1509 Main Street, Suite 900
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ICF TECHNOLOGY INCORPORATED

90068490

TO: David Wineman, Region 6 RPO

THRU: K. H. Malone Jr., FITOM

THRU: Tim A. Hall, ICF - AFITOM DeLandl for TA-H

PREPARED BY: John L. Jones, ICF Technology, Inc. JJ.

DATE: August 8, 1988

SUBJECT: Gulf Chemical and Metallurgical - PA Reassessment
Freeport, Brazoria County, TX
EPA ID #TXD074195678, TDD #F-6-8804-27, PAN #FTX0742PAA

Gulf Chemical and Metallurgical (GCMC) in Freeport, Texas operates a metals recovery process extracting molybdenum and vanadium from spent oil-refinery hydro-desulfurization catalyst.

Spent catalyst is received in railcars, drums, bags, and trucks from various refineries throughout the world. The catalyst is stored in a pile on a concrete pad that is walled on three sides by a 6 foot retaining wall. The water that is sprayed on the pile to cool the material is collected in a sump and then pumped to one of three surface impoundments. The catalyst is transferred to multiple hearth roasters where it is calcined. The exhaust gases from the roasters are cleaned in electrostatic precipitators prior to being emitted to the atmosphere (TACB Permit Nos. 1157B/1157C). The dust collected in the electrostatic precipitators is recycled back to the roasters.

The calcined catalyst is ground and pumped to a leaching system. The leached solids (tailings) are pumped to the three surface impoundments (TWC Solids Waste Permit No. 30952 and RCRA Solid Waste TXD074195678). There is a fourth surface impoundment approximately 9 miles to the north of the site that receives excess tailings from the three on-site surface impoundments. When economically attractive, the company had planned to reprocess the tailings in the impoundments to recover cobalt and nickel. According to the TWC's April 13, 1987, Solid Waste Compliance Monitoring Inspection Report, by the end of 1987, the company will no longer be stockpiling these tailings. GCMC will either use it as a cement additive or send it to Belguim for metals recovery. The company also plans to slowly work down the material stored in all four impoundments.

The leachate solution is processed to recover the molybdenum and vanadium as molybdenum trioxide and vanadium pentoxide. The wastewater remaining from the leachate solution is pumped through a solvent extraction system to further reduce the concentration of molybdenum and vanadium, stripped for ammonia recovery, and neutralized. The treated effluent is discharged through Outfall 001 (Permits, TWC No. 01861, NPDES No. TX0034739) into the Dow waste canal. The facility also has Outfall 002 into the Old Brazos River for stormwater runoff.

Summary of RCRA and CERCLA file information on the site:

- Aug 24, 1976, Enforcement Order. The plant was cited because it was permitted by the TDWR to discharge only from Outfall 001, however stormwater contaminated with molybdenum, vanadium, nickel and zinc was allowed to drain to one side of the plant prior to release. GCMC cleaned the stormwater ditch, constructed a weir dam and placed the spent catalyst on pads.

- March 23, 1977, Site identification from TDWR files.

- May 21, 1980, Site identification due to letter from the Mayor of Freeport, Mr. Tobey L. Davenport, requesting an unannounced inspection of the site.

- Nov. 19, 1980, Application for Hazardous Waste Permit, Consolidated Permits Program.

- Nov. 24 & 25, 1980, Preliminary Assessment performed by TDWR during a RCRA inspection of the site.

- May 4, 1981, EPA files Compliance Order and Notice of Opportunity for Hearing under RCRA.

- June 4, 1981, Respondent's answer and Request for a Hearing.

- Nov. 5, 1981, EPA files Notice and Final Order upon Withdrawal.

- May 25, 1982, TWC Industrial Solid Waste Disposal Compliance Monitoring Inspection.

- March 9, 1984, Site inspection performed by Engineering Science Inc., representatives for the TDWR, noted several self reported violations by GCMC from NPDES Outfall 001. The violations included temperature, TSS molybdenum, vanadium.

- March 25, 1985, TWC Industrial Solid Waste Compliance Monitoring Inspection.

- Aug. 30, 1985, TWC withdrew GCMC's application for a hazardous waste permit based on review of Part A and the Affidavit of Exclusion.

- April 13, 1987, TWC Solid Waste Compliance Monitoring Inspection Report

- Sept. 25, 1987, TWC informs GCMC of Violation of the Financial Requirement for Closure and Liability.

Since there is a potential for contamination of groundwater and surface water, the FIT recommends that a site visit be performed to obtain further information on this site. During the site visit the following aspects of the site need to be evaluated:

- The condition of the embankments at the surface impoundments to identify any erosion.

- The current level at which ground water is reached.

- The exact location of 1) the drainage pathways and 2) Outfalls 001 & 002. The locations used at this time are approximations.

- A records search at the facility to 1) determine if any laboratory data exists to support the reference (Reference 3) to various self reported violations involving high concentrations of ammonia, molybdenum and vanadium. 2) determine the average inventory of spent catalyst on site at any one time.

Based on the site visit, a sampling plan may be prepared if conditions at the site indicate that sampling could prove an observed release to the groundwater and/or surface water.

The facility's fourth surface impoundment located approximately 9 miles north of the site should be visited at the same time as the plant. Due to its distance from the main site, this impoundment should be considered as a separate facility. The pond has four groundwater monitoring wells and from the available data the groundwater shows no evidence of contamination.

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PREPARED BY: John L. Jones, ICF Technology, Inc. JJ

DATE: August 8, 1988

SUBJECT: Gulf Chemical and Metallurgical - Preliminary HRS
Freeport, Brazoria County, TX
EPA ID #TXD074195678, TDD #F-6-8804-27, PAN #FTX0742PAA

Gulf Chemical and Metallurgical (GCMC) in Freeport, Texas operates a metals recovery process extracting molybdenum and vanadium from spent oil-refinery hydro-desulfurization catalyst.

When spent catalyst is received at the plant, it is stored in a pile on a concrete pad that is walled on three sides. Water is sprayed on the catalyst pile to keep it cool. The runoff water is collected in a sump and then pumped to one of the three surface impoundments on site. The metals recovery process involves roasting the spent catalyst and then leaching the desired metals out of the calcined catalyst. The leachate solution is processed to recover the molybdenum and vanadium as molybdenum trioxide and vanadium pentoxide.

The wastewater remaining from the leachate solution is pumped through a solvent extraction system to further reduce the concentration of molybdenum and vanadium. It is stripped for ammonia recovery, and neutralized, prior to being discharged through Outfall 001 into the Dow Waste Water Canal. The facility also has Outfall 002 into the Old Brazos River for stormwater runoff.

With the information currently available to the FIT, the site will not receive the minimum score required to be included on the National Priorities List. The surface water supply intake for the city of Freeport's water utility system is upstream of the site thus decreasing the usage factors for the surface water. However there is some industrial and recreational water use of the down stream surface water and there are coastal wetlands near the site.

Groundwater within 3 miles of the site is also used as a drinking water source by the city of Freeport in their water utility system. However the groundwater score is low due to the lack of an observed release and the low permeability of the soil beneath the site.

Since there is a potential for contamination of groundwater and surface water, the FIT recommends that a site visit be performed to obtain further

information on this site. During the site visit, the following aspects of the site need to be evaluated:

- The condition of the embankments at the surface impoundments to identify any erosion;

- The current level at which groundwater is reached;

- The exact location of 1) the drainage pathways, and 2) Outfalls 001 and 002. The locations used at this time are approximations; and

- A records search at the facility to 1) determine if any laboratory data exists to support the reference (Reference 3) to various self reported violations involving high concentrations of ammonia, molybdenum and vanadium and 2) determine the average inventory of spent catalyst on site at any one time.

A fourth surface impoundment, approximately 9 miles north of the site, could be visited during the site visit, but should be considered as a separate facility. The fourth surface impoundment has four groundwater monitoring wells and from the available data the groundwater shows no evidence of contamination.

DOCUMENTATION RECORDS

FOR

HAZARD RANKING SYSTEM

INSTRUCTIONS: The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic- type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Gulf Chemical and Metallurgical Co.

LOCATION: Freeport, Brazoria County, TX. LAT 28° 57′ 22" LONG 95° 20′ 17"

GROUND WATER ROUTE

1. OBSERVED RELEASE

Contaminants detected (5 maximum):

There is no documented evidence of an observed release to the groundwater from this site.

Rationale for attributing the contaminants to the facility:

N/A

2. ROUTE CHARACTERISTICS

<u>Depths to Aquifer of Concern</u>

Name/description of aquifer(s) of concern:

The Chicot Aquifer is the aquifer of concern at this site. The aquifer is comprised of the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene Age, and any overlying Holocene Alluvium (Ref. 1, p. 40).

Depth(s) from the ground surface to the highest seasonal level of the saturated zone [water table(s)] of the aquifer of concern:

The groundwater within 3 miles of the site begins between 150-180 feet below the surface (Reference 6, 16).

Depth from the ground surface to the lowest point of waste disposal/ storage:

The depth of Tailing Pond #3 is 16 feet below ground level. Depth to Aquifer of Concern 150 - 16 = 134 ft (Reference 3).
HRS Value = 1

<u>Net Precipitation</u>

Mean annual or seasonal precipitation (list months for seasonal):

The mean annual precipitation for the area around the site is 46" (Reference 2, p. 14).

Mean annual lake or seasonal evaporation (list months for seasonal):

The mean annual lake evaporation for the area is 53"
(Reference 2, p. 13).

Net precipitation (subtract the above figures):

The net precipitation for the area around the site is (46" - 53") = -7"
(Reference 2).
HRS Value = 1

<u>Permeability of Unsaturated Zone</u>

Soil type in unsaturated zone:

The soil in the unsaturated zone is alluvium, consisting of clay, silt, sand and gravel. From well log BH-81-06-405 the soil type in the unsaturated zone appears to be clay (Reference 15, 16).

Permeability associated with soil type:

Since the soil is not homogeneous, the permeability associated with the least permeable component, i.e. clay, is used: $< 10^{-7}$ cm/sec (Reference 2).
HRS Value = 0

<u>Physical State</u>

Physical state of substances at time of disposal (or at present time for generated gases):

The spent catalyst stored on-site prior to reclamation contains vanadium and molybdenum and is a solid.

The tailings contained in the settling ponds on-site are in the form of sludge (Reference 3). The sludge waste yields the higher score for physical state.
HRS Value = 3

3. CONTAINMENT

<u>Containment</u>

Method(s) of waste or leachate containments evaluated:

The spent catalyst is stored in a pile on a concrete pad with retaining walls on three sides. The tailings are stored in three surface impoundments, two of which had less than 1 ft. of freeboard.
Reference 3

Method with highest score:

The containment method with the highest score for the groundwater route is essentially non-permeable compatible liner, liner with no leachate collection system, or inadequate freeboard (Reference 2, p. 17).
HRS Value = 1

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

The following compounds are known to be on-site:

	Toxicity	Persistence
Ammonia	3	0
Molybdenum	3	3
Vanadium	3	3

Reference 2, 3, 10

Compound with highest score:

Molybdenum and vanadium scored Toxicity - 3 (Ref. 2, p. 19; Ref. 10), Persistence - 3 (Ref. 2, p. 18; Ref. 10)
HRS Value = 18

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

The total quantity of hazardous substances at the facility are the tailings in the on-site surface impoundments:
Pond(1) - (768,000 cu. ft.)
Pond(2) - (272,000 cu. ft.)
Pond(3) - (258,000 Cu. ft.)

Total = 1898000 cu. ft. = (189,8000 cu. ft.) $\left(\frac{1 \text{ cu. yd}}{27 \text{ cu. ft.}}\right)$ = 70,296 cu. yds,

Reference 2,3

Basis of estimating and/or computing waste quantity:

The volume of the tailings in the surface impoundments was estimated as the waste quantity (Reference 3).
HRS Value = 8

5. TARGETS

Ground Water Use

The aquifer of concern is used as a source of drinking water by the city of Freeport, since surface water alone cannot fully supply the city's needs (Ref. 5, 6, 7, 13).
HRS Value = 3

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply.

The nearest well drawing from the aquifer of concern is the city of Freeport well #8. Well #8 is located 3200 feet south of the site at the intersection of Terminal and Broad Street.
(Ref. 7).

Distance to above well or building:

The distance of the nearest well is 0.7 mile (Ref. 7, 9).
HRS Value = 3

Population Served by Ground Water Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

There are eight water wells in the city of Freeport water utility system and 13,500 people are served by the system (Ref. 7).

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):

There is no irrigated land within 3 miles of the site (Ref. 17).

Total population served by ground water within a 3-mile radius:

The total population served by groundwater in a 3-mile radius is 13,500 (Reference 2,6).
HRS Value = 5
HRS Matrix Value = 35

SURFACE WATER ROUTE

1. OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

There is no documented evidence of an observed release to the surface water from this site.

Rationale for attributing the contaminants to the facility:

N/A

2. ROUTE CHARACTERISTICS

<u>Facility Slope and Intervening Terrain</u>

Average slope of facility in percent:

The average slope of the facility is < 1% towards the south. The site is essentially a flat graded area (Ref. 3, 9).

Name/description of nearest downslope surface water:

The nearest downslope surface water is the Old Brazos River that is used for ship and barge transport and contact recreation. The site's stormwater Outfall 002 drains into the Old Brazos River. The site's treated process wastewater drains into the, Dow Barge canal via Outfall 001 (Ref. 6, 9, 18).

Average slope of terrain between facility and above-cited surface water body in percent:

The average slope of the terrain between the facility and the above cited surface water body is zero. However, Outfall 002, the stormwater drainage ditch from the site, drains into the above cited surface water body (Ref. 3,9).

Is the facility located either totally or partially in surface water?

The facility is not located either totally or partially in surface water, except for an intermittent stream to the northwest (Ref. 2, p. 31; Ref. 9).
HRS Value = 0

Is the facility completely surrounded by areas of higher elevation?

The facility is not completely surrounded by areas of higher elevation (Ref. 9).

1-Year 24-Hour Rainfall in Inches

The 1-year, 24-hour rainfall is 4 inches (Reference 2, p. 33).
HRS Value = 3

Distance to Nearest Downslope Surface Water

The distance from the site to the nearest downslope, surface water (The Dow Barge Canal) is 1320 feet (Ref. 9).
Reference 2, p. 32
HRS Value = 2

Physical State of Waste

The spent catalyst pile is a solid.
The tailings in the surface impoundments is a sludge (Ref. 3).
HRS Value = 3

3. CONTAINMENT

Containment

Methods of waste or leachate containment evaluated:

The spent catalyst site was evaluated as a pile, surrounded by sound diversion or containment system. The tailings in the surface impoundments were evaluated as a surface impoundment with diking not leaking but potentially unsound (Ref. 3).

Method with highest score:

The containment method with the highest score is, diking not leaking but potentially unsound (Ref. 2, pg. 35).
HRS Value = 2

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

The compounds evaluated were:

	Tox.	Persistence
Ammonia	3	0
Molybdenum	3	3
Vanadium	3	3

References 2, 3, 10

Compound with highest score:

Molybdenum and Vanadium both scored a toxicity/persistence matrix value of 18.
Toxicity - 3 (Ref. 2, pg. 19; Ref. 10)
Persistence - 3 (Ref. 2, pg. 18; Ref. 10)

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

The total quantity of hazardous substances at the facility are the tailings in the on-site surface impoundments.
Pond(1) - 768,000 cu. ft.
Pond(2) - 272,000 cu. ft.
Pond(3) - 858,000 cu. ft.
Total (1,898,000 cu. ft.) $\left(\frac{1 \text{ cu. yd.}}{27 \text{ cu. ft.}}\right)$ = 70,296 cu. yds (Ref. 2, 3).

Basis of estimating and/or computing waste quantity:

The volume of the tailings in the surface impoundments was estimated as the waste quantity (Ref. 4).
Reference 2, p. 19
HRS Value = 8

5. TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

The Old Brazos River within 3 miles downstream of the hazardous substance is used for ship and barge transport, and contact recreation. The Dow Fresh Water Canal which runs next to and south of the Dow Barge Canal, has a surface water intake 0.75 mile upstream of the site. The intake supplies water to the city of Freeport. (References 5, 6, 13, 17)
HRS Value = 2

Is there tidal influence?

The Dow Fresh Water Canal has no tidal influence since it dead ends into the Dow Plant northeast of the site. However, there is tidal influence in certain surface water bodies near the site since the Dow Barge Canal, north of the site, and the Old Brazos River, south of the site, are open to the Gulf of Mexico (Ref. 6, 11).

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

The distance to the nearest 5-acre wetland is 0.4 miles from the site (Reference 14, 15).
HRS Value = 3

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

There are no fresh-water wetlands within 1 mile of the site (Reference 7, 11).

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

There is no critical habitat of an endangered species or national wildlife refuge within 1 mile or less of the site (Ref. 11).
HRS Value = 3

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

There are no water-supply intakes within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance. The free flowing surface water bodies are the Dow Barge Canal and the Old Brazos River (References 5, 6, 7, 9).

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

N/A

Total population served:

The total population served by surface water downstream of the hazardous substance is zero.

Name/description of nearest of above water bodies:

N/A

Distance to above-cited intakes, measured in stream miles.

N/A

AIR ROUTE

1. OBSERVED RELEASE

Contaminants detected:

Date and location of detection of contaminants:

Methods used to detect the contaminants:

Rationale for attributing the contaminants to the site:

2. WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

Most incompatible pair of compounds:

Toxicity

Most toxic compound:

Hazardous Waste Quantity

Total quantity of hazardous waste:

Basis of estimating and/or computing waste quantity:

3. TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi 0 to 1 mi 0 to ½ mi 0 to ¼ mi

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

Distance to critical habitat of an endangered species, if 1 mile or less:

Land Use

Distance to commercial/industrial area, if 1 mile or less:

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

Distance to residential area, if 2 miles or less:

Distance to agricultural land in production within past 5 years, if 1 mile or less:

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

Is a historic landmark site (National Register or Historic Places and National Natural Landmarks) within the view of the site?

FIRE AND EXPLOSION

1. CONTAINMENT

Hazardous substances present:

Type of containment, if applicable:

2. WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

Ignitability

Compound used:

Reactivity

Most reactive compound:

Incompatibility

Most incompatible pair of compounds:

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

Basis of estimating and/or computing waste quantity:

3 TARGETS

Distance to Nearest Population

Distance to Nearest Building

Distance to Sensitive Environment

Distance to wetlands:

Distance to critical habitat:

Land Use

Distance to commercial/industrial area, if 1 mile or less:

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

Distance to residential area, if 2 miles or less:

Distance to agricultural land in production within past 5 years, if 1 mile or less:

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

Is a historic or landmark site (National Register or Historic Places and National Natural Landmarks) within view of the site?

Population Within 2-Mile Radius

Buildings Within 2-Mile Radius

DIRECT CONTACT

1. OBSERVED INCIDENT

Date, location, and pertinent details of incident:

2. ACCESSIBILITY

Describe type of barrier(s):

3. CONTAINMENT

Type of containment, if applicable:

4. WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

Compound with highest score:

5. TARGETS

Population within one-mile radius

Distance to critical habitat (of endangered species)

Facility Name: Gulf Chemical and Metallurgical Co.

Location: LAT 28° 57' 22" LONG 95° 20' 17"

EPA Region: VI

Person(s) In Charge of the Facility: Gerald W. Walker (Plant Manager)

Harold L. Newman (Director of Environmental Affairs)

Name of Reviewer: John L. Jones Date: August 8, 1988

General Description of the facility:
(For example landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Gulf Chemical and Metallurgical (GCMC) operates a metals recovery process extracting molybdenum and vanadium from spent oil - refinery hydro-desulfurization catalyst. Prior to processing, the spent catalyst is stored in a pile on a concrete pad walled on three sides. After extraction the tailings left over are stored in three on-site surface impoundments

The contaminants of concern are Molybdenum, Vanadium, and ammonia.

Scores: S_M = 8.05 (S_{gw} = 9.98 S_{sw} = 9.70 S_a = 0)

S_{FE} = 0

S_{DC} = 0

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. Section)
[1] Observed Release	0 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
- Depth to Aquifer of Concern	0 (1) 2 3	2	1	6	
Net Precipitation	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone	(0) 1 2 3	1	0	3	
Physical State	0 1 2 (3)	1	3	3	
	Total Route Characteristics Score		5	15	
[3] Containment	0 (1) 2 3	1	1	3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste	0 1 2 3 4 5 6 7 (8)	1	8	8	
	Total Waste Characteristics Score		26	26	
[5] Targets					3.5
Ground Water Use	0 1 2 (3) -	3	9	9	
Distance to Nearest Well/Population Served	0 4 6 8 10 12 16 18 20 24 30 32 (35) 40	1	35	40	
	Total Targets Score		44	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			5720	57,330	
[7] Divide line [6] by 57,330 and multiply by 100 S_{gw} = 9.98					

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. Section)
[1] Observed Release	0 45	1	0	45	4.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 (2) 3	2	4	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			10	15	
[3] Containment	0 1 (2) 3	1	2	3	4.3
[4] Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
[5] Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/ Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			6240	64,350	
[7] Divide line [6] by 64,350 and multiply by 100 S_{sw} = 9.70					

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. Section)
[1] Observed Release	0 45	1		45	5.1
Date and Location:					
- Sampling Protocol:					
If line [1] is 0, the S_a = 0, Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Route Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]				35,100	
[5] Divide line [4] by 35,100 and multiply by 100 S_a =					

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	9.98	99.60
Surface Water Route Score (S_{sw})	9.70	94.09
Air Route Score (S_a)		0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		152.45
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		13.92
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		8.05

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. Section)
[1] Containment	1 3	1		3	7.1
[2] Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
[3] Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
[4] Multiply [1] x [2] x [3]				1,440	
[5] Divide line [4] by 1440 and multiply by 100 S_{FE} =					

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. Section)
[1] Observed Incident	0 45	1		45	8.1
If line [1] is 45, proceed to line [4] If line [1] is 0, proceed to line [2]					
[2] Accessibility	0 1 2 3	1		3	8.2
[3] Containment	0 15	1		15	8.3
[4] Waste Characteristics Toxicity	0 1 2 3	5		15	8.4
[5] Targets					8.5
Population Within a 1-mile radius	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat	0 1 2 3	4		12	
Total Targets Score				32	
[6] If line [1] is 45, mulitply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]				21,600	
[7] Divide line [6] by 21,600 and multiply by 100 S_{DC} =					

FIGURE 12
DIRECT CONTACT WORK SHEET

HRS DOCUMENTATION LOG SHEET

SITE NAME Gulf Chemical and Metallurgical Co.
CITY Freeport STATE TX
IDENTIFICATION NUMBER TXD074195678

REFERENCE NUMBER	DESCRIPTION OF THE REFERENCE
1	Texas Department of Water Resources. Stratigraphic and hydrogeologic framework of part of the coastal plain of Texas. Report 236, July 1979.
2	Uncontrolled Hazardous Waste Ranking System: A User's Manual 47FR31219-31243, 16 July 1982 (Appendix A, CERCLA).
3	Dunn, David W., Philip S. Liang, Engineering Science Inc. for TDWR. U.S.E.P.A. Potential Hazardous Waste Site, Site Inspection Report Form T2070-3. March 12, 1984.
4	U.S. Department of Agriculture. Soil Conservation Service. Soil Survey of Brazoria County, TX., June 1981.
5	ROC TO: Bill Shipp, Water Superintendent, Freeport, TX. FROM: John L. Jones, FIT-Analyst, EPA Region VI. RE: City of Freeport Water Utility System, June 13, 1988.
6	ROC TO: Bill Shipp, Water Superintendent, Freeport, TX. FROM: John L. Jones, FIT-Analyst, EPA Region VI. RE: City of Freeport Water Utility System. June 29, 1988.
7	City of Freeport, Water Utility. Map of the City of Freeport locating the Surface Water Treatment Plant and the Water Wells in the system. June 15, 1988.
8	Jones, John L., FIT-Analyst. Site Sketch Gulf Chemical and Metallurgical. July 25, 1988.
9	U.S.G.S. 7.5 minute series topographic maps. Oyster Creek, TX. 1963, photorevised 1974. Jones Creek, TX. 1963, photorevised 1974.

HRS DOCUMENTATION LOG SHEET

SITE NAME Gulf Chemical and Metallurgical Co.
CITY Freeport STATE TX
IDENTIFICATION NUMBER TXD074195678

REFERENCE NUMBER	DESCRIPTION OF THE REFERENCE
	Freeport, TX. 1964, photorevised 1974.
10	SAX, N. Irving. Dangerous Properties of Industrial Materials, Sixth Edition, Van Nostrand Reinhold Co., 1984.
11	ROC TO: Ron Bisbee, U.S. Fish and Wildlife Service, Angleton, TX. FROM: John L. Jones, FIT Analyst, EPA Region VI. RE: Location of Wildlife Refuges, Endangered Species Habitats and Wetlands in the Freeport Area, June 30, 1988.
12	U.S. Department of the Interior. Fish and Wildlife Service. Prepared by, Office of Biological Services For The National Wildlife Inventory. Map of wetlands in the Freeport area, National Wetlands Inventory.
13	ROC TO: Bill Shipp, Water Superintendent, Freeport, TX. FROM: John L. Jones, FIT-Analyst, EPA Region VI. RE: City of Freeport Water Utility System. July 7, 1988.
14	Texas Water Commission. Reconnaissance Investigation of the GroundWater Resources of the Gulf Coast Region, Texas. Bulletin 6305. June 1963, Second Printing November 1971.
15	Fisher, W.L., Director, Bureau of Economic Geology. The University of Texas at Austin, Austin, Texas. Geologic Atlas of Texas, Beeville - Bay City Sheet, 1975.
16	U.S.G.S., Well logs for the City of Freeport, TX.
17	ROC TO: Johnson A. Campbell, District Conservationist, U.S. Soil Conservation Service, Brazoria County, TX. FROM: John L. Jones, FIT-Analyst, EPA Region VI, RE: Irrigated Land In The Freeport area. June 30, 1988.
18	Texas Water Commission, Texas Surface Water Quality Standards. Informational copy, December 1986.

