (1.4 to 2.4 mg/1) was exceeded only for the brine pond water sample (3.0 mg/1) (Table 5.6.10). A fluoride concentration of approximately 1.0 mg/1 appears to be the optimum concentration for the prevention of dental caries without the effects of dental fluorosis(8). The fluoride concentration of the water from the brine pond, well WW 1, and well MW 9 (3.0, 2.2, and 2.3 mg/1) significantly exceed this optimum concentration for dental health.

The U. S. Public Health Service Standard for chloride was exceeded for wells WW 1 and MW 9 (Table 5.6.10). Chloride at concentrations above the standard of 250 mg/1 give an objectionable salty taste to water. However, concentrations as high as 2,000 mg/1 have been shown to have no adverse effects on man(7). The chloride concentrations of wells WW 1 and MW 9 are well below this concentration.

The U. S. Public Health Service Standard for sulfate was exceeded for three of the wells sampled and for the brine pond (Table 5.6.10). High levels of sulfate in drinking water may have a cathartic effect on humans (9).

The EPA radiochemical parameters were exceeded on a large number of the well water samples (Table 5.6.10). The EPA standard for gross alpha was exceeded for all of the five well water samples (wells WW 1, MW 5, MW 9, MW 10, and MW 11). Indeed, the gross alpha concentration of 1,100 ± 400 picocuries per liter (pCi/1) for well MW 9, considerably exceeded the EPA standard of 15 pCi/1.

Three wells (WW 1, MW 9, and MW 10) have gross beta concentrations over the EPA standards of 50 pCi/1 (Table 5.6.10). The gross beta concentration of 1,200 pCi/1 for well MW 9, again, greatly exceeded the EPA standard. The highest values for gross alpha and gross beta concentrations were found for the water sample of well MW 9. This well also contained the highest concentration of natural uranium (179 pCi/1 compared to the next highest concentration of 27 pCi/1 for well MW 5).

The EPA standards for the radiochemical parameters (gross alpha and gross beta activity and radium 226) were not exceeded on either of the pond samples.

The level of radioactive material in the environment, which has been measured for the sampled wells, is only one of several factors required to determine radiation dose to individuals. Among these factors are the types of radiation emmitters present, the distribution of ingested radioactive materials within the body, and the metabolic pathways of the radioactive materials. Therefore, the radiation dose which would be received from consumption of water from the wells with high radiochemical values cannot be determined. However, it can be expected that the high levels of radiation activity found in several of the wells, especially well MW 9, could result in radiation dose of sufficient quantity to cause potential adverse effects on human health.

The results for the soil samples are reported in Table 5.6.7 on a dry weight basis. Of all the trace metals tested, all were detected except for mercury and selenium. Of the pesticides tested, endrin was detected in two of the soil samples and lindane was detected in one soil sample. Although not quantified, all of the soil samples contained concentrations in the low part per billion range of p, p' - DDE, a breakdown product of DDT. DDT was used for many years in agricultural areas.

The presence of these pesticides and pesticide by-products in soil samples would be of little significance, except for the fact that high levels of organic halogens were also present in all the water samples. Although none of the well water samples would be judged non-potable on the basis of total organic halides alone, a long-term soil accumulation of pesticides and pesticide degradation by-products resulting from agricultural applications seems to be reflected in the local water quality.

The soils sample data showed higher levels of sodium and potassium in the marshy area (Soil Sample No. 1) than in the other areas sampled. This was expected because the brine pond routinely overflows towards this marshy area.

A strict comparison of the results to the standards indicates that all of the background water samples failed to meet drinking water standards for one or more parameters. Cadmium was the most frequently excessive, followed by gross alpha, lead, gross beta, selenium, and chromium, in that order. Based on the specific conductance values, all water tested as brackish or saline except that from the stock pond and well MW 10 (which is downstream from the stock pond). Well MW 10, however, is heavily mineralized with iron and manganese. The stock pond water quality is only marginally below drinking water standards, i.e., the concentrations of cadmium and iron were slightly higher than the standards. Because of concentration effects due to evaporation in the pond at the time of sampling, this represents the worst condition as far as water quality is concerned.

The groundwater samples from each well seemed to be strongly affected by localized mineralogical conditions. It can be concluded from this that either these aquifers are discontinuous or that groundwater movement is so slow that local mineralogy is a major contributor to localized groundwater quality values. The latter case is also consistent with the long period of time required for the wells to recover after purging (24-48 hours).

5.6.4 Conclusions

In summary, the groundwater in the vicinity of the facility is of a poor quality. Because the groundwater zones are either discontinuous or so slow in movement, the characteristics of the various groundwaters are chemically distinct. Further, the contamination that exists probably is the result of oil well development and from agricultural pesticide use. The slow recharge of the wells and the absence of any significant surface water indicate low quantities of groundwater available for use.

5.6.5 References

1. State of Colorado, Division of Water Resources, Office of the State Engineer, 1981.

2. Rocky Mountain Analytical Laboratory, 1981.

3. Environmental Protection Agency, 1976a. Quality Criteria for Water. Washington, D.C. 501 pp.

4. Environmental Protection Agency, 1976b. Interim Primary Drinking Water Regulations, Promulgation of Regulations on Radionuclides. Federal Register Vol. 41, No. 133.

5. Lauwerys, R. R. 1979. Health Effects of Cadmium. Pages 43-64 in E. D. Ferrante, ed. Trace Metals: Exposure and Health Effects. Pergamon Press Inc. New York. 262 pp.

6. Committee on Biologic Effects of Atmospheric Pollutants, Division of Medical Sciences, National Research Council. 1974. Medical and Biological Effects of Environmental Pollutants: Chromium. National Academy of Sciences. Washington, D.C. 155 pp.

7. Sawyer, C. N. and P. L. McCarty. 1967. Chemistry for Sanitary Engineers. Second Edition. McGraw-Hill Book Company. New York. 518 pp.

8. Waldbott, G. L., A. W. Burgstahler, and H. L. McKinney. 1978. Fluoridation: The Great Dilemma. Coronado Press Inc. Lawrence, Kansas. 423 pp.

9. Environmental Protection Agency, 1975. National Interim Primary Drinking Water Regulations. Federal Register Vol. 40, No. 248.

5.7 AIR QUALITY AND NOISE

5.7.1 Air Quality

5.7.1.1 Clean Air Act

The Federal Clean Air Act of 1970 and subsequent amendments require ambient air quality standards. These were established in order to protect public health and welfare from known or anticipated effects of sulfur dioxide (SO_2), particulates (TSP), carbon monoxide (CO), nitrogen dioxide (NO_2), hydrocarbons (HC), and ozone (O_3). The standards for these pollutants are listed in Table 5.7.1.

5.7.1.2 Attainment Status

In accordance with the Clean Air Act Amendments of 1977, states are required to submit to the United States Environmental Protection Agency a list identifying those air quality control regions, or portions thereof, which meet or exceed the national standards or cannot be classified because of insufficient data. Portions of air quality control regions which are shown by monitored data or air quality modeling to exceed any national ambient air quality standard are designated "nonattainment" areas. The Highway 36 Land Development Project is located in Adams County Metropolitan Denver Intrastate Air Quality Control Region. Within this region, Adams County is designated "nonattainment" for O_3 and CO, and "better than national standards" for SO_2, NO_2, and TSP.

TABLE 5.7.1

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) (1)

Pollutant	Averaging Time[1]	Primary Standard[2]	Secondary Standard[3]
Sulfur Dioxide	Annual Average	80 ug/m^3 (0.03ppm)	-
	24 hr.	365 ug/m^3 (0.14ppm)	-
	3 hr.	-	1300 ug/m^3 (0.5ppm)
Suspended Particulate Matter	Annual Geometric Mean	75 ug/m^3	60 ug/m^3
	24 hr.	260 ug/m^3	150 ug/m^3
Carbon Monoxide	8 hr.	10 mg/m^3 (9ppm)	Same
	1 hr.	40 mg/m^3 (35ppm)	Same
Nitrogen Dioxide	Annual Average	100 ug/m^3 (0.05ppm)	Same
Hydrocarbons (corrected for Methane)	3 hr. (6-9 a.m.)	160 ug/m^3 (0.24ppm)	Same
Ozone	1 hr.	235 ug/m^3 (0.12ppm)	Same
Lead	3 Month Average	1.5 ug/m^3	Same

[1] Standards based on other annual average or annual geometric mean are not to be exceeded.

[2] Primary standards - set to protect human health.

[3] Secondary standards - set to protect public welfare.

ug/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter
ppm = parts per million

5.7.1.3 Background Air Quality Data

Of the various air pollutants listed in Table 5.7.1, the one most relevant to this project is suspended particulate matter. This is because of the nature of the reagents employed, e.g., cement kiln dust or fly ash, for the soldification operation, as well as the fugitive dust emissions that could result from wind erosion of overburden stock pile areas, traffic along gravel roads, movement of earth during excavation of secure disposal cells, and overall construction of the proposed facilities.

Because no long-term air quality background data were available for the specific project site, a search was made for existing air quality data from a point reasonably close to the site that could be representative, or approximate, of actual background conditions at the site. In accordance with discussions held with the Air Pollution Control Division of the Colorado Department of Health, background particulate sampling data from the Public Service Company of Colorado's (PSC) power plant at Brush, Colorado (about 35 miles north of the project site) were utilized. The 1980 data from that location are summarized in Table 5.7.2. The arithmetic and geometric means for these data are 82 ug/m^3 and 71 ug/m^3, respectively.

5.7.1.4 Wind

The open conditions characteristic of the high plains generate conditions suitable for sustained surface winds. Mean annual wind speed is about 9 miles per hour at Stapleton International Airport with a range up to 56 miles per hour associated with thunderstorms during spring and fall months(3). Air flow is mainly from the south and northwest, with southerly air flows prevailing. To depict wind data typical of the semi-arid

TABLE 5.7.2

AIR QUALITY DATA REPORT
AT PSC POWER PLANT, BRUSH CO. (2)

AGENCY: STATE STATE: COLORADO PROJECT: POPULATION-ORIENTED SURV.

PARAMETER: TOTAL SUSPENDED PARTICULATE UNITS: U-GMS/M3 (25 DEG C,1013 M-BARS AREA CODE: 0280

COLLECTION METHOD: HI-VOL ANALYSIS METHOD: GRAVIMETRIC

SAMPLING INTERVAL: DAILY SITE: 134. BRUSH - CLAYTON AND EDISON STS. - MORGAN YEAR: 1980

TYPE	PRIMARY STANDARD(S)	SECONDARY STANDARD(S)
FEDERAL	75 UG/M3 (25 C) ANNUAL GEOMETRIC MEAN	60 UG/M3 (25 C) ANNUAL GEOMETRIC MEAN

	MONTH														
DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01											145		1	145	145
02	38		150			45			64				4	74	150
03		65		80								79	3	74	80
04							65			90			2	77	90
05					55						169		2	112	169
06	44		80			131			79				4	83	131
07		32		76									2	54	76
08							88			111			2	99	111
09					62						88		2	85	88
10	124		131			81			35				4	92	131
11		107		37								96	3	80	107
12							78			103			2	90	103
13					44						13		2	28	44
14	27		113			99			45				4	71	113
15		33		60								123	3	72	123
16							115			41			2	78	115
17					17						65		2	41	65
18	37		79						78				3	64	79
19		125		80								22	3	75	125
20							47			95			2	71	95
21					184			80			86		3	116	184
22	38		60			44			52				4	48	60
23		114		145								51	3	103	145
24							92			123			2	107	123
25					111						30		2	74	111
26	21		40						111				3	57	111
27		223		47								144	3	138	223
28							81			69			2	75	81
29					73			95			64		3	77	95
30	55					136			109				3	100	136
31												152	1	152	152
NO	8	7	7	7	7	6	7	2	8	7	8	7	81		
MEAN	48	99	93	75	80	89	80	87	71	90	83	95		62	
MAX	124	223	150	145	184	136	115	95	111	123	169	152			223

high plains, wind data have been included for Akron, Colorado in Figure 5.7.1. Seasonal wind speed data and wind direction data are given for Denver in Figure 5.7.2 for comparison purposes.

5.7.2 Noise

Prior to Phase I construction, the site land use was agricultural. In addition, an operating oil well and underground pipeline are located on the site. Existing ambient noise levels, when the surrounding lands are not being worked by agricultural equipment, range from 35 to 45 decibels of equivalent sound level (dBA Leq)(4).

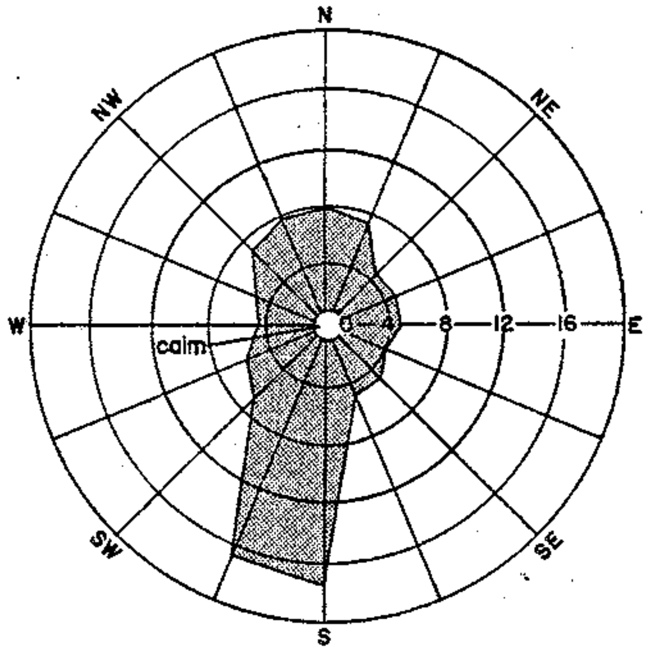
Noise levels from traffic along highways leading to the site may be affected due to anticipated increased usage. Noise levels were estimated for the 1982 traffic patterns projected in Chapter 4. The results are summarized in Table 5.7.3.

TABLE 5.7.3

ESTIMATED 1982 NOISE LEVELS FOR SEVERAL HIGHWAYS IN COLORADO

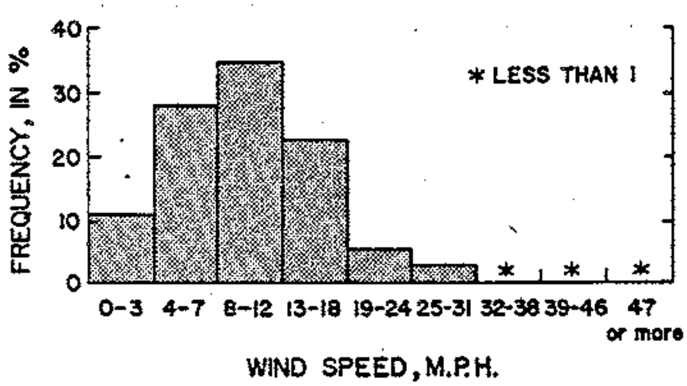
Highway & Location	Noise Level (dBA Leq)
I-25 between Colorado Springs & Denver	74
I-70 between Denver and Byers	70
U.S. 36 between Byers & the Site	67
U.S. 36 between Last Chance & the Site	67
U.S. 36 east of Last Chance	67
S.H. 71 north of Last Chance	67
S.H. 71 south of Last Chance	65

The Noise Control Act of 1972 gave the Environmental Protection Agency the authority to identify items that were excessively loud and to prepare emission standards for these items. The EPA has identified construction equipment as a major source of noise. Chapter 8 identifies anticipated



YEARLY WIND ROSE

NUMBERS ARE % OF TIME FOR DIRECTION.



WIND SPEED AND FREQUENCY

HNTB
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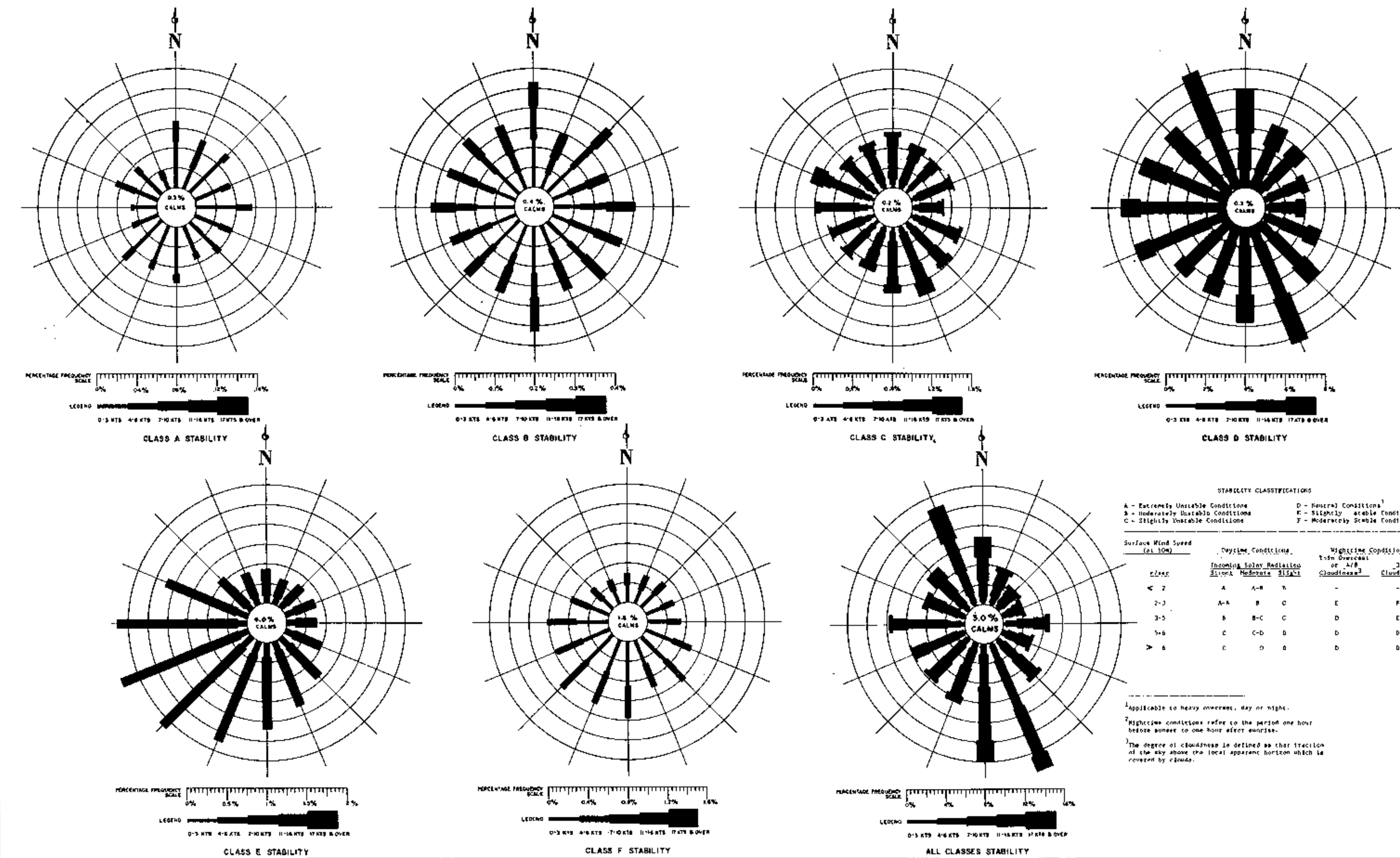
ARCHITECTS ENGINEERS PLANNERS

FIGURE Nº 5.7.2
YEARLY WIND ROSE AND SPEED AT DENVER, CO.

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO



STABILITY CLASSIFICATIONS

A - Extremely Unstable Conditions
B - Moderately Unstable Conditions
C - Slightly Unstable Conditions
D - Neutral Conditions[1]
E - Slightly Stable Conditions
F - Moderately Stable Conditions

Surface Wind Speed (at 10m) m/sec	Daytime Conditions: Incoming Solar Radiation Strong	Moderate	Slight	Nighttime Conditions[2]: Thin Overcast or ≥4/8 Cloudiness[3]	≤3/8 Cloudiness
< 2	A	A-B	B	-	-
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
> 6	C	D	D	D	D

[1] Applicable to heavy overcast, day or night.

[2] Nighttime conditions refer to the period one hour before sunset to one hour after sunrise.

[3] The degree of cloudiness is defined as that fraction of the sky above the local apparent horizon which is covered by clouds.

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

ANNUAL WIND ROSE FOR AKRON, COLORADO
HOURLY STABILITY DATA 1950 - 1954

SHEET NO.
FIG. 5.7.1
OF

noise impacts from construction equipment at the site. Typical sound levels from several types of construction equipment are given in Table 5.7.4.

TABLE 5.7.4

CONSTRUCTION EQUIPMENT SOUND LEVELS(5,6)

Equipment Type	Sound Level (dBA) at 50 Feet
Off-Highway Truck	82-93
Bulldozer	70-95
Earthmover	76-95
Motor Grader	72-91

5.7.3 References

1. Code of the Federal Regulations, 40 (50), June, 1979.

2. Colorado Department of Health, Air Pollution Control Division.

3. National Oceanographic and Atmospheric Administration, Local Climatological Data; Denver, Colorado, (1979).

4. Community Noise, Wyle Laboratories for U.S. Office of Noise Abatement and Control, Washington, D.C. (December 31, 1971).

5. U.S. EPA, "Report to the President and Congress on Noise," (February, 1972).

6. "Highway Construction Noise: Measurement, Prediction, and Mitigation," U.S. Dept. of Transportation (June, 1976).

5.8 ENVIRONMENTAL INVENTORY

5.8.1 Climate

5.8.1.1 Regional Characteristics

The climate of the study area and vicinity is continental steppe, typical of the semiarid high plains. The area is characterized by cold winters, hot summer days, cool summer nights, abundant sunshine, low relative humidity, and low but highly variable precipitation. Most precipitation falls during the late spring and summer as thunderstorms, but periodically spring rains fail, resulting in droughts. The climate is modified somewhat by the Rocky Mountains to the west(1). Figure 5.8.1 depicts the study area and vicinity.

5.8.1.2 Temperature and Growing Season

The average annual temperature is near 50°F, with relatively wide ranges in daily and seasonal temperatures (Table 5.8.1). Extremely hot summer weather or extremely cold winter weather is generally of short duration and is followed by more moderate temperature.

The average annual growing season in Adams County is about 150 days, with the last killing frost occurring in early May and the first killing frost occurring in late September or early October. The soil temperature is above 41°F for about 250 days, from April 10th to about December 18th (at 20 inches depth). During the summer months, soil temperature averages about 70°F, with slightly higher temperatures on exposed cropland than areas with grass cover(2).

5.8.1.3 Precipitation, Humidity, and Evapotranspiration

Data collected over long periods indicate that the annual precipitation for Adams County ranges from 12.5 to 14.5 inches(2). The average annual rainfall at Byers is 14.05 inches (Table 5.8.1). There is considerable variability in the amount of precipitation from year to year and between nearby localities in the same general area, particularly during the spring and summer months. The average annual snowfall at Byers is about 46 inches.

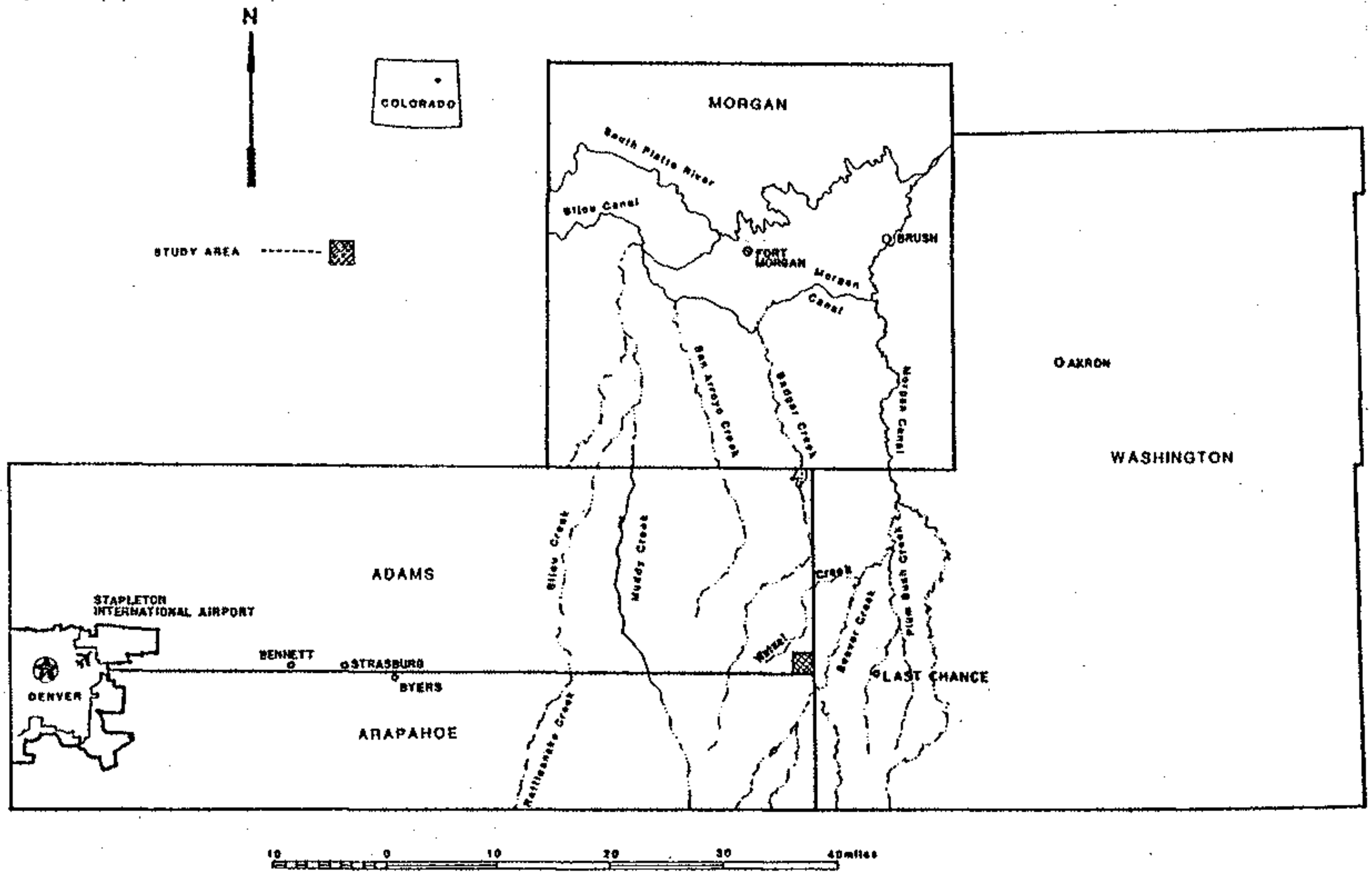


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FIGURE Nº5.8.1
GENERAL LOCATION AND STUDY AREA
FOR ENVIRONMENTAL INVENTORY
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 5.8.1
TEMPERATURE AND PRECIPITATION DATA (2)

MONTH	TEMPERATURE				PRECIPITATION				
	Average daily Maximum	Average daily Minimum	2 years in 10 will have at least 4 days with -		Average Total	2 years in 10 will have -		Average Number of Days With Snow Cover	Average Depth of Snow on Days With Snow Cover
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than-		Less than-	More than-		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches		Inches
January	43	14	61	-6	0.43	0.1	0.8	8	2
February	46	18	64	-2	.47	.2	.7	9	3
March	52	23	70	4	.87	.4	1.6	7	3
April	62	33	79	19	1.86	.7	2.8	3	4
May	71	42	86	32	2.54	.9	3.7	1	3
June	84	51	96	40	1.58	.7	2.6	0	0
July	91	57	99	50	2.01	1.0	3.2	0	0
August	89	56	98	49	1.49	.7	2.1	0	0
September	80	47	94	35	1.14	.2	1.7	1/2	4
October	69	36	83	25	.72	.1	1.5	1	2
November	54	23	71	7	.54	.2	.9	5	3
December	46	18	64	2	.40	.1	.6	7	4
Year	66	35	[1]101	[2]-14	14.05	9.2	18.3	41	3

[1]Average annual highest temperature.
[2]Average lowest annual temperature.

Source: Data for Byers, Arapahoe County, The average relative humidity is 39% during daylight hours and 62% at night. It is slightly higher in winter than in summer. On the average, the sun shines 69% of the possible sunlight hours annually.

Evaporation and transpiration moisture loss from soils exceeds precipitation from June 15th to the early part of November. During this period, the moisture supply on the upper 3 to 12 inches of the soil is depleted below the wilting point and plants must depend on summer rainfall for additional growth. The normal annual Class A pan evaporation is about 65 inches per year(3). The mean annual lake evaporation is about 55 inches per year, about 74% of which occurs between the months of May and October, as shown in Table 5.8.2(4). Lake evaporation, rather than pan evaporation, is considered to be the best estimate of evaporation that would occur, for example, on surface impoundments and holding ponds.

TABLE 5.8.2

LAKE EVAPORATION FOR DENVER, COLORADO(4)

Month	Mean Monthly Value (Inches)
January	1.6
February	1.8
March	2.5
April	3.7
May	5.0
June	7.4
July	8.8
August	8.4
September	6.7
October	4.6
November	3.0
December	1.9
TOTAL ANNUAL LAKE EVAPORATION	55.4

5.8.2 Natural Ecosystems

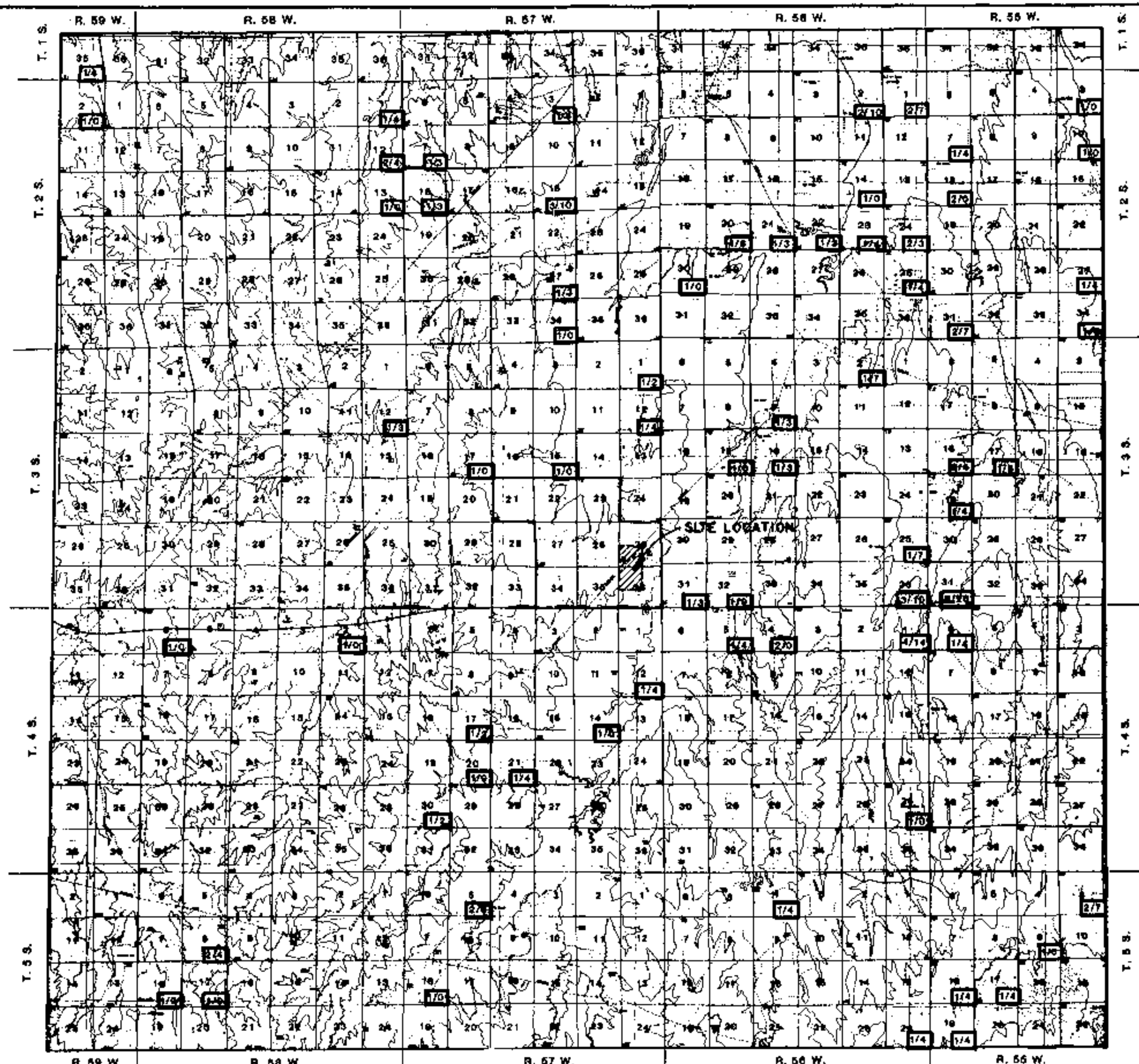
5.8.2.1 Natural Vegetation

Natural vegetation covers approximately 2% of the study area. Most of this vegetation consists of native grassland. This grassland cover is almost entirely restricted to the narrow stream valley of Wetzel Creek and its tributaries, with most of the rolling upland areas in winter wheat cropland. Numerous forbs are associated with the grass species, but few trees or shrubs are present on the site.

Grasslands of this area are referred to as mixed grass prairie. Mid-grass prairie species generally predominate on the deeper, more moist soils of flood plains, while short-grass prairie species predominate on the dry upland soils. Common mid-grass species found along Wetzel Creek include needle and thread grass (Stipa commata), western wheatgrass (Agropyron Smithii), sand dropseed (Sporobolus cryptandrus), and alkali sacaton (Sporobolus airoides).

Short-grass prairie species are found on some dry upland areas along the upper terraces of Wetzel Creek. Dominant grasses include blue grama (Bouteloua gracilis) and buffalo grass (Buchloe dactyloides), with Indian rice grass (Orysopsis hymenoides) also well represented. Numerous legumes, composites, and other forbs are found in association with the short-grass prairie community.

Wetland vegetation is found along an impoundment on Wetzel Creek on the southwest corner of the site. Water tolerant vegetation growing in this area includes bullrush (Scirpus spp.), spikerush (Eleocharis sp.), smartweeds (Polygonum spp.), cattails (Typha latifolia), and various other



LEGEND

HOUSING UNITS —X/XX— POPULATION

SCALE: MILES 1/2 0 1 2 4

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

HOUSING UNITS & POPULATION COUNT WITHIN A TEN MILE RADIUS OF SITE

SHEET NO.
FIG. 5.8.2
OF

wetland grasses and sedges. Slightly higher areas around this impoundment as well as moist areas along Wetzel Creek support grasses which require a moist soil including switchgrass (*Panicum virgatum*) and Canada ryegrass (*Elymus canadensis*).

The stream bed of Wetzel Creek is often dry and lacks vegetative cover in most places. However, some portions of the stream bed and banks have been colonized by an assemblage of plants characteristic of disturbed areas. Among those present are cocklebur (*Zanthium strumarium*), Russian thistle (*Kochia scoparia*), Amaranthus (*Amaranthus* sp.), and saltbush (*Atriplex* sp.)

5.8.2.2 Wildlife

The Colorado Division of Wildlife has developed and maintains a computer data bank on the distribution of wildlife species in the State of Colorado. As part of the wildlife inventory for this assessment, a computerized listing of vertebrates was generated and is included in this report as requested by the Division of Wildlife (Table 5.8.3). In addition, two biological reconnaissance visits were made to the site, and a site inspection with representatives of the Colorado Division of Wildlife was also made to supplement the wildlife inventory.

Mixed grass prairie and agriculture fields provide essentially all of the terrestrial wildlife habitat on the site. Some intermittent aquatic habitat is provided by Wetzel Creek and several impoundments on this stream system. The only permanent body of water on the site is an impoundment on Wetzel Creek in the southwest corner of the site.

TABLE 5.8.3

WILDLIFE SPECIES EXPECTED IN EASTERN ADAMS COUNTY (6)

Common Name	Scientific Name	Seasonal Status
American Avocet	Recurvirostra americana	Likely Breeder
American Golden Plover	Pluvialis dominica	Accidental
American Green-Winged Teal	Anas crecca	Accidental
American Kestral	Falco sparverius	Likely Breeder
American Redstart	Setophaga ruticilla	Accidental
American Robin	Turdus migratorius	Likely Breeder
Badger	Taxidea taxus	Breeding
Baird's Sandpiper	Calidris bairdii	Migrant
Bald Eagle	Haliaeetus leucocephalus	Winter Visitor
Barn Owl	Tyto alba	Breeding
Barn Swallow	Hirundo rustica	Breeding
Barred Tiger Salamander	Ambystoma tigrinum mavortium	Breeding
Belted Kingfisher	Megaceryle alcyon	Accidental
Black-and-White Warbler	Mniotilta varia	Accidental
Black-Bellied Plover	Pluvialis squatarola	Migrant
Black-Billed Magpie	Pica pica hudsonia	Likely Breeder
Black-Headed Grosbeak	Pheucticus melanocephalus	Likely Breeder
Black-Tailed Jackrabbit	Lepus californicus	Breeding
Black-Tailed Prairie Dog	Cynomys ludovicianus	Breeding
Black Tern	Chlidonias niger	Migrant
Blue-Winged Teal	Anas discors	Migrant
Blue Grosbeak	Guiraca caerulea	Likely Breeder
Blue Jay	Cyanocitta stelleri	Likely Breeder
Boreal Chorus Frog	Pseudacris triseriata maculata	Breeding
Brewer's Blackbird	Euphagus cyanocephalus	Likely Breeder
Brewer's Sparrow	Spizella breweri	Likely Breeder
Broad-Winged Hawk	Buteo platypterus	Accidental
Brown-Headed Cowbird	Molothrus ater	Likely Breeder
Brown Thrasher	Toxostoma rufum	Breeding
Bullfrog	Rana catesbiana	Breeding
Bullsnake	Pituophis melanoleucus sayi	Breeding
Burrowing Owl	Athene cunicularia	Breeding
Canada Goose	Branta canadensis	Winter Visitor
Cassin's Kingbird	Tyrannus vociferans	Likely Breeder
Cassin's Sparrow	Aimophila cassinii	Likely Breeder
Chipping Sparrow	Spizella passerina	Likely Breeder
Clay-Colored Sparrow	Spizella pallida	Migrant
Cliff Swallow	Petrochelidon pyrrhonota	Breeding
Common Crow	Corvus brachrhynchos	Likely Breeder
Common Flicker	Colaptes auratus	Breeding
Common Grackle	Quiscalus quiscula	Breeding
Common Nighthawk	Chordeiles minor	Likely Breeder
Common Raven	Corvus corax sinuatus	Winter Visitor
Common Snipe	Capella gallinago	Resident
Common Tern	Sterna hirundo	Accidental
Common Yellowthroat	Geothlypis trichas	Likely Breeder
Coyote	Canis latrans	Breeding
Dark-Eyed Junco	Junco hyemalis	Winter Visitor
Deer Mouse	Peromyscus maniculatus	Breeding
Desert Cottontail	Sylvilagus audobonii	Breeding
Dickcissel	Spiza americana	Breeding
Double-Crested Cormorant	Phalacrocorax auritus	Accidental
Downy Woodpecker	Picoides pubescens	Likely Breeder
Eastern Bluebird	Sialia sialis	Accidental
Eastern Cottontail	Sylvilagus floridanus	Breeding
Eastern Kingbird	Tyrannus tyrannus	Likely Breeder
Eastern Short-Horned Lizard	Phrynosoma douglassi brevirostre	Breeding
Eastern Wood Rat	Neotoma floridana	Breeding
Eastern Yellow-Bellied Racer	Coluber constrictor flaviventris	Breeding
Ferruginous Hawk	Buteo regalis	Likely Breeder
Fox Sparrow	Passerella iliaca	Accidental
Fox Squirrel	Sciurus niger	Breeding
Gadwall	Anas strepera	Likely Breeder
Golden-Crowned Kinglet	Regulus satrapa	Winter Visitor
Golden Eagle	Aquila chrysaetos	Likely Breeder
Grasshopper Sparrow	Ammodramus savannarum	Likely Breeder
Greater Yellowlegs	Tringa melanoleucus	Migrant
Great Blue Heron	Ardea herodias	Likely Breeder
Great Horned Owl	Bubo virginianus	Breeding
Great Plains Toad	Bufo cognatus	Breeding
Green-Tailed Towhee	Pipilo chlorurus	Accidental
Hispid Pocket Mouse	Perognathus hispidus	Breeding
Horned Lark	Eremophila alpestris	Likely Breeder
House Finch	Carpodacus mexicanus	Likely Breeder
House Sparrow	Passerdo domesticus	Likely Breeder
House Wren	Troglodytes aedon	Breeding
Killdeer	Charadrius vociferus	Breeding
Lark Bunting	Calamospiza melanocorys	Likely Breeder
Lark Sparrow	Chondestes grammacus	Breeding
Lazuli Bunting	Passerina amoena	Likely Breeder
Least Sandpiper	Calidris minutilla	Migrant
Leopard Frog	Rana pipiens	Breeding
Lesser Earless Lizard	Holbrookia maculata maculata	Breeding
Lesser Yellowlegs	Tringa flavipes	Migrant
Loggerhead Shrike	Lanius ludovicianus	Likely Breeder
Long-Billed Curlew	Numenius americanus	Likely Breeder
Long-Billed Dowitcher	Limnodromus scolophaceus	Migrant
Long-Tailed Weasel	Mustela frenata	Breeding

TABLE 5.8.3
(Continued)

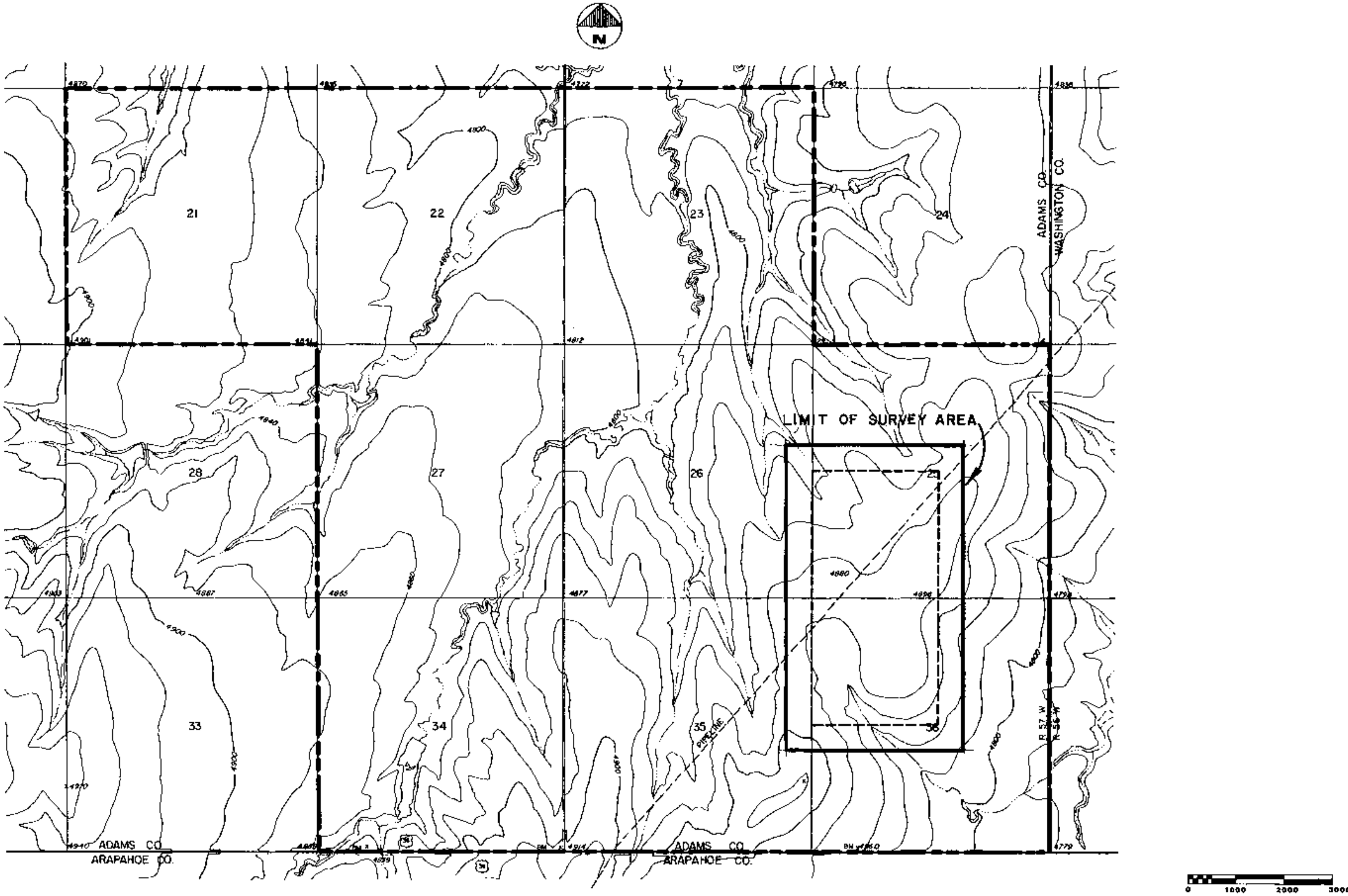
Common Name	Scientific Name	Seasonal Status
MacGillivray's Warbler	Oporornis tolmiei	Migrant
Mallard	Anas platyrhynchos	Breeding
Marsh Hawk	Circus cyaneus	Likely Breeder
McCown's Longspur	Calcarius mccownii	Breeding
Mississippi Kite	Ictinia mississippiensis	Nonbreeder-Nesting Season Resident
Mockingbird	Mimus polyglottos	Likely Breeder
Mountain Bluebird	Sialia currucoides	Migrant
Mountain Plover	Charadrius montanus	Breeding
Mourning Dove	Zenaida macroura	Breeding
Mule Deer	Odocoileus hemionus	Breeding
Northern Grasshopper Mouse	Onochomys leucogaster	Breeding
Northern Green Heron	Butorides striatus	Likely Breeder
Northern Lined Snake	Tropidoclonion lineatum lineatum	Breeding
Northern Many-Lined Skink	Eumeces multivirgatus multivirgatus	Breeding
Northern Oriole	Icterus galbula	Breeding
Northern Pocket Gopher	Thomomys talpoides	Breeding
Northern Prairie Lizard	Scelophorus undulatus garmani	Breeding
Opposum	Didelphis marsupialis	Breeding
Orchard Oriole	Ictereus spurius	Likely Breeder
Ord's Kangaroo Rat	Dipodomys ordii	Breeding
Ornate Box Turtle	Terrapene ornata ornata	Breeding
Pectoral Sandpiper	Calidris melanotos	Migrant
Pine Siskin	Carduelis pinus	Winter Visitor
Pintail	Anas acuta	Likely Breeder
Plains Harvest Mouse	Reithrodontomys montanus	Breeding
Plains Hognosed Snake	Heterodon nasicus nasicus	Breeding
Plains Pocket Gopher	Geomys bursarius	Breeding
Plains Spadefoot	Scaphiopus bombifrons	Breeding
Porcupine	Erethizon dorsatum	Breeding
Prairie Falcon	Falco mexicanus	Resident
Prairie Rattlesnake	Crotalus viridis viridis	Breeding
Prairie Six-Lined Racerunner	Cnemidophorus sexlineatus	Breeding
Prairie Vole	Microtus ochrogaster	Breeding
Pronghorn	Antilocapra americana	Breeding
Raccoon	Procyon lotor	Breeding
Redhead	Aythya americana	Accidental
Red-Eyed Vireo	Vireo olivaceus	Migrant
Red-Headed Woodpecker	Melanerpes erythrocephalus	Breeding
Red-Tailed Hawk	Buteo jamaicensis	Likely Breeder
Red-Winged Blackbird	Agelaius phoeniceus	Breeding
Ring-Billed Gull	Larus delwarensis	Migrant
Ring-Necked Pheasant	Phasianus colchicus	Resident
Rock Dove	Columba livia	Likely Breeder
Rock Wren	Salpinctes obsoletus	Breeding
Rough-Legged Hawk	Buteo lagopus	Winter Visitor
Rough-Winged Swallow	Stelgidopteryx ruficollis	Likely Breeder
Ruddy Duck	Oxyura jamaicensis	Accidental
Ruddy Turnstone	Arenaria interpres	Accidental
Rufous-Sided Towhee	Pipilo erythrophthalmus	Migrant
Sandhill Crane	Grus canadensis	Migrant
Say's Phoebe	Sayornis saya	Breeding
Scissor-Tailed Flycatcher	Muscivora forticata	Accidental
Short-Eared Owl	Asio flammeus	Winter Visitor
Silky Pocket Mouse	Perognathus flavus	Breeding
Solitary Sandpiper	Tringa solitaria	Migrant
Song Sparrow	Melospiza melodia	Likely Breeder
Spotted Sandpiper	Actitus macularia	Likely Breeder
Starling	Sturnus vulgaris	Breeding
Stilt Sandpiper	Micropalama himantopus	Migrant
Summer Tanager	Piranga rubra	Accidental
Swainson's Hawk	Buteo swainsoni	Breeding
Swainson's Thrush	Catharus ustulata	Accidental
Swift Fox	Vulpes velox	Breeding
Thirteen-Lined Ground Squirrel	Spermophilus tridecemlineatus	Breeding
Townsend's Solitaire	Myadestes townsendi	Winter Visitor
Tree Sparrow	Spizella arborea	Winter Visitor
Tree Swallow	Iridoprocne bicolor	Migrant
Turkey Vulture	Cathartes aura	Migrant
Veery	Catharus fuscescens	Migrant
Vesper Sparrow	Pooecetes gramineus	Breeding
Warbling Vireo	Vireo gilvus	Likely Breeder
Water Pipit	Anthus spinoletta	Migrant
Western Grebe	Aechmophorus occidentalis	Nonbreeder-Nesting Season Resident
Western Harvest Mouse	Reithrodontomys megalotis	Breeding
Western Kingbird	Tyrannus verticalis	Breeding
Western Massasauga	Sistrurus catenatus tergiminus	Likely Breeder
Western Meadowlark	Sturnella neglecta	Likely Breeder
Western Milk Snake	Lampropeltis triangulum gentilis	Breeding
Western Painted Turtle	Chrysemys picta belli	Breeding
Western Plains Garter Snake	Thamnophis radix haydeni	Breeding
Western Sandpiper	Calidris mauri	Migrant
Western Tanager	Piranga ludoviciana	Accidental
Western Wood Pewee	Contopus sordidulus	Likely Breeder
White-Crowned Sparrow	Zonotrichia leucophrys	Winter Visitor
White-Faced Ibis	Plegadis chihi	Accidental
White-Necked Raven	Corvus cryptoleucus	Likely Breeder
White-Rumped Sandpiper	Calidris fuscicollis	Accidental
White-Tailed Jackrabbit	Lepus townsendii	Breeding
Willet	Catoptrophorus semipalmatus	Migrant
Wilson's Phalarope	Steganopus tricolor	Migrant
Wilson's Warbler	Wilsonia pusilla	Migrant
Woodhouse's Toad	Bufo woodhousei woodhousei	Breeding
Yellow-Headed Blackbird	Xanthocephalus xanthocephalus	Likely Breeder
Yellow-Rumped Warbler	Dendroica coronata	Migrant
Yellow Warbler	Dendroica petechia	Breeding

Principal wildlife associated with the grassland on the site include various field songbirds, numerous small rodents, various hawks and owls, and game animals such as jack rabbits and cottontail rabbits. A pronghorn antelope population of 200-300 occurs within a five mile radius of the site, and 100-150 mule deer are present in this same area(5). Groups of these animals undoubtedly range to the site on occasion. Other mammals expected in the area probably include coyote, badger, fox, and raccoon. Game birds occurring on or in the vicinity of the site include mourning dove and pheasant.

The impoundment on the southwest corner of the site provides seasonal use by shorebirds and migratory waterfowl. Since streams in the area are intermittent, no fishery resource is expected in the area. The above mentioned impoundment is too small and shallow to sustain a fisheries resource. This impoundment is probably subject to freeze out during the coldest part of the winter.

5.8.2.3 Threatened and Endangered Species

A number of State and/or Federally threatened or endangered wildlife species occur in the prairie province of eastern Colorado or have occurred there within historical times (Table 5.8.4). However, there is no evidence that any of these species presently occur on or in close proximity to the site. Also, no "essential habitat," as defined by the Colorado Division of Wildlife and delineated on state maps for each State or Federally threatened or endanged species, occurs within the study area (6). The Colorado Division of Wildlife defines "essential habitat" as any geographic area that is absolutely necessary for the maintenance and recovery of a threatened or endangered species and bases the determination on an evaluation of several habitat factors.



REFERENCE: U.S.G.S. QUAD. MAP

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

HERITAGE & CULTURAL RESOURCES SURVEY LIMITS

SHEET NO.
FIG. 5.8.3

TABLE 5.8.4

THREATENED OR ENDANGERED WILDLIFE

COMMON NAMES	SCIENTIFIC NAME	
Johnny Darter	Estheostoma nigrum	State Threatened
Plains Orangethroat Darter	Estheostoma spectabile pulchellum	State Threatened
White Pelican	Pelecanus erythrorhynchos	State Threatened
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus	Federally Endangered
Greater Praire Chicken	Tympanuchus cupido pinnatus	State Endangered
Lesser Prairie Chicken	Tympanuchus pallidicinctus	State Threatened
Prairie Sharp-Tailed Grouse	Pediocetes phasianellus jamesi	State Endangered
Gray Wolf	Canis lupus	Federally Endangered
Grizzly Bear	Ursus arctos	Federally Endangered
Black-Footed Ferret	Mustela nigripes	Federally Endangered
River Otter	Lutra canadensis	State Endangered

Since mixed prairie habitat is essentially the only wildlife habitat that is present on the site other than cropland, only those State and Federally threatened or endangered species dependent on such habitat will be considered for the purposes of this discussion. Species which meet these criteria for Colorado include the greater prairie chicken, the lesser prairie chicken, the prairie sharp-tailed grouse, and the black-footed ferret. Below is a discussion of each of these species and its State and Federal status.

<u>Greater Prairie Chicken</u> (*Tympanuchus cupido pinnatus*)

Status: Endangered State of Colorado

Historically, the greater prairie chicken is thought to have occurred throughout much of northeastern Colorado. Presently, its' known range in Colorado is limited to southern Phillips and northern Yuma Counties where about 600 birds are thought to occur. This area is about 75 miles ENE of the study area.

The greater prairie chicken requires relatively undisturbed tall grass or mixed grass prairie vegetation for survival(6). To sustain a viable population, it is thought that at least eight square miles of land use are required, with at least 50% in grassland. Ideally, the grassland should be interspersed with cropland and have available surface water.

<u>Lesser Prairie Chicken</u> (*Tympanuchus pallidicinctus*)

Status: Threatened State of Colorado

The lesser prairie chicken was found historically in southeastern and east central Colorado on both sides of the Arkansas River, but primarily south of the river(6). It is thought to have occurred in both the mixed prairie and sand sagebrush grassland. Presently, the species is known from separate populations in Prowers and Baca Counties about 130 miles southeast of the study area where it is restricted to sagebrush grassland interspersed with agricultural areas. The above populations consist of a total of 350-450 birds.

The limiting factor for the lesser prairie chicken is lack of adequate nesting and broodrearing habitat. A minimum of eight sections of land that are at least 50% sand sagebrush grassland should be maintained to ensure the existence of viable populations. At least 25% of this should constitute acceptable nesting habitat: tall grass sufficient to conceal nesting birds.

Prairie Sharp-tailed Grouse (*Pedioecetes phasianellus jamesii*)

Status: Endangered Subspecies State of Colorado

The prairie sharp-tailed grouse is an inhabitant of the ecotone between prairie and large shrub communities. Historically, it ranged widely south of the South Platte River in northeastern and east central Colorado. Presently, a population of 150-300 birds occurs in Elbert and Douglas Counties, about 60 miles west southwest of the study area.

The best composite habitat for the sharp-tailed grouse consists of the mixed or tall grass shrub ecotone with light grazing, but some stands of shrub present without grazing(6). It is thought that to maintain a viable population, a tract of at least eight square miles is desirable with at least 50% grassland. At least 25% of the remainder should have grass shrubland cover.

Black-footed Ferret (*Mustela nigripes*)

Status: Endangered State of Colorado and Federally

The black-footed ferret is apparently limited by the distribution and abundance of prairie dogs (*Cynomys* spp.) upon which it preys almost exclusively. Although probably never common, the species occurred historically throughout Colorado except in the high mountains. There are no confirmed sightings of the species in Colorado in recent times, but there are unverified sightings from Prowers County in the past 13 years(7). The principal known populations of ferrets occur in South Dakota.

5.8.3 Land Use and Population

5.8.3.1 Population Characteristics

Population trends for Adams County are characterized by densely populated urban areas on the west end of the county, contiguous to the City of Denver, decreasing gradually to the sparsely populated agricultural region to the east. Population figures for Adams County for the period 1950-1980 are shown below. They reflect a steady increase in population, primarily in the urban areas adjacent to Denver.

Adams County Population, 1950-1980		% Change
1950	40,234	-
1960	120,296	198.9
1970	185,789	54.4
1980	244,786*	31.8

*Preliminary Census Count

The population in the urban areas of Adams County accounts for a substantial majority of total county population. As indicated in Table 5.8.5, these areas have been broken down by incorporated and unincorporated places. Most show significant increases over 1970 counts due to the movement of the Denver population to outlying suburban communities, some of which are in Adams County, and the general propensity of the population to migrate to urban areas for increased job opportunities and other services.

In 1970, the total county population was 185,789. Of this amount, 160,801 people, or 80.6% of the total county population, were living in urban areas. About 25,000 people (13.4%) lived in the rural areas of the county(8). From 1970 to 1980, the trend of moving into the urban areas in the county increased. This is probably the result of increased job opportunties in the urban areas. The total population for Adams County in 1980 increased to 244,786. A total of 217,935 people, or 89% of total county population, now reside in the urban areas of Adams County, most of which are adjacent to the City of Denver. During the same period, rural population increased in number to 26,851, but decreased as a percentage of total county population to 11%(9).

Residential housing figures for the county follow the same upward trend as the population data, as indicated by Table 5.8.5. In 1970, there was a total of 51,457 housing units in the county. This figure jumped by 37,708, or 73.3%, to 89,165 in 1980. The population for Adams County increased 31.8% during the same period. Average household size for the county is 3.1 persons per household(9).

TABLE 5.8.5

POPULATION AND HOUSING UNITS IN ADAMS COUNTY

AREA	POPULATION				HOUSING UNITS			
	Preliminary Census 1980	Final Census 1970	Change, 1970 to 1980		Preliminary Census 1980	Final Census 1970	Change, 1970 to 1980	
			Number	Percent			Number	Percent
Adams County	244,786	185,789	58,997	31.8	89,165	51,457	37,708	73.3
Incorporated Places	175,547	117,276	58,271	49.7	64,713	32,729	31,984	97.7
Arvada [Part]	1,393	1,663	-2.10	-16.2	415	396	19	4.8
Aurora [Part]	29,192	27,159	2,033	7.5	11,926	8,715	3,211	36.8
Bennett	939	613	326	53.2	337	184	153	83.2
Brighten [Part]	12,870	8,309	4,561	54.9	4,405	2,481	1,924	77.5
Broomfield [Part]	5,418	—	5,418	—	1,864	—	1,864	—
Commerce City	16,220	17,407	-1,187	-6.8	5,684	4,939	7,745	15.1
Federal Heights	7,815	1,502	6,313	420.3	3,577	744	2,833	380.8
Northglenn	29,748	27,785	1,963	7.1	9,833	6,685	3,148	47.1
Thorton	39,948	13,326	26,622	199.8	14,470	3,341	11,129	333.1
Westminister [Part]	32,004	19,512	12,492	64.0	12,202	5,244	6,958	132.7
Unincorporated Places	42,388	43,525	-1,137	-2.6	14,526	11,179	3,347	29.9
Derby	8,444	10,206	-1,762	-17.3	2,854	2,716	138	5.1
Sherrelwood	17,676	18,868	-1,192	-6.3	5,951	4,729	1,222	25.8
Strasburg [Part]	671	—	671	—	251	—	251	—
Welby	9,606	6,875	2,731	39.7	3,292	1,613	1,679	104.1
Westminister East	5,991	7,576	-1,585	-20.9	2,178	2,121	57	2.7
BALANCE OF COUNTY	26,851	24,988	1,863	7.5	9,926	7,549	2,377	31.5

The average median age in Adams County is 23.7 years. Racial composition is 97.6% white, 0.8% Negro, and 1.6 percent other races. 50.1% of the county population is male and 49.9% female. Of the total population, 40.9% are under the age of 18 and 4.7% over the age of 65. The age group 18-65 accounts for 54.4% of the total county population(8).

The population in the vicinity of the site is extremely sparce. Based on the detailed field study results presented in Table 5.8.6 and Figure 5.8.2, there is an estimated total of 247 people living within ten miles of the nine section property boundaries. This area includes portions of Adams, Arapahoe, and Washington Counties. There is a total of 95 residential structures in the area.

TABLE 5.8.6

HOUSING & POPULATION WITHIN 10 MILES OF
NINE SECTION PROPERTY BOUNDARY

Miles from Property	No. of Houses	No. of Occupied Houses	Population
0-1	3	1	3
1-2	5	3	12
2-3	8	5	13
3-4	4	1	4
4-5	4	3	12
5-6	14	14	50
6-7	25	21	72
7-8	10	9	20
8-9	12	12	35
9-10	10	10	26
Total	95	79	247

5.8.3.2 Regional and Local Land Use

Land use in Adams County is primarily agricultural, with some residential and commercial areas in the urban sections of the county on the southwestern end. A substantial majority of the developed land in Adams

County is located in this area. Agricultural land, by far the predominant land use in the county, is prevalent in the eastern two-thirds of the county.

The urban areas of Adams County are located in the western third of the county. These urban areas are characterized by low to medium density development in the residential, commercial, and industrial categories. Commercial and residential uses are most prevalent in the incorporated areas, with the main industrial uses occurring along the primary highway routes, i.e., Interstate 25, Interstate 76, and Colorado State Highway 2. Land use within the incorporated areas is made up of office buildings, financial institutions, shopping centers, neighborhood service establishments, and various commercial activities, in addition to the residential areas. There are also several large residential areas in the unincorporated urban section of the county.

Land use in the eastern two-thirds of the county is virtually all agricultural. Bennett and Strasburg are the largest towns in this part of the county with populations of 939 and 998, respectively. This section of the county consists primarily of farms and ranches. Adams County occupies a total area of approximately 1,250 square miles, or 800,000 acres. Agricultural land use accounts for 755,000 acres of the total (94%), the majority of this is being utilized for dry land farming, primarily in the north central part of the county. A breakdown of overall county land use is provided in Table 5.8.7.

