CONS/2770-1
UC-95e

Title I
Preliminary Engineering for:
A.S.E.F. SOLID WASTE TO METHANE GAS

Waste Management, Inc.
Solid Waste Reduction

Pompano Beach, Florida

Contract No.: E(11-1)-2770
Energy Research and Development Administration (ERDA)
Division of Buildings and Community Systems

Prime Contractor:
Waste Management, Inc.
Oak Brook, Illinois

Engineer/Contractor:
Jacobs Constructors, Inc.
Chicago, Illinois

January, 1976

DISCLAIMER

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	- Experimental Test Conducted with a Rotostrainer Pilot Unit
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Section I

SUMMARY

SECTION 1.0
SUMMARY

This report (Title I) documents an assignment to provide preliminary engineering of an Advanced System Experimental Facility for production of Methane Gas from Urban Solid Waste for U.S. Energy Research and Development Administration. The experimental facility will be constructed on a now-existing solid waste shredding and landfill facility owned and operated by Waste Management, Inc. in Pompano Beach, Florida.

The Title I Report contains general description of the project, justification of basic need, process design, preliminary drawings, outline specifications, preliminary estimate of cost, time schedules for design and construction of accomplishment for Phase I and Phase II. ERDA's Exhibit I of Contract E(11-1)-2770 has outlined the scope of work in three phases:

Section 1.0
Summary

Phase I - Design
Phase II - Construction
Phase III - Plant Operation

The preliminary cost estimate for Phases I and II of the experimental program as defined by this report is $2,960,000. The estimate has an accuracy of ± 10%. This estimate, as shown and discussed in Section 6.0 of this Report, is based on December, 1975 and January, 1976 costs.

A time schedule of eight months to complete the Detailed Design, Equipment Procurement and the Award of Subcontracts; etc., by October, 1976. The subcontract construction phase is based on the long delivery equipment purchased before May, 1976 and field mobilization would commence by November, 1976. The overall schedule is based on the approval of Title I Report by March 1, 1976 and the start-up of the Definitive Design (Title II).

Section 1.0
Summary

Additional restudy may be required before Detail Design commences. If so, this could occur in such areas as receiving and storage of the primary refuse; classification; mixing in the digesters; and liquid-solids separation. These areas are described in Section 4.0.

Section II

INTRODUCTION

SECTION 2.0
INTRODUCTION

2.1 General

On June 13, 1975, Waste Management, Inc. was selected by ERDA to provide the complete program for A.S.E.F. Solid Waste to Methane Gas Experimental Facility. The program includes design, construction and operation. Jacobs Constructors, Inc. will implement the design and construction phases, and Waste Management, Inc. will over view Phases I and II and will conduct the full scale operation of the facility.

The purpose of this program is to evaluate and verify the technical and economical feasibility of the Solid Waste to Methane Fermentation Process. Since anaerobic fermentation of solid waste materials has not been demonstrated on a large scale, there is a definite risk factor that the system will not perform as current research suggests.

2.1 General - continued

The full scale experimental facility shall have the major objectives listed below:

1. To establish information concerning product quantities and product values;
2. To evaluate process reliability and economics;
3. To determine optimum design and operation parameter values for each process stage and system operation;
4. To establish a basis for comparing the process to other means of energy production and/or resource recovery from urban waste; and
5. To establish the technological and economic basis for commercial utilization of the process.

During July, 1975 through January, 1976, JCI has been developing the preliminary engineering for the facility. During this period, various elements of the process and plant arrangement were investigated by the assigned engineering personnel. Also, JCI has made three on-site visits to review the proposed site, to meet with local officials and subcontractors and to conduct a gas mixing

2.1 General - continued

experimental program. Various equipment vendors were contacted to aid in selection of process equipment. The two areas of the process in which JCI found no previous experience or design data were:

- Mixing of a slurry with 10% content of solid waste (particle size of minus 4 inches) and primary sludge.

- Solid/liquid separation of a fibrous material.

The equipment vendors that were contacted were unfamiliar with handling this type of material.

During the week of November 17, 1975, JCI/WMI conducted a simulated gas mixing experiment at the project site. A report of this experiment is included in Section 3.0. This experiment documents the first time anyone has mixed shredded solid waste with a slurry consistency of 5 to 12% solids by using compressed air as the mixing element. It was observed that gas mixing may be a positive means of continuously

2.1 General - continued

mixing this type of slurry in the digester. Two of the mechanical mixing equipment vendors also conducted tests using turbine type of mixer. No positive recommendation could be obtained at this time with a definite performance guarantee. These vendors will require additional research and development of their mixing equipment with this type of material.