Ref. 1

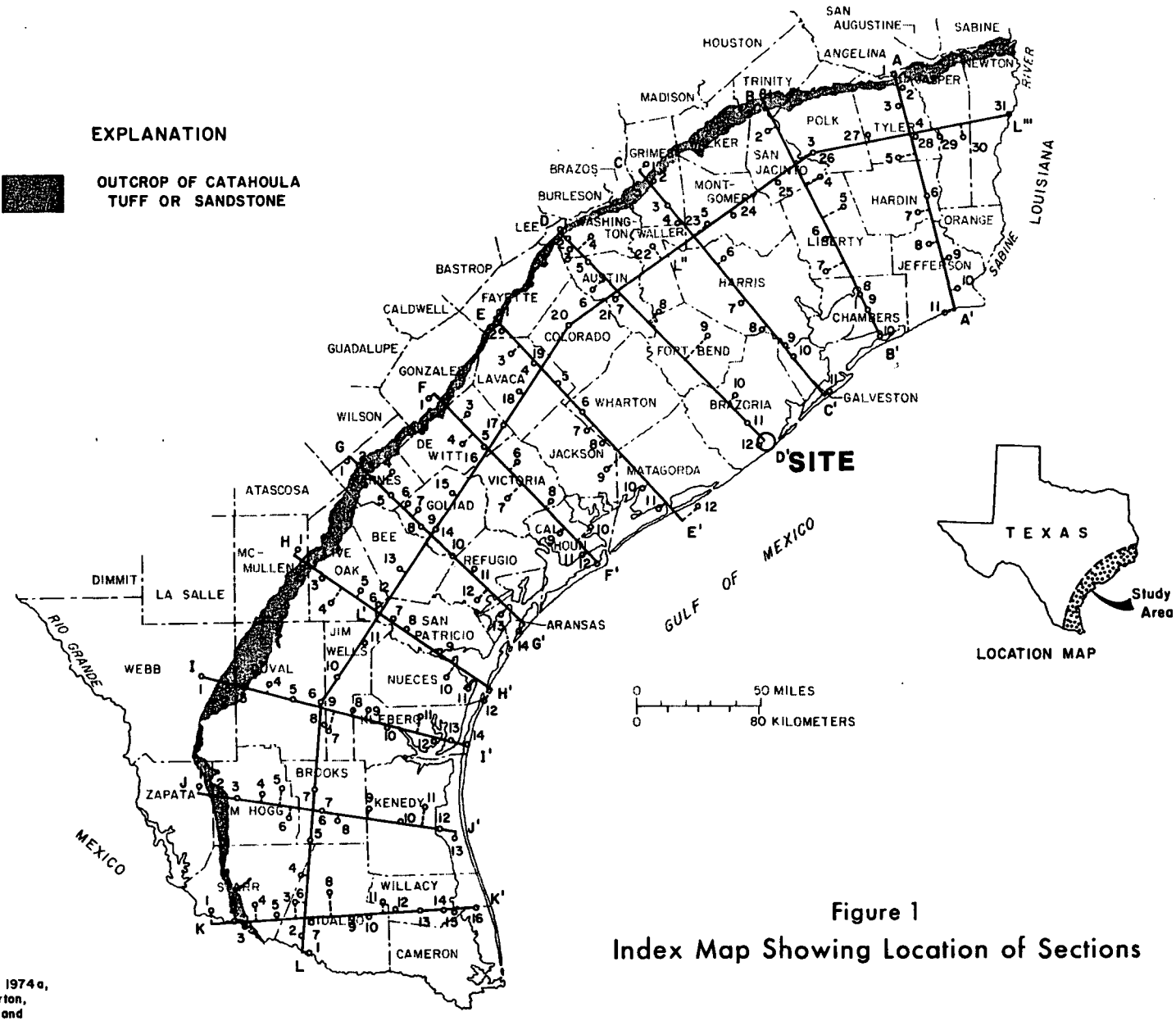
REPORT 261

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS

TEXAS DEPARTMENT OF WATER RESOURCES

Table 1.--Stratigraphic and Hydrogeologic Framework of Part of the Coastal Plain of Texas

Era	System	Series	Stratigraphic Units	Hydrogeologic Units	Selected Faunal Markers	Remarks
CENOZOIC	Quaternary	Holocene	Alluvium	Chicot aquifer		Quaternary System undifferentiated on sections.
		Pleistocene	Beaumont Clay Montgomery Formation Bentley Formation Willis Sand			
	Tertiary	Pliocene	Goliad Sand	Evangeline aquifer		Goliad Sand overlapped east of Lavaca County.
		Miocene	Fleming Formation	Burkeville confining system	*Potamides matsoni* *Bigenerina nodosaria var. directa* *Bigenerina humblei* *Amphistegina sp.*	
			Oakville Sandstone	Jasper aquifer		Oakville Sandstone included in Fleming Formation east of Washington County.
			Surface: Catahoula Tuff or Sandstone Subsurface: Upper part of Catahoula Tuff or Sandstone	Catahoula confining system (restricted)	*Discorbis nomada* *Discorbis gravelli* *Heterostegina sp.* *Marginulina idiomorpha*	Catahoula Tuff designated as Catahoula Sandstone east of Lavaca County.
		?	Subsurface: Anahuac Formation			Anahuac and "Frio" Formations may be Oligocene in age.
		?	Subsurface: "Frio" Formation		*Textularia mississippiensis*	
		Oligocene(?)	Surface: Frio Clay Subsurface: Vicksburg Group equivalent	Not discussed as hydrologic units in this report.	*Textularia warreni*	Frio Clay overlapped or not recognized on surface east of Live Oak County.
		?	Jackson Group, Whitsett Formation: Fashing Clay Member			Indicated members of Whitsett Formation apply to south-central Texas. Whitsett Formation east of Karnes County may be, in part or in whole, Oligocene in age.
			Jackson Group, Whitsett Formation: Calliham Sandstone Member or Tordilla Sandstone Member			
			Jackson Group, Whitsett Formation: Dubose Member		*Marginulina cocoaensis*	
		?	Jackson Group, Whitsett Formation: Deweesville Sandstone Member			
			Jackson Group, Whitsett Formation: Conquista Clay Member		*Textularia hockleyensis* *Massilina pratti*	
			Jackson Group, Whitsett Formation: Dilworth Sandstone Member			
		Eocene	Jackson Group: Manning Clay			
			Jackson Group: Wellborn Sandstone		*Textularia dibollensis*	
			Jackson Group: Caddell Formation			
			Claiborne Group: Yegua Formation		*Nonionella cockfieldensis*	
			Claiborne Group: Cook Mountain Formation		*Discorbis yeguaensis*	
			Claiborne Group: Sparta Sand		*Eponides yeguaensis*	
			Claiborne Group: Weches Formation		*Ceratobulimina eximia*	
			Claiborne Group: Queen City Sand			
			Claiborne Group: Reklaw Formation			
			Claiborne Group: Carrizo Sand			
			Wilcox Group			
		Paleocene	Midway Group			



Geology from Barnes (1968a, b; 1974a, b; 1975) and modified from Darton, Stephenson, and Gardner (1937) and from Barnes (1976a, b, c)

Figure 1
Index Map Showing Location of Sections

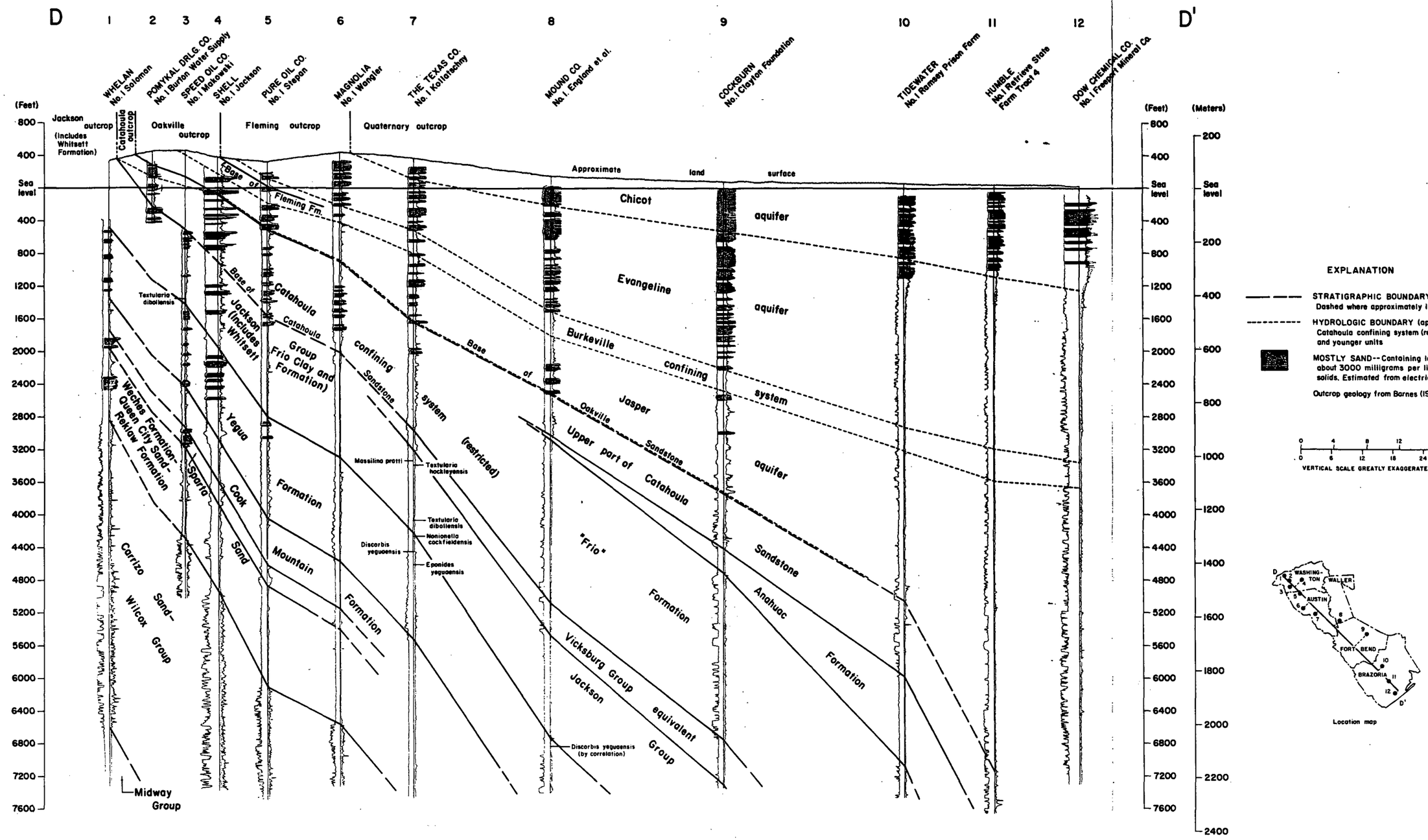


Figure 5
Stratigraphic and Hydrogeologic Section D-D'

subsurface correlations of the Catahoula-Fleming contact, as well as formation thicknesses, will continue to differ.

Burkeville Confining System

The Burkeville confining system, which was named by Wesselman (1967) for outcrops near the town of Burkeville in Newton County, Texas, is delineated on the sections from the Sabine River to near the Rio Grande. It separates the Jasper and Evangeline aquifers and serves to retard the interchange of water between the two aquifers.

The Burkeville has been mapped in this report as a rock-stratigraphic unit consisting predominantly of silt and clay. Boundaries were determined independently from time concepts although in some places the unit appears to possess approximately isochronous boundaries. In most places, however, this is not the case. For example, the entire thickness of sediment in the Burkeville confining system in some areas is younger than the entire thickness of sediment in the Burkeville in other places.

The configuration of the unit is highly irregular. Boundaries are not restricted to a single stratigraphic unit but transgress the Fleming-Oakville contact in many places. This is shown on sections D-D' to G-G' and J-J' (Figures 5-8 and 11). Where the Oakville Sandstone is present, the Burkeville crops out in the Fleming but dips gradually into the Oakville because of facies changes from sand to clay downdip.

The typical thickness of the Burkeville ranges from about 300 to 500 feet (91 to 152 m). However, thick sections of predominantly clay in Jackson and Calhoun Counties account for the Burkeville's gradual increase to its maximum thickness of more than 2,000 feet (610 m) as shown on section F-F' (Figure 7).

The Burkeville confining system should not be construed as a rock unit that is composed entirely of silt and clay. This is not typical of the unit, although examples of a predominance of silt and clay can be seen in some logs in sections H-H' and I-I' (Figures 9-10). In most places, the Burkeville is composed of many individual sand layers, which contain fresh to slightly saline water; but because of its relatively large percentage of silt and clay when compared to the underlying Jasper aquifer and overlying Evangeline, the Burkeville functions as a confining unit.

Evangeline Aquifer

The Evangeline aquifer, which was named and defined by Jones (Jones, Turcan, and Skibitzke, 1954) for a ground-water reservoir in southwestern Louisiana, has been mapped also in Texas, but heretofore has been delineated no farther west than Washington, Austin, Fort Bend, and Brazoria Counties. Its presence as an aquifer and its hydrologic boundaries to the west have been a matter of speculation. D. G. Jorgensen, W. R. Meyer, and W. H. Sandeen of the U.S. Geological Survey (written commun., March 1, 1976) recently refined the delineation of the aquifer in previously mapped areas and continued its delineation to the Rio Grande. The boundaries of the Evangeline as they appear on the sections in this report are their determinations.

The Evangeline aquifer has been delineated in this report essentially as a rock-stratigraphic unit. Although the aquifer is composed of at least the Goliad Sand, the lower boundary transgresses time lines to include sections of sand in the Fleming Formation. The base of the Goliad Sand at the outcrop coincides with the base of the Evangeline only in South Texas as shown in sections H-H' to K-K' (Figures 9-12). Elsewhere, the Evangeline at the surface includes about half of the Fleming outcrop. The upper boundary of the Evangeline probably follows closely the top of the Goliad Sand where present, although this relationship is somewhat speculative.

The Evangeline aquifer is typically wedge shaped and has a high sand-clay ratio. Individual sand beds are characteristically tens of feet thick. Near the outcrop, the aquifer ranges in thickness from 400 to 1,000 feet (122 to 305 m), but near the coastline, where the top of the aquifer is about 1,000 feet (305 m) deep, its thickness averages about 2,000 feet (610 m). The Evangeline is noted for its abundance of good quality ground water and is considered one of the most prolific aquifers in the Texas Coastal Plain. Fresh to slightly saline water in the aquifer, however, is shown to extend to the coastline only in section J-J' (Figure 11).

Chicot Aquifer

The Chicot aquifer, which was named and defined by Jones (Jones, Turcan, and Skibitzke, 1954) for a ground-water reservoir in southwestern Louisiana, is the youngest aquifer in the Coastal Plain of Texas. Over the years, the aquifer gradually was mapped westward from Louisiana into Texas where, heretofore, its most

westerly mapped limit was Austin, Fort Bend, and Brazoria Counties. In this report, the delineation of the Chicot was refined in previously mapped areas and extended to near the Rio Grande by D. G. Jorgensen, W. R. Meyer, and W. M. Sandeen of the U.S. Geological Survey (written commun., March 1, 1976).

It is believed that the base of the Chicot in some areas has been delineated on the sections in this report as the base of the Pleistocene. Early work in Southeast Texas indicates that the Chicot probably comprises the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age and any overlying Holocene alluvium (Table 1). The problem that arises in this regard is that the base of the Pleistocene is difficult to pick from electrical logs. Thus any delineation of the base of the Chicot in the subsurface as the base of the Pleistocene is automatically suspect. At the surface, the base of the Chicot on the sections has been picked at the most landward edge of the oldest undissected coastwise terrace of Quaternary age. In practice, the delineation of the Chicot in the subsurface, at least on the sections in Southeast Texas, has been based on the presence of a higher sand-clay ratio in the Chicot than in the underlying Evangeline. In some places, a prominent clay layer was used as the boundary. Differences in hydraulic conductivity or water levels in some areas also served to differentiate the Chicot from the Evangeline.

The high percentage of sand in the Chicot in Southeast Texas, where the aquifer is noted for its abundance of water, diminishes southwestward. Southwest of section G-G' (Figure 8) the higher clay content of the Chicot and the absence of fresh to slightly saline water in the unit is sharply contrasted with the underlying Evangeline aquifer that still retains relatively large amounts of sand and good quality water.

Ref. 3

3045 2
8/13/84

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

REGION	SITE NUMBER (to be assigned by Hq)
6	TX05185

GENERAL INSTRUCTIONS: Complete Sections I and III through XV of this form as completely as possible. Then use the information on this form to develop a Tentative Disposition *(Section II)*. File this form in its entirety in the regional Hazardous Waste Log File. Be sure to include all appropriate Supplemental Reports in the file. Submit a copy of the forms to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force *(EN-335)*; 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME	B. STREET (or other identifier)		
Gulf Chemical & Metallurgical Co.	302 Midway Road		
C. CITY	**D. STATE**	**E. ZIP CODE**	**F. COUNTY NAME**
Freeport	TX	77541	Brazoria

G. SITE OPERATOR INFORMATION

1. NAME		2. TELEPHONE NUMBER	
Gulf Chemical and Metallurgical Co.		(409)233-7882	
3. STREET	**4. CITY**	**5. STATE**	**6. ZIP CODE**
Same	Same	TX	77541

H. REALTY OWNER INFORMATION *(if different from operator of site)*

1. NAME	2. TELEPHONE NUMBER	
Gulf Chemical and Metallurgical Co.	Same	
3. CITY	**4. STATE**	**5. ZIP CODE**

I. SITE DESCRIPTION

Metals Extraction Facility

J. TYPE OF OWNERSHIP

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☒ 5. PRIVATE

II. TENTATIVE DISPOSITION *(complete this section last)*

A. ESTIMATE DATE OF TENTATIVE DISPOSITION *(mo., day, & yr.)*

B. APPARENT SERIOUSNESS OF PROBLEM

☐ 1. HIGH ☐ 2. MEDIUM ☒ 3. LOW ☐ 4. NONE

C. PREPARER INFORMATION

1. NAME	2. TELEPHONE NUMBER	3. DATE (mo., day, & yr.)
David W. Dunn	(713)943-2922	[redacted]

III. INSPECTION INFORMATION

A. PRINCIPAL INSPECTOR INFORMATION

1. NAME	2. TITLE
Philip S. Liang	Project Engineer

3. ORGANIZATION	4. TELEPHONE NO. (area code & no.)
Engineering-Science, Inc.	(713)943-2922

B. INSPECTION PARTICIPANTS

1. NAME	2. ORGANIZATION	3. TELEPHONE NO.
David W. Dunn	Engineering-Science, Inc.	(713)943-2922
Philip S. Liang	Engineering-Science, Inc.	(713)943-2922

C. SITE REPRESENTATIVES INTERVIEWED *(corporate officials, workers, residents)*

1. NAME	2. TITLE & TELEPHONE NO.	3. ADDRESS
Gerald W. Walker	Plant Manager (409)233-7882	302 Midway Road, P.O. Box 2290 Freeport, TX 77541
Harold L. Newman	Director of Env. Affairs (713)945-4411	Highway FM 519, P.O. Box 2130 Texas City, TX 77590

Continued From Front

III. INSPECTION INFORMATION (continued)

D. GENERATOR INFORMATION (sources of waste)

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE GENERATED
Gulf Chemical & Metallurgical	(409)223-7882	302 Midway Road Freeport, TX 77541	Solid waste in form of tailings from process

E. TRANSPORTER/HAULER INFORMATION

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE TRANSPORTED
None			

F. IF WASTE IS PROCESSED ON SITE AND ALSO SHIPPED TO OTHER SITES, IDENTIFY OFF-SITE FACILITIES USED FOR DISPOSAL.

1. NAME	2. TELEPHONE NO.	3. ADDRESS
None, except surface impoundment #4 located 9 miles from plant.		

G. DATE OF INSPECTION (mo., day, & yr.)	H. TIME OF INSPECTION	I. ACCESS GAINED BY: (credentials must be shown in all cases)
3/9/84	10:00 am - 1:30 pm	[x] 1. PERMISSION [ ] 2. WARRANT

J. WEATHER (describe)

Sunny, clear, 70°F, wind approximate 5 mph

IV. SAMPLING INFORMATION

A. Mark 'X' for the types of samples taken and indicate where they have been sent e.g., regional lab, other EPA lab, contractor, etc. and estimate when the results will be available.

1. SAMPLE TYPE	2. SAMPLE TAKEN (mark 'X')	3. SAMPLE SENT TO:	4. DATE RESULTS AVAILABLE
a. GROUNDWATER		None taken See Attachment A.	
b. SURFACE WATER			
c. WASTE			
d. AIR			
e. RUNOFF			
f. SPILL			
g. SOIL			
h. VEGETATION			
i. OTHER (specify)			

B. FIELD MEASUREMENTS TAKEN (e.g., radioactivity, explosivity, PH, etc.)

1. TYPE	2. LOCATION OF MEASUREMENTS	3. RESULTS
	None taken See Attachment A.	

Continue On Page 3

Continued From Page 2

IV. SAMPLING INFORMATION (continued)

C. PHOTOS

1. TYPE OF PHOTOS: [X] a. GROUND [ ] b. AERIAL
2. PHOTOS IN CUSTODY OF: U.S. EPA Region 6

D. SITE MAPPED?

[X] YES. SPECIFY LOCATION OF MAPS: See 7-1/2' Quad of Freeport & attached maps.

E. COORDINATES

1. LATITUDE (deg.-min.-sec.): 28° 56' 22" N
2. LONGITUDE (deg.-min.-sec.): 95° 20' 17" W

V. SITE INFORMATION

A. SITE STATUS

[X] 1. ACTIVE (Those inductrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)

[ ] 2. INACTIVE (Those sites which no longer receive wastes.)

[ ] 3. OTHER (specify): _____ (Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)

B. IS GENERATOR ON SITE?

[ ] 1. NO [X] 2. YES (specify generator's four-digit SIC Code): 3341

C. AREA OF SITE (in acres): 30

D. ARE THERE BUILDINGS ON THE SITE?

[ ] 1. NO [X] 2. YES (specify): Plant process buildings

VI. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

X	A. TRANSPORTER *	X	B. STORER *	X	C. TREATER *	X	D. DISPOSER
	1. RAIL	X	1. PILE		1. FILTRATION		1. LANDFILL
	2. SHIP	X	2. SURFACE IMPOUNDMENT		2. INCINERATION		2. LANDFARM
	3. BARGE		3. DRUMS		3. VOLUME REDUCTION		3. OPEN DUMP
X	4. TRUCK		4. TANK, ABOVE GROUND	X	4. RECYCLING/RECOVERY		4. SURFACE IMPOUNDMENT
	5. PIPELINE		5. TANK, BELOW GROUND		5. CHEM./PHYS./TREATMENT		5. MIDNIGHT DUMPING
	6. OTHER (specify):		6. OTHER (specify):		6. BIOLOGICAL TREATMENT		6. INCINERATION
					7. WASTE OIL REPROCESSING		7. UNDERGROUND INJECTION
					8. SOLVENT RECOVERY		8. OTHER (specify):
					9. OTHER (specify):		

*Site is not a hazardous waste facility based on RCRA testing. No inactive waste management facilities are on-site. See Attachment A.

E. SUPPLEMENTAL REPORTS: If the site falls within any of the categories listed below, Supplemental Reports must be completed. Indicate which Supplemental Reports you have filled out and attached to this for..

[ ] 1. STORAGE [ ] 2. INCINERATION [ ] 3. LANDFILL [X] 4. SURFACE IMPOUNDMENT [ ] 5. DEEP WELL

[ ] 6. CHEM/BIO/PHYS TREATMENT [ ] 7. LANDFARM [ ] 8. OPEN DUMP [ ] 9. TRANSPORTER [ ] 10. RECYCLOR/RECLAIMER

VII. WASTE RELATED INFORMATION

A. WASTE TYPE

[X] 1. LIQUID [X] 2. SOLID [ ] 3. SLUDGE [ ] 4. GAS

B. WASTE CHARACTERISTICS

[ ] 1. CORROSIVE [ ] 2. IGNITABLE [ ] 3. RADIOACTIVE [ ] 4. HIGHLY VOLATILE

[ ] 5. TOXIC [ ] 6. REACTIVE [X] 7. INERT [ ] 8. FLAMMABLE

[X] 9. OTHER (specify): Wastes are presently classified nonhazardous.

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

Company record and manifest.

Continue On Reverse

Continued From Front

VII. WASTE RELATED INFORMATION *(continued)*

2. Estimate the amount *(specify unit of measure)* of waste by category; mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT: None	AMOUNT: None	AMOUNT: None	AMOUNT: None	AMOUNT: 3.2×10^6	AMOUNT: None
UNIT OF MEASURE:	UNIT OF MEASURE:	UNIT OF MEASURE:	UNIT OF MEASURE:	UNIT OF MEASURE: lb/yr	UNIT OF MEASURE:
[X] (1) PAINT, PIGMENTS	[X] (1) OILY WASTES	[X] (1) HALOGENATED SOLVENTS	[X] (1) ACIDS	[X] (1) FLYASH	[X] (1) LABORATORY, PHARMACEUT.
[ ] (2) METALS SLUDGES	[ ] (2) OTHER *(specify)*:	[ ] (2) NON-HALOGNTD. SOLVENTS	[ ] (2) PICKLING LIQUORS	[ ] (2) ASBESTOS	[ ] (2) HOSPITAL
[ ] (3) POTW		[ ] (3) OTHER *(specify)*:	[ ] (3) CAUSTICS	[ ] (3) MILLING/MINE TAILINGS	[ ] (3) RADIOACTIVE
[ ] (4) ALUMINUM SLUDGE			[ ] (4) PESTICIDES	[ ] (4) FERROUS SMELTING WASTES	[ ] (4) MUNICIPAL
[ ] (5) OTHER *(specify)*:			[ ] (5) DYES/INKS	[ ] (5) NON-FERROUS SMLTG. WASTES	[ ] (5) OTHER *(specify)*:
			[ ] (6) CYANIDE	[X] (6) OTHER *(specify)*: 1) tailings from recovery process to be reprocessed at a later time. 2) spent catalyst for processing.	
			[ ] (7) PHENOLS		
			[ ] (8) HALOGENS		
			[ ] (9) PCB		
			[ ] (10) METALS		
			[ ] (11) OTHER *(specify)*:		

D. LIST SUBSTANCES OF GREATEST CONCERN WHICH ARE ON THE SITE *(place in descending order of hazard)*

1. SUBSTANCE	2. FORM *(mark 'X')*			3. TOXICITY *(mark 'X')*				4. CAS NUMBER	5. AMOUNT	6. UNIT
	a. SOLID	b. LIQ.	c. VAPOR	a. HIGH	b. MED.	c. LOW	d. NONE			
Process tailings:	X					X			approx. 3.2×10^6	lb/yr
1. Vanadium pentoxide	X	X				X		1314-62-1	Unknown	
2. Ammonium vanadate	X	X				X		7440-62-2	Unknown	
3. Vanadium	X	X				X		7803-55-6	Unknown	

VIII. HAZARD DESCRIPTION

FIELD EVALUATION HAZARD DESCRIPTION: Place an 'X' in the box to indicate that the listed hazard exists. Describe the hazard in the space provided.

[ ] A. HUMAN HEALTH HAZARDS

 Continue On Page 5

Continued From Page 4

VIII. HAZARD DESCRIPTION *(continued)*

☐ B. NON-WORKER INJURY/EXPOSURE

☐ C. WORKER INJURY/EXPOSURE

☐ D. CONTAMINATION OF WATER SUPPLY

☐ E. CONTAMINATION OF FOOD CHAIN

☐ F. CONTAMINATION OF GROUND WATER

☒ G. CONTAMINATION OF SURFACE WATER

GCMC has had several self-reported violations from NPDES outfall 001. These violations have included temperature, TSS, TOC, molybdenum, and vanadium.

 Continue On Reverse

Continued From Front

VIII. HAZARD DESCRIPTION *(continued)*

☐ H. DAMAGE TO FLORA/FAUNA

☐ I. FISH KILL

☐ J. CONTAMINATION OF AIR

☐ K. NOTICEABLE ODORS

☒ L. CONTAMINATION OF SOIL

Contamination of soil is possible and may have occurred in some areas. Of particular concern is the stormwater holding ditch that contains the runoff from the plant during testing (prior to release). Metal precipitates or particle settling may have increased the metals concentration in the area. Other areas of concern are the dike areas and the area between ponds 1 and 3 (due to apparent overflow).

☐ M. PROPERTY DAMAGE

 Continue On Page 7

Continued From Page 6

VIII. HAZARD DESCRIPTION (continued)

[X] N. FIRE OR EXPLOSION

The plant recently had a fire in its solvent extraction process that has significantly curtailed reprocessing the surface impoundment water.

[X] O. SPILLS/LEAKING CONTAINERS/RUNOFF/STANDING LIQUID

As a result of the fire, solvent and tailings material were discharged onto the ground and collected in the stormwater runoff ditch. This spill contaminated a large section of the plant area.

[ ] P. SEWER, STORM DRAIN PROBLEMS

[ ] Q. EROSION PROBLEMS

[ ] R. INADEQUATE SECURITY

[ ] S. INCOMPATIBLE WASTES

 Continue On Reverse

VIII. HAZARD DESCRIPTION (continued)

☐ T. MIDNIGHT DUMPING

☐ U. OTHER (specify):

IX. POPULATION DIRECTLY AFFECTED BY SITE

A. LOCATION OF POPULATION	B. APPROX. NO. OF PEOPLE AFFECTED		C. APPROX. NO. OF PEOPLE AFFECTED WITHIN UNIT AREA		D. APPROX. NO. OF BUILDINGS AFFECTED		E. DISTANCE TO SITE (specify units)	
	Plant site	Pond 4	Plant site	Pond 4	Plant site	Pond 4	Site	Pond 4
1. IN RESIDENTIAL AREAS	11,000	150	11,000	150	3,600	50	1-2 mi.	2-3 mi.
2. IN COMMERCIAL OR INDUSTRIAL AREAS	300	25	300	25	10	10	<1 mi.	2-3 mi.
3. IN PUBLICLY TRAVELLED AREAS	9,400	4,000	9,400	4,000	0	0	<1 mi.	<1 mi.
4. PUBLIC USE AREAS (parks, schools, etc.)	2,000	0	2,000	0	3	0	<1 mi.	2-3 mi.

X. WATER AND HYDROLOGICAL DATA

CL=Lower Chicot, CU = Upper Chico

A. DEPTH TO GROUNDWATER (specify unit)	B. DIRECTION OF FLOW	C. GROUNDWATER USE IN VICINITY
4-10',30-40',15-25',90-140'*	S/SE (Shallow);SW(CL);variable(CU)	monitoring (Pond 4)
D. POTENTIAL YIELD OF AQUIFER	**E. DISTANCE TO DRINKING WATER SUPPLY (specify unit of measure)**	**F. DIRECTION TO DRINKING WATER SUPPLY**
0-2000 gpm (Chicot)	0.8 miles	West

G. TYPE OF DRINKING WATER SUPPLY

☐ 1. NON-COMMUNITY < 15 CONNECTIONS ☒ 2. COMMUNITY (specify town): > 15 CONNECTIONS Dow Chemical's water wells

☐ 3. SURFACE WATER ☒ 4. WELL

 Continue On Page 9

* Initial value is saturated zone depth in feet for 'Pond 4' while the second figure is depth to static water in the Chicot aquifer. The third value indicates static levels in the lower Chicot at the main plant and the final value shows static levels for the more heavily drawn upper Chicot.

Continued From Page 8

X. WATER AND HYDROLOGICAL DATA (continued)

H. LIST ALL DRINKING WATER WELLS WITHIN A 1/4 MILE RADIUS OF SITE

1. WELL	2. DEPTH (specify unit)	3. LOCATION (proximity to population/buildings)	4. NON-COMMUNITY (mark 'X')	5. COMMUNITY (mark 'X')
None				

I. RECEIVING WATER

1. NAME: Brazos River

☐ 2. SEWERS ☒ 3. STREAMS/RIVERS ☐ 4. LAKES/RESERVOIRS ☐ 5. OTHER (specify):

6. SPECIFY USE AND CLASSIFICATION OF RECEIVING WATERS

Brazos River Basin, Segment 1201:
contact recreation, noncontact recreation, and propagation of fish & wildlife

XI. SOIL AND VEGITATION DATA

LOCATION OF SITE IS IN:

☐ A. KNOWN FAULT ZONE ☐ B. KARST ZONE ☒ C. 100 YEAR FLOOD PLAIN ☐ D. WETLAND

Velasco Drainage District

☒ E. A REGULATED FLOODWAY ☐ F. CRITICAL HABITAT ☐ G. RECHARGE ZONE OR SOLE SOURCE AQUIFER

XII. TYPE OF GEOLOGICAL MATERIAL OBSERVED

Mark 'X' to indicate the type(s) of geological material observed and specify where necessary, the component parts.

'X'	A. OVERBURDEN	'X'	B. BEDROCK (specify below)	'X'	C. OTHER (specify below)
	1. SAND				
X	2. CLAY	X			
	3. GRAVEL				

XIII. SOIL PERMEABILITY

☐ A. UNKNOWN ☐ B. VERY HIGH (100,000 to 1000 cm/sec.) ☐ C. HIGH (1000 to 10 cm/sec.)
☐ D. MODERATE (10 to .1 cm/sec.) ☐ E. LOW (.1 to .001 cm/sec.) ☒ F. VERY LOW (.001 to .00001 cm/sec.)

G. RECHARGE AREA

☐ 1. YES ☒ 2. NO 3. COMMENTS:

H. DISCHARGE AREA

☐ 1. YES ☒ 2. NO 3. COMMENTS:

I. SLOPE

1. ESTIMATE % OF SLOPE: Flat (less than 1%)

2. SPECIFY DIRECTION OF SLOPE, CONDITION OF SLOPE, ETC.: In general, slopes toward south

J. OTHER GEOLOGICAL DATA

The outcropping geologic stratum is Recent-Quaternary age alluvium (clay, silt, sand, and gravel with organic matter) derived from backswamp, coastal marsh, levee, and stream deposits of the Brazos River floodplain low-lying coastal zones. This relatively thin veneer of sediments is underlain by Pleistocene age sediments of the*

 Continue On Reverse

* See Attachment A

Continued From Front

XIV. PERMIT INFORMATION

List all applicable permits held by the site and provide the related information.