TABLE 5.8.7

ADAMS COUNTY LAND USE (ACRES)

Winter Wheat and Barley (Dry Land Farming)	360,000
Irrigated Crop Land	155,000
Grazing and Native Grass	240,000
Urban Land	45,000
Total	800,000

The primary non-irrigated crops are forage sorghum, barley, and winter wheat. The primary irrigated crops are barley, corn, alfalfa, sugar beets, wheat, oats, and rye(10).

Agricultural land use in the eastern portion of the county is characterized by large farms and ranches engaged primarily in the production of cash crops and livestock. The average farm size for Adams County in 1978 was 870 acres, down from 1,056 acres in 1974(11). Additional information regarding farming operations are summarized in Tables 5.8.8 and 5.8.9.

TABLE 5.8.8

FARMS BY TYPE OF ORGANIZATION, 1978

Individual or Family	639
Partnership	108
Corporation	56
Other	0

TABLE 5.8.9

FARM OPERATOR CHARACTERISTICS, 1974 & 1978

	1974	1978
Tenure of Operator		
Full Owner	356	380
Part Owner	271	262
Tenant	133	161
Average Age of Operator	52.1	50.2
Sex of Operator		
Male	NA	764
Female	NA	39

Land use in the vicinity of the site is entirely agricultural. The closest incorporated town to the site is Byers (in Arapahoe County) which is approximately 30 miles to the southwest where State Highway 36 interchanges with Interstate 70. Byers has a population of 875. The agricultural land in this area is used primarily for grazing and dry land farming.

5.8.3.3 Zoning

The Adams County Zoning Regulations list three types of agricultural districts, A-1, A-2, and A-3. Each type allows different phases of agricultural land use, as described below.

A-1:

Exclusively a rural, single famly dwelling district where the minimum lot area for a home site is dependent on the availability of public water and sewer facilities and other necessary utilities and services. Limited farming uses are permitted including the cultivation of land and the keeping of a limited amount of animals for individual homeowners use.

A-2:

Land use in this district is for rural subdivisions of at least 10 acres in size where adequate provisions are made for internal and external roads and access, water and sewer facilities, for fire protection and other emergency services, and for other public services and utilities. Farming uses are permitted, including the cultivation of land and the keeping of a limited amount of animals.

A-3:

Land in this district is primarily in holdings of at least 35 acres of dry land or irrigated farming, pasturage, or other related food production use.

The entire eastern two-thirds of Adams County is zoned agricultural, although the type of agriculture is not defined. It is assumed that A-3 zoning applies to the site due to its size.

5.8.4 Economic Activities

5.8.4.1 Employment

The economic structure of Adams County is predicated on a variety of industries and occupations. Employment patterns indicate a diverse economy with predominant trends in several categories. Table 5.8.10 shows the industry of employed persons for Adams County and the State of Colorado for the years 1970 and 1978. Total county employment in 1970 was 69,284. This figure dropped 14.8% to 60,343 in 1978. The predominant industries in Adams County are manufacturing, which in 1978 represented 22.7% of the total, construction activity at 10.4%, wholesale trade at 9.8%, and eating and drinking places at 7.2%. The State generally indicates the same downward trends, with a slightly lower volume of manufacturing and construction activity. Wholesale employment for the State is 7.1% of the total, compared with 9.8% for the county. The State also shows a slightly higher percentage of employment in the eating and drinking establishments category.

The occupation of employed persons for Adams County and the State of Colorado is shown in Table 5.8.11. These figures reflect the same types of trends as the employment data in Table 5.8.10. Clerical and kindred workers are the largest occupational employment category for the county, accounting for 20.5% of total county employment. They are followed by craftsmen, foremen, and kindred workers at 16.1%, and professional, technical and kindred workers at 12.9%. State occupational employment data varies somewhat from these figures but still reflects the predominant categories.

TABLE 5.8.10

INDUSTRY OF EMPLOYED PERSONS, ADAMS COUNTY AND STATE OF COLORADO, 1970 and 1978.

	COUNTY				STATE			
	1970		1978		1970		1978	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
TOTAL [1]	69,284	100.0	60,343	100.0	825,776	100.0	920,811	100.0
Agricultural, forestry, and fisheries	1,723	2.5	471	.B	38,093	4.6	3,306	.4
Mining	442	.6	226	.4	14,232	1.7	27,417	3.0
Construction	5,249	7.6	6,286	10.4	54,668	6.6	78,992	8.6
Manufacturing	13,138	19.0	13,728	22.7	120,581	14.6	167,079	18.1
Railroads and railway express service	660	.9	NA		7,108	.8	NA	
Trucking service and warehousing	2,639	3.8	3,658	6.0	12.890	1.6	16,395	1.8
Other transportation	2,184	3.2	1,231	2.0	12,520	1.5	14,432	1.6
Communications	1,036	1.5	(F)[5]		13,330	1.6	21,958	2.4
Utilities	1,105	1.6	329[2]	.5	14,840	1.8	9,292[2]	1.0
Wholesale trade	5,373	7.8	5,914	9.8	37,798	4.6	65,606	7.1
Food, bakery, and dairy stores	2,145	3.1	2,560[3]	4.2	18,761	2.3	26,109[3]	2.8
Eating and drinking places	2,667	3.8	4,354	7.2	31,886	3.9	79,994	8.7
General merchandise retailing	2,257	3.3	2,863	4.7	23,743	2.9	24,762	2.7
Motor vehicle retailing and service stations	1,844	2.7	2,390	4.0	22,599	2.8	29,238	3.2
Other retail trade	3,242	4.7	3,780	6.3	48,824	5.9	60,869	6.6
Banking and credit agencies	1,398	2.0	1,285	2.1	14,953	1.8	25,455	2.8
Insurance, real estate, and other finance	2,418	3.5	2,207	3.7	31,456	3.8	43,641	4.7
Business and repair services	2,590	3.6	2,168	3.6	28,559	3.5	43,055	4.7
Private households	349	.5	NA		8,617	1.1	NA	
Other personal services	2,055	3.0	2,446	4.1	31,217	3.8	46,453	5.0
Entertainment and recreation services	595	.8	416	.7	8,569	1.0	12,642	1.4
Hospitals	2,360	3.4	(F)[5]		34,677	4.2	28,250	3.1
Health services, except hospitals	1,165	1.7	2,533	4.2	20,234	2.5	31,505	3.4
Elementary, secondary schools, and colleges--government	3,292	4.8	502[4]	.8	63,430	7.7	9,971[4]	1.1
Elementary, secondary schools, and colleges--private	848	1.2			15,832	1.9		
Other education and kindred services	271	.4	NA		4,551	.5	NA	
Welfare, religious, and nonprofit membership organizations	810	1.2	613	1.0	13,587	1.6	14,992	1.6
Legal, engineering, and miscellaneous professional services	1,231	1.8	NA		23,321	2.8	NA	
Public administration	4,198	6.0	NA		54,900	6.6	NA	

1. 16 years old and over.
2. Electric, gas and sanitary services.
3. Food stores.
4. Educational services, all schools.
5. (F): 500-999

Source: 1970 Census of the Population, Colorado, Vol. 1.
1978 County Business Patterns, Colorado, Bureau of the Census

TABLE 5.8.11

OCCUPATION OF EMPLOYED PERSONS, ADAMS COUNTY AND STATE OF COLORADO, 1970

OCCUPATION	COUNTY Number	COUNTY %	STATE Number	STATE %
Total*	69,284	100.0	825,776	100.0
Professional, Technical, and kindred workers	8,972	12.9	148,351	18.0
Managers and administrators, except farm	5,335	7.8	78,725	9.5
Sales workers	4,818	7.0	63,513	7.7
Clerical and kindred workers	14,225	20.5	154,465	18.7
Craftsmen, foremen, and kindred workers	11,141	16.1	102,957	12.5
Operatives, except transport	7,586	10.9	67,670	8.2
Transport equipment operatives	3,993	5.8	30,052	3.6
Laborers, except farm	3,216	4.6	33,385	4.0
Farmers and farm managers	781	1.1	19,580	2.4
Farm laborers and farm foremen	602	.9	12,551	1.5
Service workers, except private household	8,263	11.9	105,809	12.8
Private household workers	352	.5	8,718	1.1

* 16 years old and over

Source: 1970 Census of the Population, Colorado, Vol. 1.

The preceding data is actually more descriptive of the west end of the county, which is more urbanized than the eastern two-thirds. The employment centers in Adams County are concentrated primarily around the urban areas adjacent to Denver, and along the main highway routes in that portion of the county. Employment patterns in the vicinity of the project site are primarily agricultural with some scattered oil and gas activity. Employment within the agricultural category may be further subdivided into employment associated with cattle grazing and breeding, other livestock and poultry production, production of crops, and agricultural services. Employment in these areas are the most prevalent occupational patterns in the east end of the county.

5.8.4.2 Income

The income characteristics of Adams County reflect a fairly equitable distribution of personal income among the various sectors of the economy. Personal income in the county has grown steadily in the past decade, particularly in the urban areas on the west end. This growth may be attributed to the economic diversification of the county and the subsequent employment increases in each area. The county has traditionally been dependent on its agricultural resources for income generation, but as it becomes more urbanized different income patterns and sources begin to emerge. Income generation from non-farm uses such as manufacturing, retail trade, government sources, and services are becoming more prevalent, while farm income as a percentage of the total remains small.

Personal income distribution by industry for Adams County and the State for the years 1971-1976 is shown in Tables 5.8.12 and 5.8.13. These figures reflect a steady increase in total personal income for the State and county over the six year period.

TABLE 5.8.12

ADAMS COUNTY - PERSONAL INCOME BY MAJOR SOURCES 1971-1976 (THOUSDANDS OF DOLLARS)

Source:	1971		1972		1973		1974		1975		1976	
	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total
By Industry -												
Farm	8,231	2.2	8,314	1.8	12,359	2.2	17,230	2.9	19,530	2.9	13,764	1.9
Non-Farm	370,298	97.8	461,718	98.2	542,394	97.8	572,460	97.1	657,387	97.1	721,153	98.1
Private	265,703	70.2	349,352	74.3	418,152	75.4	431,893	73.3	491,809	72.7	545,963	74.3
Ag. Serv., For., Fish & other	(D)		(D)		(D)		2,062	.3	(D)		(D)	
Mining	(D)		(D)		(D)		4,459	.7	(D)		(D)	
Construction	49,726	13.1	66,221	14.1	83,917	15.1	73,735	12.5	66,033	9.8	68,180	9.3
Manufacturing	81,135	21.4	125,173	26.6	143,228	25.8	141,555	24.0	144,424	21.3	159,380	21.6
Non-Durable Goods	27,836	7.4	32,290	6.8	36,459	6.6	40,184	6.8	47,498	7.0	55,346	7.5
Durable Goods	53,299	14.0	92,883	19.8	106,769	19.2	101,371	17.2	96,926	14.3	104,034	14.2
Transportation & Public Utilities	14,414	3.8	16,324	3.5	19,996	3.6	21,506	3.6	41,806	6.2	49,295	6.7
Wholesale Trade	18,060	4.8	22,925	4.9	27,552	5.0	36,070	6.1	67,114	9.9	71,900	9.8
Retail Trade	40,949	10.8	47,166	10.1	60,468	10.9	69,431	11.7	78,418	11.6	89,615	12.2
Finance, Insurance & Real Estate	22,370	5.9	23,057	4.9	25,868	4.7	26,395	4.5	22,248	3.3	25,108	3.4
Services	35,516	9.4	44,384	9.4	51,933	9.4	56,680	9.6	63,262	9.3	72,390	9.8
Government & Government Enterprises	104,595	27.6	112,366	23.9	124,242	22.4	140,567	23.8	165,578	24.4	175,190	23.8
Federal, Civilian	32,092	8.5	36,450	7.8	39,504	7.1	45,524	7.7	55,190	8.2	54,231	7.4
Federal, Military	24,013	6.3	21,322	4.5	20,295	3.7	23,487	3.9	23,294	3.4	21,782	2.9
State and Local	48,490	12.8	54,594	11.6	64,443	11.6	71,556	12.1	87,094	12.8	99,177	13.5

Source: Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Department of Commerce, Department of Economic Analysis.

TABLE 5.8.13

COLORADO - PERSONAL INCOME BY MAJOR SOURCES 1971-1976 (THOUSANDS OF DOLLARS)

Source:	1971		1972		1973		1974		1975		1976	
	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total
By Industry -												
Farm	279,334	3.7	309,123	3.5	547,435	5.3	532,674	4.8	487,286	4.1	327,199	2.5
Non-Farm	7,310,437	96.3	8,410,171	96.5	9,634,279	94.7	10,526,961	95.2	11,370,590	95.9	12,705,146	97.5
Private	5,566,510	73.4	6,465,292	74.2	7,459,660	73.3	8,144,248	73.6	8,705,849	73.4	9,795,073	75.2
Ag. Serv., For., Fish & other	25,241	.3	28,870	.3	33,307	.3	37,812	.3	36,510	.3	38,745	.3
Mining	149,054	2.0	169,622	1.9	193,405	1.9	271,749	2.5	362,652	3.1	419,967	3.2
Construction	634,990	8.4	795,757	9.3	957,896	9.4	956,927	8.6	838,486	7.1	924,158	7.1
Manufacturing	1,159,171	15.3	1,374,094	15.7	1,555,240	15.3	1,736,040	15.7	1,827,075	15.4	2,066,891	15.8
Non-Durable Goods	448,884	5.9	500,837	5.7	553,760	5.4	619,931	5.6	690,753	5.8	776,582	6.0
Durable Goods	710,287	9.4	873,257	10.0	1,001,480	9.8	1,116,109	10.1	1,136,322	9.5	1,290,309	9.9
Transportation & Public Utilities	589,801	7.8	683,012	7.8	782,208	7.7	862,064	7.8	922,148	7.7	1,036,498	8.0
Wholesale Trade	499,379	6.6	527,097	6.0	609,605	5.9	693,024	6.3	793,782	6.7	895,108	6.9
Retail Trade	905,858	11.9	1,035,135	11.8	1,191,469	11.7	1,285,678	11.6	1,346,785	11.3	1,539,841	11.8
Finance, Insurance, & Real Estate	434,448	5.7	514,399	5.9	582,473	5.7	583,591	5.3	611,371	5.2	695,071	5.3
Services	1,168,568	15.4	1,337,306	15.3	1,554,057	15.2	1,717,363	15.5	1,967,040	16.6	2,178,794	16.7
Government & Government Enterprises	1,743,927	22.9	1,944,879	22.3	2,174,619	21.4	2,382,713	21.5	2,664,741	22.5	2,910,073	22.3
Federal, Civilian	502,931	6.6	542,505	6.2	583,953	5.7	647,021	5.8	717,180	6.0	761,712	5.8
Federal, Military	346,881	4.6	411,253	4.7	463,995	4.5	477,565	4.3	471,688	4.0	488,333	3.7
State and Local	894,115	11.8	991,121	11.3	1,126,671	11.0	1,258,127	11.5	1,475,873	12.4	1,660,028	12.7

Source: Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Department of Commerce, Department of Economic Analysis.

Per capita income for Adams County has been rising steadily since 1971, as can be seen in Table 5.8.14. In 1971, per capita income for the county was $4,084 compared with $4,167 for the State. This upward trend continues to 1976 with the county surpassing State per capita income(12).

TABLE 5.8.14

ADAMS COUNTY PER CAPITA INCOME(12)

Year	County	% Change	State	% Change
1971	$ 4,084		$ 4,167	
1972	4,425	8.3	4,540	8.9
1973	4,884	10.4	5,046	11.1
1974	5,391	10.4	5,495	8.9
1975	5,894	9.3	5,938	8.1
1976	6,468	9.7	6,440	8.4

Household income distribution is another good indicator of the economic condition of an area. These figures for Adams County indicate a stable economy with a large middle class income range (see Table 5.8.15). Of the five counties listed, Adams has the second highest median household income at $19,114. Arapahoe County is first at $19,783.

Effective buying income (EBI), average household EBI, retail sales, and the buying power index (BPI) are some other good indicators of the economic stability of an area. These are indirect measurements which can generally indicate the direction and intensity of an area's economic structure. Table 5.8.16 outlines the effective buying power, retail sales, and buying power index for Adams County for the years 1978 and 1980. Data for the State, Arapahoe and Jefferson Counties has also been included for purposes of comparison. These figures show slight increases for Adams County in all areas.

TABLE 5.8.15

1977 HOUSEHOLD INCOME DISTRIBUTION BY JURISDICTION

Counties	$0-4,000	4-8,000	8-12,000	12-16,000	16-20,000	20-28,000	28-36,000	$36,000+	TOTAL	MEDIAN
Adams	1,888	6,219	10,521	11,383	8,913	18,981	5,087	10,908	73,900	$19,114
Arapahoe	3,371	7,060	8,352	12,036	11,030	16,936	7,818	15,897	82,500	19,783
Boulder	5,557	8,284	9,053	12,846	9,764	12,794	3,261	6,451	68,010	15,460
Denver	19,640	36,860	26,052	34,669	33,324	42,407	2,004	10,189	205,145	14,310
Jefferson	2,516	7,593	12,823	20,943	18,580	29,534	7,840	15,471	115,300	18,866
Municipalities *										
Arvada	275	1,252	3,412	5,001	4,021	6,933	992	1,795	23,681	$17,890
Aurora	2,913	5,243	4,865	5,056	3,689	7,417	5,039	9,719	43,941	20,221
Northglenn	44	398	1,287	1,712	981	1,980	989	2,216	9,607	21,541
Thornton	158	814	1,498	1,513	803	1,655	1,020	2,353	9,814	20,585
Westminster	140	593	1,289	1,651	1,720	4,236	307	817	10,753	19,961
5-County Total	32,972	66,016	66,801	91,877	81,611	120,652	26,010	58,916	544,855	$16,724

* All municipalities are in Adams County

Sources:
1. 1970 Census of the Population.
2. 1976 National Planning Data Corporation Income Update.
3. 1975 Bureau of the Census Estimate for the State of Colorado.

TABLE 5.8.16

EFFECTIVE BUYING INCOME, RETAIL SALES, AND BUYING POWER INDEX, STATE OF COLORADO
ADAMS, ARAPAHOE, AND JEFFERSON COUNTIES

		EBI ($000)	% of U.S.	% of Change from 1978*	Average Household EBI	Retail Sales ($000)	% of U.S.	% Change from 1978*	Per Household Retail Sales ($)	Buying Power Index (BPI)
STATE	1978	17,673,704	1,2278		18,196	10,969,562	1.3419		11,294	1.2632
	1980	21,843,767	1.2647	2.5	21,177	13,300,822	1.3577	.6	12,895	1.2923
ADAMS	1978	1,390,572	.0966		19.314	871,839	.1066		12,109	.1013
	1980	1,711,399	.0911	2.1	22,459	1,069,244	.1091	1.8	14,032	.1037
ARAPAHOE	1978	1,741,150	.1209		20,581	1,291,174	.1580		15,262	.1304
	1980	2,150,009	.1245	1.8	22,560	1,597,628	.1630	2.7	16,764	.1357
JEFFERSON	1978	2,553,321	.1774		21,786	1,392,053	.1702		11,878	.1711
	1980	3,200,216	.1853	3.8	24,885	1,706,703	.1742	1.7	13,271	.1784

* Adjusted For Inflation

Source: Sales and Marketing Management Magazine, 1980 Survey of Buying Power Forecaster's Handbook, 1980.

5.8.5 Heritage and Cultural Resources

A cultural resources survey and assessment of the site was performed by archeologists from Heartfield, Price and Greene, Inc.(13). The survey was conducted to conform to all relevant Federal cultural resource legislation including PL 91-190 (NEPA of 1969), PL 89-665 (NHPA of 1966), and the Advisory Council's Procedures for the Protection of Historic and Cultural Properties, defined by 36 CFR 800 and Executive Order #11593.

5.8.5.1 Methodology

As illustrated in Figure 5.8.3, the western limit of the area surveyed was 1,000 feet west of the western boundary of sections 25 and 36, T3S, R57W. The eastern boundary was 1,000 feet west of the eastern boundary of Sections 25 and 36, T3S, R57W. The northern boundary was 1,000 feet south of the northern boundary of Section 25, and the southern boundary was 1,000 feet north of the southern boundary of Section 36.

The archival/literature search and an on-the-ground survey were conducted, as summarized below.

5.8.5.1.1 Archival/Literature Search

The National Register of Historic Places and its supplements were checked for listed sites within the study area.

The Colorado Historical Society conducted a search of the Colorado Inventory of Cultural Resources for previously recorded sites within T3S, R57W, Sections 25 and 36 (Figure 5.8.4).

Personnel from Heartfield, Price and Greene, Inc. checked map files maintained by the Colorado Inventory of Cultural Resources for previously recorded sites on the Cottonwood Valley North, Last Chance Northwest, Shamrock Southeast, and Wetzel Creek USGS 7.5' quadrangle maps.

FIGURE 5.8.4

Project No. HWS

Record of Use Files

CO	T	R	S
AD	3S	57W	25&36

COLORADO HISTORICAL SOCIETY

The Colorado Heritage Center 1300 Broadway Denver, Colorado 80203

Date Received 1/15/81

Date Responded 1/15/81

At your request this office has conducted a search of the Colorado Inventory of of Cultural Resources.

The result of this file search is indicated below:

[XX] There. are no documented cultural properties in the area of impact of the proposed undertaking.

[ ] Information regarding previously documented resources in these areas is attached. These resources have not been evaluated for inclusion in the National Register. However, they must be considered to be Eligible for inclusion in the National Register until a formal determination has been completed.

[ ] Information regarding cultural resources pending nomination to or on the National Register of Historic Places in the proposed project area is attached.

Our files contain incomplete information for this area as the vast majority of Colorado has not been inventoried. There is the possibility that as yet unidentified Cultural Resources exist within the proposed impact area.

Therefore, the federal agency is required to conduct a professional survey to Identify any Eligible Cultural Resources in the proposed project area.

We anticipate consultation with this office regarding the Effect of the proposed project on any Eligible resource in accordance with the Advisory Council Procedures for the Preservation and Protection of Historic and Cultural Resources (36 CFR 800).

Please provide this office with the results of the survey for our review of professional adequacy and compliance.

Arthur C. Townsend
State Historic Preservation Officer

Howard J. Pomerantz
Acting State Archaeologist

*Information regarding significant archaeological resources is excluded from the Freedom of Information Act. Therefore, legal locations of these resources must not be included for public distribution.

Form No. 011 rev 10/80
File Search Request

The Stephen H. Hart Library of the Colorado Heritage Society, Denver, was checked for early maps and historical background information. The University of Colorado Library in Boulder was checked for pertinent historical and environmental data.

The Adams County Clerk of Court and Tax Assessor were consulted for information on early landowners and maps for the area. The Adams County Historical Society provided important historical information on the early history and land development of the area.

Finally, Quest Consulting provided information concerning conveyance records, early maps of Adams County, and provided a USDA Soil Survey for Adams County.

5.8.5.1.2 On-the-Ground Survey

Prior to conducting the on-the-ground survey, an archeological permit (#81-5, Figure 5.8.5) was obtained by the principal investigator from the Colorado Historical Society. The intensive, on-the-ground survey of 100% of the study area was conducted on January 18, 19, and 20, 1981 by a crew of two archeologists, the principal investigator, and his assistant.

The area was surveyed in a series of contiguous transects, approximately 100 meters wide and oriented east-west, until the total area had been surveyed. Transects were set up and maintained using a compass and 7.5' USGS topographic quads. Within each transect, the two surveyors, spaced approximately 40 meters apart, walked a zig-zag path from one end to the other.

Subsurface shovel testing was conducted approximately every 100 meters along the transects. Dimensions for the shovel tests were approximately

FIGURE 5.8.5

OFFICE OF THE STATE ARCHEOLOGIST

NO. 81.5

ARCHAEOLOGICAL PERMIT

Issued under the authority of the Colorado Historical, Prehistorical, and Archaeological Resources Act, CRS 1973 24-80-401 *et seq*, and under the procedures of the State Administrative Procedure Act, CRS 1973 24-4-101 *et seq*.

THIS IS TO CERTIFY that: Richard Hurt
(Name)

of: 301 Bres Suite C, Monroe, LA 71201
(Address)

representing: Heartfield, Price, and Greene, Inc.
(Institution)

has been found to be a qualified applicant for the conduct of Archaeological studies and is hereby authorized to conduct archaeological investigations as described below, subject to (a) the terms and conditions listed below and (b) in the Permit Description published by the Office of the State Archaeologist.

Nature of investigations and location: Reconnaissance and non-collecting, intensive surface survey of ca. 1000 contiguous acres within Sections 25, 26, 35, and 36 of Township 3 South, Range 57 West as illustrated on the appended U.S.G.S. 7.5 minute Quadrangles of Last Chance N.W. and Wetzel Creek.

Disposition of materials collected (subject, however, to such reservation as the State Archaeologist may impose under CRS 1973 24-80-406d): This permit stipulates that there will be no removal of material: either social, biological, paleonotological or geological.

Other Conditions: The right to access and permission to proceed are at the sole discretion of the private property owner working in concert with the project agent. A preliminary status report and copies of the site forms are required 1 week subsequent to the termination of the permit, with a final report to follow no later than 6 months after the termination of the permit.

Issued this 16 day of January, 19 81.
This Permit is valid for the Project term: 16 January, 1981 to February 15, 1981.

NOTE: You should have this Permit in your immediate possession, for inspection, in the event you are challenged.

[signature]
State Archaeologist of Colorado

0.5 x 0.5 meters and varied in depth from 0.4 to 0.6 meters below the surface. This was done in order to assess the depth of the plow zone and to determine the presence or absence of cultural remains.

Vertical exposures, present from recent construction activities, were shovel cleaned and inspected for cultural remains. Similarly, backdirt from recent apparent bore holes was examined for evidence of buried cultural remains.

5.8.5.2 Summary

It has been documented that Native Americans occupied northeastern Colorado as early as 12,000 years ago. A number of prehistoric sequences are represented in northeastern Colorado which provide evidences of the presence and cultural traditions of the people who lived there. Among these sequences were the Paleo-Indian Tradition (ca 10000-5500 BC), Archaic (5500 BC-0 BC), and Plains Woodland (0 AD-1750 AD).

Prior to the settlement of Euro-Americans in eastern Colorado, the area was occupied periodically by various historic native American tribes, including the Utes, Apache, Comanche, Cheyenne, Arapahoe, Kiowa-Apache, and Kiowa. These native Americans had a subsistence base of hunting game, principally bison, supplemented by incipient agriculture. Most of these people lived in semipermanent villages.

Euro-American settlement of eastern Colorado began in the 18th century. The area was settled by waves of trappers, traders, and explorers in the 18th and 19th centuries. These were followed by gold seekers in the mid-19th century and later by cattlemen and pioneer farmers. The South Platte River Valley was extensively utilized as a passage to the west.

By the end of the mid-19th century, Colorado was established as a leading ranching state. Ranching has remained important in eastern Adams County, but dry land farming has also become important since its inception here in the early 20th century.

5.8.5.3 Conclusions

The archival/literature review covering the study area (Figure 5.8.3) revealed no previously recorded cultural resource sites. This review included a search of the National Register of Historic Places, a computer search carried out by the Colorado Historical Society, and a search of USGS 7.5' quadrangle maps of cultural resource sites which are maintained by the Colorado Historical Society.

The on-the-ground survey of cultural features revealed no culturally significant resource sites.

5.8.6 References

1. Hansen, Wallace, et. al., Climatography of the Front Range Urban Corridor and Vicinity, Colorado, USGA, Geological Survey Professional Paper 1019, 1978.

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5. Budde, L., District Wildlife Manager, Colorado Division of Wildlife, Brush, Colorado; Personal Communication, Feb. 13, 1981.

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8. 1970 Census of the Population, Characteristics of the Population, Colorado, Vol. 1.

9. Denver Regional Council of Governments, Denver, Colorado, 1981.

10. Adams County Comprehensive Plan, 1975, Adams County Planning Commission.

11. 1978 Census of Agriculture, Bureau of the Census.

12. Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Dept. of Commerce, Dept. of Economic Analysis.

13. Heartfield, Price and Greene, Inc., "A Cultural Resources Survey and Assessment of the Location of a Proposed Hazardous Waste Facility, Adams County, Colorado," Report No. 1981-VI, February, 1981.

CHAPTER 6

DESCRIPTION OF THE FACILITY

6.1 INTRODUCTION

The design and operation of the treatment/solidification and disposal facility will protect the environment by incorporating the following features:

- o treatment of certain wastes prior to solidification so as to essentially preclude the potential for leaching;
- o solidification of all liquid and semi-solid wastes to immobilize potential contaminants;
- o disposal of the solidified product in secure disposal cells to prevent contamination of residential wells;
- o collection and treatment of disposal cell leachate, in the unlikely event that leachate should form, to further prevent contamination of residential wells;
- o a high level of additional protection provided by the natural subsurface geological and hydrogeological conditions at the site;
- o positive control of rainfall run-on and run-off to protect surface waters;
- o a monitoring program to ensure the facility has no adverse environmental effects;
- o a contingency plan to ensure effective remedial action in the event of any emergency.

The purpose of this chapter is to provide a detailed description of the functions, layout, and design of the treatment/solidification and disposal operations and related facilities. The operational controls, monitoring program, and contingency plans are described in Chapter 7.

Alternate facility locations within the nine sections of property were evaluated by considering the following factors:

- topography and surface drainage;
- site access;
- location of existing structures and utilities;
- acreage required for the site.

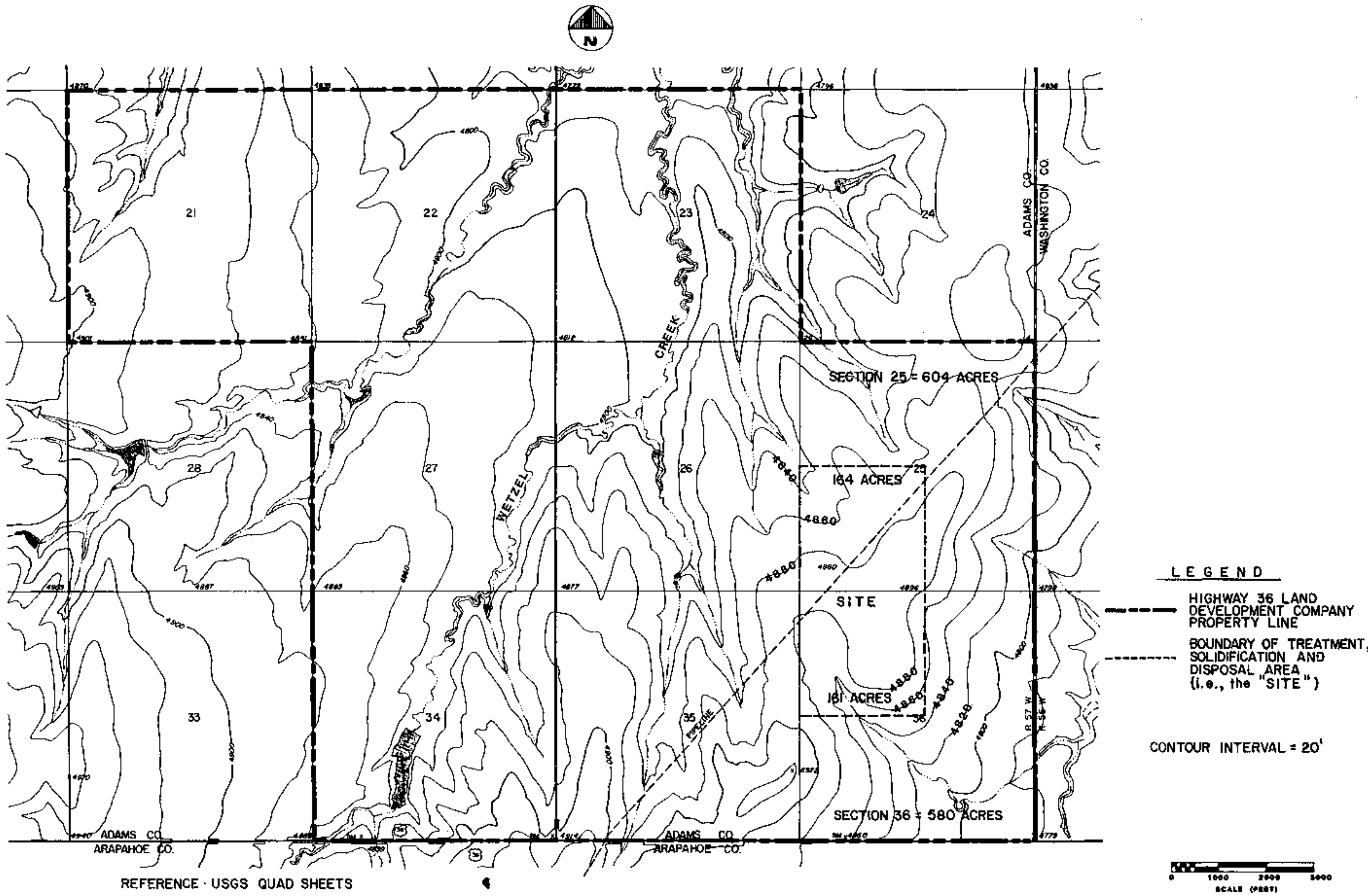
In addition to the above, it was assumed that for ease of operation the processing facilities and secure disposal cells should be integrated at a single location. To meet these considerations, 325 acres within Sections 25 and 36 were selected as illustrated in Figure 6.1.1. These two quarter sections are herein referred to as the "site."

Facility operation has been planned in two phases, as discussed in Chapter 1. For Phase I operations, treatment/solidification will be conducted in clay-lined earthen cells. The treatment/solidification operation for the Phase II facilities (which will be completed while the Phase I system is in operation) will employ concrete tanks totally enclosed in a building. For both operational phases, the solidified product will be buried in secure disposal cells.

6.2 DESIGN CONSIDERATIONS AND PROCEDURES

6.2.1 Relative Location of Phase I & Phase II Processing Areas

In order to implement the facility plan, it is desirable that the location of the Phase II processing area be separate from the Phase I processing area so that construction of the Phase II facilities can take place without interrupting or interfering with the Phase I operations. The Phase I facility is located so as to take advantage of the existing on-site access road on the eastern side of the site, as illustrated in Figure 6.2.1. The Phase II facilities will be constructed on the western side of the site and will be served by a new, all-weather access road. These are also illustrated in Figure 6.2.1. The particular location for



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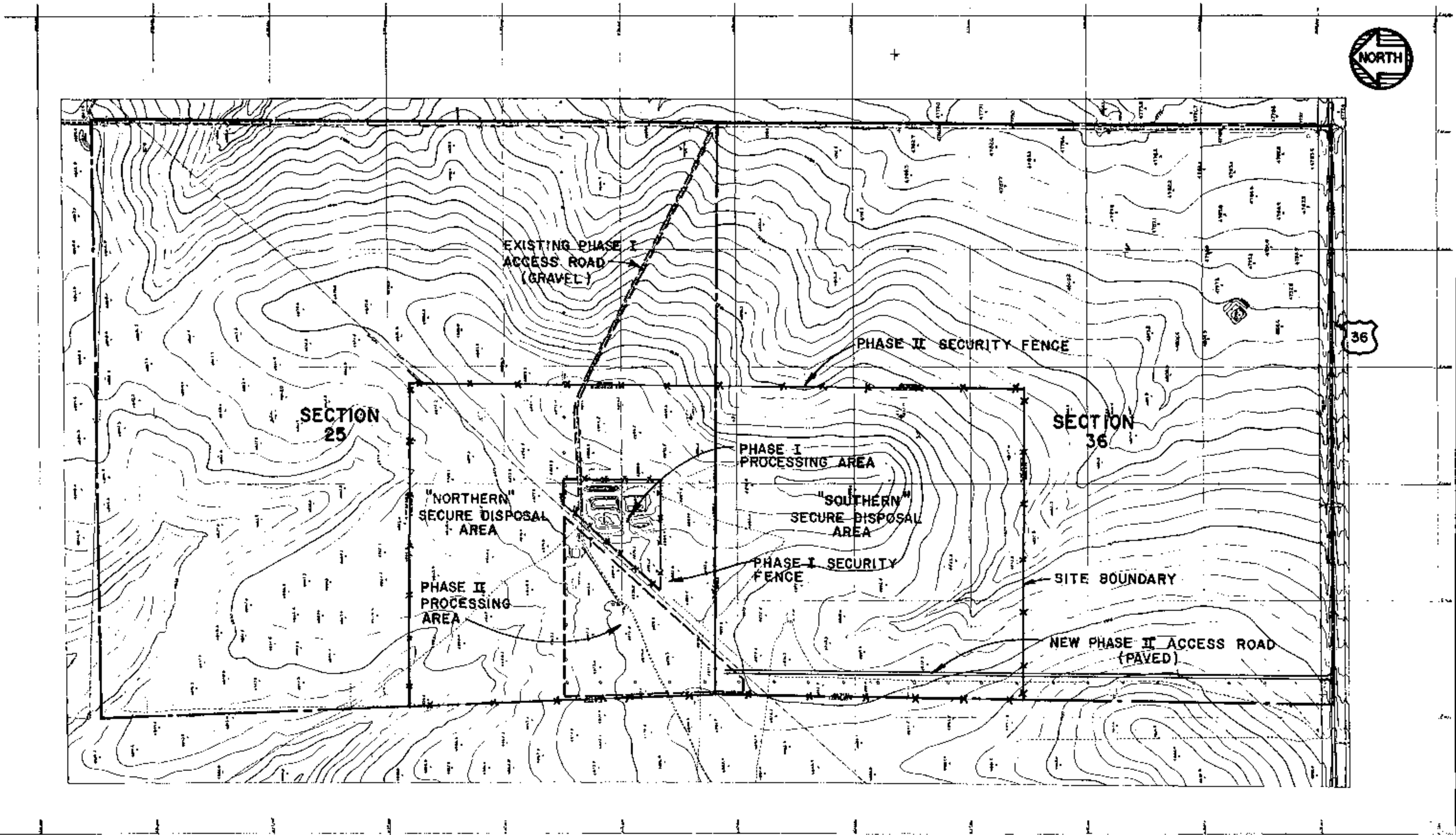
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

SITE LOCATION

SHEET NO. FIG 6.1.1



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CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

SHEET NO.
FIG. 6.2.1
OF

the Phase II facilities was selected because of its easy access from Highway 36, its location relative to existing power lines, and efficiency of space utilization. Further, this location serves to simplify overall control of surface water run-on/run-off and development of the secure disposal cells.

6.2.2 Placement of Overburden

After the general location and space requirements for the Phase I and Phase II processing facilities had been determined, the layout and number of secure disposal cells were estimated. It was found that the equivalent of about 40 standard sized cells (600 feet long, 300 feet wide, 30 feet deep, with 2:1 wall slope) could be located on the remaining site area. Because the volume of overburden (i.e., excess excavated material) is significant, computer assisted studies were performed to determine the optimal placement of the overburden. Given that each secure disposal cell would yield a maximum of about 125,000 cubic yards of excess overburden, the maximum total quantity of overburden ultimately to be distributed is about 5,000,000 cubic yards. The primary considerations employed for developing the overburden distribution plan were as follows:

- Overburden should be distributed so as to produce a final site topography consistent with the original and surrounding landscape.
- Overburden should be distributed in several locations in and around the site so as to minimize haul distance.
- Overburden would not be placed in those areas designated for the processing facilities and main access roads.
- Overburden would be placed in such a manner to minimize erosion rates.

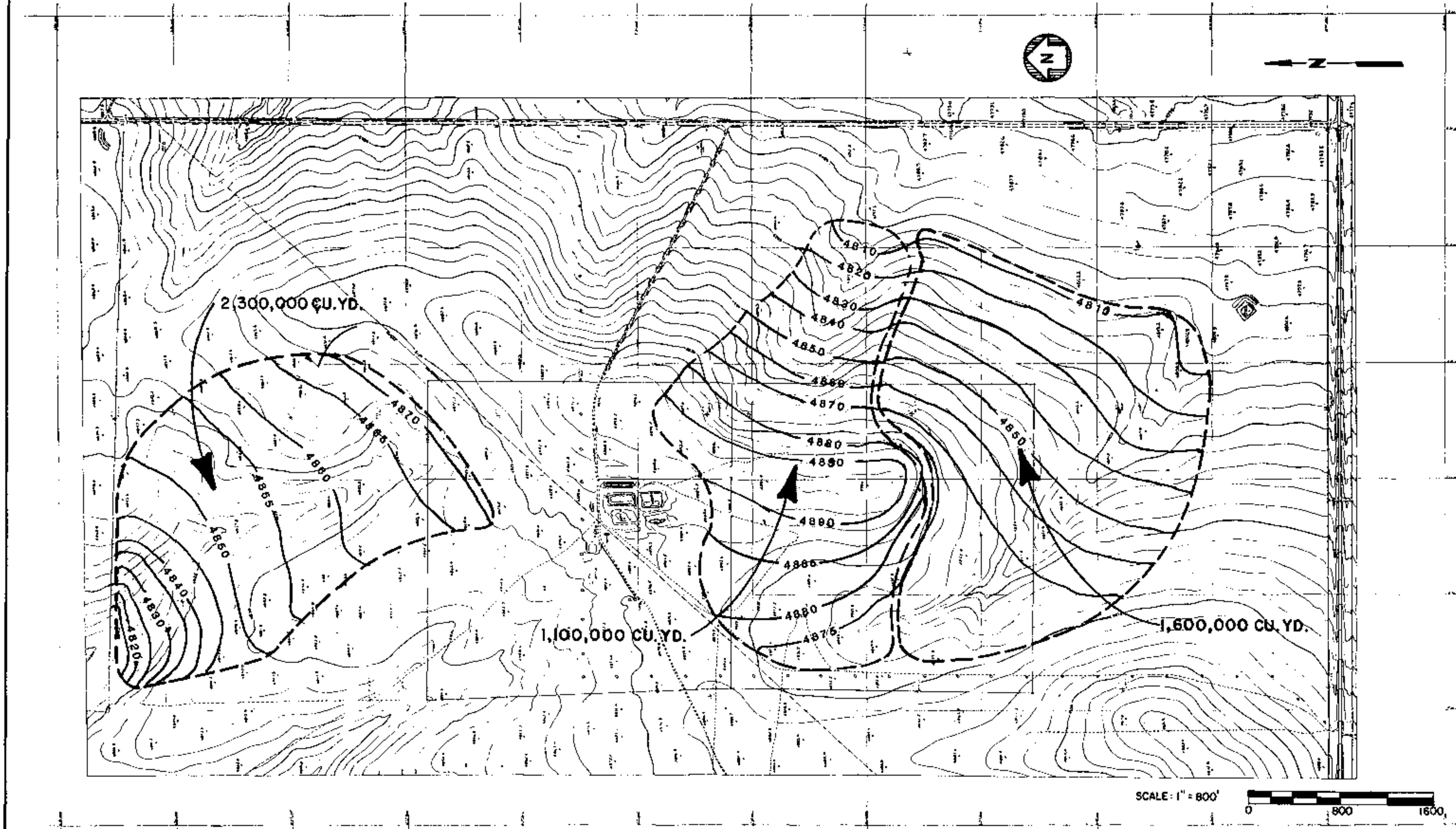
The results of the study are presented in Figure 6.2.2 which shows that the 5,000,000 cubic yards of overburden would be distributed in the three general areas indicated by the dashed lines. The resultant topography within those areas is also indicated. It is to be emphasized that the overburden will be moistened and compacted upon placement. Further, these areas will be revegatated during the course of facility operation.

Figure 6.2.2 is of particular importance because it illustrates the estimated final topography of the site after closure. It also provides the basis for designing the berm around the entire site for controlling rainfall run-off and run-on, as discussed below.

6.2.3 Control of Surface Drainage

Once the topography of the site after closure had been projected, provisions for berms to control rainfall run-off/run-on, fences to provide security, and non-contaminated surface water collection ponds for non-potable water uses were established.

As a part of the Phase I construction, a 3-foot high berm will be constructed around the active area to collect and convey all rainfall runoff to a contaminated water holding and evaporation pond, as illustrated in Figure 6.2.3. This pond was sized so as to be able to accommodate runoff resulting from a 100-year, 24-hour maximum rainfall event; it was also sized so as to evaporate all of the annual rainfall run-off collected from within the bermed area. Its design is discussed in Section 6.6.1.



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PLACEMENT OF OVERBURDEN

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6.2.2
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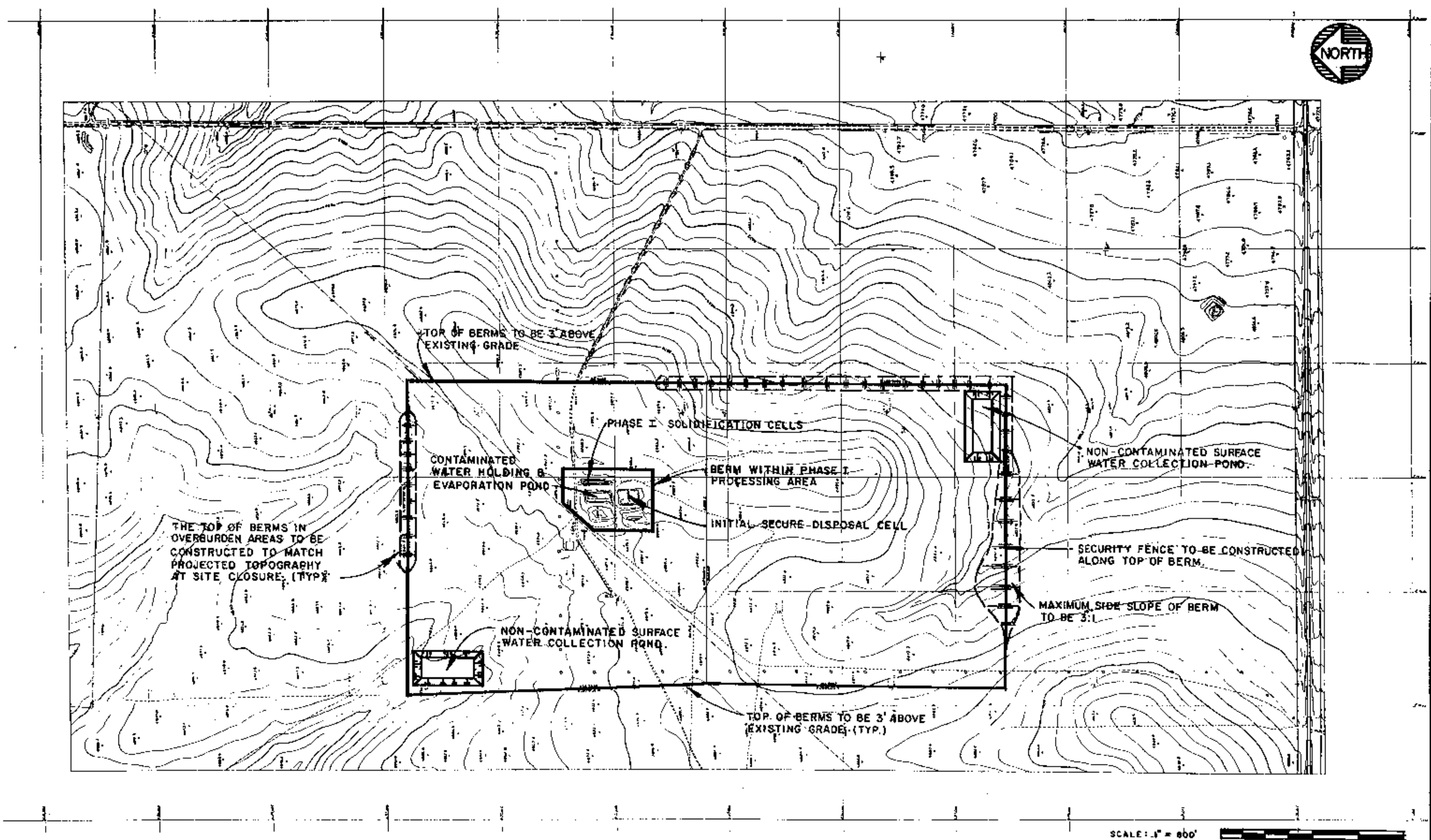

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CHEMICAL WASTE DISPOSAL FACILITY

GENERAL ARRANGEMENT OF BERMS & RUN-OFF COLLECTION FACILITIES

SHEET NO. FIG. 6.2.3 OF

As a part of the Phase II construction, a berm will be constructed around the entire site (i.e., around the two quarter sections in Sections 25 and 36). The height of the berm will correspond to the final height projected in Figure 6.2.2 at the site perimeter. In addition, a non-contaminated surface water run-off collection pond will be constructed in both the northwest corner and southeast corner of the site (see Section 6.2.7.2). The surface dimensions of these ponds will be the same as a standard sized secure disposal cell. The general layout of these surface drainage berms and collection ponds, illustrated in Figure 6.2.3, has the following advantages:

- Over the life of the site, the berm will eliminate surface water run-on to the site and run-off from the site.
- By constructing the berm to match the projected final site topography, the placement of overburden becomes well-defined at the on-set of facility operations.
- The overburden resulting from construction of the surface water collection ponds satisfies the earth requirements to construct the site berms.
- The berm serves to force on-site, non-contaminated run-off to collect in the two surface water impoundments so as to provide the required source of non-potable water for site use.
- On-site erosion will be contained.
- In accordance with the environmental monitoring program (discussed in Chapter 7), the collection ponds provide a convenient means of monitoring the quality of surface water drainage.
- Upon closure of the site or portions of the site area and the related collection ponds, surface water run-on from adjacent areas around the site will not occur and non-contaminated site drainage will runoff to the buffer zone around the northern, southern, and eastern sides of site.
- Upon closure of the northern or southern portions of the secure disposal cell areas, the respective surface water collection ponds will be excavated to the final depth to serve as the final secure disposal cell at that area.

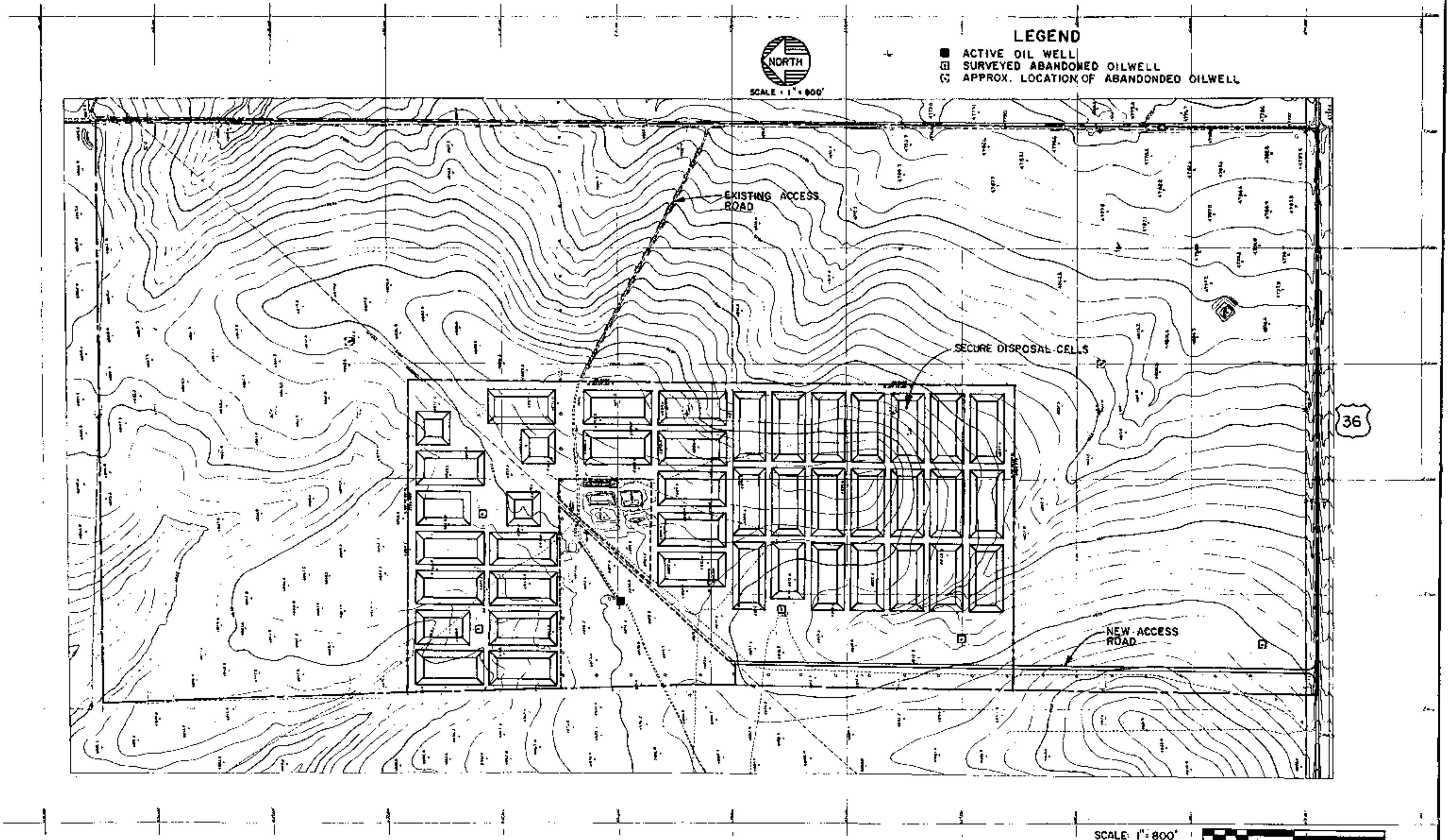
A final advantage of this arrangement is that the required security fence can be permanently constructed on top of the berm, at the final site perimeter elevation, so that it need not be periodically relocated or repositioned.

The top of the berms around the site will be approximately 10 feet wide to accommodate the security fence, and the sides will be sloped at no more than 3 to 1 so that vegetation can be established. The overburden from the non-contaminated holding water collection ponds will be used to construct the berms and will be moistened and compacted upon placement.

6.2.4 Layout of Secure Disposal Cells

The optimum layout of the secure disposal cells is illustrated in Figure 6.2.4. These cells will be constructed on an "as needed" basis over the active lifetime of the facility. Experience at other facilities indicates that as a rule-of-thumb, no more than a six month disposal capacity need be available at any one time. The cells will be separated by about 50 feet on each side to provide a graveled access road during use. As can be seen in Figure 6.2.4, none of the cells overlie any of the recorded abandoned oil wells, even though they do not impose any insurmountable problem with respect to the secure disposal cell operations.

In general, the first cells to be used will be those closest to the solidification facilities. The last cells to be used will be those at the extreme southern or northern boundaries of the site. Because the surrounding land generally slopes away from the solidification facilities, this sequence of secure disposal cell development provides the opportunity to partially construct new cells with the compacted overburden from previous cells so that the gross volume of earth moved is



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LAYOUT OF SECURE DISPOSAL CELLS

SHEET NO. FIG 6.2.4
OF

minimized. This sequence also allows vegetation to be established progresssively. Further, by confining the active cells to within a small local area, the problem of segregating potentially contaminated rainfall run-off from non-contaminated rainfall run-off is greatly simplified, as will be subsequently discussed.

6.2.5 Site Capacity

Although the initial secure disposal cell (located in Figure 6.2.3) is about 230 feet long by 150 feet wide and 20 feet deep, the dimensions of subsequent cells will generally range from 300 to 600 feet long by 300 feet wide by 30 feet deep. A standard size cell is defined herein as one which is 600 feet long, 300 feet wide, and 30 feet deep with a 2:1 wall slope. The size of the cell will be adjusted to match the incoming waste load in accordance with the rule-of-thumb noted earlier. Other than the dimensions, the design of the initial and subsequent cells are the same.

As can be seen in Figure 6.2.4, the site can accommodate a total of 43 cells (including the initial Phase I cell) that have a total volume equivalent to approximately 40 of the standard sized cells. Taking into account the space occupied by intermediate cover and the cap, the useable volume of a standard cell is about 125,000 cubic yards. Thus, the capacity of the site is about 5,000,000 cubic yards of solid waste.

6.2.6 Active Lifetime of the Site

The active lifetime of the site, i.e., the length of time required to exhaust the total capacity of the secure disposal cells, is a function of the overall rate at which wastes are received. As was pointed out earlier, the Phase II treatment/solidification operations are designed to process between 12,000,000 and 48,000,000 gallons of raw waste material per year. The active lifetime of the site is also dependent on the relative proportions of specific waste types received. This is because the ratio of the resultant solidified product volume to the original raw waste volume differs depending on the type of solidification reagent required (e.g., cement kiln dust or fly ash) and whether the raw waste is a liquid, intermediate sludge, or solid material. Past BFI operating experience at similar facilities suggests that, on the average, the volume of solidified product is about twice that of the raw waste. Although the Phase II solidification facility is designed to accommodate peak raw waste loadings of up to an equivalent of 48,000,000 gallons per year, the selected long-term design average processing rate is 24,000,000 gallons per year. Using the above ratio of solidified product volume to raw waste volume, this long-term raw waste loading is equivalent to 238,000 cubic yards of solidified product per year. For this loading, the site life would be about 21 years (5,000,000 ÷ 238,000).

6.2.7 Water Requirements and Sources

6.2.7.1 Potable Water

As was indicated previously in the hydrogeological and base line water quality sections of this report, on-site sources of potable water are virtually non-existent. Consequently, potable water (for drinking, showers, eye wash, etc.) will be purchased and transported to the site by truck. Portable storage units will be utilized for the Phase I operations, whereas for the Phase II facility (when potable water demands will be larger), an above-ground enclosed water tank will be constructed.

The quantity of potable water needed was estimated on the basis of typical per capita requirements (35 gallons per person per shift) in conjunction with the number of personnel anticipated for the Phase I and Phase II operations.

It was estimated that for the Phase I operation, an average of about 430 gallons per day will be required; and for the Phase II operations, an average of about 1,100 gallons per day will be required. Based on a two-week supply, the size of the Phase II potable water storage tank will be about 15,000 gallons.

6.2.7.2 Non-Potable Water

The major requirements for non-potable water include the following:

- preparation of secure disposal cell liners and caps;
- truck washing facilities
- irrigation to establish vegetation;
- fugitive dust control;
- moisturizing overburden;
- fire protection.

The non-potable water required during Phase I operations will be purchased and trucked to the site. Non-potable water demands during the Phase II operations will be supplied primarily from the on-site, non-contaminated surface water collection ponds noted earlier.

6.2.7.2.1 Estimated Rate of Use

The annual quantity of non-potable water required is primarily a function of the annual incoming raw waste load because it determines the rate at which secure disposal cells are constructed, the number of trucks washed, etc. At a Phase II waste loading of 24,000,000 gallons of raw waste per year, it is estimated that approximately 1,100,000 gallons will be required for construction of secure disposal cell liners and caps, and about 1,800,000 gallons will be required for the truck wash facilities. These are based on estimated water requirements of 11 gallons water per cubic yard of liner prepared, and 300 gallons per truck washed, respectively.

The estimated quantity of water required for revegetation is about 3,200,000 gallons per year, based on irrigations totalling five inches per acre. The annual amount estimated for fugitive dust control is 1,300,000 gallons. This is comprised of 400,000 gallons for the access road between the solidification building and the secure disposal cell; 400,000 gallons for the access road between a secure disposal cell and the overburden area; and 500,000 gallons for controlling dust in areas where soil is stockpiled for subsequent use. These figures are based on factors of 2,000 gallons per mile per day needed for the access roads and application rates to the stockpiled soil equal to one-half that required for revegetation.

Water required for moisturizing overburden is estimated to be 1,900,000 gallons per year, based on an application of about eight gallons per cubic yard of soil. Preliminary estimates of the volume of water required for fire protection suggest that about 1,500,000 gallons of water should be on hand.

6.2.7.2.2 Estimated Quantity Available

The quantity of on-site, non-contaminated rainfall run-off that could be collected annually was determined using the rainfall data presented in Chapter 5 (Table 5.5.2). There it was shown that between 11 to 27 million gallons (MG) could be reliably collected from the site each year. This corresponds to annual rainfalls ranging from 8 inches to 20 inches.

As can be seen from the drainage areas illustrated in Figure 5.5.1, the two collection ponds would receive essentially equal quantities of that total, i.e., 5.5 to 13.5 MG per year. However, depending on the surface area of these ponds, varying amounts of this collected water will evaporate. For example, for a surface area of 300 feet by 600 feet, the annual net evaporation (lake evaporation rate, i.e., 55 inches, minus rainfall) for 8 inch and 20 inch annual rainfalls would be 5.3 MG and 3.9 MG, respectively. This indicates that for dry years, i.e., about eight inches of precipitation, virtually all of the collected rainfall run-off would evaporate: 11 MG - (2 x 5.3 MG) = 0.4 MG available.

In order to ensure that water will be available during such dry conditions, provisions will be made to pump water from one pond to the other so as to reduce the water lost by evaporation by a factor of one-half. In general, one of the two ponds will be kept dry. After rainfall and runoff, its contents will be pumped to the other pond. In this manner, the net amount of water available for use will be at least 5.7 MG per year (11 MG minus 5.3 MG) and at most 23.1 MG (27 MG minus 3.9 MG). Because the storage volume of the collection pond located in the southern quarter section of the site will have a volume of about 26 MG (based on a surface area of 300 feet by 600 feet, 2:1 wall slope, and a depth of about 25 feet), sufficient water could thus be stored from previous years to ensure that even during extremely dry periods sufficient non-potable water will be available.

Another constraint is that of ensuring that the ponds do not overflow during peak rainfall conditions so that uncontrolled discharges do not result. As was determined in Chapter 5, the once-in-100 years, 24-hour maximum rainfall event would result in a run-off of about 7.2 MG. Each pond must, therefore, have available at all times an additional volume of about 3.6 MG (7.2 ÷ 2 ponds). For a pond area of 300 feet by 600 feet, this corresponds to only about 2.7 feet of depth, which can be easily accommodated. Taking into account an additional two feet for freeboard, the remaining collection volume within each pond will be about 20 MG.

For particularly wet years when the volume of water collected would exceed actual needs, the excess can be utilized or discarded in a number of ways. These include: (1) storing water in both collecton ponds so as to increase the evaporation rate, (2) spray irrigation within the site to further promote ground cover and evaporation, and (3) spray irrigation around the site buffer zone.

6.2.8 Sanitary Sewage Treatment

During the Phase I level of operation, portable sanitary sewage collection units will be provided. The septage will be periodically transported to municipal wastewater treatment facilities.

For the Phase II facility, an extended aeration activated sludge treatment system will be constructed to provide secondary treatment of the sanitary sewage. The treated effluent (about 1,100 gallons per day) will then be utilized on-site to maintain ground cover. At an application rate of two inches per week, an area of about 6,000 square feet could be utilized. The resultant sludge generated will be dried on sand drying beds and then used either as a soil amendment to promote ground cover for site beautification or buried in the secure disposal cells.

6.3 GENERAL LAYOUT AND DESCRIPTION OF THE FACILITIES

6.3.1 Phase I

The general location and layout of the facilities for Phase I operations is presented in Figure 6.3.1 which shows the treatment/solidification cells, initial secure disposal cell, and an evaporation pond for collecting rainfall run-off from within the bermed areas that could be contaminated. Trailers will be provided to accommodate an on-site laboratory, administrative operations, and employee welfare. A guard house will also be provided.