A solid/liquid separation experiment was conducted during the week of December 1, 1975 at the University of Illinois. A report of this experiment is included in Section 3.0. This experiment was demonstated with a Rotostrainer pilot test unit using the slurry produced from a 100 gallon tank in Dr. J. Pfeffer's laboratory. This unit appeared to produce a cake which would comply with landfill regulations in the State of Florida. Several equipment vendors have also conducted tests with this slurry material and have recommended either a vacuum filter, a basket centrifuge or a bowl centrifuge. A higher solid concentration could be obtained with one of these alternates. However, an increased capital cost would be incurred by the use of this type of equipment.

2.1 General - continued

The total process design for a Solid Waste to Methane Gas Experimental Facility is described in Section 4.0, which includes the process flow diagrams and suggested alternates for further investigation.

A definition of the physical facility complex is provided in Section 5.0 along with a plot plan, a general plant arrangement and electrical single line diagram.

A detailed estimate is presented in summary form, along with a description of the various elements of the estimate in Section 6.0.

In Section 7.0, an overall summary project schedule is presented showning time durations for engineering, equipment deliveries and a proposed method of accomplishment of construction.

In the Appendix, Section 8.0, the Equipment Index, Drawing Index, Specification Index Listing and General Outline Specifications have been included.

Section 2.0
Introduction

2.1 General - continued

A definition of the physical facility complex is provided in Section 5.0 along with a plot plan, a general plant arrangement and electrical single line diagram.

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Section 2.0
Introduction

2.2 Project Justification

Prior Development Efforts

The anaerobic digestion of refuse and refuse-sewage sludge mixtures has been investigated on a laboratory-scale for over 6 years.

In 1969, EPA - Office of Solid Waste Management Programs, funded studies in the Department of Civil Engineering at the University of Illinois, Urbana-Champaign (UIUC).

Dr. John T. Pfeffer has acted as principal investigator. This initial work took place in 5-liter-digesters, and was subsequently conducted in 15-liter reactors. The process variables that were studied included such classical digestion factors as: volatile solids loading; mesophilic or thermophilic temperature regimes; pH; volatile acid concentrations; nutrient requirements; gas production; gas composition; volatile solids

2.2 Project Justification - continued

destruction; dewaterability of the residue; and detention time.

In 1973, the funding was continued at UIUC under the auspices of the Research Applied to National Needs (RANN) program of the National Science Foundation (NSF) and the studies were conducted in a 400 liter (100 gallon) capacity mechanical-stirred fermentor. This work is on-going, even to this date, and the current effort centers on caustic pretreatment of the shredded refuse prior to feed to the digester, and residue dewatering.

Separate studies have been conducted under other auspices at laboratories of: The Institute of Gas Technology (IGT) in Chicago; of Dynatech R/D in Cambridge, Mass.; and Systems Technology Corporation in Dayton, Ohio. The data obtained by each separate

2.2 Project Justification - continued

investigating organization, on balance, confirm the validity of the results elucidated by the others. None of the experimental efforts, however, have been conducted at a scale larger than that provided by a 400-liter (100 gallon) digesting vessel, where the prepared refuse feed rate exceeded five to ten pounds per day. No inhibitory or toxic impacts on digester operation have been noted during these investigations.

Rationale for Scale-up

This laboratory-scale activity has described the characteristics, and control measures that ought to be used in the process; that is, methane producing organisms are effective in transforming organic substances to gas if it occurs in a test-tube, a 1-gallon reactor, or a 100-gallon reactor if the proper environmental conditions are maintained in the system.

2.2 Project Justification - continued

However, the ultimate attraction for scale-up to commercially-sized plants depends upon conducting an experimental program in a system with sufficient throughput capacity using commercially sized equipment. This enables one to study engineering factors, materials handling problems, utility requirements, operator attention and supervision and other unknown elements that influence costs.