A. PERMIT TYPE (e.g., RCRA, State, NPDES, etc.)	B. ISSUING AGENCY	C. PERMIT NUMBER	D. DATE ISSUED (mo., day, & yr.)	E. EXPIRATION DATE (mo., day, & yr.)	F. IN COMPLIANCE (mark 'X')		
					1. YES	2. NO	3. UNKNOWN
SWR	TDWR	30952		-	X		
RCRA Interim	EPA	TXD074195678	8/18/80	-			
NPDES	EPA	TX0034738	10/9/81	10/8/86	X		
Texas Water Code	TDWR	01861	2/22/83	2/21/88	X		
Texas Clean Air Act	TACB	1157	3/9/79	-	X		
Texas Clean Air Act	TACB	1157R	3/9/79	-	X		

XV. PAST REGULATORY OR ENFORCEMENT ACTIONS

☐ NONE ☒ YES (summarize in this space)

8/24/76 - Enf. Order 76-53 - Contaminated stormwater

The plant was cited because it was permitted by TDWR to discharge only from one site (001). However, the plant discharged process water only from that outfall, allowing the stormwater to drain to one side of the plant and then to be released. The stormwater was contaminated with molybdenum, vanadium, nickel and zinc. GCMC responded by cleaning the stormwater ditch, constructing a weir dam and placing the spent catalyst on pads. A permit (002) was granted for the stormwater outfall. (Various other self-reported problems including NH_3 wastewater loading and high Mo and Va).

NOTE: Based on the information in Sections III through XV, fill out the Tentative Disposition *(Section II)* information on the first page of this form.

SURFACE IMPOUNDMENTS SITE INSPECTION REPORT
(Supplemental Report)

INSTRUCTION
Answer and Explain as Necessary.

1. TYPE OF IMPOUNDMENT

Pond 1 Natural clay, above and below grade. Lined with PVC.

2. STABILITY/CONDITION OF EMBANKMENTS

Satisfactory but erosion problems on north and south sides.

3. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc.)*

☒ YES ☐ NO Mild erosion problems

4. EVIDENCE OF DISPOSAL OF IGNITABLE OR REACTIVE WASTE

☐ YES ☒ NO

5. ONLY COMPATIBLE WASTES ARE STORED OR DISPOSED OF IN THE IMPOUNDMENT

☐ YES ☒ NO

6. RECORDS CHECKED FOR CONTENTS AND LOCATION OF EACH SURFACE IMPOUNDMENT

☐ YES ☒ NO

7. IMPOUNDMENT HAS LINER SYSTEM

☒ YES ☐ NO PVC

7a. INTEGRITY OF LINER SYSTEM CHECKED

☐ YES ☒ NO

7b. FINDINGS

NA

8. SOIL STRUCTURE AND SUBSTRUCTURE

Unknown

9. MONITORING WELLS

☐ YES ☒ NO

10. LENGTH, WIDTH, AND DEPTH

LENGTH WIDTH DEPTH

11. CALCULATED VOLUMETRIC CAPACITY

768,000 ft^3

12. PERCENT OF CAPACITY REMAINING

less than 10%

13. ESTIMATE FREEBOARD

approx. 0.75 ft.

14. SOLIDS DEPOSITION

☒ YES ☐ NO Used to store process tailings.

15. DREDGING DISPOSAL METHOD

Reprocessed in the unit or shipped to Pond 4.

16. OTHER EQUIPMENT

Comment: Due to a fire on the solvent extraction unit in early 1984, the plant has been forced to store more water than under normal operation. Repairs are estimated to take 3-4 months. Ponds 1 and 3 appeared to have overflowed based on erosion problems (although mild), discolored slope, and the discolored area between ponds 1 and 3. Discoloration was white and gray.

SURFACE IMPOUNDMENTS SITE INSPECTION REPORT
(Supplemental Report)

INSTRUCTION
Answer and Explain as Necessary.

1. TYPE OF IMPOUNDMENT

Pond 2 - Natural clay, above and below grade. Lined with Hypalon.

2. STABILITY/CONDITION OF EMBANKMENTS

Satisfactory.

3. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc.)*

☐ YES ☒ NO

4. EVIDENCE OF DISPOSAL OF IGNITABLE OR REACTIVE WASTE

☐ YES ☒ NO

5. ONLY COMPATIBLE WASTES ARE STORED OR DISPOSED OF IN THE IMPOUNDMENT

☐ YES ☒ NO

6. RECORDS CHECKED FOR CONTENTS AND LOCATION OF EACH SURFACE IMPOUNDMENT

☐ YES ☒ NO

7. IMPOUNDMENT HAS LINER SYSTEM

☒ YES ☐ NO Hypalon

7a. INTEGRITY OF LINER SYSTEM CHECKED

☐ YES ☒ NO

7b. FINDINGS

NA

8. SOIL STRUCTURE AND SUBSTRUCTURE

Unknown

9. MONITORING WELLS

☐ YES ☒ NO

10. LENGTH, WIDTH, AND DEPTH

LENGTH WIDTH DEPTH

11. CALCULATED VOLUMETRIC CAPACITY

approx. 272,000 ft^3

12. PERCENT OF CAPACITY REMAINING

less than 10%

13. ESTIMATE FREEBOARD

approx. 1 ft.

14. SOLIDS DEPOSITION

☒ YES ☐ NO Used to store process tailings.

15. DREDGING DISPOSAL METHOD

Reprocessed in unit or shipped to pond 4.

16. OTHER EQUIPMENT

Comment: Due to a fire on the solvent extraction unit in early 1984, the plant has been forced to store more water than under normal operation. Repairs are estimated to take 3-4 months. Ponds 1 and 3 appeared to have overflowed based on erosion problems (although mild), discolored slope, and the discolored area between ponds 1 and 3. Discoloration was white and gray.

SURFACE IMPOUNDMENTS SITE INSPECTION REPORT
(Supplemental Report)

INSTRUCTION
Answer and Explain as Necessary.

1. TYPE OF IMPOUNDMENT

Pond 3 - Natural clay, above and below grade. Lined with Hypalon.

2. STABILITY/CONDITION OF EMBANKMENTS

Satisfactory with minor erosion in several areas (north side in particular).

3. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc.)*

☒ YES ☐ NO Minor erosion on north, east and west sides.

4. EVIDENCE OF DISPOSAL OF IGNITABLE OR REACTIVE WASTE

☐ YES ☒ NO

5. ONLY COMPATIBLE WASTES ARE STORED OR DISPOSED OF IN THE IMPOUNDMENT

☐ YES ☒ NO

6. RECORDS CHECKED FOR CONTENTS AND LOCATION OF EACH SURFACE IMPOUNDMENT

☐ YES ☒ NO

7. IMPOUNDMENT HAS LINER SYSTEM

☒ YES ☐ NO Hypalon

7a. INTEGRITY OF LINER SYSTEM CHECKED

☐ YES ☒ NO

7b. FINDINGS

NA

8. SOIL STRUCTURE AND SUBSTRUCTURE

Unknown

9. MONITORING WELLS

☐ YES ☒ NO

10. LENGTH, WIDTH, AND DEPTH

LENGTH 203' WIDTH 350' DEPTH 16'

11. CALCULATED VOLUMETRIC CAPACITY

858,000 ft^3

12. PERCENT OF CAPACITY REMAINING

less than 10%

13. ESTIMATE FREEBOARD

approx. 0.75 ft.

14. SOLIDS DEPOSITION

☒ YES ☐ NO Used to store process tailings.

15. DREDGING DISPOSAL METHOD

Reprocessed in the unit or shipped to pond 4.

16. OTHER EQUIPMENT

Comment: Due to a fire on the solvent extraction unit in early 1984, the plant has been forced to store more water than under normal operation. Repairs are estimated to take 3-4 months. Ponds 1 and 3 appeared to have overflowed based on erosion problems (although mild), discolored slope, and the discolored area between ponds 1 and 3. Discoloration was white and gray.

SURFACE IMPOUNDMENTS SITE INSPECTION REPORT
(Supplemental Report)

INSTRUCTION
Answer and Explain as Necessary.

1. TYPE OF IMPOUNDMENT
Pond 4 - Natural clay, above and below grade.

2. STABILITY/CONDITION OF EMBANKMENTS
Satisfactory/well vegetated.

3. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc.)*
☐ YES ☒ NO

4. EVIDENCE OF DISPOSAL OF IGNITABLE OR REACTIVE WASTE
☐ YES ☒ NO

5. ONLY COMPATIBLE WASTES ARE STORED OR DISPOSED OF IN THE IMPOUNDMENT
☐ YES ☒ NO

6. RECORDS CHECKED FOR CONTENTS AND LOCATION OF EACH SURFACE IMPOUNDMENT
☐ YES ☒ NO

7. IMPOUNDMENT HAS LINER SYSTEM
☒ YES ☐ NO 3 ft. natural clay

7a. INTEGRITY OF LINER SYSTEM CHECKED
☐ YES ☒ NO

7b. FINDINGS
NA

8. SOIL STRUCTURE AND SUBSTRUCTURE
Unknown

9. MONITORING WELLS
☒ YES ☐ NO 4 wells, one on each side

10. LENGTH, WIDTH, AND DEPTH
LENGTH , WIDTH DEPTH 26'

11. CALCULATED VOLUMETRIC CAPACITY
1,400,000 ft^3

12. PERCENT OF CAPACITY REMAINING
approx. 40%

13. ESTIMATE FREEBOARD
approx. 8 ft.

14. SOLIDS DEPOSITION
☒ YES ☐ NO Used to store process tailings.

15. DREDGING DISPOSAL METHOD
Plans call for reprocessing in the unit at a later time.

16. OTHER EQUIPMENT

Comment: Due to a fire on the solvent extraction unit in early 1984, the plant has been forced to store more water than under normal operation. Repairs are estimated to take 3-4 months. Ponds 1 and 3 appeared to have overflowed based on erosion problems (although mild), discolored slope, and the discolored area between ponds 1 and 3. Discoloration was white and gray.

RCRA 3012 SITE INSPECTION COMMENTS
GULF CHEMICAL AND METALLURGICAL COMPANY
FREEPORT, TEXAS
TX05185

On Friday, March 9, 1984, Philip Liang and David Dunn of Engineering-Science, Inc., representing the Texas Department of Water Resources, inspected the Gulf Chemical and Metallurgical Company (GCMC) facility in Freeport, Texas. Mr. Jerry Walker, the Plant Manager, and Mr. Harold Newman, Director of Environmental Affairs, accompanied the inspection team.

GCMC-Freeport operates a metals recovery process using spent refinery catalyst. Spent catalyst is charged to the process units, molybdenum and vanadium recovered, and the tailings slurry is stored in four (4) large surface impoundments.

The Company plans to reprocess these tailings for recovery of cobalt and nickel when economic conditions are better. Decanted water from the ponds is recycled to the process units to slurry the tailings to a pumpable concentration. This slurry is then returned to the ponds. Some water from the ponds is also used in the solvent extraction process and is then treated before release via outfall 001.

During field reconnaisance, the four surface impoundments were inspected. Three of these are on the main plant site, as shown on the attached map, with the fourth approximately 9 miles north of the plant. The three onsite ponds are used in the day-to-day operation of the process with slurry being added and decanted water withdrawn simultaneously. Tailings material was exposed at the surface in some areas of all the ponds and ranged to a reported depth of 10 feet in all ponds. All three ponds were filled with tailings and water at near maximum volume due to plant operational changes made necessary by a fire in the solvent extraction process in January 1984. As a result, overflow situations may occur or have occurred by accident or heavy rainfall. Several small areas of the pond 3 dikes were covered with tailings material, apparently from such an occurrence. In addition, the low area between ponds 1 and 3 was discolored (white and gray in color) presumably from the tailings material. The plant did not acknowledge that any overflow situations had occurred. Although all three ponds were well covered with vegetation, minor erosion problems were found on the dikes surrounding ponds 1 and 3. Pond 3 had erosion problems on the east, west and north sides, while pond 1 had more serious erosion problems on its north and south dikes. Pond 2 appeared in good condition but some discolored vegetation was observed on the south dike.

Pond 4 is used for additional tailings storage. Tailings are dredged from an onsite pond, loaded into trucks, hauled to the site and dumped down a synthetic material slide into the pond. This material will be removed when the plant begins reprocessing the material. Pond 4 is in good condition, with good vegetation and only minor erosion problems. Four monitoring wells, reportedly meeting TDWR standards, are in place, one on each side of the pond. Monitoring tests are being conducted by GCMC with no groundwater contamination found, according to GCMC. The site is directly adjacent to the county municipal waste landfill.

A copy of groundwater monitoring analyses, well construction details, and pertinent correspondence is attached to this report. Groundwater aluminum and molybdenum concentrations have decreased since the commencement of groundwater monitoring. Groundwater pH is typically much higher in well W-43 than the other wells. However, there is little indication that the pond has significantly impacted the groundwater.

In addition to the surface impoundments, GCMC stores large quantities of spent catalyst in a large open pile. The pile is placed on a concrete base and is controlled on 3 sides by a 6-foot retaining wall. Water, sprayed on the pile to help cool the material, is collected in an adjacent sump and then pumped to one of the surface impoundments.

Storm water runoff from the plant area is collected in a ditch along the north edge of the plant. This ditch is also used, according to GCMC, to prevent accidental releases to the Brazos River from the impoundments. The ditch was used during the solvent extraction fire to prevent such a release and the skimming booms used to control the threatened organic discharge were still in place during the inspection. This area may exhibit higher metals concentrations in soils and sediments due to particle settling, metals adsorption onto the soil, and metals precipitation caused by evaporation. This ditch is lined with in-situ natural clay and may be the greatest area of concern at the plant.

Based on the above observations and the apparent nonhazardous nature of the tailings and spent catalyst, no immediate hazard was identified during this inspection, and a low hazard assessment was made. It is recommended that GCMC take additional steps to reduce the risk of overflow from the surface impoundments and to prepare clean-up procedures should such an event occur, as well as evaluate the contamination of the soil in the storm water runoff ditch. Groundwater and surface water sampling should continue as at present to identify any future problems.

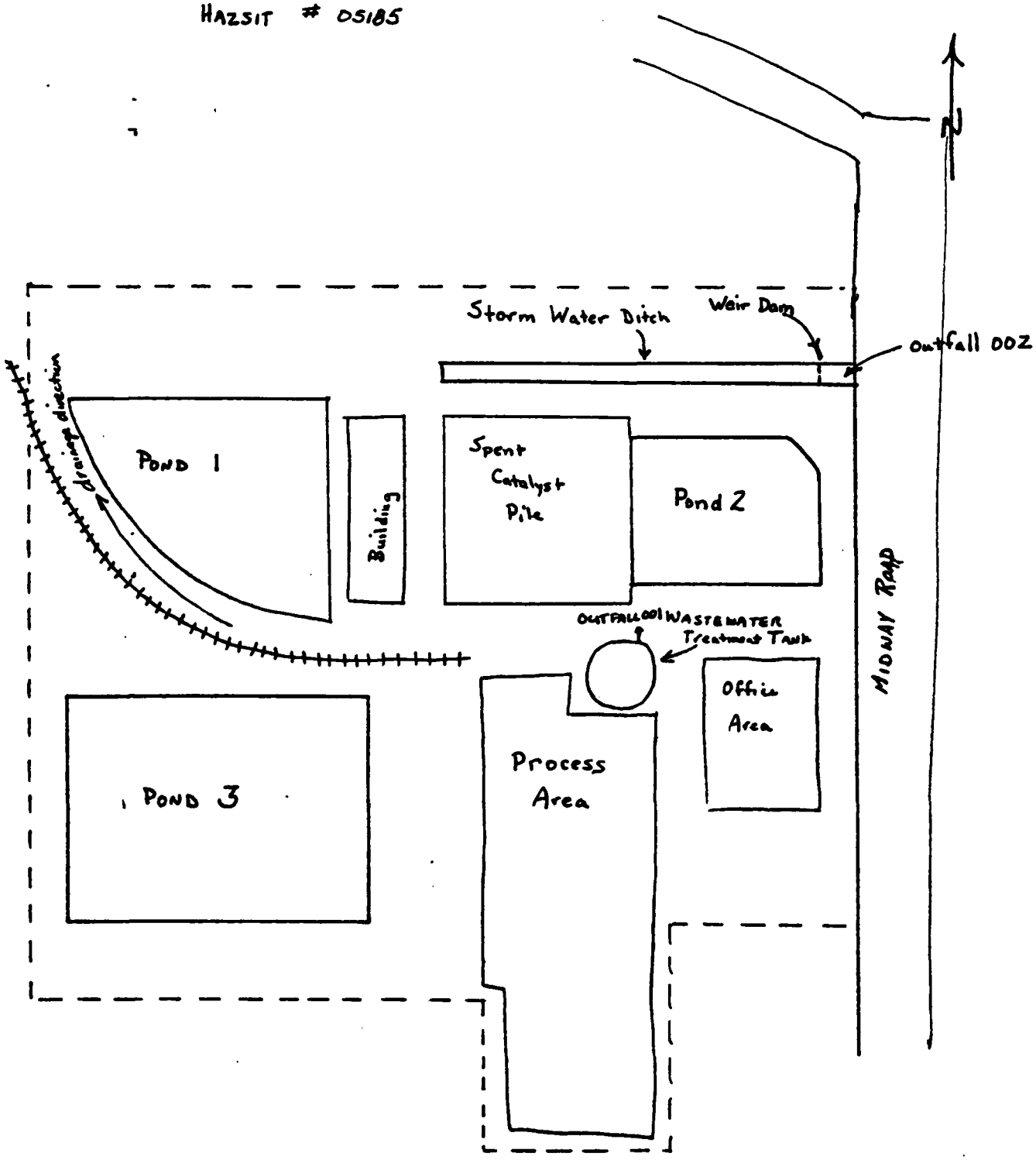
ATTACHMENT A

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT SUPPLEMENT SHEET

Instruction - This sheet is provided to give additional information in explanation of a question on the form T2070-3.

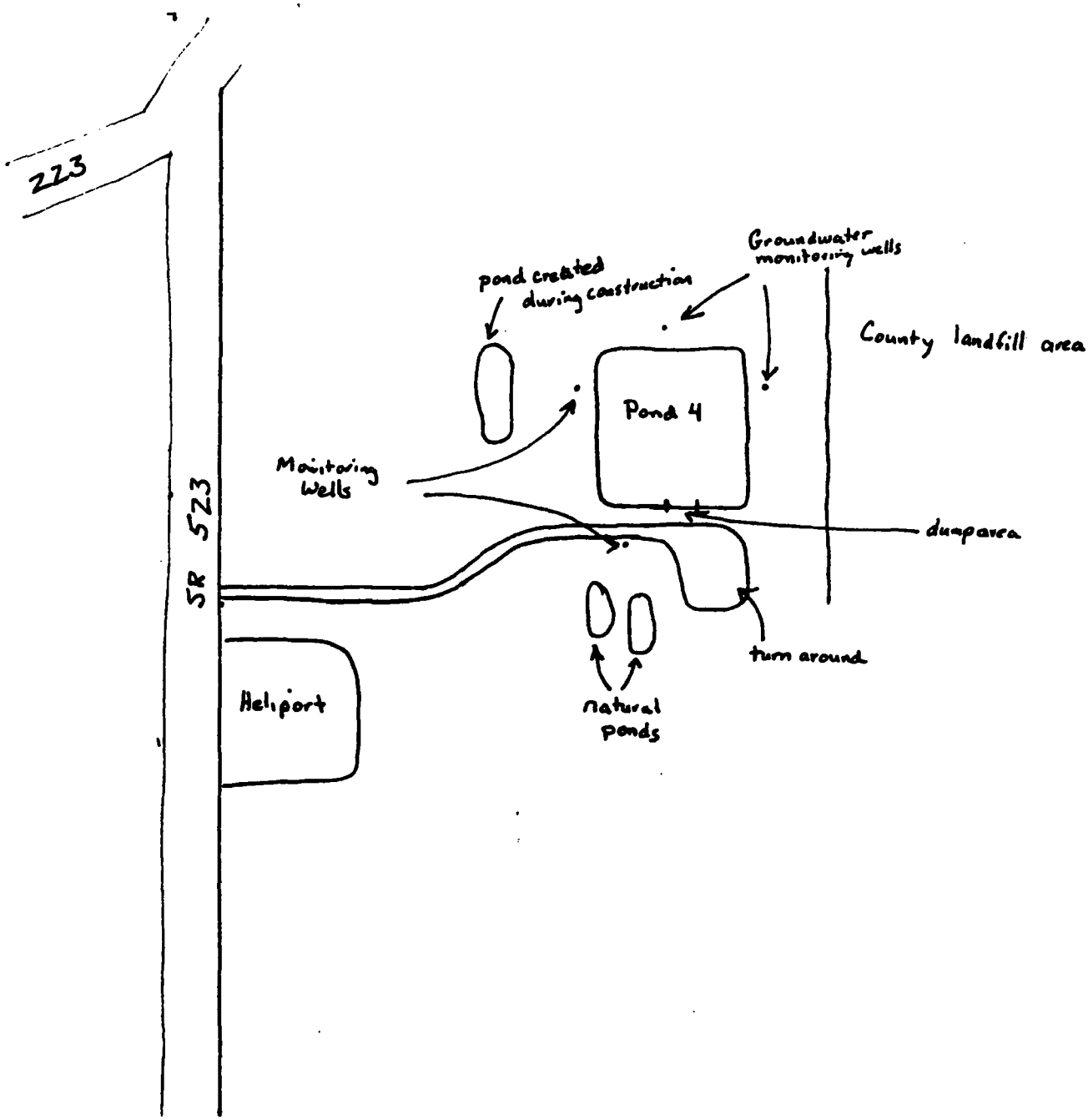
Corresponding number on form	Additional Remark and/or Explanation
XIII. J.	Beaumont Formation (clay, silt, sand & gravel) which is equal to the 'Chicot' aquifer (upper and lower units). The base of this aquifer and formation extends downward 1200 to 1250 feet beneath the site facilities. The 'upper' Chicot aquifer has a lower limit about 325 feet below the surface. Fresh water is available down to 350 feet under 'Pond 4' and to only 250 feet beneath the main plant due to heavy groundwater withdrawal in the area. The strata dip south-southeasterly toward the Gulf at progressively increasing dip values due to overburden and compaction of the unconsolidated mass. This has formed a wedge where sediments increase in thickness seaward.

Area Map of Gulf Chemical and Metallurgical Co., Freeport Tx
HAZSIT # 05185



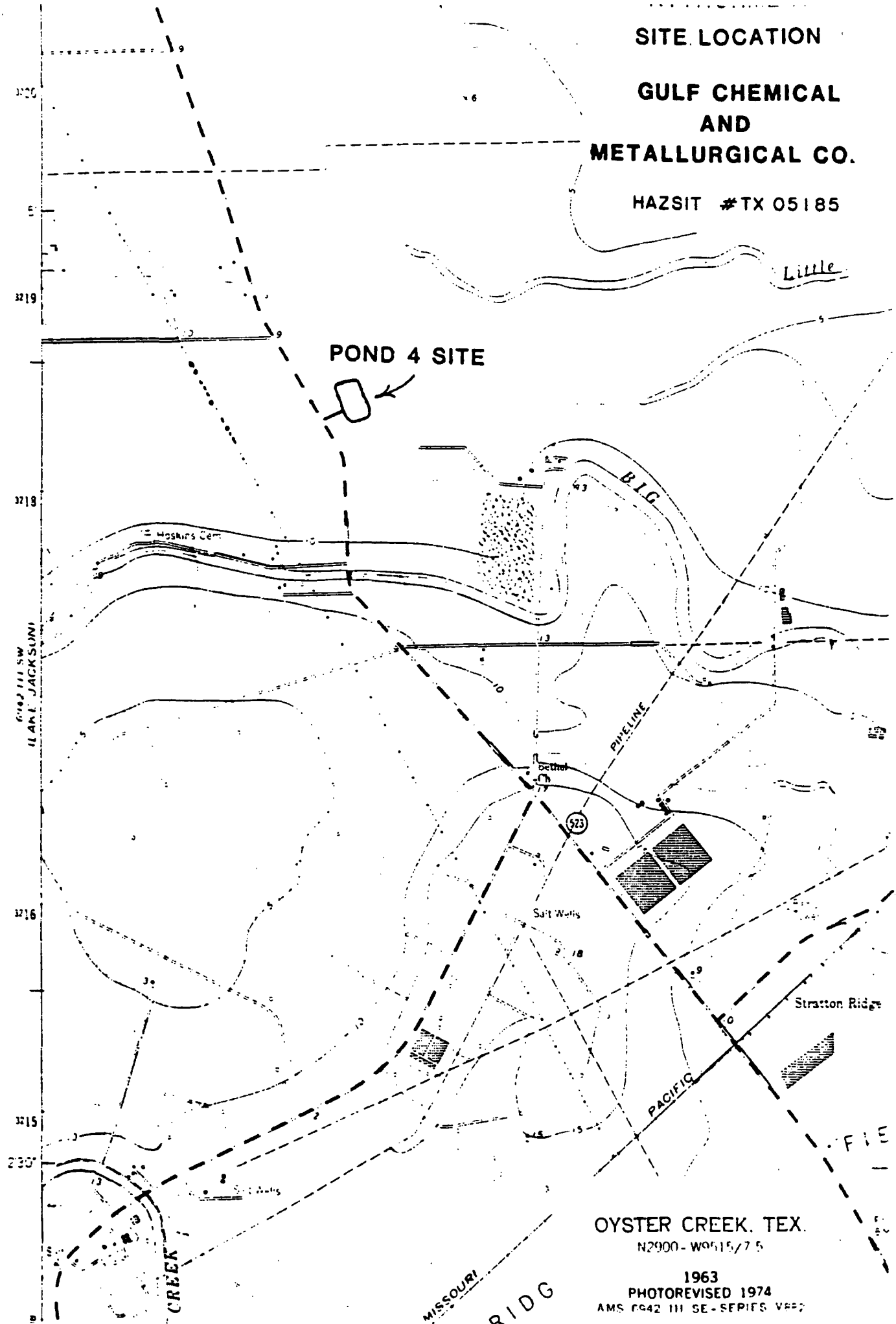
ENGINEERING-SCIENCE 16915 EL CAMINO REAL HOUSTON, TEXAS 77058	PROJECT TDWR 3012 JOB NO.	DATE 3/22	SHT 1
	DETAIL GCMC - Freeport	BY DWD	OF 2

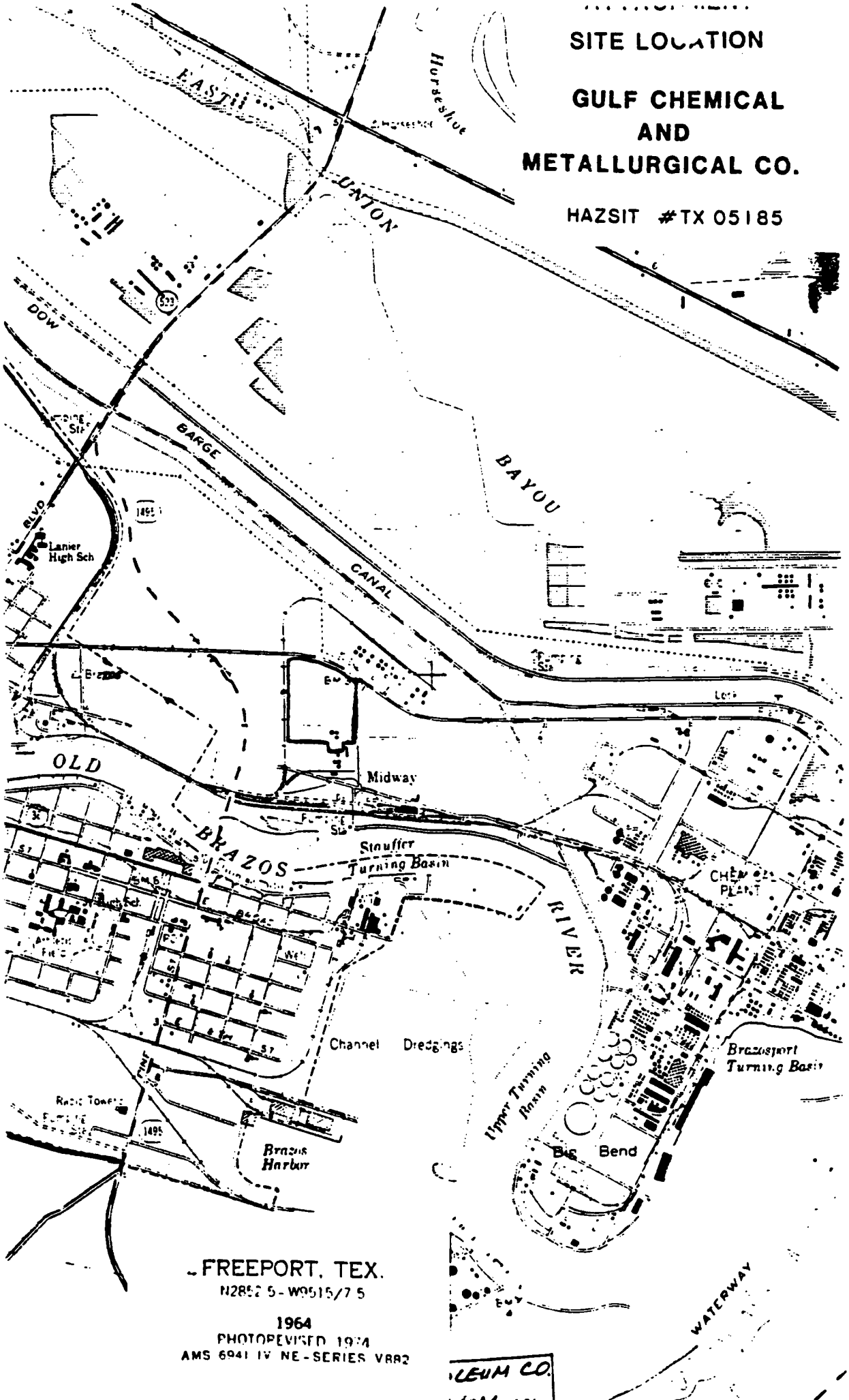
Area Map of Offsite Surface Impoundment for
Gulf Chemical and Metallurgic Co, Freeport Tx.
HAZSIT # 05185



ENGINEERING-SCIENCE
16918 EL CAMINO REAL
HOUSTON, TEXAS 77058
[illegible]-2944

PROJECT _____ JOB NO. _____ DATE _____ SHT. _____
DETAIL _____ BY _____ OF _____


SITE LOCATION
GULF CHEMICAL
AND
METALLURGICAL CO.
HAZSIT #TX 05185
POND 4 SITE
Little
BIG
PIPELINE
Bethel
Ch
523
Salt Wells
Stratton Ridge
PACIFIC
CREEK
MISSOURI
OYSTER CREEK, TEX.
N2900-W9515/7.5
1963
PHOTOREVISED 1974
AMS 6942 III SE-SERIES V882



Stormwater
002
BRAZOS

001
Process water
dewat
Dow
canal

ENGINEERING-SCIENCE, INC.
SITE INSPECTION TEAM
SITE SAFETY AND WORK PLAN

A. GENERAL INFORMATION

SITE: Gulf Chemical and Metallurgical Corp. HAZSIT NO.: TX 05185
LOCATION: Freeport, Texas 77541 302 Midway Road
PLAN PREPARED BY: David G. Johnson, P.E. DATE: 2/10/84
APPROVED BY: [illegible], P.E. DATE: 2/11/84
OBJECTIVE(S): Review records, establish history of site waste disposal operations. Inspect pile and all three lagoons, particularly levees around lagoons. Sample waste, spill areas, runoff and discharge ditches, analyze for metals (Mo, Va in particular, possibly Co, Ni, Zn, etc.) and ammonia
PROPOSED DATE OF INVESTIGATION: February 1984 one documented spill in area behind outfall 002.
PRELIMINARY ASSESSMENT HAZARD: HIGH:____ MEDIUM: X LOW:____
NONE:____ UNKNOWN:____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): LIQUID: X SOLID: X SLUDGE: X GAS:____
CHARACTERISTIC(S): CORROSIVE: X IGNITABLE: X RADIOACTIVE:____
VOLATILE:____ TOXIC: X REACTIVE: X
UNKNOWN:____ OTHER:____ (NAME)____

FACILITY DESCRIPTION: Metals extraction facility - processing of spent refinery catalyst from hydrodesulfurization operations. 1 pile and 3 lagoons on-site.