These facilities are being constructed in accordance with the designs discussed in Section 6.6. All clay liners and leachate collection/detection systems are being inspected during installation. The liner installations were tested using field density testing equipment to determine if the clay liner met the compaction specifications. Inspection and testing were performed by F. M. Fox & Associates, Inc., who have certified that the liners were installed and compacted in conformance with the design and compaction requirements. Design concepts and criteria for these operations are subsequently discussed in Sections 6.4, 6.5, and 6.6.

Off-highway vehicular equipment will be essentially the same as that for the Phase II level of operation and will include one or more of each of the following: back-hoe, off-highway dump truck, bulldozer, front-end loader, earth scraper, road grader, and water truck.

6.3.2 Phase II

The site plan of the Phase II facilities is presented in Figure 6.3.2. These facilities are more advanced than any other existing BFI treatment/solidification and disposal facility. A key feature of the complex is that wastes will be treated/solidified in a totally enclosed building, as will be discussed subsequently. The major components of the Phase II processing facilities are detailed in Figures 6.3.3 through 6.3.8.

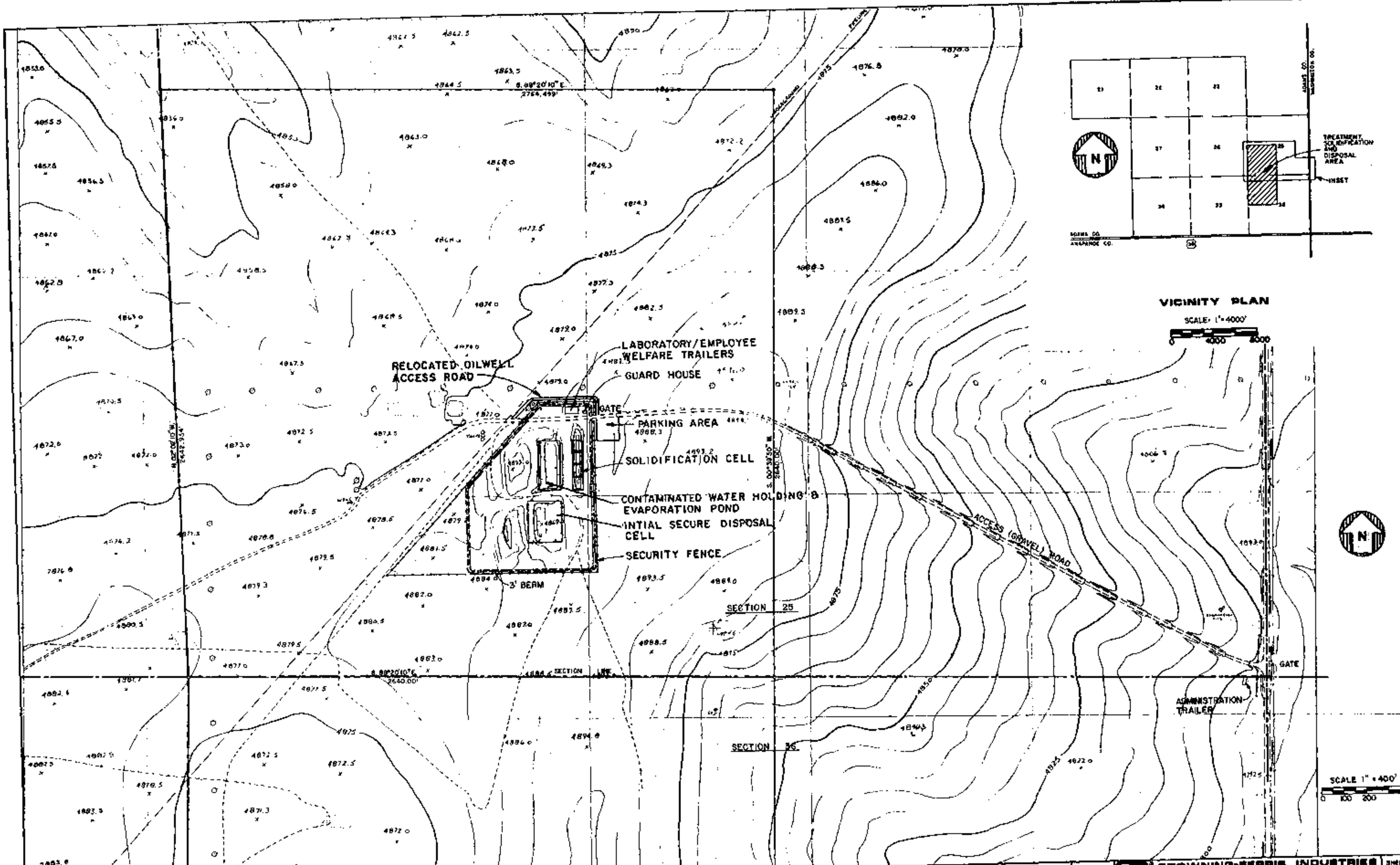
6.3.2.1 Access Road and Drainage

The main access road leading to the processing area will be asphalt or concrete pavement on a granular base and will be capable of handling the traffic intended. Parking areas for off-site vehicles will also be paved. Drainage for paved areas outside the site will be to the adjacent buffer zone. The rain water run-off from the paved access road within the site will be drained to the non-contaminated surface water ponds.

The roads and facilities have been laid-out so as to permit orderly and efficient traffic patterns. The concept has been developed whereby the traffic patterns for transport vehicles and site vehicles are segregated. Thus for example, waste and reagents will be delivered to the west side of the treatment/solidification building and solidified product will exit that building from the east side. Further, site vehicles enter the maintenance building at the north side whereas waste transport vehicles enter that building at the south side.

6.3.2.2 Administration Building and Guardhouse

The administration building, as shown on Figures 6.3.3 and 6.3.4, will house offices for supervisory and clerical staff and a meeting room. Both the administration building and the guardhouse will be an aesthetically pleasing design.



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PHASE 1 FACILITY PLAN

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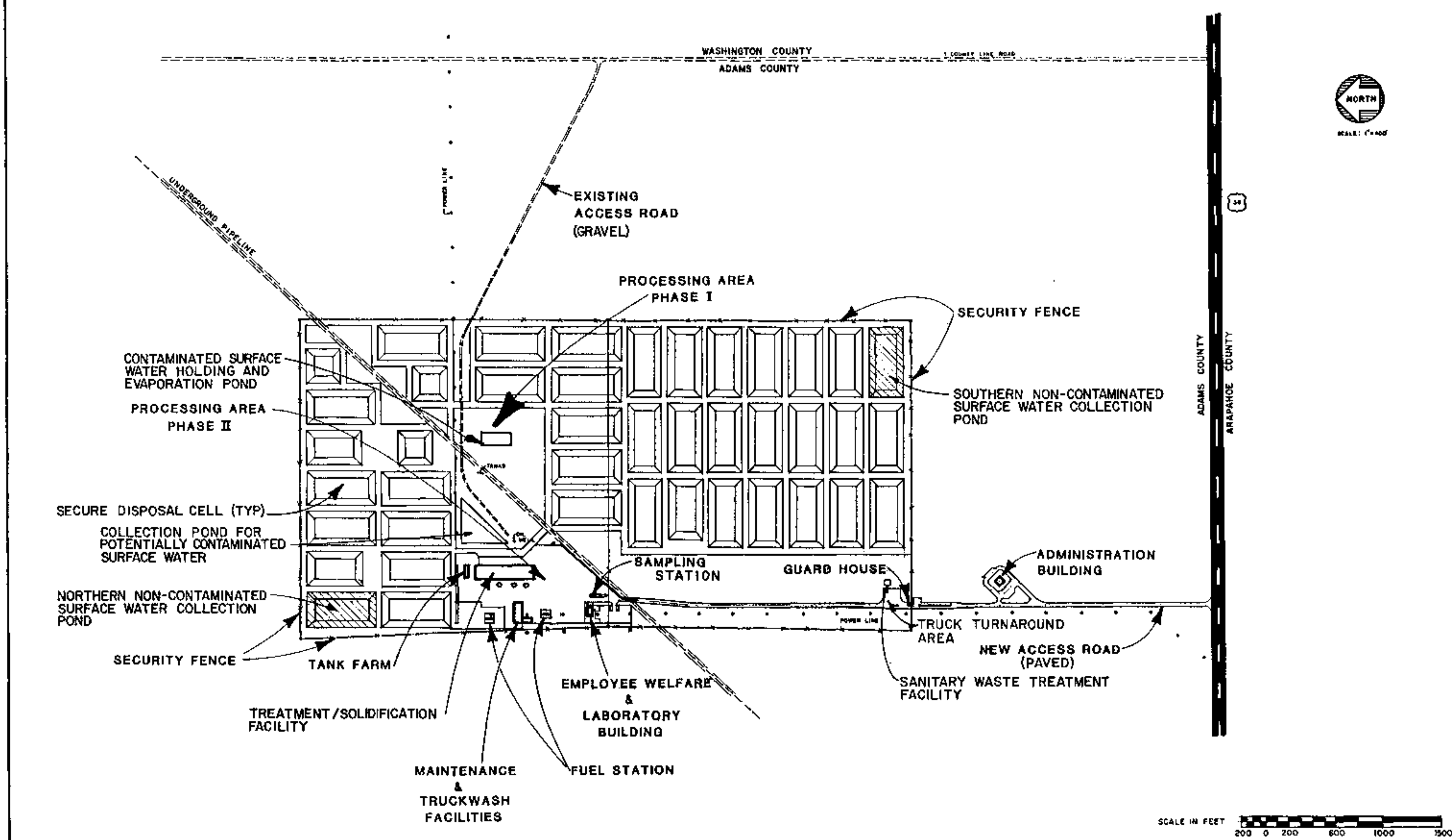

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CHEMICAL WASTE DISPOSAL FACILITY

PHASE II SITE PLAN

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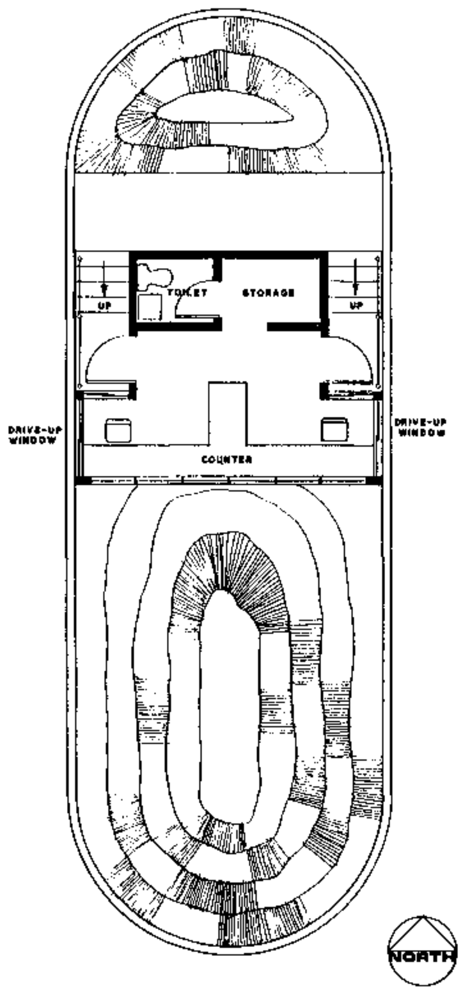

GUARD HOUSE FLOOR PLAN

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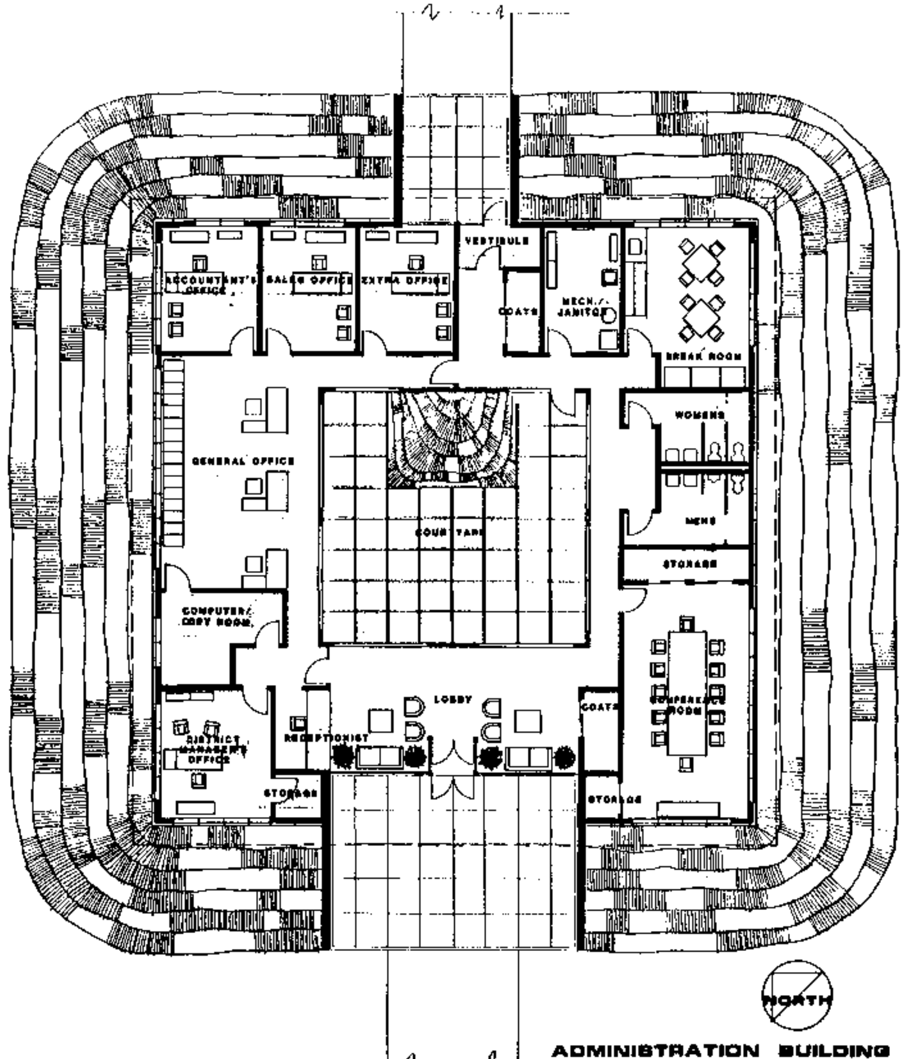

ADMINISTRATION BUILDING FLOOR PLAN

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CHEMICAL WASTE DISPOSAL FACILITY
ADMINISTRATION BLDG. & GUARD HOUSE
FLOOR PLANS

SHEET NO. FIG 6.3.3

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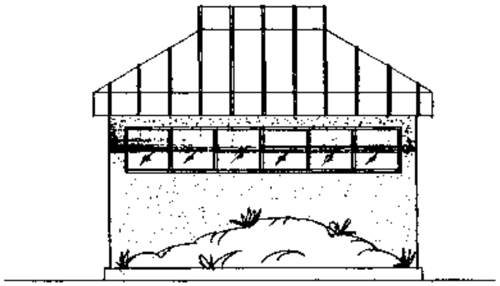

GUARD HOUSE
SOUTH ELEVATION

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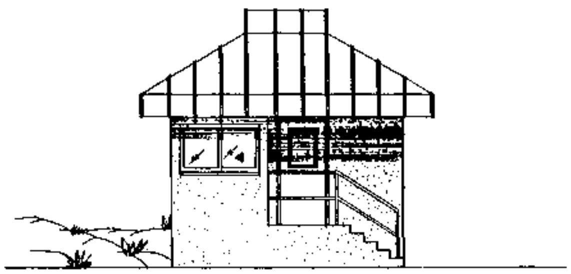
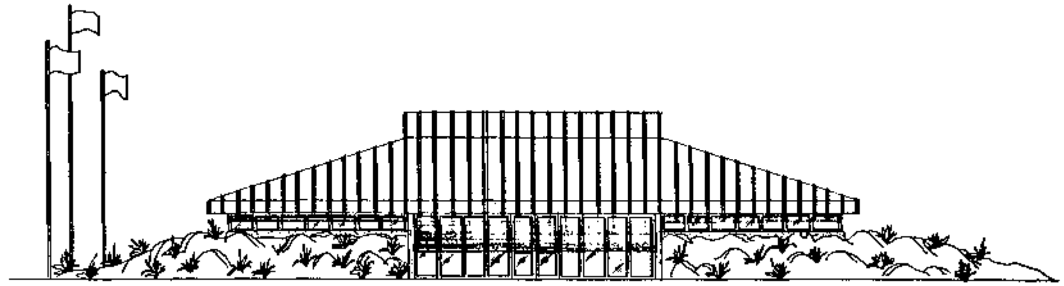


GUARD HOUSE
EAST ELEVATION

SCALE IN FT. 0 1 2 4 6



ADMINISTRATION BUILDING
SOUTHWEST ELEVATION

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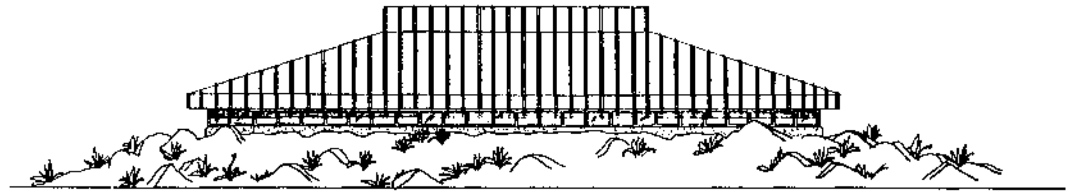
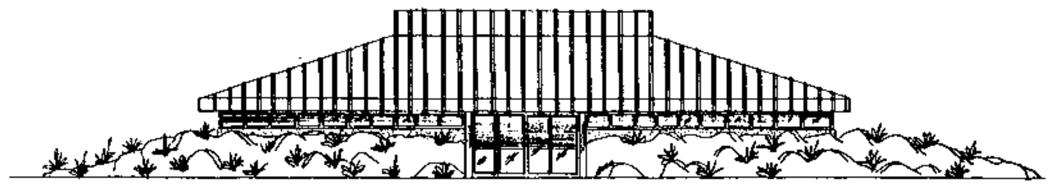


ADMINISTRATION BUILDING
NORTHWEST ELEVATION

SCALE IN FT. 0 2 4 8 12



ADMINISTRATION BUILDING
NORTHEAST ELEVATION

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ELEVATIONS

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FIG
6.3.4
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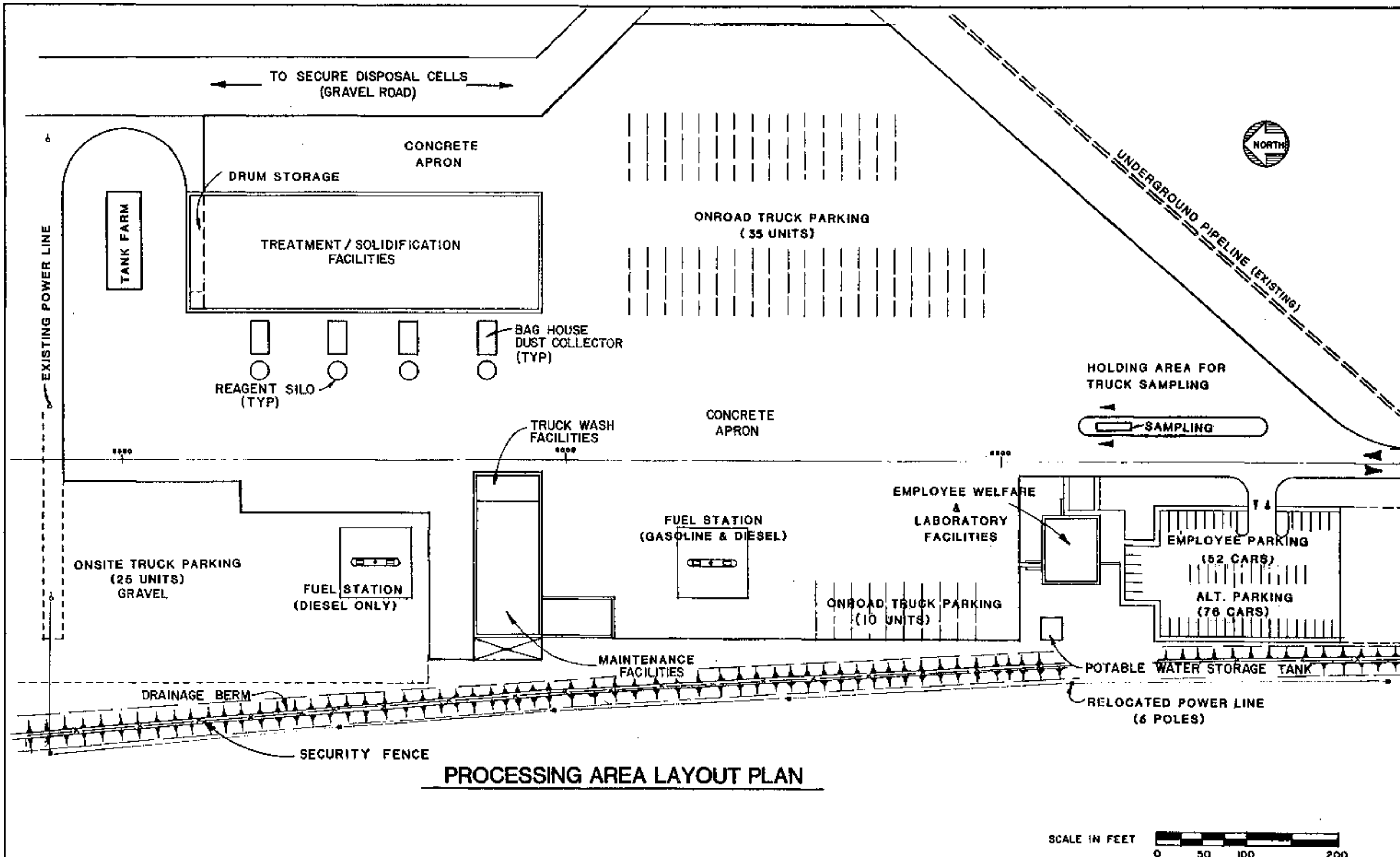

PROCESSING AREA LAYOUT PLAN

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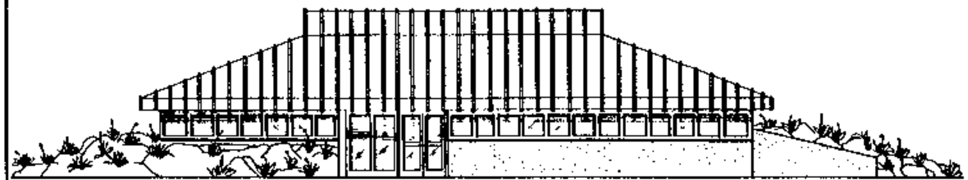
CHEMICAL WASTE DISPOSAL FACILITY
PHASE II
PROCESSING AREA LAYOUT PLAN

SHEET NO.
FIG
6.3.6
OF



SOUTH ELEVATION

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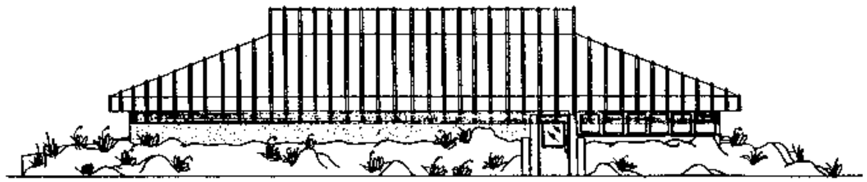

NORTH ELEVATION

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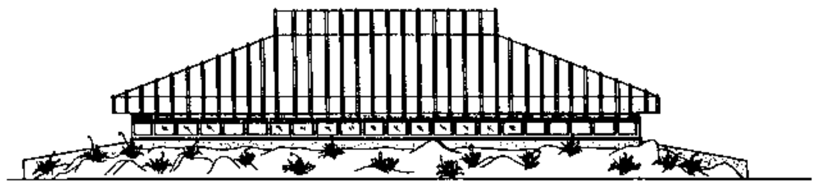

WEST ELEVATION

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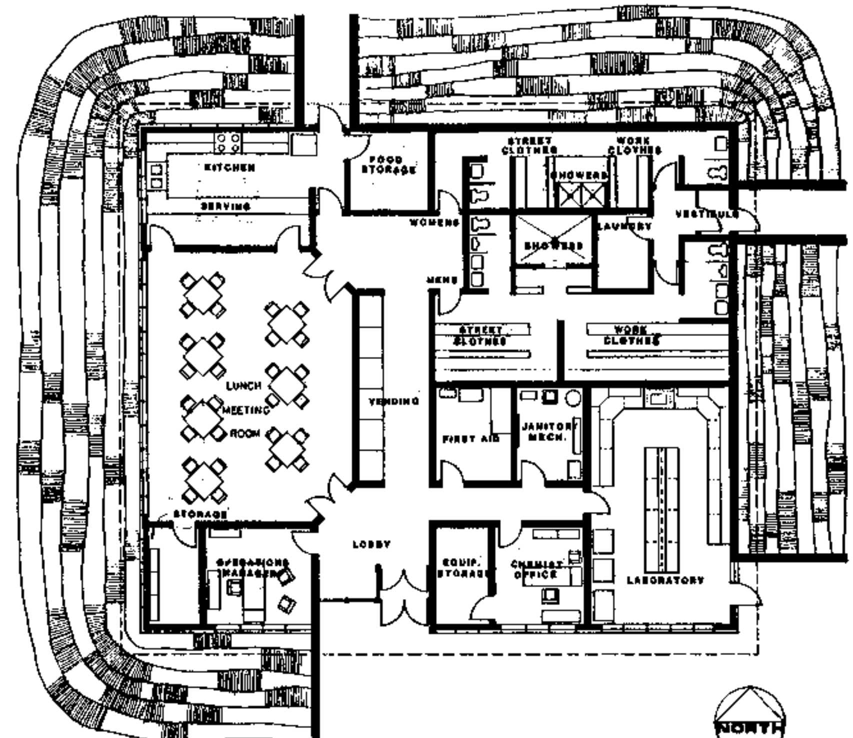

FLOOR PLAN

0 2 4 8 12

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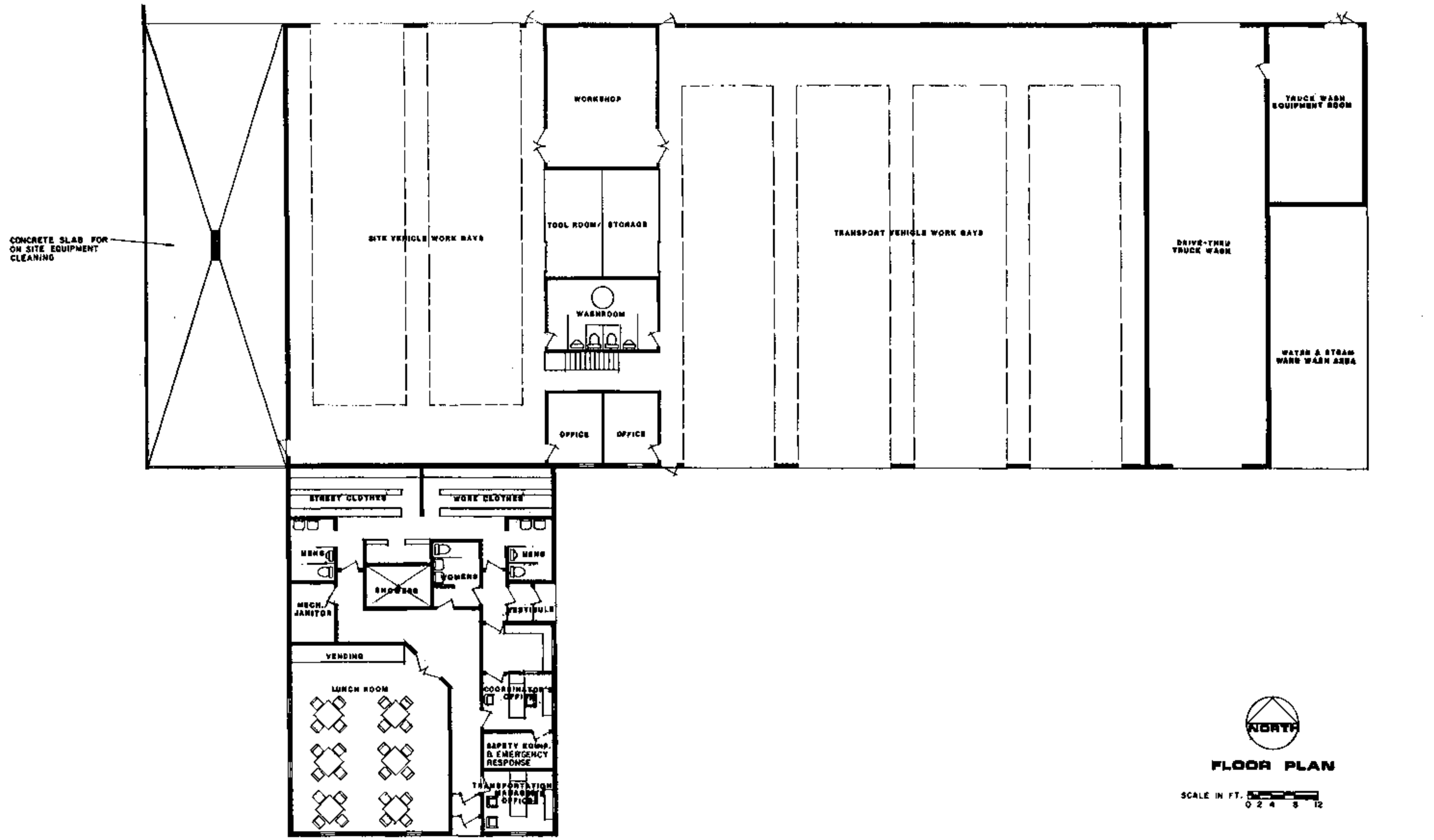
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
EMPLOYEE WELFARE/LABORATORY BLDG.
FLOOR PLAN & ELEVATIONS

SHEET NO.
FIG. 6.3.6
OF



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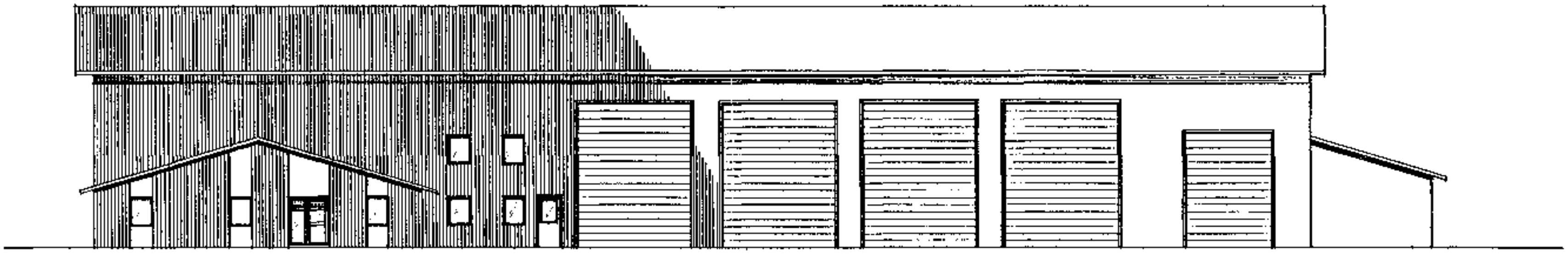
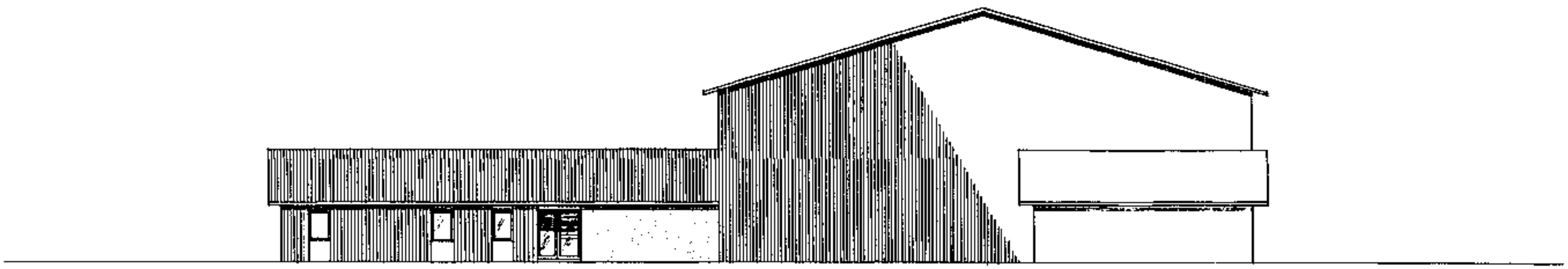
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
MAINTENANCE BUILDING
FLOOR PLAN

SHEET NO.
FIG. 6.3.7
OF



SOUTH ELEVATION

SCALE IN FT. 0 2 4 8 12



EAST ELEVATION

SCALE IN FT. 0 2 4 8 12

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HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
MAINTENANCE BUILDING
ELEVATIONS

SHEET NO.
FIG 6.3.5
OF

6.3.2.3 Facility Security

The facility will be fenced, and the access road will be gated at the guardhouse. All buildings will be accessed through lockable doors. Truck doors will be lockable. All exit doors in the processing building will be equipped with inside "crash" hardware, affording emergency exit to the outdoors but no entry from outdoors.

6.3.2.4 Employee Welfare and Laboratory Facilities

The employee welfare and laboratory facilities, as shown in Figure 6.3.6, provide washrooms, showers, separate locker rooms for work clothes and street clothes, and a lunch room. The operations manager is provided an office in this area, and first aid and personal safety equipment will be kept in this location. A safety shower and eyewash will be located in the laboratory. To provide adequate on-site control of the waste receipts, both the Phase I and Phase II laboratories will have the following minimum testing capability:

- pH
- flash point
- acidity
- alkalinity
- cyanide
- sulfide
- ammonia
- chlorine
- settleable solids
- nitrite
- total solids
- suspended solids
- viscosity
- specific gravity

Laboratory drainage will be collected, solidified, and then disposed of in the secure disposal cells.

6.3.2.5 Maintenance Facilities

A maintenance building and truck wash facility will also be provided for the Phase II level of operation, as illustrated in Figures 6.3.7 and 6.3.8. These will serve both the on-site vehicles and the raw waste transport vehicles. An additional employee welfare building is to be attached to the maintenance building for truck drivers and the maintenance personnel.

The effluent from the external truck wash will be collected and either reused as the first wash cycle for cleaning the interior of the transport trucks, or discharged to the contaminated water holding and evaporation pond. Washing the interior of trucks will be conducted at the treatment/solidification building so that the washings are discharged directly to the appropriate solidification basin. In this manner, the washings will be solidified and then disposed of in a secure disposal cell.

6.3.2.6 Tank Farm

As illustrated in Figure 6.3.5, a tank farm will be provided. As will be shown in Figure 6.4.2, it will consist of a maximum of fourteen 6,000 gallon tanks contained within a concrete basin. One of the purposes of these tanks is to store low volume waste streams until enough has accumulated for subsequent treatment/solidification. They would also be used for storing specific waste streams that could be utilized as a part of the treatment process, thereby providing resource recovery. These tanks will be filled from a vacuum truck and emptied by a vacuum truck. No interconnecting piping between the tanks will be provided. The concrete basin serves as a back-up system, in the unlikely event that a tank should spill or rupture.

6.3.3 Facility Staffing

BFI corporate staffing and typical regional staffing are illustrated in Figures 6.3.9 and 6.3.10, respectively. Facility staffing is illustrated in Figure 6.3.11.

The staffing pattern for the facility reflects the anticipated requirements over the range of waste processing rates. Initially, no contracts for reception of waste streams will be in effect, so that staffing will be substantially reduced from that shown in Figure 6.3.11. In all cases, however, BFI will maintain personnel necessary to operate the facility in an environmentally sound manner. The anticipated staff is consistent with other operations now receiving similar types of chemical wastes. About 20 persons will be employed for the Phase I level of operation and about 40 to 70 people will be required for the Phase II level of operation. Key personnel are discussed below:

(1) The District Manager will have a combination of business and technical experience with special emphasis on operations management. He has overall responsibility for the facility operation and personnel.

(2) The Sales Manager will have experience in marketing with emphasis on chemical waste management service. He is responsible to the District Manager.

(3) The Operations Manager will have a geological or civil engineering background with emphasis on excavation and dirt moving. He is responsible to the District Manager and for coordinating all areas of facility operation, including equipment operations, maintenance, future planning, and daily scheduling.

(4) The Chief Chemist is responsible for the chemists and technicians. He will have a degree in an environmentally related field with special emphasis on industrial waste testing and management or equivalent experience. His functions are:

- o to ensure the integrity of quality assurance, safety, and government compliance programs;
- o to ensure the satisfactory and cost-effective disposal of waste.

B F I
CORPORATE STAFF

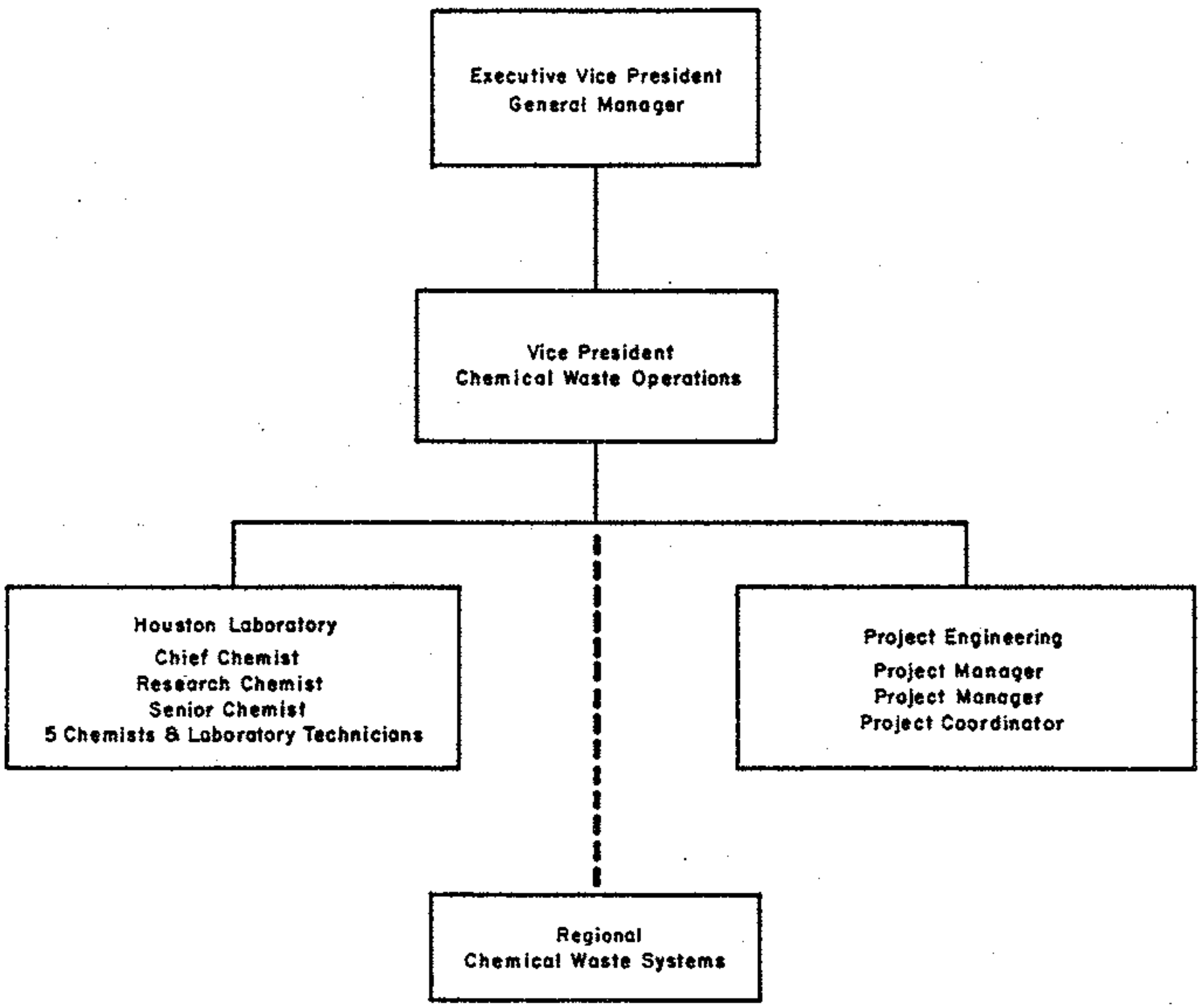

FIGURE Nº 6.3.9

BFI CORPORATE STAFF

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ARCHITECTS ENGINEERS PLANNERS

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TYPICAL REGIONAL CHEMICAL WASTE STAFF

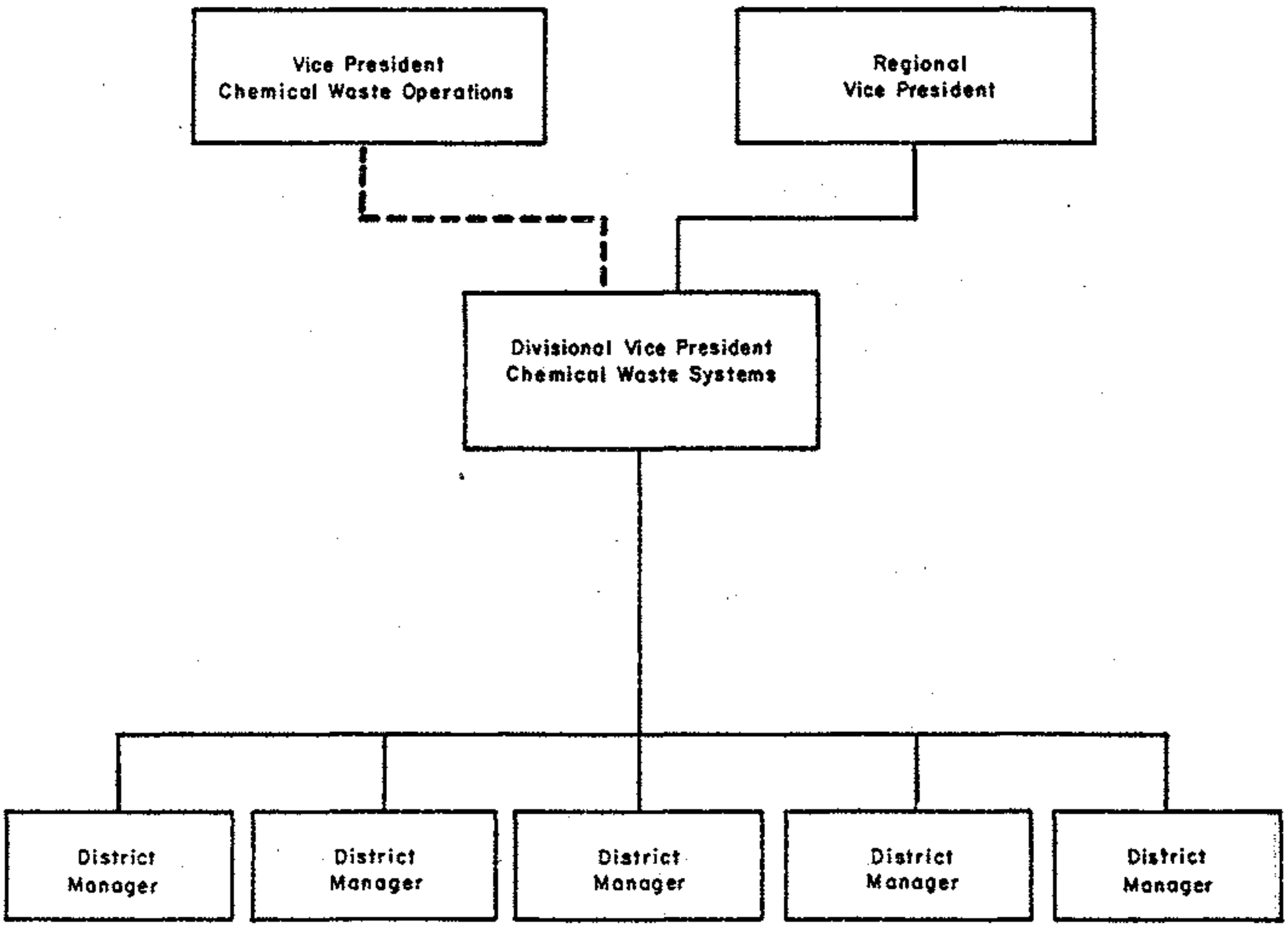

FIGURE № 6.3.10

TYPICAL BFI REGIONAL STAFF

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His normal duties include the following:

- receive, monitor, and control all incoming wastes;

- maintenance of all records associated with hazardous waste receipts, treatment and disposal, including state manifest system;

- training program for technical personnel;

- groundwater, leachate, air and surface water monitoring systems;

- perimeter security control.

(5) The Chemist is responsible to the Chief Chemist and is responsible for the technicians. His functions are to assist the Chief Chemist:

- ensure the integrity of quality assurance, safety, and government compliance programs;

- ensure the satisfactory and cost-effective disposal of waste.

His normal duties include:

- waste shipment inspection and unloading;
- document organization;
- record keeping;
- filing;
- lab analyses;
- site inspection and security;
- safety enforcement.

(6) The Technicians perform routine technical tasks as assigned by the Chemist or Chief Chemist. Their duties include:

- waste shipment inspection;
- lab analyses;
- ensure all vehicles have been cleared by lab and guard;
- ensure wastes are discharged in the proper locations;
- ensure compliance with safety rules;
- perform other routine duties as assigned.

(7) The Security & Safety Supervisor is responsible to the District Manager. Depending on staffing needs, the Chief Chemist may serve as the Security & Safety Supervisor. Duties and responsibilities include:

- emergency procedures and contingency plans;
- implementation and enforcement of site safety program;
- overall security of the facility.

FACILITY STAFFING

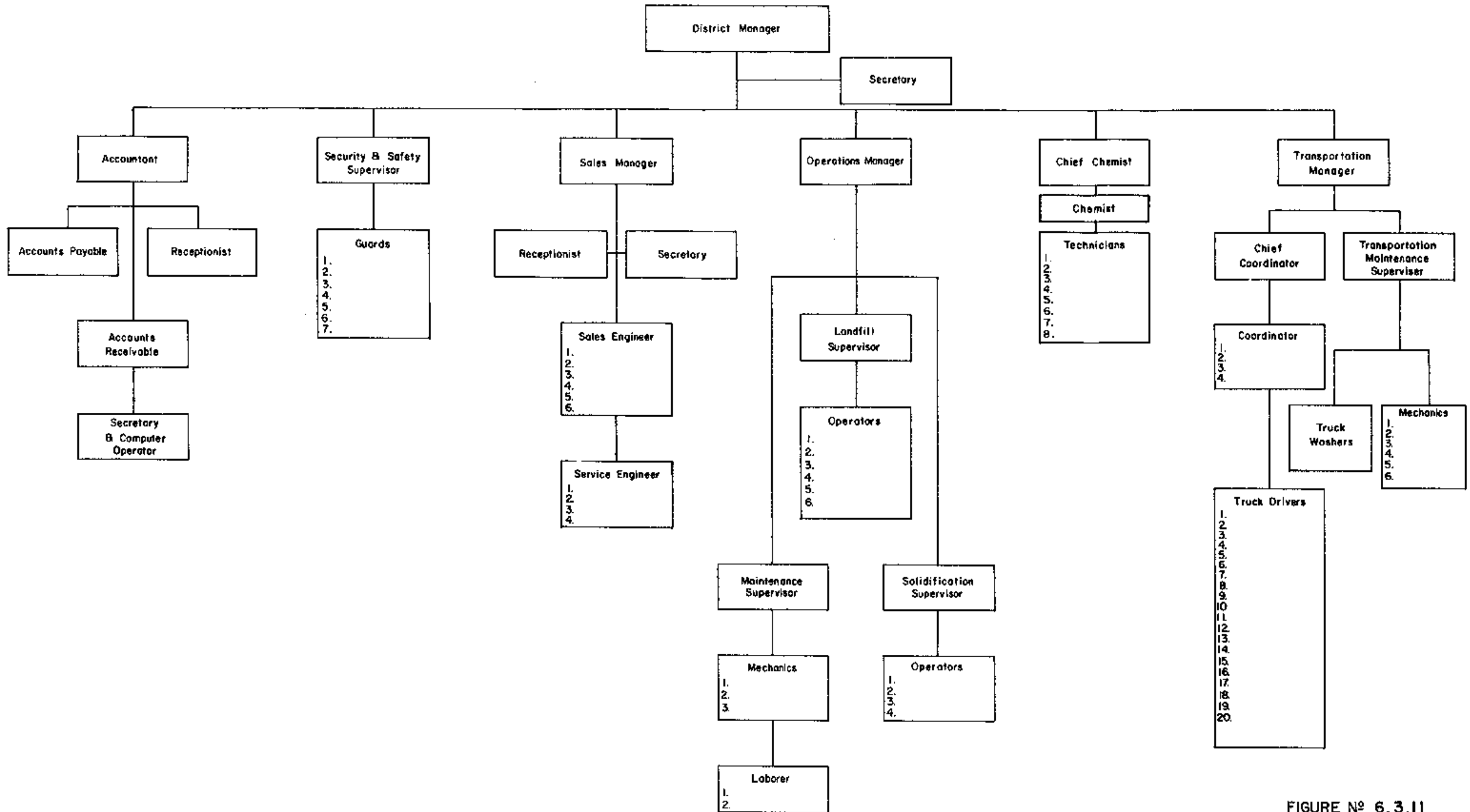

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FIGURE № 6.3.11

FACILITY STAFFING

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

(8) The Guards are responsible to the Security & Safety Supervisor, or to the Chief Chemist. Their purpose is to enforce security and safety rules and to assist with paperwork for incoming chemical wastes.

Their duties include the following:

- o man guard house and act as site receptionist;
- o restrict entry to authorized personnel and properly document vehciles;
- o direct visitors to office;
- o complete appropriate receiving records;
- o check exiting trucks for leaks and open valves.

(9) The Maintenance Supervisor, Landfill Supervisor, and Solidification Supervisor are all responsible to the Operations Manager. The Maintenance Supervisor is responsible for maintaining all on-site vehicles and facilities. The Landfill Supervisor is responsible for scheduling and directing equipment operations in the secure disposal area and disposal cell construction. The Solidification Supervisor is responsible for scheduling and directing solidification equipment operations.

6.4 DESIGN AND OPERATION OF TREATMENT/SOLIDIFICATION FACILITIES

6.4.1 Design Criteria

The main criteria used in establishing the design of the Phase I and Phase II treatment/solidification facilities are discussed in the following subsections.

6.4.1.1 Raw Waste Load Capacity

On the basis of the waste inventory analyses presented in Chapter 3, the peak design capacity selected for the Phase I facility is 8,000,000 gallons of raw waste per year. For a 365 day per year operation, this is equivalent to about 22,000 gallons per day. The Phase II facilities are designed to accommodate a raw waste volume between 12,000,000 and 48,000,000 gallons per year. The 48,000,000 gallon per year processing rate represents a peak condition that could be achieved by extending the facilities' operating hours to three shifts per day, seven days per week. The selected long-term design average process rate for the Phase II facility is 24,000,000 gallons per year. This is equivalent to about 66,000 gallons of raw waste per day.

6.4.1.2 Hours of Operation

Depending on the average rate at which raw wastes are received, the Phase I or Phase II treatment/solidification facilities would be operated from one to three shifts per day, and from five to seven days per week. In the event that night time operation of the Phase I facility is necessary, suitable temporary lighting will be provided. The Phase II treatment/solidification operation will be conducted within a totally enclosed, yet well lighted, building. A guard will be on duty at all times.

6.4.1.3 Segregation of Reactive Wastes

Because of the often complex nature of the waste materials, an important part of any waste handling system is to ensure that only compatible waste streams are combined. Failure to effectively segregate wastes could result in reactions occurring with the associated hazards from generation of heat and/or potentially dangerous gases.

To eliminate this possibility, the waste streams will be segregated into the following three categories with separate reception facilities:

- wastes which liberate gases when acidified; (acid sensitive wastes)
- wastes which liberate gases when the pH is raised; (base sensitive wastes)
- wastes which do not liberate gases when the pH is adjusted. (pH insensitive wastes)

For both the Phase I and Phase II treatment/solidification facilities, a minimum of four waste reception basins will be provided so that two basins will be available to accommodate the particular category of waste received most frequently.

6.4.1.4 Intermediate Storage Requirements

Ideally, the freshly solidified and cured product should be taken from the processing building and placed in the secure disposal area. The climatic conditions which might prevent the direct placement of freshly processed product in the product storage area are extreme wet weather, snow cover, or excessive winds. During these periods, intermediate storage of the solidified product and/or unprocessed wastes will be necessary.

Based on local climatological data, such conditions and their immediate after effects on site operations would not normally exist for periods of more than about one week. Although the access roads from the solidification facilities to the secure disposal cells will be graveled, maneuverability on the way to and in the secure disposal cell will be difficult during such periods. To provide a factor of safety, it is assumed that these conditions could last for ten consecutive days. To provide increased flexibility and to ensure that the Phase II facility can accept raw wastes continuously, intermediate storage of product and/or unprocessed wastes is provided to accommodate the equivalent of up to eleven days of raw waste volume at the Phase II design average processing rate. The Phase I facility can accommodate the equivalent of up to eight days intermediate storage, assuming an average waste load equal to one-half the peak design rate.

6.4.1.5 Reagent and Reagent Storage

As was indicated in Chapter 3, the volume of solidifying reagents required for the process will typically be two times the volume of raw wastes received, depending upon the reagents used and the waste streams. The most common reagent will likely be cement kiln dust, with a most probable waste to reagent volume ratio of 1:2. For those wastes which generate gases with the basic kiln dust, fly ash is the preferred solidifying reagent. In accordance with the selected design average processing rates for the Phase I and Phase II facilities, the volume of reagent required will typically be about 220 cubic yards per day and 650 cubic yards per day, respectively.

Waste cement kiln dust is produced at several Colorado cement plants. The operation of those plants is such that prolonged capacity shortages are expected to be rare. Nevertheless, production cutbacks due to maintenance requirements or market conditions could occur. Consequently, there should be enough on-site reagent storage capacity to accommodate irregularities in delivery so as to permit continuous, uninterrupted operation of the facility. In general, about one to two weeks of reagent storage capacity is desirable. For the Phase I facility, temporary "Portabulk" containers will be employed for this purpose, whereas for the Phase II facility, storage silos will be provided.

6.4.2 Design Concept

Several options were investigated for blending and mixing the liquid industrial wastes with the solidifying reagent(s). The two basic types of mixing considered were:

- mechanical mixers;
- mixing in concrete tanks.

Several types of mechanical mixers were investigated including paddle mixers, ribbon mixers, kneaders, pug mills and tumble mixers. However, only the cement tumble-type mixer was considered worthy of detailed investigation.

After careful consideration, the use of tumble mixers was discarded. Withdrawal of the mixed product from the mixer would be problematical because of dryness and stickiness, and undesirable flushing water would be required. Also, the holding chambers for raw wastes would require considerable agitation to maintain fluidity which was considered a further disadvantage of the mechanical mixer option.

The mixing tank concept has been used in at least three facilities in the United States. Several chambers are provided so as to allow one cell to be worked while another is being emptied. As mentioned previously, the tanks are segregated as to the type of raw waste they receive so as to prevent intermingling of mutually incompatible substances.

The method of mixing in the tank is simply to add the solidifying reagent to the tank either before or after the addition of the raw waste. Mixing is then done with a hydraulic hoe excavating machine equipped with a specially designed bucket. Details of the reagent storage and handling systems, and the dust control and ventilation systems are given in Section 6.4.3.

The tanks are emptied with the same equipment that is used for mixing. The product is left in the tanks for curing and may also be left in the tanks in the case where intermediate storage is required. For the majority of the operating time, the product will be removed from the tanks and loaded directly into dump trucks for hauling to the secure disposal cell area. To provide additional storage, floor space within the Phase II treatment/solidification building has been made available for intermediate storage of the solidified product.

In one of the tanks within the Phase II treatment/solidification building, two 10,000 gallon waste detention compartments will be provided to conduct pretreatment operations for specific wastes, e.g., chemical reduction of hexavalent chrome wastes and subsequent chemical precipitation.

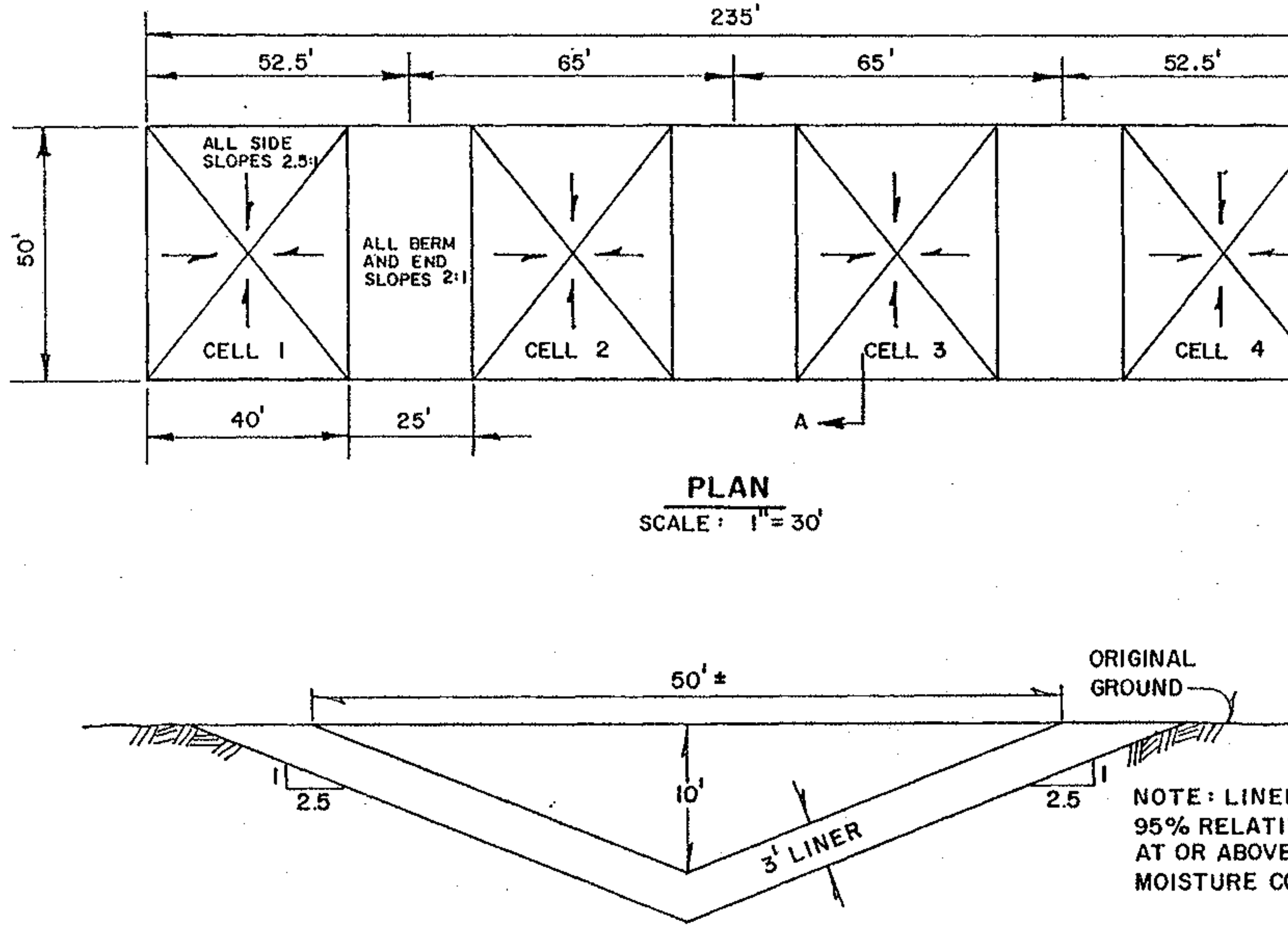
6.4.3. Details Of Processing Unit

6.4.3.1 Phase I Treatment/Solidification Facility

The Phase I solidification cells will be used until the Phase II treatment/solidification facility is operational. It is estimated that the Phase I facility will be used for 12 to 18 months.

The Phase I solidification facility consists of a rectangular earthen "V" bottom basin about 235 feet long by 50 feet wide with a maximum depth of about 10 feet. The basin is separated into four mixing cells by earthen cross dikes. The facility is provided with a compacted clay liner along the entire "V" bottom and ends. A plan and section of the facility is presented in Figure 6.4.1.

The side slopes of the "V" bottom are about 2.5:1 and the end slopes about 2:1 (horizontal to vertical). Both the bottom and end walls consist of three feet of compacted clay which constitutes the liner. The liner was compacted to 95% relative compaction (ASTM 1557) which provides permeabilities on the order of 1×10^{-8} cm/sec. based on laboratory testing. The intermediate cross dikes used to form the mixing pits have side



NOTE: LINER COMPACTED TO 95% RELATIVE COMPACTION AT OR ABOVE OPTIMUM MOISTURE CONTENT.

FIGURE Nº 6.4.1
PHASE I
SOLIDIFICATION MIXING CELLS
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slopes of 2:1 and are constructed of clay-rich soil. Excluding two feet of freeboard, the volume of each cell is about 3400 $ft.^3$.