Size of Demonstration Facility

Typical overall dimensions of "production-level" anaerobic digesters start at 50 or more feet in diameter and 20' to 27' side water depth. The volume of a 50' diameter x 23' SWD cylindrical tank is about 340,000 gallons. Capacity for two tanks (this provides operating flexibility and affords sufficient seed if one should ever fail) is 700,000 gallons. Assuming that the mean

2.2 Project Justification - continued

Size of Demonstration Facility

dry solids concentration of the digesting slurry approaches 10 per cent and "bone-dry" added volatile solids are 50 per cent of the raw refuse (25% moisture, 25% inerts removed by feed preparation, and 50% added to digesters). The feed rate in tons per day would be as follows.

$$600{,}000 \text{ gallons} \times \frac{1 \text{ unit dry solids}}{10 \text{ units slurry}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} \times \frac{8.34 \text{ lbs slurry}}{\text{gallon}} = 250 \text{ tons dry solids, detained in digester tankage}$$

This is equivalent to 500 tons of raw refuse, as received on a tipping floor. Referring to the studies of Dr. Pfeffer a typical detention time for mesophilic conditions will be 10 days, and 5 days for thermophilic investigations. Thus, the raw refuse requirement will be:

Mesophilic: 500 tons/10 days = 50 TPD

Thermophilic: 500 tons/5 days = 100 TPD

2.2 Project Justification - continued

Size of Demonstration Facility

Other considerations may have influenced ERDA, and the NSF before it, to select a variable throughput capacity of 50 to 100 TPD, but the calculations shown above provide one basis for its selection.

Section III

DESIGN CRITERIA

SECTION 3.0
DESIGN CRITERIA

3.1 General

The basic design criteria used in developing the A.S.E.F. Solid Waste to Methane Gas facility were outlined in the U.S. Energy Research and Development Administration RFP No. AT(11-1)-P-0012 dated March 21, 1975.

The RFP Scope of Work designated the basic input capacity of 50 to 100 tons per day of solid waste for feed material; the type of feed preparation; anaerobic digestion; operating modes; handling and disposal of solid waste and the experimental program for Phase III.

The JCI/WMI proposal indicated that the proposed plant site owned by, and the shredded solid waste feed material would be supplied by Waste Management, Inc., the owner and operator of a solid waste shredding facility known as the Solid Waste Reduction Center, located at 2900 NW 48th Street in Pompano Beach, Florida. The receiving and shredding facilities at the existing plant site are available and will be

3.1 General - continued

dedicated to the supply of feedstock for the A.S.E.F., for the duration of the experimental program. Any desired portion of the 300 tons or more per day of shredded urban refuse processed through the plant on a regular basis (five days per week) will be available as feed material for this experimental program. An interface feed point and feed rate has been established by WMI. A landfill adjacent to the shredding facility currently accepts all milled material and will be available for disposal of residues and excess filtrate liquors. The process design is based on the availability of these existing facilities for use in the experimental program.

WMI specified shredder operating and waste composition data:

Shredder Output:	15 TPH currently, to be increased to a total of 65 TPH by fall, 1977.
Particle Size:	-6 to -7 inches currently (70% minus 3 inches after installation of new shredder).

3.1 General - continued

Plant Operations: 8 to 10 hours/day, 5 days/week.

Composition of solid waste delivered to moisture contnet to WMI facility:

Type	Average % Dry Basis	Average % Wet Basis at 23.4% Moisture
Food	1.7	4.2
Garden	3.8	5.8
Paper	38.5	54.6
PVC, Rubber, Leather	3.5	4.4
Textiles	2.1	2.2
Wood	2.5	2.6
Ferrous Metals	7.2	7.2
Non-Ferrous Metals	1.1	1.1
Other Metals	0.1	0.1
Glass, Ceramics	12.0	12.0
Rock, Dirt, Ash	0.1	0.0
Fines	4.0	5.7
Moisture	23.4	
	100.0%	100.0%

Section 3.0
Design Criteria

3.2 Documents

The following documents assisted and were referred to in development of the process design:

- Proposal for ERDA
  "Facility for the Production of Methane Gas from Urban Solid Wastes"
  May 16, 1975
  by Waste Management, Inc. and
  Jacobs Engineering Co.

- Dynatech R/D Company
  Fuel Gas Production from Solid Waste - July 31, 1974

- J. Pfeffer and J. Liebman of
  The University of Illinois
  Biological Conversion of
  Organic Refuse to Methane
  January, 1975 and September, 1975

3.3 Reports and Design Data

The following reports and design data established the preliminary design for the facility:

- Report of Subsoil Investigation of Proposed
  Methane Gas from Solid Waste Project
  Dated November, 1975
  Prepared by: Florida Testing & Engineering Co.