Principal Disposal Method (type and location): Incoming catalyst stored in pile, molybdenum and vanadium extracted from catalyst, remainder discharged to tailings ponds for future Co and Ni recovery.

Unusual Features (dike integrity, power lines, terrain, etc.): located close to Brazos River

Status: (active, inactive, unknown): active

History: (worker or nonworker injury, complaints from public, previous remedial or enforcement agency): Site added to ERRIS list as a result of complaint by Freeport Mayor. Treatment system has a history of discharge problems with numerous permit violations. Waste alumina (containing Mo, Va, Al, Co, Ni, etc) is no longer classified as a hazardous waste. No other hazardous wastes disposed on-site.

C. HAZARD EVALUATION

No wastes on site are currently classified as hazardous, although ingestion of wastes or inhalation of dusts or particles on-site should be prevented due to metals concentrations. Do not allow wastewater to contact skin surface

D. SITE SAFETY WORK PLAN

PERSONAL PROTECTION

LEVEL OF PROTECTION: A____ B____ C____ D X

MODIFICATIONS: gloves to prevent skin contact

SURVEILLANCE EQUIPMENT AND MATERIALS: pH meter would be useful.

SITE ENTRY PROCEDURES: Contact facility personnel to arrange inspection date

DECONTAMINATION PROCEDURES: Decontaminate all equipment according to Generic Work Plan for Site Inspections.

Special Equipment, Facilities, or Procedures: None

Team Member	Responsibility
Philip Liang	
Tom Stang	

E. EMERGENCY INFORMATION

LOCAL RESOURCES

Ambulance: Freeport Fire Dept 233-2651

Hospital: Community Hospital ~~239~~- 233-4421

Poison Control Center: Galveston 654-1701 (Houston #)

Police: Free Port Police 239-1211

Fire Department: Freeport Fire Dept 233-2651

EPA Contact: Carlene Chambers (214) 767-6421

TDWR Contact: Daniel L. Scheppers (512) 475-1344

Emergency Contacts:

Project Safety Manager: Dr. Barry North (303) 455-4427

Project Manager: David G. Johnson (512) 477-9901 892-3755

Deputy Project Manager: Steve C. Neeley (512) 477-9901

ATTACHMENT A

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT SUPPLEMENT SHEET

Instruction - This sheet is provided to give additional information in explanation of a question on the form T2070-3.

Corresponding number on form	Additional Remark and/or Explanation

No samples were taken during the GCMC site inspection. Mr. Harold Newman, Director of Environmental Affairs, had placed several calls to people involved with the project, including Mr. Tony Gardner (U.S. EPA-Dallas) to discuss the project. The result of those conversations was his conclusion that no sampling was necessary for the following reasons:

1) All surface impoundments used for storage are currently active, and are therefore, not under the Superfund legislation.
2) Materials deposited in the impoundments are in storage for later use, not for disposal, and are therefore not considered waste material.
3) Materials stored, both in the spent catalyst pile and the surface impoundments, are non-hazardous, being designated Class II wastes (approaching Class III) according to TDWR regulations. This is supported by the attached analyses from Hazen Research, Inc.
4) Any samples taken from the area that the solvent extraction fire may have contaminated would not be a representative sample since normal plant operation had not caused the problem, but rather an isolated occurrence.

Mr. Newman felt that these reasons precluded the necessity of sampling at any of the sites within the plant. The inspection team agreed with the possibility that the sample collected would not be representative due to the recent fire accident, and therefore did not collect any samples during the site inspection.

However, there were several areas that the inspection team felt samples should be taken from after the solvent extraction unit is repaired:

1) Storm water runoff collection ditch - soil sample.
2) Areas between ponds 1 and 3.
3) Tailings material from the ponds.
4) Surface water in the ponds.
5) Groundwater monitoring wells at pond 4.

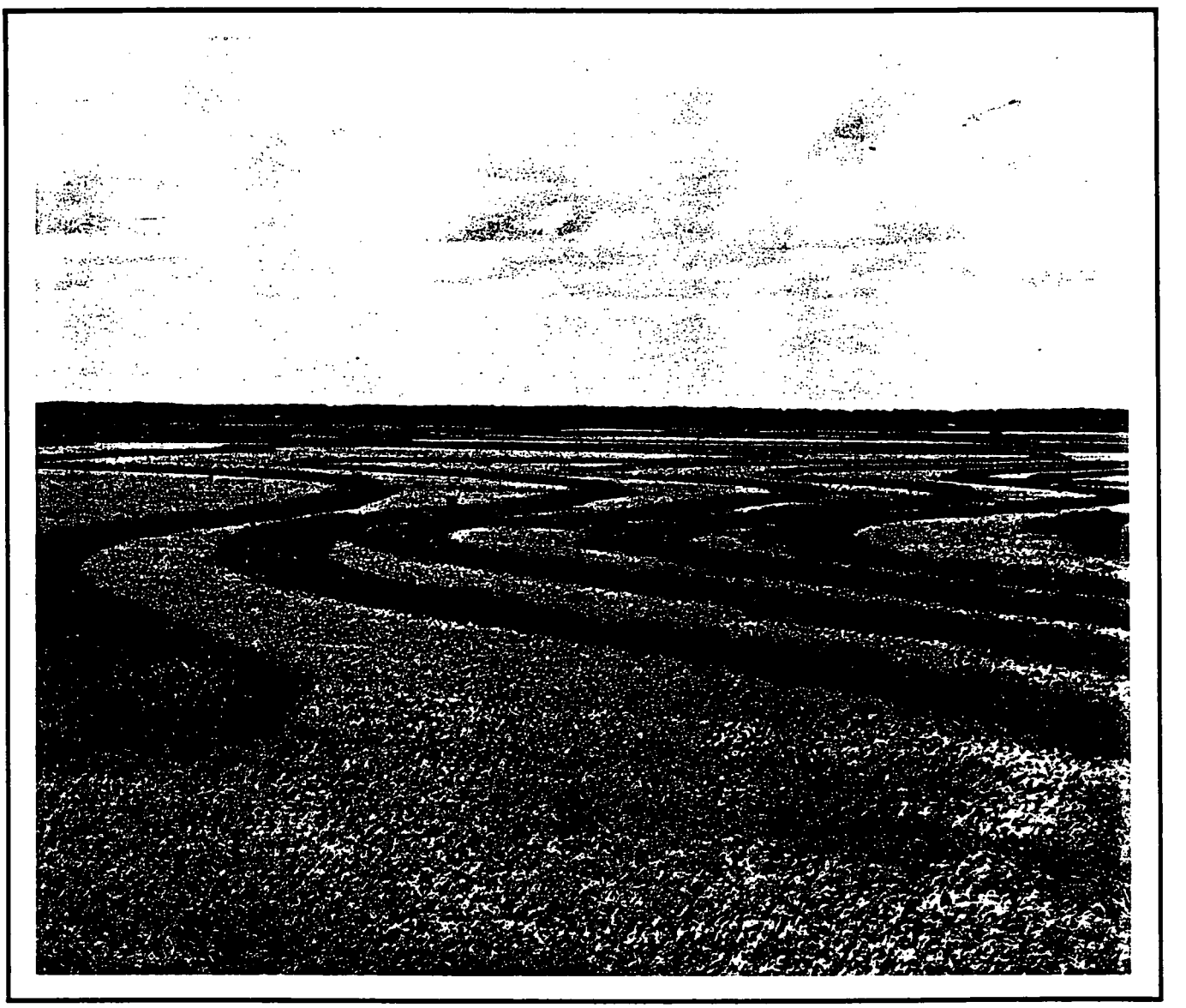
These sample locations were based on potential hazard rather than immediate hazard and would be an effort to confirm the non-hazardous nature of the materials and the lack of contamination of the site.

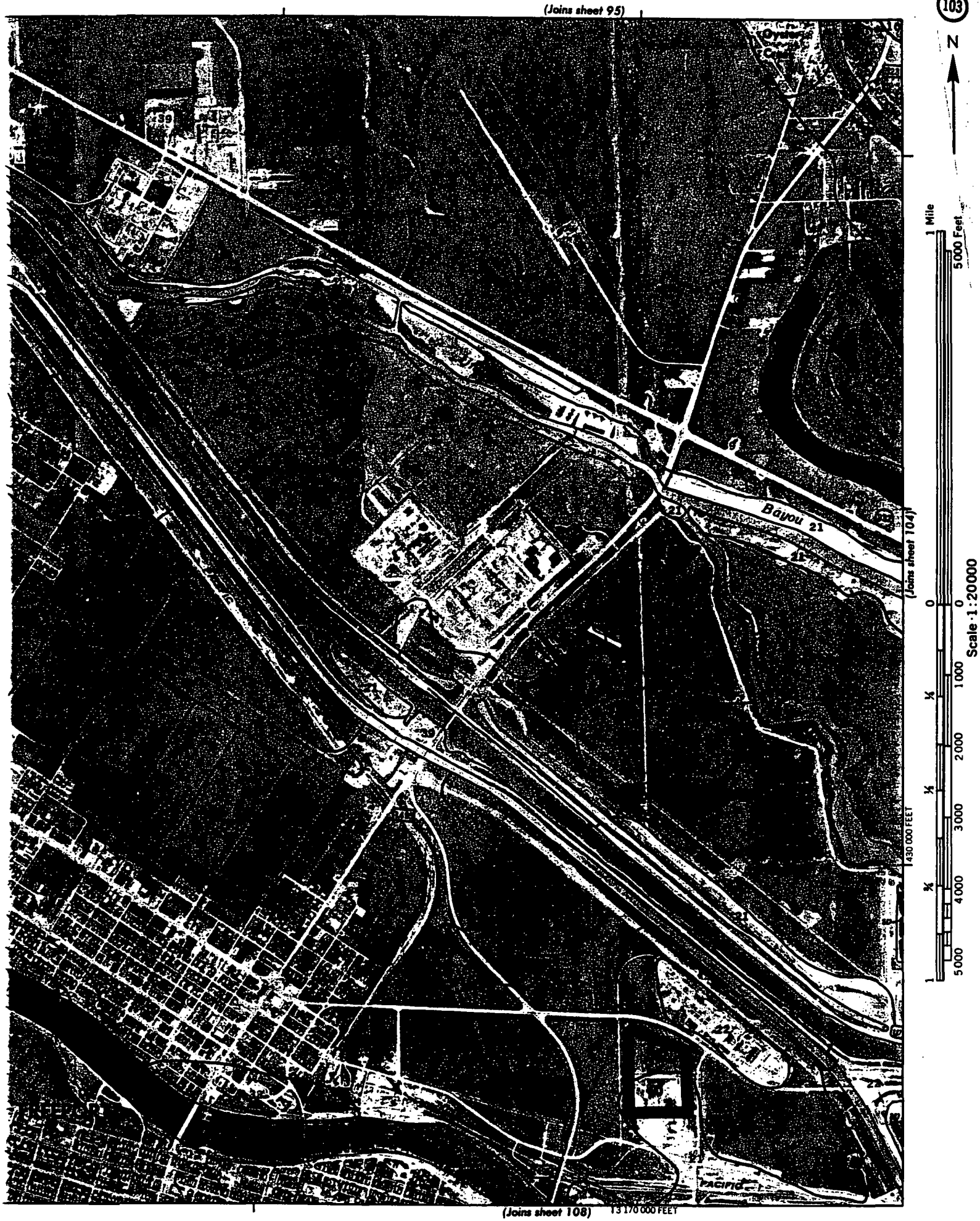
Ref. 4

United States Department of Agriculture
Soil Conservation Service
in cooperation with the
Brazoria County Commissioners Court and
Texas Agricultural Experiment Station

soil survey of

brazoria county, texas




(Joins sheet 95)
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Bayou 21
1430 000 FEET
13 170 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000

SOIL LEGEND

The publication map symbols are numeric and the map unit names are in alphabetical order. Map unit names that do not give a slope range have slopes of less than 1 percent.

SYMBOL	NAME
1	Aris fine sandy loam
2	Asa silt loam
3	Asa silty clay loam
4	Asa-Urban land complex
5	Beaches
6	Beaumont clay
7	Bernard clay loam
8	Bernard-Edna complex
9	Bernard-Urban land complex
10	Brazoria clay, 0 to 1 percent slopes
11	Brazoria clay, 1 to 5 percent slopes
12	Clemville silty clay loam
13	Edna fine sandy loam, 0 to 1 percent slopes
14	Edna fine sandy loam, 1 to 5 percent slopes
15	Edna-Aris complex
16	Follet clay loam
17	Francitas clay
18	Galveston fine sand, undulating
19	Harris clay
20	Harris-Tracosa complex
21	Ijam clay
22	Ijam-Urban land complex
23	Kenney loamy fine sand, 0 to 3 percent slopes
24	Lake Charles clay, 0 to 1 percent slopes
25	Lake Charles clay, 1 to 8 percent slopes
26	Lake Charles-Urban land complex
27	Leton loam
28	Leton-Aris complex
29	Morey silt loam
30	Mustang fine sand
31	Mustang fine sand, saline
32	Narta fine sandy loam
33	Norwood silt loam, 0 to 1 percent slopes
34	Norwood silt loam, 1 to 5 percent slopes
35	Norwood-Asa complex, 1 to 8 percent slopes
36	Pledger clay
37	Pledger-Urban land complex
38	Sumpf clay
39	Surfside clay
40	Tatlum clay loam
41	Tracosa mucky clay
42	Velasco clay
43	Veston loam
44	Veston silty clay loam, strongly saline

Typical pedon of Galveston fine sand, undulating; from the intersection of Texas Highway 332 and Farm Road 523 about 3 miles northeast of Freeport, 3.6 miles southeast on Texas Highway 332, 8.6 miles northeast on paved county road, 0.05 mile southeast on unimproved road to beach, and 100 feet north from the front of the dunes, in rangeland:

C1—0 to 19 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; common very fine and medium roots; common shell fragments; moderately alkaline; clear smooth boundary.

C2—19 to 33 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose; few very fine roots; moderately alkaline; clear smooth boundary.

C3—33 to 60 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; few light yellowish brown stains; moderately alkaline; gradual smooth boundary.

C4—60 to 66 inches; gray (10YR 6/1) fine sand, light gray (10YR 7/1) dry; single grained; loose, nonsticky and nonplastic; few shell fragments; moderately alkaline; gradual smooth boundary.

C5—66 to 80 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; few shell fragments; few brownish yellow stains; moderately alkaline.

The depth to loamy strata is greater than 72 inches. Fragments of marine shells are in some to all parts of the pedon. This soil is medium acid to moderately alkaline. Some pedons are slightly saline. The soil is white, light gray, light brownish gray, or gray. It is mainly fine sand but ranges to sand.

Harris series

The Harris series consists of nearly level, very poorly drained, saline, clayey soils. These soils are in marshes. They formed in recent clayey marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Harris clay; from the west junction of Bastrop Bayou and Cox Lake about 14 miles southeast of Angleton, 1.3 miles south across Cox Lake to south shoreline, 0.6 mile southeast along shoreline, and 400 feet south in rangeland:

A11g—0 to 8 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many fine and medium roots; few strong brown stains along root canals; saline; neutral; gradual smooth boundary.

A12g—8 to 14 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many fine and medium roots; common strong brown stains in pores and old root channels; saline; mildly alkaline; clear wavy boundary.

A13g—14 to 16 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few thin strata of light gray fine sand; few brown stains along root channels; saline; mildly alkaline; clear wavy boundary.

AC1g—16 to 35 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few single grains of light gray fine sand; few black concretions up to 3 millimeters in diameter; saline; mildly alkaline; clear wavy boundary.

AC2g—35 to 50 inches; gray (10YR 5/l) clay, gray (10YR 6/l) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few black concretions up to 3 millimeters in diameter; saline; moderately alkaline; diffuse smooth boundary.

Cg—50 to 60 inches; gray (10YR 6/1) clay, light gray (5Y 7/1) dry; common fine distinct yellowish brown (10YR 5/6), few fine faint light gray, and few fine distinct dark gray (10YR 4/1) mottles; massive; very hard, very firm, very sticky and plastic; few fine black concretions up to 2 millimeters in diameter; saline; moderately alkaline.

The salinity throughout the soil is slight to strong.

The Ag horizon ranges from 10 to 24 inches in thickness. In most pedons, it is mottled with brown. It is neutral to moderately alkaline.

The ACg horizon and Cg horizon are gray, dark gray, or very dark gray. In most pedons, they are mottled with brown.

Ijam series

The Ijam series consists of nearly level to undulating, poorly drained, saline, clayey soils. These soils are in marshes. They formed in recent clayey marine deposits that resulted from dredging operations. Slopes range from 0.5 to 8 percent.

Typical pedon of Ijam clay; from the intersection of Farm Road 523 and Texas Highway 332 about 3 miles northeast of Freeport, 1.2 miles east on Texas Highway 332, and 300 feet south in rangeland:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; common fine distinct

yellowish brown (10YR 5/6) mottles; massive; very hard, very firm, very sticky and plastic; few fine roots; few black concretions less than 1.0 millimeter in diameter; moderately alkaline; saline; diffuse smooth boundary.

Cg—9 to 60 inches; light brownish gray (2.5Y 6/2) clay, light gray (2.5Y 7/2) dry; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; massive; very hard, very firm, very sticky and plastic; few shell fragments; common concretions of calcium carbonate 1 millimeter to 3 millimeters in diameter; few thin strata of fine sand; saline; moderately alkaline.

The salinity throughout is moderate to strong.

The A horizon ranges from 0 to 10 inches in thickness. It is dark gray, gray, light gray, or dark grayish brown. It is neutral to moderately alkaline.

The Cg horizon is light olive gray, dark gray, gray, light gray, light brownish gray, or dark grayish brown. It is mottled with gray and brown. It is typically moderately alkaline. In some pedons, it does not have concretions of calcium carbonate, shells, and shell fragments.

Kenney series

The Kenney series consists of nearly level and gently sloping, well drained, nonsaline, sandy soils. These soils formed in ancient sandy fluvial deposits under prairie. Slopes range from 0.5 to 3 percent.

Typical pedon of Kenney loamy fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway 288 and county road in Sandy Point, 0.4 mile west on county road, and 600 feet south in pastureland:

Ap—0 to 16 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky and nonplastic; many fine roots; medium acid; diffuse wavy boundary.

A2—16 to 70 inches, very pale brown (10YR 7/4) loamy fine sand, very pale brown (10YR 8/4) dry; single grained; loose, nonsticky and nonplastic; few fine roots; medium acid; gradual smooth boundary.

B21t—70 to 77 inches, red (2.5YR 4/6) sandy clay loam, red (2.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and nonplastic; few fine pores; slightly acid.

The solum ranges from 65 to more than 80 inches in thickness. It is slightly acid to strongly acid throughout.

The A horizon ranges from 40 to 72 inches in thickness. It is dark grayish brown, dark brown, light brownish gray, pale brown, brown, or grayish brown.

The A2 horizon is brown, light brown, dark grayish brown, light brownish gray, pale brown, or very pale brown.

The B2t horizon is mainly sandy clay loam or clay loam, but ranges to fine sandy loam. It is red or yellowish red. It is mottled with red, brown, and yellow in some pedons.

Lake Charles series

The Lake Charles series consists of nearly level to sloping, somewhat poorly drained, nonsaline soils. These soils formed in ancient clayey coastal deposits. Slopes range from 0.1 to 8 percent.

Typical pedon of Lake Charles clay, 0 to 1 percent slopes; from the intersection of Texas Highway 36 and Farm Road 1462 in Damon, 0.7 mile south on Texas Highway 36, 2.5 miles east on county road, 0.6 mile east on shell road, 0.25 mile southeast on private road, 216 feet west along fence line, and 203 feet south in pastureland:

Ap—0 to 7 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine faint yellowish brown mottles; moderate fine blocky and subangular blocky structure; very hard, firm, very sticky and plastic; many fine roots; few medium pores; slightly acid; clear smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, few fine faint yellowish brown mottles; moderate medium subangular and moderate fine blocky structure; very hard, firm, very sticky and plastic; few small pressure faces; common fine roots; few fine pores; few black concretions; slightly acid; gradual wavy boundary.

A13—13 to 23 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, common fine faint yellowish brown (10YR 5/4) mottles; strong medium coarse blocky structure parting to fine and medium subangular blocky; very hard, firm, very sticky and plastic; few small intersecting slickensides and pressure faces; few fine roots; few black concretions; slightly acid; gradual wavy boundary.

A14—23 to 32 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, few fine faint yellowish brown and strong brown mottles; strong fine and medium blocky structure; very hard, firm, very sticky and plastic; common small pressure faces and intersecting slickensides; few fine roots; neutral; gradual wavy boundary.

A15—32 to 50 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, common fine faint yellowish brown (10YR 5/4) and few medium distinct olive brown (2.5Y 4/4) mottles; strong medium and coarse blocky and moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common medium pressure faces and intersecting slickensides; neutral; few fine roots; clear wavy boundary.

ACg—50 to 64 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry, few fine faint yellowish brown and common medium distinct light olive brown (2.5Y 5/4) mottles; strong medium and coarse blocky structure;

The IIC horizon is at a depth of 40 to 80 inches. It is light reddish brown, reddish brown, reddish yellow, yellowish red, brown, strong brown, light gray, or light brown. Some pedons have loamier and sandier strata of varying thickness. These strata have contrasting colors that commonly differ from those described for this horizon.

Surfside series

The Surfside series consists of deep, nearly level, poorly drained, saline soils. These soils are in marshes. They formed in recent clayey fluvial deposits. Slopes range from 0.1 to 0.6 percent.

Typical pedon of Surfside clay; from the intersection of Texas Highway 332 and Farm Road 523 about 3 miles northeast of Freeport, 0.3 mile southeast on Texas Highway 332, and 300 feet south in rangeland:

A11g—0 to 14 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine and medium roots; many strong brown stains along old root channels; saline; mildly alkaline; gradual smooth boundary.

A12g—14 to 32 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown (10YR 5/4) and few fine faint gray mottles; moderate coarse prismatic structure parting to moderate medium and fine blocky; few prism faces thinly coated with light gray silt material; very hard, very firm, very sticky and very plastic; few fine roots; saline; mildly alkaline; clear smooth boundary.

B2g—32 to 72 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; common fine and medium distinct gray (10YR 6/1) and few fine distinct very dark gray (10YR 3/1) mottles; weak medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few concretions of calcium carbonate up to 10 millimeters in diameter; calcareous; saline.

The solum ranges from 40 to more than 60 inches in thickness.

The Ag horizon is dark gray, very dark gray, dark grayish brown, very dark grayish brown, black, or very dark brown. It is neutral to moderately alkaline and slightly saline to moderately saline.

The B2g horizon is reddish brown, yellowish red, brown, strong brown, dark brown, or dark reddish brown. It is mildly to moderately alkaline. It is commonly calcareous, but in some pedons it is noncalcareous.

Some pedons have a Cg horizon, which has the same texture and color range as the B horizon. A few strata of loamy and sandy materials are in some pedons at depths greater than 50 inches.

Tatlum series

The Tatlum series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in recent loamy marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Tatlum clay loam; from the intersection of Cold Pass and Churchill Bayou on Follets Island, across Cold Pass at a compass heading of 20 degrees, and 60 feet north of the bank, in rangeland:

A1g—0 to 18 inches; gray (10YR 5/1) clay loam, common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; flows easily between fingers and leaves small residue in hand when squeezed; slightly sticky and slightly plastic; common fine and medium roots; extremely saline; moderately alkaline; clear boundary.

C1g—18 to 28 inches; gray (10YR 5/1) clay loam; massive; flows with some difficulty between fingers and leaves small residue in hand when squeezed; slightly sticky and slightly plastic; extremely saline; moderately alkaline; gradual smooth boundary.

C2g—28 to 42 inches; gray (10YR 5/1) clay; few strata of clay loam; common medium faint gray (N 5/0) mottles; massive; firm, slightly sticky and slightly plastic; extremely saline; moderately alkaline; gradual smooth boundary.

C3g—42 to 60 inches; gray (N 5/0) stratified clay loam and clay, common medium distinct strong brown (7.5YR 5/8) and many medium distinct grayish brown (10YR 5/2) mottles; few fine black concretions; massive; firm, slightly sticky and slightly plastic; extremely saline; moderately alkaline.

The water table is at or very near the surface throughout the year. The surface layer is 20 to 40 inches thick and has a slightly fluid to fluid consistence. Electrical conductivity ranges from 25 to 90 millimhos per centimeter, and the content of exchangeable sodium is more than 30 percent. Most pedons have a 1- to 6-inch-thick organic mat of decomposing plant material on the surface.

The A horizon is gray, dark gray, very dark gray, or black. It is mottled with brown and gray in most pedons.

The C horizon is mainly stratified clay loam and loam but ranges from fine sandy loam to clay. It is light gray, light brownish gray, grayish brown, dark gray, dark grayish brown, or gray. It is mottled with gray, brown, and greenish gray in many pedons. Below 40 inches, some pedons have brown clayey horizons, which are commonly calcareous.