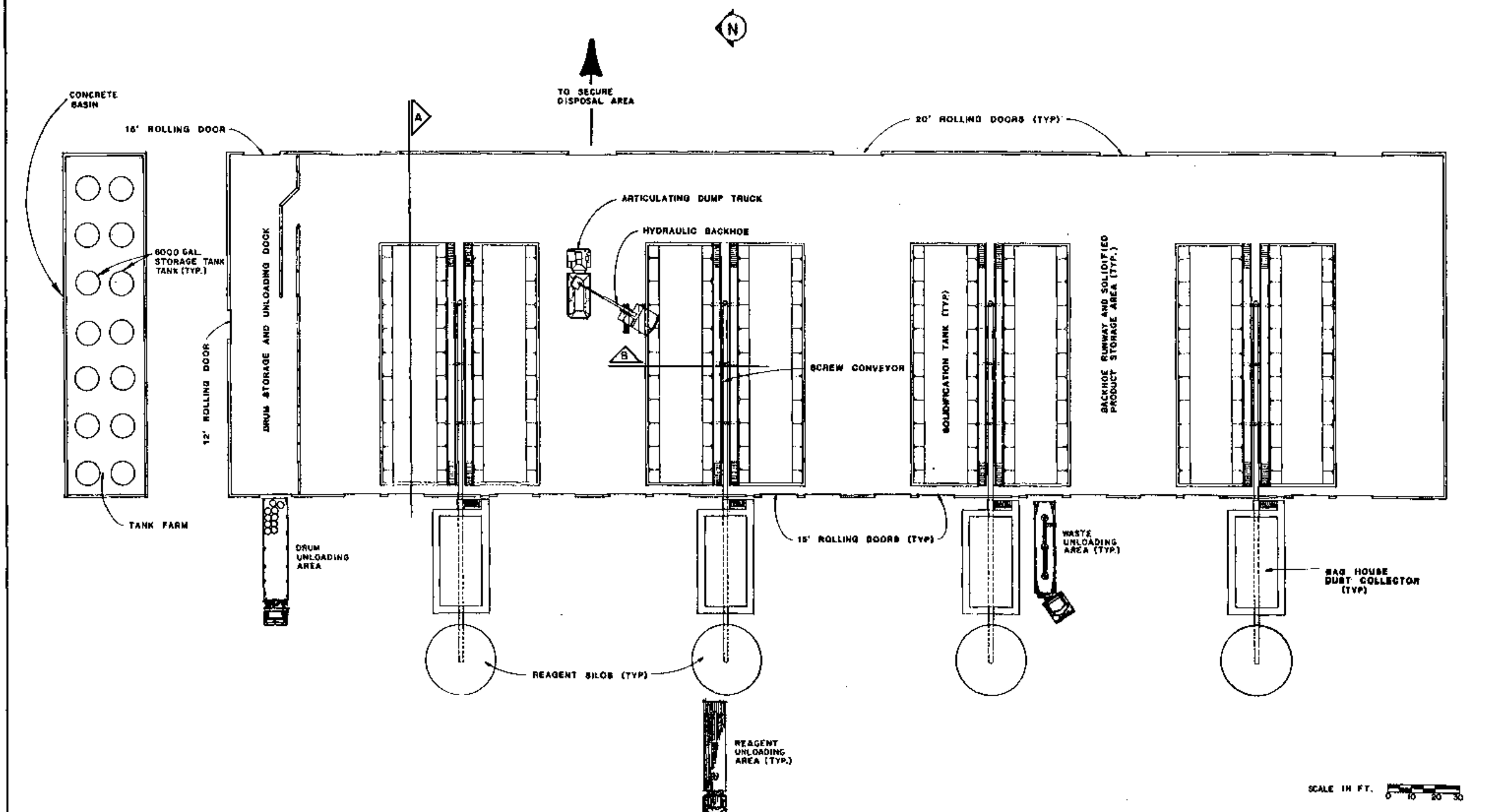
Seepage analyses performed on the facility liner indicate that it will contain the wastes longer than the expected life of the facility. The liner will be periodically inspected for deterioration, and repaired if necessary.

Wastes from the transport vehicles will be discharged directly to the solidification cells along with reagents and then mixed. A backhoe will be used for mixing and removal of the materials into off-highway dump trucks for transportation to the secure disposal cells. When the Phase II solidification facility becomes operational, the Phase I facility will be closed. All contaminated materials, including the liner, will be excavated and placed in a secure disposal cell in accordance with the closure plan presented in Section 7.7.

Provisions have been made to receive drummed wastes, as discussed in Section 7.9.1. After inspection, the drums will be emptied into appropriate tanks by use of a drum handler attachment for the front-end loader. Drums containing solids will be directed to the secure disposal cell following inspection. Empty drums will be crushed or shredded and then buried in the secure disposal cell.

6.4.3.2 Phase II Treatment/Solidification Facility

The overall layout of the Phase II processing area was shown in Figure 6.3.5. Conceptual drawings of the treatment/solidification building are presented in Figures 6.4.2, 6.4.3, and 6.4.4. It is estimated that approximately 8 to 12 months will be required for construction of the processing unit.



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HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

TREATMENT / SOLIDIFICATION BUILDING PLAN

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FIG 6.4.2
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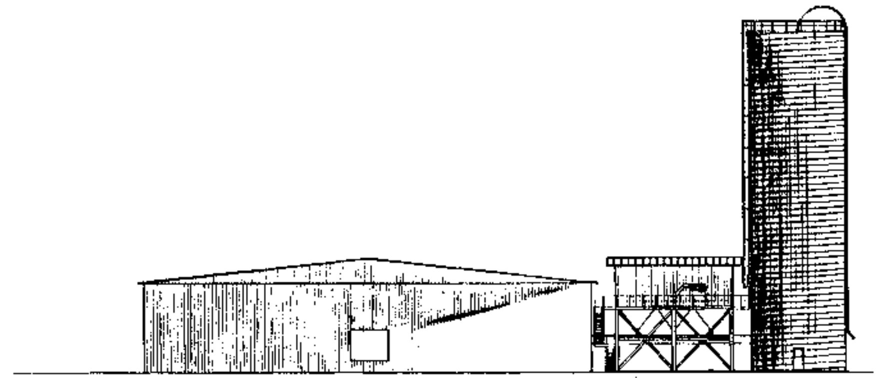
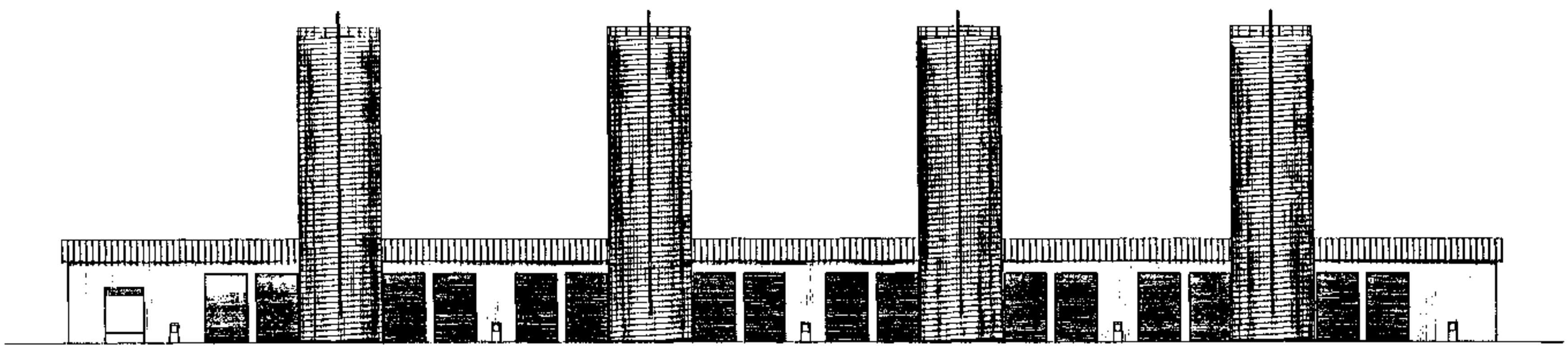


NORTH ELEVATION



WEST ELEVATION

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HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

TREATMENT / SOLIDIFICATION BUILDING
ELEVATIONS

SHEET NO. FIG 6.4.3 OF

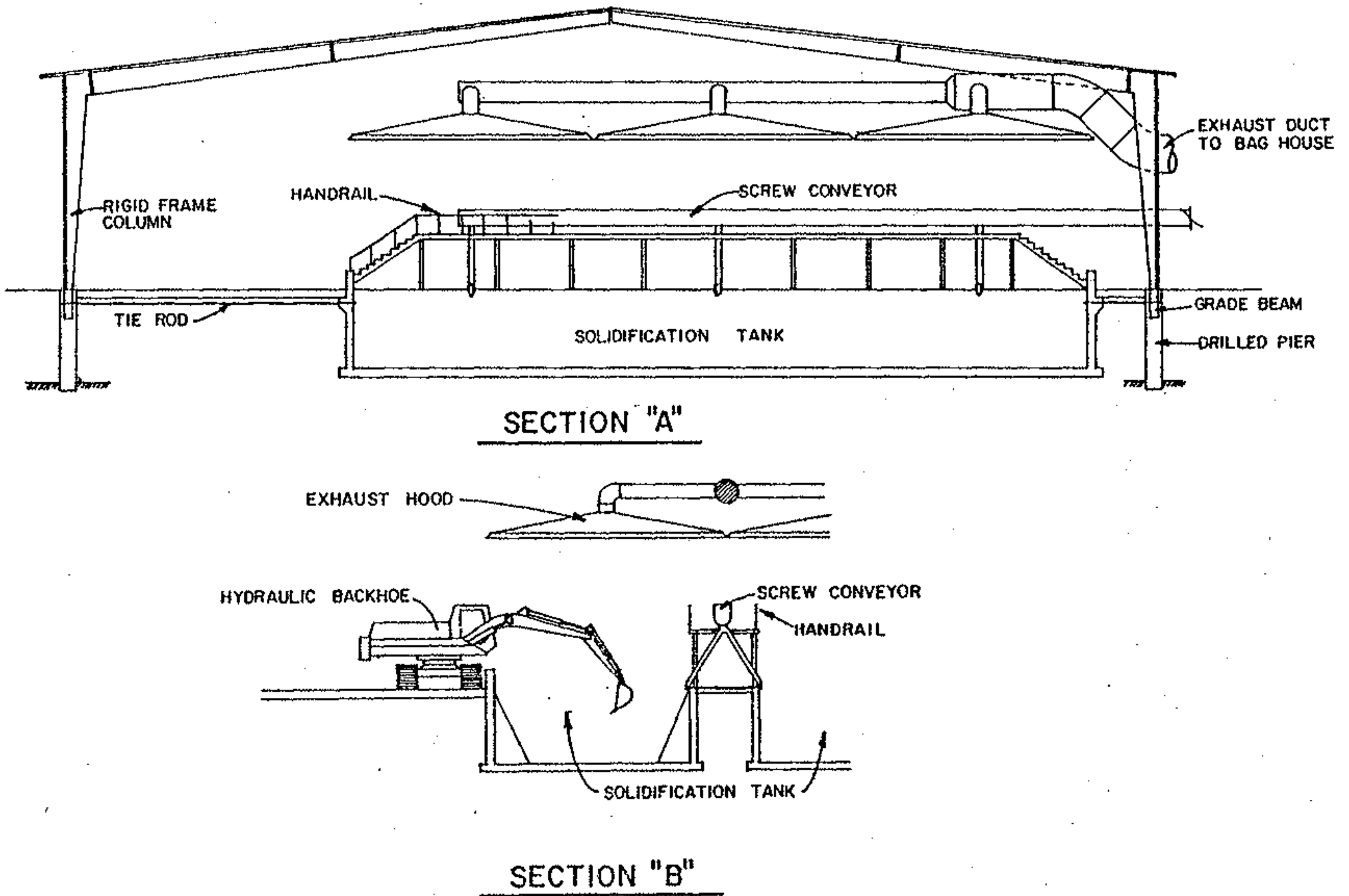

FIGURE №6.4.4

TREATMENT/SOLIDIFICATION BUILDING SECTIONS

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6.4.3.2.1 Mixing Tanks

Each of the treatment/solidification tanks will be approximately 100 feet long and 10 feet deep (excluding freeboard), and will have a volume of about 22,000 $ft.^3$. The depth and cross sectional area of the mixing tanks are determined by the capabilities of the hoe excavator to be used for mixing. The length of the tanks and the number of tanks then become mainly a function of the quantities of the various categories of wastes and the holding period desired in the tanks. At least two tanks have been provided for acid sensitive wastes (allows one for mixing while unloading or receiving in the other). Two or more tanks have been provided for pH insensitive wastes and one tank for base sensitive wastes.

For increased flexibility, one week of storage (calculated as solidified product) is provided in the mixing tanks for the design processing rate. This will provide for the majority of the intermediate product storage when access to the secure disposal cell area might be limited. In addition, however, approximately 14,000 square feet of floor space in the building have been provided for product storage. This provides an additional four days of product intermediate storage, if needed. The configuration shown is optimal with respect to minimizing equipment movements as well as reagent addition and dust collection.

The tanks will be constructed of reinforced concrete to suit the loadings intended. The operating floors between tanks will be of reinforced concrete with surface hardening to provide a good wearing surface. Tanks will have perimeter bumper guards to prevent equipment or trucks from slipping off the operating floor. A waterproofing system will be used for the tank walls and floors. These tanks will be routinely inspected and immediately repaired, if needed.

The delivery of raw wastes to the tanks will be either by vacuum type tank trucks or sludge boxes ("roll-off" containers). The contents of the sludge boxes will be dumped directly into the head ends of the chambers; tankers will either discharge directly into the tanks or from outside the building via hose connections. Provisions have been made to receieve drummed wastes at the north end of the building (refer to Section 7.9.1). After inspection, the drums will be emptied into the appropriate tanks from the floor by hand or by use of a drum handler attachment for the front end loader equipment or fork-lift truck. Drums containing solids will be directed to the secure disposal cell following inspection. Empty drums will be crushed or shredded and then buried in the secure disposal cell.

6.4.3.2.2 Mixing and Product Transportation Equipment

Mixing will be achieved using two diesel powered hydraulic hoe excavator machines. The machines will be fitted with specially designed buckets suitable for both mixing and loading of product into transportation trucks.

Trucks used to haul the solidified product from the processing building to the secure disposal cells will be heavy duty diesel powered dump haulers (e.g., articulated dump trucks). Two haulers will be sufficient to transport the product. Turn around times for trucks (loading, hauling, dumping, and returning) are estimated to be 20-30 minutes depending upon site conditions.

For those times when storage is required on the floor, two extra product handling steps will be involved: placing product on the floor and loading product from the floor to the hauler. During these infrequent situations, a diesel powered front end loader will be transferred from outdoor operations for use inside the building in order to build the piles and subsequently load trucks from the piles.

For working comfort, the cabs of all equipment working inside the building will be equipped with filtered fresh air intakes.

6.4.3.2.3 Process Building

The building housing the mixing tanks and floor storage will be of steel frame design with prefabricated metal panel siding and a mechanically seamed metal panel roof. The overhead doors will be heavy commercial industrial grade, and those on the front of the building will be equipped with manually actuated electric motor operators.

The entire concrete floor area will be curbed with concrete to 12-18 inches above floor level with vehicle access ramps at the doors. The floors will be sloped slightly towards the chambers to facilitate the clean up of any spilled materials within the building.

The building will have electric infrared heating above the floor area between the cells and at the cell tipping ends. This will eliminate ice on maneuvering areas and will generally keep frost out of the building.

Workers in the building will normally be in heated vehicular cabs, except for emergency maintenance for which portable heaters could be used if necessary.

The electrical classification in the building will be Class II, Division 2 (accumulations of dust that interfere with the safe dissipation of heat from electrical equipment). Therefore, all electrical equipment, heaters, outlets, conduits, etc., and the incandescent lighting system in the building will have to comply with the requirements of this classification (dustproof). Electrical service to the building will be 3 phase, 480 volts (to air exhaust fans, conveyor motors, heaters, etc.). The remainder of the power for lighting will be 110 volt, three phase, mainly for lighting. The electrical panels will be located adjacent to the processing building.

The reagent storage and handling system and the building dust collection and ventilation system are discussed under separate headings.

No fixed fire protection system is required in the building as the waste materials will be nonflammable. Hand held dry powder fire extinguishers will be provided for equipment. Extinguishers will be strategically located around the building. All rolling stock will be equipped with dry powder fire extinguishers on board. Further details on safety precautions are given in Chapter 7.

6.4.3.2.4 Reagent Storage and Handling

As noted previously, the primary reagents to be used will be cement kiln dust or fly ash. Vertical cylindrical silos with conical bottoms are suitable to handle either reagent. Four silos, approximately 30 feet in diameter and 90 feet total height, will provide sufficient reagent storage (11 day storage capacity at the design rate). The silos and the building will be finished to appear much like an agricultural installation. An elevation view of the processing facility was shown in Figure 6.4.3.

The silos will receive the reagent from pneumatically off-loaded delivery trucks. Each silo will be equipped with its own baghouse dust collector to handle offloading exhaust air. These collectors will be automatically shaken into the silos after deliveries. Each silo will also be equipped with high and low level alarms and intermediate level indicators.

The bottom rotary valve feeders will be interlocked with the reagent conveyors serving a pair of chambers. The reagent conveyors will be the screw type with three draw off gates at 25 foot centers. The gates will be actuated by the plant operator. Conveyor maintenance can be carried out from the walkway provided (see Figure 6.4.4).

Only two chambers will be mixed at any one time at design capacity. One baghouse type dust collector per pair of mixing chambers will be provided, as shown in Figure 6.4.2.

6.4.3.2.5 Dust Collection and Ventilation Systems

The dust collection system will utilize hoods over each basin whereby a 75 ft./min. capture velocity across the face of the mixing chambers will be achieved. Separate headers will serve each pair of adjacent chambers and will be connected to a single baghouse type dust collector. Each header will have its own separate damper. Header velocity will be high so as to prevent dust fallout and subsequent plugging in the ducts. A velocity of 5,000 ft./min. or higher will be provided.

Each chamber, when being worked, will require approximately 85,000 cu.ft./min. of air for dust collection. The baghouse air-to-cloth ratio will be approximately eight. The removal efficiency of the baghouse is anticipated to be greater than 99%. Dust will be collected off the filter cloth media in a hopper beneath the bag-house collector, which will be emptied by gravity to the same conveyor system utilized for the silo reagent feed system.

Adequate fresh air will be brought into the building via gravity louvers at the front of the building to maintain all air contaminants in the building to below their threshold limit values (TLVs). A large volume of air will be exhausted from the building by the dust collectors. Further dilution, however, will be required to meet the appropriate air standards, as discussed below.

The most critical source of air contaminants will be the diesel exhaust from the equipment and the trucks working in the building. The parameter which determines the dilution rate required for the diesel exhaust was found to be oxides of nitrogen which can run as high as 1,000 ppm in the exhaust gas while their TLV is 5 ppm (as NO_2).

The air movement created by two dust collection systems, each rated at 85,000 cu.ft./min., will provide slightly less than half the required dilution of the engine exhaust gases assuming prolonged periods of maximum operation. To provide the additional air movement required, four 60,000 cu.ft./min. exhaust fans (including one spare) will be provided in the ceiling. The resulting air change will be approximately nine air changes per hour, considering the entire building volume.

6.5 DESIGN AND OPERATION OF THE SECURE DISPOSAL CELLS

The solidified wastes will be buried in secure disposal cells located adjacent to the Phase I and Phase II solidification facilities. The design of these cells incorporates proven engineering criteria in addition to the naturally favorable geologic conditions at the project site. The combination of suitable geology and sound engineering design will provide a facility that will meet or exceed all applicable regulatory requirements. These two key facets of the secure disposal cells are discussed below.

6.5.1 Site Geological Conditions

The detailed geological and hydrogeological site characterization was presented in Section 5.4. There it was concluded that the site is geotechnically suitable for the proposed facility, as summarized below.

6.5.1.1 Subsurface Soils

The characterization showed that the site is located on top of a geologic unit known as the Pierre Shale which is about 4,300 feet thick. Table 5.4.1 (presented in Section 5.4) indicated that this is the most suitable geological formation in the Denver Basin for developing a safe waste disposal facility. The Pierre Shale at the site has weathered to varying degrees. For discussion purposes, the subsoils have been divided into three major soil groups:

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The clay content, moisture content, and dry density generally increase with depth, and in most borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec; pH values ranged from 7.9 to 8.2. Based on the cation exchange capacity values (see Appendix G) and the geologic environment, the clay appears to be an illite. No x-ray diffraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec. range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1 x 10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it will meet or exceed the requirement as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface except in test holes G1, G2, and G3, which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4 x 10^{-7} cm/sec. and a low of "completely impervious" (no flow could be induced).

6.5.1.2 Groundwater

No major groundwater aquifers underlie the site, nor are any exposed at the surface. However, due to the very low permeability of the Pierre Shale, perched water tables typically occur in the alluvial fill drainages. Groundwater of this type was encountered in the drainage swails outside the perimeter of the secure disposal cell area at depths ranging from 35 to 45 feet. Recharge to these areas comes from vertical infiltration in the immediate drainage area.

A minor amount of deep groundwater exists at the site in the Pierre Shale bedrock. Recharge probably comes from horizontal flow through the small fracture networks. Groundwater of this type was encountered in two deep borings at depths of 182 feet and 99 feet, both corresponding to an elevation of about 4,700 feet. Pump tests indicated virtually dry well conditions, i.e., 0.16 gallons per minute.

6.5.2 Secure Disposal Cells

6.5.2.1 Description

Presented in Figures 6.5.1 and 6.5.2 are plan and section views, respectively, of the standard size secure disposal cell. As can be seen there, typical cells will have surface dimensions of 600 feet by 300 feet and will be about 30 feet deep. The sides will be sloped at 2:1 horizontal to vertical, and the bottom will slope from one end to the other at 1%. Compacted clay liners will be installed on the bottom and sides of the cell to further immobilize the solidified product. When a particular cell is in use, a road constructed over the wall liner will provide access to the bottom of the cell (not shown). A leachate collection/detection system will be installed in the bottom of each cell for removal of leachate, even though leachate formation is unlikely.

The solidified wastes will be placed in the cells in lifts of varying thicknesses (four to eight feet) and compacted with a bulldozer. The surface of each lift will be covered with six inches of clay on a daily basis. This procedure will be repeated until the cell is filled to within one foot of the ground surface. Wastes placed within any given layer may be separated, depending on their compatibility, by clay partitions about two feet wide. When the capacity of a cell is exhausted, a three foot compacted clay cover (cap) will be placed on the cell. A minimum of 6 inches of topsoil will then be placed over the cap to provide a 3%

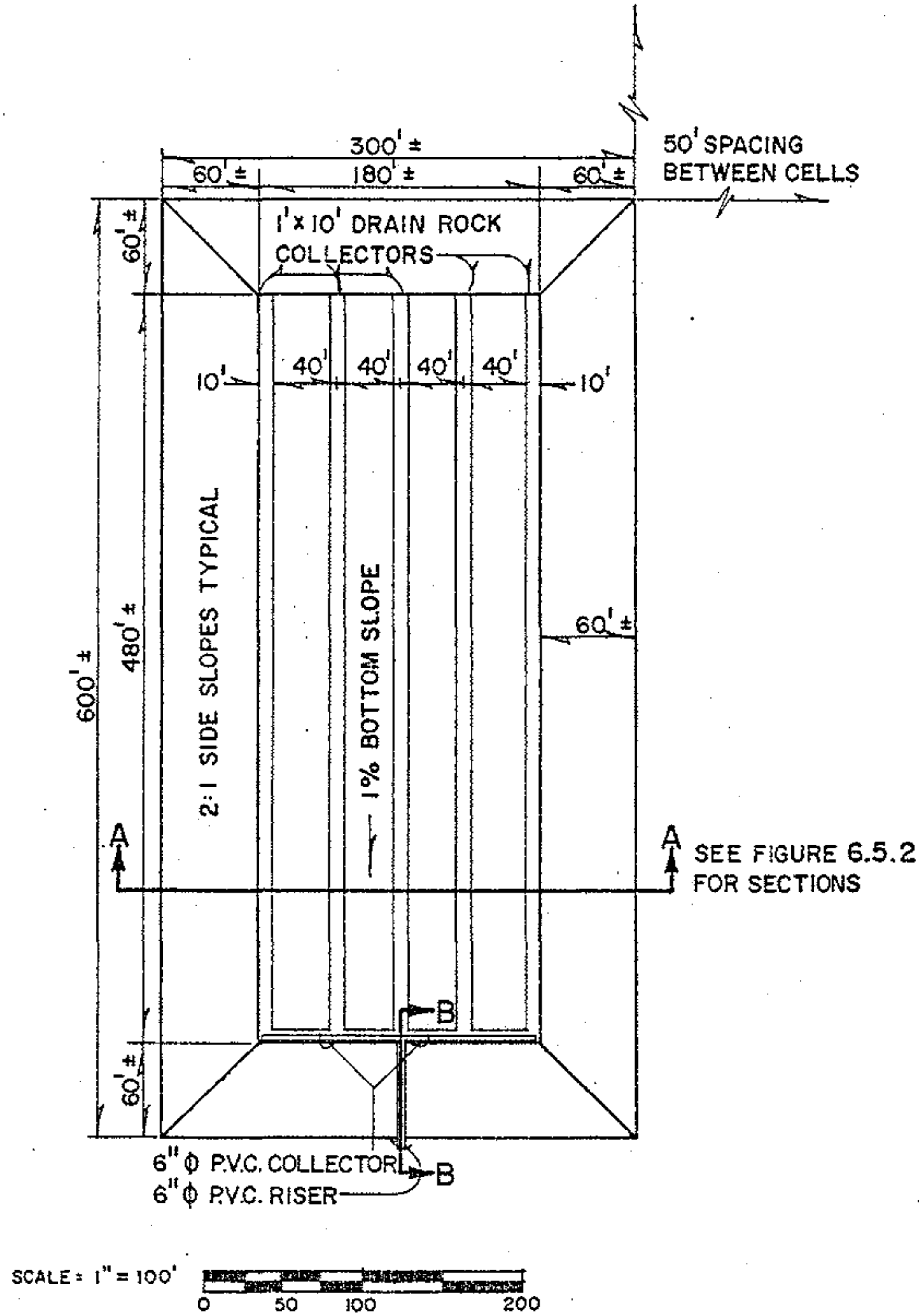

FIGURE № 6.5.1

STANDARD SIZE SECURE DISPOSAL CELL -- PLAN

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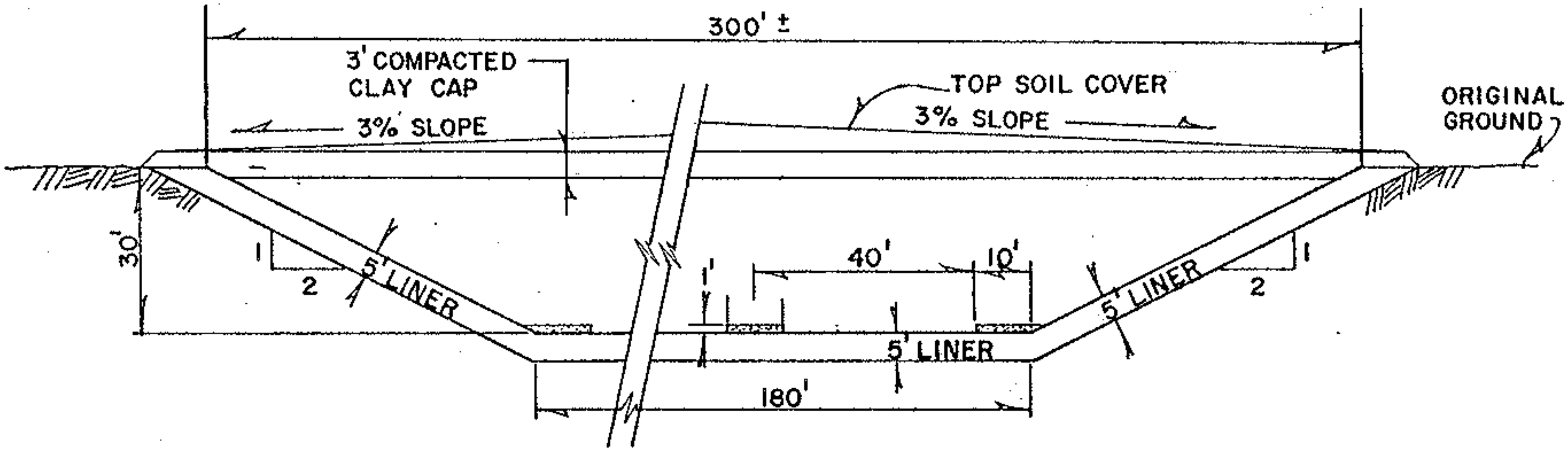
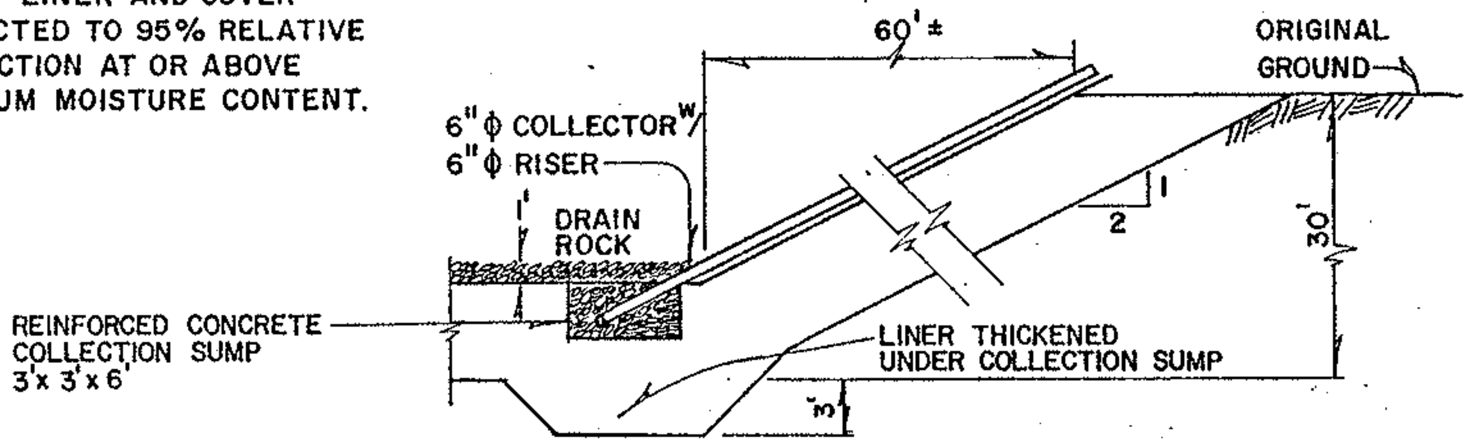


CELL-SECTION A-A

SCALE: 1" = 30'

NOTE: LINER AND COVER COMPACTED TO 95% RELATIVE COMPACTION AT OR ABOVE OPTIMUM MOISTURE CONTENT.



LEACHATE COLLECTION DETAIL-SECTION B-B

SCALE: 1" = 10'

FIGURE № 6.5.2
STANDARD SIZE SECURE DISPOSAL CELL-SECTION
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slope for drainage and to allow revegetation. During the operation of a secure disposal cell, berms will be constructed around the cell to divert surface run-off from outside the area to the non-contaminated surface water collection ponds.

Some important statistics for the standard sized cell are summarized in Table 6.5.1 below.

TABLE 6.5.1

STATISTICS OF STANDARD SIZED SECURE DISPOSAL CELL

Description

1. 300' wide x 600' long x 30' deep (with liner in place)
2. Side walls sloped at 2:1 horizontal to vertical
3. 5' thick wall and floor liner
4. 3' thick cap (minimum)
5. 48" per lift, including 6" of cover (alternatively, 96")

Volume Statistics

Total excavation per cell (including overcut for liners)	= 185,000 cubic yards
Empty volume (with liners in place)	= 150,000 cubic yards
Volume of floor liner	= 16,000 cubic yards
Volume of wall liner	= 19,000 cubic yards
Volume of intermediate cover	= 15,000 cubic yards
Volume of cap	= 20,000 cubic yards
Useable volume for solidified waste	= 125,000 cubic yards
Volume of overburden*	= 125,000 cubic yards

*Note: Volume of overburden includes that portion of the cell cap which extends above the original ground surface.

6.5.2.2 Liner

The liners of the secure disposal cell will consist of five feet of clay compacted at or above optimum moisture content to 95% of Modified Procter maximum dry density per the ASTM D1557 test method. The on-site clays meeting the following criteria are suitable for liner construction:

greater than 80% passing the No. 200 Sieve, the Liquid Limit greater than or equal to 30, and the Plasticity Index greater than or equal to 7. Laboratory test results from on-site clays compacted to the above compaction criteria indicate the liners will have a permeability on the order of 1×10^{-8} cm/sec.

In order to evaluate the performance of the liner, a seepage analysis was conducted using the method of McWhorter and Nelson, of Colorado State University, as presented in their paper "Unsaturated Flow Beneath Tailing Impoundments" (in U.M.T.M., Vol. I, Proceedings of Symp., Nov. 20, 1978). Their procedure was developed for analyzing flow through partially saturated porous media. It is to be emphasized that the leachate collection system prevents the formation of a fluid head, in the unlikely event that leachate should occur. Without a fluid head, no seepage can possibly occur. Consequently, in order to perform the seepage analysis, three unrealistic assumptions were necessary: (1) that leachate would occur; (2) that the leachate collection system would fail; and (3) that a one foot fluid head existed over the bottom liner for a six-month period. Using the measured liner permeability of 1×10^{-8} cm/sec, the analysis indicated that for these conditions the maximum seepage would be one foot below the liner bottom.

6.5.2.3 Cap

The top of each secure disposal cell will receive a three foot clay cover (cap) compacted to 95% relative compaction which will achieve permeabilities similar to the liner. In addition, topsoils will be placed over the cap to form a mound with a minimum 3% slope, thereby promoting surface drainage. The top will be planted with suitable vegetation to minimize erosion. Rainfall run-off from the surface of the capped cells will be collected in the non-contaminated surface water collection ponds.

6.5.2.4 Leachate Collection/Detection

Leachate should be virtually non-existent because of the nature of the solidified product, the absence of groundwater, and the installation of at least three feet of compacted clay cover over the top of the cell. However, in the unlikely event that leachate forms, a collection/detection system will be provided in each cell. As was illustrated in Figure 6.5.2, the system will consist of one foot thick by ten foot wide drain rock (gravel) collectors spaced about 40 to 45 feet apart longitudinally along the bottom. At the low end, a similar drain blanket will be installed across the cell with a six inch diameter plastic drain pipe in it. At the center, it will be connected to a collection sump with a six inch diameter plastic pipe riser to the ground surface so any accumulated leachate can be pumped from the collection system to the contaminated water holding pond for evaporation and/or for subsequent conveyance to the treatment/solidification facilities.

6.5.2.5 Construction and Operating Plan

The following steps will be employed during construction and filling of a typical secure disposal cell:

1. The area will be stripped of usable topsoil. This soil will be stockpiled for future use on completed cells.
2. The cell will be excavated to the required depth and width, with overburden placed in predesignated areas.
3. The five foot thick bottom and side liners will then be constructed.
4. The gravel leachate collection/detection system will be installed on top of the bottom liner.

5. The necessary surface drainage control facilities will be constructed concurrent with the above items.

6. The wastes will be placed at the high end and worked toward the low end. The wastes will be deposited from dump trucks and spread with a dozer.

7. A six-inch thick layer of clay will be maintained over the top of the waste surface. It will be shaped and compacted with a dozer. This process will be repeated as the cell is filled.

8. The top of the cell will have a three foot thick compacted clay cap. Additional compacted soil will be placed over the cap to form a crown with 3% slopes to promote surface drainage.

9. The final crowned surface will be vegetated to resist erosion.

As the filling of one secure disposal cell progresses, excavation of the next cell will begin so that space is available for solidified wastes at all times.

6.6 DESIGN OF SURFACE DRAINAGE COLLECTION FACILITIES

Surface drainage has been separated into three categories: non-contaminated, contaminated, and potentially contaminated. The collection ponds for the non-contaminated surface run-off were discussed in Sections 6.2.3 and 6.2.7.2.2. They will be constructed to the same specifications as the standard sized secure disposal cells except that they will be shallower and a leachate collection system will not be employed. The designs for the contaminated water holding pond and the potentially contaminated holding water collection pond are discussed below.

6.6.1 Contaminated Water Holding Pond

The location of the holding and evaporation pond for contaminated water was illustrated earlier in Figures 6.2.2 and 6.3.3. This pond is under construction and will be utilized for both the Phase I and Phase II levels of operation. It is approximately 250 feet by 150 feet and 10 feet deep. A plan view is presented in Figure 6.6.1, and a section view, with leachate collection detail, is presented in Figure 6.6.2. Two feet of freeboard is provided for the pond. In the unlikely event that the level of the pond gets too high, liquid will be drawn off, treated at the solidification facility, and the solidified product placed in a secure disposal cell.

The water conveyed to the contaminated water holding pond will consist of the folllowing:

- run-off from the area immediately adjacent to the secure disposal cell in use (which will be surrounded by an earth berm);
- leachate collected from the leachate collection/detection system of the secure disposal cells (should leachate occur), the potentially contaminated holding pond, and the contaminated holding pond;
- run-off from access routes to secure disposal cells;
- external truck wash water, when required.

The pond bottom will have a longitudinal slope of about 1%. The pond liner will consist of compacted clay with a leachate collection/detection system sandwiched near the middle. Two feet of compacted clay will be installed on the sides and bottom. Across the bottom, 12 inches of drain rock (gravel) will be placed for the leachate collection/detection system. At the lower end of the pond, six-inch diameter plastic drain pipe will be placed across the width of the gravel. It will be connected to a drainage sump in the middle. A six-inch diameter plastic pipe riser laid against the slope and extended above the ground surface will be used to drain the system. An additional three feet of clay will be compacted on top of the leachate collection system to complete the liner system. All compaction will be performed with the soil at or above optimum moisture

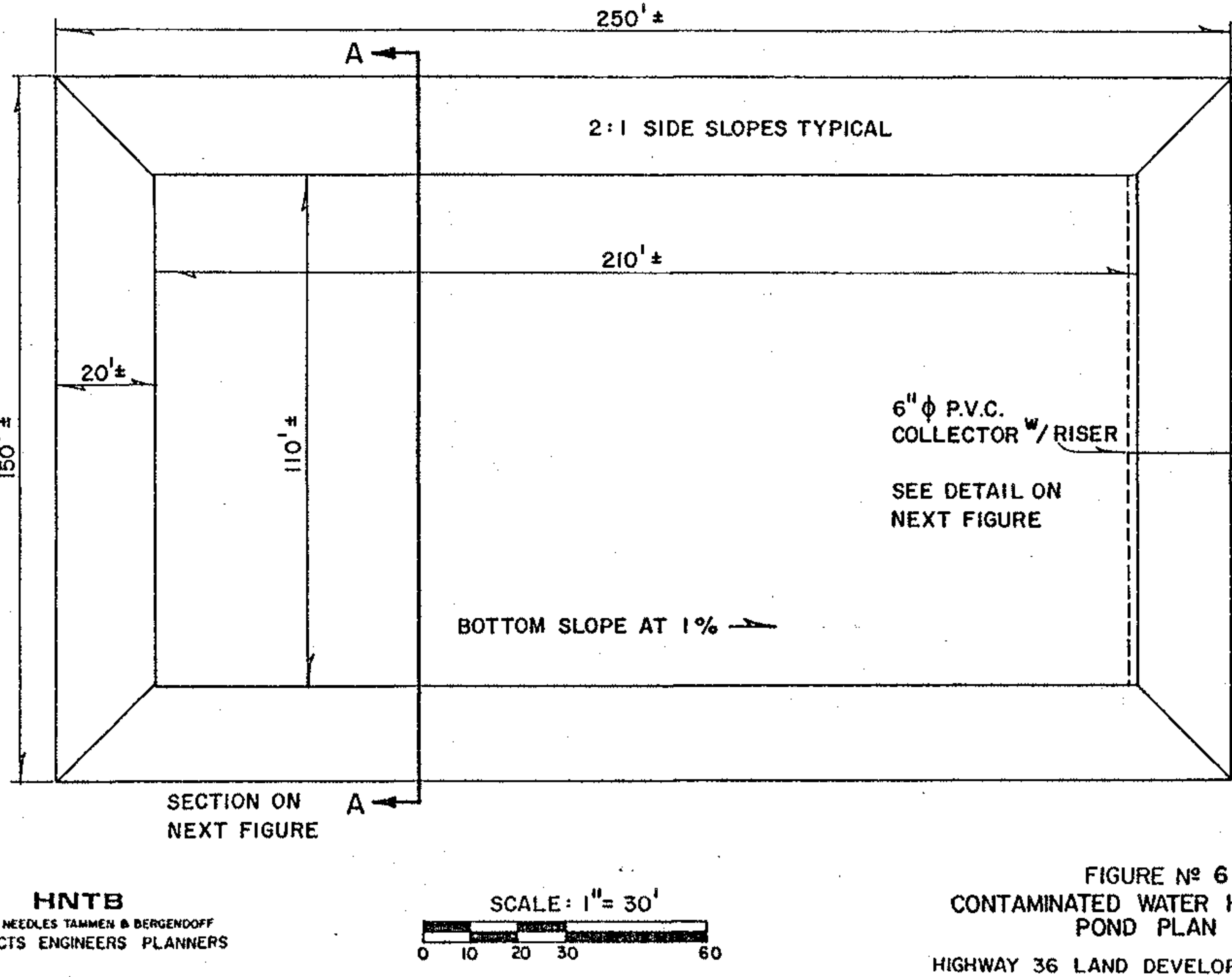

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FIGURE Nº 6.6.1
CONTAMINATED WATER HOLDING
POND PLAN

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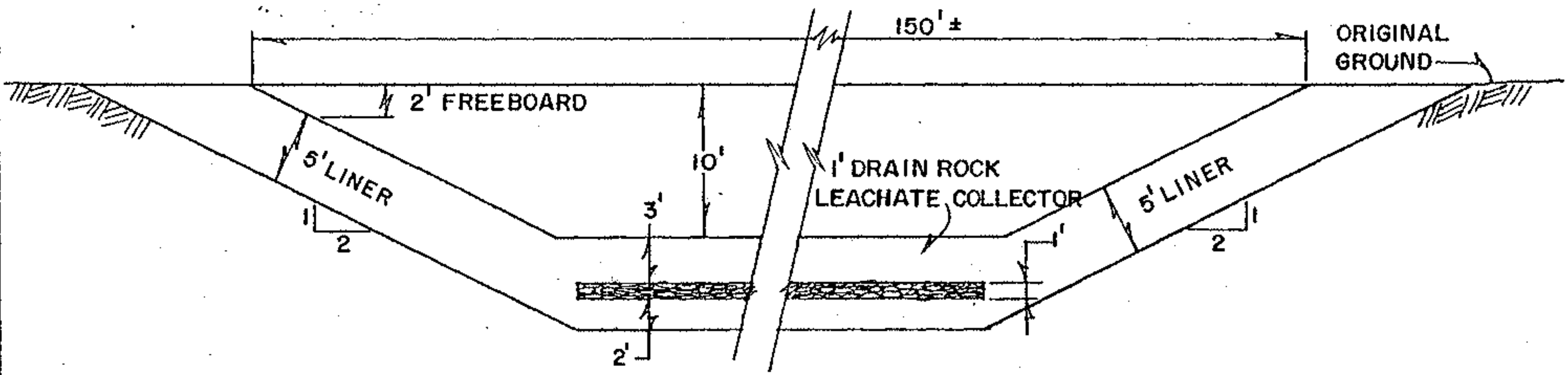
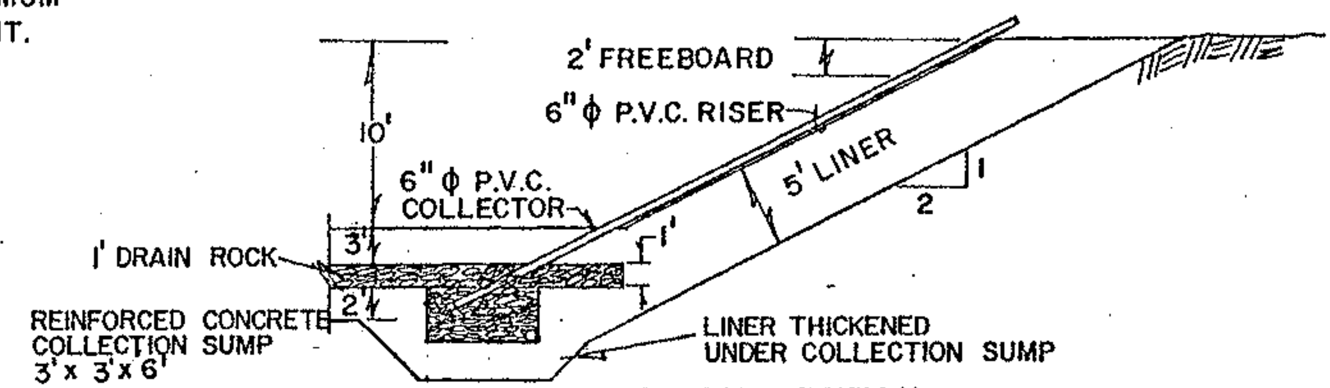
ADAMS CO., COLORAI



SECTION A-A

SCALE: 1" = 10

NOTE: LINER COMPACTED TO 95% RELATIVE COMPACTION AT OR ABOVE OPTIMUM MOISTURE CONTENT.



LEACHATE COLLECTION DETAIL

SCALE: 1" = 10'

0 5 10 20

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FIGURE Nº 6.6.2
CONTAMINATED WATER HOLDING POND — SECTION AND DETAILS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

content and with sufficient effort to achieve 95% relative compaction to achieve a permeability of about 1×10^{-7} cm/sec or less. The sides will be lined with five feet of compacted clay to the same requirements as the bottom liner.

Construction of the contaminated water holding pond will involve the following steps:

1. The area will be stripped of usable topsoil. The soil will be stockpiled for future use on completed cells.
2. The impoundment will be excavated to the required depth and width.
3. The pond bottom will be sloped from one end to the other at a 1% grade.
4. The first clay liner will be compacted in place on the bottom and side walls.
5. The gravel leachate collection/detection system will be installed on the bottom.
6. The second or top clay liner will be compacted in place on top of the leachate collection/detection system.
7. The remainder of the wall liner will be installed.
8. The impoundment will be ready for use.

A seepage analysis (using the method discussed in Section 6.5.2.2) was conducted on the liner in which an average liquid head of six feet was assumed. Using the measured liner permeability of 1×10^{-8} cm/sec, the analysis indicated that seepage would travel a maximum of eight feet below the bottom of the lower liner in 20 years.

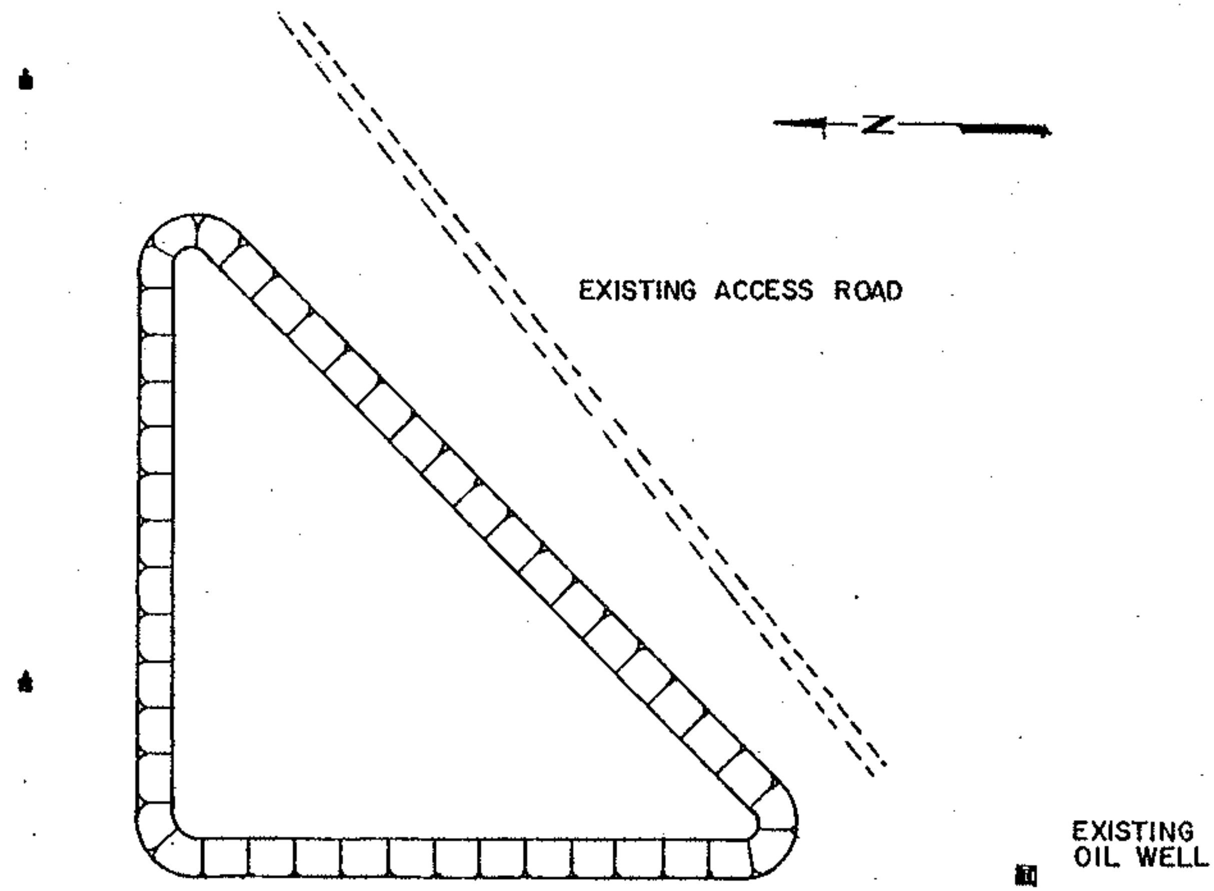
6.6.2 Potentially Contaminated Water Holding Pond

The traffic pattern in the Phase II processing area has been specifically designed so as to separate off-road vehicles (e.g., articulating dump trucks) from on-road vehicles (e.g., waste transport trucks). In this manner, the rainfall run-off from portions of the paved processing area will be non-contaminated and thus will be drained to the non-contaminated surface water collection ponds. However, run-off from certain portions of the paved area might occasionally be degraded, e.g., in the general area around the tank farm and the solidification facilities. Consequently, a pond will be constructed to collect run-off from these potentially contaminated surfaces. Wherever possible, the runoff will flow by gravity into this pond using earth berms to control its direction. Those areas that cannot be drained to the pond by gravity will be provided with a collection sump and pumping arrangement. In order to minimize the size requirement for this pond, the roof run-off from the major buildings will be discharged to the non-contaminated water holding ponds. Further, the apron run-off immediately around the solidification building and the maintenance building will be directed to the solidification basins.

The location of this pond was illustrated earlier in Figure 6.3.2 and, with the exception of surface dimensions, it will be constructed to the same specifications as the contaminated water holding pond illustrated in Figures 6.6.1 and 6.6.2. A plan view is presented in Figure 6.6.3. The surface area and volume of this pond will be about 58,000 square feet and 3,500,000 gallons, respectively. It is anticipated that these dimensions are sufficient to evaporate all potentially contaminated run-off. However, if needed, a similar shaped pond will be constructed in the adjacent area reserved on the other side of the existing oil pipline.

6.7 DISPOSAL FEES

Costs for chemical waste treatment/solidification and disposal are a function of several variable factors. These include type of waste,



POTENTIALLY CONTAMINATED WATER HOLDING POND PLAN

SCALE: 1" = 100'

0 50 100 200

FIGURE Nº 6.6.3

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special handling requirements, treatment requirements, quantity and type of reagent employed, and resultant volume of the solidified product. Because processing and disposal costs per unit volume of raw waste are quite variable, the user costs must be determined on a case-by-case basis.

Processing and disposal costs are also subject to changes which are independent of the particular raw waste. Although the ever changing costs for labor and materials are somewhat predictable, other important costs are non-predictable. For example, costs for the stringent operational controls and monitoring programs (discussed in Chapter 7) could significantly increase in the event that new additional regulatory requirements be developed.

In spite of the variability and uncertainty of cost related factors, the processing and disposal fees for the facility addressed herein will be consistent with nationally reported price ranges. According to a recent EPA sponsored survey (U.S. EPA, "Hazardous Waste Generation and Commercial Hazardous Waste Management Capacity - An Assessment," SW-894, Dec. 1980), actual reported prices for chemical processing ranged from 6¢ to 200¢ per gallon; and prices for disposal in secure landfills ranged from 8¢ to 152¢ per gallon. It is noted that these prices are in terms of 1980 dollars and exclude transportation costs.

CHAPTER 7

OPERATIONAL CONTROLS AND MONITORING

7.1 INTRODUCTION

The implementation of the Resource Conservation and Recovery Act, or RCRA, (Public Law 94-580) resulted in the promulgation of numerous requirements governing the operation of hazardous waste treatment, storage, and disposal (TSD) facilities. The majority of these requirements were published in the Federal Register, Vol. 45-No. 98, on May 19, 1980. Various additional requirements, and modifications to those previously published have been presented in other issues of the Federal Register. Additional requirements and modifications appearing in the Federal Register through February 5, 1981 have been incorporated into this chapter.

At the present time, the applicable requirements for the operation of this facility are the interim status standards for owners and operators of hazardous waste treatment, storage and disposal facilities. These standards are contained in Chapter 40 of the Code of Federal Regulations, Part 265, Subparts A through R (40 CFR 265.1-265.430) and are included in Appendix H. As specified in the recently promulgated RCRA regulations, interim status standards are applicable to all TSD facilities (meeting certain requirements) until administrative action is taken on the individual facility's application for a final permit by the United States Environmental Protection Agency (EPA).

The purpose of this chapter is to describe the proposed operation of this facility and to demonstrate how the facility will conform to the interim status standards. To do this, various plans and procedures are presented. For the convenience of reviewers of this chapter, this presentation is arranged in the same sequence and with the same headings as the published standards. Because each of the chapter sections must be written to stand on their own, some of the material has been presented several times, as required, to make each major section essentially a complete and separate document.

The interim status standards do not apply to certain specific hazardous waste disposal activities such as ocean disposal, underground injection, treatment at a publicly-owned treatment works, waste reclamation, generator storage for less than 90 days and several others. None of these exemptions are relevant to this facility. The only other exemption to the interim status standards is for facilities located in a state which has a RCRA hazardous waste program authorized by EPA to operate in lieu of the Federal program. Since Colorado does not presently have an authorized program, this exemption does not apply.

7.2 GENERAL FACILITY STANDARDS

The general facility standards are contained in 40 CFR 265.10 to 265.17. These standards cover a series of requirements, including facility identification number, general waste analysis, security, general inspection requirements, personnel training, and general requirements for ignitable, reactive, or incompatible wastes. Compliance procedures for these standards are contained in the following subsections.

7.2.1 Identification Number

The owner or operator of every hazardous waste treatment, storage, or disposal facility must apply to EPA for a permanent EPA identification number. This identification number must be used in all subsequent permit applications and related correspondence, annual reporting functions, and hazardous waste shipping documents.

A notification of hazardous waste activity (EPA Form 8700-12) was completed by the Highway 36 Land Development Company and submitted to EPA, in accordance with Section 3010 of RCRA and is contained in Appendix B. This notification resulted in issuance of EPA Identification Number COT 090010620 to this facility (Appendix C).

7.2.2 General Waste Analysis

The district manager will establish a program to determine the specific physical and chemical properties of hazardous wastes destined for treatment, storage, or disposal at this facility. The purpose of this waste analysis program is to:

- verify the identity of incoming wastes;
- promote safe storage and handling of the wastes; and
- permit proper treatment and disposal in accordance with all pertinent regulations.

The following elements constitute the waste analysis program. Figure 1.4, previously presented, illustrated this plan schematically.

1. Prequalification of Waste Streams

   Waste streams proposed for treatment, storage or disposal at this facility will first undergo a preliminary screening process by BFI to determine that the characteristics of candidate waste streams are compatible with the capabilities of the facility. This prescreening process will involve laboratory analysis of a representative sample of the waste at BFI's laboratory in Houston, Texas or submission of independent laboratory analyses by the generator, and when appropriate, could include review of chemical manufacturer's specifications or published data on these or similar wastes.

2. Waste Characterization by Generator

   The generator will be required to submit a completed BFI waste characterization data sheet as shown in Figure 7.2.1.

3. Decision to Accept or Reject Candidate Waste Stream

   A recommendation to accept or reject a candidate waste stream will be made by BFI's technical staff. This recommendation will

FIGURE 7.2.1

Browning-Ferris Industries

CHEMICAL WASTE SYSTEMS

BFI-Waste Code No. ____________
EPA-Waste Code No. ____________
State Waste Code No. ____________
Generator No. ____________

WASTE CHARACTERIZATION DATA

General Directions: In order for us to determine whether we can lawfully and safely transport, treat, and dispose of your waste material, we must obtain certain information about the chemical and physical properties of the waste and its chemical composition. Please be complete in your answers; if your response is "none" or "not available", so indicate. Answers must be printed in ink or typewritten and the completed form must be signed. Please make a copy of this form for your records.

(1.) Generator Name: ____________

(2.) Generating Facility Name/Address:

____

____

____

____

(3.) Authorized Company Representative: ____________ Title ____________

(4.) Phone Number: ____________

(5.) Emergency Contact

____________ Title ____________

Phone Number ____________

(6.) General Description of The Waste:

____

____

____

____

(7.) Process Generating Waste: ____________

____

(8.) Anticipated volume ____________ ☐ Gallons ☐ Tons ☐ Cubic Yards ☐ Drums, or ☐ Other ____________
Per: ☐ Day ☐ Week ☐ Month ☐ Year, or ☐ Other ____________

(9.) Waste Properties:

(a.) Vapor Pressure (in mm of Hg @ 25 °C) ____________
(b.) Flash Point ____________ °C ☐ Closed Cup ☐ Open Cup
(c.) Phases/layers: ☐ Single ☐ Bilayered ☐ Multilayer
(d.) Physical State @ 20°C: ☐ Solid ☐ Liquid ☐ Semi Solid ☐ Powder ☐ Other ____________
(e.) Solubility (g/100 g H_2O) @ 20 °C: ____________
(f.) pH ____________
(g.) Density: ____________ ☐ lb/ft^3 ☐ lb/gal. ☐ Other ____________
(h.) Odor: ☐ Strong ☐ Mild ☐ None
(j.) Reactivity.

Hydrophoric	☐ Yes	☐ No	Thermally Sensitive	☐ Yes	☐ No
Pyrophoric	☐ Yes	☐ No	Shock Sensitive	☐ Yes	☐ No
Autopolymerizable	☐ Yes	☐ No	Explosive	☐ Yes	☐ No

(10.) Waste composition (with ranges — indicate % or ppm.)

ORGANIC	INORGANIC

Attach Additional Pages If Necessary

(11.) Does this waste contain biological materials, pathogens or etiological agents? ____________ If yes, please specify.
(12.) Have you obtained toxicity studies of this waste material? ____________ If so, please attach a copy of the results.
(13.) Required personnel protective equipment & procedures. (Please attach additional pages if necessary.)

I hereby certify that the above and attached description is complete and accurate to the best of my knowledge and ability to determine, that no deliberate or willful omissions of composition or properties exists, and that all known or suspected hazards have been disclosed.

Generator's authorized Signatory

____________ Title ____________ Date ____________

Confidentiality Agreement: As consideration for the Generator's release of the above information and any other supplemental data, the undersigned agrees to treat such information as confidential property and will not disclose such information to others except as is required by law, and in such circumstances only after first giving notice to the Generator.

By ____________
Name

____
Title

be based on the facility's capabilities, following review of the data obtained by the procedure outlined in #1 and #2 above. If a waste stream is found to be acceptable for receipt at this facility, the generator will be notified and a laboratory pretreatment and disposal recommendation form, as shown in Figure 7.2.2., will be prepared. The generator will also be notified as to any specific pretreatment or packaging requirements which may be applicable for the particular waste. Typical contractual agreements for waste treatment/solidification and disposal are given in Appendix M.

4. <u>Facility Notification</u>

   Copies of laboratory data, forms and correspondence indicated above will be transmitted to this facility for use by the facility management and technical personnel when the waste stream is subsequently shipped to the facility.

5. <u>Verification of Waste Identity</u>

   Upon arrival of a waste stream at the facility, its identity will be verified by comparing its physical and chemical characteristics to those described in the documents on file (see #4 above) and by comparing results of laboratory analysis of a representative sample of the waste as received to those results previously obtained during the prequalification process. The facility laboratory will be equipped to perform the necessary analyses on incoming wastes.

The following procedures are planned for the implementation of the waste analysis plan at this facility:

1. The vehicle carrying the hazardous waste shipment will be stopped at the guardhouse at the site entrance. The security guard will obtain a bill of lading and check the hazardous waste manifest (See Figure 7.2.3 for an example) from the driver.

2. The vehicle driver will present the bill of lading and the hazardous waste manifest to the chief chemist or his designee.

3. A technician under the direction of the chief chemist will check the bill of lading and the generator and transporter portions of the manifest for completeness and consistency with data in site files, then verify that a waste characterization data sheet and a laboratory pretreatment and disposal recommendation form are on file for the waste, and that the shipment is scheduled for receipt.

4. A technician under the direction of the chief chemist will then obtain a representative sample of the waste shipment for on-site analysis to determine that the material contained in the

FIGURE 7.2.2

Browning-Ferris Industries
HOUSTON LABORATORY

Date ________________

PRETREATMENT AND DISPOSAL RECOMMENDATION

BFI ____________ Source ____________

1. Sample Description: Liquid ________ Sludge ________ Solid ________ Mix ________

   Number of Phases (% v/v of each) ________ Color ________ Odor ________

   pH ________ Density ________ (lb/gal) (lb/cu. ft.) Flash Point ________°F Total Solids ________ % w/w Ash ________ % w/w

   Comments:

2. Pretreatment:

   ________ A. Phase Separation ________ C. Oxidation/Reduction

   ________ B. pH Adjustment ________ D. Other ________

   Comments:

3. Disposal Recommendation:

   ________ A. Solidification: Volume percent of Original Waste ________

   1. Kiln Dust ________ Fly Ash ________
      a. Ratio of Absorbent to Waste ________ c. Volume Increase ________ times original
      b. Reaction upon mixing ________ d. Final Disposal: See attached leachate data ________
         (1) Sanitary Landfill ________
         (2) Secure Landfill ________
         Cell Type ________
   2. Liq-Wa-Con® ________
      a. Reagent Ratio ________ c. Volume Increase ________ times original
      b. Reaction upon Mixing ________ d. Final Disposal: See attached leachate data ________
         (1) Sanitary Landfill ________
         (2) Secure Landfill ________
         Cell Type ________

   ________ B. Deep Well Disposal: Volume percent of Original Waste ________

   1. Calcasieu ________ 3. Chaparral ________
   2. Sonics ________ ________ See attached Deep Well Analysis

   ________ C. Incineration: Volume percent of Original Waste ________

   ________ D. Other:

   Comments:

The above is a recommendation of the BFI Houston Laboratory Group. It must be understood that local regulations (if more stringent regarding disposal of specific wastes takes precedence over the laboratory's recommendations.

____

FIGURE 7.2.3

Browning-Ferris Industries

HAZARDOUS WASTE SHIPPING MANIFEST

(SEE BACK FOR OTHER PROVISIONS/INSTRUCTIONS)

Manifest Document No 80-00301

BFI WASTE CODE ____ / ____ / ____ / ____ DESTINATION'S EPA IDENTIFICATION NO ________

GENERATOR'S EPA IDENTIFICATION NO ________ GENERATOR'S EMERGENCY PHONE NO. ________

TRANSPORTER'S EPA IDENTIFICATION NO ________ NATIONAL EMERGENCY RESPONSE CENTER PHONE NUMBER 800 – 424-8802

SECTION I — GENERATOR INFORMATION

SUBSECTION A. — GENERAL INFORMATION

COMPANY NAME ________ BUSINESS PHONE NO. ________

ADDRESS ________ EMERGENCY PHONE NO. ________

________ EPA IDENTIFICATION NO. ________

COMPANY REPRESENTATIVE ________ TITLE ________

SUBSECTION B. — WASTE IDENTIFICATION

	DESCRIPTION OF WASTE/PROCESS SOURCE BY PROPER EPA AND DOT SHIPPING NAME	DOT HAZARD CLASS	EPA/STATE HAZARDOUS WASTE NO.	AMOUNT OF WASTE	UNIT OF MEASURE	TYPE/NO. OF CONTAINER(S)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

SUBSECTION C. — CERTIFICATION

As the duly authorized representative of the above identified generator, I hereby certify that:

(i) I have personally examined and am familiar with the information contained in this shipping manifest and in all attached documents; and

(ii) The information contained in this shipping manifest is true, accurate, and complete; and

(iii) The named hazardous wastes/materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to applicable regulations of the U.S. Department of Transportation, the U.S. Environmental Protection Agency, and all applicable state and local authorities; and

(iv) The designated destination for the hazardous waste/materials is in compliance with all permit requirements for the storage, treatment and disposal of hazardous waste/materials.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

GENERATOR'S AUTHORIZED REPRESENTATIVE SIGNATURE ________ TITLE ________ DATE OF SHIPMENT ________

SECTION II — TRANSPORTER INFORMATION

SUBSECTION A. — GENERAL INFORMATION

COMPANY NAME ________ BUSINESS PHONE NO. ________

ADDRESS ________ EMERGENCY PHONE NO. ________

________ EPA IDENTIFICATION NO. ________

COMPANY REPRESENTATIVE ________ TITLE ________

SUBSECTION B. — CERTIFICATION

As the duly authorized representative of the above identified transporter, I hereby certify that I have reviewed the information contained in this manifest and agree to comply with all applicable instructions. In the event that I cannot comply with those instructions, for any reason, I will immediately contact the above identified generator's appropriate representative at the emergency phone number listed herein.