- Material Balance of the Process prepared by JCI

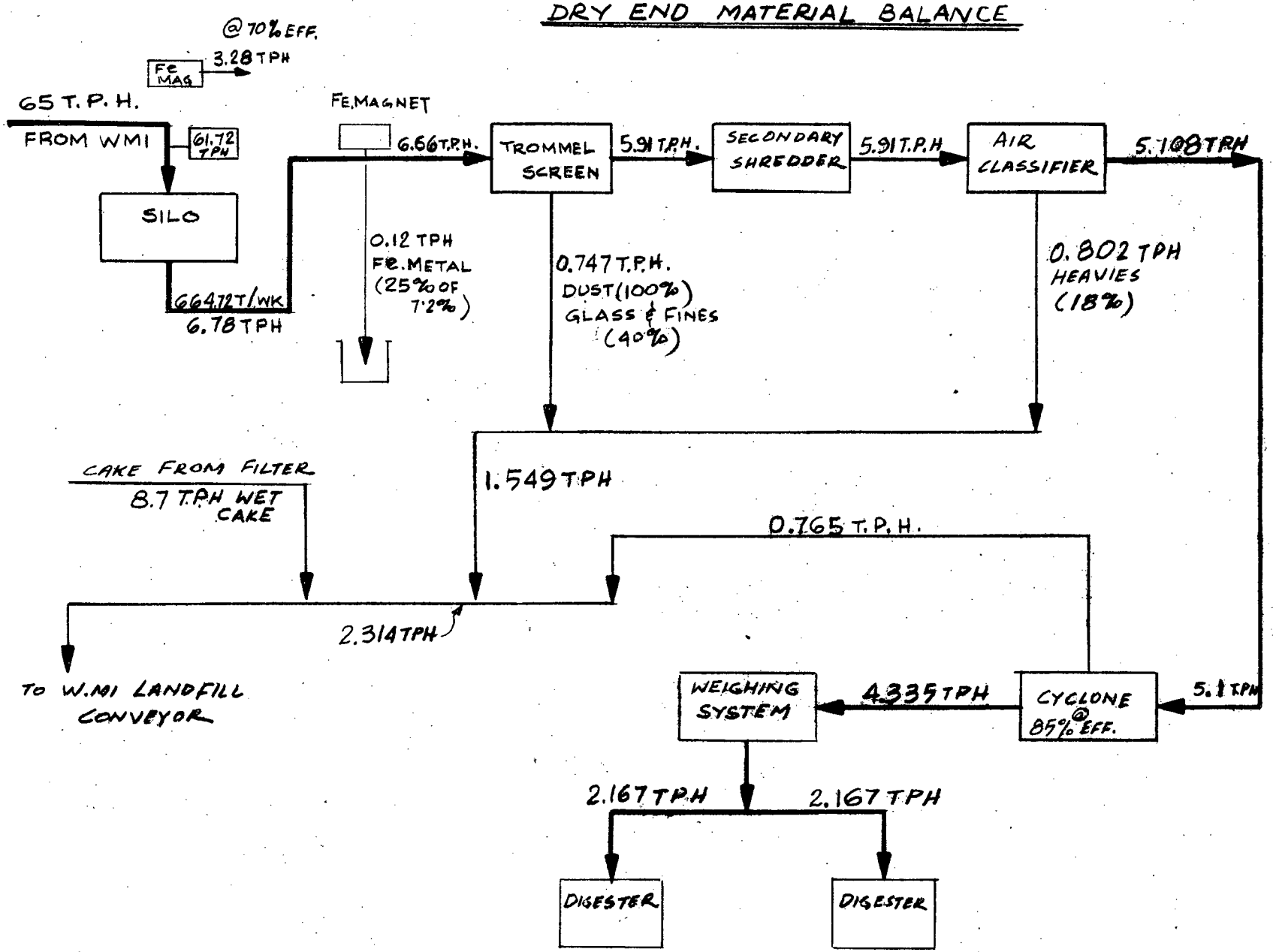
- Heat Balance of the Process

- Experimental test with a Rotostrainer Pilot Unit conducted at University of Illinois by Dr. J. Pfeffer

3.4 Equipment Vendors

Various equipment vendors were contacted to make design recommendations and quote a preliminary cost for the equipment.

DRY END MATERIAL BALANCE



JACOBS CONSTRUCTORS INC.