Tracosa series

The Tracosa series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in recent clayey marine deposits. Slopes are less than 0.1 percent.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organi matte
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
15:*										
Aris	0-23	10-25	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	5	<2
	23-33	25-35	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.32		
	33-60	35-50	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
16 Follet	0-4	15-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43	5	—
	4-60	18-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43		
17 Francitas	0-18	35-50	<0.06	0.10-0.18	6.1-8.4	<4	High	0.32	5	<2
	18-36	40-60	<0.06	0.06-0.12	6.6-8.4	4-25	Very high	0.32		
	36-77	40-60	<0.06	0.06-0.12	7.9-8.4	8-25	Very high	0.32		
18 Galveston	0-60	2-8	6.0-20	0.05-0.10	5.6-8.4	<4	Low	0.15	5	<.5
	60-80	2-8	6.0-20	0.05-0.10	5.6-8.4	<4	Low	0.15		
19 Harris	0-16	40-60	0.06-0.2	0.02-0.20	6.6-9.0	4-16	High	0.20	5	2-1
	16-60	40-60	<0.06	0.01-0.10	6.6-9.0	4-16	High	0.32		
20:*										
Harris	0-15	40-60	0.06-0.2	0.02-0.20	6.6-9.0	4-16	High	0.20	5	2-1
	15-60	40-60	<0.06	0.01-0.10	6.6-9.0	4-16	High	0.32		
Tracosa	0-5	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High	0.37	5	—
	5-60	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High	0.37		
21 Ijam	0-9	20-50	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32	5	—
	9-60	40-55	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32		
22:*										
Ijam	0-6	20-50	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32	5	—
	6-60	40-55	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32		
Urban land.										
23 Kenney	0-70	2-12	6.0-20	0.06-0.10	5.1-6.5	<2	Low	0.17	5	<1
	70-77	15-35	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.24		
24 Lake Charles	0-13	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
	13-64	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
	64-80	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
25 Lake Charles	0-22	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
	22-40	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
	40-60	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
26:*										
Lake Charles	0-18	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
	18-60	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
Urban land.										
27 Leton	0-23	10-25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low	0.43	5	1-3
	23-62	20-35	0.06-0.2	0.15-0.20	5.6-8.4	<2	Moderate	0.37		
28:*										
Leton	0-21	10-25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low	0.43	5	1-3
	21-60	20-35	0.06-0.2	0.15-0.20	5.6-8.4	<2	Moderate	0.37		
Aris	0-20	10-25	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	5	<2
	20-31	25-35	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.32		
	31-48	35-50	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
	48-60	30-40	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
29 Morey	0-11	15-30	0.6-2.0	0.16-0.24	5.1-7.3	<2	Low	0.37	5	1-4
	11-36	25-35	0.06-0.2	0.18-0.22	5.6-7.8	<2	Moderate	0.37		
	36-60	30-45	0.06-0.2	0.18-0.22	6.1-8.4	<2	High	0.37		
30 Mustang	0-4	2-8	6.0-20	0.01-0.07	6.6-8.4	<4	Low	0.15	5	<1
	4-72	2-8	6.0-20	0.01-0.06	6.6-8.4	<8	Low	0.15		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
31---------- Mustang	0-8	2-8	6.0-20	0.01-0.04	6.6-8.4	>4	Low----------	0.15	5	<1
	8-60	2-8	6.0-20	0.01-0.04	6.6-8.4	>4	Low----------	0.15		
32---------- Narta	0-7	10-25	0.6-2.0	0.05-0.11	6.6-8.4	2-16	Low----------	0.49	5	.5-2
	7-18	35-45	<0.06	0.-0.02	7.4-9.0	>8	High----------	0.43		
	18-74	30-45	<0.06	0.-0.02	7.9-9.0	>8	High----------	0.43		
33---------- Norwood	0-13	10-27	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low----------	0.43	5	.5-2
	13-48	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	48-64	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
34---------- Norwood	0-26	10-27	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low----------	0.43	5	.5-2
	26-40	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	40-60	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
35:*										
Norwood---------	0-18	27-40	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate-----	0.32	5	.5-2
	18-55	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	55-63	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
Asa----------	0-11	18-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low----------	0.28	5	1-3
	11-38	18-35	0.6-2.0	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
	38-60	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
36---------- Pledger	0-26	40-60	0.06-0.2	0.12-0.22	6.1-8.4	<2	High----------	0.32	5	1-3
	26-50	35-60	<0.06	0.12-0.18	7.4-8.4	<2	High----------	0.32		
	50-64	---	---	---	---	---	----------	----		
37:*										
Pledger---------	0-26	40-60	0.06-0.2	0.12-0.22	6.1-8.4	<2	High----------	0.32	5	1-3
	26-50	35-60	<0.06	0.12-0.18	7.4-8.4	<2	High----------	0.32		
	50-60	---	---	---	---	---	----------	----		
Urban land.										
38---------- Sumpf	0-60	60-80	<0.06	0.14-0.19	7.4-8.4	<2	High----------	0.32	5	1-4
39---------- Surfside	0-14	35-70	<0.06	0.05-0.10	6.6-8.4	4-16	High----------	0.32	5	2-10
	14-72	60-80	<0.06	0.01-0.10	7.4-8.4	>16	High----------	0.32		
40---------- Tatlum	0-28	27-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate-----	0.43	5	---
	28-60	18-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate-----	0.43		
41---------- Tracosa	0-5	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High----------	0.37	5	---
	5-60	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High----------	0.37		
42---------- Velasco	0-30	60-70	<0.06	0.06-0.12	6.6-9.0	>8	High----------	0.32	5	2-10
	30-65	60-70	<0.06	0.01-0.10	7.4-8.4	>16	High----------	0.32		
43---------- Veston	0-11	27-40	0.2-0.6	0.05-0.15	6.6-8.4	---	Moderate-----	0.49	5	<1
	11-26	12-27	0.6-2.0	0.02-0.10	7.9-9.0	>8	Low----------	0.49		
	26-60	15-35	0.06-0.2	0.02-0.10	7.9-9.0	>8	Moderate-----	0.32		
44---------- Veston	0-10	15-27	0.6-2.0	0.02-0.10	6.6-8.4	>8	Low----------	0.49	5	<1
	10-28	12-27	0.6-2.0	0.02-0.10	7.9-9.0	>8	Low----------	0.49		
	28-60	15-35	0.06-0.2	0.02-0.10	7.9-9.0	>8	Moderate-----	0.32		

* See description of the map unit for composition and behavior characteristics of the map unit.

RECORD OF COMMUNICATION	|x| Phone Call	|_| Discussion	|_| Field Trip
	|_| Conference	|_| Other (Specify)	Ref. 5

(Record of Item Checked Above)

TO:	FROM:	DATE
Bill Shipp Water Superintendent Freeport, TX (409) 233-3526	John L. Jones FIT Analyst ICF Technology (214) 744-1641	6/13/88 TIME 0938

SUBJECT

City of Freeport Water Utility

SUMMARY OF COMMUNICATION

Mr. Shipp said that the city was on ground and surface water, the north side (old Velasco) has 3 wells in it, the south side (Freeport) has 3 wells, with one standby, the standby has very poor water. The intake from the Dow fresh water canal is just about where Hwy. 523 intersects with the canal and the canal is on the south side of the Dow Barge Canal. The city water utility serves only the city limits with the exception of the Jones creek and Slaughter road area. The Bridge Harbor area is in the city limits even though it is about 5 miles away and is in the city water system.

The cities of Jackson and Clute have wells but are soon going to a surface water system based at the intersection of Hwy. 332 and Hwy. 3004 run by the

CONCLUSIONS, ACTION TAKEN OR REQUIRED

Brazos Port Water Authority.

INFORMATION COPIES TO:

EPA FORM 1300-6 (7-72)
Replaces EPA HQ Form 5300-3 Which May Be Used Until Supply is Exhausted.

RECORD OF COMMUNICATION	|x| Phone Call |_| Discussion |_| Field Trip |_| Conference |_| Other (Specify) Ref. 6	
	(Record of Item Checked Above)	
TO: Bill Shipp Water Superintendent City of Freeport (serv. bldg.) Freeport, TX.	FROM: John L. Jones FIT - Analyst ICF Technology (214) 744-1641	DATE 6/29/88 TIME 1610

SUBJECT (409) 233-4241
City of Freeport Water Utility

SUMMARY OF COMMUNICATION

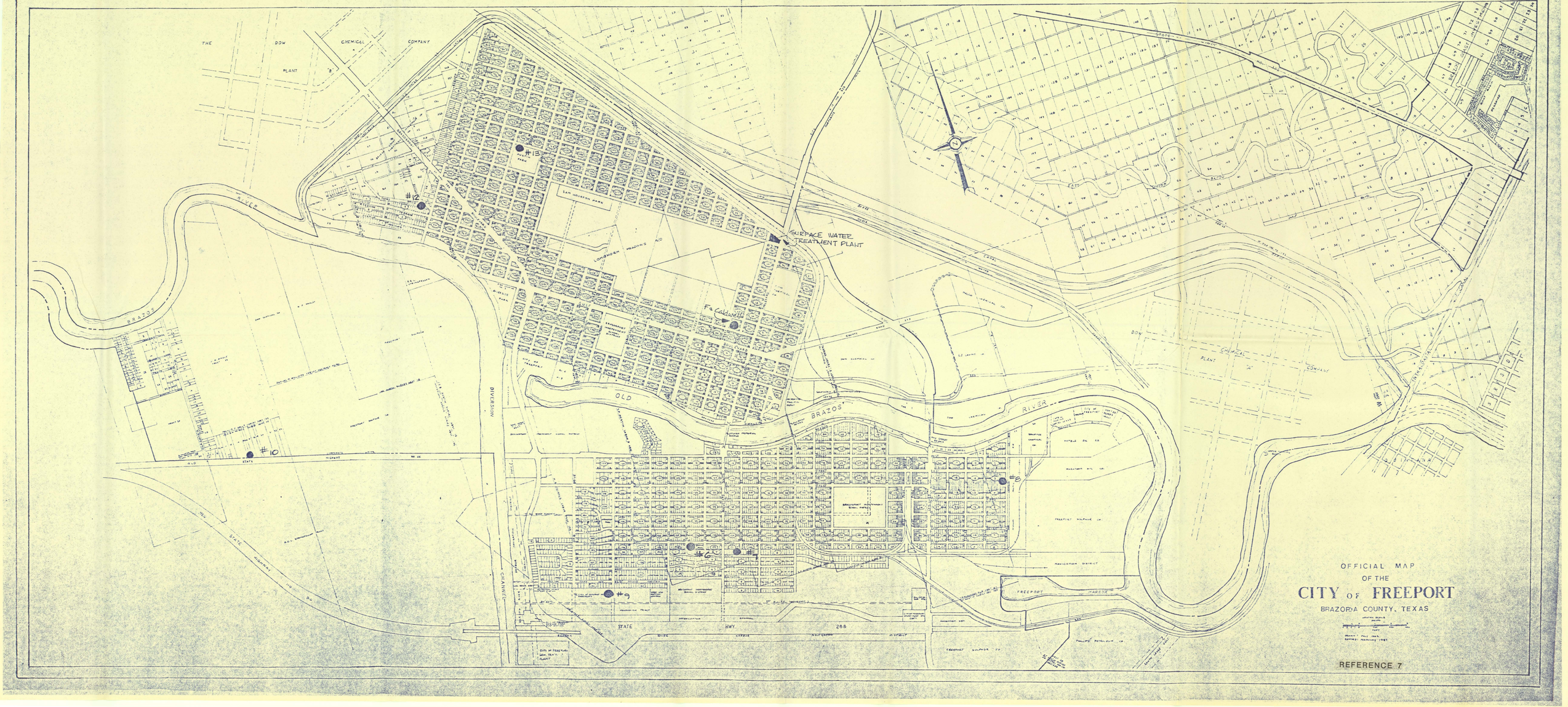
I called to clarify several points about the water resources around Freeport. I thanked him for sending me the map showing the location of the city wells. He said the one well marked E + Caldwell is well #11 on the intersection of Avenue E and Caldwell Street, which also is the location of two 500,000 gallon underground pump storage tanks. The entire utility has 3,600 connections and serves about 13,500 people. All private, domestic and industrial wells (i.e. Dow Chemical) are outside the city limits. I asked if there was any mixing between the water supply north of the old Brazos river channel verses south of the channel. He said that there is some but not much. Originally the area north of the Old Brazos was

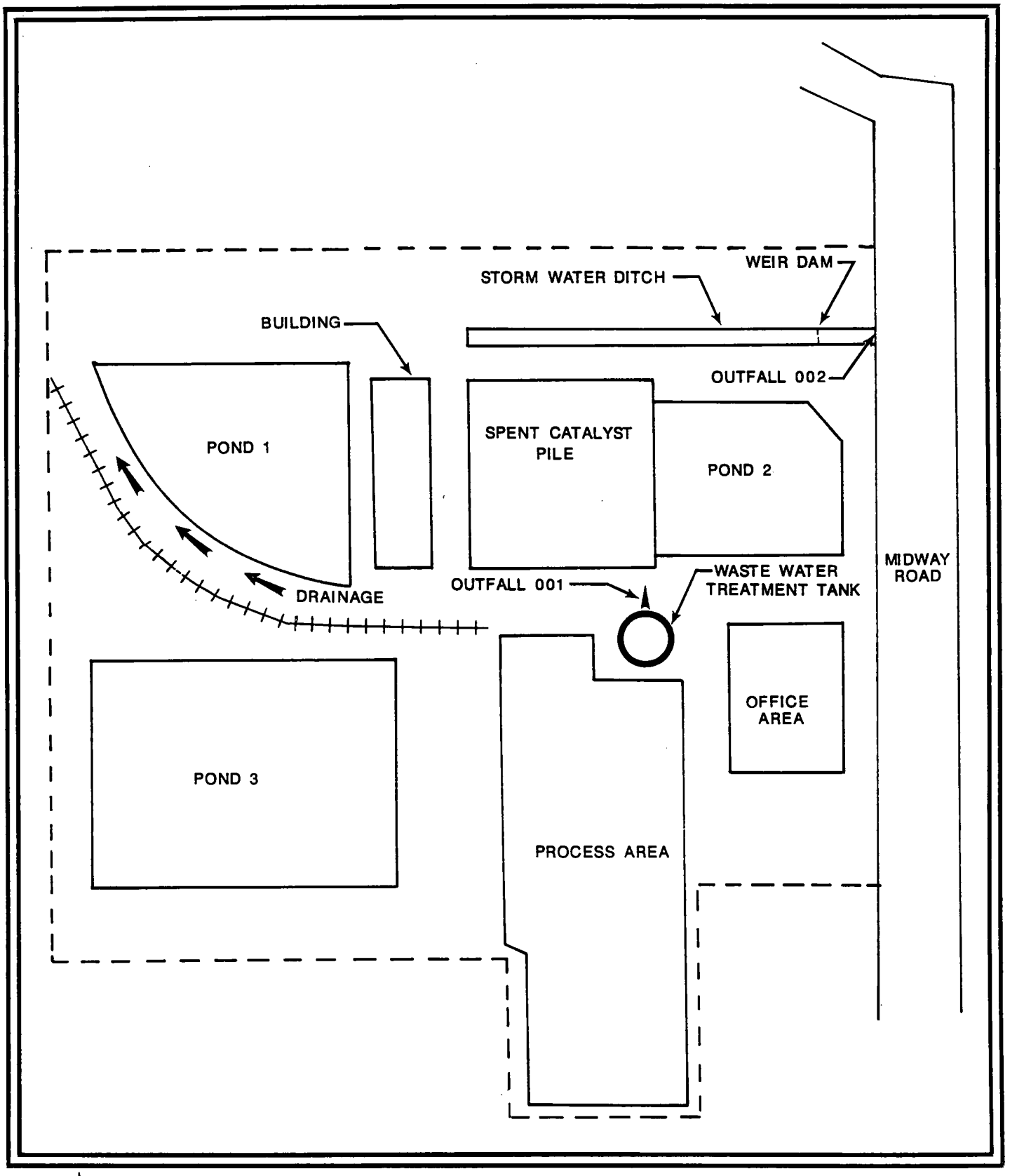
CONCLUSIONS, ACTION TAKEN OR REQUIRED

the town of Velasco and they did not have the surface water intake off the Dow Canal till they became a part of Freeport. Now the north post is primarily on surface with some ground water (i.e. well #11). The south Freeport side is primarily ground water. However, two 12" water lines go across the Old Brazos river to connect the north and south systems so there is some mixing. Ground water is found 180' - 200' deep. I asked about surface water usage and tidal influence, he said that the Brazos is salty all around Freeport due to tidal influence. Dow canal intakes are at 1) Brazoria and 2) Harris reservoirs. The intake is about 15 miles North of Freeport with the Harris 8 miles North of Brazoria, therefore the Dow fresh water canal did not have tidal influence. There is no irrigation from the surface water around Freeport due to the salty water. However, in Northern Brazoria county there was rice farming that probably used surface water irrigation, but this would be more than 10 miles from Freeport. Surface water use in the area downstream of the site would include ship and Barge transport.

INFORMATION COPIES TO:

EPA FORM 1300-6 (7-72)


OFFICIAL MAP
OF THE
CITY OF FREEPORT
BRAZORIA COUNTY, TEXAS
REFERENCE 7
THE DOW CHEMICAL COMPANY PLANT
SURFACE WATER TREATMENT PLANT
OLD BRAZOS RIVER
BRAZOS RIVER
DIVERSION CHANNEL
DOW CHEMICAL COMPANY PLANT
FREEPORT HARBOR
STATE HWY. 288
#6
#7
#8
#9
#10
#12
#13



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NOT TO SCALE

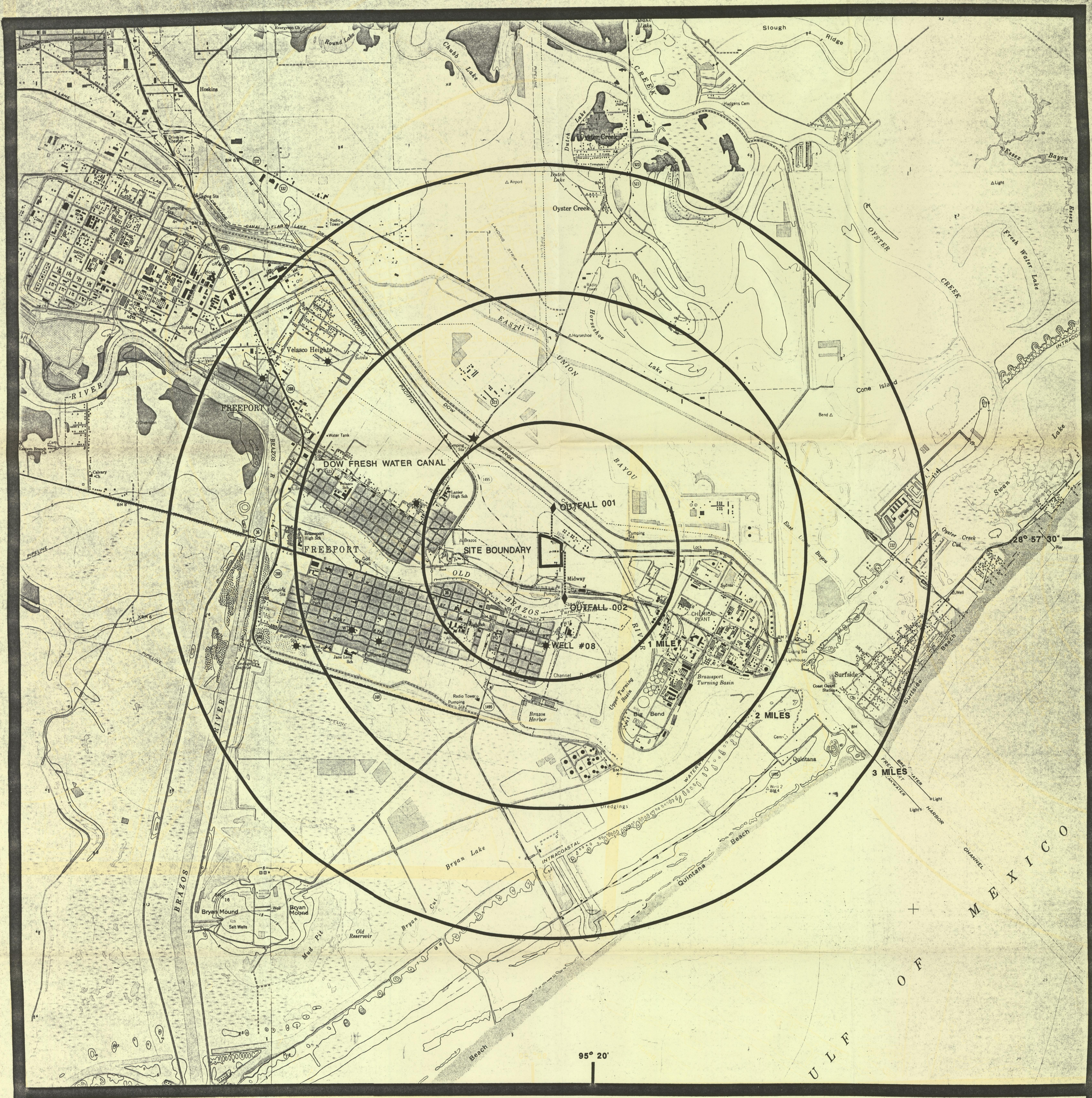
Site Sketch

GULF CHEMICAL AND METALLURGICAL

FREEPORT, TX

TDD NO. F-6-8804-27

CERCLIS NO. TXD074195678



GULF CHEMICAL AND METALLURGICAL
FREEPORT, TX

CERCLIS NO. TXD074195678

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

★ CITY OF FREEPORT SURFACE WATER INTAKE

✸ CITY OF FREEPORT WATER WELLS

········ DRAINAGE PATHWAYS

QUADRANGLES

PHOTOREVISED 1974

LAKE JACKSON, TEXAS 1963

OYSTER CREEK, TEXAS 1963

JONES CREEK, TEXAS 1963

FREEPORT, TEXAS 1964

TEXAS
QUADRANGLE LOCATION

Ref. 10

Dangerous Properties of Industrial Materials

Sixth Edition

N. Irving Sax

Dangerous Properties of Industrial Materials

Sixth Edition

N. IRVING SAX

Assisted by:

Benjamin Feiner/Joseph J. Fitzgerald/Thomas J. Haley/Elizabeth K. Weisburger

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Toxicology Review: NEURAI 3,58,53; PHREA7 19, 472,39; FNSCA6 2,67,73.

THR: A barbiturate. HIGH orl in hmn. MOD via oral route. A depressant. Large doses cause poor judgment, emotional instability and at times a toxic psychosis. Neurological signs may include nystagmus, dysarthria and ataxia. A potentially fatal dose = 5g, although recovery reported from 33g. Continued use of this material may lead to habituation.

Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

AMITRIPTYLINE-N-OXIDE

CAS RN: 4317140 NIOSH #: HO 9550000
mf: $C_{20}H_{23}NO$; mw: 293.44

SYNS:

AMITRIPTYLINOXIDE
1-PROPANAMINE, 3-(10,11-DIHYDRO-5H-DIBENZO(A,D)CYCLOHEPTEN-5-YLIDENE)-N,N-DIMETHYL-N-OXIDE

TOXICITY DATA: 3-2	CODEN:
orl-rat LD50:1800 mg/kg	ARZNAD 28,1898,78
ipr-rat LD50:110 mg/kg	ARZNAD 28,1898,78
ivn-rat LD50:25 mg/kg	ARZNAD 28,1898,78
orl-mus LD50:330 mg/kg	ARZNAD 28,1898,78
ipr-mus LD50:320 mg/kg	ARZNAD 28,1898,78
ivn-mus LD50:87 mg/kg	ARZNAD 28,1898,78
orl-dog LD50:330 mg/kg	ARZNAD 28,1898,78
orl-rbt LD50:330 mg/kg	ARZNAD 28,1898,78
orl-gpg LD50:330 mg/kg	ARZNAD 28,1898,78

THR: HIGH via ipr, ivn, and oral routes. MOD oral.

Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

AMMINE PENTAHYDROXO PLATINUM

mf: H_8NO_5Pt; mw: 297.2

THR: An explosively unstable compound. See also platinum compounds. Explodes @ > 250°.

AMMONIA

CAS RN: 7664417 NIOSH #: BO 0875000
mf: H_3N; mw: 17.04

Colorless gas, extremely pungent odor, liquefied by compression. mp: −77.7°, bp: −33.35°, lel = 16%, uel = 25%, d: 0.771 g/liter @ 0°, 0.817 g/liter @ −79°, autoign. temp.: 1204°F, vap. press: 10 atm @ 25.7°, vap. d: 0.6. Very sol in water, mod sol in alc.

SYNS:

AMMONIA ANHYDROUS
AMMONIAC (FRENCH)
AMMONIACA (ITALIAN)
AMMONIA GAS
AMMONIAK (GERMAN)
AMONIAK (POLISH)
SPIRIT OF HARTSHORN

TOXICITY DATA: 3-2	CODEN:
mmo-esc 1500 ppm/3H	AMNTA4 85,119,51
cyt-rat-ihl 19800 ug/m3/16W	BZARAZ 27,102,74
ihl-hmn LCLo:30000 ppm/5M	TJSGA8 45,458,67
ihl-hmn TCLo:20 ppm TFX:IRR	AGGHAR 13,528,55
unk-man LDLo:132 mg/kg	85DCAI 2,73,70
orl-rat LD50:350 mg/kg	PHIT**
ihl-rat LCLo:2000 ppm/4H	JIHTAB 31,343,49
ihl-mus LD50:4837 ppm/1H	NTIS** PB214-270
ihl-cat LCLo:7000 ppm/1H	JIHTAB 26,29,44
ihl-cat TCLo:1000 ppm/10M	AEHLAU 35,6,80
ihl-rbt LCLo:7000 ppm/1H	JIHTAB 26,29,44
ihl-mam LCLo:5000 ppm/5M	AEPPAE 138,65,28

Aquatic Toxicity Rating: TLm96:10-1 ppm WQCHM* 2,-,74.

TLV: Air: 25 ppm DTLVS* 4,16,80. OSHA Standard: Air: TWA 50 ppm (SCP-V) FEREAC 39,23540,74. DOT: Nonflammable Gas, Label: Nonflammable Gas FEREAC 41,57018,76. Occupational Exposure to Ammonia recm std: Air: CL 50 ppm NTIS**. "NIOSH Manual of Analytical Methods" VOL 1 205, VOL 5 S347#. Reported in EPA TSCA Inventory, 1980.

For further information see Vol. 2, No. 1 in *DPIM* Report.

THR: MUT data. A hmn IRR. HIGH orl, unk (man), ihl. Powerful irr to eyes (@ 140 ppm) and mu mem of respiratory tract. Signs and symptoms of exposure are irr of the eyes, conjunctivitis, swelling of the eyelids, irr of the nose and throat, coughing, dyspnoea and vomiting. Irr of the skin may be experienced, especially if it is moist. Corneal ulcers have been reported following splashing of ammonia water in the eye. A common air contaminant.

Fire Hazard: Low, because it is difficult to ignite, when exposed to heat or flame.

Spontaneous Heating: No. Requires high conc in air before it catches fire.

Explosion Hazard: Mod, when exposed to flame or in a fire. NH_3 + air in a fire can detonate.

Incomp: In contact with Ag, acetaldehyde, acrolein, B, BI_3, halogens, BrF_5, $HClO_3$, ClO, ClF_3, chlorites, chlorosilane, CrO_3, chromyl chloride, (ethylene dichloride + liquid ammonia), ethylene oxide, Au, hexachloromelamine, (hydrazine + alkali metals), HBr, HOCl, $Mg(ClO_4)_2$, Hg, HNO_3, NO_2, N_2O_4, NCl_3, NF_3, nitryl chloride, OF_2, P_2O_5, P_2O_3, picric acid, (K + AsH_3), (K + PH_3), (K + $NaNO_2$), $KClO_3$, potassium ferricyanide, potassium mercuric cyanide, AgCl, (Na + CO), Sb, S, SCl_2, tellurium hydropentachloride, trichloromelamine, boron halides, ClN_3, ethylene oxide, NO_2Cl, gold(III)chloride, CrO_3, dichlorine oxide, O_3F_2, ammonium peroxo disulfate, H_2O_2, (O_2 + Pt), $AgNO_3$, Ag_2O, SbH_3, $TeCl_4$, tetramethyl ammonium amide, $SOCl_2$, thiotrithiazylchloride.

Disaster Hazard: Mod dangerous; when exposed to heat, emits tox fumes of NH_3 and NO_x.

To Fight Fire: Stop flow of gas.

For further information see Vol. 3, No. 3 of *DPIM Report.*

AMMONIA-D

mf: ND_3; mw: 20.05

Gas. mp: −74°; bp: −33.4°.

SYN: TRIDEUTERIO AMMONIA

THR: See ammonia, anhydrous.

Incomp: Oxidizing materials.

SYNS:
FLAVOMYCIN
MENOMYCIN
MOENOMYCIN A

TOXICITY DATA: 3-2 CODEN:
scu-mus LD50:500 mg/kg 85ERAY 1,740,78
ivn-mus LD50:200 mg/kg 85ERAY 1,740,78

THR: HIGH ivn; MOD scu.

MOLDCIDIN B

CAS RN: 11006307 NIOSH #: QA 3710000

Produced by an actinomycete strain Streptomyces sp. 1068 (85ERAY 2,994,78)

SYN: PENTAMYCIN

TOXICITY DATA: 3-2 CODEN:
orl-mus LD50:1624 mg/kg 85ERAY 2,994,78
ipr-mus LD50:14 mg/kg 85ERAY 2,994,78

THR: HIGH ipr; MOD orl.

MOLECULAR SIEVE 13X with 14.6% DI-n-BUTYLAMINE

NIOSH #: QA 3900000

TOXICITY DATA: 2 CODEN:
eye-rbt 26 mg SEV UCDS** 6/14/60
orl-rat LD50:2000 mg/kg UCDS** 6/14/60
ihl-pig LCLo:1650 mg/m3/150M UCDS** 6/14/60

THR: MOD orl, ihl. An eye irr. See also di-n-butylamine.

MOLECULAR SIEVE 13X with 16.6% PIPERIDINE

NIOSH #: AQ 3950000

TOXICITY DATA: 2 CODEN:
eye-rbt 26 mg SEV UCDS** 6/14/60
orl-rat LD50:2800 mg/kg UCDS** 6/14/60
skn-rbt LD50:3800 mg/kg UCDS** 6/14/60

THR: HIGH orl, skn. An eye irr. See also piperidine.

MOLINDONE HYDROCHLORIDE

CAS RN: 15622658 NIOSH #: NM 3325000
mf: $C_{16}H_{24}N_2O_2 \cdot ClH$; mw: 312.88

SYNS:
3-ETHYL-6,7-DIHYDRO-2-METHYL-5-MORPHOLINO-METHYLINDOLE-4(5H)-ONE HYDROCHLORIDE
3-ETHYL-6,7-DIHYDRO-2-METHYL-5-MORPHOLINO-METHYLINDOL-4(5H)-ONE HYDROCHLORIDE

TOXICITY DATA: 3-2 CODEN:
orl-rat LD50:180 mg/kg TXAPA9 18,185,71
orl-mus LD50:670 mg/kg FEPRA7 26,738,67
ipr-mus LD50:243 mg/kg 27ZQAG -,134,72

THR: HIGH orl, ipr; MOD orl.
Disaster Hazard: When heated to decomp it emits very tox fumes of NO_x and HCl.

MOLLICELLIN C

NIOSH #: AQ 4215000

TOXICITY DATA: CODEN:
mmo-sat 20 ug/plate AEMIDF 36,412,78

THR: MUT data.

MOLLICELLIN E

NIOSH #: AQ 4250000

TOXICITY DATA: CODEN:
mmo-sat 20 ug/plate AEMIDF 36,412,78

THR: MUT data.

MOLYBDATE ORANGE

CAS RN: 12656858 NIOSH #: QA 4660000

SYNS:
CHROME VERMILION
C.I. 77605
C.I. PIGMENT RED 104
MOLYBDATE RED
MOLYBDENUM RED
NCI-C54626

TOXICITY DATA:
Reported in EPA TSCA Inventory, 1980. EPA TSCA 8(a) Preliminary Assessment Information Proposed Rule FERREAC 45,13646,80.
THR: No data. See also molybdenum and chromium.

MOLYBDENUM

CAS RN: 7439987 NIOSH #: QA 4680000
af: Mo; aw: 95.94

Cubic, silver-white metallic crystals or gray-black powder; mp: 2622°; bp: approx 4825°; d: 10.2; vap press: 1 mm @ 3102°.

TOXICITY DATA: 3 CODEN:
orl-rat TDLo:6050 ug/kg (35W pre) GISAAA 42(8),30,7
orl-mus TDLo:448 mg/kg (MGN) AEHLAU 23,102,71
ipr-rat LDLo:114 mg/kg 28ZLA8 -,214,61
itr-rbt LDLo:70 mg/kg NTIS** PB249-458

TLV: Air: 5 mg/m3 (soluble compound) DTLVS 4,289,80. Air: 10 mg/m3 (insol. compound) DTLVS 4,289,80. *Toxicology Review:* JAVMA4 164(3),277,74; FOREAE 7,313,42; KOTTAM 11(11),1300,75; "NIOSH Manual of Analytical Methods" VOL 1, 173#. Reported in EPA TSCA Inventory, 1980.
THR: HIGH ipr, itr. See also molybodenum compounds.
Fire Hazard: MOD, in the form of dust; when exposed to heat or flame, violent reaction with BrF_3, ClF_3, F_2 and PbO_2. See also powdered metals.
Explosive Hazard: Slight, in the form of dust, when exposed to flame. See also powdered metals.
Incomp: Oxidants.