By executing this manifest, I acknowledge that the above identified transporter is solely responsible for notifying all appropriate authorities (including the U.S. Department of Transportation: Phone Number 800 – 424-8802) and the required clean-up with respect to the spillage or discharge of any materials transported under this shipping manifest.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

TRANSPORTER'S AUTHORIZED REPRESENTATIVE SIGNATURE ________ TITLE ________ DATE OF RECEIPT ________

SECTION III — DESTINATION INFORMATION

SUBSECTION A. — DESTINATION DESIGNATION

Primary Shipment Destination. (Note: All facilities designated by the generator to receive hazardous waste must be in compliance with all federal, state and local permit requirements, including but not limited to those requirements contained in 40 CFR Parts 122, 123, 124, 125 and 265.)

FACILITY NAME ________ EPA IDENTIFICATION NO. ________

ADDRESS ________ FACILITY OPERATOR'S EMERGENCY PHONE NO. ________

FACILITY OPERATOR'S NAME (ie. COMPANY NAME) ________ FACILITY OPERATOR'S BUSINESS PHONE NO. ________

ADDRESS ________

Secondary Shipment Destination.

FACILITY NAME ________ EPA IDENTIFICATION NUMBER ________

ADDRESS ________ FACILITY OPERATOR'S EMERGENCY PHONE NO. ________

FACILITY OPERATOR'S NAME (ie. COMPANY NAME) ________ FACILITY OPERATOR'S BUSINESS PHONE NO. ________

ADDRESS ________

SUBSECTION B. — CERTIFICATION

I hereby certify that I have inspected and/or analysed the hazardous waste accompanying this shipment in accordance with the requirements of 40 CFR § 265.13 and that to the best of my knowledge, the quantity and quality of the hazardous waste received substantially conform to the hazardous wastes identified and listed herein.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

DESTINATION'S AUTHORIZED REPRESENTATIVE SIGNATURE ________ TITLE ________ DATE OF RECEIPT ________

ORIGINAL—SEND TO GENERATOR AFTER FULLY DELIVERED

REPRESENTATIVE SIGNATURE ________ TITLE ________ DATE OF RECEIPT ________

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SECOND PART—GENERATOR COPY

REPRESENTATIVE SIGNATURE ________ TITLE ________ DATE OF RECEIPT ________

© BROWNING-FERRIS INDUSTRIES, INC. 1980

THIRD PART—TRANSPORTER COPY

© BROWNING-FERRIS INDUSTRIES, INC. 1980

FOURTH PART—DESTINATION COPY

shipment conforms to the waste described on the hazardous waste manifest accompanying the shipment and to the waste characterization data sheet for that waste. The specific tests necessary for any particular waste will be determined by BFI's laboratories (Houston) or BFI's chief chemist and will be sufficient for comparison purposes.

The observations and analyses which may be performed at the facility on incoming wastes are listed below.

- Flash point
- Odor
- Color
- Number of phases
- Viscosity
- Specific gravity or bulk density
- Reactivity (water/air)
- pH
- Settleable Solids
- Acidity
- Alkalinity
- Cyanide
- Sulfide
- Chloride
- Nitrate
- Total Solids
- Suspended Solids

In addition to the above tests, if the waste is destined for solidification followed by burial in a secure disposal cell, the following analyses may have to be performed to determine the compatibility of the incoming waste with site operations:

- Reaction or evolution of gases resulting from the addition of hydrochloric acid to a portion of the sample until the pH of the mixture is less than one.
- Reaction or evolution of gases resulting from addition of sodium hydroxide to a portion of the sample until the pH of the mixture is greater than 13.

5. The above analytical data will be entered in a bound laboratory notebook under a heading identifying the origin of the sample along with other data identifying the shipment, and the quantity of waste received. Calculations associated with the generation of analytical data will be shown in the laboratory notebook.

6. A shipment will be detained for any of the following reasons until all discrepancies are resolved to the satisfaction of the facility chief chemist:

   - if the hazardous waste manifest is incomplete or incorrect;
   - if the required forms are not on file for the waste material;
   - if the shipment has not been previously scheduled;
   - if the on-site analysis shows the shipment to differ substantially from the waste described, the hazardous waste manifest or the waste characterization data sheet.

If no resolution is possible, the shipment will be returned to the generator.

If all of the above requirements are met, the designated facility technical personnel under the direction of the operations manager, using the results of onsite analysis and information obtained from the pretreatment and disposal recommendation sheet, will prepare a shipment/receipt/transfer form shown in Figure 7.2.4 for the shipment, indicating a waste receipt into the site. This form will contain detailed instructions regarding the location at which the material is to be off-loaded and any special procedures and safety equipment to be utilized during off-loading.

7. The facility technical personnel will then complete and sign the facility portion of the hazardous waste manifest, retaining one copy for facility files, and forwarding the remaining copies as instructed on the manifest.

8. The shipment/receipt/transfer form will be read and signed by the vehicle driver and the facility personnel under the direction of the operations manager responsible for off-loading the shipment. By signing the form, the driver and facility operations personnel signify that they have read and understood the instructions contained on the form and, further, that they are capable of executing the off-loading in accordance with those procedures.

9. The shipment will then be off-loaded by technicians in coordination with the solidification supervisor in accordance with the instructions on the shipment/receipt/transfer form, observing all safety precautions and wearing all required protective equipment. BFI policy is that any variation from the instructions stated on that form without the written authorization of the district manager or failure to wear all required personnel protective equipment and observe all safety procedures, constitutes grounds for disciplinary action, including dismissal.

10. If required, the vehicle which contained the waste shipment will be internally/externally washed out or decontaminated in accordance with instructions listed on the shipment/receipt/transfer form. Upon completion of off-loading and truck washout, the shipment/receipt/transfer form will be returned to the site chief chemist or his designee indicating that the shipment was properly received.

7.2.3 Security Plan

The security plan regulations outlined in 40 CFR 265.14 have a two-fold purpose:

FIGURE 7.2.4

Browning-Ferris Industries, Inc.

SHIPMENT/RECEIPT/TRANSFER FORM

DATE____________
BFI WASTE CODE______
TDWR TICKET #______
TDWR WASTE CODE_____
VOLUME_____/UNITS____

TRUCK #_____ SHIPMENT/RECEIPT/TRANSFER (circle one)
JOB #______ SHIPMENT/RECEIPT/TRANSFER TANK OR LAGOON #____________
GENERATOR____

SPECIAL SAFETY INSTRUCTIONS____________________________________

HANDLING/SEGREGATION______________________________________

TRUCK WASHOUT____

SIGNATURES (read before signing)

CHEMIST______________________________ TIME____________

COORDINATOR__________________________ TIME____________

DRIVER_______________________________ TIME____________

TANK FARM PERSONNEL__________________ TIME____________

COORDINATOR__________________________ TIME____________

- o to set general performance standards which prevent the unknowing entry of people onto the active portion of the site;

- o to minimize the potential for the unauthorized entry of the people, livestock, or other animals onto the active portion of the site.

The security system proposed for this site provides for positive control and monitoring of all entry onto the active portion of the site. The structures and security personnel at the access points will prevent the direct entry of unauthorized personnel onto the site and the fence and signs surrounding the site will prevent the unknowing entry of people, livestock, or other animals onto the active portion of the site. The required warning signs will indicate that only authorized personnel are allowed within the active portion of the site and that entry may be dangerous. The warning signs will be in the English language because the demographic characteristics in the surrounding area are such that there are not significant non-English speaking population groups.

To satisfy the requirements of Section 40 CFR 265.14 of RCRA, the district manager will implement the following security system to prevent the unknowing and unauthorized entry of people, livestock, or other animals onto the active portion of the facility:

- o A chain link perimeter security fence will surround the active portion of the site (see Figure 6.2.1). The fence will be of sufficient height to meet the intentions of the regulations.

- o Security personnel will be stationed in a guard house at the operating access point onto the active portion of the site at all times. All other gates used occasionally for maintenance, inspections, etc., will stay closed and secured. They will be opened only by security personnel during maintenance and inspections and will be monitored by the security personnel while open during these activities.

- o Gates onto the active portion of the site will be controlled manually or electro-mechanically by security personnel during site operating hours and closed and secured during non-operating hours.

- o A sign will be posted at each access point onto the active portion of the site. It will have the following legend, "DANGER - Unauthorized Personnel Keep Out", and will be legible from a distance of at least 25 feet.
- o Signs will be posted along the periphery of the site at approximately 200 foot intervals having the legend, "DANGER - Unauthorized Personnel Keep Out", to warn unknowing people that entering onto the active portion is potentially dangerous.
- o A daily survey will be conducted to inspect the perimeter security fence for damage from vandalism or weather. The results of the perimeter security fence survey will be recorded in the site operational log and any damage found will be corrected.
- o Entry to the active portion of the site will be restricted to site personnel and properly identified persons whose entry is authorized by the site management. Authorized visitors will only be allowed near the active area of the site when accompanied by a site representative designated for that purpose by the district manager.
- o The entry gate, guard house, and immediate surroundings will be well lighted during periods of darkness.

7.2.4 General Inspection Plan

The general inspection plan for this facility has been developed in four interrelated parts, which correspond to the four sub-sections in 40 CFR 265.15. These parts are the statement of need, written inspection schedule, response to incidents, and inspection records.

7.2.4.1 Statement of Need

BFI recognizes the need for periodic inspection of the facility components and equipment, as an intrinsic part of an overall personnel safety and environmental security program. Therefore, the district manager will establish and adhere to an on-going general inspection plan which is intended to identify and correct problems before they result in harm to health or the environment.

The on-going BFI corporate maintenance scheduling program will be used at the site to assure reliable and effective equipment availability. This program will be expanded, as required, to meet the specific needs of the Adams County site.

7.2.4.2 Written Inspection Schedule

A complete facility inspection will be conducted daily on normal operating days by trained and technically qualified personnel assigned to this duty by the operations manager. Some items, such as tanks, drainage ditches, and concrete structures, require periodic inspection, but are not subject to sudden failure or deterioration. These items will be inspected on a weekly basis, in conjunction with the routine daily inspection. In addition, mechanical equipment requires periodic service and preventive maintenance procedures to ensure proper functioning and reliability. These procedures, and their frequency, vary. The district manager will develop an equipment service and maintenance schedule coordinated with existing BFI maintenance programs in accordance with the specific recommendations of the manufacturer of the various items of equipment which are used at this facility.

Each daily and weekly inspection will be documented by an inspection report form, which will be completed, signed, and dated by the person assigned to perform the inspection under the direction of the operations manager. The inspection report form will indicate the items inspected and will note any deficiencies observed during the inspection, including, if appropriate, a comment on the severity of the condition. Examples of daily and weekly inspection report forms are shown in Figures 7.2.5 and 7.2.6, respectively.

FIGURE 7.2.5
SAMPLE DAILY SITE INSPECTION REPORT

General Facility Conditions

- Security fencing-gates-locks
- Unauthorized entry
- Liquid discharges-odor
- Perimeter drainage facilities
- Wind-blown wastes-debris
- Emergency response equipment
- Spilled material within facility
- Condition of non-all-weather roads - Dust, ruts
- "No Smoking" regulations obeyed

Solidification Facilities

- Observe freeboard levels in tanks
- Personnel protective equipment used
- Decontamination equipment accessible
- Emergency equipment in place
- Spillage-discharge from facility
- Security barriers
- Unusual odor

Secure Landfill

- Free liquids in landfill
- Personnel protective equipment used
- Decontamination equipment accessible
- Emergency equipment in place
- Integrity of leachate standpipes
- Area drainage facilities
- Unusual odors-other emissions
- Presence of fugitive material
- Integrity of monitoring wells
- Operating guidelines/procedures

Containers

- Leakage or spillage
- Placement-segregation of containers
- Identification of contents
- Damage to containers
- Accessibility within facility
- Emergency equipment in place

Tanks

- Personnel protective equipment used
- Decontamination equipment accessible
- Emergency equipment in place
- Discharge control equipment
- Operating guidelines/procedures
- Unusual odors-other emissions
- Spillage-discharge from facility

Impoundments

- Freeboard level (2 feet or greater)
- Unusual odors-other emissions

OBSERVATIONS AND COMMENTS

Date: ____________________ Signature: ____________________

FIGURE 7.2.6
SAMPLE WEEKLY SITE INSPECTION REPORT

General Facility Conditions

Perimeter drainage facilities
Condition of hard surfaced roads
Operability of emergency equipment
Remote monitoring well condition

Solidification Facilities

Condition of mechanical equipment
Operability of decontamination equipment
Operability of emergency equipment

Secure Landfill

Operability of decontamination equipment
Operability of emergency equipment
Condition of drainage systems
Degree of cover over wastes
Damage to closed portions
Escape of leachate-closed portions

Containers

Container corrosion/deterioration
Operability of emergency equipment
Condition of storage pad
Condition of protective barriers

Tanks

Operability of decontamination equipment
Operability of emergency equipment
Evidence of corrosion
Structural integrity of tanks-supporting structures
Erosion or damage in the area

Impoundments

Condition of embankments, erosion
Evidence of leakage
Condition of vegetation-other cover

OBSERVATIONS AND COMMENTS

Date: ____________________ Signature: ______________________

Inspection reports will be directed to the district manager or his designee, who will be responsible for noting the deficiencies and implementing the appropriate corrective action. Inspection reports will be incorporated into the daily operating record of the facility.

On days the facility is not operating, such as weekends and holidays, site security personnel will conduct tours of the facility to check for unusual conditions or breaches of security.

The following items are proposed to be included in the daily facility inspection: (See Figure 7.2.5)

- General Facility Conditions:
  - Integrity of security fencing, gate(s), and locks;
  - Evidence of unauthorized entry;
  - Evidence of unauthorized liquid discharges or unusual odor;
  - Functioning of perimeter drainage control berms;
  - Presence of wind-blown wastes or debris;
  - Presence of spilled, dropped or leaked material along access roads, transportation routes within the facility, and waste loading/unloading areas;
  - Condition of non-all-weather surface roads as to dust or ruts;
  - Adherence to "No Smoking" regulations, where applicable;
  - Presence of emergency response equipment.

- Solidification Facilities:
  - Observation of freeboard levels in all receiving basins;
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Accessibility of personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Evidence of spillage or discharge around or from the facility;
  - Condition of security barriers;
  - Unusual odors.

- Secure Disposal Cells
  - Presence of free liquids in the secure disposal cell;
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Accessibility to personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Integrity of leachate collection standpipes;
  - Operation of area drainage facilities;
  - Presence of unusual odors, vapors, or other emissions;
  - Observance of operating guidelines and procedures;
  - Presence of any fugitive wastes or debris;
  - Evidence of escape of leachate;
  - Integrity of monitoring wells adjacent to active areas.

- <u>Containers</u>:
  - Evidence of leakage or spillage;
  - Proper placement, storage or segregation of containers;
  - Container contents identified;
  - Damage to containers;
  - Accessibility throughout the storage facility;
  - Presence of emergency response equipment.

- <u>Tanks</u>:
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Presence of personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Evidence of leakage, spillage, or discharge in, around, or from the facility;
  - Observance of required operating guidelines and procedures;
  - Unusual odors, vapors or other emissions;
  - Level of tank contents;
  - Condition of discharge control equipment (waste feed cut-off systems, by-pass systems, etc.).

- <u>Impoundments</u>:
  - Observe freeboard level to be two feet or greater;
  - Check for unusual odors, vapors or other emissions.

The following items are proposed to be included in the weekly facility inspection (see Figure 7.2.6):

- <u>General Facility Conditions</u>:
  - Condition of perimeter drainage facilities;
  - Condition of all-weather surface roads;
  - Condition of emergency response equipment;
  - Surface condition of remote monitoring wells.

- <u>Solidification Facilities</u>:
  - Condition of tanks, pumps, and other mechanical equipment;
  - Operability of personnel decontamination equipment;
  - Condition of emergency response equipment.

- <u>Secure Disposal Cells</u>:
  - Operability of personnel decontamination equipment;
  - Condition of emergency response equipment;
  - Condition of area drainage facilities;
  - Degree of cover over buried wastes;
  - Evidence of erosion, differential settlement, ponding, or cap damage on closed portions of the landfill;
  - Evidence of escape of leachate from closed portions on the landfill.

- <u>Containers</u>:
  - Evidence of corrosion or deterioration of containers;
  - Operability of emergency response equipment;
  - Condition of storage pad;
  - Condition of protective barriers.

- o Tanks:
  - Operability of personnel decontamination equipment;
  - Operability of emergency response equipment;
  - Evidence of corrosion;
  - Structural integrity of tanks and supporting structures;
  - Evidence of erosion or damage within the area.

- o Impoundments:
  - Condition of embankments, erosion;
  - Evidence of leakage;
  - Condition of vegetation or other cover.

7.2.4.3 Response to Incidents

The facility employee assigned to perform the site inspections will record his observations on the appropriate inspection report, utilizing a system similar to placing a checkmark along side an inspection item that was observed to be satisfactory, and an "X" along side an item that was found not to be in compliance. When appropriate, a notation would be made on the report as to the severity of an item requiring corrective action, to assist facility management in taking a timely and appropriate course of action. Any items found not to be in compliance, but which are corrected at the time of the inspection, will be marked as being non-compliant, but with a notation that appropriate corrective action was taken.

Upon completion of each inspection, the person performing the inspection will sign and date the inspection report, to acknowledge that the inspection was complete, was personally performed, and that the inspection report accurately reflects the conditions actually observed.

It is the intent of BFI management to encourage prompt and on-the-spot correction, whenever possible, of any non-compliant conditions.

Any situation or condition encountered during the inspection which constitutes an actual or potential threat to health, safety or the environment, and cannot be remedied on the spot, will be immediately reported to the district manager, operations manager, or other responsible person who has authority and responsibility to immediately initiate whatever remedial action is appropriate.

7.2.4.4 Inspection Records

The facility operations manager will maintain a record of all inspections by entering the originals of the inspection reports into the site operating log system with the reports arranged in chronological order. These reports will remain on file for a minimum of three years.

An integrated record or log system will be maintained to show the corrective action taken with respect to items found during inspections which require subsequent corrective action. This system will reflect each condition requiring correction, the date it was discovered, the corrective action taken, and the date of the corrective action. This system will consist of either a summary log, or chronologically organized copies of those inspection reports which show items requiring correction, upon which the date and the corrective action taken would be entered.

7.2.5 Personnel Training Program

BFI will assure that the operation of the facility will not endanger the health or safety of its personnel and visitors, or threaten the environment. Thorough training of facility personnel is recognized as being an important step toward these goals. Consequently, a comprehensive personnel training program, which has already been used in training other BFI personnel, will be developed (as appropriate for the site) and employed throughout the operating life of the facility.

The two major objectives of the personnel training program will be:

- o to thoroughly train all employees in the proper performance of their individual job duties;
- o to ensure that all appropriate employees are capable of effectively implementing the proper emergency procedures, should the need arise.

It is felt that accidents and emergency situations can be avoided, or at least minimized, by having a work force which is trained to perform jobs properly, using adequate precautions. If an emergency incident does occur, its consequences can be minimized through rapid and effective emergency response.

To accomplish this, the district manager will initiate a comprehensive personnel training program directed by a person having appropriate training in hazardous waste management and related environmental health sciences. Instruction in hazardous waste management procedures, safety, emergency procedures, legal requirements, and facility operational procedures, and similar related subjects will be provided by that individual or other persons who are technically qualified to provide such instruction. Training manuals, other types of training aids, technical seminars, and formal classroom education will be utilized in training activities.

Personnel will receive training appropriate to their personal needs as well as to their job duties and responsibilities, including their responsibilities for emergency response. Successful completion of the appropriate training activities will be a condition of filling a technical or operating position or of transfer or promotion to a new position which requires additional training.

On-the-job training will be provided to all employees on an individual basis. This training will be specific to the duties, tasks and responsibilities of the employee's particular position. Experienced employees or supervisors who are knowledgeable of the requirements for satisfactory performance of the job will provide this training and monitor its progress. On-the-job training will be progressive in nature, beginning with demonstration and followed by closely supervised practice. When the employee has shown his ability to understand and perform his job and the basic safety and emergency response functions related to it, his supervisor will formally acknowledge the satisfactory completion of the employee's on-the-job training, in that employee's training file.

The training policy of BFI requires that all new employees must successfully complete their specific training within six months of their employment or assignment to the facility. Upon transfer or promotion of an existing employee to a new position with training requirements that differ from those for the previous position, that employee shall complete the required additional training within six months.

Pending satisfactory completion of the specific training required for a particular job, an employee will receive intensive supervision to assure that the job is performed properly and safely.

On-going continuing education and training will be provided to employees by the operator of the facility. The frequency of continuing education and training activities will vary according to the type of job.

Figure 7.2.7 presents an outline of the proposed personnel training program along with the schedule for conducting the training and the personnel who would be scheduled to participate. The frequency of formal training activities varies from monthly for emergency response and contingency plan functions, to annually for training which does not relate directly to emergency situations. By scheduling training functions at six month intervals or less, new employees will be able to receive all necessary training within six months of their employment.

7.2.5.1 Training Records

Documentation of training will be provided by three record systems and files which will be maintained at the facility.

The first record system will be a listing of job titles for every position at the facility, along with the name of the person who occupies each position. This list will be revised as this becomes necessary. Each list will be dated, and copies of each previous list will remain on file at the facility for a minimum of three years.

The second record system relating to training will be a written job description for each position at the facility (previously given in Section 6.3.3). Included in the job description will be any required education and experience or equivalent, the training required both initially and on an ongoing basis, and the job duties and responsibilities including those during emergency response, if any. Generally, the training requirements for various categories of jobs are displayed in Figure 7.2.7. The specific descriptions of the type and amount of introductory and ongoing training to be given will be incorporated into the written job descriptions.

FIGURE 7.2.7

PERSONNEL TRAINING PROGRAM - FORMAL TRAINING ACTIVITIES

Activity Description		Frequency	Personnel
I.	Hazardous Waste Management Overview		
	A. Synopsis of Federal/State Regs.	Annually	All Facility Pers.
	B. Definition of Hazardous Waste	"	"
	C. Manifest System and Records	"	"
	D. Generator Requirements	"	"
	E. Transporter Requirements	"	"
	F. TSD Facility Requirements	"	"
II.	Facility Policies and Procedures		
	A. Waste Approval	"	"
	B. Site Security	"	"
	C. Facility Inspection, General	"	"
	D. Preparedness and Prevention	"	"
	E. Industrial Hygiene	"	Appro. Tech. Pers.
	F. Inspection and Maintenance of Emergency, Monitoring, Alarm, and Communication Systems	Quarterly	"
	G. Response to Fires or Explosions	Monthly	"
	H. Response to Spills, Ground Water Contamination, or Air Emissions	"	"
III.	Waste Receipt, Inspection, Sampling and Verification Procedures		
	A. General overview	Annually	All Facility Pers.
	B. Specific Procedures	"	Lab and Security
IV.	Safety in Handling Hazardous Wastes		
	A. Chemical reactions and chemistry	Annually	All Pers. Except Accounting, Sales and Clerical
	B. Personal protective equipment	Semi-Annually	All Personnel
	C. Truck loading, unloading, and washout	"	All Pers. Except Accounting, Sales and Clerical
	D. Use of Shipment/Receipt/ Transfer Forms	"	"
	E. Contingency Plan and Emergency Procedures	"	All Personnel
	F. First Aid	Semi-annually	All Personnel
	G. Safe Handling of Specific Wastes	Monthly	Approp. Tech. & Oper. Pers.
V.	Solidification Facilities, Tank Farm and Containers		
	A. Waste Ident. and Segregation	Semi-annually	Approp. Oper. Pers.
	B. Care in Handling Wastes	"	"
	C. Operation and Monitoring	"	"
	D. Use and Care of Emergency Systems	Monthly	"
	E. Waste Feed Cut-off Systems	"	"
	F. Emergency Shutdown	"	"
VI.	Secure Landfill and Impoundments		
	A. Design Considerations	Semi-annually	"
	B. Waste Ident. and Segregation	"	"
	C. Operation and Controls	"	"
	D. Monitoring	"	"
	E. Use and Care of Emergency Systems	Monthly	"
	F. Emergency Response	"	"

Records of training given to facility personnel will constitute the third method of training documentation. These records will consist of both a general facility training file and inclusion of a record of his or her training in each employee's personnel file. The general facility training file will contain a description of each formal training activity, the date(s), the personnel who attended, and an indication of satisfactory accomplishment of the goals of the training activity by each person. The same or similar information will be included in the personnel file maintained at the facility for each person.

At least twice a year, facility management will review each employee's personnel file against that person's job description training requirements, to verify that the frequency and type of training required for that job is being provided. This semi-annual review will also demonstrate that the facility's training objectives are being met.

Training records will be retained for a minimum of three years or until completion of closure of the facility. In the event an employee transfers to another facility and his personnel file is transferred with him, the general facility training file will be used to document the training he was provided during his employment at the facility.

7.2.6 General Requirements For Ignitable, Reactive, or Incompatible Wastes

7.2.6.1 Identification of Ignitable, Reactive, or Incompatible Wastes

The operations manager of this facility will implement precautions to prevent accidental ignition of ignitable wastes, or chemical reaction of reactive or incompatible wastes.

The precautions which will be implemented include prescreening of candidate wastes to determine if particular waste streams proposed for treatment or disposal at this facility can be safely handled at the facility, or if special handling techniques and/or pretreatment are required. Those wastes which cannot be safely handled even with special techniques or pretreatment will be excluded from the facility. Those which can be accepted only with special handling or pretreatment will have those particular requirements stated on the pretreatment and disposal recommendation form (see Section 7.2.2), a copy of which will be on file at the facility along with all other forms from wastes which have been approved for treatment and/or disposal.

Upon arrival of a waste shipment at the facility, the waste will be examined and sampled, and these results will be compared to the shipping documents and manifest accompanying the waste, as well as the data in the facility files concerning the waste. After these procedures have demonstrated that the waste characteristics are known, the waste shipment will be accepted by the facility for treatment or disposal. Additional details of these procedures were described in the general waste analysis plan, in Section 7.2.2.

The special precautions for ignitable, reactive or incompatible wastes will be implemented for wastes which meet the definitions of "ignitability" and "reactivity" contained in EPA regulations 40 CFR 261.21 and 40 CFR 261.23, respectively. A description and examples of incompatible wastes are also presented in the following discussion.

The characteristic of ignitability from 40 CFR 261.21 is as follows:

"A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

(1) It is a liquid, other than an aqueous solution containing less than 24% alcohol by volume, and has a flash point less than 60°C (140°F), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79, or a Setaflash Closed Cup Tester, using the test method specified in ASTM standard D-3278-78, or as determined by an equivalent test method approved by the Administrator under the procedures set forth in 40 CFR 260.20 and 260.21.

(2) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

(3) It is an ignitable compressed gas as defined in 49 CFR 173.300 and as determined by the test methods described in that regulation or equivalent test methods approved by the Administrator under 260.20 and 260.21.

(4) It is an oxidizer as defined in 49 CFR 173.151." (DOT regulations)

The characteristic of reactivity, from 40 CFR 261.23, is as follows:

"A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

(1) It is normally unstable and readily undergoes violent change without detonating.

(2) It reacts violently with water.

(3) It forms potentially explosive mixtures with water.

(4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

(7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

(8) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88." (DOT regulations)

Incompatible wastes are not as explicitly defined as those which are ignitable or reactive. Generally, incompatible wastes are those which may produce adverse chemical reactions when brought into contact with certain other wastes. Incompatible wastes, when mixed with other waste or materials at a hazardous waste facility, can produce effects which are harmful to human health and the environment, such as:

- excessive heat or pressure;
- fire or explosion;
- violent reaction;
- toxic dusts, mists, fumes, or gases; or
- flammable fumes or gases.

It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g., adding acid to water rather that water to acid) or that neutralizes them (e.g., strong acid mixed with a strong base), or that controls substances produced (e.g., by generating flammable gases in a closed tank equipped so that ignition cannot occur, and burning the gases in an incinerator).

The decision tree shown on Figure 7.2.8 will be used by technical personnel to avoid mixing incompatible wastes.

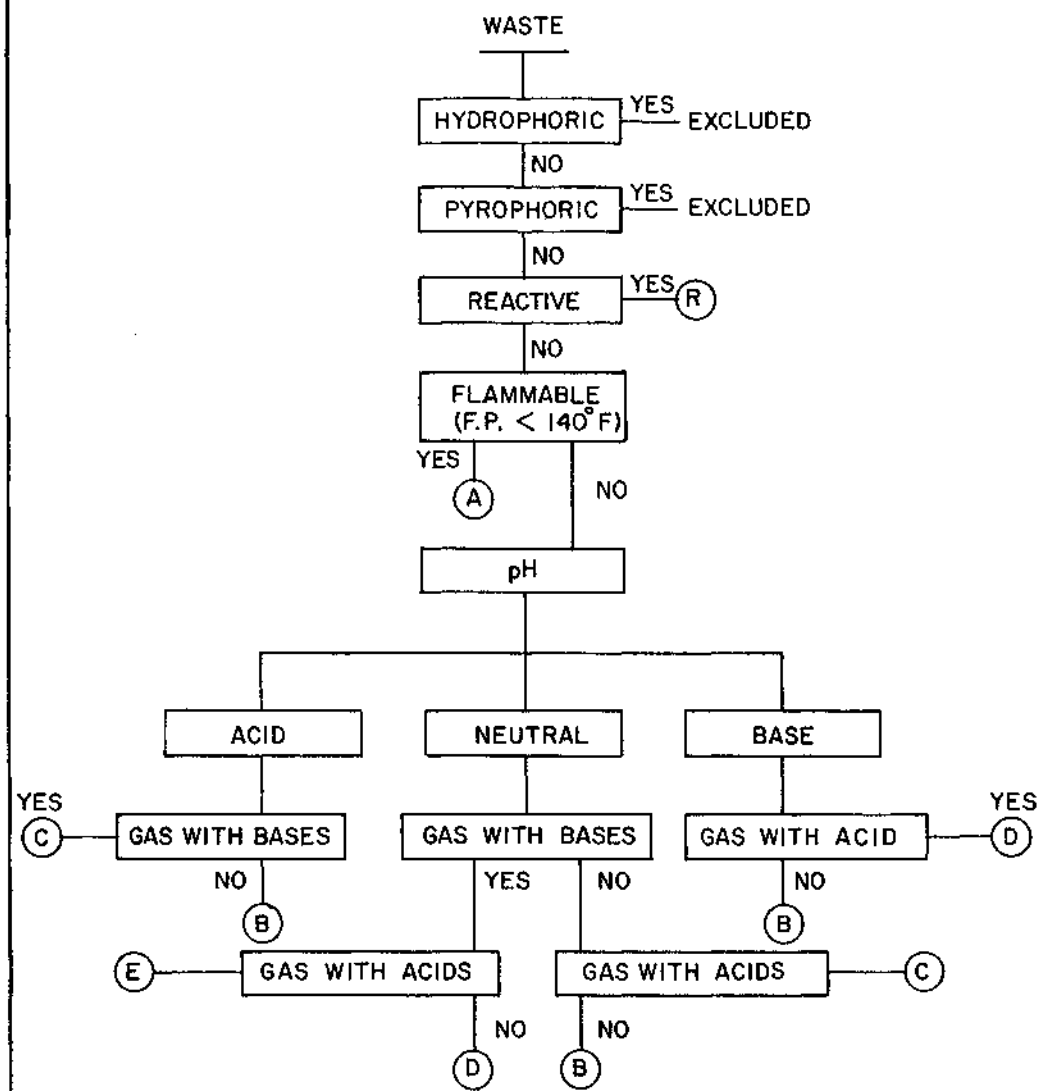
7.2.6.2 <u>Precautions to be Taken With Ignitable, Reactive or Incompatible Wastes</u>

Ignitable, reactive or incompatible wastes will be handled, stored, treated, solidified, and/or disposed utilizing due precautions to prevent accidental or spontaneous ignition, or chemical reaction. These wastes will be identified before and during receipt and adequately separated or isolated from sources of ignition or reaction during handling, storage, processing and disposal.

The first of the specific precautions to be taken with ignitable, reactive or incompatible wastes will be the special pretreatment or handling requirements that will be communicated to the generator. This is to assure proper handling, packaging or protection, and labeling of wastes prior to commencing transport to the facility.

The second precaution will be that upon arrival of any ignitable, reactive or incompatible wastes at the facility, the waste identification process described in Section 7.2.2 and previously in this section will be used to verify the nature and identity of the waste. The specific instructions in the pretreatment and disposal form will be implemented. Facility technical personnel will prepare a shipment/receipt/transfer form, which indicates receipt of the waste at the site. This form is also used to designate the specific location within the facility where the waste is to go for off-loading, as well as all of the procedures and safety requirements which must be explicitly followed during the off-loading procedure.

These precautions will insure that accidental ignition or reaction of wastes does not occur as a result of incorrect handling or placement of wastes. Potential causes of accidental ignition or reaction, such as exposure to adverse environmental conditions or contact with other incompatible wastes or waste residues, will be eliminated by strict adherence to the handling, storage, treatment, solidification, and disposal requirements specified in the pretreatment and disposal recommendation



LEGEND

The wastes approved for disposal will be grouped into one of six types:

TYPE A - Non-reactive wastes with a flashpoint below 140° F.

TYPE B - (1) Acids which do not liberate gas when mixed with basic material; (2) neutral materials which do not liberate gas when mixed with acids or bases; (3) basic materials which do not liberate gas when mixed with acids.

TYPE C - (1) Acids which liberate gas when mixed with bases; (2) neutral materials which liberate gas when mixed with bases, but do not liberate gas when mixed with acids.

TYPE D - (1) Basic materials which liberate gas when mixed with acids; (2) neutral materials which liberate gas when mixed with acids, but do not liberate gas when mixed with bases.

TYPE E - Neutral materials which liberate gas when mixed with either acids or bases.

TYPE R - Other reactive wastes.

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FIGURE Nº. 7.2.8

CHEMICAL COMPATABILITIES

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ADAMS CO., COLORADO

form. It should be emphasized that the instructions contained on that form will be explicit, and will be prepared by BFI's staff of qualified chemists, and will represent considerable corporate knowledge and experience in proper management of hazardous wastes.

The third specific precaution to be incorporated into the management of ignitable, reactive and incompatible wastes will be the use of separate areas and separate facilities for these wastes, to prevent accidental ignition or reaction on a long term basis.

Incompatible drummed wastes will be segregated to minimize reaction in the event of concurrent spills, or damage to other containers from a spill of a reactive waste.

Within the secure disposal cells, isolation of ignitable, reactive or incompatible wastes will be provided by means of interior isolation barriers of compacted clay. It should be emphasized that the facility does not anticipate receiving significant quantities of waste materials of this type to be disposed of directly without first having undergone pretreatment or solidification processing in order to minimize or eliminate their ignitability, reactivity or incompatibility.

Other specific precautions to be taken include isolating ignitable or reactive wastes from open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition (e.g., from heat-producing chemical reactions), and radiant heat.

During the operating life of the facility, smoking and open flame will be confined to specially designated locations. "No Smoking" signs will be conspicuously placed wherever there is a hazard from ignitable or reactive waste.

The treatment, storage, solidification, or disposal of ignitable or reactive waste, and the mixture or commingling of incompatible wastes, or incompatible wastes and materials, will be conducted so that it does not:

- o generate extreme heat or pressure, fire or explosion, or violent reaction;
- o produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health;
- o produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions;
- o damage the structural integrity of the device or facility containing the waste; or
- o through other like means threaten human health or the environment.

7.3 PREPAREDNESS AND PREVENTION

7.3.1 Introduction

The preparedness and prevention measures required by the hazardous waste regulations (40 CFR Part 265) have been developed for the purpose of minimizing accidents and emergency situations which could threaten human health or the environment.

The regulations address the preparedness and prevention measures as a separate subpart because they contain relatively explicit facility standards which are independent of the contigency plans (presented in Section 7.4). It is appropriate to design preparedness and prevention measures into facility operations before discussing planning for and response to emergencies.

These measures have been designed into each operational unit of the facility to minimize or prevent the occurrence of a fire, explosion, or release of a hazardous waste, to alert personnel required, and to contain the emergency situation.

7.3.2 General Measures

The following measures are applicable to the facility in general, or are common to all operations involving handling, treatment, storage, solidification, or disposal of hazardous waste. To avoid repetition, these measures are presented in the following section with the understanding that they are considered to be incorporated into the specific facility preparedness and prevention measures that follow. Typical safety equipment and arrangements are shown on Figures 7.3.1 through 7.3.9.

- Alarm stations will be appropriately located to insure immediate access in the event of an emergency. Specific emergency procedures will be developed for facility personnel in the event of fire, explosion or release of a hazardous waste.

- The emergency life support equipment will be located to insure quick access by facility personnel in the event of an emergency.

- Arrangements will be made to familiarize area clinics and hospitals as to the possible types of injuries or illnesses which could result from fires, explosions or releases at the facility.

- The layout of the facility and placement of equipment will allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.

- Signs prohibiting smoking will be posted where visible to all employees, vehicle operators, and visitors and in all areas where wastes are received, handled, treated, stored, or disposed.

- Procedures will be devised for testing and maintaining facility communications and alarm systems, fire fighting equipment, spill control equipment, and personnel decontamination station equipment located at the site.

- Fire extinguishers, spill control equipment, and decontamination equipment will be located in adequate numbers and locations throughout the facility to insure expedient access in the event of an emergency.

- o Company and government emergency response personnel will be provided with the site and building layout and design, properties of wastes stored, location of personnel working at the facility and all internal roads and evacuation routes. Governmental emergency response personnel will be encouraged to visit the facility for greater familiarization with it.

- o Arrangements will be made with any State and local emergency response teams, emergency response contractors and equipment suppliers as needed to minimize contamination.

- o Facility personnel will be given a thorough physical examination by outside medical consultants before employment and follow-up as needed.

- o All facilities will be furnished with proper types and number of fire fighting equipment, decontamination stations, fume vents, exhaust fans, and emergency evacuation equipment to insure compliance with local, State, and Federal OSHA regulations (see Figures 7.3.1 through 7.3.9).

7.3.3 Laboratory

- o The chief chemist or technician will review the manifest and other pertinent documents or data to determine the proper procedures and equipment required to safely obtain a representative sample of the incoming waste.

- o All samples will be immediately labeled as to their health hazards and dangerous properties from information obtained from the manifest and other documents.

- o Samples will be containerized, stored and handled in accordance with local, State, and Federal occupational safety and health regulations until the required analyses have been completed.

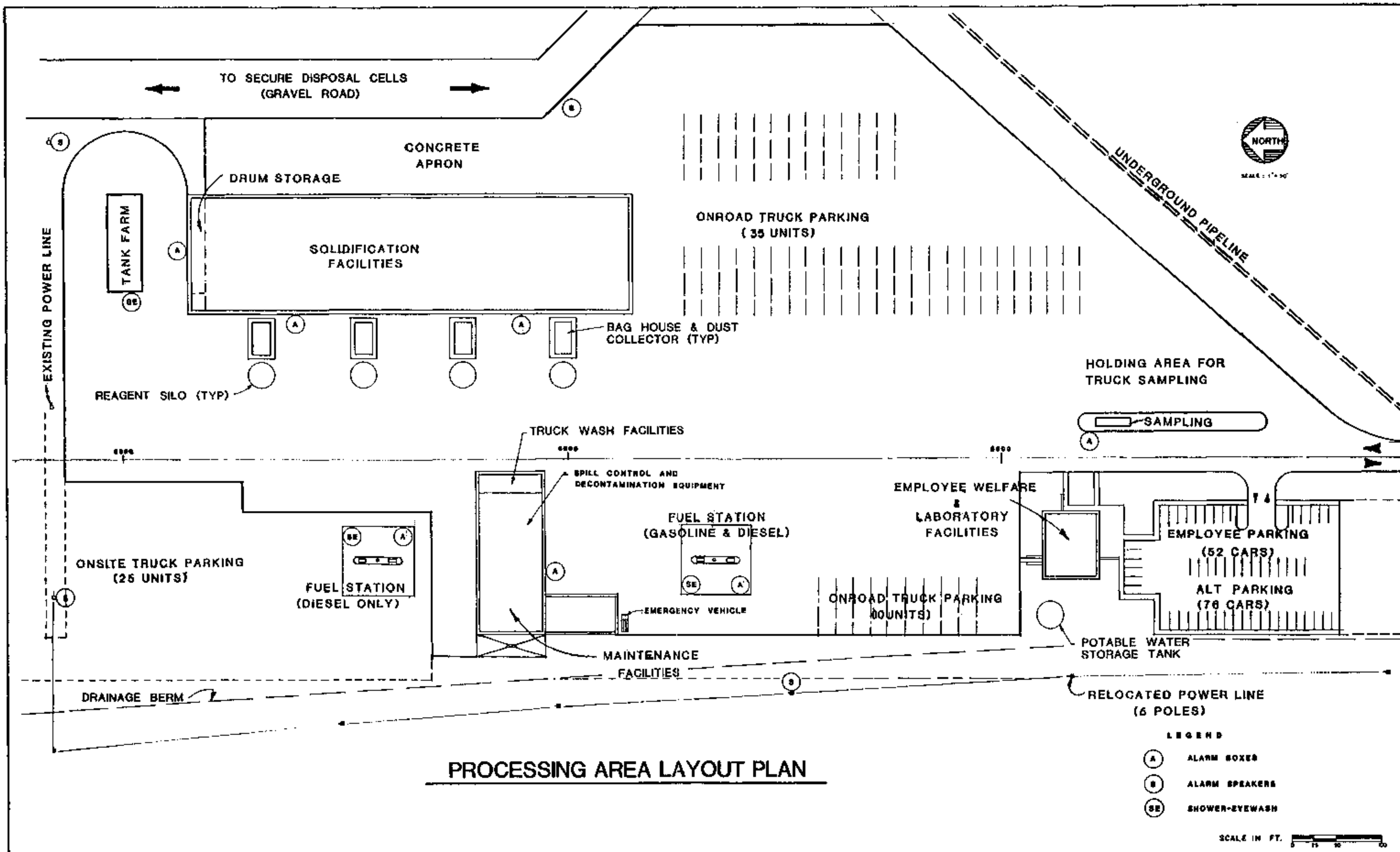
- o Excess samples or portions of samples not used during analyses will be stored in compliance with local, State and Federal occupational safety and health regulations pending on-site disposal as hazardous waste.

7.3.4 Tank Farm

- o Tanks and connections will be clearly identified to insure no incompatible wastes are commingled.

- o Tank construction, pipes, valves, pumps, and other equipment will meet prescribed safety standards and will be designed and selected in accordance with good engineering practice.

- o The tank farm will be diked to meet spill prevention control and countermeasure (SPCC) criteria. If flammable or reactive material are received, they will be placed in tank(s) spaced to meet National Fire Prevention Association (NFPA) buffer zone requirements.



PROCESSING AREA LAYOUT PLAN

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER / DRAFTING / PROJ. ENGR / PROJ. MGR. / BY / DATE

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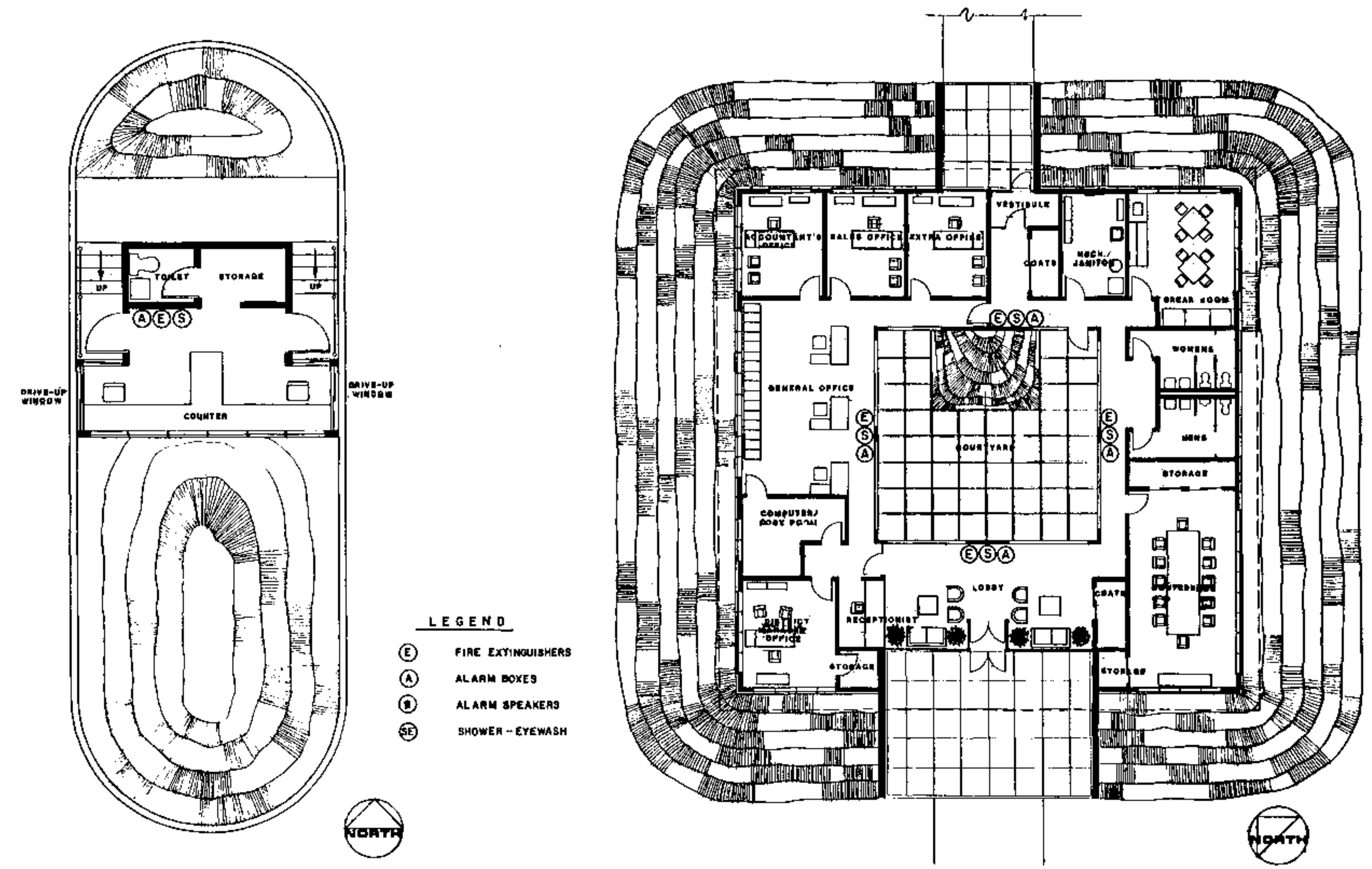
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

EXTERNAL COMMUNICATION, ALARM SYSTEM & SHOWER-EYEWASH LOCATION

SHEET NO. FIG. 7.3.1 OF



GUARD HOUSE FLOOR PLAN

SCALE IN FT. 0 1 2 4 6

ADMINISTRATION BUILDING FLOOR PLAN

SCALE IN FT. 0 2 4 8 16

LEGEND

- (E) FIRE EXTINGUISHERS
- (A) ALARM BOXES
- (S) ALARM SPEAKERS
- (SE) SHOWER – EYEWASH

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER / DRAFTING / PROJ. ENGR. / PROJ. MGR. / BY / DATE

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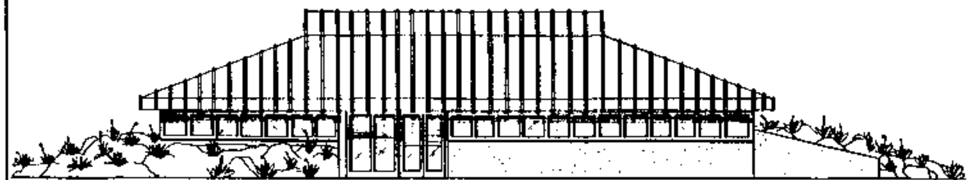
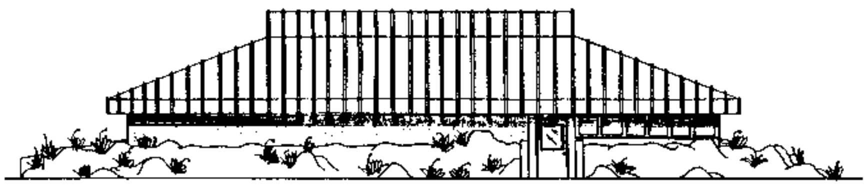
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
ADMINISTRATION BLDG. & GUARD HOUSE
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN

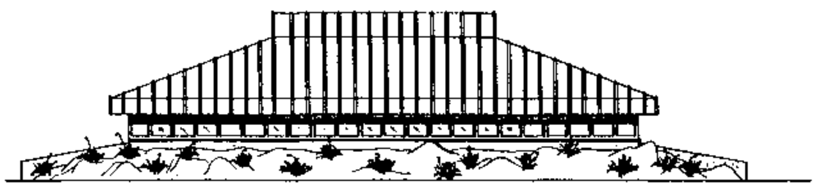
SHEET NO. FIG. 7.3.2 OF



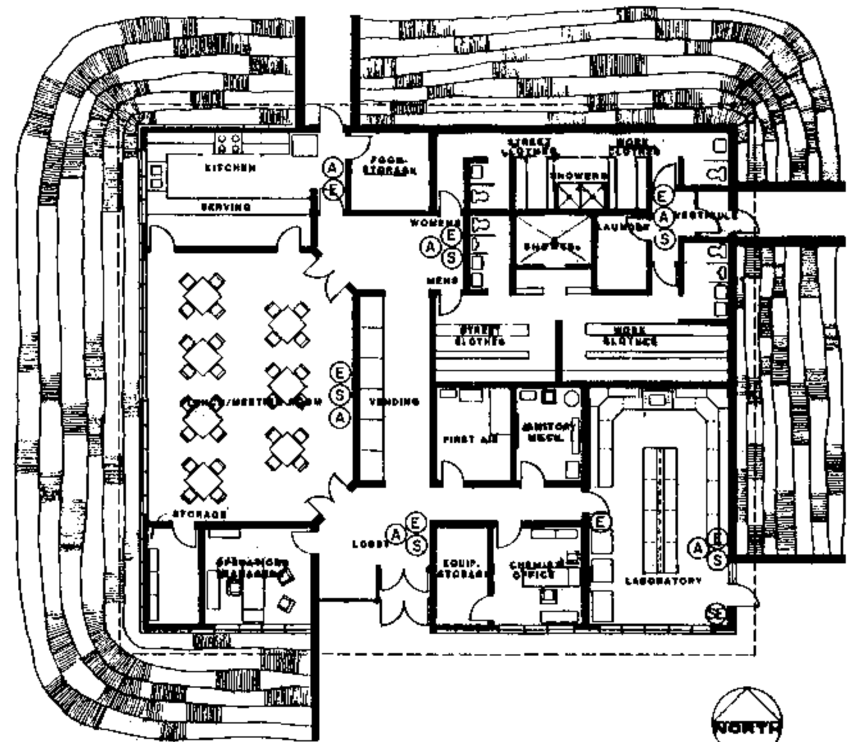
SOUTH ELEVATION



NORTH ELEVATION



WEST ELEVATION



FLOOR PLAN

LEGEND

(E)	FIRE EXTINGUISHERS
(A)	ALARM BOXES
(S)	ALARM SPEAKERS
(SE)	SHOWER – EYEWASH

SCALE IN FT. 0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

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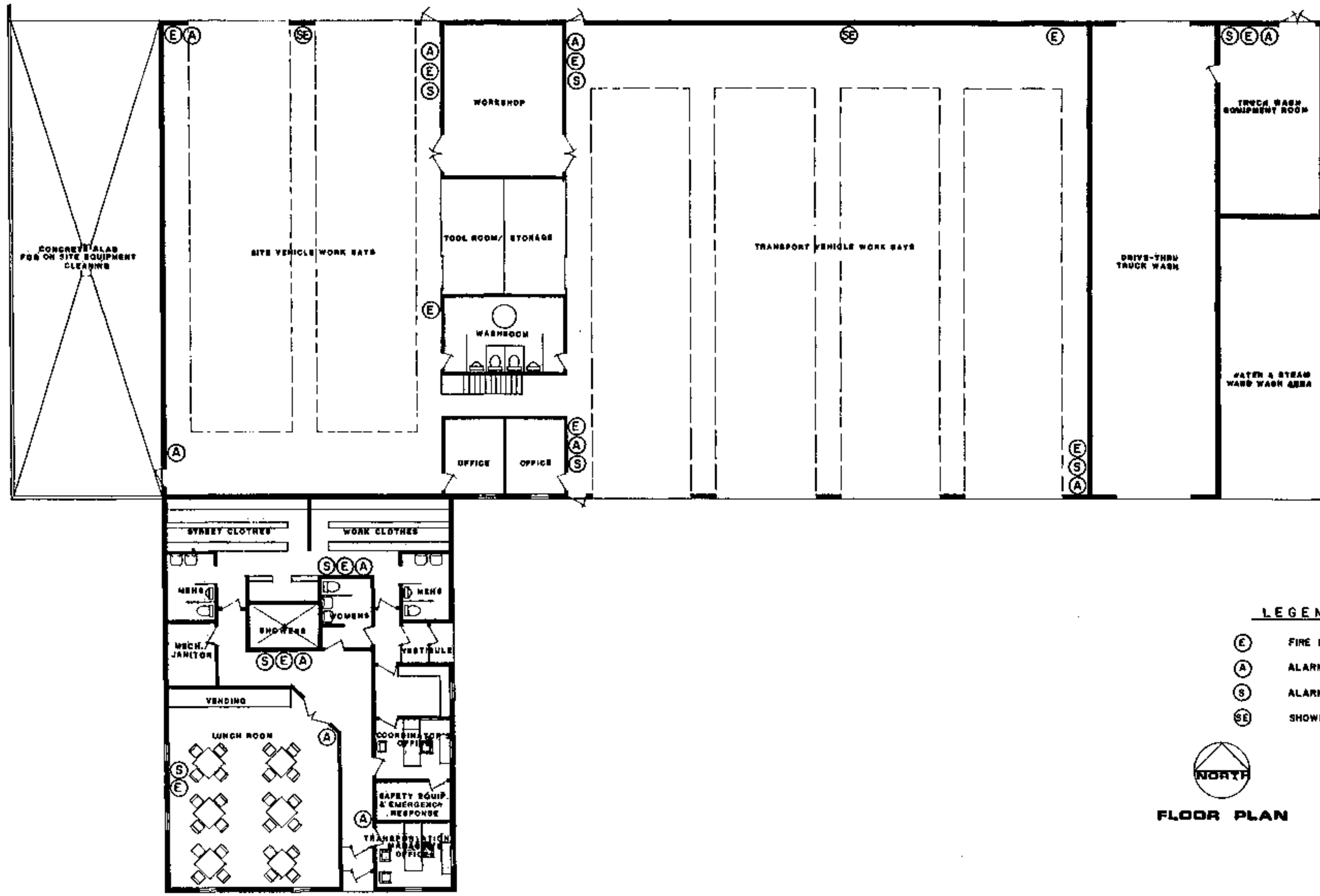
JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
EMPLOYEE WELFARE/LABORATORY BLDG.
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN

SHEET NO.
FIG. 7.3.3
OF



LEGEND

- (E) FIRE EXTINGUISHERS
- (A) ALARM BOXES
- (S) ALARM SPEAKERS
- (SE) SHOWER-EYEWASH

NORTH

FLOOR PLAN

SCALE IN FT. 0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

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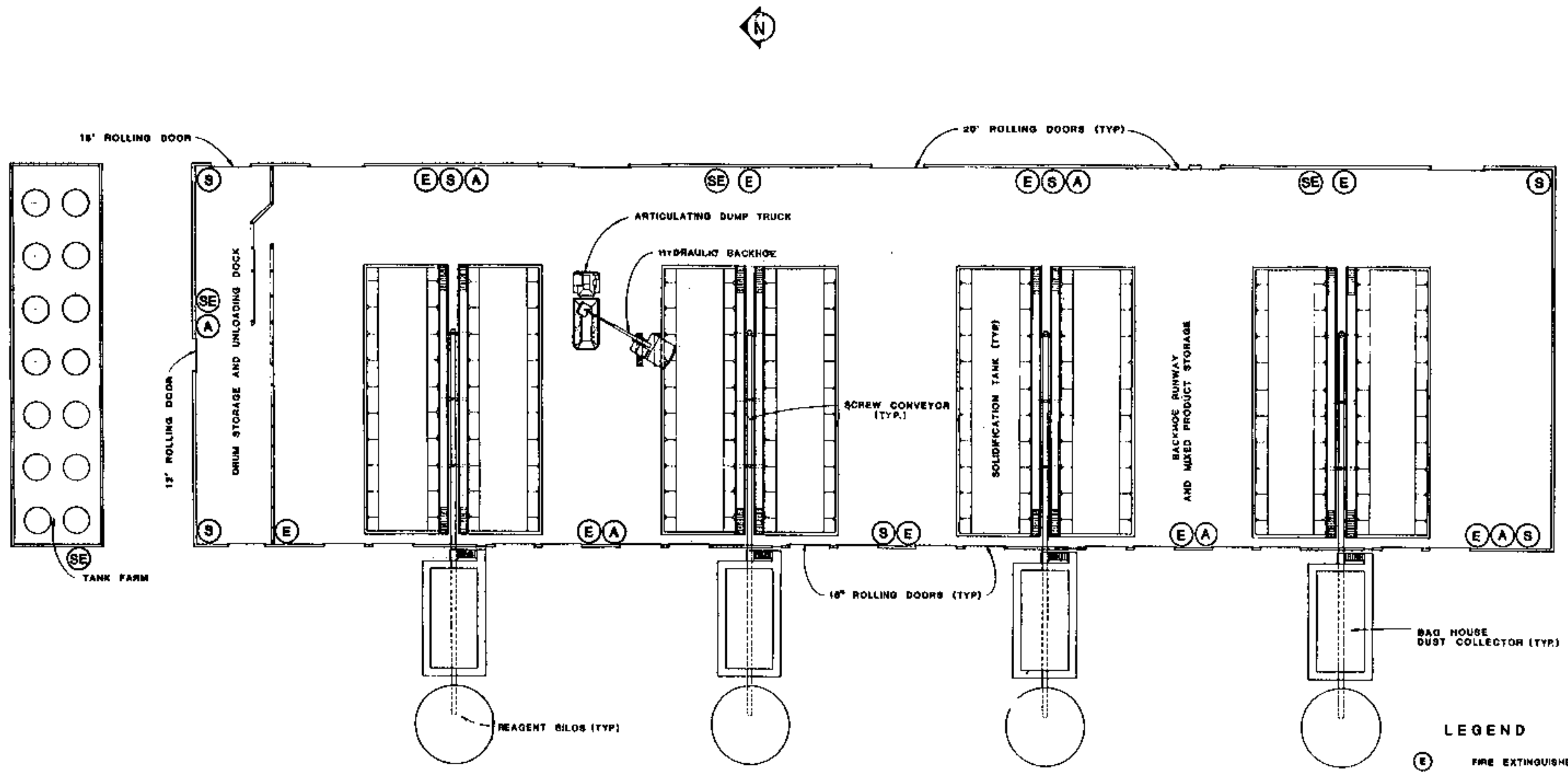
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
MAINTENANCE AND TRUCKWASH FACILITIES
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN

SHEET NO
FIG. 7.3.4
OF



PLAN

LEGEND

- (E) FIRE EXTINGUISHERS
- (A) ALARM BOXES
- (S) ALARM SPEAKERS
- (SE) SHOWER-EYEWASH

SCALE IN FT. 0 10 20 30

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

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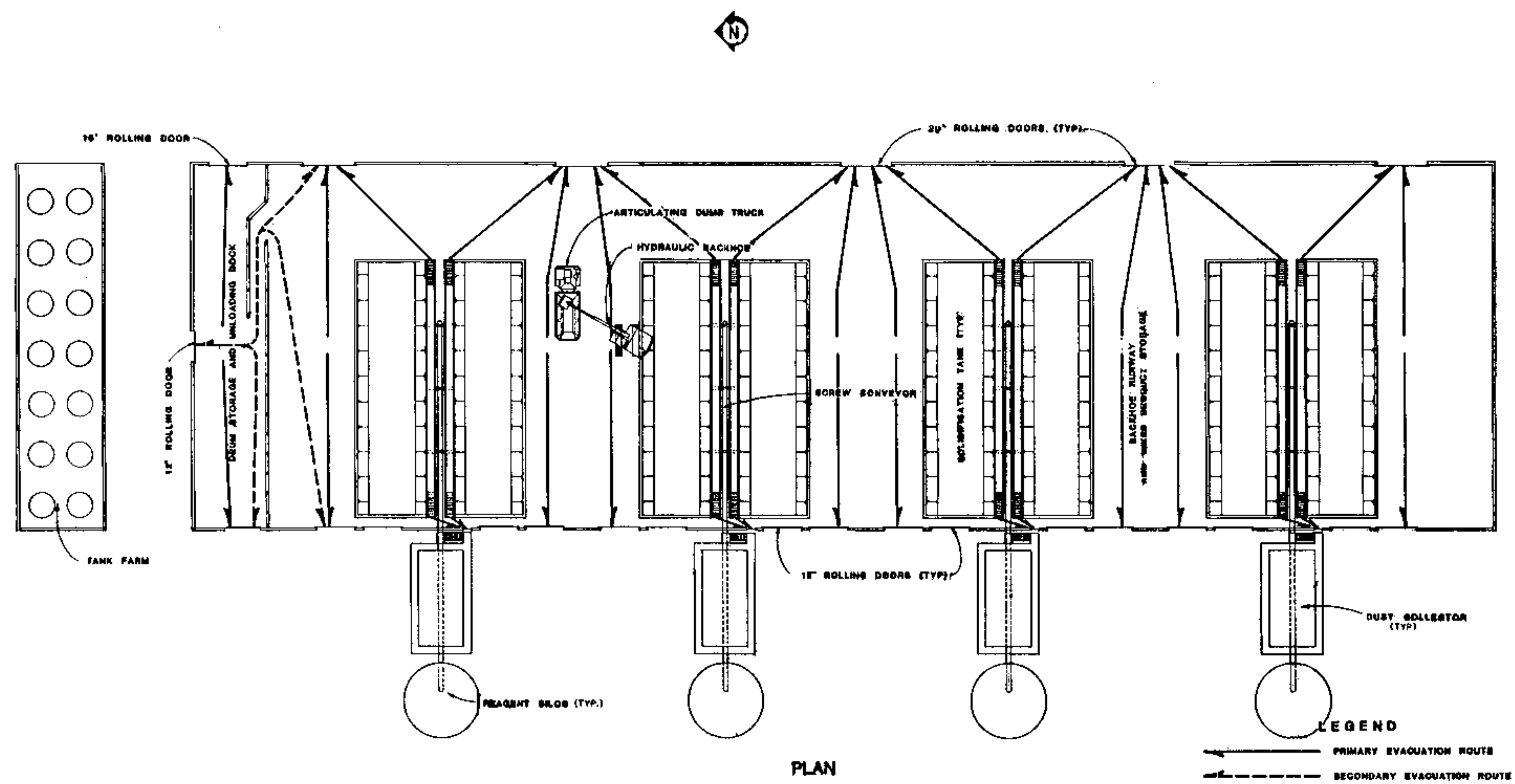
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
TREATMENT / SOLIDIFICATION BUILDING
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN

SHEET NO.
FIG. 7.3.5



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BY
DATE

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DATE 16 MAR 81

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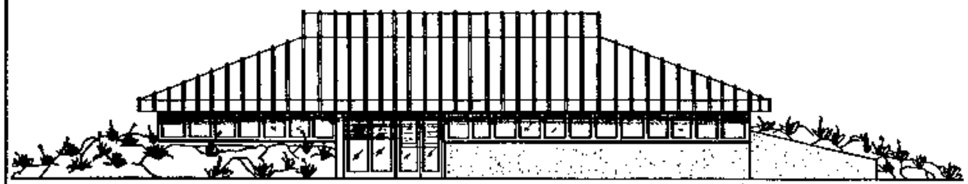
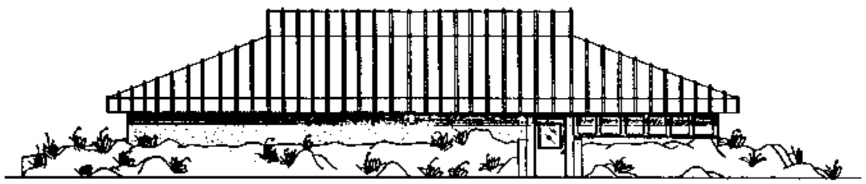
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

TREATMENT / SOLIDIFICATION BUILDING
PRIMARY & SECONDARY EVACUATION PLAN

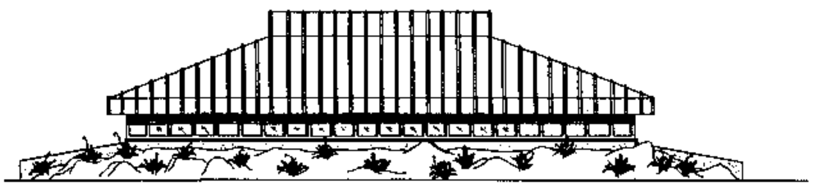
SHEET NO. FIG. 7.3.6 OF



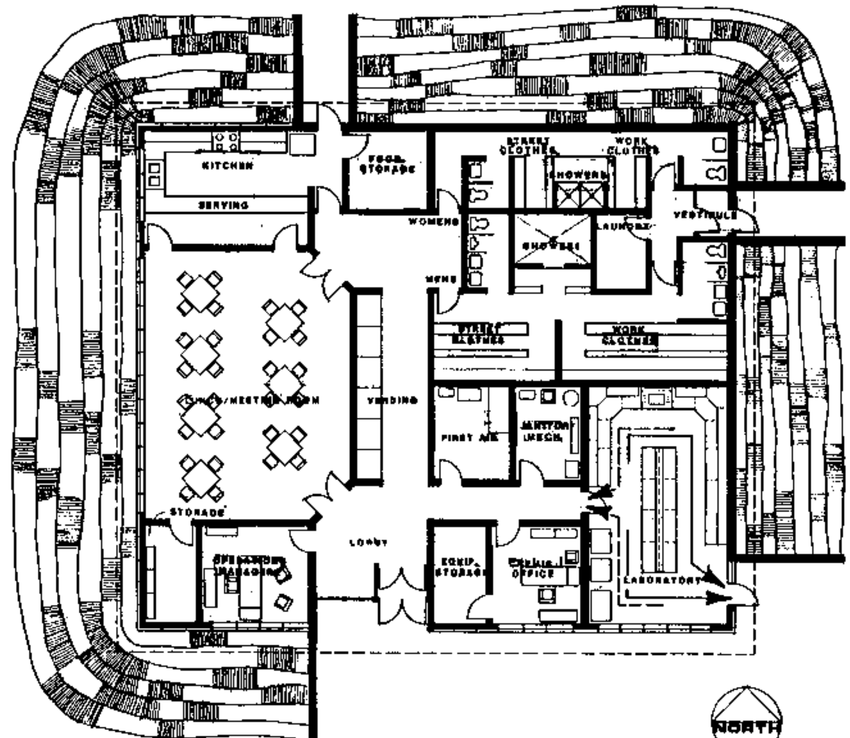
SOUTH ELEVATION



NORTH ELEVATION



WEST ELEVATION



FLOOR PLAN

LEGEND

PRIMARY EVACUATION ROUTE

SECONDARY EVACUATION ROUTE

SCALE IN FT. 0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

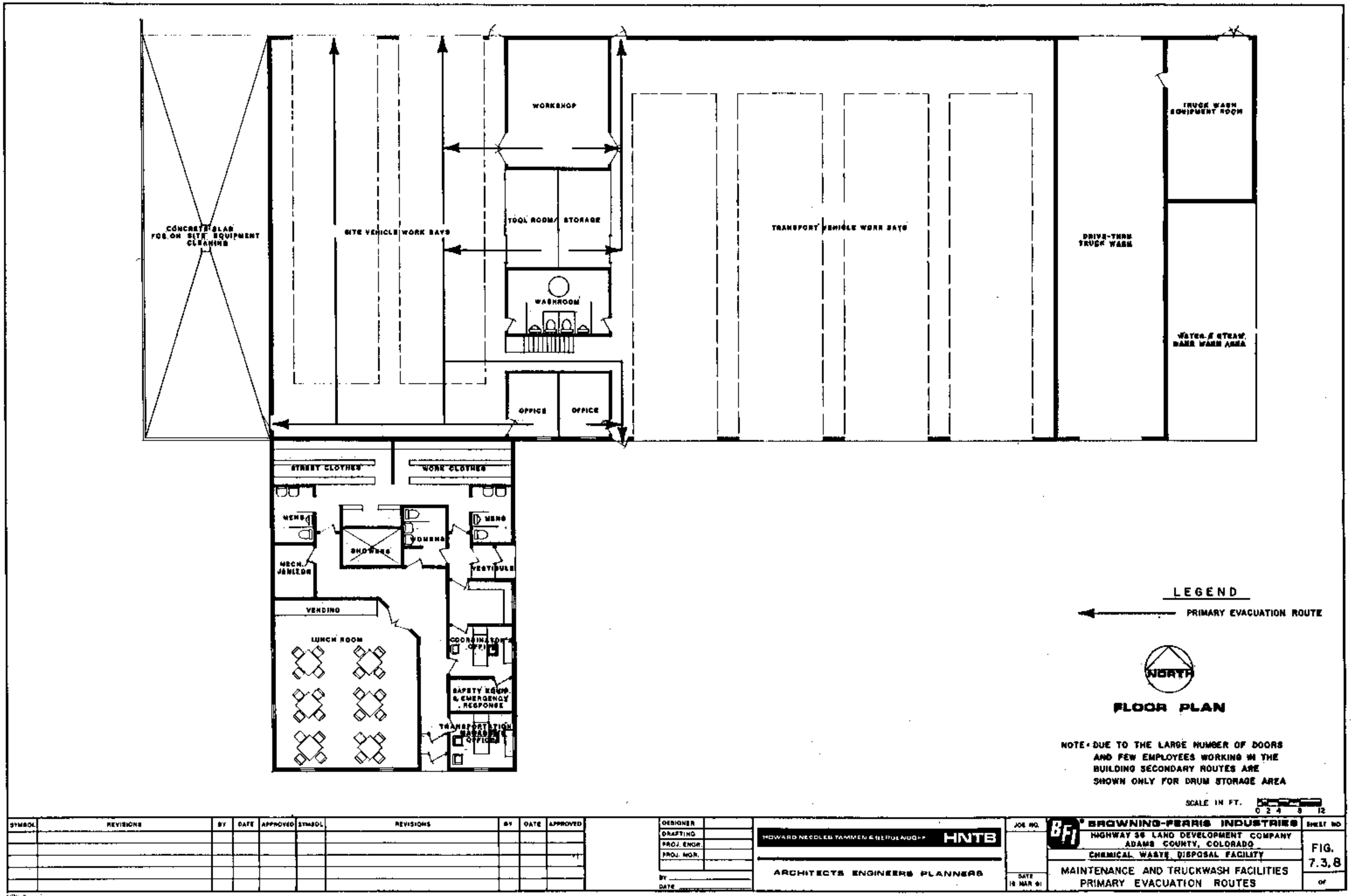
DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 18 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
LABORATORY BLDG.
PRIMARY AND SECONDARY
EVACUATION ROUTE

SHEET NO.
FIG. 7.3.7
OF


CONCRETE SLAB FOR ON SITE EQUIPMENT CLEANING
SITE VEHICLE WORK BAYS
WORKSHOP
TOOL ROOM/ STORAGE
WASHROOM
OFFICE
OFFICE
TRANSPORT VEHICLE WORK BAYS
DRIVE-THRU TRUCK WASH
TRUCK WASH EQUIPMENT ROOM
WATER & STEAM HAND WASH AREA
STREET CLOTHES
WORK CLOTHES
MENS
SHOWERS
WOMENS
MENS
MECH. JANITOR
VESTIBULE
VENDING
LUNCH ROOM
COORDINATOR'S OFFICE
SAFETY EQUIP. & EMERGENCY RESPONSE
TRANSPORTATION MANAGER'S OFFICE
LEGEND
PRIMARY EVACUATION ROUTE
NORTH
FLOOR PLAN
NOTE: DUE TO THE LARGE NUMBER OF DOORS AND FEW EMPLOYEES WORKING IN THE BUILDING SECONDARY ROUTES ARE SHOWN ONLY FOR DRUM STORAGE AREA
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BFI
BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
MAINTENANCE AND TRUCKWASH FACILITIES
PRIMARY EVACUATION ROUTES
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FIG.
7.3.8
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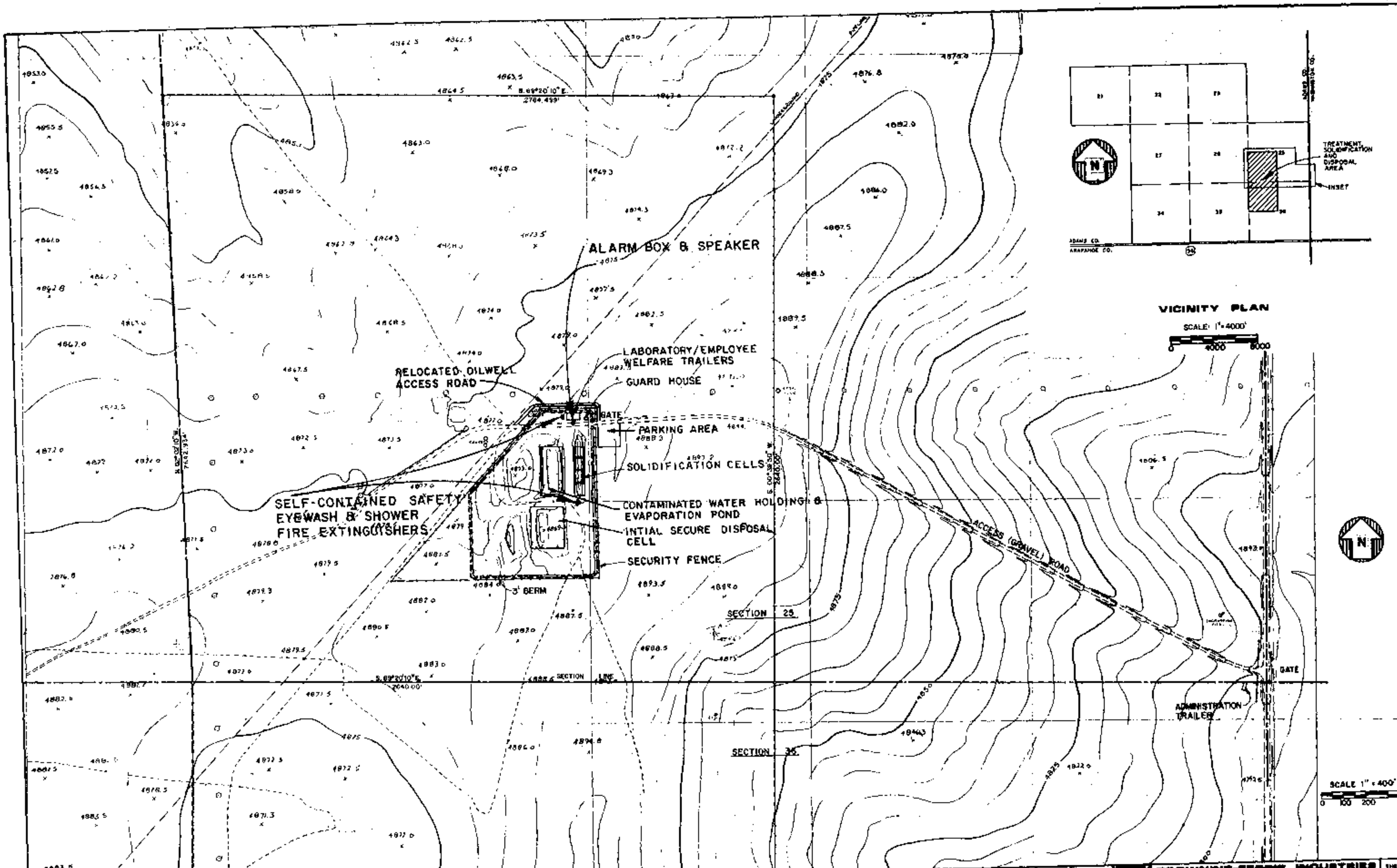

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ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

PHASE I ALARM SYSTEM, SHOWER/EYEWASH AND FIRE EXTINGUISHER LOCATION PLAN

SHEET NO. FIG. 7.3.9 OF

- Tanks will be constructed of materials and linings which will not be prematurely degraded by wastes stored in the tanks.

- Procedures will be utilized for testing and preventive maintenance at all components critical to the tank farm integrity and safety.

- Procedures (as shown in Figure 7.2.8) will be utilized to insure that the waste previously stored in a tank is chemically compatible with incoming waste prior to transfer operations. If incompatibility exists, the tank will be properly cleaned prior to transfer of the incompatible waste into the tank.

- An inspection will be made daily of all discharge control equipment and the level of waste in each tank. Equipment and structural components of the tanks will be inspected in accordance with the general inspection plan in Section 7.2.4. Inspection results will be recorded on an inspection report form.

- An inspection will be made weekly of all discharge confinement structures to insure no erosion or obvious signs of leakage. Inspection results will be recorded on an inspection report form.

- All damages and sub-specification conditions will be recorded and replaced or repaired promptly.

- Procedures have been developed to store reactive and ignitable waste in such a way that it is protected from any material or condition which may cause the waste to ignite or react. These procedures will be used when appropriate.

7.3.5 Solidification Facilities

- Building construction, equipment, and other structures will meet prescribed safety standards and be designed in accordance with good engineering practice.

- Solidification cells and tanks will be clearly identified to prevent the commingling of incompatible wastes.

- Procedures will be utilized for testing and preventative maintenance at all locations critical to the structural integrity of the solidification building.

- The facility will be designed so that all wash water from building clean-up is collected for proper treatment and disposal.

- Physical inspections will be made routinely throughout this building, and results will be recorded on inspection report forms, as provided in Section 7.2.4 in the general inspection plan.

- All damages and sub-specification conditions will be recorded and replaced or repaired promptly.

- Exhaust systems and air pollution control equipment will be installed to prevent the possibility of explosion, to protect the workers' health, and to assure that emmissions from the solidification building do not adversely affect ambient air quality. This equipment will be inspected and tested as recommended by the manufacturer.

7.3.6 Off-Site Vehicle Wash Area

- Wash water from cleaning the interiors of hazardous waste transporters will be captured and transferred directly to the appropriate solidification cell or tank.

- Wash water from cleaning exteriors of hazardous waste transporters will be recycled to clean the interior of the vehicles with subsequent wash water treatment as previously described or will be conveyed to the contaminated water holding and evaporation pond.

- Building construction, equipment, and other structures will meet prescribed safety standards and be designed in accordance with good engineering practice.

7.3.7 Maintenance Building

- The water from the washing of equipment which has been on the active portion of the site will be transferred to a solidification cell or basin, or to the contaminated water holding and evaporation pond.

- All equipment from the active portion of the site will be properly cleansed before maintenance is performed.

- Building construction, equipment and related facilities have been designed to meet prescribed safety and design standards, and designed in accordance with good engineering practices.

7.3.8 Surface Impoundment (Solidification)

- A freeboard of at least two feet will be maintained to prevent any escape of liquid due to overfilling.

- A daily site inspection will be performed to check and record the freeboard level, as outlined in Section 7.2.4.

- A weekly inspection will be performed to check and record any deterioration or failures in the cells or tanks, as outlined in Section 7.2.4.

- Any deterioration or malfunction will be recorded in the inspection report and will be promptly remedied.

- There will be no mixing or commingling of incompatible waste, or of wastes and other materials, which may: generate extreme heat, pressure, fire, explosion or violent reaction; produce uncontrolled toxic or flammable mists, fumes, or dusts in sufficient quantities to threaten human health; or cause damage to the structural integrity of the impoundment.

7.3.9 Surface Impoundments (Contaminated Water, Non-Contaminated Surface Water, and Potentially Contaminated Water Holding Ponds)

- A freeboard of at least two feet will be maintained to prevent any escape of liquid due to overfilling, wave action, or a storm.

- Appropriate protective material or vegetation will be used as a protective cover to minimize wind and water erosion of the surface impoundment embankments.

- A site inspection will be performed to check and record any deterioration or failures in the impoundment, as provided in the general inspection plan in Section 7.2.4.

- Deterioration and malfunctions will be recorded in the inspection report and will be promptly remedied.

- The surface impoundment for contaminated and potentially contaminated water will have a containment system which meets the design and operating requirements of 40 CFR, Part 264 Subpart K. A daily schedule will be developed for inspection of the surface impoundment's containment system. If any liquids are collected by the impoundment's leachate collection system, the liquid will be immediately analyzed to determine if it is leachate. If the analytical data identifies the liquid as leachate, then (as required in 40 CFR 264.227 (b)) the surface impoundment will be removed from service and repaired.

7.3.10 Secure Disposal Area

- Loud speakers and/or two-way radios will be located to insure the alerting of landfill personnel in the event of an emergency.

- Each piece of operating equipment will carry a fire extinguisher.

- The secure disposal cell will be designed to prevent run-off and run-on from the processing/disposal area.

- A map will be maintained showing the location, depth and dimensions of each cell with respect to a surveyed permanent benchmark.

- A map will be maintained showing the approximate location and type of hazardous waste within each cell.

- Incompatible wastes will either be pretreated to reduce or eliminate incompatibility, or will be isolated by compacted clay barriers on all sides when placed in the secure disposal cell.

- o All liquid wastes or wastes containing free liquids will be solidified before being placed into the disposal cell.
- o A groundwater monitoring system will be installed which meets the requirements of 40 CFR 265 Subpart F, as discussed in Section 7.6.
- o Each disposal cell will be lined with at least five feet of re-compacted clay and contain a leachate collection system.

7.4 CONTINGENCY PLAN AND EMERGENCY PROCEDURES

7.4.1 Introduction

The preparedness and prevention plan presented in Section 7.3 is designed to minimize the possibility of fire, explosion, or unplanned sudden or non-sudden release of hazardous waste. The contingency plan and emergency procedures presented in this section outline the actions to be taken by facility personnel in the event of a fire, explosion, or unplanned sudden or non-sudden release of hazardous waste to air, soil, or surface water. In the event of an emergency, the provisions of this plan will be implemented immediately.

This plan describes the actions which will be taken by facility personnel in response to an emergency. It describes the arrangements made with and addresses/telephone numbers for (Appendix F) local police departments, hospitals, and State and local emergency response teams to assist during an emergency event. It designates qualified individuals as emergency coordinator and alternates. The emergency coordinator and his alternates will be thoroughly familiar with all aspects of the facilities contingency plan, the operational activities of each process, the location and characteristics of wastes handled, the location of all facility records and the facility layout. The emergency coordinator will have the authority to commit the resources necessary to fully implement the contingency plan.

The emergency procedures to be carried out by the emergency coordinator or his alternate are outlined in detail within this plan. These procedures detail the responsibilities of the emergency coordinator or his alternate during and after the emergency.

This plan provides for a trained and equipped on-site emergency response unit to respond to all on-site emergency events and any off-site company hazardous waste transportation accidents. This unit will be available to assist any local, State, or Federal agency, upon request, in the event of other non-company hazardous waste accidents. The emergency coordinator or his alternate will direct this group.

A list of typical on-site emergency equipment and its location was provided in Figures 7.3.1 through 7.3.5 and 7.3.9. This includes all fire extinguishing systems, spill control equipment, external and internal communication and alarm systems, decontamination equipment, and safety showers and eye washes.

An evacuation plan will be prepared following preparation of detailed design/construction plans. This evacuation plan will cover all areas where there is a possibility that evacuation could be necessary. Both primary and secondary evacuation routes will be designated, where appropriate. A preliminary indication of evacuation routes was presented in Figures 7.3.6 through 7.3.8.

The required training program will instruct all facility personnel as to their specific responsibilities during emergency situations. The alarm system has been designed to identify the location of the incident to the emergency response unit. The emergency coordinator will thoroughly review the contingency plan on a quarterly basis in the monthly employee safety meeting.

Amendments will be made to the contingency plans whenever:

- o the regulations change;
- o the plan is found to be deficient during an emergency;
- o the facility changes its design, construction, operation, or maintenance;
- o the emergency coordinator changes; or
- o the list of emergency equipment changes.

Copies of this contingency plan will be maintained on-site and submitted to all local police departments, hospitals, and State and local emergency response teams that may be called upon during an emergency. Lists of specified emergency response agencies will be posted near the telephone of the emergency coordinator, the employee bulletin board, the main guard house and in the laboratory.

7.4.2 Emergency Coordinator

The operations manager will be designated as the emergency coordinator. The site supervisors will be designated as emergency coordinator alternates. These employees will have a thorough knowledge of all aspects of the facilities activites and contingency plans and the authority to commit the resources needed to carry out the plan.

7.4.3 Emergency Procedures of Emergency Coordinator

1. Whenever there is an imminent or actual emergency situation the emergency coordinator will immediately activate the facility alarm system, thus alerting all personnel as to the situation.

2. He will immediately identify the character, exact source, amount, and the extent of any fire, explosion or release of hazardous waste.

3. He will notify the appropriate Federal, State and local agencies affected by the emergency.

4. He will immediately assess the possibility of hazards to facility personnel.

5. He will assist the local authorities in deciding whether local areas should be evacuated and to what distances.

6. During the emergency, the emergency coordinator will take the appropriate reasonable measures necessary to prevent recurrence or spreading.

7. After facility shut-down due to an emergency, the emergency coordinator will monitor for other dangerous situations which may occur due to the incident.

8. The emergency coordinator will make arrangements to store, treat, or dispose of all hazardous clean-up residual.

9. The operator will submit a report to the EPA Regional Administrator and appropriate State and local agenices within 15 days after the incident which details the incident and includes the following:

   a. Name, address, and telephone number of the facility owner.
   b. Name, address, and telephone number of the facility.
   c. Date, time, and type of incident.
   d. Name and quantity of material(s) involved.
   e. The extent of injuries, if any.
   f. An assessment of actual or potential hazards to human health or the environment, where applicable.
   g. Estimated quantity and final disposition of recovered material that resulted from the incident.

7.4.4 Laboratory Contingency Plan

7.4.4.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the building using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct supervision of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator will evaluate all injuries and take appropriate steps to minimize them.

7. The hospital or other medical facility will be given all known information concerning the injury of any incoming patients.

8. The cause of the incident will be determined and appropriate measures will be taken to prevent future fires or explosions.

7.4.5 Tank Farm and Drum Storage Contingency Plan

7.4.5.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. The cause of the incident will be determined and appropriate measures will be taken to prevent another fire or explosion.

7.4.5.2 Sudden or Unexpected Release

1. The person first noting the release will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using the predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. The hospital or other medical facility will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures taken to prevent another release.

7.4.5.3 Non-Sudden Release

1. The person first noting the release will immediately notify the emergency coordinator or his alternate.

2. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation.

3. If the situation is determined to be an imminent or actual emergency situation, then the emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

4. The tank contents will be transferred to another storage facility, taking care to assure compatibility of materials.

5. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

6. The cause of the incident will be determined and appropriate measures taken to prevent another release.

7.4.6 Solidification Facility Contingency Plan

7.4.6.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures taken to prevent another fire or explosion.

7.4.6.2 Sudden or Unexpected Release of Gases or Vapor

1. The person nearest an alarm station will immediately activate the alarm system.

2. Employees will immediately put on respirators or self-contained breathing equipment, or leave the building.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures will be taken to prevent another release.

7.4.7 Surface Impoundments

7.4.7.1 Liner or Berm Failure

1. As soon as it has been determined that the primary liner has failed, the emergency coordinator or his alternate will be contacted immediately.

2. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation, and will implement his responsibilities as listed in Section 7.4.3.

3. The flow of waste into the impoundment will immediately cease and no other wastes will be discharged into the impoundment.

4. Any leakage will be contained and if possible the leak will immediately be stopped.

5. The impoundment will be emptied if the leak cannot be stopped.

6. The cause of the incident will be determined and appropriate measure taken to prevent another failure.

7. Upon determining the cause, the containment system will be repaired and certified by a registered professional engineer prior to reuse.

7.4.7.2 Non-Sudden Release

1. The leachate collection system will be inspected monthly for the presence of liquids.

2. The ground water monitoring wells will be sampled and analyzed for evidence of ground water contamination in accordance with the provisions contained in Section 7.6.

3. If liquids are found in the leachate collection system, an analysis will be performed to determine if the liquid is leachate.

4. If liquid extracted is determined to be leachate, or the groundwater appears to be contaminated, the emergency coordinator or his alternate will be notified.

5. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation.

6. If the situation is determined to be an imminent or actual emergency situation, the emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

7. The cause of the release will be determined and appropriate measures taken to prevent another release.

7.4.8 Secure Disposal Cells

7.4.8.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm automatically alerts the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator will evaluate any injuries and take approporiate steps.

7. Hospital or medical care facilities will be given all known information concerning injuries of the incoming patient(s).

8. Upon completion of clean-up, the area will be tested to insure no residual environmental contamination exists.

9. The cause will be determined and appropriate measures taken to prevent another fire.

7.4.8.2 Non-Sudden Release

1. The leachate collection system will be inspected monthly for the presence of liquids.

2. The ground water monitoring wells will be sampled and analyzed for evidence of ground water contamination in accordance with the provisions contained in Section 7.6.

3. If liquids are found in the leachate collection system, an analysis will be performed to determine if the liquid is leachate.

4. If the liquid is leachate, immediate actions, as deemed appropriate by the emergency coordinator or his alternate, will be taken to determine the location of the leaching and measures taken to prevent further leaching.

7.4.9 Emergency Contacts

In the event of an emergency, the emergency coordinator must notify the appropriate State, local or Federal agencies which have been designated response roles if their help is needed. These appropriate agencies along with their responsibilities and capabilities have been identified and will be periodically briefed to insure a knowledgable working relationship in the event of an emergency. Also, the nearest hospitals, and emergency transportation services have been located to insure proper care and removal in the event of an on-site injury. Their capabilities and response times have been identified and are described within the plan.

Appendix F lists the local, State, and Federal agencies and hospitals and emergency transportation services which may be contacted in the event of an emergency or injury and gives their emergency telephone numbers and contact persons.

The Adams County Sheriff will be contacted by the emergency coordinator in the event of an emergency. The facility is not located in a fire district; thus, the county sheriff assumes the same responsibilities as a fire chief. He would assist the emergency coordinator in dealing with other local and State agencies.

The Tri-County Health Department will be contacted by the emergency coordinator in the event of an emergency. The Department's primary responsibility is as a consultant to the emergency coordinator for containment and evacuation. The Health Department does not have any equipment necessary to extinguish fires or contain and clean up spills.

The Hazardous Waste Control Section of the State Health Department will also be contacted by the emergency coordinator in the event of an emergency. They will provide technical assistance to the local agencies if requested and can obtain samples for analysis, as required. The Hazardous Waste Control Section does not have the equipment necessary to extinguish fires or contain and clean up spills.

The U.S. EPA Region VIII Emergency Response Branch will also be contacted by the emergency coordinator in the event of an emergency. The EPA Response Branch will access the reported emergency and determine if they are required at the site. They will also assist in the contacting of appropriate State and local agencies. Their equipment is limited to personal protection. They can obtain samples and perform analysis if required, to test for residual contamination.

In the event of an injury, the on-site first aid specialist who supports the emergency coordinator will evaluate the extent of the injury. If the first aid specialist determines that the injury is serious, emergency medical air service will be immediately contacted. This service consists of two helicopters and is provided by the St. Anthony Hospital. St. Anthony's Hospital is a major metropolitan hospital located in Denver, which provides complete health care facilities. However, specific injuries such as burns or poisoning are transported instead to the University of Colorado Medical Center or Denver General Hospital, respectively. Each helicopter contains electrocardiographic monitors, oxygen, defibrillator, suction apparatus, endotracheal intubation equipment, intravenous fluids, and emergency drugs and is staffed by specialized registered nurses (RNs) who are trained in critical injury care. Each helicopter can accommodate two stretcher patients, one patient sitting, the critical injury care nurse, and the pilot. The helicopter has a range of 300 miles and response time to the site would be approximately 40 minutes. Upon arrival, the critical injury care nurse will evaluate the type of injury, stabilize the patient, and depending on the type of injury determine the appropriate hospital. The air service has access to an emergency medical service patch matrix communication system which connects the critical injury care nurse with the designated hospital or any physician who will be utilized upon arrival of the patient. This allows for specialized treatment of the injury while enroute to the designated hospital.

If the on-site first aid specialist determines the injury to be non-serious, then the Morgan County Ambulance service will be contacted for transport. The service is operated by the Morgan County government and has ambulances located in Ft. Morgan (two), Brush, and Wiggins. The ambulances are on call 24 hours a day and are staffed by emergency medical technicians. The estimated response time to the facility is one hour.

A non-critical patient will be transported to the Ft. Morgan Community Hospital. The facility has 40 beds, 10 staff doctors, 10 registered nurses, and 15 licensed practical nurses. Serious injuries to the head or spinal column and chemical or third degree burns can be stabilized at this hospital, then transported to the applicable hospital in Denver. The hospital has a 24 hour emergency room staffed with trained emergency medical technicians (EMT's) and has doctors on call for serious injuries. There are two x-ray suites, two operating rooms, a complete laboratory, and 24 hour respiratory therapy.

The facility will have its own trained and fully equipped on-site emergency response team for the containment and clean-up of hazardous waste releases. In the event of a release, the necessary equipment will be utilized to contain the release and clean up the area.

7.4.10 Emergency Equipment

Fire fighting equipment to be used by the emergency response team will include the site water trucks which will be modified for fire fighting use and (for Phase II) a trailer mounted foam dispensing unit to be used on chemical fires.

The facility will have 10 and 20 pound Purple K portable fire extinguishers positioned throughout the site. Also, portable fire extinguishers will be located on each site vehicle. The emergency coordinator is responsible for insuring the inspection and maintenance of all extinguishers. Typical locations of fire extinguishers have been identified in Figures 7.3.1 through 7.3.5 and 7.3.9.

Major equipment maintained on-site for containment and clean-up of hazardous waste in the event of a release consists of vacuum equipment, absorbents, foams, back-hoes, bulldozers, and dump trucks. The facility will have an equipped emergency response van which will contain shovels, rakes, ropes, personal safety equipment, volatile vapor analyzers, and other support equipment. The location of the emergency response van and equipment has been designated as shown in Figure 7.3.1, pending detailed design of the facility.

The facility will have both internal and external alarm and loudspeaker systems located throughout the site to insure immediate response to the emergency in the appropriate area of the facility. The loudspeakers will be connected to the plant telephones located in the administration office, dispatchers office, chemist's office, truckwash building, tank farm, and solidification facility. Typical locations of loudspeaker telephones and alarms are indicated in Figures 7.3.1 through 7.3.5 and 7.3.9.

Safety showers and eye washes will be located in the laboratory, tank farm area, solidification facility, truck wash area, and secure disposal cell area. The showers and eye washes will be located in convenient positions in the event of a spill or fire. Typical locations of the showers and eye washes are indicated in Figures 7.3.1 to 7.3.5 and 7.3.9.

7.4.11 Evacuation

In the event of an imminent or actual emergency situation the emergency coordinator will activate internal facility alarms or communication systems to alert facility personnel. The personnel will evacuate the facility using the pre-designated primary and secondary evacuation routes which are designated in Figures 7.3.6 to 7.3.8. The evacuation will be directed by the emergency coordinator and be coordinated with the security guard(s) on duty to expedite the evacuation.

7.5 MANIFEST SYSTEM, RECORD KEEPING, AND REPORTING

The interim status standards contain various requirements for record keeping systems and for reporting operations and incidents. These requirements are summarized in Subpart E of the standards, although certain details of the requirements are also contained in various other subparts.

The following discussion is intended to identify the applicable record keeping and reporting requirements, and to indicate the procedures to be used to comply with these requirements.

7.5.1 Use of Manifest System

All hazardous waste treatment, storage, and disposal facilities which receive hazardous wastes in non-exempt quantities from off-site generators must utilize a manifest system which meets the requirements contained in 40 CFR 265.71 and 265.72.

This facility will comply with these requirements by employing the following procedures:

1. The designated facility technical staff member will sign, date, and return to the transporter a copy of each manifest received with each shipment of non-exempt hazardous waste.

2. Any significant discrepancies in the quantity and type of hazardous waste received and quantity and type of hazardous waste described in the manifest will be reconciled with the generator within 15 days of receipt of the waste or the details of the discrepancy will be immediately reported by letter to the EPA Regional Office. Additional procedures for discrepancies may be found in Sections 7.5.2 and 7.2.3.

3. Within 30 days of receipt of a conforming, non-exempt hazardous waste, the operator will send a copy of the signed manifest to the generator for purposes of verifying to him that the conforming waste was received.

4. The facility's copy of the manifest will be retained on file at the facility for a minimum of three years.

7.5.2 Manifest Discrepencies

As indicated in Section 7.5.1, any significant discrepancies in the quantity and type of hazardous waste received or the quantity and type of hazardous waste described in the manifest will be reconciled with the generator within 15 days of receipt of the waste before processing or in the event of no reconciliation, the details of the discrepancy will be immediately reported in detail by letter to the EPA Regional Office, along with copies of the manifest.

A "significant discrepancy" in quantity is:

- o for bulk waste shipments, any variation in quantity greater than 10% of weight; or
- o for containerized shipments, any variation in piece count, such as a discrepancy of one drum per truckload.

A significant discrepancy in type is a difference which can be discovered through visual inspection or waste analysis, such as waste solvent substituted for waste acid, or toxic constituents not being reported.

All significant discrepancies must also be noted on the manifest.

7.5.3 Operating Records

During the operating life of the facility, the operations manager will maintain a written operating record. This record will be retained until final closure of the facility.

The operating record will contain the following information:

- o An itemized listing of each hazardous waste received, including a waste description, quantity, and the method(s) and date(s) of treatment, solidification, and disposal.
- o The location and quantity of each waste stored or disposed of at the facility. The location and quantity of each waste will be recorded on a grid map of the disposal cell. This data will also be cross-referenced to the manifest numbers associated with each waste.
- o Results of all analyses and trial tests conducted on wastes.
- o Reports showing pertinent details of every incident which required implementation of the contingency plan contained in Section 7.4.
- o Results of facility inspections and corrective action taken as outlined in Section 7.2.4. As noted in that section, these records will be retained for three years.
- o Results obtained from the groundwater monitoring program described in Section 7.6. These results will be retained throughout the post-closure monitoring period.
- o Closure and post-closure cost estimates, including subsequent annual adjustment or revisions, as described in Section 7.6.

7.5.4 Training Records

The district manager will maintain complete training records to show both the training provided to employees, and employees participation in formal and on-the-job training. These records are described in Section 7.2.5 and will contain:

- o The job title for each position at the facility related to hazardous waste management, and the name of the employee filling each position.

- o A written job description for each position. This description will include the requisite skill, education, or other qualifications and duties assigned to each position.
- o A written description of the type and amount of both introductory and continuing training that will be given to each person filling each position listed.
- o Records that document that training or job experience required has been given to and satisfactorily completed by all appropriate facility personnel.

7.5.5 Availability, Retention, and Disposition of Records

The records, plans, and other data that are developed and employed in accordance with Section 7.5 and Subpart E of the interim status standards will be furnished upon request, and made available at reasonable times for inspection, by any officer, employee or representative of U.S. EPA who is duly designated by the administrator of that agency. Similar access to these records, plans, and data will be granted to duly authorized representatives of Colorado or local governmental agencies acting either under specific statutory authority with respect to hazardous waste facilities, or the written authorization of the administrator of U.S. EPA.

The minimum retention period for each of the records mentioned in this section is three years. In the event of any enforcement action, the retention period for all records will automatically be extended indefinitely, pending resolution of that action. From initial notification of an enforcement action and until its resolution, none of the records covered by the action will be discarded or destroyed. Should the EPA Regional Administrator or his duly appointed representative ever request extension of the retention period for any records, that request will be honored.

7.5.6 Annual Report

Prior to March 1 of each year of the operating life of the facility, the operator will prepare and submit to the U.S. EPA Regional Administrator an annual report, using EPA Form 8700-13, as shown in Figures 7.5.1 and 7.5.2. Upon notification that the enforcement authority for RCRA has been transferred to a Colorado State agency, the operator will instead begin submitting annual reports on the prescribed form to the designated State agency. Upon final closure of the facility, a final annual report will be prepared and submitted.

The annual report will provide the following information, as a minimum:

- The EPA identification number, name, and address of the facility.
- The calendar year covered by the report.
- The EPA identification number for each hazardous waste generator from which the facility received hazardous waste during the year. For imported shipments, the report will give the name and address of the foreign generator.
- A description and the quantity of each hazardous waste the facility received during the year, by EPA identification number for each generator.
- The method of treatment, solidification, and disposal for each hazardous waste.
- Monitoring data for the previous year.
- The most recent closure cost estimate and the most recent post-closure cost estimate.
- The certification section of the report will be signed by the district manager or his authorized representative.

7.5.7 Unmanifested Waste Report

In the event unmanifested hazardous wastes are received by the facility and are stored, treated, or disposed of without being reconciled with the generator, the operator will file a report utilizing EPA form 8700-13 and

FIGURE 7.5.1

Reprinted from:

Federal Register / Vol. 45, No. 98 / Monday, May 19, 1980 / Rules and Regulations

Please print or type with ELITE type (12 characters per inch).

GSA No. 12345 XX
Form Approved OMB No. 158-R0.IXX

EPA — U.S. ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE REPORT

PLEASE PLACE LABEL IN THIS SPACE

I. TYPE OF HAZARDOUS WASTE REPORT

PART A: GENERATOR ANNUAL REPORT

THIS REPORT IS FOR THE YEAR ENDING DEC. 31, 19__

PART B: FACILITY ANNUAL REPORT

THIS REPORT FOR YEAR ENDING DEC. 31, 19__

PART C: UNMANIFESTED WASTE REPORT

THIS REPORT IS FOR A WASTE RECEIVED (day, mo., & yr.) __-__-19__

INSTRUCTIONS: You may have received a preprinted label attached to the front of this pamphlet; affix it in the designated space above–left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Sections II, III, and IV below blank. If you did not receive a preprinted label, complete all sections. "Installation" means a single site where hazardous waste is generated, treated, stored, or disposed of. Please refer to the specific instructions for generators or facilities before completing this form. The information requested herein is required by law (Section 3002/3004 of the Resource Conservation and Recovery Act).

II. INSTALLATION'S EPA I.D. NUMBER

F __ 1

III. NAME OF INSTALLATION

IV. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX

3

CITY OR TOWN | ST. | ZIP CODE

4

V. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER

5

CITY OR TOWN | ST. | ZIP CODE

6

VI. INSTALLATION CONTACT

NAME (last and first) | PHONE NO. (area code & no.)

2

VII. TRANSPORTATION SERVICES USED (for Part A reports only)

List the EPA Identification Numbers for those transporters whose services were used during the reporting year represented by this report.

VIII. COST ESTIMATES FOR FACILITIES (for Part B reports only)

A. COST ESTIMATE FOR FACILITY CLOSURE

$ ___,___,___

B. COST ESTIMATE FOR POST CLOSURE MONITORING AND MAINTENANCE (Disposal facilities only)

$ ___,___,___

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. PRINT OR TYPE NAME | B. SIGNATURE | C. DATE SIGNED

EPA Form 8700-13 (4-80)

PAGE 1 OF ____

FIGURE 7.5.2

Reprinted from:

Federal Register / Vol. 45, No. 98 / Monday, May 19, 1980 / Rules and Regulations

Please print or type with ELITE type (12 characters/inch).

GSA No. 12345-XX
Form Approved OMB No. 158 R00XX

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

FACILITY REPORT – PARTS B & C

(Collected under the authority of Section 3004 of RCRA.)

FOR OFFICIAL USE ONLY (Items 1 & 3)

1. DATE RECEIVED 19

2. RECEIVED BY

XVI. TYPE OF REPORT (enter an "X")

☐ PART B ☐ PART C

XVII. FACILITY'S EPA I.D. NO.

G

XVIII. GENERATOR'S EPA I.D. NO.

XIX. GENERATOR NAME (specify)

XX. GENERATOR ADDRESS (street or P.O. box, city, state, & zip code)

XXI. WASTE IDENTIFICATION

LINE NUMBER	A. DESCRIPTION OF WASTE	B. EPA HAZARDOUS WASTE NUMBER (see instructions)	C. HANDLING METHOD (enter code)	D. AMOUNT OF WASTE	E. UNIT OF MEASURE (enter code)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

XXII. COMMENTS (enter information by line number — see instructions)

EPA Form 8700-13B (5-80)

BILLING CODE 6560-01-C

PAGE ____ OF ____

8700-13B (see Figures 7.5.1 and 7.5.2) within 15 days of receipt of the waste. This report will include the following information:

- The EPA identification number, name and address of the facility.
- The date the facility received the waste.
- The EPA identification number, name, and address of the generator and the transporter, if available.
- A description and the quantity of each unmanifested hazardous waste the facility received.
- The method of treatment, storage, solidification, or disposal for each hazardous waste.
- A brief explanation of why the waste was unmanifested, if known.
- The certification of the report will be signed by the district manager or his authorized representative.

If a hazardous waste shipment is unmanifested because it is in an exempted quantity, the district manager will endeavor to obtain certification of the exempted status of the waste from the generator. This certification will be incorporated into the facility's operating records and also reported to the EPA Regional Administration. If such certification cannot be obtained, an unmanifested waste report will be prepared and submitted as described above.

7.5.8 Additional Reports

In addition to the annual reports and the unmanifested waste reports previously discussed, the facility operator will prepare and submit to the EPA Regional Administrator, or the appropriate Colorado State agency, the following reports:

- Hazardous Waste Release Reports. All reportable spills, leaks, fires and explosions will be reported immediately to the local governmental emergency response coordinator and the National Response Center (Phone 800-424-8802). A written report will be submitted to the EPA Regional Administrator within 15 days. At a minimum, this report will include:

- Name, address, and telephone number of the facility operator.
- Name, address, and telephone number of the facility.
- Date, time, and type of incident (e.g., fire, explosion).
- Name and quantity of material(s) involved.
- Extent of injuries, if any.
- An assessment of actual or potential hazard to human health or the environment, where this is applicable.
- Estimated quantity and disposition of recovered material that resulted from the incident.

o <u>Closure Notification</u>. At least 180 days prior to commencement of closure, the facility operator will submit the closure plan for approval to the EPA Regional Administrator. Following completion of closure, the operator and an independent registered professional engineer will certify to the Regional Administrator that the facility has been closed in accordance with the specifications in the approved closure plan.

7.6 ENVIRONMENTAL MONITORING PROGRAM

The fundamental objectives of environmental monitoring at land disposal sites are to serve as a check on potential leachate contamination of groundwater; surface water contamination from runoff; and particulate emissions during facility operations. In cases where potential groundwater contamination is sufficiently neutralized by natural hydrogeological conditions and by engineered safeguards, EPA regulations provide that the requirement for groundwater monitoring may be waived(6).

This facility is located in a favorable hydrogeological setting, and the surface impoundments and disposal cells will be provided with both leachate collection/detection systems and recompacted clay liners. Even though these conditions would appear to be sufficient to justify waiving the groundwater monitoring requirements, it has been decided, as an additional safeguard, to initiate a monitoring program to detect any potential impact the facility may have on groundwater quality.

Monitor wells have been installed and will periodically be sampled along with surface water impoundments for analysis of selected parameters.

Initial background levels will be compared to subsequent measurements to determine if there has been a change in value for any parameters. Such changes will be statistically evaluated to determine if they were actually significantly different, or were simply caused by variations inherent to the sampling and analytical methods. This evaluation will employ the use of statistical procedures as indicated in pertinent 40 CFR 265 Subpart F.

If a determination should ever be made that the facility may be contaminating the environment, a monitoring program review will be performed. If this review indicates sufficient grounds, a more comprehensive environmental assessment program will be implemented, as recommended in 40 CFR 265 Subpart F.

The Colorado Air Quality Commission has the authority under the Colorado Revised Statutes 1973, Section 25-7-106 to request that BFI monitor air quality at the facility. Should the Commission request an air monitoring program, the following is proposed: Monitor total suspended particulates and meteorological data during all of Phase I and through the first full year of Phase II operations.

The monitoring program for total suspended particulates shall consist of one high volume air sampling system (hi-vol sampler) along with a 10 meter meteorological data tower.

The hi-vol sampler and meteorological tower shall be placed at the property line downwind of the site along the most predominant wind direction.

The hi-vol sampler shall consist of a basic sampler with flow controller, elapsed time clock, and a six-day timer. The sampling for TSP shall occur once every six days.

The meteorological tower shall collect and record wind speed, wind direction, and solar radiation data from which stability class can be determined.

An annual report containing TSP and meteorological data shall be formulated and submitted to the State of Colorado Air Pollution Control Division. The TSP data shall be compared to the National Ambient Air Quality Standards. The meteorological data will be tabulated and analyzed with a STAR program.

7.6.1 Location and Installation of Groundwater Monitoring Wells

Well locations are detailed in the monitor well location map (Figure 7.6.1). The wells to be included in the monitoring program are MW5, MW9, MW10, MW11, AND WW1. Four of these wells are screened in the shallow alluvium associated with drainages which slope away from the disposal site. The other well, WW1, is screened into the much deeper shale zone (see Section 5.4).

MW8, located in a drainage area to the west of the facility, has not produced water to date. Wells such as MW8 that are not producing sufficient water for sampling will be maintained as control points. These control points (i.e., MW1, MW2, MW3, MW4, MW6, MW7, and MW8) will provide the opportunity to detect any changes in the areal extent of superficial groundwater due to seasonal variations or topographical modifications.

The well installation details are given in Table 7.6.1, and a typical well diagram in Figure 7.6.2. Key characteristics of the wells include the following:

- PVC pipe with square threaded flush joints was used exclusively in all monitoring wells and control points.
- All wells were grouted above the slotted sections with a bentonite slurry. Bentonite without additives was used.
- The wells were concreted around the top three feet.
- All well heads are protected by locking covers.

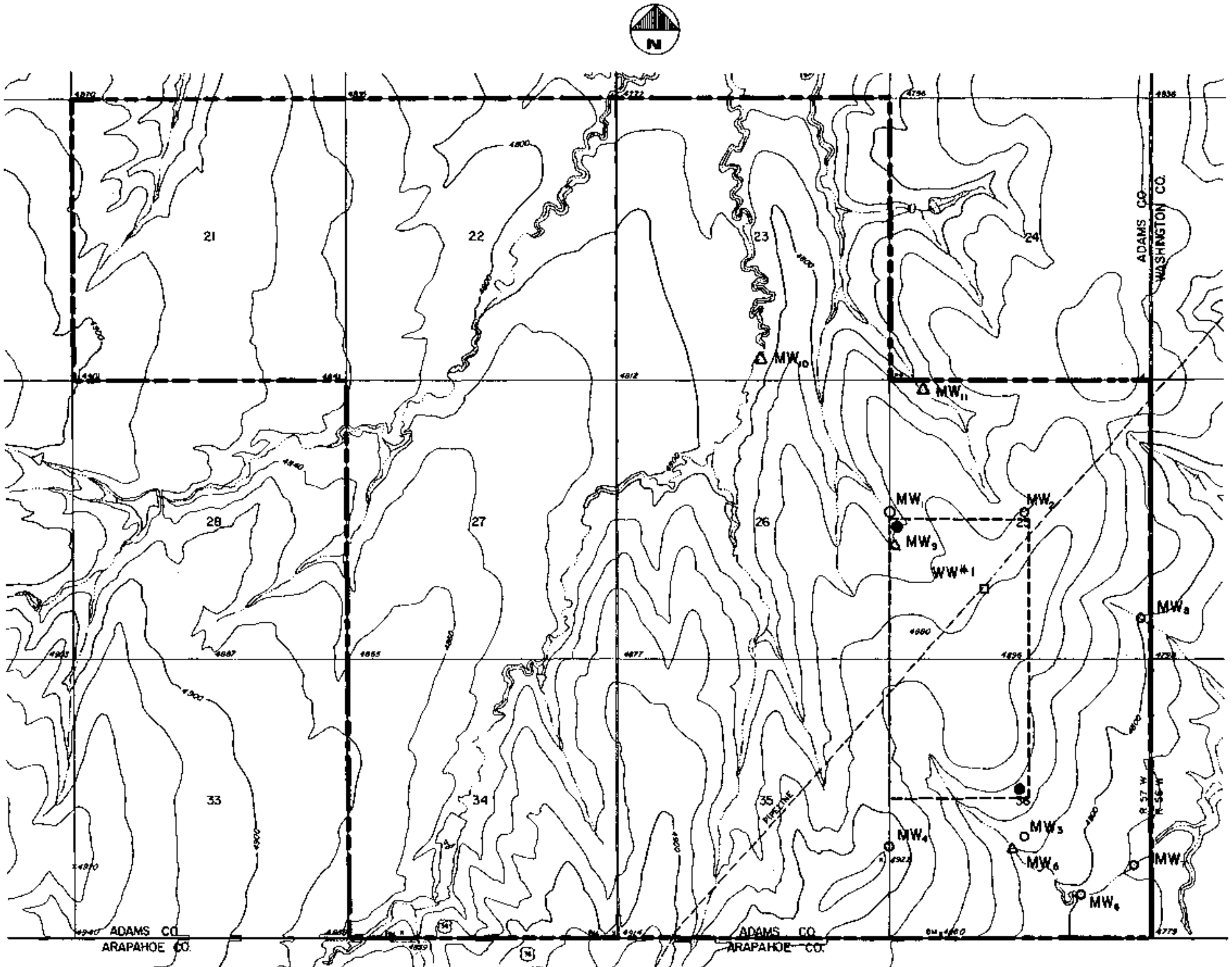
7.6.2 Surface Water Sampling

During Phase II, surface water samples will be obtained from each of the non-contaminated run-off collection facilities in the northwest and southeast corners of the active site. Location of these sampling points is shown on Figure 7.6.1. The sampling schedule and testing procedures will be the same as for the groundwater samples.

7.6.3 Sample Collection

Prior to groundwater sampling, the static water level will be measured. Then each well will be purged of 3 to 5 casing volumes of water by bailing or pumping. After recharge, normally 24 to 48 hours with these wells, water samples will be collected initially by means of a stainless steel bailer with a bottom ball check valve. Field records will include the well number, date, time, and the name of the person sampling. They will also include the initial water level, and the approximate volume of water removed prior to sampling.

Surface water samples will be collected about three feet below the surface of the middle of the impoundment or midway between the surface and the bottom if the total depth is less than five feet by using a Kemmerer



L E G E N D

△	MW_x	MONITOR WELL TO BE SAMPLED
□	WW#x	WATER WELL #X
○	MW_x	MONITOR WELL TO BE USED AS CONTROL POINT
●	SW_x	SURFACE WATER SAMPLING POINT

0 1000 2000 3000
SCALE (FEET)

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF **HNTB**
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

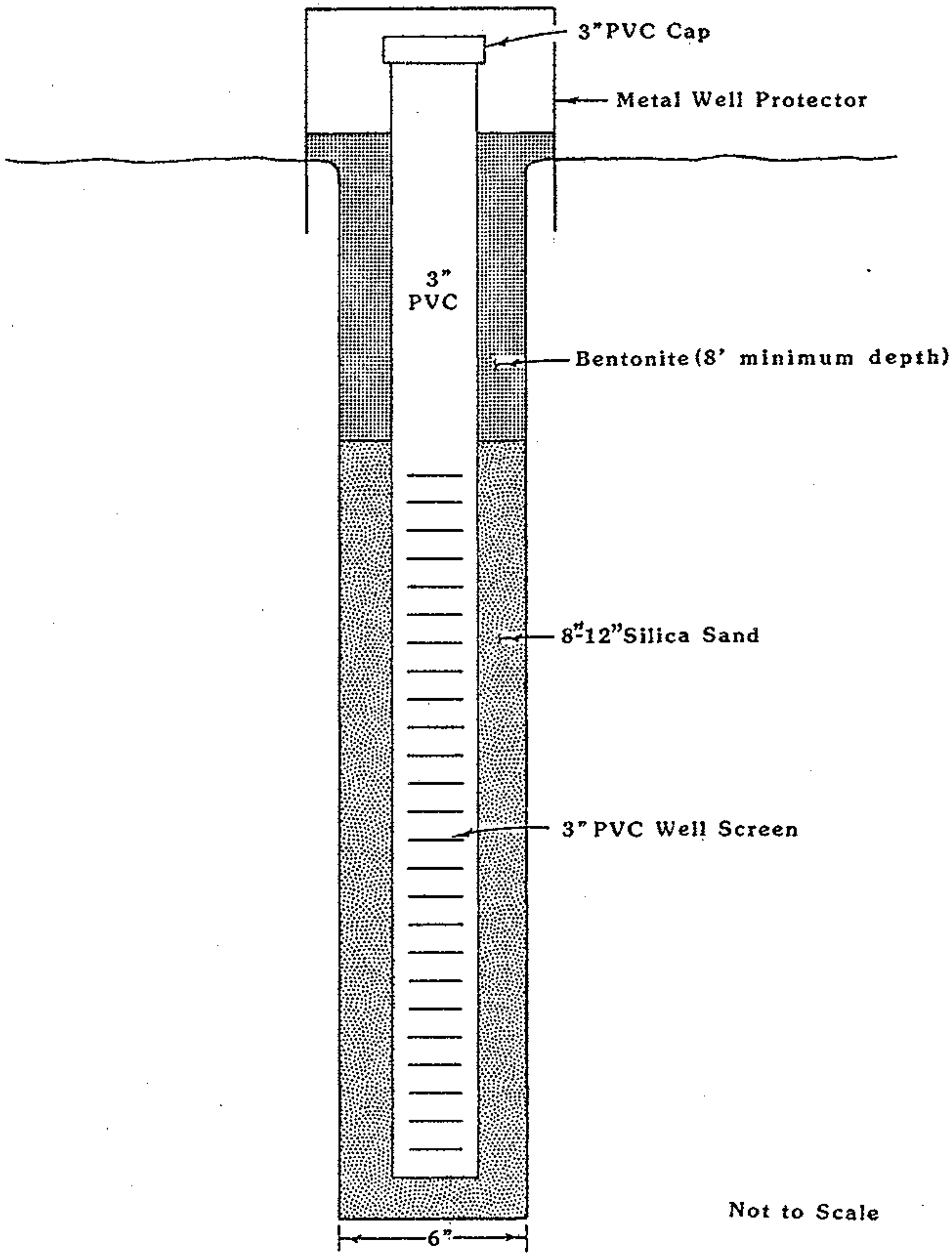
MONITOR WELL LOCATION MAP

SHEET NO. 7.6.1

TABLE 7.6.1

MONITORING/WATER WELL INSTALLATION DETAILS

HOLE NO.	HOLE DEPTH (ft.)	WATER DEPTH (ft.)	INTERVAL CASED AND SEALED (ft.)	INTERVAL SLOTTED AND SAND PACKED (ft.)
MW-1	120	None	0-60, 3" I.D. threaded PVC	60-120, 3" I.D. threaded PVC
MW-2	120	None	0-20, 3" I.D. threaded PVC	20-120, 3" I.D. threaded PVC
MW-3	119	None	0-42, 3" I.D. threaded PVC	42-119, 3" I.D. threaded PVC
MW-4	120	None	0-8, 3" I.D. threaded PVC	8-120, 3" I.D. threaded PVC
MW-5	50	35.7	0-9, 3" I.D. threaded PVC	9-50, 3" I.D. threaded PVC
MW-6	49	None	0-9, 3" I.D. threaded PVC	9-49, 3" I.D. threaded PVC
MW-7	54	46.0	0-9, 3" I.D. threaded PVC	9-54, 3" I.D. threaded PVC
MW-8	49	None	0-8, 3" I.D. threaded PVC	8-49, 3" I.D. threaded PVC
MW-9	49.5	44.0	0-8, 3" I.D. threaded PVC	8-49, 1/2, 3" I.D. threaded PVC
MW-10	40	15.0	0-8, 3" I.D. threaded PVC	8-28, 3" I.D. threaded PVC
MW-11	40	12.0	0-8, 3" I.D. threaded PVC	8-38, 3" I.D. threaded PVC
WW-1	500	251.0	0-100, 8-5/8" I.D. steel casing	100-500, 4" I.D. threaded PVC



TYPICAL MONITORING WELL CROSS SECTION	Job No: 1-2543-3233
FOX Consulting Engineers and Geologists	Date: 3/5/81
	Figure 7.6.2

water sampler (or equal). Sampling data, time, and location will be noted, along with the name of the person sampling the impoundment.

7.6.4 Sample Preservation and Containers

Water samples will be preserved in the field at the time of collection by procedures defined in the Federal Register, 40 CFR, Part 136(1). All sample containers are to be prewashed with an anionic detergent and final rinsed with distilled deionized water. Bottles for pesticide and herbicide analyses will be given a final rinse with pesticide grade acetone and allowed to dry. Preservative will be premeasured and added to the containers prior to sampling. A list of sample containers and preservatives is given in Table 7.6.2. The sample containers should be completely filled to prevent unnecessary exposure to air.

After labeling, samples will be packed with ice in insulated coolers for shipment. Samples collected in this way will be delivered to the analytical lab within 30 hours.

7.6.5 Labeling and Chain of Custody

Each sample will be labeled at the time of collection. The sample label will contain the well number, surface impoundment designation, and the date (which together shall constitute the sample number), preservatives used, analyses required, and the sampler's initials.

The samples will be handled by as few people as possible. Generally, the sampler will be the only custodian of the samples until delivery to the analytical laboratory. If any other transfers of custody must be made, a chain of custody document will be used. The person relieved of the samples will sign a release and the recipient will sign for them. Samples

TABLE 7.6.2

SAMPLE CONTAINERS AND PRESERVATION

Parameter Group	Sample Containers and Preservation
(1) Metals	Polyethylene bottle, 500 ml, containing 5 ml/l conc. HNO_3.
(2) Radiochemistry	Polyethylene bottle, 1/2 gallon, containing 5 ml/l conc. HNO_3.
(3) Nutrients	Glass bottle, 1 qt., containing 2 ml/l conc. H_2SO_4. Hold at 4°C.
(4) TOX	Polyethylene bottle 500 ml, containing 2 ml/l conc. H_2SO_4. Hold at 4°C.
(5) TOC	Polyethylene bottle, 125 ml, containing 2 ml/l conc. H_2SO_4. Hold at 4°C.
(6) Oil and Grease	Glass bottle, 1 qt. containing 2 ml/l conc. H_2SO_4. Hold at 4°C.
(7) Cyanide	Polyethylene bottle, 500 ml, containing 2 ml/l 12.5 N NaOH. Hold at 4°C.
(8) Fecal coliforms	Sterile glass bottle, 250 ml. Hold at 4°C.
(9) Herbicides	Glass bottle, 1 qt., with a teflon lined cap. Hold at 4°C.
(10) Pesticides	Glass bottle, 1 qt., with a teflon lined cap. Hold at 4°C.
(11) Anions and Others	Polyethylene bottle, 1/2 gal., Hold at 4°C.

will always be in the personal possession of the custodian or under lock. Shipment containers will be sealed with evidence tape or its equivalent. Upon receipt of the samples, laboratory personnel will examine the evidence tape to make sure it has not been tampered with.

7.6.6 Laboratory Procedures and Methods

Upon receipt, the sample for coliforms will be submitted promptly for analysis. All other water samples will be allowed to settle for 24 hours at 4°C, and then the supernatant fluid decanted. The supernate used for metals analyses will first be subjected to a dilute hydrochloric and nitric acid leach at 90°C for one hour, and then filtered. The results of metals determinations performed on this filtrate should be considered to be the sum of soluble and leachable constituents. The supernates prepared for other determinations will be filtered prior to analysis. A summary of analytical methods with reference citations is given in Tables 7.6.3 to 7.6.6.

7.6.7 Parameters to be Monitored

Four sets of parameters are to be monitored, as outlined in Tables 7.6.3 through 7.6.6.

- o Parameters characterizing the suitability of the surface and groundwater as a drinking water supply(6) will be measured quarterly during the first year. The values measured will be compared to the National Primary Drinking Water Standards(4). See Table 7.6.3.

- o Parameters used as indicators of groundwater contamination(6) will be sampled quarterly during the first year and then semi-annually through the active life of the facility and continuing through the post-closure period. Four replicate measurements of each parameter will be made for each water sample. See Table 7.6.4.