MOLYBDENUM AZIDE PENTACHLORIDE

mf: Cl_5MoN_3; mw: 315.22

THR: No tox data. See also azides, chlorides. It is an explosion hazard.
Disaster Hazard: When heated to decomp it emits very tox fumes of NO_x and Cl^-.

MOLYBDENUM COMPOUNDS

THR: HIGH exper ipr and scu. Molybdenum and its compounds are highly tox based upon animal experiments. But in spite of their considerable use in industry, hmn industrial poisoning by molybdenum inhal has yet to be reported. Some studies have been made of its effects, and it is suggested that suitable precautions should be taken against human inhal of significant amounts of the more sol molybdenum compounds. Experimentally, no fatalities occurred to those subjected to molybdic oxide fumes for 25, 1-hour exposures at an average conc of 1.5 mg/cu ft of air, and only 1 fatality in 24, 1-hr exposures to molybdenite dust at an average conc of 8.1 mg/cu ft of air.

Molybdenum is rapidly excreted by the body. Experiments with the sodium salts of hexavalent chromium, tungsten and molybdenum have shown that sodium molybdate is the least tox of the three, and is less tox following intraperitoneal injection than either sodium chromate or sodium tungstate in equivalent doses. All molybdenum compounds can be referred to molybdenum or to more tox anions if present.

Recent studies have shown that molybdenum has importance as a trace element in the normal growth and development of certain forms of plant life. It is found also in animal tissue, although its precise function is unknown. It is a common air contaminant.

MOLYBDENUM DIAZIDE TETRACHLORIDE

mf: Cl_4MoN_6; mw: 321.79

THR: See also molybdenum compounds and azides.
Explosion Hazard: Highly explosive.
Disaster Hazard: When heated to decomp it emits very tox fumes of NO_x and Cl^-.

MOLYBDENUM OXIDE

CAS RN: 18868434 NIOSH #: QA 4688000
mf: MoO_2; mw: 127.94

SYN: MOLYBDENUM DIOXIDE

TOXICITY DATA: 3 CODEN:
hmn LD50:318 mg/kg ZVKOA6 19,186,74

Reported in EPA TSCA Inventory, 1980. EPA TSCA 8(a) Preliminary Assessment Information Proposed Rule FERREAC 45,13646,80.
THR: HIGH scu. See also molybdenum compounds.

MOLYBDENUM PENTACHLORIDE

CAS RN: 10241051 NIOSH #: QA 4690000
mf: Cl_5Mo; mw: 273.19

Green-black solid, dark-red as liquid or vapor; hygroscopic, reacting with water and air, sol in dry ether, dry CS and other anhydrous organic solvents; mp: 194°; bp: [illegible]°; d: 2.9.

TOXICITY DATA: 3
DOT: ORM-B, Label: None FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980.

THR: HIGH tox. See hydrochloric acid and molybdenum compounds.
Disaster Hazard: Dangerous. See also hydrochloric acid, Cl^-.

MOLYBDENUM(IV) SULFIDE

mf: MoS_2; mw: 160.07

Black lustrous powder. mp: 1185°; bp: decomp in air; d: 4.80 @ 14°.

SYNS:
MOLYBDIC SULFIDE MOLYBDENITE

THR: See also sulfides, molybdenum compounds.
Disaster Hazard: When heated to decomp it emits tox fumes of SO_x.
Incomp: Potassium nitrate. Violent reaction with H_2O_2.

MOLYBDENUM TRIOXIDE

CAS RN: 1313275 NIOSH #: QA 4725000
mf: MoO_3; mw: 143.94

White or yellow to slightly bluish powder or granules; sol in 1000 parts water in conc mineral acids and solutions of alkali hydroxides, ammonia or potassium bitartrate; mp: 795°; bp: 1155°; d: 4.696 @ 26°/4° which solidifies to a yellowish-white mass, sublimes at higher temp; Low solubility in H_2O.

SYNS:
MOLYBDIC ANHYDRIDE MOLYBDIC TRIOXIDE

TOXICITY DATA: 3 CODEN:
ipr-mus TDLo:4750 mg/kg/7W-I TFX:NEO CNREA8 36,1744,76
orl-rat LD50:125 mg/kg 28ZLA8 -,214,61
ipr-gpg LDLo:400 mg/kg 12VXA5 8,699,68
ihl-man TCLo:6 mg/m3/4Y TFX:PUL NTIS** AEC-T
ihl-rat LC75:431 mg/m3/1H EQSSDX 1
scu-mus LD50:94 mg/kg ZVKOA6

OSHA Standard: Air: TWA 5 mg(Mo)/m FEREAC 39,23540,74. Reported in EPA TSCA tory, 1980. EPA TSCA 8(a) Preliminary Assessm Information Proposed Rule FERREAC 45,13646,80.
THR: An exper NEO. A hmn PUL. HIGH orl, ipr, scu, ihl. A powerful irr. See also molybdenum compounds. Violent reaction with ClF_3, Li, Mg, K, Na.
Incomp: Interhalogens; metals.

MONILIFORMIN

CAS RN: 52591227 NIOSH #: QA 6130000

Isolated from Fusarium Moniliforme sheldon, a fungus found on maize (FCTXAV 15,579,77)

TOXICITY DATA: 3-2 CODEN:
orl-rat LD50:41 mg/kg FCTXAV 15,579,77
orl-ckn LD50:4 mg/kg FCTXAV 15,579,77
orl-dck LD50:3680 mg/kg FCTXAV 15,579,77

THR: HIGH orl; MOD orl.

i-VALERYL-k-STROPHANTHIDIN

CAS RN: 63979737 NIOSH #: FH 4980000
mf: $C_{28}H_{40}O_7$; mw: 488.68

SYN: ISOVALERYL-K-STROPHANTHIDIN

TOXICITY DATA: 3 CODEN:
ivn-cat LDLo:880 ug/kg AEPPAE 185,329,37
ivn-rbt LDLo:700 ug/kg AEPPAE 185,329,37

THR: HIGH ivn.
Disaster Hazard: When heated to decomp it emits acrid smoke and fumes.

VALINE

CAS RN: 72184 NIOSH #: YV 9361000
mf: $C_5H_{11}NO_2$; mw: 117.17

An essential amino acid; white crystalline solid; sol in water; very slightly sol in alc; insol in ether; mp (dl): 298° (decomp); mp (1): 315°; d (1): 1.230.

SYNS:
L(+)-ALPHA-AMINOISOVALERIC ACID L-VALINE

TOXICITY DATA: 1 CODEN:
ipr-rat LD50:5390 mg/kg ABBIA4 58,253,55

Reported in EPA TSCA Inventory, 1980.
THR: LOW ipr. A nutrient and/or dietary supplemental food additive.
Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

d-VALINE

CAS RN: 640686 NIOSH #: YV 9360000
mf: $C_5H_{11}NO_2$; mw: 117.17

TOXICITY DATA: 1 CODEN:
ipr-rat LD50:6093 mg/kg ABBIA4 64,319,56

Reported in EPA TSCA Inventory, 1980.
THR: LOW ipr.
Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

VALINOMYCIN

CAS RN: 2001958 NIOSH #: YV 9468000
mf: $C_{54}H_{90}N_6O_{18}$; mw: 1111.50

Shiny rectangular platelets. mp: 190°. Almost insol in water; very sol in petr ether, ether, benzene, chloroform, glacial acetic acid, butyl acetate, acetone.

SYN: ANTIBIOTIC N-329 B

TOXICITY DATA: 3 CODEN:
orl-mus LD50:2500 ug/kg 85ERAY 1,325,78
ipr-mus LD50:980 ug/kg 85ERAY 1,325,78
scu-mus LD50:4140 ug/kg 85ERAY 1,325,78

Reported in EPA TSCA Inventory, 1980.
THR: HIGH orl, ipr, scu.
Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

VALISONE

CAS RN: 2152445 NIOSH #: TU 3835000
mf: $C_{27}H_{37}FO_6$; mw: 476.64

SYNS:
BETAMETHASONE-17-VALERATE BETA-METHASONE-17-VALERATE

TOXICITY DATA: 3-2 CODEN:
scu-rat LDLo:2000 mg/kg ARZNAD 27,2102,77
scu-mus LDLo:100 mg/kg ARZNAD 27,2102,77

THR: HIGH scu; MOD scu.
Disaster Hazard: When heated to decomp it emits tox fumes of F^-.

VALONEA TANNIN

NIOSH #: YW 0305000

SYNS:
QUERCUS AEGILOPS L. TANNIN TANNIN FROM VALONEA

TOXICITY DATA: 3 CODEN:
scu-rat TDLo:750 mg/kg/2W-I TFX:ETA BJCAAI 14,147,60

THR: An exper ETA. See also tannin.

VANADIUM

CAS RN: 7440622 NIOSH #: YW 1355000
af: V; aw: 50.94

A bright white, soft ductile metal; slightly radioactive; bp: 3000°; d: 6.11 @ 18.7°; mp: 1917°. Insol in water.

TOXICITY DATA: 3 CODEN:
ims-rat TDLo:340 mg/kg/43W-I TFX:ETA NCIUS* PH 43-64-886,SEPT,71

TLV: Air: 0.05 mg/m3 DTLVS* 4,425,80. Occupational Exposure to Vanadium recm std: Air: TWA 1.0 mg(V)/m3 NTIS**. "NIOSH Manual of Analytical Methods" VOL 3 S391, VOL 5 173#,290#. Reported in EPA TSCA Inventory, 1980.
THR: An exper ETA. See also vanadium compounds.
Fire Hazard: MOD in dust form from heat or flame, sparks.
Disaster Hazard: Violent reaction with BrF_3, Cl_2, Li, oxidants.

VANADIUM AZIDE TETRACHLORIDE

mf: Cl_4N_3V; mw: 234.76

THR: No tox data. See also vanadium compounds, azides, chlorides. Explosive.
Disaster Hazard: When heated to decomp it emits very tox fumes of Cl^- and NO_x.

VANADIUM COMPOUNDS

THR: Variable. Vanadium compounds act chiefly as irr to the conjunctivae and respiratory tract. Prolonged exposures may lead to pulmonary involvement. There is still some controversy as to the effects of industrial exposure on other systems of the body. Responses are acute, never chronic.

The first report of vanadium poisoning in hmns described rather widespread systemic effects, consisting of polycythemia, followed by red blood cell destruction and anemia, loss of appetite, pallor and emaciation, albuminuria and hematuria, gastrointestinal disorders, nervous complaints and cough, sometimes severe enough to cause hemoptysis. More recent reports describe symptoms which, for the most part, are restricted to the conjunctivae and respiratory system, no evidence being found of disturbances of the gastrointestinal tract, kidneys, blood or CNS. Though certain workers believe that it is only the pentoxide which is harmful, other investigators have found that patronite dust (chiefly vanadium sulfide) is quite tox to animals, causing acute pulmonary edema. The fumes are highly tox.

Symptoms and signs of poisoning are pallor, greenish-black discoloration of the tongue, paroxsymal cough, conjunctivitis, dyspnea and pain in the chest, bronchitis, rales and rhonchi, bronchospasm, tremor of the fingers and arms, radiographic reticulation. See also specific compounds.

These are common air contaminants.

VANADIUM DICHLORIDE

CAS RN: 10580526 NIOSH #: YW 1575000
mf: Cl_2V; mw: 121.84

Hexagonal green plates, deliquescent. d: 3.23 @ 18°. Sol in absolute alc; glacial acetic acid.

TOXICITY DATA: 2 CODEN:
orl-rat LD50:540 mg/kg AIHAAP 30,470,69

Occupational Exposure to Vanadium recm std: Air: CL 0.05 mg(V)/m3/15M NTIS**.

THR: MOD orl. See hydrochloric acid and vanadium compounds.

Disaster Hazard: Dangerous; see chlorides; will react with water or steam to produce tox and corrosive fumes.

VANADIUM ORE

NIOSH #: YW 1630000

TOXICITY DATA: 3 CODEN:
ihl-hmn TDLo:4 ug/kg:PUL AMIHAB 12,635,55

Occupational Exposure to Vanadium recm std: Air: CL 0.05 mg(V)/m3/15M NTIS**.

THR: A hmn PUL. See also vanadium compounds.

VANADIUM OXIDE TRIISOBUTOXIDE

CAS RN: 19120628 NIOSH #: YW 1115000
mf: $C_{12}H_{27}O_4V$; mw: 287.14

SYNS:
ISOBUTYL ORTHOVANADATE
TRIISOBUTOXYOXOVANADIUM
TRIISOBUTYL ORTHOVANADATE
TRIISOBUTYL VANADATE
TRIISOPROPOXYVANADIUM OXIDE

TOXICITY DATA: 3-2 CODEN:
skn-rbt 500 mg/24H SEV PESTC* 9,5,80
eye-rbt 100 mg SEV PESTC* 9,5,80
orl-rat LD50:293 mg/kg PESTC* 9,5,80
skn-rbt LD50:1930 mg/kg PESTC* 9,5,80

THR: HIGH orl; MOD skn. A skn, eye irr. See also vanadium compounds.

Disaster Hazard: When heated to decomp it emits acrid smoke and fumes of VO_x.

VANADIUM OXYTRICHLORIDE

CAS RN: 7727186 NIOSH #: YW 2975000
mf: Cl_3OV; mw: 173.29

Yellow deliques liquid; mp: −77° ± 2°; bp: 126.7°; d: 1.811 @ 32°.

SYN: VANADYL TRICHLORIDE

TOXICITY DATA: 3 CODEN:
orl-rat LD50:140 mg/kg AIHAAP 30,470,69

DOT: Corrosive Material, Label: Corrosive FEREAC 41,57018,76. Occupational Exposure to Vanadium recm std: Air: CL 0.05 mg(V)/m3/15M NTIS**. Reported in EPA TSCA Inventory, 1980.

THR: HIGH orl. See vanadium compounds and hydrochloric acid. Can react violently with P.

Disaster Hazard: When heated to decomp it emits tox fumes of Cl^-.

For further information see Vol. 1, No. 8 and Vol. 2, No. 2 of *DPIM Report.*

VANADIUM PENTOXIDE (DUST)

CAS RN: 1314621 NIOSH #: YW 2450000
mf: O_4V_2; mw: 181.88

Yellow to red crystalline powder. mp: 690°; bp: decomp @ 1750°; d: 3.357 @ 18°.

SYNS:
ANHYDRIDE VANADIQUE (FRENCH)
C.I. 77938
VANADIC ANHYDRIDE
VANADIUM OXIDE
VANADIO, PENTOSSIDO DI (ITALIAN)
VANADIUMPENTOXID (GERMAN)
VANADIUMPENTOXYDE (DUTCH)
VANADIUM, PENTOXYDE DE (FRENCH)
WANADU PIECIOTLENEK (POLISH)

TOXICITY DATA: 3 CODEN:
mrc-bcs 500 mmol/L MUREAV 77,109,80
ihl-hmn TCLo:346 mg/m3:PUL AMIHAB 19,497,59
ihl-hmn TCLo:1 mg/m3/8H:ALR AEHLAU 14,709,67
orl-rat LD50:10 mg/kg ATXKA8 16,182,56
ihl-rat LCLo:70 mg/m3/2H NTIS** AEC-TR-6710
ipr-rat LD50:12 mg/kg ATXKA8 16,182,56
scu-rat LD50:14 mg/kg ATXKA8 16,182,56
itr-rat LDLo:25 mg/kg NTIS** AEC-TR-6710
scu-mus LD50:10 mg/kg ZVKOA6 19,186,74
ihl-cat LCLo:500 mg/m3/23M 30ZIAO -,140,64
scu-rbt LDLo:20 mg/kg 27ZWAY 3.3,1541,-
ivn-rbt LDLo:10 mg/kg 27ZWAY 3.3,1541,-
scu-gpg LDLo:20 mg/kg 30ZIAO -,140,64

TLV: Air: 0.5 mg/m3 DTLVS* 3,275,71. *Toxicology Review:* FRMBAZ 21(6),325,73; 85DHAX V,46,74; 27ZTAP 3,150,69. OSHA Standard: Air: CL 500 ug/m3 (SCP-O) FEREAC 39,23540,74. Occupational Exposure to Vanadium recm std: Air: CL 0.05 mg(V)/

RECORD OF COMMUNICATION	|x| Phone Call |_| Discussion |_| Field Trip |_| Conference |_| Other (Specify) Ref. 11

(Record of Item Checked Above)

TO:	FROM:	DATE
Ron Bisbee	John L. Jones	6/30/88
US Fish and Wildlife	FIT Analyst	TIME
Angleton, TX	ICF Technology	1115
(409) 849-6062	(214) 744-1641	

SUBJECT

Location Of Wildlife Refuges, Endangered Species Habitats, and Wetlands In The Area

SUMMARY OF COMMUNICATION

Mr. Bisbee said that he manages the wildlife refuges in the area and that there are no Federal refuges within 1 mile or less. The closest refuge is a state wildlife refuge 3-4 miles to the west. There are 2 federal refuges 5-6 miles away. As for endangered species habitats, there are Brown Pelicans at the San Bernard, refuge 9-10 miles away from Freeport. Since Freeport was built on salt water marshes the surrounding marshes (located on the topo) are considered coastal wetlands, because there is tidal influence and the water in the marshes is salty. There are no fresh water wetlands within 1 mile or less. He said he would send me a copy of a map locating these coastal wetlands. Mr. Bisbee said for more information I could call the US Wildlife Ecological Services field office in Clear Lake at (713) 750-1700, where they have

CONCLUSIONS, ACTION TAKEN OR REQUIRED

staff biologists that could answer questions on endangered species and wildlife impact refuges. The Field Supervisor there is David Handly.

INFORMATION COPIES TO:

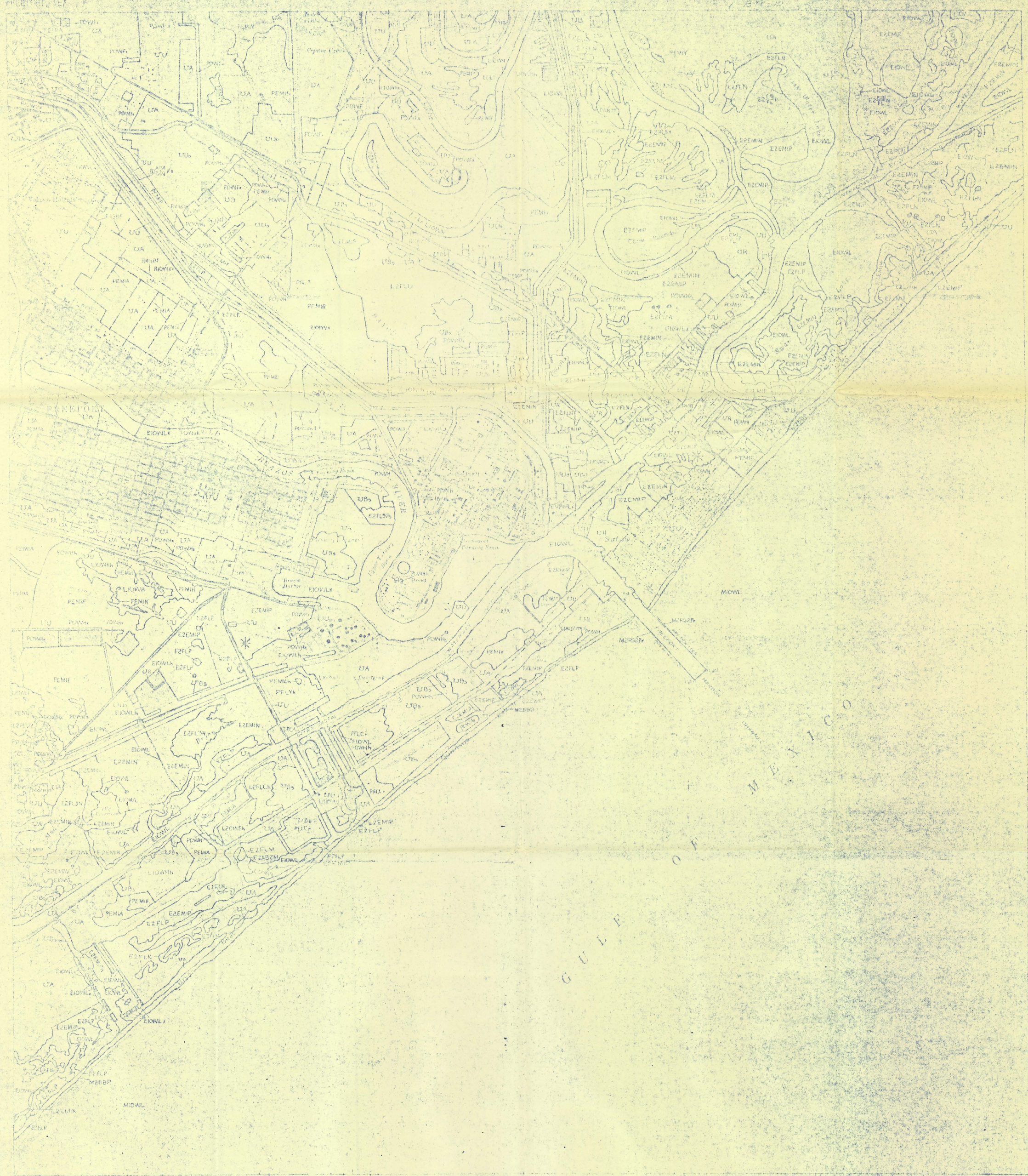
EPA FORM 1300-6 (7-72)
Replaces EPA HQ Form 5300-3 Which May Be Used Until Supply is Exhausted.

NATIONAL WETLANDS INVENTORY

UNITED STATES DEPARTMENT OF THE INTERIOR

REFERENCE 12

FREEPORT, TEX



DAY CITY NW

FREEPORT, TEX

28°52'30"

95°45'

MAP LEGEND

Other information concerning the wetland resources depicted on this document may be available. For information, contact:

Regional Director (ARDE) Region II
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103

SPECIAL NOTE

This document was prepared primarily by stereoscopic analysis of high-altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and topography in accordance with Classification of Wetlands and Deep Water Habitats of the United States (An Operational Draft), Cowardin, et al, 1977. The aerial photographs typically reflect conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of the aerial photographs. Thus, a detailed on-the-ground and historical analysis of a single site may result in a revision of the wetland boundaries established through photographic interpretation. In addition, some small wetlands and those obscured by dense forest overstory may be excluded on this document.

Federal, State and local regulatory agencies with jurisdiction over wetlands may define and delineate wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, State or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

SYMBOLOGY EXAMPLE

NOTES TO THE USER

- Wetlands which have been field examined are indicated on the map by an asterisk (*).
- Observance type (either migratory or sedentary animal) can be added to the map by the interested user.
- Additions or corrections to the wetlands information displayed on this map are solicited. Please forward such information to the address indicated.
- Some areas designated R4SB, R4SBJ, or R4SBJ (intermittent streams) may not meet the definition of wetlands.

AERIAL PHOTOGRAPHY

DATE	11 / 7 / 79
SCALE	1:65 000
TYPE	CIR
DATE	/ /
SCALE	
TYPE	
DATE	/ /
SCALE	
TYPE	

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Prepared by Office of Biological Services for the National Wetlands Inventory

WETLAND LEGEND

(*) Primarily represents upland areas, but may include unidentified wetlands which remain in specified areas, non-photo-identifiable areas and/or cartographic omissions.

ECOLOGICAL SYSTEM — E — ESTUARINE

1 - Subtidal — 2 - Intertidal

ECOLOGICAL SYSTEM — M — MARINE

1 - Subtidal — 2 - Intertidal

ECOLOGICAL SYSTEM — P — PALUSTRINE

ECOLOGICAL SYSTEM — L — LACUSTRINE

1 - Littoral — 2 - Limnetic

ECOLOGICAL SYSTEM — R — RIVERINE

1 - Tidal — 2 - Lower Perennial — 3 - Upper Perennial — 4 - Intermittent

MODIFYING TERMS

WATER REGIMES — Tidal, Lunar, Irregular, Regular, Diurnal, Semi-diurnal, Mixed semi-diurnal, Permanent, Seasonal, Intermittent, Temporary, Saturated, Artificial, Permanent, Seasonal, Intermittent, Temporary, Artificial

WATER CHEMISTRY — Coastal salinity, Inland salinity, pH Modifiers (for all Palustrine)

SOIL — Organic, Mineral

SOIL COLOR MODIFIERS — Dark, Dark Surface, Black, Gleyed, Low Chroma, Redox Features

RECORD OF COMMUNICATION	[x] Phone Call [ ] Discussion [ ] Field Trip [ ] Conference [ ] Other (Specify) Ref. 13

(Record of Item Checked Above)

TO:	FROM:	DATE
Bill Shipp Water Superintendent Freeport Service Bldg. Freeport, TX.	John L. Jones FIT Analyst ICF Technology (214) 744-1641	7-7-88 TIME 1205

SUBJECT (409) 233-4241
Alternative Source Of Water For Freeport

SUMMARY OF COMMUNICATION

Mr. Ship said that currently the city obtains 1.3 million gpd. of surface water from Dow's fresh water canal. The balance is from ground water for a total of 2.13 million gpd. The contract with Dow expires in 1990-1991, however, there is a clause in the contract with Dow that if an alternate source of surface water becomes available then Dow could cancel the contract earlier. An alternate source will become available in March 1989. Freeport will begin obtaining 2 million gpd. from the Brazos Port Water Authority (BWA) that is installing a pipe line from far upstream on the Brazos rive to serve Angleton, Clute Lake Jackson, Brazoria, Surfside and Freeport. At that time Mr. Ship fully anticipates that Dow will cancel the contract and the shortfall between the city's need of 2.133 million gpd.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

per day and the supply of 2 million gpd. from BWA will still require the use of the city's wells. He said that the city will always use the wells and surface water in combination since one source alone will not be sufficient.

INFORMATION COPIES
TO:

EPA FORM 1300-6 (7-72)
Replaces EPA HQ Form 5300-3 Which May Be Used Until Supply is Exhausted.

Ref. 14

PRELIMINARY INVESTIGATION OF THE GROUND WATER RESOURCES OF THE GULF COAST REGION, TEXAS

TEXAS WATER COMMISSION

[illegible]

[illegible]

Texas Water Development Board

The upper part of the Beaumont Clay fronts many of the lagoons and bays along the coast and extends inland adjacent to the major river valleys as alluvial plains. The formation here is composed of interbedded, unconsolidated, light-colored sands and clays and minor lenses of gypsum, coquina, and caliche. It ranges in thickness from 0 to 200(?) feet.

Sands in the alluvial plains are a minor source of water for domestic and livestock needs except in the Rio Grande Valley where they may yield small to large amounts for irrigation, industry, and public supply. Sand beds in the upper part of the Beaumont Clay near the coast yield only small to moderate amounts of water used chiefly for public supply and industry. However, as these sand beds contain only small quantities of fresh water, they generally cannot sustain heavy pumping without resultant salt-water invasion.

Recent Series

Eolian Deposits

Widespread eolian deposits cover almost 2,800 square miles in the southern part of the region, being thickest in Kenedy County where dunes are 30 to 50 feet high. Farther west, the dunes are smaller and more stable. Dominantly west-blowing winds, semiarid climate, and the concentration of sand on the beaches of Kenedy County by longshore currents are the factors that create a more or less constant movement of sand dunes toward the interior. The sand is very fine, light-colored, well sorted, and unconsolidated. The sands readily absorb rains and in some places they yield small quantities of water to wells but should not be considered a dependable source for large supplies.

Alluvium

The upper delta deposits of the Rio Grande are an important source of ground water and they yield moderate to large quantities of fresh water for irrigation, public supply, and industry. The unconsolidated deltaic sands, silts, and clays are 100 to 300 feet thick near the river.

Along the lower reaches of the Brazos River, unconsolidated sands and gravels of the Brazos River alluvium yield moderate to large quantities of water for irrigation, public supply, and industrial purposes.

Except along the Brazos River and the Rio Grande, most of the Recent alluvial deposits along the rivers crossing the region are less than 30 feet thick and are not principal sources of water.

Wave and storm action along the coast have built off-shore islands and sand dunes. These dune and island deposits, which consist of well-sorted, unconsolidated, fine sand, 50 or more feet thick, produce sufficient water for livestock and domestic needs in many places. Larger supplies of moderately saline water have been developed for sanitary and fire-fighting purposes on Matagorda and Mustang Islands, but are no longer used. The unconsolidated clay and silt that gradually is filling the bays and lagoons are not sources of fresh water.

Aquifers

Because of the difficulty in differentiating the rocks of Miocene, Pliocene, and Pleistocene age in the subsurface, the rocks are grouped into four major aquifers. Figure 9 shows the areal extent of the aquifers.

The principal aquifer in the region includes the Goliad Sand, Willis Sand, and Lissie Formation. The aquifer yields large quantities of fresh to slightly saline water in a wide belt extending from the Rio Grande to the Sabine River (Figure 9). Most of the water in the Goliad, Willis, and Lissie in subregions I, II, and III is fresh--less than 1,000 ppm (parts per million) dissolved solids--and the sands have a large coefficient of transmissibility. Much of the water in subregions IV and V is slightly saline and the thinner sands have a much smaller coefficient of transmissibility.

The aquifer that includes the Catahoula Sandstone, Oakville Sandstone, and the Lagarto Clay yields small to large quantities of fresh to slightly saline water in a wide belt extending from near the Rio Grande to the Sabine River (Figure 9). The aquifer in the Catahoula, Oakville, and Lagarto has less sand thickness than that in the Goliad, Willis, and Lissie and a smaller coefficient of transmissibility. Also, the chemical quality of the water is much less consistent. In many parts of the region, water from the Catahoula, Oakville, and Lagarto is slightly saline, although fresh water is yielded from many wells, especially in subregions I, II, and III.