- o Required parameters establishing surface and groundwater quality(6) will be measured quarterly during the first year and then annually thereafter through the active life of the facility

TABLE 7.6.3

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS A DRINKING WATER SUPPLY

Parameter	Units	Detection Limits	Preservative*	Method	Methodology Reference**
Arsenic	mg/l	0.005	1	Furnace AA	3 - Method 206.2
Barium	mg/l	0.1	1	Flame AA	3 - Method 208.1
Cadium	mg/l	0.005	1	Flame AA	3 - Method 213.1
Chromium	mg/l	0.01	1	Flame AA	3 - Method 218.1
Fluoride	mg/l	0.1	1	Electrode	3 - Method 340.2
Lead	mg/l	0.05		Flame AA	3 - Method 239.1
Mercury	mg/l	0.0002	1	Flameless AA	3 - Method 245.1
Nitrate (as N)	mg/l	0.05	3	Colorimetric	3 - Method 352.1
Selenium	mg/l	0.005	1	Furnace AA	3 - Method 270.2
Silver	mg/l	0.01	1	Flame AA	3 - Method 272.1
Endrin	mg/l	0.0001	10	GC	1 - Method 608
Lindane	mg/l	0.00005	10	GC	1 - Method 608
Methoxychlor	mg/l	0.001	10	GC	1 - Method 608
Toxaphene	mg/l	0.0025	10	GC	1 - Method 608
2,4-D	mg/l	0.005	9	HPLC	9
2,4,5-TP (Silvex)	mg/l	0.002	9	HPLC	9
Radium 226	pCi/l	0.1	2	Alpha Spectrometry	5 - Method 705
Natural Uranium	pCi/l	1.3	2	Fluorimeter	7
Gross Alpha	pCi/l	1	2	Proportional Counter	5 - Method 703
Gross Beta	pCi/l	1	2	Proportional Counter	5 - Method 703
Coliform Bacteria	No./100ml	0	8	Membrane Filter	5 - Method 909

* See Sample Methods and Preservation, Table 7.6.2.
** See References, Section 7.10.

TABLE 7.6.4

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION

Parameter	Units	Detection Limits	Preservative*	Method	Methodology Reference**
pH	pH units	.1	11	Electrode	3 - Method 150.1
Specific Conductance	umhos/cm	10	11	Wheatstone Bridge	3 - Method 120.1
TOC	mg/1	1	5	Combustion Infrared	3 - Method 415.1
TOX	ug Cl/1	5	4	Dohrman TOX	8 - Method 450.1

* See Sample Methods and Preservation, Table 7.6.2.
** See References, Section 7.10.

TABLE 7.6.5

REQUIRED PARAMETERS ESTABLISHING GROUNDWATER QUALITY

Parameter	Units	Detection Limits	Preservative*	Method	Methodology Reference**
Chloride	mg/l	5	11	Titration	3 - Method 325.3
Iron	mg/l	0.05	1	Flame AA	3 - Method 326.1
Manganese	mg/l	0.025	1	Flame AA	3 - Method 243.1
Phenolics	mg/l	0.005	3	Distillation Colorimatric	3 - Method 420.1
Sodium	mg/l	1	1	Flame Emission	3 - Method 273.1
Sulfate	mg/l	10	11	Turbidimetric	3 - Method 375.4

* See Sample Methods and Preservation, Table 7.6.2.
** See References, Section 7.10.

TABLE 7.6.6

OTHER PARAMETERS RELATED TO GROUNDWATER QUALITY

Parameter	Units	Detection Limits	Preservative*	Method	Methodology Reference**
Ammonia	mg/l	0.05	3	Electrode	3 - Method 350.3
Color	mg/l	1	11	Platinum Cobalt	3 - Method 110.2
Copper	mg/l	0.03	1	Flame AA	3 - Method 220.1
Cyanide	mg/l	0.005	7	Distillation-Colorimatric	3 - Method 335.2
Magnesium	mg/l	1	1	Flame AA	3 - Method 242.1
Nickel	mg/l	0.06	1	Flame AA	3 - Method 249.1
Phosphate	mg/l	0.01	11	Colorimetric	3 - Method 265.2
Potassium	mg/l	1	1	Flame Emission	3 - Method 288.1
Zinc	mg/l	0.02	1	Flame AA	3 - Method 289.1

* See Sample Methods and Preservation, Table 7.6.2.
** See References, Section 7.10.

and continuing through the post-closure period. These data will be used to establish the initial background levels for use in the event that a water quality assessment program must be implemented as provided for in Section 7.6.10. See Table 7.6.5.

- Other parameters related to water quality will be measured quarterly during the first year. These data will be used to establish the initial background levels for use in the event that a water quality assessment program must be implemented as provided for in Section 7.6.10. See Table 7.6.6.

- On an annual basis the district manager will determine if additional parameters should be checked in any of the sampling points for the purpose of updating the chemical characterization of groundwater and surface water.

7.6.8 Evaluation of Data; Indicator Monitoring Program

The Student's t-test will be used to determine the statistical significance of changes in the values of parameters used as indicators of water contamination as compared to the initial background levels established during the first year. All measurements made during the first year will be used to calculate the initial background arithmetic mean and the initial background variance for each parameter for each sampling point. For subsequent samples (i.e., after the first year), the arithmetic mean and the variance will be calculated from the four replicate measurements made of each water contamination indicator parameter for each sampling point.

The Student's t-test involves the calculation of a t-statistic for each parameter for each sampling point. This t-statistic is then compared to critical values of "t" in an appropriate statistical table. If the calculated value of "t" exceeds the single tailed value of t found in the table (or the double-tailed value of "t" in the case of pH) at the 0.01 level of significance, then there is a statistically significant difference between the two arithmetic means.

If no significant differences are found among the four indicator parameters and, in the absence of other evidence to the contrary, the water will be evaluated as not contaminated. The occurrence of a statistically significant increase in a parametric value (or pH decrease), will indicate a possible problem which will be evaluated in a monitoring review, as provided for in Section 7.6.9.

7.6.9 Monitoring Review

If the indicator monitoring program reveals a possible groundwater or surface water problem, a monitoring review shall be conducted as rapidly as possible to ascertain the need for the more comprehensive water quality assessment program (see Section 7.6.10). The monitoring review shall consist of two parts:

1. Analytical Check - additional samples will be obtained immediately from all potentially involved sampling locations. These samples will be split in two, and four replicate measurements of the parameter(s) of interest will be taken on all these additional samples to determine whether the significant difference was a result of laboratory error.

2. Program and Analytical Review - in conjunction with the additional analytical work, the monitoring program shall be reviewed. In particular, the results for the particular sampling point(s) of interest need to be compared with similar results from other points in the monitoring system. The spatial distribution of the points must be considered in relationship to the indicated zone(s) of potential contamination, groundwater flow rates and flow directions, and the locations of possible sources of contamination. Historical data may need to be considered. Additional statistical procedures may need to be used to check or further clarify the apparent discrepency. The entire monitoring program must be considered before a determination can be made that the facility is indeed contaminating the environment.

Results of a monitoring review will be forwarded to the EPA Region VIII Regional Administrator and to the appropriate State and county agencies within seven days of its conclusion.

7.6.10 Water Quality Assessment

If the conclusion of the monitoring review is that hazardous waste or hazardous waste constituents from the facility may be contaminating groundwater or surface water, then a water quality assessment will be conducted. To accomplish this, a plan will be developed which will specify:

- o The number, location and depth of any new sampling points.
- o Frequency of sampling and sampling methods.
- o Parameters chosen and analytical methods to be employed. Parameters which may be used to trace the migration of possible waste plumes may include, but are not limited to, the parameters developed in the initial background work.
- o Evaluation procedures, including any use of previously gathered water quality information.

This plan will be designed to determine, at a minimum:

- o Whether hazardous waste or hazardous waste constituents have, in fact, entered the water.
- o The rate and extent of migration of hazardous waste or hazardous waste constituents in the water.
- o The concentrations of hazardous waste or hazardous waste constituents in the water.
- o An evaluation of the data generated by the assessment.
- o An initial prediction of the environmental and economic consequences of the contamination, if such exists.

The first set of determinations will be made as soon as technically feasible and the results will be reported to the EPA Region VIII administrator and to the appropriate state and county health agencies within 15 days of completion. If it is determined that no hazardous waste or hazardous waste constituents have entered the water, the indicator monitoring program will be reinstated. If it is determined that hazardous waste or hazardous waste constituents have entered the water and that this condition represents a significant impediment to the beneficial use of the water, then the water quality assessment program will continue on a quarterly basis with reports to be submitted on an annual basis, until final closure of the facility.

7.6.11 Record Keeping and Reporting

- Quarterly reports: During the first year, the values of parameters measured to establish the suitability of ground and surface water for drinking will be reported to the EPA Region VIII Regional Administrator and to the appropriate State and local officials within 15 days of the completion of each quarterly analysis. This report will separately identify for each sampling point, any parameter whose value has been found to exceed the limits specified in the National Interim Primary Drinking Water Standards(4).

- Annual reports under the indicator monitoring program: The values of parameters used as indicators of water contamination, together with the evaluations of these values will be included in an annual report to the EPA Region VIII administrator and to the appropriate State and local officials. This report will separately identify any significant differences in monitoring points from the background levels established during the first year.

- Annual reports under the water quality assessment program: The annual report will be adjusted to include the results, should a water quality assessment program be implemented as provided in Section 7.6.10. This report will include, but not be limited to, calculations (or measurements) of the extent of any water contamination and the rate of transport of any hazardous wastes or hazardous waste constituents in the water during the reporting period.

- Record keeping: Records of all analyses, together with evaluations, performed under the water monitoring program will be maintained during the entire active life of the facility and during the post closure period (see Section 7.7).

7.7 CLOSURE AND POST-CLOSURE PLANS

This section presents the closure and post-closure plans for BFI's chemical waste treatment/solidification and disposal facility located in Adams County, Colorado. Section 3004 of RCRA, through its implementing regulation contained in 40 CFR, Subpart G, requires that hazardous waste disposal facilities have closure and post-closure plans. The plans' purposes are to ensure that the facility is closed properly to minimize future maintenance and also prevent post-closure escape of contaminants to the environment. In accordance with the RCRA regulations, these plans are addressed separately and are written as essentially a complete and separate document.

7.7.1 Facility Closure Plan

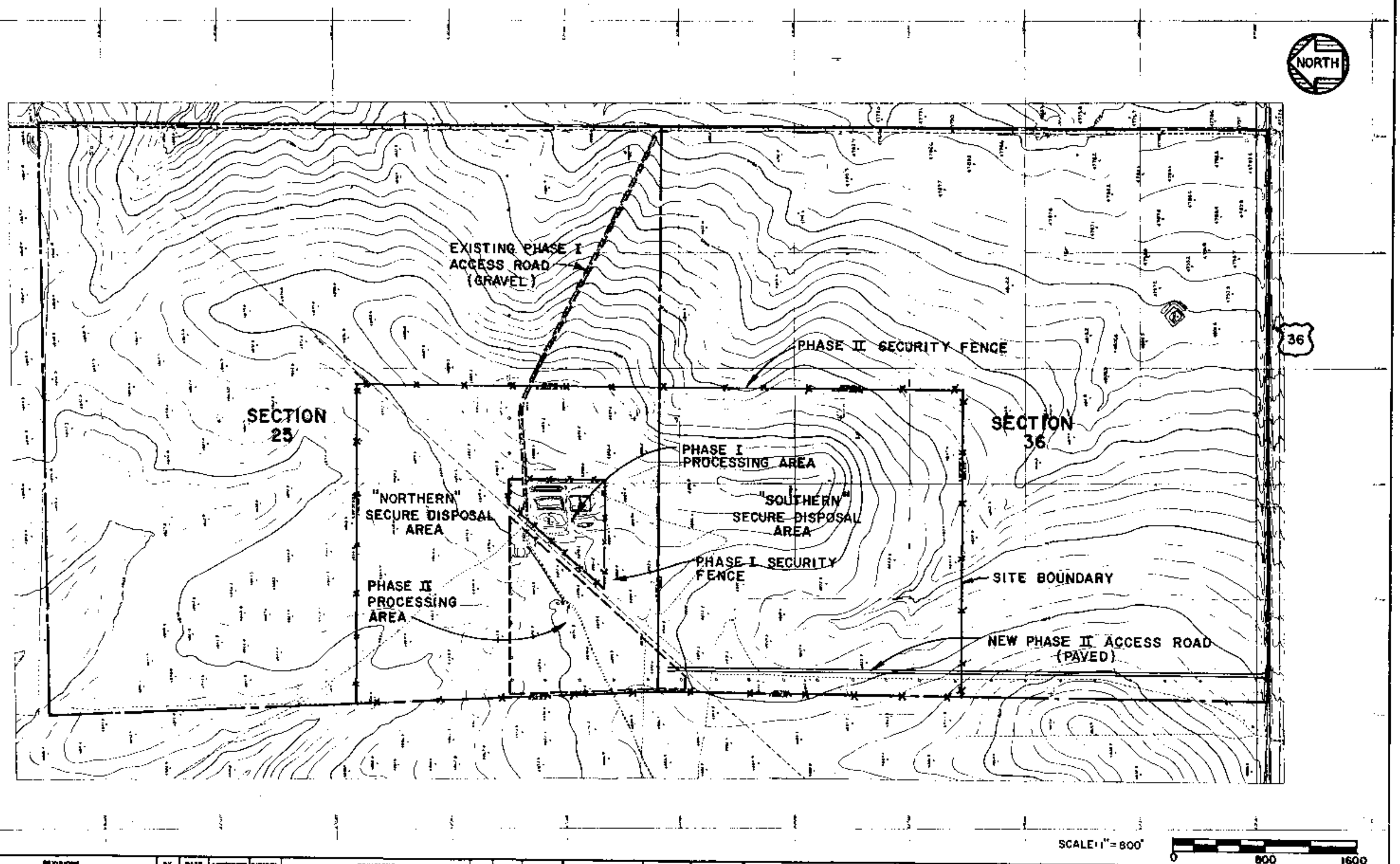
7.7.1.1 General

The facility closure plan presents the methods and procedures by which this facility will be ultimately closed in order to minimize the need for post-closure maintenance and also to control, minimize or eliminate post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall, or waste decomposition by-products, to the extent necessary to protect human health and the environment.

Some of the individual disposal and process facilities will be closed prior to final closure of the entire site. These early closures are specifically addressed in the plan.

7.7.1.2 Facility Description

The site will be operated under two levels. Phase I level of operation essentially consists of clay-lined earthen waste solidification mixing cells, a secure disposal cell, and a contaminated water holding pond. Phase II will consist of a more sophisticated solidification building with concrete mixing tanks and reagent silos, a tank farm, a drum storage and segregation area, additional secure disposal cells, the same contaminated water holding pond, a potentially contaminated water holding pond, and two non-contaminated surface water collection ponds. The locations of the Phase I and Phase II processing areas are shown in Figure 7.7.1. The proposed processes at this facility are:



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BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

DATE 16 MAR 81

FIG. 7.7.1

- o the segregation and temporary storage of bulk and drummed liquid waste;
- o treatment and solidification of liquid waste and sludges;
- o secure landfill disposal of bulk and drummed solid wastes and previously solidified liquids and sludges.

It is anticipated that this treatment, solidification, and disposal facility will receive a wide variety of chemical wastes, as discussed in Chapter 3. Operating records, daily logs and manifest will contain specific information on the types, quantities, and disposal of the wastes accepted for treatment. It is estimated that these facilities, when in full operation, will handle an average annual raw waste volume of 24,000,000 gallons which will be about 60% liquids, 25% sludges, 10% solids and 5% drums. The facility is expected to have an operating life of 20 to 25 years.

The basic operational concept for solidification is the mixing of reagents with liquid or semi-liquid chemical wastes to form a solid product for burial in secure disposal cells. The resultant treated/solidified product can be handled more easily and is very resistant to the formation of leachate. Cement kiln dust and fly ash will be the primary reagents used and they will be stored in portabulk containers for Phase I and reagent silos for Phase II.

Some wastes will be received in 55-gallon drums. The drum storage area during Phase I operations will consist of an open area with an 18-inch minimum thickness compacted clay liner which will extend up the sides of a total enclosed dike. During Phase II operations, the drum storage area will be a separate area within the treatment/solidification building.

One holding pond is to receive and contain contaminated surface run-off from disposal cells and access routes (the active area), the external truck washing area, and any collected leachate. A second holding pond will contain potentially contaminated runoff from portions of the paved surfaces in the Phase II processing area including the general areas around the solidification facility and tank farm.

The secure disposal cells will receive the treated/solidified wastes. The standard sized cell will be approximately 300 feet by 600 feet by 30 feet deep, including a five foot thick compacted clay liner. A leachate collection/ detection system will be installed in the cell bottom with provisions for removal of accumulated leachate, even though leachate formation is unlikely.

7.7.1.3 Site Conditions

7.7.1.3.1 General

The facility is located approximately 70 miles east of Denver in the gently rolling high plains of eastern Colorado. The topography of the site varies between elevation 4,835 and 4,900 feet (mean sea level datum). There is one producing oil well on the site that is expected to remain in production throughout the facility's life. An oil pipeline runs through the site in a northeast and southwest direction. The site has been used in the past for wheat farming and grazing. The surrounding area is used for similar agricultural purposes.

The climate is semi-arid with an approximate mean temperature of about 50°F and an average precipitation of about 14 inches per year. The average evaporation rate applicable to the impoundments of the facility (lake evaporation) is about 55 inches per year.

A detailed geological and hydrogeological site characterization was prepared by F. M. Fox & Associates Inc., Consulting Engineers and Geologists. The study indicates that the site is geotechnically suitable for the facility.

7.7.1.3.2 Subsurface Soils

The site is located on top of a geologic unit known as the Pierre Shale that is about 4,300 feet thick. No major aquifers exist beneath the site and the site does not contribute to recharge of major aquifers.

The Pierre Shale below the site has weathered to varying degrees and for discussion purposes has been divided into three major soil groups, as follows, with the lowest group number the closest to the surface.

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The clay content, moisture content, and dry density generally increase with depth, and in many borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2 Based on the cation-exchange capacity values (see Appendix G) and the geologic environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1×10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface, except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4×10^{-7} cm/sec and a low of "completely impervious" (no flow could be induced).

7.7.1.3.3 Groundwater Conditions

Groundwater was encountered in the test borings drilled in drainages outside the perimeter of the secure disposal cell area. This water is most likely a result of surface recharge from rainfall run-off. None of the test borings in the secure disposal cell area encountered groundwater. The only exception was the 500 foot deep borings that encountered very minor amounts of water in fractures of the shale at a depth of about 100 feet. Pumping tests were conducted on this well and the results of the test indicate essentially dry well conditions.

7.7.1.4 Closure Methods

The facility's projected life span is 20 to 25 years at which time the space available for disposal of the solidified wastes will be exhausted.

When this point is reached, wastes will no longer be accepted at the facility and it will be closed in accordance with the applicable regulations in the manner discussed in the subsequent sections. The projected final topography of the closed facility is presented on Figure 7.7.2.

7.7.1.4.1 Drum Storage Area

When final closure of the facility is imminent, receipt of drummed waste materials will be terminated. All drums on hand which contain solid wastes without releasable liquids will be placed in a secure disposal cell based upon compatibility of waste materials. Drummed liquids and semi-solid wastes will be removed from the drums and solidified. The emptied drums will be crushed or shredded and buried. The Phase I drum storage area and protective barriers will be excavated and buried in a secure disposal cell. The excavation will be backfilled with clean, compacted on-site soils. The Phase II drum storage area is contained within the treatment/solidification building and then will be closed as indicated in Section 7.7.1.4.3.

7.7.1.4.2 Storage Tanks

Receipt of bulk liquid wastes will be terminated when final closure of the facility is imminent. At that time, all bulk liquids and residues remaining in storage will be solidified. The resulting solidified product will be disposed of in a secure disposal cell.

Tanks, pumps, valves, controls or piping will be salvaged, if possible, only after cleaning and triple rinsing with appropriate cleaning materials has removed any residual contamination. Any equipment which cannot be feasibly or adequately cleaned and salvaged will be dismantled and buried in a cell.

All auxiliary facilities, such as loading/unloading pads and equipment, protective barriers and drainage facilities will be removed, and either salvaged or buried as indicated above. Any contaminated soil will be removed and buried. After all equipment and any contaminated soil has been removed, the area will be backfilled with clean compacted soil and graded to provide positive drainage.

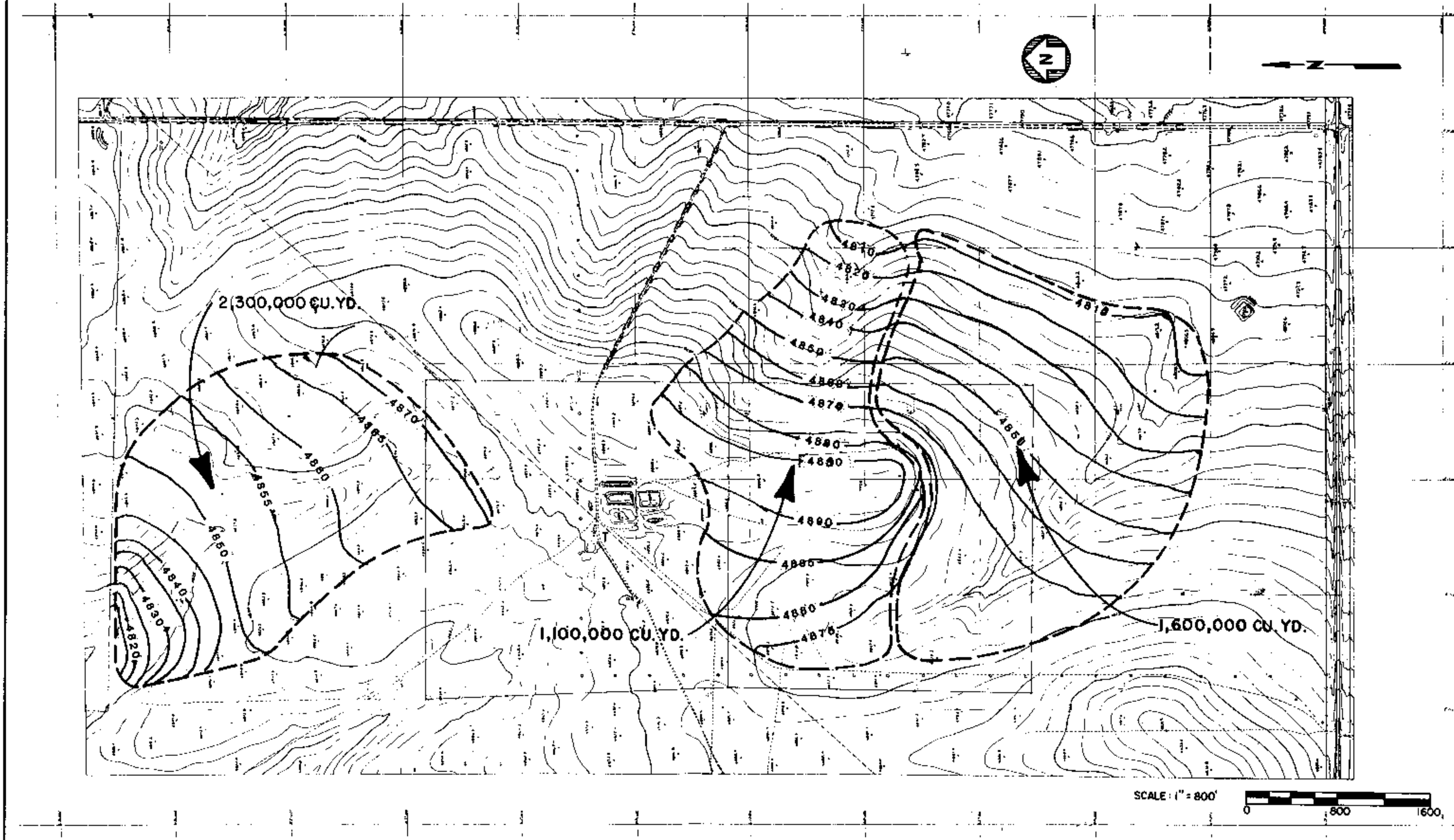
7.7.1.4.3 Solidification Facilities

The Phase I solidification facility will be closed when the Phase II facility is operational. This is expected within 12 to 18 months after the site is approved. When the Phase I facility is closed, the solidification cell liners and all contaminated soil will be removed and disposed of in a secure disposal cell. The excavation will be backfilled with clean compacted on-site soils up to the original ground surface. The surface will be graded to conform with the surrounding ground.

The Phase II facility will be closed after all liquids and sludges from closure of the other facilities have been solidified. The remaining solidification reagents will be emptied from the storage silos and either removed from the site for other uses or buried in a disposal cell.

All equipment which can be decontaminated and has salvage value will be thoroughly cleaned and triple rinsed. All facilities and equipment which either cannot be decontaminated or which have insufficient salvage value will be dismantled and buried in a disposal cell.

The concrete solidification tanks will be cleaned of any remaining waste materials. On-site soils will be placed as compacted backfill in the tanks. The concrete pads also will be decontaminated and covered with



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DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

PLACEMENT OF OVERBURDEN

SHEET NO.
FIG 7.7.2
OF

about two feet of compacted fill. The entire top surface will be final graded with a slight crown to provide positive drainage.

7.7.1.1.4 Secure Disposal Cells

The secure disposal cells shall be the repository of all of wastes treated and solidified at this site. Closure of the secure disposal area will occur progressively throughout the life of the facility. Each completed disposal cell will be capped with a three foot thick cover of clay compacted to 95% of Modified Proctor maximum dry density (per ASTM D1557 test method) at or above the optimum moisture content. Laboratory test performed on on-site clays to the above compaction specifications indicate that a permeability of 1×10^{-8} cm/sec can be achieved. The cap will be covered with 6 to 12 inches of topsoil and seeded to provide protective vegetation on an earthen mound with 3% slopes to promote surface drainage.

7.7.1.4.5 Holding Ponds

Liquid in the potentially contaminated and contaminated hold ponds will be allowed to evaporate and the residual will be removed, solidified, and then disposed of in a secure disposal cell. Any contaminated soil, including the liner, will be excavated and buried. The ponds will be filled with compacted on-site soils and sloped to prevent ponding and promote drainage. The non-contaminated water collection ponds will be emptied via spray irrigation, excavated to final depth, and affected surfaces relined in accordance with the specifications of the secure disposal cells. Leachate collection facilities will be installed, and then the cells will be utilized as the final secure disposal cells.

7.7.1.4.6 Equipment Decontamination

All contaminated tools and equipment, including trucks, will be thoroughly cleaned with high-pressure, heated water prior to removal of the protective berms serving the area in which the equipment is washed. Judgments regarding the adequacy of decontamination of each vehicle or piece of equipment will be made by the district manager or his appointed representative. All other equipment, clothing, and personal use items which cannot be decontaminated will be buried.

7.7.1.4.7 Final Grading

When the facility is closed, the site berms will be removed and the site will be graded so that natural drainage patterns are reinstated. As discussed in Chapter 6, the tops of berms around the active site will correspond to the final grading so that earth work during closure will be minimal. The result will be to smooth out the contour lines of the site and provide adequate surface drainage. Following this, the site will be fertilized and seeded with appropriate vegetation (see Chapter 8).

Samples of surface runoff will be collected and tested semi-annually for one year to ensure that all surfaces are not contaminated.

7.7.1.5 Monitoring Wells

Monitoring wells have been designed to conform with 40 CFR, Part 265, Subpart F. Additional wells will be installed throughout the life of the site, as required. The wells will be used to perform groundwater monitoring. The monitoring wells will not be closed or abandoned when the site is closed. They will continue to be used for post-closure monitoring of the site. Figure 7.6.1 showed the location of the existing wells.

7.7.1.6 Environmental Safety Features

A key element of site closure is protection of the environment from release of contaminants by the facility. The design of this facility in combination with the natural geologic features and climatic conditions provides excellent protection of the environment.

The potential source of contamination from a facility of this type would be leachate seeping from the disposal cells into groundwater. The possibility of this occurring is extremely remote because of the following reasons:

- In order for leachate to form, a liquid medium must be present to leach the contaminants from the wastes. The formation of leachate at the facility is a remote possibility because of the absence of groundwater available to infiltrate into the cells, the low annual rainfall, provisions to promote runoff from the landfill cells and the highly impervious cap to prevent surface infiltration. Also, the wastes will be solidified so that they themselves will not generate any free liquids.

- In the unlikely event leachate should form, the cell has been designed to prevent its escape. First, a leachate collection/detection system is provided in each cell. Leachate collected in the system will be pumped from the cell and disposed of at the site during the site operating life and hauled to another disposal facility after site closure. Second, each cell is provided with a five foot thick compacted clay liner to retain the leachate. The liner will have a permeability less than 1×10^{-7} cm/sec.

- In the extremely unlikely sequence of events that leachate forms, that the leachate collection system fails, and that leachate seeps through the liner, the leachate would have to seep through at least 100 feet of natural soils with permeabilities of 1×10^{-6} cm/sec. or less before reaching groundwater under the disposal area. It would take decades for this to occur.

- Preliminary water quality test results indicate that the groundwater currently fails to meet the National Interim Drinking Water Standards. Also, the quantity of groundwater available appears to be insufficient for domestic supply based upon pump test results.

- A final safeguard is that a water quality monitoring program, as discussed in Section 7.6, has been developed for the site and will be performed during the life of the site and for the post-closure period.

7.7.1.7 Site Security

During closure the district manager will be responsible for maintenance and repair of the security systems used during the previous operations and to prevent access by unauthorized persons, livestock, or other animals. Following the final closure, the entrance gate will remain locked at all times when the site is unattended. Emergency information will be provided on signs at the gate.

7.7.1.8 Schedule of Final Closure

The following schedule for closure of the facility is proposed:

Approximately one week prior to commencing of closure	- Cease acceptance of all wastes - Complete treatment and disposal of waste materials in drum and tank storage
Closure begins	- Initiate treatment and disposal of liquids and/or residues in the holding ponds
Week 1	- Dismantle and dispose of tank and drum storage facilities
Week 3	- Dispose of all other equipment, tools, etc., that cannot be decontaminated - Decontaminate vehicles
Week 4	- Begin final grading - Complete treatment and disposal of liquids and/or residues in holding ponds
Week 6	- Complete removal of solidified wastes from solidification facility
Week 7	- Decontaminate and dismantle solidification facility
Week 9	- Complete backfilling and grading of the holding ponds, solidification facility, and final disposal cell
Week 12	- Complete site grading for drainage
Week 14	- Complete vegetation of site.
	SITE CLOSED

7.7.1.9 Closure Notification

When closure activities have been completed, a notification-of-closure letter will be forwarded, in accordance with the requirements of 40 CFR, Section 265.115, to the EPA Regional Administrator and/or other appropriate State and local regulatory agencies. This letter will contain certifications by a duly-authorized representative of the facility and a professional engineer that the closure has been completed in accordance with this plan (except as specifically noted).

7.7.1.10 Notice to Local Land Authority

Within 90 days of the completion of final closure activities, the site manager will notify the local land authority and the Regional Administrator. A certified survey plat will be provided indicating the location and dimensions of the disposal cells with respect to permanently surveyed bench marks. A record of the type, location and quantity of hazardous wastes disposed of within each cell will also be provided. The plat will contain a note including the restriction on the use of the land during the post-closure period which will probably include:

- The land cannot be farmed for food products for human consumption, either directly or by food chain.
- The compacted soil cover cannot be removed unless:
  - Provisions to control the run-on, run-off, and groundwater are acceptable to the EPA Regional Administrator, or other appropriate authority.
  - Provisions to re-establish the cover as a barrier to infiltration of run-off or rainfall are acceptable to the Regional Administrator or other appropriate authority.
- The land use shall preclude the establishment of surface impoundments.
- The land use shall not diminish the effectiveness of the groundwater monitoring system.

At the completion of closure, the district manager will designate to the EPA Regional Administrator or other appropriate authority the agent which will conduct post-closure activities.

7.7.1.11 Closure Cost Estimate

The following figures are the estimated cost for closure of the site:

A.	Solidification Facility	
	- Cost of building demolition is equal to the salvage value: no net cost	$ -0-
	- Decontamination of building pad and mixing pits: $3,000 lump sum	3,000
	- Earth backfilling of cells & tanks plus earth cover over building pad: 15,000 CY @ $3.00/CY	45,000
B.	Drum Storage	
	- Cost of building demolition is equal to salvage value: no net cost	-0-
	- Remove concrete pad and containment wall and bury: 150 CY @ $10.00/CY	1,500
C.	Tank Farm	
	- Tank decontamination: $1,000/tank x 14 tanks	14,000
	- Tank removal is equal to salvage value: no net cost	-0-
	- Remove concrete slab and walls: 250CY @ $10.00/CY	2,500
	- Regrade tank from area: $2,000 lump sum	2,000
D.	Holding Ponds	
	- Excavate contaminated pond, contaminated soil and residue; bury in disposal cell: 12,000 CY @ $1.50/CY	18,000
	- Excavate potentially contaminated pond contaminated soil and residue; dispose of in disposal cell: 15,000 CY @ $1.50/CY	22,500
	- Backfill contaminated pond: 20,000 CY @ $3.00/CY	60,000
	- Backfill potentially contaminated pond: 32,000 CY @ $3.00/CY	96,000
E.	Disposal Cells	
	- Cover and mound, 1 cell maximum: 29,000 CY @ $4.00/CY	116,000
F.	Miscellaneous Site Grading	
	- Remove berms, grade site, install ditches and clean up: 325 acres @ $100.00/acre	32,500
	- Establish vegetation: 150 acres @ $50.00/acre	7,500
	TOTAL ESTIMATED CLOSURE COST	$420,500

7.7.2 POST-CLOSURE PLAN

7.7.2.1 General

The post-closure plan presents the requirements for post-closure maintenance including periodic groundwater and leachate monitoring and site inspections. The plan also describes the conditions at the site and the environmental safeguards the facility possesses to prevent contaminant migration.

7.7.2.2 Facility Description

The project is a treatment/solidification, and disposal facility for hazardous wastes. The facility will receive primarily liquid and semi-solid wastes that will be solidified using absorbant reagents. The resultant solidified product will be buried in secure disposal cells.

The facilities will be operated under two levels. Phase I level of operation essentially consists of clay-lined earthen waste solidification mixing cells, a secure disposal cell, and a contaminated water holding pond. Phase II level of operation will consist of a more sophisticated solidification building with concrete mixing tanks and reagent storage silos, a tank farm, a drum storage area, additional secure disposal cells, the same contaminated holding water pond, a potentially contaminated water holding pond, and two non-contaminated surface water collection ponds. Figure 7.7.1 presented the locations of the Phase I and Phase II processing areas.

It is anticipated that the treatment, solidification, and disposal facility will receive a wide variety of chemical wastes. Operating records, daily logs and manifests will contain specific information on the types, quantities, and disposal of the wastes at the site. It is estimated that these facilities, when in full operation, will handle an average annual volume of 24,000,000 gallons of raw waste which will be about 60% liquids, 10% solids, 25% semi-solids (sludges), and 5% drums. At this rate, the available disposal area will be completed in approximately 20 to 25 years.

Closure of the Phase I solidification facility will occur when the Phase II facility is operational (about 12 to 18 months after the site is approved). Closure of the secure disposal cells will be done progressively as each is filled. The remainder of the site will be closed at the end of the facility's life. Figure 7.7.2 presented a final contour plan of the closed facility. A closure plan has been prepared for the site and is presented in Section 7.7.1.

7.7.2.3 Site Conditions

7.7.2.3.1 General

The facility is located approximately 70 miles east of Denver in the gently rolling high plains of eastern Colorado. The topography varies between elevation 4,835 and 4,900 feet (mean sea level datum). There is one producing oil well on the site that is expected to remain in production throughout the facility's life. An oil pipeline runs through the site in a northeast to southwest direction. The site has been used in the past for wheat farming and grazing. The surrounding area is used for similar agricultural purposes.

The climate is semi-arid with an approximate mean temperature of 50°F and an average precipitation of about 14 inches per year. The average lake evaporation rate applicable to the facility is about 55 inches per year.

A detailed geological and hydrogeological site characterization was prepared by F. M. Fox & Associates Inc., Consulting Engineers and Geologists (see Section 5.4). The study indicates that the site is geotechnically suitable for the facility.

7.7.2.3.2 Subsurface Soils

The site is located on top of a geologic unit known as the Pierre Shale that is about 4,300 feet thick. No major aquifers exist beneath the site and the site does not contribute to recharge of major aquifers.

The Pierre Shale below the site has weathered to varying degrees and for discussion purposes, has been divided into three major soil groups, as follows, with the lowest group number the closest to the surface.

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The clay content, moisture content, and dry density generally increase with depth, and in many borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2 Based on the cation-exchange capacity values (see Appendix G) and the geologic environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1 x 10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface, except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4 x 10^{-7} cm/sec and a low of "completely impervious" (no flow could be induced).

7.7.2.3.3 Groundwater Conditions

Groundwater was encountered in the test borings drilled in drainages outside the perimeter of the proposed secure disposal area. This water is most likely a result of surface recharge from rainfall runoff. None of the test borings in the proposed disposal area encountered groundwater. The only exception was the 500 foot deep boring that encountered very minor amounts of water in fractures of the shale at a depth of about 100 feet. Pumping tests were conducted on this well and the results of the test indicate essentially dry well conditions.

7.7.2.4 Facility Design

7.7.2.4.1 General

The primary purposes of post-closure monitoring are to prevent deterioration of the site and, consequently, minimize the possibilities of contaminant migration; and to detect contaminant migration, should it occur. The major design objective for the site is the prevention of leachate formation and migration from the disposal cells into the groundwater.

The design of the facility (discussed below), in combination with the natural geologic features and climatic conditions, provides excellent protection of the environment.

7.7.2.4.2 Secure Disposal Cells

Each disposal cell will be provided with a five foot thick compacted clay liner on the bottom and sides. On-site clays will be used for the liner and they will be compacted to 95% of the Modified Procter maximum dry density (per ASTM D1557 test method) at or above the optimum moisture content. Laboratory tests performed on the on-site clays to this compaction specification indicate that permeabilities of 1×10^{-8} cm/sec can be achieved. The compacted liner will provide excellent containment should leachate occur in a cell.

Each cell also will be provided with a leachate collection/detection system. The system consists of several 10 foot by 1 foot thick drain rock blankets placed longitudinally in the bottom of the cell on top of the liner. At the low end of the cell a similar drain rock blanket will be placed across the cell. The blanket will have 6-inch diameter PVC drain pipe placed its full width. This will be connected in the middle to a drainage sump with a 6-inch diameter PVC riser to the ground surface to allow removal of any collected leachate.

Once the cell is filled, a three foot thick, compacted clay cover (cap) will be installed. The cap will be compacted to the same specifications as the liner and achieve the same permeability. On top of the cap, six or more inches of topsoil will be added. Seeding will provide protective vegetation on the earthen mound with 3% slopes to promote surface drainage and prevent erosion.

7.7.2.5 Environmental Safety Features

The potential source of contamination from a facility of this type would be leachate seeping from the disposal cells into the groundwater. Because of the following environmental safety features (both natural and man made), the possibilities of this occurring are extremely remote.

- In order for leachate to form, a liquid medium must be present to leach the contaminants from the wastes. The formation of leachate at the facility is remote because of the absence of groundwater available to infiltrate into the cells, the low annual rainfall, the surface mounding to promote runoff and the highly impervious cap to prevent surface infiltration. Also, the wastes will be solidified so they will not generate any free liquids.

- In the unlikely event leachate should form, the cell has been designed to prevent its escape. First, a leachate collection/detection system is provided in each cell. Leachate collected in the system will be pumped from the cell and disposed of at another facility after closure. Second, each cell is provided with a five foot thick compacted clay liner that will have a permeability less than 1×10^{-7} cm/sec to contain leachate between pumpings.

- In the extremely unlikely sequence of events that leachate forms, that the leachate collection system fails, and that leachate seeps through the liner, it would have to seep through at least 100 feet of natural soils with permeabilities of 1×10^{-6} cm/sec or less before reaching groundwater. It would take decades for this to occur.

- Preliminary water quality test results indicate that the groundwater currently fails to meet the National Interim Drinking Water Standards. Also, the quantity of groundwater available appears to be insufficient for domestic supply based upon pump test results.

- o A final safeguard is that a water quality monitoring program, as discussed subsequently and in Section 7.6, has been developed for the site and will be performed during the life of the site and the post closure period.

7.7.2.6 Site Security

During site closure all perimeter fencing will be inspected and repaired or replaced, as required, to provide a continuous perimeter access barrier. Any gates, other than the entrance gate to be used after closure, will be removed or securely locked. The entrance gate itself will be securely locked.

Appropriate signs will be provided to warn that the site is a hazardous waste disposal facility. Emergency procedures, including names and telephone numbers of personnel to be contacted, will be provided on signs at the gate.

7.7.2.7 Monitoring Wells

Monitoring wells have been designed and installed in conformance with 40 CFR Part 265, Subpart F. The locations were presented in Figure 7.6.1. Additional wells may be installed in the disposal cell area during the life of the site. An updated plan showing these locations will be provided prior to site closure.

7.7.2.8 Post-Closure Monitoring

7.7.2.8.1 General

Post-closure monitoring will consist of periodic inspection of the site's grading, security fencing, and disposal cell leachate collection systems and testing of the monitoring wells. These items are discussed in the following sections.

7.7.2.8.2 Site Grading and Security Fencing

Inspection of the site grading and the security fencing will be done on a semi-annual basis for the first year and yearly thereafter. Inspection of both items would be performed at the same time.

Inspection of the site grading will include the drainage facilities and the disposal cell caps. The drainage facilities will be checked for erosion, overtopping and proper slope to ensure that they are functioning properly.

Inspection of the disposal cell caps will include checking for severe surface cracking, erosion, proper slope, and vegetative cover condition. Each cell will be inspected individually to ensure that the caps are functioning properly, preventing surface water infiltration.

The yearly inspections will be performed in the spring as damage would most likely occur during the winter. Any deficiencies encountered will be promptly repaired. A record will be made of the area repaired and the method used.

7.7.2.8.3 Leachate Collection Systems

The leachate collection systems will be monitored quarterly for the first year, semi-annually for the next two years and annually thereafter. Each disposal cell will be checked for leachate. Those cells where leachate is found, if any, will be pumped. The liquids will be placed in vacuum trucks and disposed of off-site in accordance with appropriate hazardous waste regulations. Those cells with leachate will be recorded along with the amount of liquid removed and the disposal location.

7.7.2.8.4 Monitoring Wells

At least five monitoring wells will be sampled on a semi-annual basis during post-closure. A sample from each well will be tested for TOC, TOX, pH and specific conductance. All sampling and testing procedures will be performed in accordance with the appropriate regulations and standards in effect at the time of sampling. Test results will be reported to the appropriate regulatory agency.

If the monitoring results show a significant variance from previous results, additional samples will be collected and tested. If a significant variance is confirmed, the appropriate regulatory agency will be informed and a specific environmental assessment plan developed. Upon completion of the assessment the results will be analyzed and additional plans or corrective measures will be developed, as needed.

7.7.2.9 Monitoring Program Modifications

The frequency or items involved in the post-closure program may be modified depending upon the results of the monitoring as time goes on. Appropriate regulatory agency approval will be obtained prior to any modifications.

7.7.2.10 Post-Closure Monitoring Cost Estimate

The figures below provide the estimated yearly cost of the post-closure monitoring discussed in Section 7.7.2.8.

A. Inspect the Site Grading and Security Fencing - Inspect the site: 1 man day/visit @ \$160/man day @ 2 visits per year =	\$ 320
B. Inspect Leachate Collection Systems - Inspect 40 cells @ 30 min/cell = 20 hours Inspection and travel time from Denver = 4 man days/inspection @ \$160/man day x 2 inspections/year =	1,280

- Sample and test 5 monitoring wells	
Purge 5 monitoring wells = 1 man day/inspection @ $160/man day x 4 inspections/year =	640
Sample 5 monitoring wells = 1 man day/inspection @ $160/man day x 4 inspections/year =	640
Sample lab testing: pH @ $4 TOC @ $18 TOX @ $62 SC @ $7 $91/sample	
$91 x 4 repetitions x 5 samples x 2/year=	3,640
- Contingency cost for site grading, fence repair and replacement and leachate removal and disposal =	5,000
Subtotal: Estimate annual post-closure cost =	$ 11,520
TOTAL COST: Annual closure cost x 30 year period =	$345,600

The above cost estimate has a $5,000 contingency for annual repair costs associated with maintenance of the facility. This cost may vary from year to year but the average cost is representative.

7.8 FINANCIAL REQUIREMENTS

BFI has developed closure and post-closure plans, along with cost estimates for closure and post-closure monitoring and maintenance. These plans and cost estimate are contained in Section 7.7. The closure cost estimate is based on closure of the facility at a point in its operation when closure costs would be maximized.

Copies of these plans and cost estimates will be maintained at the facility, along with all subsequent estimates that will be prepared in the manner described below.

If the closure plan is ever revised from that contained in Section 7.7 such that the cost of closure changes, the closure cost estimate will be revised accordingly. Likewise, if the post-closure monitoring and maintenance plan change, corresponding revisions to the post closure monitoring and maintenance cost estimate will be made.

Once each year during the operating life of this facility, on or about November 19, BFI will adjust the most recent cost estimates for closure and post-closure monitoring and maintenance. The adjustment will be made by means of an inflation factor, which will be derived from the annual Implicit Price Deflator for Gross National Product, as published by the U.S. Department of Commerce in its Survey of Current Business. The inflation factor to be used for each annual adjustment to the cost estimates will be determined by dividing the then current annual deflator by the annual deflator for the previous year.

The formula for annual adjustments to the cost estimates is as follows:

$$\text{Current Adjusted Cost Estimate} = \text{Most Recent Cost Estimate} \times \frac{\text{Current Annual Deflator}}{\text{Previous Year's Annual Deflator}}$$

BFI will establish financial assurance for the closure of the facility and for the post-closure monitoring and maintenance, in accordance with the plans presented in Section 7.7. The method of establishing financial assurance for closure and post-closure monitoring and maintenance will be in accordance with Federal and State financial assurance requirements. In the case of Federal requirements, they are listed in 40 CFR 264.143 and 264.146.

BFI will provide adequate financial security against liability claims which could arise from sudden and accidental, nonsudden and accidental, and general liability occurrences. BFI maintains the following liability insurance to protect its facilities financially from such occurrences:

- o up to $250,000 - self-insured
- o $250,000 to $600,000 - CNA of Dallas, Texas
- o $600,000 to $5,000,000 - Lloyds of London
- o $5,000,000 to $20,000,000 - Lloyds of London

7.9 SPECIFIC FACILITY STANDARDS

In addition to the general facility standards and the various requirements for plans, records and reporting contained in the interim status standards, there are several subparts which contain standards pertaining to specific types of facilities which may be provided at a hazardous waste treatment, solidification, and disposal facility.

Section 7.9 is intended to describe how this chemical waste processing/ disposal facility will comply with the applicable standards for the specific types of treatment, solidification, and disposal systems being utilized.

The types of waste handling systems and the corresponding subparts in the interim status standards are as follows:

1. Containers: Subpart I - Use and Management of Containers (40 CFR 265.170-265.177)

2. Tanks: Subpart J - Tanks (40 CFR 265.190-265.199)

3. Surface Impoundments: Subpart K - Surface Impoundments (40 CFR 265.220-265.230)

4. Secure Disposal Cells: Subpart N - Landfills (40 CFR 265.300-265.315)

5. Solidification Process: Subpart Q - Chemical, Physical, and Biological Treatment (40 CFR 265.400-265.406)

7.9.1 Containers

The facility will store hazardous wastes for varying periods of time, pending treatment of the wastes in the solidification process. Bulk liquids will be stored in various tanks, according to chemical compatibility, as discussed in Section 7.9.2. Other liquids, semi-solids, and solids with releasable liquids will be received in drums or similar containers, and will be stored in the drum storage area until the drum contents are transferred to the solidification process.

The drum storage area during Phase I operations will consist of an open area with an 18 inch minimum thickness compacted clay liner, which will extend up the sides of a total enclosure dike. Crushed rock will be placed above the liner to facilitate all-weather access and provide a stable base for upright drums. A compacted clay entrance ramp will also be provided. The enclosure dike will be of sufficient height to contain spilled drum contents and any anticipated rainfall, with adequate freeboard. The bottom of the area will be sloped gradually to drain to a corner sump, to facilitate collection and removal of any liquid to the contaminated water holding pond by means of a vacuum truck.

During Phase II operations, the drum storage area will be a separate area within the solidification building. Access to the drum storage area will be by means of a loading/unloading dock. This enclosed drum storage area will have a concrete floor sloped to drain to a sump to facilitate drainage, confinement and recovery of liquid wastes in the event of a spill, leak or rupture of any container.

The following container management practices will be employed by the operator during operations:

- If a container holding hazardous waste is not in good condition, or if it begins to leak, the operator will transfer the hazardous waste from this container to a container that is in good condition, or manage the waste in some other way that complies with the regulations, e.g., place the waste in the solidification cell or tank.

- The operator will use a container made of or lined with materials which will not react with or are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired. In cases where the generator utilizes his own containers, the generator will be required to meet this criteria.

- A container holding hazardous waste will always be closed during storage, except when it is necessary to add or remove waste.

- A container holding hazardous waste will not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

- Containers of liquids, semi-solids or solids with releasable liquids will be crushed or shredded and landfilled on-site following emptying.

- The operator will inspect areas where containers are stored, at least weekly, looking for leaks and for deterioration caused by corrosion or other factors, as provided in Section 7.2.4.

- Containers holding ignitable or reactive waste will be located more than 15 meters (50 feet) from the facility's property line.

- Incompatible wastes, or incompatible wastes and materials, will not be placed in the same container.

- Hazardous wastes will not be placed in an unwashed container that previously held an incompatible waste or material unless the container has been properly cleaned.

- A storage container holding a hazardous waste that is incompatible with any waste or other materials stored in other containers will be physically separated from that waste or other materials.

- Each storage container will be identified as to its contents and generator, and any special precautions associated with the nature of the waste material will be clearly shown, by use of DOT shipping labels or similar methods.

7.9.2 Tanks

No bulk storage tanks for liquid hazardous wastes are proposed for the Phase I operation of this facility. Instead, bulk shipments of liquid wastes will be deposited directly into one of four solidification cells. The identity and chemical characteristics of each incoming liquid waste shipment will be determined as described in Section 7.2.2 so as to verify correct assignment of each waste to a particular solidification cell, and to assure chemical compatibility, as indicated in Section 7.2.6. These procedures are described more fully in Sections 7.9.3 and 7.9.5.

A tank farm consisting of a maximum of 14 tanks is planned for the Phase II operation of this facility to provide temporary storage capacity for bulk shipments of liquid wastes, when necessary, pending transfer of these wastes to the solidification building or to another properly permitted facility.

The tank farm will be surrounded by a continuous concrete wall of sufficient height to impound the liquid waste in the event of a total discharge of the contents of a tank, along with any anticipated precipitation. The ground area within the tank farm will have a concrete surface sloped to drain to a collection sump or sumps which will facilitate removal of spillage or potentially contaminated runoff to the solidification process or the contaminated holding pond, whichever is appropriate.

Each of the tanks will be clearly identified, and will be designated by the facility operator as to the family of compatible liquids a particular tank may receive. The tanks will be completely above grade and will be closed rather than open-top. Each tank will have an access hatch that will permit entry into the tank to inspect for corrosion or internal damage. Other appropriate devices, such as flame arrestors and special vents and emission controls will be provided as necessary for the intended use of particular tanks. None of the tanks will be used for the treatment of hazardous wastes.

The following general operating procedures will be employed:

- Hazardous wastes will not be placed in a tank if such wastes could cause the tank or its liner to rupture, leak, corrode, or otherwise fail before the end of its intended life.
- The tanks will not be operated until the tank farm is equipped with the containment structure.
- In addition to the waste analysis program described in Section 7.2.2, the operator will employ special procedures whenever a tank is to be used to store a hazardous waste which is substantially different from waste previously treated or stored in that

tank. In this event, the operator will conduct waste analyses and trial treatment or storage test (e.g., bench scale or pilot plant scale tests) or obtain written, documented information on similar storage or treatment of similar waste under similar operating conditions to show that this proposed storage will meet all applicable requirements of the items listed above. The operator will place the results from each waste analysis and trial test, or the documented information, in the operating record of the facility, as provided in Section 7.5.

- Inspection of the tank farm facility will be conducted as indicated in Section 7.2.4.

- In the event the facility will store ignitable or reactive wastes in any of the enclosed tanks, it will comply with the National Fire Protection Association's (NFPA's) buffer zone requirements for tanks, contained in Tables 2-1 through 2-6 of the "Flammable and Combustible Code-1977".

- Incompatible wastes, or incompatible wastes and materials, will not be placed in the same tank.

- Hazardous wastes will not be placed in an unwashed tank which previously held an incompatible waste or material.

7.9.3 Surface Impoundments

RCRA regulations 40 CFR-Subpart K, Sections 265.220 to 265.230 cover surface impoundments. There are several surface impoundments at the facility that will be governed by the regulations (Section 265.220). These include the clay-lined earthen solidification cells and contaminated water holding pond constructed during Phase I and the potentially contaminated water and non-contaminated surface water holding ponds to be constructed in Phase II.

The holding ponds will be used to retain the liquid portion of the runoff from various areas of the site as discusssed in Section 6.6 of this report. The ponds have been designed and sized to retain all the runoff from their respective areas. There will be no discharge from the ponds; an NPDES permit will not be required.

The holding ponds will be excavated into the natural soils and lined with compacted clay. In accordance with the general operating requirements (Section 265.222) the holding ponds will have a minimum of two feet of freeboard to prevent overflow. The holding ponds will be inspected daily to check the freeboard level and weekly to check the condition of the ponds in order to detect leaks, deterioration or failures. Wastes will not be directly placed in the holding ponds; therefore, incompability will not be a problem. Leachate, should it occur, will be tested prior to placement in the contaminated holding pond. If the leachate is incompatible with other materials in the pond, it will be solidified and buried in a disposal cell. There will be no treatment of the liquids in the holding ponds.

The Phase I solidification facility is being constructed and will be used until the Phase II facility is operational. The Phase I facility will be used for about the first 12 to 18 months of the site's life. The facility consists of a rectangular earthen "V" bottom trench about 235 feet by 50 feet and 10 feet deep at the center of the "V". It is separated into four mixing cells by earthen cross dikes. The solidification facility is provided with a compacted clay liner along the entire bottom and ends. Since the facility will treat hazardous wastes, it is considered a surface impoundment under Section 265.220 and the regulations under Subpart K are applicable to it. This impoundment is also a mixing facility where liquid wastes will be placed in one of the cells, the solidification reagent added, and the two substances mixed. The mixed product will be removed, loaded in dump trucks and transported to a secure disposal cell. Since the facility is a mixing unit, the general operating requirement of Section 265.222 requiring two feet of freeboard is not directly applicable. However, the operations will be performed such that the wastes and/or solidified product level will be kept at least two feet below the top. The facility will be used daily, and inspection of the freeboard condition will be monitored. The operator will conduct trial treatment tests or obtain documented information that the treatment/solidification process will work in order to be in compliance with Section 265.225. This subject is addressed in Section 7.9.5. Ignitable or reactive wastes that are treated at the facility will be mixed immediately after placement in the cells/tanks and addition of the reagent. Incompatible wastes will not be placed in the same cell for mixing as required by Section 265.230.

Section 265.228 regulates closure and post-closure monitoring of the site. The closure plan and post-closure plan are presented in Sections 7.7.1 and 7.7.2 of this report, respectively.

7.9.4 Secure Disposal Cells

Secure disposal cells are regulated under 40 CFR-Subpart N, Sections 265.300 to 265.339. All solidified wastes will be buried in a secure disposal cell. Therefore, the facility is regulated under Subpart N according to Section 265.300.

It is estimated that for the projected 20 to 25 year life span of the site, about 40 disposal cells will be used. The standard sized disposal cell will be approximately 600 feet by 300 feet by 30 feet deep. However, the initial Phase I disposal cell is about 250 feet by 150 feet by 20 feet deep. All cells will have the bottom and sides lined with a five foot thick compacted clay liner which will have a permeability less than 1×10^{-7} cm/sec. Each cell also will be provided with a leachate collection/detection system with provisions to remove any leachate, even though it is unlikely that leachate will form. When a cell is full, it will receive a three foot compacted clay cap with the same permeability as the liner. Six or more inches of topsoil will be added to support vegetation. The surface of the cell will be sloped about 3% to promote surface runoff and control erosion.

Surface water run-on will be prevented from entering the active portion of the secure disposal area by an earthen berm around its perimeter. The same berm will be used to collect any surface run-off within the active area. The run-off will be placed in the contaminated water holding pond.

The wastes received at the site will be predominantly liquids and sludges that will be solidified and will not be subject to dispersal by wind. Those solid wastes received at the site that are fine enough to be wind-borne will be placed in disposal cells when the wind is calm enough not to disperse them or they will be mixed with other compatible wastes in the solidification tanks.

The facility will maintain operating records. In accordance with Section 265.309, part of the records will include a map showing the location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks. The facility also will keep records on the contents of each cell and the approximate location of each hazarous waste type.

Section 265.310 regulates closure and post-closure monitoring of the site. The closure plan and post-closure plan are presented in Sections 7.7.1 and 7.7.2 of this report, respectively.

It will be standard practice at the facility to analyze all waste streams. The compatibility of these waste streams will be checked prior to treatment/solidification and disposal to prevent mixture of incompatible wastes.

Disposal in a disposal cell of bulk or non-containerized liquid wastes containing free liquids is prohibited by Section 265.314 unless the cell has a liner, a leachate collection and removal system and the wastes are stabilized chemically or physically. As discussed at the beginning of this section, each cell will have a bottom and side liner and a leachate collection system that will allow for removal of collected liquids in the unlikely event that leachate should develop. Also, all liquid and semi-solid wastes will be solidified physically by mixing the wastes with kiln dust, fly ash or other suitable reagents, so that the potential for leachate formation is essentially precluded.

7.9.5 Solidification Process

A solidification process will be provided at the facility to convert liquid, semi-solid, and solid wastes with releasable liquids into a solidified product which can be subsequently deposited in a disposal cell as a stable, solid material. This process will use various reagent chemicals, such as fly ash and kiln dust, to produce the solidification reactions. This process is described in Chapter 3.

During Phase I operations, the solidification process will take place in four clay-lined earthen cells. Section 7.9.3 describes certain aspects of the specific facility standards which are applicable to the solidification process in the impoundments during Phase I.

The Phase II solidification process will take place in open concrete tanks located within the solidification building. Each of the tanks will have a designated use for a family of mutually compatible chemicals. Solidification will be accomplished on a batch process basis, with the type and amount of solidification reagents to be recommended by the chief chemist, based on the characteristics of the particular wastes to be solidified.

Four reagent storage silos will be provided to supply reagents to the solidification tanks by means of a mechanical conveyor system. By providing each set of tanks with a companion storage silo, reagents can be used which are particularly suited to a designated group of wastes intended for each tank.

Wastes will be placed in the solidification tanks in several ways. Liquids which have been stored in holding tanks will be transferred to the appropriate solidification tanks by a vacuum truck. Liquid wastes which are received in drums may be transferred to holding tanks pending accumulation of a sufficient volume for batch treatment. Most commonly, it is expected that drummed liquids, semi-solids, and solids with releasable liquids will be emptied directly into the appropriate solidification tank after appropriate inspection and waste verification. If the appropriate tank is available for use upon arrival of a waste shipment which requires solidification, the waste will usually be deposited directly into the tank.

Under all circumstances, the precautions regarding ignitable, reactive and incompatible wastes described in Section 7.2.6 and subsequently in this section will be observed. Particular care will be exercised to assure that the hazardous wastes and the reagent chemicals will not cause the process facility or equipment to rupture, leak, corrode or otherwise fail suddenly or prematurely. Since this is a batch treatment process, no waste feed cut-off system other than the discharge control valves on the vacuum trucks is necessary. The flow of reagents will be controlled by the solidification supervisor, who will be able to regulate that flow as necessary.

Before treating or processing a new waste, or treating or processing a waste by a different process or with different reagents, the technical personnel will either conduct waste analyses and trial treatment tests (e.g., bench scale or pilot plant scale test) or obtain written, documented information on treatment of similar waste under similar operating conditions to show that this proposed treatment will not damage the facility or equipment, and will meet the requirements in Section 7.2.6 concerning ignitable, reactive, and incompatible wastes. The performance of these waste analyses or trial tests is included in the waste analysis plan provided in Section 7.2.2, and the results of these analyses or tests will be maintained in the operating records described in Section 7.5. Incompatible wastes, or incompatible wastes and materials, will not be placed in the same treatment tank. Hazardous waste will not be placed in unwashed processing tanks which previously held an incompatible waste or material, unless that tank has been adequately cleaned.

The solidification facilities will be inspected regularly, following the procedures contained in Section 7.2.4. During the weekly inspections, specific attention will be paid to the construction materials of the treatment process and equipment, to detect corrosion or leaking of fixtures or seams, and to the area immediately surrounding the processing facility. Should any significant deterioration or other problems be apparent, appropriate corrective measures will be undertaken.

7.10 REFERENCES

1. Guidelines for Establishing Test Procedures for the Analysis of Pollutants, 40 CFR, Part 136, December 3, 1979 as corrected December 18, 1979.

2. Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, EPA-530/SW-611, August, 1977.

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1979.

4. National Interim Primary Drinking Water Regulations, EPA-570/9-76-003, September, 1976.

5. Standard Methods for the Examination of Water and Wastewater, 14th Edition, American Public Health Association, 1975.

6. Groundwater Monitoring, Sampling and Analysis, Federal Register, Volume 45, Part 265, May 19, 1980.

7. Selected Methods of the U.S. Geological Survey for Analysis of Wastewaters, Fishman and Brown, USGS open-file report, 1976.

8. TOX procedure available from the EPA, Environmental Monitoring & Support Laboratory, Cincinnati, Ohio.

9. "Half Hour Determination Method for Chlorophenoxy Acids and Esters Using Liquid Chromatography", Waters Associates, J22, May, 1978.

CHAPTER 8

ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATING MEASURES

8.1 INTRODUCTION

This chapter discusses the potential environmental impacts of the project and sets forth mitigating measures to be taken. The items assessed in this chapter include the following:

- o geologic impacts;
- o topographic and surface drainage impacts;
- o water quality impacts;
- o air quality and noise impacts;
- o environmental conditions impacts;
  - climatic impacts;
  - natural ecosystems impacts;
  - land use and population impacts;
  - impacts on economic activities;
  - heritage and cultural resources impacts;
  - traffic and transportation impacts;
  - visual impacts;
- o steps to minimize harm to the environment.

8.2 GEOLOGIC IMPACTS

Due to the relatively small scale of this operation, it is not expected to have any harmful or negative long or short-term impacts on the geology of the region or site during either Phase I or Phase II operations. Other than the displacement of subsoils by construction of individual disposal cells, the project should have no negative impact on the subsoil conditions. As emphasized in Chapter 5, the subsoil conditions at the site are very well suited for a chemical waste disposal facility.

8.3 TOPOGRAPHIC AND SURFACE DRAINAGE IMPACTS

8.3.1 Topographic Impacts

The facility will have only a temporarily negative impact on the site specific topography due to topsoil stockpiles, overburden stockpiles, and open disposal cells. As secure disposal cells are filled, the overburden and topsoil will be replaced, and the surface will be returned to the original general topography. Figure 6.2.2 detailed final contours of the site. There it was shown that, over the long term, overburden placement will reduce surface slopes in some areas and thereby serve to reduce present soil erosion rates.

8.3.2 Surface Drainage Impacts

8.3.2.1 Rainfall Runoff

Surface runoff will not cause a negative impact, as discussed in Section 8.4.1 on surface water quality.

8.3.2.2 Stream Modification or Impoundment

This facility will not involve the crossing of any streams and will not require the impoundment of any permanent stream.

8.3.2.3 Flood Hazard Evaluation

Based on the flood plain analysis presented in Section 5.5.3, the disposal site is an estimated 93 feet above the 100-year flood level of Beaver Creek. Thus, the project site is not in a flood plain and, therefore, cannot constitute a significant encroachment on any flood plain.

8.4 WATER QUALITY IMPACTS

8.4.1 Surface Water Quality Impacts

The notable surface water sources in the vicinity of the site are a small brine pond within the site, a permanent stock pond located about one and one-half miles southwest of the site, an intermittent stream (Wetzel Creek) located one-half mile west of the site, and another intermittent stream (Beaver Creek) located approximately one mile east of the site. The Colorado Geological Survey and the Colorado Department of Health(1) recommend a minimum distance of one mile from the disposal site to any perennial stream channel or permanent body of standing water, or isolation from these features by local topography. No perennial streams or permanent water bodies are located within one mile of the site.

Contamination of surface water by waste polluted groundwater will not be a potential source of water quality degradation because of natural conditions and measures that will be taken to protect groundwater (see Section 8.4.2).

The solidification process will not be a source of surface water contamination. The earthen solidification cells for the Phase I facility will be provided with a three-foot compacted clay liner and will maintain a two-foot freeboard. The Phase I processing area and disposal area will be surrounded by a berm so that run-on is prevented and all run-off is collected in a contaminated water holding and evaporation pond. When the Phase II facility becomes operational, the Phase I solidification cells will be closed. Upon closure of the Phase I solidification cells, all contaminated materials, including the liners, will be excavated and placed in a secure disposal cell. During the Phase II operation, run-off in the immediate vicinity of the solidification building will be drained directly to the solidification tanks. Further, a potentially contaminated water holding pond will collect run-off from the general Phase II processing area. Run-off from secure disposal cell access roads will be conveyed to the contaminated water holding and evaporation pond.

Liquids held in the contaminated and potentially contaminated holding ponds will not impact surface water quality. Should the level of the ponds get to within two feet of the top, liquid will be drawn off, treated at the solidification facility, and placed in a secure disposal cell. Both ponds will be provided with a five foot thick, compacted clay liner and a leachate collection system.

To further protect surface water quality outside the facility, a berm, constructed from the natural soils of the disposal area, will be placed around the entire site. The height of the berm will correspond to the final topography projected for the site perimeter. The berm will eliminate surface water run-on to the site. Further, in conjunction with the non-contaminated surface water collection ponds, it will contain all run-off. The non-contaminated surface water collection ponds will be constructed in the northwest corner and southeast corner of the site. In addition to providing the primary source of water for secure disposal cell construction operations and for controlling fugitive dust, these ponds will provide a convenient means of monitoring the quality of surface water drainage.

Wastewater derived from the washrooms and showers will not adversely impact surface water in the site vicinity. During Phase I, portable sanitary sewage collection units will be provided. The septage from these units will be periodically transported to municipal wastewater treatment facilities. For the Phase II facility, an extended aeration activated sludge treatment system will be constructed to provide secondary treatment of the sanitary sewage. The treated effluent will be utilized on-site to maintain ground cover.

Erosion and sediment control measures will be taken to prevent adverse impacts on surface water quality during construction and earth work activities. During Phase II construction, the non-contaminated surface water holding ponds and site berm will be established initially to trap debris and sediment and prevent these materials from being transported from the site by surface runoff. During construction activities, exposed areas will be protected from erosion and sedimentation by temporary vegetation and/or other fugitive dust control measures such as wetting the soil.

During the placement of subsoil (transported from the secure disposal area) and removal and redistribution of topsoil in the overburden area, control measures will be taken to reduce erosion. After the topsoil has been redistributed to its final location, the overburden area will be revegetated with a native grass mixture to prevent wies will be taken to reduce sedimentation in surface water. After the topsoil has been redistributed to its final location, the overburden area will be revegetated with a native grass mixture to prevent wind and water erosion. Topsoil overburden stockpiles that will be stored for long periods of time will also be revegetated with a grass mixture suitable for stabilizing slopes, as specified by USDA Conservation Service Standards and Recommendations(2). The secure disposal cell caps will be covered with a minimum of six inches of topsoil and revegetated with a suitable grass mixture to minimize erosion yet achieve good drainage.

8.4.2 Groundwater Quality Impacts

The Colorado Geological Survey and the Colorado Department of Health have developed a number of suitability criteria for hazardous waste disposal sites to ensure protection of groundwater(1). These criteria and the adherence to these criteria are discussed below.

- The site should contain a minimum thickness of 150 feet of impermeable clay or shale with permeabilities less than 1×10^{-7} cm/sec: The soils in the secure disposal area are predominately silty clays overlying 4300 feet of Pierre Shale bedrock. These soils and shale have the highest probability of developing a safe storage facility for hazardous waste in the Denver basin. The surficial materials are generally of low permeability and, when densified, will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec (Section 5.4).

- The disposal site should be isolated from any underlying aquifers: No aquifers underlie the site. The site is ideally located east of the Denver metropolitan aquifers and west of the Ogallala exposures in an area where runoff and infiltration do not recharge these aquifers. Groundwater exists only in the sands of surface drainages adjacent to the site and to a very minor extent below depths of approximately 100 feet in the Pierre Shale (Section 5.4).

- Avoidance of geologic hazards such as avalanches, rockfalls, seismic activity, and other related activities should be considered in site selection: No geologic hazards have been observed or are expected at the site (Section 5.4).

- The mean annual evaporation should exceed the mean annual precipitation by 20 inches per year: If evaporation significantly exceeds precipitation, infiltration will be restricted so that surficial water will not contact the waste material. The mean annual lake evaporation rate at the site (55 inches per year) exceeds the mean annual precipitation (14 inches per year) by 41 inches per year.

- The maximum 24-hour storm should be no greater than 6 inches: It is important that heavy rains do not cause erosion of the protective clay cap of the secure disposal cells. The maximum 24-hour storm is slightly over 4 inches at Byers and 5.3 inches at Hoyt, the two nearest weather stations(3). The tops of the secure disposal cell will receive a three-foot compacted clay cap. On top of the cap, additional clay soils will be compacted and vegetated to form a mound with a minimum 3% slope to promote surface drainage while at the same time minimize erosion.

- The site should be resistant to wind erosion, which can reduce the integrity of the disposal cells and contribute to waste release: Wind erosion is a potential problem in the site vicinity due to moderately strong average wind speed (nine miles per hour with a range to 56 miles per hour associated with thunderstorms) and erosive soils(4). However, the area does not experience the severe winds of long duration that occur along the Front Range (3). With proper erosion control measures, e.g., revegetation of the area with a native grass mixture and fugitive dust controls, winds in the site vicinity should not present any serious problems of facility integrity.

In addition to above favorable hydrogeologic and climatic characteristics at the site, the groundwater quality will be further protected by design and operational measures, as briefly discussed below.

Due to the very low permeability of the Pierre Shale, perched water tables typically occur in the alluvial fill drainages. The possibility of groundwater contamination is precluded by the compacted clay cap and liner, solidification of wastes, minimal potential of water infiltration into a cell, and the leachate collection system in each disposal cell. Possible recharge of perched water tables outside the site from contaminated run-off will be prevented by the berm which will enclose the entire secure disposal cell area.

The Phase I solidification cells are provided with a three foot clay liner compacted to 95% relative compaction (ASTM 1557), which provides permeabilities of less than 1×10^{-7} cm/sec based on laboratory testing. Seepage analyses performed on the clay liner indicate that it will contain the waste for longer than the expected life of the Phase I facility. When the Phase II facility becomes operational, the Phase I solidification cells will be closed by excavating all contaminated materials, including the liners, and placing the material in a secure disposal cell. The Phase II solidification tanks will be constructed of reinforced concrete and will be regularly inspected to insure no leaks occur.

During the solidification process, the liquid or semi-solid waste is bound in kiln dust (a waste product from the manufacture of Portland cement), cement powder, or fly ash to form a relatively impermeable solid. The permeability of compacted samples of the kiln dust solidified product is 1×10^{-7} to 2×10^{-6} cm/sec; that of the cement powder product is less than 1 x 10^{-8} cm/sec; and the permeability of the product solidified with fly ash is on the order of 2.5 x 10^{-5} cm/sec(5). The low permeabilities of the solidified product and its absorbant nature virtually eliminates the potential for leaching to occur.

The secure disposal cells are designed to prevent release of any waste products to the environment. A three foot compacted clay cap will restrict infiltration of precipitation and, thus further eliminate the potential for generation of leachates. The clay cap will form a mound with a minimum 3% slope to promote surface drainage. A five foot compacted clay liner inside the disposal cell will restrict groundwater infiltration and contain any leachate, even though leachate formation is unlikely. The clay will be compacted at or above optimum moisture content to 95% of Modified Procter maximum dry density per the ASTM D1557 test method. Laboratory test results from on-site clays compacted to this extent indicate that the liners will have a permeability of less than 1 x 10^{-7} cm/sec.

The chief chemist will check for compatibility between the clay liner and laboratory generated leachates from the solidified wastes. This check and the resistance of the solidified waste to leachate formation, in addition to no groundwater infiltration, no free liquids in the waste, low rainfall, and minimal surface infiltration, indicate that contamination of groundwater would be virtually impossible.

In summary, no adverse long-term or short-term impacts on surface or groundwater quality are expected. A program will be implemented, however, to monitor surface and groundwater quality (see Section 7.6). Further, a contingency plan has been developed that will serve to minimize potential impacts on water quality in the event of an emergency spill on site or along transportation corridors to the site (see Section 7.4).

8.4.3 References

1. Hynes, J. and Sutton, C., Hazardous Wastes in Colorado, Colorado Geologic Survey and Department of Health, Denver, Colorado, 1980.

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3. Hansen, Wallace, et al., Climatography at the Front Range Urban Corridor and Vicinity, Colorado, USDA Geological Survey Professional Paper, 1019, 1978.

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5. Dillon Consulting Engineers and Planners, Solidification Facilities for Liquid Industrial Wastes, Environmental Assessment Report, Volume II, Prepared for Browning-Ferris Industries, 1980.

8.5 AIR QUALITY AND NOISE IMPACTS

8.5.1 Air Quality Impacts

8.5.1.1 Introduction

A local or microscale analysis was performed to estimate total suspended particulates (TSP) emitted during the Phase I and Phase II levels of operation. The analysis was not done for the other pollutants, e.g., carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x), etc., because the materials that the facility will accept will generally be aqueous solutions of inorganics, semi-solids, and solids which, in accordance with the waste segregation practices discussed in Chapters 1, 3, 6, and 7, will not release gases that would affect the National Ambient Air Quality Standards.

The microscale analysis for TSP included the emissions of cement kiln dust from the treatment/solidification operations and fugitive dust emissions from soil removal operations, dumping of soil, wind erosion of soil stockpile and overburden areas, soil replacement operations, traffic over unpaved roads, and particulates emitted by all diesel powered equipment. The analysis was performed for both the Phase I and Phase II levels of operation using EPA's Climatological Dispersion Model (CDM)(1). As an aid in assessing the need to provide fugitive dust emission control measures, the modeling effort employed assumptions that would maximize the calculated emission rates, i.e., operation of the Phase I and Phase II facilities at the peak raw waste processing rates (for this analysis a Phase I raw waste loading of 12,000,000 gallons per year was assumed which is 50% greater than the peak design rate, and a Phase II raw waste loading of 48,000,000 gallons per year was assumed which is 100% greater than the average design rate), no fugitive dust control measures, and that the facility would operate under all types of wind conditions. Further, a range of particulate fall-out conditions were examined.

8.5.1.2 Project Description

The chemical waste treatment/solidification and disposal facility will have two levels of operation, Phase I and Phase II. During the two phases, the basic construction and waste disposal activities will remain the same, except an increase in the rate of activity will occur for Phase II in accordance with the raw waste design capacity. However, the treatment/solidification operations for the two phases will differ. For Phase I operations, the treatment/solidification process will take place in open clay-lined cells, whereas for Phase II the process will take place inside a building in concrete tanks and will utilize exhaust hoods and baghouse particulate collectors, as discussed in Chapter 6.

A general listing of the operational activities related to the modeling effort is presented below. Other than the rate at which operations are conducted, the basic sequence of the Phase I and Phase II activities is the same.

1. A 300 foot wide by 600 foot long by 30 foot deep secure disposal cell is dug with earth movers. The cell is overcut five feet to provide for the compacted clay floor and wall liners.

2. Some of the soil removed is stored in a stockpile for later use in preparing the liners, providing intermediate cover, preparing the cell cap, and providing topsoil final cover. The remaining soil is placed in a predesignated overburden area.

3. After the cell is dug, a five-foot thick compacted clay liner is placed on all sides of the secure disposal cell.

4. Incoming truck loads of waste are discharged to the solidification tanks or cells, and incoming reagents (e.g., cement kiln dust) are stored in silos or portabulk containers. The reagent is added to the basin or cell and then mixed with the waste material. As noted earlier, the Phase I treatment/solidification operation will take place in open, clay-lined cells whereas the Phase II treatment/solidification process will be conducted in a closed building operated under negative pressure with a baghouse to collect suspended particulates.

5. Upon solidification of the waste, it is loaded into off-highway trucks and taken to the secure disposal cell. After spreading a 42 inch lift of waste in the cell, a 6 inch lift of soil from the stockpile is placed to provide intermediate cover.

6. After the last lift of waste is placed, the secure disposal cell cap is constructed and the topsoil is then replaced; utilization of the next secure disposal cell then begins.

Gravel or paved roads will handle all traffic at the site. The entrance road to the processing area will be gravel for Phase I and paved for Phase II. For both phases of operation, gravel roads will connect the processing facility to the secure disposal cells and the secure disposal area to the overburden areas.

8.5.1.3 Emission Factors

Emission factors for construction equipment were obtained from EPA's "AP-42"(2) for the anticipated equipment at the site. For Phase I and Phase II, the particulate emissions were calculated for each piece of equipment using the hours of operation, the average fuel consumption, and the emission factors. Fugitive dust emissions were calculated for each of the operations. Fugitive dust caused by excavating the secure disposal cells was broken into two parts: that caused by removing the topsoil(3) and that caused by removing the remaining soil(4), i.e., different emission factors were used for each type of soil. The dust emissions from the stockpiled soil were calculated using equations in EPA's "AP-42" (2). These emissions included those caused by traffic, load out from the stockpile, dumping onto the stockpile and back into the cell, and wind erosion. Equations in "AP-42" were also used to calculate the dust from unpaved roads. Factors affecting the emissions from unpaved roads are:

- percentage of silt in the road;
- speed of vehicles;
- number of days per year with 0.01 inches of precipitation;
- number of wheels per vehicle;
- size of tires.

A summary of this data is presented in Table 8.5.1

The final source of dust considered was the cement kiln dust emitted. In accordance with analogous operations at cement batching plants (without controls), an emission factor of 0.54 pounds of kiln dust per ton of kiln dust was employed(2). For Phase I, it was assumed that all of the particulates go directly into the air since the mixing process takes place outdoors. For the Phase II operation, utilization of the baghouse greatly reduces the dust emission, as indicated in Table 8.5.1.

TABLE 8.5.1

PARTICULATE EMISSION DATA BASE

STANDARD SIZED SECURE DISPOSAL CELL
CONSTRUCTION (QUANTITIES PER CELL)

Total Excavation per Cell (including overcut for liners)	185,000 cu.yds.
Volume of Topsoil Removed	3,500 cu.yds.
Volume of Soil Removed	181,500 cu.yds.
Volume of Soil to be Stockpiled	73,500 cu.yds.
Volume of Soil Placed in Overburden Area	111,500 cu.yds.
Average Area of Overburden Placement	11.5 Acres

UNCONTROLLED FUGITIVE DUST EMISSION FACTORS
FOR SECURE DISPOSAL CELL CONSTRUCITON

Topsoil Removal(3)	0.38 lb./cu.yd.
Soil Removal(4)	0.075 lb./ton
Dumping of Soil(2)	0.214 lb./ton
Wind Erosion (Stockpile & Overburden Areas)(5)	1.07 tons/acre-yr.

NOTE: Density of soil assumed to be 110 lbs./cu.ft.

UNPAVED ROAD EMISSIONS(2)

Phase I (Based on 12,000,000 gals./yr., i.e., 50% higher than the peak raw waste loading)

Gravel Roads	2% Silt
Days/yr. with 0.01 inches or more of precipitation	93
Vehicle Speed	15 mph
Earthmover Speed	10 mph
Four Wheel Vehicles	0.30 lb./VM
Vehicle Miles	2,600 miles
Six Wheel Vehicles	0.60 lb./VM
Vehicle Miles	1,100 miles
Earthmovers	0.40 lb./VM
Vehicle Miles	2,300 miles

Phase II (Based on 48,000,000 gals./yr. peak raw waste loading)

Gravel Roads	10% Silt
Days/yr. with 0.01 inches or more of precipitation	93
Vehicle Speed	15 mph
Earthmover Speed	10 mph
Four Wheel Vehicles	1.51 lb./VM
Vehicle Miles	6,144 miles
Six Wheel Vehicles	3.02 lb./VM
Vehicle Miles	19,000 miles
Earthmovers	2.01 lb./VM
Vehicle Miles	9,560 miles

Table 8.5.1
(Continued)

WASTE PROCESSING

Phase I

Reagents Used	53,500 tons/yr.
Emitted to Air(1)	14.6 tons/yr.

Phase II

Reagents Used	320,860 tons/yr.
Emitted within Confines of Building(1)	87.3 tons/yr.
Hood Efficiency	95%
Baghouse Efficiency(1)	99.7%
Emitted to Air	4.6 tons/yr.

8.5.1.4 Microscale Projection Methodology

The microscale air quality analysis considered the total TSP emitted for each phase of operation. Based on the factors presented in the preceding section, the particulate emissions from the various sources for both phases were calculated for an annual period. The results are presented in Table 8.5.2. There it can be seen that process emissions will be small, but that fugitive dust emissions could be significant without proper control measures. Such measures will be discussed subsequently.

The EPA's CDM computer model was used to predict the TSP concentrations at various locations around the site, as shown by the air quality receptor locations in Figure 8.1. Twenty-three (23) receptors were defined, 16 of which were along the property line. Three were east of the site, and three were north-northwest of the site to be in line with the predominant wind directions. A receptor was also placed in Last Chance, Colorado.

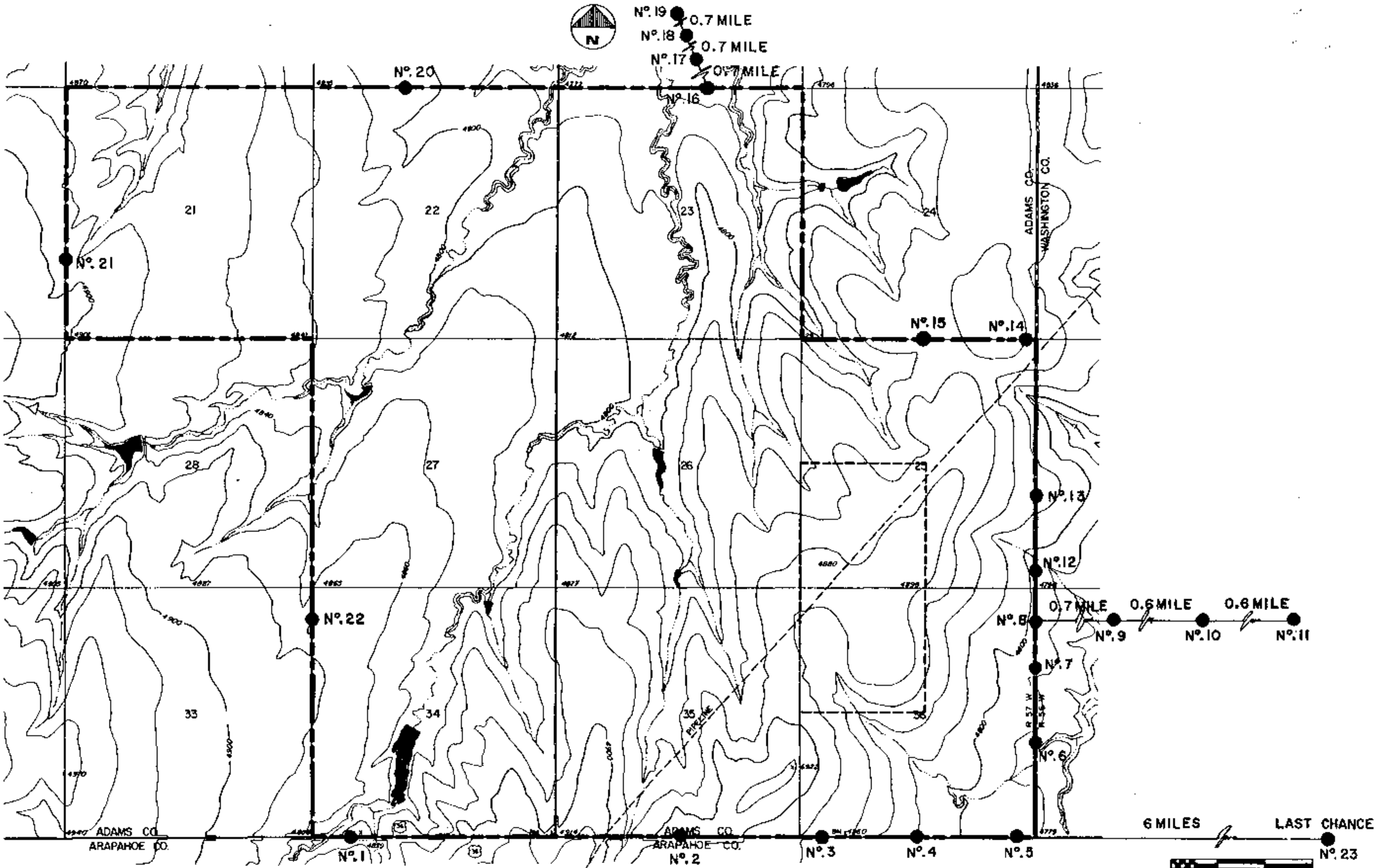
The CDM model is applicable for estimating long-term concentrations of nonreactive pollutants due to emissions from area and point sources in an urban area(1). It is noted that for the original version of the model, the stability class coefficients for the dispersion were established from experiments conducted over flat and relatively smooth rural terrain. To make an allowance for the thermal and mechanical influences of urban areas, corrections are included in the CDM model to take into account that air in an urban area is less stable than in a rural area. For the analysis used herein, however, the original stability class coefficients were returned to the computer program to reflect the rural terrain in the project area.

TABLE 8.5.2

TOTAL ANNUAL SUSPENDED PARTICULATE PROJECTIONS
ASSUMING NO FUGITIVE DUST CONTROLS
Tons/Year

SOURCE	PHASE I	PHASE II *	
	(max. processing rate)	(max. processing rate)	(design processing rate)
Diesel Exhaust	0.7	2.8 (2.8)	1.4
Kiln Dust	14.6	4.6 (4.6)	2.3
Fugitive Dust Emissions			
a. Traffic on unpaved roads	1.2	42.9 (31.9)	21.5
b. Wind erosion	13.6	41.2 (19.6)	20.6
c. Topsoil and Soil Removal	10.8	43.2 (43.2)	21.6
d. Dumping soil in Stockpile and Overburden Areas	29.4	117.6 (91.6)	58.8
e. Replacement of soil and Topsoil	15.8	63.2 (46.0)	31.6
TOTAL	86.1	315.5 (243.1)	157.8

* NOTE: Estimates for emissions, assuming application of fugitive dust control measures, are given in parenthesis. None of the estimates take into account particulate fallout.



REFERENCE: USGS QUAD SHEETS
CONTOUR INTERVAL = 20'

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF **HNTB**

ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE MAR 1981

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

AIR MONITORING RECEPTOR LOCATIONS

SHEET NO.
FIG. 8.1

The projected concentrations are dependent on several parameters used in the program, as listed below:

- area source emission rates;
- location of source;
- location of receptor;
- wind speed, wind direction, and stability class;
- afternoon mixing height;
- nocturnal mixing height;
- decay half-life of the pollutant.

The annual meteorological data used was from a STAR program from Akron, Colorado (Figure 5.7.1). Average afternoon mixing height and noctural mixing height were based on information presented in Reference 6.

Two decay half-lifes were used in each computer run. A very large half life (i.e., infinity) corresponds to no particulate fallout and a half life of .038 hours provides a more reasonable estimate of actual particulate fallout conditions(3). The half-life was calculated using the fallout function(3) and an average wind speed of 12.1 knots (6.33 m/sec) from the STAR program for Akron, Colorado. All of the data listed above remained the same for both Phase I and Phase II, with the exception of the area source emission rates.

Phase I was modeled using two area sources, both of which were in the general area of the Phase I processing area. Because Phase II operations will be more spread out, ten emission source areas were defined within the site and overburden areas. Separate emissions were estimated for each of the sources in accordance with the respective activities in each area. The totals emitted were equivalent to the estimates presented in Table 8.5.2.

8.5.1.5 Results and Conclusions

The output from the CDM model for Phase I and Phase II is given in Appendix N, and the results are summarized in Table 8.5.3. The results of the computations and computer modeling study indicate that, if no fugitive dust control measures were taken, the maximum particulate emissions from the Phase I and Phase II operations would be 86 tons/year and 315 tons/year, respectively. As expected, the vast majority of the particulates would be emitted as fugitive dust. As has been discussed previously, provisions have been made for controlling emissions of fugitive dust. In accordance with Colorado particulate emissions regulations, these include wetting down (including prewatering), replanting with native vegetation, temporary and permanent paving, restricting the speed of vehicles on the site, prevention of the deposit of dirt and mud on paved areas, minimizing topsoil disturbance, and reclaiming as soon as possible. As was indicated in Chapter 6, water collected on site will be used for these purposes, e.g., based on the annual design processing rate, 0.8 MG for watering access roads, 0.5 MG for dust control at stockpile areas, 1.9 MG for moisturizing placement of the overburden, 3.2 MG for revegetation of overburden, and 1.1 MG for secure disposal cell liner and cap construction. For the Phase II maximum processing rate, such fugitive dust control practices are expected to reduce TSP emissions to 243 tons per year, as indicated in Table 8.5.2 (which assumes no particulate fallout). This level is below the threshold quantity for a "major emitting facility," pursuant to Section 169(1) of the federal Clean Air Act.

Table 8.5.3 shows that for the maximum Phase II processing rate, the annual average total particulate concentrations at the property lines would increase by 0-5 ug/m^3, assuming realistic particulate fallout rates. With the fugitive dust control measures mentioned above, this range is expected to be 0-4 ug/m^3,

TABLE 8.5.3

AIR QUALITY MODELING RESULTS

TOTAL SUSPENDED PARTICULATES PROJECTIONS
ASSUMING NO FUGITIVE DUST CONTROL MEASURES
(Micrograms/Cubic Meter)

Receptor Location	Phase I at Maximum Processing Rate	Phase II at Maximum Processing Rate	Phase II at Design Avg. Processing Rate
1	0-0	0-1	0-0
2	0-1	0-3	0-1
3	0-1	1-5	1-3
4	0-2	2-6	1-3
5	0-1	1-5	1-2
6	1-2	2-8	1-4
7	1-3	4-11	2-5
8	2-5	4-11	2-6
9	0-1	0-4	0-2
10	0-1	0-2	0-1
11	0-0	0-1	0-1
12	2-5	4-11	2-6
13	1-3	3-10	2-5
14	0-1	2-6	1-3
15	0-2	5-12	3-6
16	0-1	0-2	0-1
17	0-0	0-1	0-1
18	0-0	0-1	0-0
19	0-0	0-1	0-0
20	0-0	0-1	0-0
21	0-0	0-0	0-0
22	0-0	0-1	0-0
23	0-0	0-0	0-0

Note: Refer to Figure 8.1 for air monitoring model receptor locations. The range of concentrations given for each level of operation corresponds to the assumed range of particulate fallout rates (see text).

in accordance with the estimates presented in Table 8.5.2. Considering the base line particulate data presented in Chapter 5, these estimates indicate that the facility will have virtually no impact on air quality.

8.5.2 Noise Impacts

8.5.2.1 Noise Sources

Two sources of noise were considered for the maximum operation level during Phase II - construction equipment noise and site generated traffic. The Phase I operation will generate less activity than Phase II and, therefore, will have fewer noise impacts than the Phase II maximum operation levels considered herein for impact analysis.

8.5.2.1.1 Construction Equipment

Construction of Phase II buildings, access roads, perimeter fences, and berms will require up to 15 months. After this construction, normal on-site construction will consist of building additional secure disposal cells and covering completed secure disposal cells. The combined construction equipment used in the noise analysis is listed below:

- off-highway trucks which deliver the solidified waste to the secure disposal cell from the processing facility;
- a bulldozer which spreads and compacts the solidified waste in the secure disposal cell and one that works in the overburden area;
- earthmovers which dig the secure disposal cells and transport the soil to the stockpile and overburden areas;
- motor grader which levels the overburden areas;
- trucks transporting building materials and equipment (concrete, asphalt, etc.).

8.5.2.1.2 Site Generated Traffic

Site generated traffic includes all highway traffic which is caused by the facility. This includes trucks delivering the waste and reagents, plus the employees' daily trips.

The highways affected by the majority of site-generated traffic are:

- U.S. 36 west of Adams-Washington County line;
- S.H. 71 north and south of Last Chance;
- I-70 west of Byers;
- I-25 between Colorado Springs and Denver.

8.5.2.2 Noise Analysis Procedures

The FHWA Level 2 Highway Traffic Noise Prediction Model, STAMINA 1.0 was used to predict the noise levels for the highways affected by the site generated traffic(7). This mathematical model provides accurate noise predictions. The noise level at a point away from the highway is a function of:

- the distance from the roadway;
- the relative elevations of the roadway and the receiver;
- traffic volume on the roadway;
- the percentage of light-duty (2 axles and 4 tires), medium-duty (2 axles and 6 tires), and heavy-duty (more than 2 axles) vehicles;
- vehicle speed;
- roadway grade;
- the noise source height of the vehicles;
  - Automobiles - 0.0 feet (tires produce most of the automobile noise;
  - Medium-Duty Trucks - 2.3 feet (exhaust noise is the primary contribution);
  - Heavy-Duty Trucks - 8.0 feet (combination of engine, mechanical, exhaust, intake, cooling fan and tire noise).

Traffic data used in modeling base line conditions were based on 1978 average daily traffic counts by the Colorado Department of Transportation. These figures were increased to correspond to the 2-1/2% to 3-1/2% average annual traffic growth rate for the specific highways detailed previously in Table 4.2. The maximum site generated traffic (corresponding to a raw waste load of 48,000,000 gallons per year) was added to the projected base line traffic volume for simulating traffic noise at the peak operating capacity.

Construction noise levels were modeled according to the Highway Construction Noise: Measurement, Prediction and Mitigation publication(8). Noise levels at the south property line along U.S. Highway 36 and along the east property line were computed using the procedures outlined therein. As a first approach, noise from Phase II construction activities and peak Phase II disposal activities were superimposed. Although this produced unrealistically high noise estimates, it served to show that noise levels would not be excessive and at the same time eliminated the need to compute noise levels for various alternative situations.

8.5.2.3 Noise Analysis Results

Facility related traffic has no significant increase in traffic induced sound levels along the access routes. The maximum increase was 1 dBA which occurred in two locations: on S.H. 71 south of Last Chance and U.S. 36 between Byers and the site. Table 8.5.4 lists the results of the highway traffic noise modeling with and without the facility.

TABLE 8.5.4

IMPACT OF HIGHWAY TRAFFIC NOISE

Highway and Location	Noise Level, dBA L_{eq}*	
	Without Site	With Site
I-25 between Colorado Springs and Denver	74	74
I-70 between Denver and Byers	70	70
U.S. 36 between Byers and the Site	67	68
U.S. 36 between Last Chance and the Site	67	67
U.S. 36 East of Last Chance	67	67
S.H. 71 North of Last Chance	67	67
S.H. 71 South of Last Chance	65	66

*Measured at the right-of-way.

For the Phase II peak raw waste loading of 48,000,000 gallons per year (design average equals 24,000,000 gallons per year), the site operational/construction noise anticipated would be less than 79 dBA L_{eq} along the east property line and less than 76 dBA L_{eq} along the south property line. The Colorado Noise Abatement Law for a construction site sets the maximum allowable noise level at 80 dBA with a maximum increase of 10 dBA for a period not to exceed 15 minutes in any one-hour period. These values correspond to a twelve hour L_{eq} of approximately 81 dBA. Consequently, the Colorado Noise Abatement Law will not be exceeded.

8.5.3 References

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8.6 ENVIRONMENTAL CONDITIONS IMPACTS

8.6.1 Climatic Impacts

The facility will not have any effect on regional or local climatic factors. Precipitation, temperature, wind, and other climatic regimes will remain the same as experienced under present conditions.

8.6.2 Natural Ecosystems Impacts

8.6.2.1 Natural Vegetation

8.6.2.1.1 Impact on Natural Vegetation

The facility will have a beneficial effect on natural vegetation. Less than one acre of native grassland will be lost during Phase I of the project. At present, essentially all of the site is winter wheat cropland. With Phase II operation of the site, these croplands will be seeded to native range grasses except where earth moving and construction is active.

To encourage establishment of the permanent grass cover, wheat stubble will be left on the site as mulch following harvest of the last winter wheat crop. The site will then be planted during the next suitable planting season. During seedbed preparation and seeding, a maximum amount of the plant stubble will be left on the surface to prevent soil blowing and to conserve moisture. The grass mixture to be used for range planting and seeding rates are given in the revegetation plan (Section 8.6.2.1.2).

A permanent cover of native grasses will be established on closed secure disposal cells, berms, and final overburden placement areas. These areas will be covered with at least six inches of topsoil prior to seedbed establishment. Areas to be revegetated will be fertilized, seeded and mulched in accordance with Standards and Specifications for Critical Area Planting(1). Irrigation will be provided for establishment of grass cover when seasonal rainfall is inadequate.

Temporary stockpiles of topsoil and excavated subsoil material will also be seeded to a protective grass cover while these materials are being stored. Areas which are under active construction will be protected from wind erosion and fugitive dust by surface irrigation and temporary erosion control measures, including use of berms.

In summary, there will be both short-term and long-term beneficial effects on natural vegetation. Very little natural vegetation will be destroyed, and in fact, there will be a net increase of vegetated area. As discussed below, an extensive revegetation program is planned to control erosion, to mitigate adverse impacts on soils, and to provide native wildlife habitat.

8.6.2.1.2 Revegetation Plan

At the start of Phase II operation, winter wheat cropping will be discontinued on the active site. At that time, any croplands not under active construction or earthmoving activity will be seeded with a native grass mixture to aid in controlling wind and water erosion, minimize dust, and provide wildlife habitat.

Seeding of grasses will be done in accordance with USDA Soil Conservation Service Standards and Specifications for Range Seeding(2). Following removal of the last crop of winter wheat, stubble will be left on the site until the next suitable planting season to conserve soil moisture and minimize erosion. During seedbed preparation and seeding, a maximum amount of plant stubble residue will be left on the surface to prevent soil blowing.

The grass mixture to be used for range planting and seeding rates are given in Table 8.6.1 as recommended by USDA(3).

TABLE 8.6.1

MIXTURE FOR RANGE SEEDING

Species	Mix	Drilled Rate Pounds/Acre	Pounds Live Seed/Acre
Sideoats Grama	50%	4.5	2.25
Blue Grama	30%	1.5	0.45
Western Wheat Grass	20%	8.0	1.6

Topsoil and subsoil stockpiles that will be stored for at least one growing season will be revegetated with a native grass mixture suitable for stabilizing steep slopes, in accordance with USDA Soil Conservation Service Standards and Recommendations for critical area plantings(3). Also, any berms or impoundments constructed on the site will be revegetated with these critical area plantings.

All steep slopes of stockpiles, berms, etc., will be covered with at least six inches of topsoil, fertilized, seeded and mulched with wheat straw to stabilize the soil surface. Land slopes will be kept within 3:1 slope (33%) wherever practical. Fertilizer will be applied during the seeding operation on steeply sloping areas with at least 40 pounds of nitrogen and 40 pounds of phosphate per acre. When seasonal rains are inadequate for establishment of grass cover, seeded and mulched areas will be irrigated to ensure development of a protective grass cover.

The seeding mixture and rate of seeding will be as shown in Table 8.6.2.

TABLE 8.6.2

MIXTURE FOR CRITICAL AREA PLANTING

Species	Mix	Drilled Rate Pounds/Acre	Pounds Live Seed/Acre
Western Wheat Grass	50%	16	8
Streambank Wheat Grass	50%	11	5.5

8.6.2.2 Wildlife

Full development of the site will benefit wildlife because most of the active area will be converted at the onset of Phase II operation from winter wheat cropland to native grasses. Where active earth moving and construction activities are occurring, there will be a minor loss of wildlife habitat from loss of winter wheat cropland. These croplands provide some habitat for field songbirds, field rodents, and predatory animals, but are of low wildlife habitat value compared to native grassland.

In addition to benefits to wildlife from planting portions of the site not under active development to native grasses, there will also be some benefits to wildlife from revegetation of disposal cell caps and overburden storage and placement areas. As discussed earlier, secure disposal areas and overburden areas will be covered with at least six inches of topsoil and seeded to native grasses.

There will be some loss of habitat for larger mammals from fencing the processing/disposal area. This area will be fenced for safety purposes and also to exclude big game animals which might otherwise be subject to contamination in this area. The fence will be chain link of sufficient height to provide these securities.

Following heavy rains, it is expected that some runoff may pond in open disposal cells. This ponded water could be attractive to migratory waterfowl. To minimize water quality degradation and hazard to waterfowl, this water will be drained from the disposal cell and pumped to the contaminated water holding pond. The contaminated holding pond is located near the solidification facilities where day-to-day truck and processing activities will discourage use by waterfowl. If these activities are not sufficient to discourage use by waterfowl, other scare devices will be used.

Rodents and other vectors normally associated with sanitary landfills are not expected to be a health problem at this site. The inert nature of the solidified waste and the practice of daily cover with soil in the secure disposal cell will prevent harboring and breeding of vectors.

8.6.2.3 Wetlands

This project will not impact the biological, physical or hydrological processes of any wetlands.

8.6.2.4 Threatened and Endangered Species

No State or Federally threatened or endangered species are known to exist in the site vicinity. No habitat for rare and endangered species will be lost as a result of the facility operation. The range and habitat characteristics of four threatened and endangered species which are dependent on prairie habitat in eastern Colorado were presented earlier in Section 5.8.2.3. These species included the greater prairie chicken, the lesser prairie chicken, the prairie sharp-tailed grouse, and the black-footed ferret. In the case of the first three species, insufficient prairie habitat is present in the immediate vicinity of the active area for support of these species. For the black-footed ferret, the lack of prairie dogs on the site precludes the occurrence of this species.

8.6.3 Land Use and Population Impacts

8.6.3.1 Land Use Impacts

No formal land use plan exists for eastern Adams County. The primary environmental impact relative to land use is the transition of two sections of agricultural land to a designated use. The remaining seven sections will continue in its present agricultural status. No other changes in land use are expected to occur in the vicinity of the project site. Some land use changes may occur in the small towns in the region as a result of increased demand for services and goods.

8.6.3.2 Population Impacts

Development of the facility will not have any significant impact on local or regional population characteristics. Some moderate impacts may be experienced by some of the small towns in the area (Byers, Brush, Fort Morgan, and Limon), but no substantial shifts are expected. This is due to the relatively small number of people which will be employed at the facility and the existing labor pool in the small towns in the area. In the absence of further industrial development, no substantial increases in population are expected to occur.

8.6.4 Impacts on Economic Activities

8.6.4.1 Employment Impacts

Effects on employment from development of the facility will be moderate. The facility will employ approximately 70 people, including plant personnel and truck drivers. These effects will be felt at the local level, but on a county-wide basis this employment increase will be absorbed into existing employment levels and will not cause any significant changes. The labor force for this facility is expected to be found within 40 miles of the area. This will have some moderate, positive impacts on the local economic base of these areas.

8.6.4.2 Impacts on Income

Development of the facility will be beneficial to local area personal income. The average salary at the facility will be approximately $25,000. At this rate, 70 employees will generate $1.75 million in personal income annually. As mentioned in the previous section, the majority of employees for this facility will be found in the small towns in the vicinity of the site. The income they earn at this facility will be introduced into the local economies. Most of this income will be spent in these small towns on goods and services, and through the multiplier effect will be turned over many times. The increased cash flow in these communities will be beneficial to their economic base.

Another effect brought on by operation of this facility is the loss of 1,184 acres of agricultural land. Loss of income and employment in this area will be more than offset by operation of the facility and the income which it will generate. In 1978, the average market value of the products sold per 870 acre farm in Adams County was $94,678. Based on this average, the site's two sections of agricultural land (1,184 acres) can be expected to generate a crop with a market value of $128,849 in a single year, or adjusted for inflation about $162,000 in 1981. A 1,184 acre tract of agricultural land represents only 0.16% of the Adams County total. Therefore, the loss of this tract to an industrial use will not have any significant effects on the overall status of the agricultural areas in the county, from either a loss of income or land perspective.

8.6.5 Heritage and Cultural Resources Impacts

No cultural resource sites are known for the site vicinity, and the project should not impact any significant cultural resources. However, deeply buried subsurface sites are known to exist in northeastern Colorado. In the event that such a site is encountered, construction work will stop immediately and the office of the State Historic Preservation Officer in Denver will be notified.

8.6.6 Traffic and Transportation Impacts

Traffic analysis for peak hour volumes of vehicles in the site vicinity indicate no necessary changes in the level of service on area roads. (Section 4.6). The projected maximum 1982 volume in the vicinity of the site is 194 vehicles per hour, which is well within the service A range of 280 vehicles per hour that can be accommodated by U.S. Highway 36. Other roadways along routes to the site have large enough volumes of traffic to make the increases due to site-generated traffic insignificant. Therefore, increases in traffic levels generated by the site will not cause a significant effect on the level of service provided by area highways. No traffic mitigating measures are necessary with respect to complete development and operation of the site.

No other significant transportation related impacts are expected in conjunction with operation of the site as hazardous waste disposal facility. Federal and State regulations governing transport of hazardous waste will be complied with as discussed in Section 4.2. All vehicles and vehicle tanks will be maintained in secure and roadworthy condition and will be equipped with two-way radios. A contingency plan has been developed (Chpater 7) in the event of a road accident resulting in a spill on access routes to the site.

8.6.7 Visual Impacts

One moderate, adverse short-term visual impact is expected to occur during the Phase I level of operation because the solidification process will not be in an enclosed building. However, full development of the site is not expected to result in any significant adverse visual impacts. The administration building, guard house, and employee welfare/laboratory building will be modern one-story structures that will add to the overall visual qualities of the area. The maintenance building and solidification building will be constructed of prefabricated metal panel siding much like the material and design of many farm buildings in the area. These buildings will not conflict with the rural agricultural scenery of the area.

Extensive revegetation of the area and use of dust control measures will mitigate any adverse effects from increased fugitive dust and extensive earthwork in the area. The construction of a vegetated berm around the entire secure disposal and processing areas will screen much of the active earthwork from nearby roads. Wind blown debris, if any, will be policed to avoid negative visual impacts.

8.6.8 References

1. USDA, Soil Conservation Service, Colorado, Standards and Specifications, Critical Area Planting, Technical Guide, Section IV, August, 1980.

2. USDA, Soil Conservation Service, Colorado, Standards and Specifications for Range Seeding, January, 1971.

3. USDA, Soil Conservation Service, Colorado, Seeding Rates, Technical Guide, Section IV, November, 1980.

8.7 STEPS TO MINIMIZE HARM TO THE ENVIRONMENT

8.7.1 Conclusions

Minimization of potential harm to the environment is an important consideration in all aspects of the site selection, design and operation of any chemical waste management facility. Of primary importance in selecting a site for this facility was location within the most suitable geologic area as defined by the Colorado State Department of Health(1). Principally for this reason, the site was located over the Pierre Shale of eastern Colorado. A large number of other environmental elements or requirements were also considered in selecting the site location which minimize potential harm to the environment. These include many physical, biological, land use and population, economic, transportation and other environmental elements addressed previously in the text of this report.

Numerous features are included in the design of the facility to minimize potential harm to the environment. Principal among these are the use of secure, clay-lined disposal cells and waste solidification facilities that essentially preclude release of waste to the external environment. Other design features include laboratory testing facilities, surface runoff collection facilities, employee welfare facilities, truck washes, protective berms, site security facilities, leachate collecting and monitoring system, and on-site fire, safety and emergency response facilities and equipment.

The operation of the facility also includes a wide variety of environmental protection features, safeguards and contingency plans that minimize harm to the environment or mitigate adverse impacts on the environment. Among these operational features are:

- o chemical waste analysis plan;
- o safety preparedness and prevention program;
- o hazardous spill contingency plan;
- o site security plan;
- o facility inspection plan;
- o air quality maintenance plan;
- o water quality monitoring program;
- o revegetation plan;
- o erosion, sedimentation and water control measures;
- o site closure plan;
- o post closure plan.

The forgoing discussion and listing of environmental plans provide a general summary of the areas in which measures to minimize harm to the environment will be taken. Specific environmental factors, features and designs relating to these plans are presented and discussed in appropriate sections of this report and form an integral part of this entire chemical waste treatment/solidification and disposal facility plan.

8.7.2 References

1. Hynes, J. and Sutton, C., Hazardous Wastes in Colorado, Colorado Geologic Survey and Department of Health, Denver, Colorado, 1980.

CHAPTER 9

QUALIFICATIONS OF BFI

9.1 INTRODUCTION

The information in the remainder of this chapter was prepared by BFI for HNTB in order to summarize BFI's history of service and qualifications in the chemical waste management industry.

9.2 INTRODUCTION TO BROWNING-FERRIS INDUSTRIES, INC.

Browning-Ferris Industries has been actively engaged in the development of specialized methods for the proper management of industrial waste materials since the early 1970's. In this period of time, the management of such wastes has evolved from the use of standard municipal refuse disposal practices, which were largely unregulated, into a strictly regulated and prescribed assembly of high-technology processes, many of which bear no resemblance to their precursors.

Although use of established concepts from disciplines such as civil, chemical and mechanical engineering, chemistry, geology, and hydrology are fundamental to the development of improved methods for industrial waste management, a tremendous contribution to such development has been derived from practical experience in the management of such wastes. In this respect, those companies with the longest histories of industrial waste management are normally the ones best suited to provide practical solutions to the broad spectrum of waste problems facing industry today.

The extent of Browning-Ferris Industries' current involvement in the management of industrial wastes is documented in subsequent sections of this chapter. As indicated in these sections, Browning-Ferris Industries has cumulatively managed approximately 3,500,000 tons of industrial wastes at the sites described herein. Each of the sites listed is or was operated over a period of time in which the demands for more sophisticated management methods, greater volume throughput, and environmental protection have increased exponentially. In order to meet these demands, many of the sites have undergone extensive renovation. Specialized technical personnel have been added to site staff in order to provide quality control and ensure compliance with all environmental and occupational safety regulations. In some instances where it was not deemed technologically practicable or economically feasible to upgrade sites to conform to the increasing environmental demands, sites have been closed. Browning-Ferris Industries has been largely successsful in responding to the complex and continually changing technological and environmental requirements for safe waste management.

Nevertheless, there have occasionally been judicial or administrative proceedings initiated by various governmental entities, under local, state, or federal law, in which it has been asserted that a particular operation at a site is not conforming to a particular operating standard. These proceedings must be considered in the context of the rapidly changing standards for operation of waste management sites, and are not indicative of a reluctance to meet, or lack of concern regarding, such standards. Many of the alledged violations are in fact procedural, rather than substantive. In those cases where site correction measures have been required, however, BFI has taken prompt and appropriate remedial actions. Just as the company benefits from operating experience, so does it benefit from experience in meeting the complex requirements of regulatory authorities. The ability to draw on both forms of experience, coupled with the availability of vast technical support both inside and outside the company, has enabled Browning-Ferris Industries to provide practical, responsible solutions to a wide variety of industrial waste management problems, and will continue to do so in the future.

9.3 HISTORY OF BFI'S CHEMICAL WASTE DISPOSAL SITES

The following subsections comprise an annotated history of each chemical waste disposal site owned or operated by Browning-Ferris Industries, including facility capabilities, typical waste receipts, date of acquisition, total industrial waste tonnage managed by the facility, regulatory authorities, administrative or judicial proceedings brought by federal, state, or local authorities, and actions taken to resolve or mitigate problems. In addition, a comprehensive list of all other solids waste disposal sites (sanitary landfills) either owned or operated by Browning-Ferris Industries is provided in Table 9.1. This listing is intended to satisfy the February 17, 1981, request of the Adams County Board of Commissioners.

9.3.1 Facility Name: Browning-Ferris, Inc. Chemical Processing Center (CPC), Baltimore, Maryland

Facility Capabilities:

- o Vacuum truck service for collection and transportation of bulk liquid industrial wastes.
- o Open basin absorbent solidification of bulk industrial liquid and semi-solid wastes with cememt kiln dust. Mixing and transfer of treated materials to hydration basin by hydraulic backhoe.
- o pH adjusted gravity separation of bulk and drummed industrial oil and solvent wastes. Segregation and storage of oil and solvent materials in closed tankage prior to shipment off-site for energy recovery. Absorbent solidification of aqueous and sediment portions of oil and solvent wastes.
- o Neutralization and oxidative processing of bulk industrial wastewater. Discharge of processed waste to publicly-owned treatment works.

TABLE 9.1

BFI SOLID WASTE LANDFILL SITES

January 1981

	Number of Sites	Own	Jointly Owned	Partially Owned and Leased	Operate	Leased
Arrowhead Region						
Eden Prairie, Minnesota	1	X				
Boyer (Hamil), Minnesota	1	X				
Boulder, Colorado	1					
Denver, Colorado	1					
Omaho, Nebraska	1				X	
Missoula, Montana	1	X				
Calgary, Canada	1					
Minneapolis, Minnesota (Phoenix)	1	X				
Illinois Region						
Barrington, Illinois	1	X				
Waukegan, Illinois	1	X				
Rockford, Illinois	1	X				
Peoria, Illinois	1				X	
Hillside, Illinois	1		X			
East Central						
Baltimore, Maryland (Norris Farms)	1	X				
Glen Burnie, Maryland	1	X				
Winchester, Virginia	1	X				
Fairfax County, Virginia	1					
Toledo, Ohio	1	X				
Ridge, Ontario, Canada	1	X				
Richmond, Virginia	1	X				
Northeast Region						
Boston, Massachusetts	1	X				
Rockingham, Vermont	1	X				
Plymouth, Massachusetts	1				X	
Halifax, Massachusetts	1					
Quincy, Massachusetts	1				X	
Pacific Region						
San Mateo, California (City)	1				X	
Menlo Park, California (Marsh Road)	1				X	
Burlingame, California	1				X	
San Jose, California	1	X				
Fresno, California	1	X				
Half Moon Bay, California (Ox Mountain)	1	X				
Los Angeles, California (Sunshine Canyon)	1	X				

TABLE 9.1
(continued)

	Number of Sites	Own	Jointly Owned	Partially Owned and Leased	Operate	Leased
Southern Region						
Kansas City, Missouri	1					X
Redbird (St. Louis, Missouri)	1					X
Evansville, Indiana	1					X
Missouri City, Missouri	1					X
Sykes Road (Memphis, Tennessee)	1	X				
Shelby Drive (Memphis, Tennessee)	1					X
Bankhead (Atlanta, Georgia)	1	X				
Biloxi, Mississippi	1					X
New Orleans, Louisiana	1	X				
Anniston, Alabama	1				X	
Jackson, Mississippi	1					X
Columbia, South Carolina	1	X				
Cincinnati, Ohio (Bobmeyer Road)	1	X				
Cincinnati, Ohio (Bond Road)	1				X	
Mobile, Alabama	2				XX	
Lexington, Kentucky	1				X	
Charleston, South Carolina	1					X
Southwest Region						
Houston, Texas (McCarty Drive)	1	X				
Hitchcock, Texas	1			X		
Oklahoma City, Oklahoma	1		X			
Tulsa, Oklahoma	1					X
Lake Charles, Louisiana	1			X		
Alamagordo, New Mexico	1				X	
Houston, Texas (Little York Road)	1	X				
Lubbock, Texas	1	X				
Steel Region						
Green Twp. (Youngstown, Ohio)	1					X
Poland Twp. (Youngstown, Ohio)	1					X
Sandusky, Ohio	1	X				
Imperial (Pittsburgh, Ohio)	1					X
Elyria, Ohio	1					X
TOTALS:	63	28	2	2	13	18

Note: The Detroit, Michigan (Lyon Dev.); Memphis, Tennessee (Holmes Road); and the Hellyer Canyon landfills are not shown on this listing since they are not yet operational. When the Holmes Road landfill opens, it will replace the Shelby Drive landfill.

Typical Waste Receipts:

- o Acid solutions from metal finishing processes.
- o Spent naphtha degreasing agent from manufacturer of automotive engine parts.
- o Wastewater treatment residue from manufacturer of power tools.

Facility Start-Up Date: June 1, 1976

Total Industrial Waste Tonnage Managed By Facility
Since Start-Up: 96,000 T.

Comments: At present, approximately 5% of total waste receipts are managed by neutralization and oxidative processing, 15% are managed by oil and solvent recovery, and 80% are managed by absorbent solidification.

Facility Regulated By:

- o State of Maryland Water Resources Administration.
- o State of Maryland Department of Health and Mental Hygiene.
- o Baltimore County Health Department.

Legal Proceedings:

- o Maryland Department of Health and Mental Hygiene vs. BFI of Maryland

State of Maryland alleged commencement of construction of the CPC facility without an air quality permit. On June 22, 1979, the Department of Health entered orders allowing operation of the facility so long as the vapor pressure of such materials did not exceed 0.1 psi. In March, 1981, BFI entered into a Consent Secretarial Order resolving all matters relating to air quality and requiring evaluation of incoming waste streams and equipment to reduce possible hydrocarbon vapor emissions.

9.3.2 Facility Name: Browning-Ferris, Inc., Glen Burnie, Maryland

Facility Capability:

- Secure landfill disposal for bulk and drummed solid and semi-solid industrial wastes.

Typical Waste Receipts:

- Spent ore from chrome pigment production.
- Dewatered paint overspray from small electrical appliance manufacturing.
- Dewatered press residues from ceramic insulator production.
- Packaged asbestos insulation wastes from ship refitting operation.

Date of Facility Acquisition: January 1, 1972

Total Industrial Waste Tonnage Managed by Facility Since Acquisition: 1,171,000 T.

Facility Regulated By:

- State of Maryland Water Resources Administration.
- State of Maryland Department of Health and Mental Hygiene.
- Anne Arundel County Health Department.

Legal Proceedings:

- State of Maryland Department of Health and Mental Hygiene vs. Browning-Ferris, Inc.

The State of Maryland is seeking injunctive relief and civil penalties in regard to two matters. On June 30, 1980, wastes were brought to BFI properly manifested in accordance with State and local law from the cleanup of contaminated soil associated with an unrelated abandoned waste disposal site in North Carolina. In accordance with Federal and State regulations, BFI tested the wastes prior to agreeing to accept them. The wastes were classified as Class III under Maryland law, pursuant to the test. State laboratory tests showed that the waste contained minute quantities of trichlorophenol which is classified by Maryland law as a Class II rather than Class III hazardous waste. Even though trichlorophenol appeared to be present only at 0.38 mg/kg, which is below the level of analytical variability (current analytical techniques are not accurate enough to confirm such low quantities), the State of Maryland brought suit on the basis that the Solley Road facility was not authorized to accept trichlorophenol. Because of the extremely low amount of the trichlorophenol reported by the State, BFI is challenging the State's allegation.

The second matter complained that on July 31, 1980, the Solley Road landfill allegedly accepted "liquid" rather than semi-solid wastes. The Solley Road landfill is authorized by permit to accept only solid or semi-solid waste. The material accepted was a mixture consisting of 50% solid and 50% liquid material. Waste sludge, which is classified as a semi-solid, is considered to be a mixture of 50% solids and 50% liquid. BFI is contesting the State's claim on the basis that the waste was a semi-solid sludge in accordance with the permit.

Prior to accepting wastes at Solley Road, BFI performs tests on the waste to assure, as far as reasonably possible, that the wastes meet the characteristics required by the landfill's permit, but there may be unavoidable discrepancies between BFI's test results and those of the State of Maryland regarding the analytical composition or characteristics of the waste. In both of the above instances, the disputes arose from differences in interpretation and application of regulatory standards to test results.

- State of Maryland vs. Browning-Ferris, Inc.

The State alleges that the landfill operated during restricted hours. Also at issue is whether, under Maryland law, the county may lawfully require an operating license. The State of Maryland hazardous waste statute and regulations have been held to preempt local law, and BFI is therefore challenging the claim that the county may require a license. BFI is more carefully monitoring operations to assure that there are no technical violations of the prohibition against operating at night, on Sundays or holidays.

9.3.3 Facility Name: Browning-Ferris Industries of Elizabeth, New Jersey, Inc.

Facility Capabilities:

- Roll-off box service for collection and transportation of bulk and drummed solid and semi-solid industrial wastes.
- Covered storage of mutually compatible bulk solid and semi-solid industrial wastes. Transfer of wastes by wheeled loader to dump trailers to a secure landfill for ultimate disposal.

Typical Waste Receipts:

- Filter cake residue from manufacturer of surfactants.
- Wastewater treatment residue from manufacturer of business machines.

Date of Facility Start-up: January 15, 1974.

Total Industrial Waste Tonnage Processed by Transfer Station Since Facility Start-Up: 16,800 T.

Facility Regulated By:

- New Jersey Department of Environmental Protection.

Legal Proceedings:

- New Jersey Department of Environmental Protection vs. Browning-Ferris of Elizabeth, New Jersey, Inc.

The New Jersey Department of Environmental Protection alleged operation of a haul truck without proper registration number and alleged spillage of sludge. The alleged technical violations were corrected and all claims settled.

9.3.4 Facility Name: Browning-Ferris Industries of Illinois, Inc., - Rockford, Illinois

Facility Capability:

- Secure landfill co-disposal for bulk and drummed solid and semi-solid industrial wastes with conventional solid waste.

Typical Waste Receipts:

- Residue from lime treatment of pickling acids generated by the manufacturer of specialty alloys.
- Wastewater treatment residue from electroplating operations.
- Spent filter media from industrial painting operations.

Date of Facility Acquisition: December 16, 1976.

Date of Commencement of Special Waste Management: March, 1978.

Total Special Waste Tonnage Managed By Facility
Since March, 1978: 22,500 T. (Prior to March, 1978, no differentiation of wastes was made by Illinois EPA).

Facility Regulated By: Illinois EPA

Legal Proceedings: None

9.3.5 Facility Name: Browning-Ferris Industries of Illinois, Inc., - Waukegan, Illinois

Facility Capability:

- o Secure landfill co-disposal for bulk and drummed solid and semi-solid industrial wastes with conventional solid waste.

Typical Waste Receipts:

- o Secondary treatment residue from publicly-owned treatment works.
- o Spent filter media from industrial painting operations.

Date of Facility Acquisition: August 30, 1976.

Date of Commencement of Special Waste Management: March, 1978. (Prior to March, 1978, no differentiation of wastes was prescribed by Illinois EPA).

Total Special Waste Tonnage Managed by Facility Since March, 1978: 45,000 T.

Facility Regulated by: Illinois EPA

Legal Proceedings:

- o U. S. EPA, Region V In the Matter of BFI Illinois, Winthrop Harbor (Waukegan, Illinois)

The January 28, 1981, complaint alleges that at the time of facility inspection on November 28, 1980, a list of emergency equipment and personnel training record was not on-site as required by the newly effective RCRA interim status regulations, 40 C.F.R. 265.52 (e) and 265.16 (d) (2).

In fact, the personnel training records were on site and the list of emergency equipment was provided to U. S. EPA on February 17, 1981. Since BFI is in compliance with matters alleged in Complaint, U. S. EPA will take no futher action.

9.3.6 Facility Name: Browning-Ferris Industries of Ohio, Inc., East Palestine, Ohio

Facility Capability:

- o Open basin storage of mutually compatible aqueous industrial wastes.

Typical Waste Receipts:

- o Spent pickling acid solutions.
- o Waste carbide lime slurries.

Comment: Waste receipts were terminated at this facility in 1979. Closure operations are currently underway.

Date of Facility Start-Up: June 10, 1974.

Total Industrial Waste Tonnage Managed by Facility Since Start-Up: 650,000 T.

Facility Regulated By: Ohio EPA

Legal Proceedings:

- o Ohio EPA vs. BFI of Ohio

A complaint was filed by certain public officials and the Chamber of Commerce of East Palestine, Ohio, alleging that the site leased from Ecological Services by BFI of Ohio is causing air and water pollution. This site is now being closed by BFI following procedures required by Ohio EPA.

9.3.7 Facility Name: Browning-Ferris Industries of Ohio, Inc., Warren, Ohio

Facility Capability:

- o Segregation and storage of bulk and drummed liquid waste and drummed semi-solid and solid waste prior to shipment to properly permitted facilities for ultimate disposal.

Date of Facility Start-Up: December 4, 1973.

Total Industrial Waste Tonnage Managed by Facility
Since Start-Up: 32,500 T.

Comments: No industrial wastes are presently received at this facility.

Facility Regulated by: Ohio EPA

Legal Proceedings: None.

9.3.8 Facility Name: Browning-Ferris Industries, Inc., Clay County, Missouri

Facility Capabilities:

- pH adjusted gravity separation of bulk industrial oil and solvent wastes. Segregation and storage of oil and solvent materials in closed tankage prior to shipment off-site for energy recovery. LIQWACON™ solidification of aqueous and sediment portions of oil and solvent wastes.

- Open-basin pH adjustment and/or oxidative/reductive treatment of aqueous wastes followed by absorbent solidification of the treated wastes.

- Open basin LIQWACON™ treatment (solidification using cement and sodium silicate) of predominantly aqueous bulk liquid and semi-solid wastes using a trailer mounted mixing and treating unit. Pumping of treated wastes to hydration basin. Disposal of resulting solids in on-site landfill.

- Open-basin absorbent solidification of bulk liquid and semi-solid wastes using cement kiln dust. Mixing accomplished by hydraulic backhoe. Treated materials hydrate in mixing basin, and are then transferred to landfill disposal cell using a tracked loader.

- Lanfill disposal of bulk industrial solids, semi-solids and site-processed solids.

Typical Waste Receipts:

- Separator sediment from refinery processes.

- Spent lacquer thinner (solvent) from auto body painting.

- Contaminated metal and piping from demolition of agricultural chemicals plant.