The Beaumont Clay is an aquifer in a large part of the region between the Nueces and Sabine Rivers; wells tapping sand beds in the Beaumont Clay yield small to moderate amounts of water throughout much of the area outlined on Figure 9. Where the wells tap the basal sand (Alta Loma of Rose (1943)) in southeastern Harris County, Galveston County, and Orange County, they yield large quantities of fresh to slightly saline water. The quality of water from the Beaumont Clay generally is better east of the Colorado River than west.

Alluvium of Recent age is a principal aquifer in the Rio Grande Valley in Hidalgo and Cameron Counties (Figure 9). The chemical quality of water from the alluvium in the Lower Rio Grande Valley varies considerably from place to place, but generally is better nearer the river (Baker and Dale, 1961, p. 49).

Alluvium also is an aquifer in other major river valleys crossing the region, although it is used extensively only in the Brazos River Valley. Major wells tapping the alluvium in the Freeport area yield water for public supplies and industries. Irrigation wells tap the alluvium in Waller, Fort Bend, and Brazoria Counties.

Figure 9 shows that in many parts of the region a single well might tap two or more of the major aquifers; in fact, many wells do, especially the large-capacity wells in the Houston area.

GROUND WATER IN THE SAN JACINTO RIVER BASIN AND ADJACENT COASTAL AREAS (SUBREGION II)

General

Subregion II is the smallest subregion, having an area of about 5,500 square miles, but it has about 50 percent of the population (about 1,500,000). Houston, the largest city, had a population of more than 938,000 in 1960. Galveston, the second largest, had a population of about 67,000.

The climate is moist subhumid; the average annual precipitation at Houston is about 45 inches.

For discussion, subregion II is divided into thirds, roughly of the same size, designated the northern, central, and southern. The northern third lies north of a line extending through the intersection of U. S. Highway 290 and the Harris-Waller County line and the intersection of U. S. Highway 59 and the Liberty-Montgomery County line. The southern third lies south of a line that passes through the common corner of Fort Bend, Harris, and Brazoria Counties and the point where the San Jacinto River enters Galveston Bay just south of Baytown (Plate 4).

Occurrence

Fresh to slightly saline water is present in nearly every part of subregion II. The most prolific water-bearing sands are in the central third in Harris County and adjoining parts of Waller, Fort Bend, and Liberty Counties. The base of the fresh to slightly saline water in part of this area is more than 3,000 feet below sea level, although in most of the area it is between 2,000 and 3,000 feet below sea level and is at or above sea level near a salt dome in western Harris County (Plate 5). Nearly all of the areas where the base of fresh to slightly saline water is at a shallow depth are associated with salt domes or oil fields.

The total thickness of the fresh to slightly saline water-bearing sands in the central third of the subregion is generally between 800 and 1,200 feet (Plate 6). Most of the sand in this area is in the upper 1,500 feet of sediments (principally the aquifer in the Goliad, Willis, and Lissie) where the ratio of sand to clay is from 1:1 to 2:1. The deeper sediments contain a smaller ratio of sand to clay and are principally in the aquifer in the Lagarto, Oakville, and Catahoula.

In the southern third, the base of the fresh to slightly saline water rises rather sharply from about 2,400 feet below sea level in Harris County to 1,000-1,400 feet below sea level in Brazoria and Galveston Counties, thence it rises gently to 600-800 feet at the coastline.

The principal aquifer in the southern third is the Beaumont Clay. In western Chambers County, southeastern Harris County, and Galveston County, a massive sand 100 to 250 feet thick at the base of the Beaumont Clay, the Alta Loma sand, yields large quantities of water to wells. However, the Alta Loma contains salty water in southern Galveston County in the Texas City and Galveston areas.

The Alta Loma is present in extreme eastern and southern Brazoria County near the coast, but is not recognizable in the central and northern parts of the County. The sand beds in the upper part of the Beaumont Clay throughout most of Galveston and Brazoria Counties in subregion II furnish moderate to large quantities of water to major wells, although near the coast the water is generally slightly saline. In northern Brazoria County and the southeast corner of Fort Bend County, the upper part of the Goliad, Willis, and Lissie yields water to wells, but the lower part contains moderately saline to saline water. The total thickness of fresh to slightly saline water sand in the southern third ranges from less than 100 to more than 800 feet, averaging about 400 feet (Plate 6).

In the northern third, the base of the fresh to slightly saline water zone is generally from 1,400 feet to 2,000 feet below sea level. However, an area in central Montgomery County possibly has fresh to slightly saline water at a depth as great as 3,600 feet below sea level. The presence of fresh to slightly saline water to this depth is indicated by electric logs but has not been confirmed by sampling. Sand beds containing moderately saline to saline water lie above the deep fresh to slightly saline water and below the general level of the base of the fresh to slightly saline water (Plate 5). Some of the northern third was not contoured because of the lack of electric logs and other data.

The principal aquifer in the northern third is in the Catahoula, Oakville, and Lagarto. The Goliad, Willis, and Lissie yield moderate to large quantities of water to wells in northeastern Waller, southern Montgomery, and northwestern Liberty Counties but thins rapidly northward so that only shallow wells tap the section in the latitude of Conroe. The Catahoula, Oakville, and Lagarto yields moderate to large quantities of water to wells throughout the northern third.

Section D-D' (Figure 6) through subregion II shows that the thickest part of the fresh to slightly saline water zone and the greatest total thickness of sands are in the central third. Although much of the northern third has a thick fresh to slightly saline water zone, the thickness of sand is proportionately less because most of the zone is made up of the aquifer in the Catahoula, Oakville, and Lagarto, which has a much lower ratio of sand to clay than does the aquifer in the Goliad, Willis, and Lissie.

Major wells in the central third discharge from 1,000 to more than 3,000 gpm and average about 2,000 gpm. The specific capacities of wells in this part of the subregion range from 20 to 55 gpm per ft. The major wells tap from 1 to 20 or more different sand beds, and most withdraw water from more than one formation, although those wells that tap the Alta Loma sand in eastern Harris County generally do not tap underlying sand beds. Most major wells in the central third tap sands in the aquifer in the Goliad, Willis, and Lissie, although many also tap sand beds in the Catahoula, Oakville, and Lagarto. Wells are as deep as 2,500 feet. The coefficient of transmissibility of the Alta Loma sand ranges from 90,000 to 150,000 gpd per ft. The coefficient of transmissibility measured in the other aquifers in the central third ranged from 50,000 to more than 200,000 gpd per ft., depending on the thickness of sands tapped by the well.

Major wells that tap the Alta Loma sand in the southern third yield from 750 to 1,500 gpm; the wells have specific capacities ranging from 20 to 40 gpm per ft. Major wells tapping the sand in the upper part of the Beaumont Clay yield from 100 to 500 gpm and have specific capacities of from less than 5 gpm per ft. to as much as 20 gpm per ft. The coefficient of transmissibility of

the sands in the upper part of the Beaumont ranges from less than 5,000 to as much as 40,000 gpd per ft. In subdivision SJ-BR-3, several major wells are less than 150 feet deep, tapping alluvium of Recent age. Most of them are used for the irrigation of row crops during periods of below-normal precipitation.

Major wells tapping the aquifer in the Goliad, Willis, and Lissie in the northern third yield from 300 to 2,500 gpm. The specific capacities of wells tested ranged from 8 to 40 gpm per ft. and the coefficient of transmissibility ranged from 6,000 to 85,000 gpd per ft. Major wells tapping sand beds in the Catahoula Sandstone and the Lagarto Clay yield from 100 to 1,000 gpm. The specific capacity in those wells tested was about 8 gpm per ft. or less and the coefficient of transmissibility ranged from 14,000 to 45,000 gpd per ft.

Chemical Quality

The chemical quality of ground water in subregion II is generally very good, especially in the central third. Except for the water in the slightly to moderately saline zones, the hardest water is yielded by wells generally less than 500 feet deep. Most of the water from deeper wells is softer than that from shallow wells except where the dissolved-solids content is more than 1,000 ppm. Most of the water in subregion II in the fresh to slightly saline zone has a dissolved-solids content of less than 500 ppm.

Table 4 contains chemical analyses of water from representative wells in subregion II--31 fresh, 4 slightly saline, and 2 moderately saline. All three types of water can be obtained anywhere in the subregion except that fresh water is unavailable in an area near the coast in Brazoria and Galveston Counties. In the rest of subregion II slightly saline and moderately saline water lie successively beneath the fresh water. In sands that are continuous over several miles, all three types of water can be obtained in the same sand because progressively more saline water is present downdip beyond the body of fresh water.

Because of the many different sand beds tapped by most major wells, the quality of the water produced from adjacent wells may be significantly different. The permeability and thickness of the sand beds change from place to place. Thus, if two similarly screened wells are 1,000 feet apart, one may obtain a greater proportion of water from a different depth. The temperature of the water discharged from wells also is different in many places for the same reason. The temperature of ground water in subregion II normally is equal to the average annual air temperature plus about 1°F for each 75 to 100 feet of depth. Wells less than 1,000 feet deep generally yield water between 70° and 80°, wells between 1,000 and 1,800 feet deep yield water between 80° and 90°, and wells deeper than 1,800 feet yield water of 90°, or more.

Water suitable for public supply is obtained in the northern third from wells tapping the aquifer in the Catahoula, Oakville, and Lagarto and in the southern part from the aquifer in the Goliad, Willis, and Lissie (wells 1-9, Table 4). In the northern third the lower part of the Catahoula, Oakville, and Lagarto contains slightly saline water.

In the central third, water suitable for public supply is obtained from wells tapping the Goliad, Willis, and Lissie and the upper part of the Catahoula, Oakville, and Lagarto. In southeastern Harris County the sands in the

Table 4.--Analyses of water from wells in subregion II

(Results are in parts per million except specific conductance, pH, and SAR.)

Water-bearing unit: B, Beaumont Clay; C, Catahoula Sandstone; G, Goliad Sand; L, Lissie Formation; La, Lagarto Clay; O, Oakville Sandstone; W, Willis Sand.

Analysis No.	Location of Well	Screened interval (ft.)	Water-bearing unit	Silica (SiO_2)	Iron (Fe) (Total)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
1	Huntsville, Walker County	360-659	C	--	--	--	86	3.2	71	314	20	73	--	0.0	--	--	480	228	2.0	748	--
2	7 mi. SSW Huntsville, Walker County	?-115	O,La	35	--	--	228	8.1	62	364	28	290	--	2.0	--	--	835	602	1.1	1,490	--
3	13 mi. SSE Huntsville, Walker County	160-180	O,La	45	[1] 0.04	--	98	2.5	40	249	11	90	0.1	.0	--	--	434	255	1.1	684	6.7
4	San Jacinto County, 22 mi. NE Conroe	574-586	C,O, La	--	[1] .03	--	79	7.4	52	270	10	77	--	.0	--	--	386	228	1.5	--	--
5	San Jacinto County, 6 mi. NW Cleveland	560-582	C,O, La	--	[1] 4.3	--	52	12	60	320	15	22	--	.0	--	--	319	180	1.9	539	--
6	8 mi. N Conroe, Montgomery County	* 805-880	C,O, La	32	.61	0.02	52	7.6	40 5.9	272	12	17	.2	.0	0.08	0.07	301	161	1.4	472	7.7
7	In Conroe, Montgomery County	*1,090-1,320	C,O, La	26	.18	.01	34	6.6	90 7.5	281	26	45	.2	.0	.08	.06	373	112	3.7	613	7.6
8	15 mi. WNW Conroe, Montgomery County	?-230	C,O, La	25	[1] .05	--	126	7.6	20 6.4	403	4.9	42	.6	.2	--	--	433	346	.5	717	7.0
9	Montgomery County, 14 mi. SW Cleveland	?-39	G,W,L	24	--	--	15	.9	14	64	4.3	9.0	--	2.5	--	--	101	41	1.0	144	6.7
10	26 mi. NW Houston, Harris County	?-400	G,W,L	26	--	--	25	3.4	41	124	4.4	42	--	--	--	--	203	76	--	--	2.0
11	19 mi. N Houston, Harris County	1,037-1,052	G,W,L	17	.80	--	10	3.4	140 2.2	294	11	68	.8	.2	--	.30	398	39	9.7	478	8.2
12	In Houston, Harris County	?-745	G,W,L	24	4.8	--	42	11	35 4.0	203	14	40	.0	.5	--	.32	271	150	1.2	457	8.1
13	do	*1,001-2,510	C,L	22	[1] .1	--	4.3	1.1	202 4.0	400	3.7	87	1.8	.0	--	.46	520	15	23	882	8.0
14	do	* 785-1,755	G,W,L	17	.07	.00	4.8	1.0	173 .9	370	9.3	53	1.1	.0	.3	.34	443	16	19	737	8.2
15	do	* 692-1,490	G,W,L	23	[1] .02	--	33	7.6	66 5.8	243	12	38	.2	.2	--	--	349	114	2.7	507	8.2

See footnotes at end of table.

Table 4.--Analyses of water from wells in subregion II--Continued

Analysis No.	Location of Well	Screened interval (ft.)	Water-bearing unit	Silica (SiO_2)	Iron (Fe) (Total)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)		Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
16	do	* 530-1,000	G,W,L	28	0.07	0.00	42	8.0	56	2.0	243	14	36	0.3	0.2	0.1	0.08	310	138	2.1	516	7.8
17	do	*1,050-1,715	G,W,L	15	.11	.00	10	3.1	120	1.7	284	11	37	.6	.0	.5	.26	344	38	8.5	574	8.0
18	16 mi. W Houston, Harris County	449-464	G,W,L	22	1/ .28	--	72	7.4	34	2.3	266	4.6	46	.0	.2	--	--	310	210	1.0	544	7.0
19	In Houston, Harris County	?-1,224	G,W,L	17	1/ .00	--	4.0	1.1	225		474	.4	82	--	.0	--	--	585	14	26	967	7.7
20	do	?-1,710	G,W,L	17	.00	--	5.5	1.5	139		296	13	47	--	.0	--	--	379	20	14	625	7.8
21	22 mi. E Houston, Harris County	?-606	B	--	--	--	8.2	2.5	170		364	5	68	--	.2	--	--	448	31	13	728	--
22	25 mi. W Houston, Harris County	2,830-2,930	C,O, La	29	1.1	--	62	7.9	2,000	18	806	2.6	2,710	.7	--	--	7.9	5,230	187	64	8,990	7.5
23	Fort Bend County, 30 mi. W Houston	?-172	G,W,L	--	--	--	100	10	28		290	4	78	--	.5	--	--	407	290	.7	--	--
24	Fort Bend County, 20 mi. SW Houston	* 555-802	G,W,L	--	--	--	68	12	35		238	10	63	--	--	--	--	305	219	1.0	--	--
25	do	1,545-1,606	G,W,L	14	1/ .03	--	14	3.6	119	6.6	259	16	61	1.0	.2	--	--	363	50	7.3	661	7.6
26	Chambers County, 9 mi. NE Baytown	?-886	B	19	--	--	100	24	686	--	388	443	770	--	2.5	--	.74	2,240	348	16	3,750	7.5
27	Brazoria County, 14 mi. S Houston	?-87	B	--	--	--	80	28	96		427	--	110	--	--	--	--	544	318	2.3	--	--
28	Brazoria County, 25 mi. S Houston	590-715	L(?),B	18	.04	--	16	5.0	259		342	1	240	1.0	.0	--	--	709	60	15	--	8.1
29	3 mi. SE Angleton, Brazoria County	?-235	B	17	1/ .05	--	14	5.2	284		428	2	224	1.3	.8	--	--	759	56	17	--	--
30	23 mi. SE Houston, Harris County	480±-610±	B	30	--	--	9.3	2.9	142		308	.2	65	--	.0	--	--	400	35	10	670	8.0
31	11 mi. NW Texas City, Galveston County	* 498-576	B	14	1/ .02	--	5.4	1.3	182	3.6	370	2	79	1.0	.2	--	--	471	19	18	838	8.1
32	4 mi. W Texas City, Galveston County	* 578-700	B	15	.50	--	7.7	2.2	265	3.4	430	2	178	1.0	1.2	--	--	698	28	22	1,270	7.9
33	In Texas City, Galveston County	897-1,004	B	--	--	--	39	15	797		350	2	1,100	--	1.2	--	--	2,130	159	27	4,560	--

See footnotes at end of table.

Table 4.--Analyses of water from wells in subregion II--Continued

Analysis No.	Location of Well	Screened interval (ft.)	Water-bearing unit	Silica (SiO_2)	Iron (Fe) (Total)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
34	10 mi. W Texas City, Galveston County	* 703-884	B	28	--	--	50	19	561	332	0.8	815	--	0.2	--	--	1,640	203	17	3,070	8.1
35	12 mi. NW Texas City, Galveston County	* 647-767	B	26	--	--	19	5.6	236	347	2.0	210	0.6	.0	--	--	680	70	12	1,200	8.4
36	In Galveston, Galveston County	?-397	B	17	--	--	18	14	562	745	1.8	490	--	7.8	--	--	1,480	102	24	2,670	8.5
37	do	*1,185-1,310	B	35	--	--	87	53	2,130	330	.0	3,400	--	--	--	--	5,870	435	44	10,500	7.5

* Not screened throughout interval.
1/ Iron in solution at time of analysis.

Beaumont Clay also furnish water of good quality; however, here the Catahoula, Oakville, and Lagarto contains slightly to moderately saline water and the base of the fresh to slightly saline zone rises rapidly. At the Harris-Galveston County line the Goliad, Willis, and Lissie contains slightly saline water.

In the southern third, the only water suitable for public supply is obtained from sands in the Beaumont Clay except for the uppermost sands of the Goliad, Willis, and Lissie in Brazoria County. No major wells obtain fresh water south of a line intersecting the boundary of the subregion 10 miles south of Angleton and running through Texas City.

Industrial water is obtained from wells throughout the subregion although the wells in southern Brazoria and Galveston Counties yield slightly to moderately saline water, which generally is used for cooling. Water from the rest of the subregion commonly can be selected for the purpose for which it is to be used by testing the different sands as the wells are drilled and screening only those yielding the most favorable water. For example, many laundries in Houston drilled wells tapping sands 1,000 to 1,500 feet deep to obtain soft water. Iron generally is not a problem in water from major wells in the subregion.

Water for irrigation is obtained generally from wells that are shallower than the public-supply and industrial wells. The shallower water generally has a higher calcium and magnesium content and, therefore, a lower SAR. However, with the ample rainfall and the rotation practices of rice irrigators, even a high SAR water may be used successfully.

Utilization

The total pumpage from all major wells (Plate 4) in subregion II in 1959 was about 380,000 acre-feet, an average rate of about 340 mgd. Of course, the daily rate was much higher during the warmer months than during the winter because nearly all the irrigation water was pumped during the spring and summer; much of the industrial water is used for cooling and more is used in summer than in winter; also more water is used for public supply in summer than in winter. The largest withdrawal from major wells in 1959 was for public supply, about 140,000 acre-feet, although withdrawals for industrial uses and for irrigation were nearly as large, about 130,000 and 120,000 acre-feet, respectively (Table 5). In several of the dry years during the 1950's, the largest use of ground water was for irrigation.

Most of the pumpage in subregion II is from major subdivisions SJ-8, SJ-9, and SJ-10, SJ-BR-1, and TR-SJ-1 (Plate 4), these subdivisions also having the greatest concentration of major wells. The principal use of ground water in SJ-8 is for irrigation, in SJ-9 for public supply, and in SJ-10 for industry.

The city of Houston and its suburbs depend upon wells for 80 percent of the water in the public-supply systems, and pumped 97 mgd of the approximately 120 mgd pumped for public supply in subregion II in 1959. In addition to the ground water used, about 25 mgd of treated surface water was sold by the Houston Water Department in 1959 for public supply. Also, about 75 mgd of untreated surface water was sold to industries along the Houston Ship Channel. All cities in the subregion (II) except Houston depend exclusively on wells for their public supplies, although industries in the Baytown and Texas City areas use both ground water and surface water.

Ref. 15

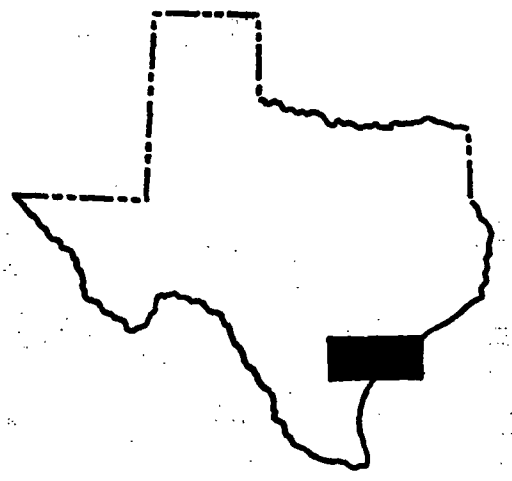
BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
AUSTIN, TEXAS 78712

W. L. FISHER, *Director*

GEOLOGIC ATLAS OF TEXAS

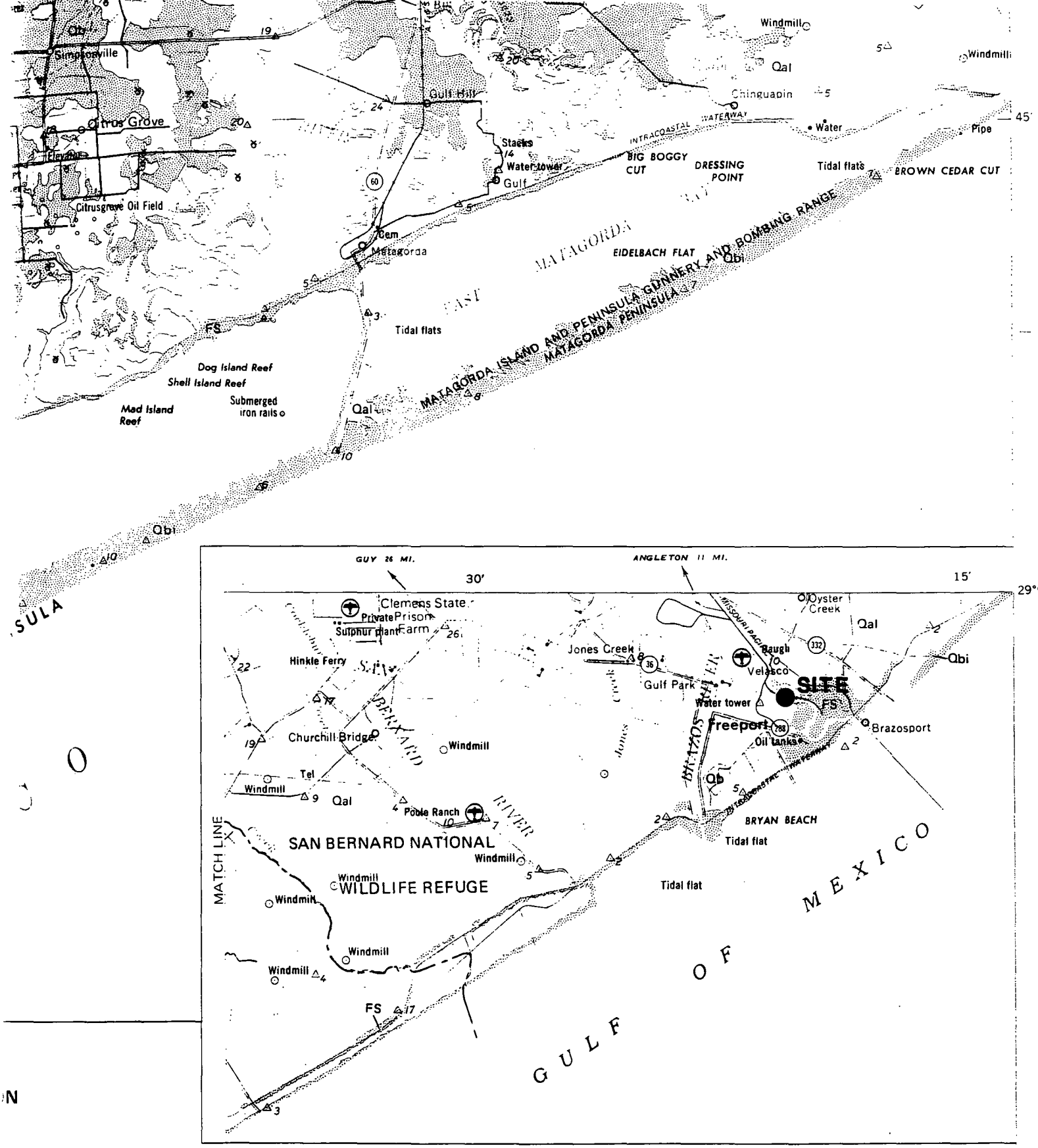
Beeville–Bay City Sheet

Scale: 1:250,000



1975

2021


Simpsonville
Citrus Grove
Citrusgrove Oil Field
Gulf Hill
Stacks
Water tower
Gulf
Cem
Matagorda
Windmill
Qal
Chinguapin
INTRACOASTAL WATERWAY
Water
Pipe
BIG BOGGY CUT
DRESSING POINT
Tidal flats
BROWN CEDAR CUT
EIDELBACH FLAT
MATAGORDA
EAST
Tidal flats
Dog Island Reef
Shell Island Reef
Mad Island Reef
Submerged iron rails
MATAGORDA ISLAND AND PENINSULA GUNNERY AND BOMBING RANGE
MATAGORDA PENINSULA
Qbi
GUY 26 MI.
ANGLETON 11 MI.
30'
15'
29°00'
Clemens State Prison Farm
Private Sulphur plant
Hinkle Ferry
Churchill Bridge
Windmill
Tel
Qal
Poole Ranch
SAN BERNARD NATIONAL WILDLIFE REFUGE
MATCH LINE
Jones Creek
Gulf Park
Velasco
Oyster Creek
Raugh
SITE
Water tower
Freeport
Oil tanks
Brazosport
BRYAN BEACH
Tidal flat
Tidal flat
GULF OF MEXICO
Pg
Goliad Formation
Mf
Mo
Pliocene

EXPLANATION

Recent

F S

Fill and Spoil

Fill, F, material dredged for raising land surface above alluvium and barrier island deposits and for creating land. Spoil, S, dredged material forming islands along waterways

Qal

Alluvium

Clay, silt, sand, and gravel, organic matter abundant locally; includes point bar, natural levee, stream channel, backswamp, coastal marsh, mud flat, clay dune, sand dune, and oyster reef deposits. Includes older deposits exposed in pits in floodplain of Guadalupe River in vicinity of Victoria

Qbi

Barrier island deposit

Sand, silt, and clay; mostly sand, well sorted, fine grained, abundant shells and shell fragments; interfingers with silt and clay in landward direction; includes beach ridge, spit, tidal channel, tidal delta, washover fan, and sand dune deposits

Recent or Pleistocene

Qd | Qd

Deweyville Formation

Sand, silt, clay, and gravel, locally indurated with calcium carbonate (caliche); includes point bar, natural levee, stream channel, and locally, Recent and older sand dune deposits; surface characterized by relict meanders of much larger radius of curvature than those of present streams; thickness 50± feet. Top surfaces range from a few feet to 40 feet above floodplain level along Guadalupe and Nueces Rivers; those surfaces 25 feet or more above floodplain level are shown by stippled pattern. Along Nueces River within the Beeville-Bay City Sheet, the Deweyville surface ranges from 45 feet above floodplain level at the southern edge of the sheet to less than 10 feet at the western edge of the sheet

Pleistocene

Qt

Fluviatile terraces undivided

Clay, silt, sand, gravel, and caliche, in deposits along valley walls; probably in large part correlatives of Deweyville, Beaumont, Lissie, and Willis deposits; may include some terraces cut in older rocks

Qbb | Qb | Qb

Beaumont Formation

Beaumont Formation, Qb, with barrier island and beach deposits, Qbb, mapped separately. Beaumont Formation, Qb, mostly clay, silt, sand, and gravel; includes mainly stream channel, point bar, natural levee, and backswamp deposits, and to a lesser extent coastal marsh, mud flat, lagoonal, Recent and older lake, clay dune, and sand dune deposits; gravel deposits mostly along Guadalupe River in vicinity of Victoria; concretions and massive accumulations of calcium carbonate (caliche) and concretions of iron oxide and iron-manganese oxides in zone of weathering; surface almost featureless east of Guadalupe River with poorly defined meanderbelt ridges (with many pimple mounds especially towards eastern edge of map area) separated by relatively smooth featureless backswamp deposits; west of Guadalupe River surface pitted by shallow lakes or dry lake beds with associated clay dunes which in places align along meanderbelt ridges; pimple mounds only in vicinity of Qbb unit; thickness 100± feet

QUATERNARY

The stippled overprint (source shown in Index to Geologic Mapping) shows areas that are "Dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity; geologic units include interdistributary muds, abandoned channel-fill muds, and fluvial overbank muds." The nonstippled areas are "Dominantly clayey sand and silt of low-moderate permeability, moderate drainage, level relief with local mounds and ridges, and high shear strength; geologic units include meanderbelt, levee, crevasse splay, and distributary sands"

Barrier island and beach deposits, Qbb, mostly fine-grained sand, shells scarce; surface slightly higher than that of surrounding deposits, characterized by numerous pimple mounds and poorly defined relict beach ridges; includes many Recent, locally active sand dunes; probably part of "Ingleside" barrier island system; thickness less than 60 feet

Ql

Lissie Formation undivided

Within the Beeville-Bay City Sheet, the Montgomery and Bentley Formations (upper and lower units of the Lissie) are essentially indistinguishable and for that reason are not separately mapped

Sand, silt, clay, and minor amount of gravel; iron oxide and iron-manganese nodules common in zone of weathering, in upper part locally calcareous, some concretions of calcium carbonate; surface fairly flat and featureless except for numerous rounded shallow depressions and pimple mounds, lower part very gently rolling; characterized by "moderate permeability, moderate drainage, and high shear strength; geologic units include meanderbelt, levee, crevasse splay, and distributary sands and floodbasin mud over meanderbelt sand;" thickness 200± feet

Qw

Willis Formation

Gravel, sand, silt, and clay; gravel, mostly siliceous, locally cobble-size quartz and chert, some petrified wood; sand, fine to very coarse grained; clay, silty, light yellowish gray, where deeply weathered, mottled red and light gray; iron oxide concretions locally abundant, some beds highly indurated by iron oxide cement; fluviatile; forms landward escarpment; supports oak forest; discontinuous patches rest on Goliad Formation west of Guadalupe River, not shown where gravel is less than 2 feet thick; thickness 30± feet, pinches out southwestward

Pg

Goliad Formation

Clay, sand, sandstone, marl, caliche, limestone, and conglomerate; clay, commonly light shades of pink or green, locally contains calcareous concretions; sand and sandstone, medium to very coarse grained, in part crossbedded, mostly quartz, some black and red chert; conglomerate, black chert and dark siliceous granules and pebbles in calcareous (caliche) matrix; sandstone and conglomerate, locally well bedded; marl and limestone, poorly bedded or massive; Tertiary vertebrate and reworked Cretaceous invertebrate fossils fairly common; thickness 75-200 feet, thins northeastward. Partially obscured locally by Willis or Willis-like deposits of coarse gravel less than 2 feet thick

Mfo | Mf | Mo

Fleming Formation and Oakville Sandstone

Fleming Formation and Oakville Sandstone, Mfo, not separately mapped in southwestern part of sheet

Fleming Formation, Mf, clay and sandstone; clay, commonly calcareous, forms brownish black soil; sandstone, medium grained, calcareous, thick bedded, some crossbedding, light yellowish gray to light gray; some quartz and chert pebbles; fossil wood and vertebrate fossils locally common; thickness 1,300-1,450 feet

Oakville Sandstone, Mo, sandstone and clay; sandstone, medium grained, calcareous, light yellowish gray to light gray, thick bedded, some crossbedding, locally contains quartz and chert gravel, fossil wood, and vertebrate fossils; clay, calcareous, yellowish gray; forms cuesta of smoothly rounded hills; thickness 300-500 feet

Pleistocene — QUATERNARY

Pliocene — TERTIARY

Miocene — TERTIARY

Miocene

Mc

Catahoula Formation

Clay and sand; clay, bentonitic, noncalcareous except for some calcareous concretions locally, light olive gray; sand, tuffaceous, crossbedded lenses, gray; some thin pelecypod-gastropod beds in basal part in northern part of sheet; thickness 350± feet

Eocene

Edd

Ecd

Whitsett Formation

The Whitsett Formation is subdivided into an upper unit, Edd, composed from the top down of the Dubose Member and the Deweesville Sandstone Member, and a lower unit, Ecd, composed from the top down of the Conquista Clay Member and Dilworth Sandstone Member

Dubose Member, clay, sandstone, and siltstone; clay, bentonitic, pale yellowish brown; sandstone and siltstone, tuffaceous; grades downward to Deweesville Sandstone Member; thickness 85 feet

Deweesville Sandstone Member, sandstone, siltstone, clay, and tuff; sandstone, fine to medium grained, friable, tuffaceous, crossbedded, lenticular, gray to yellowish brown, locally bored by *Ophiomorpha*; thin beds of bentonitic clay and tuff; uranium deposits locally near base; thickness 30 feet

Conquista Clay Member, clay and sandstone; clay, bentonitic, slightly carbonaceous, locally lignitic, pale to medium yellowish brown, some marine megafossils; sandstone, fine grained, lenticular; thickness 50 feet

Dilworth Sandstone Member, sandstone, fine to medium grained, crossbedded to massive, generally friable, locally well indurated, gray to yellowish brown, abundantly bored by *Ophiomorpha*; thickness 40 feet

Em

Manning Formation

Clay, tuff, and sandstone; chiefly bentonitic clay and lignitic tuff, some interbedded fine-grained, light yellowish gray sandstone; fossil wood common. Sandstone, fine grained, tuffaceous, indurated, brittle, thick bedded, forms resistant ledges within clay. Thickness 250-350 feet

TERTIARY

Geologic mapping mostly by T. E. Brown, J. L. Brewton, and Saul Aronow, Bureau of Economic Geology, The University of Texas at Austin, and D. H. Eargle, U. S. Geological Survey, with contributions gratefully acknowledged from Humble Oil & Refining Company (Exxon), Shell Oil Company, and sources shown on Index of Geologic Mapping. Hoye Eargle's manuscript mapping was received posthumously through the kindness of the U. S. Geological Survey; Barnes integrated the mapping into the Atlas Sheet. Appreciation is expressed to Soil Conservation Service, U. S. Department of Agriculture, for courtesies extended to Saul Aronow. Geologic mapping field checked and compiled by T. E. Brown, J. L. Brewton, and Saul Aronow using mosaics kindly furnished by Edgar Tobin Aerial Surveys and U. S. Geological Survey topographic maps. Geologic mapping scribed by R. L. Dillon. Geological mapping reviewed by Geologic Atlas Committee, Corpus Christi Geological Society, R. G. Martin (U. S. Geological Survey), Chairman, M. J. Maxon (Mobil Oil Corporation), John C. Wyeth (Continental Oil Company), K. A. Dickinson (U. S. Geological Survey), J. A. Knupke (Independent Geologist), C. E. Buck (Consulting Geologist), and Deane Dubois (Geological Drafting and Scouting Service).

Ref. 16

WRD Exp. (GW)
April 1966

Well No. BH 81-06-402

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD W. SANDEEN — 1:24,000

Record by (W. L. NAPTEL 8-11-52) Source of data E. VICKERS Date 1-16-67 Map FREEPORT 1963

State TEXAS [40] County (or town) BRAZORIA [BH]

Latitude: 28 56 [illegible] N S (deg, min, sec) Longitude: [illegible] (degrees, min, sec) Sequential number: 1

Lat-long accuracy: 1 T. ___ N S, R ___ E W, Sec ___, ___ ¼, ___ ¼, ___ ¼

Local well number: BH 81 06 402 Other number: CITY # 9 (B & M)

Local use: Owner or name: CITY FREE PORT

Owner or name: CTY FREEPORT Address: FREEPORT, TEXAS

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist — M

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other — P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed — W

DATA AVAILABLE: Well data ___ Freq. W/L meas.: 8-11-52 [O] Field aquifer char. ___

Hyd. lab. data: ___

Qual. water data; type: (RAW) — P

Freq. sampling: RPT 3-24-59 [I] Pumpage inventory: yes (no) period: ___

Aperture cards: ___ yes

Log data: ___ [DE]

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 249 ft [249] Meas. (rept) accuracy — 6

Depth cased: (first perf.) 209 ft [209] Casing type: ___; Diam. 10¾ in [10]

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other — G

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot, (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other — H

Date Drilled: MARCH, 1953 [353] Pump intake setting: ___ ft

Driller: LAYNE TEXAS (name, address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other — T Deep Shallow ___

Power (type): diesel, (elec), nat gas, gasoline, hand, LP gas, wind; H.P. 50 Trans. or meter no. ___

Descrip. MP TOP 1" BREATHER NIPPLE, 3.0 ft (above) below LSD Alt. MP ___

Alt. LSD: 2± [2] Accuracy: (source) 5' TOPO — 3

Water Level 142.46 ft above below MP; Ft above below LSD [139] Accuracy: TAPE — A

Date meas: 8-11-52 [852] Yield: RPT 420 gpm [420] Method determined ___

Drawdown: ___ ft Accuracy: ___ Pumping period ___ hrs

QUALITY OF WATER DATA: Iron ___ ppm Sulfate ___ ppm Chloride ___ ppm Hard. ___ ppm

Sp. Conduct ___ K x 10⁶ Temp. ___ °F Date sampled ___

Taste, color, etc.

C.U

-137
8-57

Well No.

Well No. BH 81-06-402

Latitude-longitude N S
d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19) Physiographic Province: _____ 0 3 (20–21) Section: _____

F (22) Drainage Basin: _____ 5 2 B (23–25) Subbasin: _____ (26)

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat _____ (27) F

MAJOR AQUIFER: _____ system, _____ series Q G (28–29) _____ aquifer, formation, group C U (30–31)

Lithology: _____ (32–33) Origin: _____ (34) Aquifer Thickness: _____ ft

(35–37) Length of well open to: 30 ft 3 0 (38–40) Depth to top of: 209 ft 2 0 9 (41–43)

MINOR AQUIFER: _____ system, _____ series (44–45) _____ aquifer, formation, group (46–47)

Lithology: _____ (48–49) Origin: _____ (50) Aquifer Thickness: _____ ft

(51–53) Length of well open to: _____ ft (54–56) Depth to top of: _____ ft (57–59)

Intervals Screened: 209 - 239

Depth to consolidated rock: _____ ft (60–63) Source of data: _____ (64)

Depth to basement: _____ ft (65–68) Source of data: _____ (69)

Surficial material: _____ (70–71) Infiltration characteristics: _____ (72)

Coefficient Trans: _____ gpd/ft (73–75) Coefficient Storage: _____ (76–78)

Coefficient Perm: _____ gpd/ft^2; Spec cap: _____ gpm/ft; Number of geologic cards: _____ (79)

Well No. BH 81-06-402

GPO 857-700

WRD Exp. (GW)
April 1966

Well No. BH 81-0[illegible]-[illegible]

WELL SCHEDULE

TBWE 1947; #309

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

Record by W. S[illegible] Source of data [illegible] Date [illegible] Map [illegible]

State TEXAS County (or town) [illegible]

Latitude: 2 8 [illegible] N S Longitude: [illegible] 3 8 Sequential number: 1 GDM

Lat-long accuracy: 1 T. ___ N S, R ___ E W, Sec ___, ___ ¼, ___ ¼, ___ ¼ ___ B & M

Local well number: BH 81 06 40[illegible] Other number: WELL [illegible]

Local use: Owner or name: CITY OF FREEPORT

Owner or name: CITY FREEPORT [illegible] Address: FREEPORT, TEXAS

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Mnd, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed W

DATA AVAILABLE: Well data ___ Freq. W/L meas.: 1956-67 A Field aquifer char. ___

Hyd. lab. data: ___

Qual. water data; type: ___ P

Freq. sampling: 9-6-67 Φ Pumpage inventory: yes no period: ___

Aperture cards: ___ yes

Log data: ___ D

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 249 ft 249 Meas. rept accuracy 6

Depth cased: (first perf.) 206 ft 206 Casing type: ___; Diam. 12 in 12

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (Φ) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other G

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot, (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other H

Date Drilled: 1942 942 Pump intake setting: 200 ft

Driller: LAYNE TEXAS (name), ___ (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other T Deep Shallow

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. ___ Trans. or meter no. ___

Descrip. MP 1.5 ft above below LSD. Alt. MP ___

Alt. LSD: 2± 2 Accuracy: (source) 5' TOPO 3

Water Level 139.05 ft above below MP Ft above below LSD 138 (9-6-67) Accuracy: ___ A

Date meas: 1-23-67 167 Yield: 350 gpm 350 Method determined O

Drawdown: ___ ft Accuracy: ___ Pumping period ___ hrs

QUALITY OF WATER DATA: Iron ___ ppm Sulfate ___ ppm Chloride ___ ppm Hard. ___ ppm

Sp. Conduct ___ K x 10^6 Temp. ___ °F Date sampled ___

Taste, color, etc.

-114
9-1-49

REWORKED JULY, 1967
CU

-136
1-67

Well No.

Well No. [illegible]

Latitude-longitude ___ d ___ m ___ s N S ___ d ___ m ___ s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19) Physiographic Province: ___ 0 3 (20–21) Section: ___

___ F (22) Drainage Basin: ___ 5 2 B (23–25) Subbasin: ___ (26)

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat ___ (27) F

MAJOR AQUIFER: ___ system, ___ series Q G (28–29) ___ aquifer, formation, group C U (30–31)

Lithology: ___ (32–33) Origin: ___ (34) Aquifer Thickness: ___ ft

(35–37) Length of well open to: 28 ft 2 8 (38–40) Depth to top of: 206 ft 2 0 6 (41–43)

MINOR AQUIFER: ___ system, ___ series (44–45) ___ aquifer, formation, group (46–47)

Lithology: ___ (48–49) Origin: ___ (50) Aquifer Thickness: ___ ft

(51–53) Length of well open to: ___ ft (54–56) Depth to top of: ___ ft (57–59)

Intervals Screened: 206 - 234

Depth to consolidated rock: 6 8 ft (60–63) Source of data: ___ (64)

Depth to basement: ___ ft (65–68) Source of data: ___ (69)

Surficial material: ___ (70–71) Infiltration characteristics: ___ (72)

Coefficient Trans: ___ gpd/ft (73–75) Coefficient Storage: ___ (76–78)

Coefficient Perm: ___ gpd/ft^2; Spec cap: ___ gpm/ft; Number of geologic cards: ___ (79)

FORMER OBSERVATION WELL; REWORKED, JULY, 1967

Well No.

GPO 857-700

WRD Exp. (GW)
April 1966

Well No. BH 81-06-405

TBWC, 1947; #3092.

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

Record by: [illegible] Source of data: [illegible] Date: 9-6-67 Map: FREEPORT [illegible]

State: TEXAS County (or town): [illegible]

Latitude: 28 56 48 N (deg min sec) Longitude: 095 20 21 (degrees min sec) Sequential number: 1 GDM

Lat-long accuracy: 1 T. ____ N S, R ____ E W, Sec ____, ____ k, ____ k, ____ k

Local well number: BH [illegible] Other number: B & M WELL [illegible]

Local use: ____ Owner or name: CITY FREEPORT

Owner or name: CITY FREEPORT [illegible] Address: FREEPORT, TEXAS

Ownership: (C) County, (F) Fed Gov'd, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist ____ 67 M

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Mnd, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other ____ 68 P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdrawal, (X) Waste, (Z) Destroyed 69 W

PWG (4)

DATA AVAILABLE: Well data ____ 70 Freq. W/L meas.: 1955 - 67 Field aquifer char. 72 ____

Hyd. lab. data: ____ 73 ____

Qual. water data; type: ____ 74 P

Freq. sampling: 9-6-67 75 Pumpage inventory: yes no, period: ____ 76 ____

Aperture cards: ____ yes 77 ____

Log data: ____ 78 D 79 ____

WELL-DESCRIPTION CARD

TEST HOLE 250

SAME AS ON MASTER CARD 19 Depth well: 249 ft 20 249 23 Meas. rept DAL 24 ____

Depth cased (first perf.): 205 ft 25 205 28 Casing type: STEEL; Diam. 10 3/4 in 29 10 30

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., screen, sd. pt., (S) shored, (T) open hole, (Z) other ____ 31 G

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot, (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other ____ 32 ____

Date Drilled: 30 JULY, 1949 33 9 49 35 Pump intake setting: ____ ft 36 ____ 38

Driller: LAYNE TEXAS (name), ____ (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other T 39 Deep ____ Shallow 40 ____

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. 50 V 41 Trans. or meter no. ____

Descrip. MP: T CASING 2.5 ft above/below LSD. Alt. MP ____

Alt. LSD: 5± 42 ____ 45 5 Accuracy (source): 5' TOPO 47 3

Water Level: 139.06 ft above/below MP; Ft above/below LSD 48 137 Accuracy: TAPE 52 A

Date meas.: 1-23-67 53 1 67 55 Yield: 330 gpm 56 330 60 Method determined 61 O

Drawdown: ____ ft 62 ____ 64 Accuracy: ____ 65 Pumping period ____ hrs 66 ____ 68

QUALITY OF WATER DATA: Iron ____ ppm 69 Sulfate ____ ppm 70 Chloride ____ ppm 71 Hard. ____ ppm 72

Sp. Conduct ____ K x 10^6 73 Temp. ____ °F 74 ____ 76 Date sampled ____ 77 ____ 79

Taste, color, etc.

Well No.

CU.

-95
8-40

-122
1-67

Well No. BH 81-06

Latitude-longitude ___ d ___ m ___ s N/S ___ d ___ m ___ s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19) Physiographic Province: ___ 0 3 (20–21) Section: ___

___ F (22) Drainage Basin: ___ 5 2 B (23–25) Subbasin: ___ (26)

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat ___ (27) F

MAJOR AQUIFER: ___ system, ___ series, Q G (28–29) ___ aquifer, formation, group, C U (30–31)

Lithology: ___ (32–33) Origin: ___ (34) Aquifer Thickness: ___ ft

(35–37) Length of well open to: 40 ft (38–40) Depth to top of: 205 ft (41–43) 2 0 5

MINOR AQUIFER: ___ system, ___ series (44–45) ___ aquifer, formation, group (46–47)

Lithology: ___ (48–49) Origin: ___ (50) Aquifer Thickness: ___ ft

(51–53) Length of well open to: ___ ft (54–56) Depth to top of: ___ ft (57–59)

Intervals Screened: 205-245

Depth to consolidated rock: ___ ft (60–63) Source of data: ___ (64)

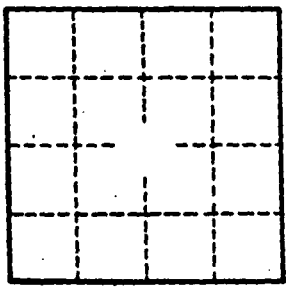
Depth to basement: ___ ft (65–68) Source of data: ___ (69)

Surficial material: ___ (70–71) Infiltration characteristics: ___ (72)

Coefficient Trans: ___ gpd/ft (73–75) Coefficient Storage: ___ (76–78)

Coefficient Perm: ___ gpd/ft^2; Spec cap: ___ gpm/ft; Number of geologic cards: ___ (79)

5	5	TOP SOIL
124	119	CLAY
138	14	SAND & STRAYS OF SHALE
150	12	FINE WHITE SAND
215	65	SHALE
250	35	COARSE SAND & GRAVEL



Well No. BH 81-06-405

GPO 857-700

NOTE: INCORRECT "INTERVAL SCREENED" PUBLISHED AS 206-247. MP SHOULD READ 1.5 ABOVE LDS.

4-81-06-406

(OLD # 308) BWE 1947

U. S. DEPT. OF THE INTERIOR — WATER RESOURCES DIVISION

MASTER CARD

Record by (W. SANDEEN) (RAY SUNDSTRAM 6-19-41) Source of data J.C. REED Date 4-10-67 (6-19-41) Map FREEPORT 1963 1:24,000

State TEXAS 49 County (or town) BRAZORIA BH

Latitude: 285654 N Longitude: 0952151 Sequential number: 1 GOAA

Lat-long accuracy: 1 T. S, R W, Sec , k, k, k

Local well number: BH8106406 Other number: WELLHO B & M (1231 W. 8th STREET)

Local use: Owner or name: CITY OF FREEPORT

Owner or name: CTY FREEPORT Address:

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist M

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Mnd, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (Y) Inte, (Z) Destroyed W

DATA AVAILABLE: Well data 8 Freq. W/L meas.: 1941, 1946, 1959-67 ANNUAL Field aquifer char.

Hyd. lab. data:

Qual. water data: type:

Freq. sampling: Pumpage inventory: yes (no) period:

Aperture cards: yes

Log data: driller's log 0-249 D

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 249 ft 249 Meas. rept accuracy 3

Depth cased: (first perf.) 214 ft 214 Casing type: steel; Diam. 14 OD in 13

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. screen, (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other G

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other H

Date Drilled: 1941 941 Pump intake setting: ft

Driller: LAYNE TEXAS

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple, (cent.), (M) multiple, (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other T Deep Shallow D

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. 30 V Trans. or meter no.

Descrip. MP HOLE IN PUMP BASE + 1.5 ft above below LSD. Alt. MP 6

Alt. LSD: 5 ± 5 Accuracy: (source) Topo map 3

Water Level 140.90 ft above below MP; Ft above below LSD 141 Accuracy: steel tape A

Date meas: 1-23-67 167 Yield: 6-28-41 420 gpm 420 Method determined Q

Drawdown: 77 ft 77 Accuracy: RPT Pumping period N.A hrs

QUALITY OF WATER DATA: Iron ppm Sulfate ppm Chloride ppm Hard. ppm

Spc. Conduct. Temp. Nat'l Radiation

Factory code, etc.

-54 CU 6-71

-109 10-46

-136 9-55

-141 1-67

Well No. BH 81-06-406

Well No. BH 81 - 06 - 406

Latitude-longitude 28 56 54 N 095 21 51
d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD

Physiographic Province: 03 Section:

F Drainage Basin: 52B Subbasin:

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat F

MAJOR AQUIFER: system, series QG aquifer, formation, group CU

Lithology: SAND S Origin: Aquifer Thickness: ft

Length of well open to: 20 ft 20 Depth to top of: 214 ft 214

MINOR AQUIFER: system, series aquifer, formation, group

Lithology: Origin: Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

Intervals Screened: 214 - 234

Depth to consolidated rock: ft Source of data:

Depth to basement: ft Source of data:

Surficial material: Infiltration characteristics:

Coefficient Trans: gpd/ft Coefficient Storage:

Coefficient Perm: gpd/ft^2; Spec cap: gpm/ft; Number of geologic cards:

Well No. BH 81-06-406

GPO 884-708

RECORD OF COMMUNICATION	|x| Phone Call |_| Discussion |_| Field Trip |_| Conference |_| Other (Specify) Ref. 17

(Record of Item Checked Above)

TO:	FROM:	DATE
Johnson A. Campbell	John L. Jones	6/30/88
District Soil Conserv.	FIT Analyst	TIME
US Soil Conserv. Serv.	ICF Technology	1335
Brazoria County	(214) 744-1641	

SUBJECT (409) 849-6820
Irrigated Land Area In The Freeport Area

SUMMARY OF COMMUNICATION

Mr. Campbell said that there is no irrigated crop land in the area of Freeport within 10 miles of the city due to the saline nature of the soil. There is some water used for watering lawns and the Freeport country Club Gulf course but not for food crops. Irrigated crops start about 10 miles to the north of the city. I also asked about ground water flow. Mr. Campbell said that it would be toward the Gulf i.e. to the southeast.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

INFORMATION COPIES
TO:

EPA FORM 1300-6 (7-72)
Replaces EPA HQ Form 5300-3 Which May Be Used Until Supply is Exhausted.

Ref. 18

TEXAS SURFACE WATER QUALITY STANDARDS

Informational Copy

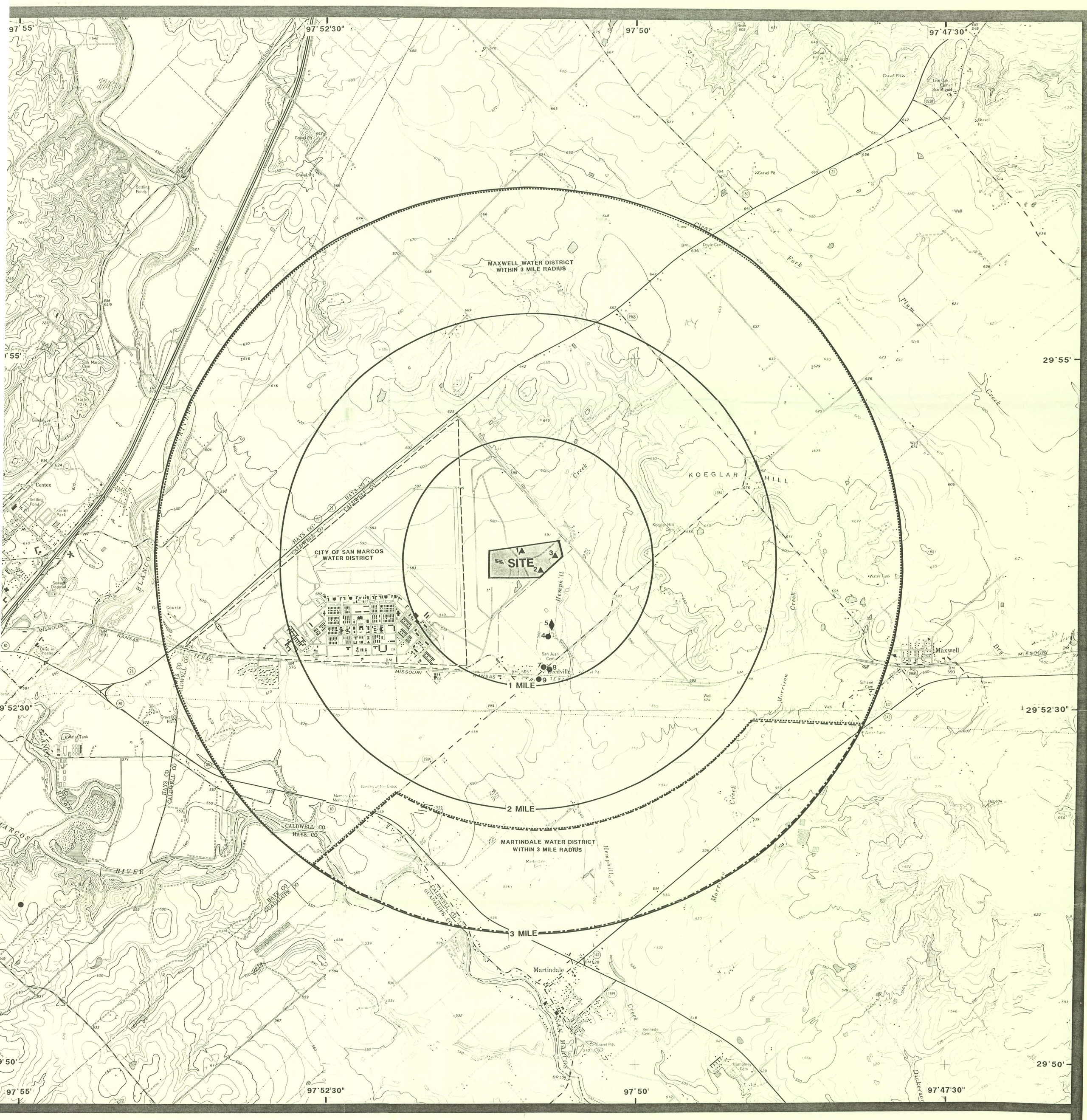
Texas Water Commission

December 1986

TX 2026

SAN JACINTO-BRAZOS COASTAL BASIN		USES				CRITERIA						
SEGMENT NUMBER	SEGMENT NAME	RECREATION	AQUATIC LIFE	DOMESTIC WATER SUPPLY	OTHER	CHLORIDE (mg/L) Annual average not to exceed	SULFATE (mg/L) Annual average not to exceed	TOTAL DISSOLVED SOLIDS (mg/L) Annual average not to exceed	DISSOLVED OXYGEN (mg/L) Not less than	pH RANGE	FECAL COLIFORM (#/100 mL) Thirty-day geometric mean not to exceed	TEMPERATURE (°F) Not to exceed
1101	Clear Creek Tidal	NCR	H						4.0	6.5-9.0	2,000	95
1102	Clear Creek Above Tidal	NCR	H			200	100	600	5.0	6.5-9.0	2,000	95
1103	Dickinson Bayou Tidal	CR	H						4.0	6.5-9.0	200	95
1104	Dickinson Bayou Above Tidal	NCR	H			200	100	600	5.0	6.5-9.0	2,000	90
1105	Bastrop Bayou Tidal	CR	H						4.0	6.5-9.0	200	95
1107	Chocolate Bayou Tidal	CR	H						4.0	6.5-9.0	200	95
1108	Chocolate Bayou Above Tidal	NCR	H			150	50	600	5.0	6.5-9.0	2,000	90
1109	Oyster Creek Tidal	NCR	H						4.0	6.5-9.0	2,000	95
1110	Oyster Creek Above Tidal	NCR	H	PS		300	150	750	5.0	6.5-9.0	2,000	90
1111	Old Brazos River Channel	CR	H						4.0	6.5-9.0	200	95
1113	Armand Bayou Tidal	CR	H						4.0	6.5-9.0	200	95

SEGMENT	DESCRIPTION
1109	Oyster Creek Tidal - from the confluence with the Intercoastal Waterway in Brazoria County to a point 100 meters (110 yards) upstream of FM 2004 in Brazoria County
1110	Oyster Creek Above Tidal - from a point 100 meters (110 yards) upstream of FM 2004 in Brazoria County to the Brazos River Authority diversion dam 1.8 kilometers (1.1 miles) upstream of SH 6 in Fort Bend County
1111	Old Brazos River Channel - from the confluence with the Intercoastal Waterway in Brazoria County to SH 288 in Brazoria County
1113	Armand Bayou Tidal - from the confluence with Clear Lake in Harris County to a point 0.8 kilometer (0.5 mile) downstream of Genoa-Red Bluff Road at Pasadena in Harris County
1201	Brazos River Tidal - from the confluence with the Gulf of Mexico in Brazoria County to a point 100 meters (110 yards) upstream of SH 332 in Brazoria County
1202	Brazos River Below Navasota River - from a point 100 meters (110 yards) upstream of SH 332 in Brazoria County to the confluence of the Navasota River in Grimes County
1203	Whitney Lake - from Whitney Dam in Bosque/Hill County to a point immediately upstream of the confluence of Camp Creek on the Brazos River Arm in Bosque/Johnson County and to a point immediately upstream of the confluence of Rock Creek on the Nolan River Arm in Hill County, up to the normal pool elevation of 533 feet (impounds Brazos River)
1204	Brazos River Below Lake Granbury - from a point immediately upstream of the confluence of Camp Creek in Bosque/Johnson County to DeCordova Bend Dam in Hood County
1205	Lake Granbury - from DeCordova Bend Dam in Hood County to a point 100 meters (110 yards) upstream of FM 2580 in Parker County, up to the normal pool elevation of 693 feet (impounds Brazos River)
1206	Brazos River Below Possum Kingdom Lake - from a point 100 meters (110 yards) upstream of FM 2580 in Parker County to Morris Sheppard Dam in Palo Pinto County
1207	Possum Kingdom Lake - from Morris Sheppard Dam in Palo Pinto County to a point immediately upstream of the confluence of Cove Creek at Salem Bend in Young County, up to the normal pool elevation of 1000 feet (impounds Brazos River)



LEGEND

- ● RESIDENTIAL WELLS SAMPLED
- ♦ NEAREST RESIDENTIAL WELL
- ▲ MONITORING WELL

ecology and environment, inc.

USGS TOPOGRAPHIC MAPS

SITE NAME GARY JOB CORP.
LOCATION SAN MARCOS, TEXAS
SITE ID TX1161630644

NAME SAN MARCOS NORTH DATE 1964 REVISED 1973	NAME UHLAND, TEXAS DATE 1964 REVISED 1973	REFERENCE REF 7
NAME SAN MARCOS SOUTH DATE 1964 REVISED 1973	NAME MARTINDALE, TEXAS DATE 1964 REVISED 1973	QUADRANGLE LOCATION

Scale 1:24000

1 1/2 0 1 mile

N