CALCULATION SHEET

BY WIL DATE 12-22-75 SUBJECT A.S.E.F. SOLID WASTE TO METHANE C4F, DRY END SHEET NO. OF

CHKD. BY DATE JOB NO. 25-1372

JACOBS CONSTRUCTORS INC.

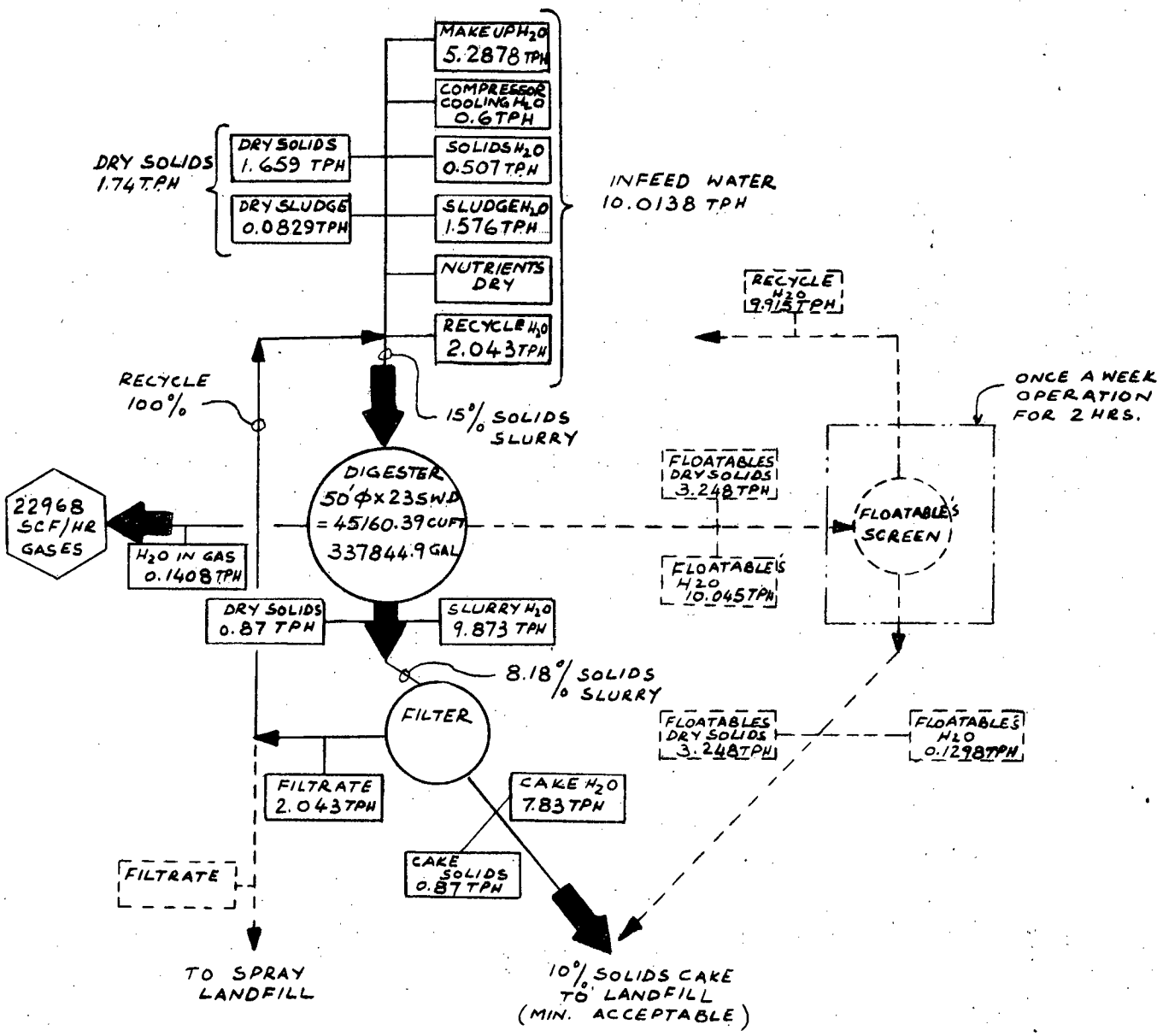
CALCULATION SHEET

BY NIL DAS DATE 12-22-75 SUBJECT ASEF SOLID WASTE TO METHANE GAS WET END SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. 05-1372

REVISE PER NOTES OF MARCH 18 MEETING

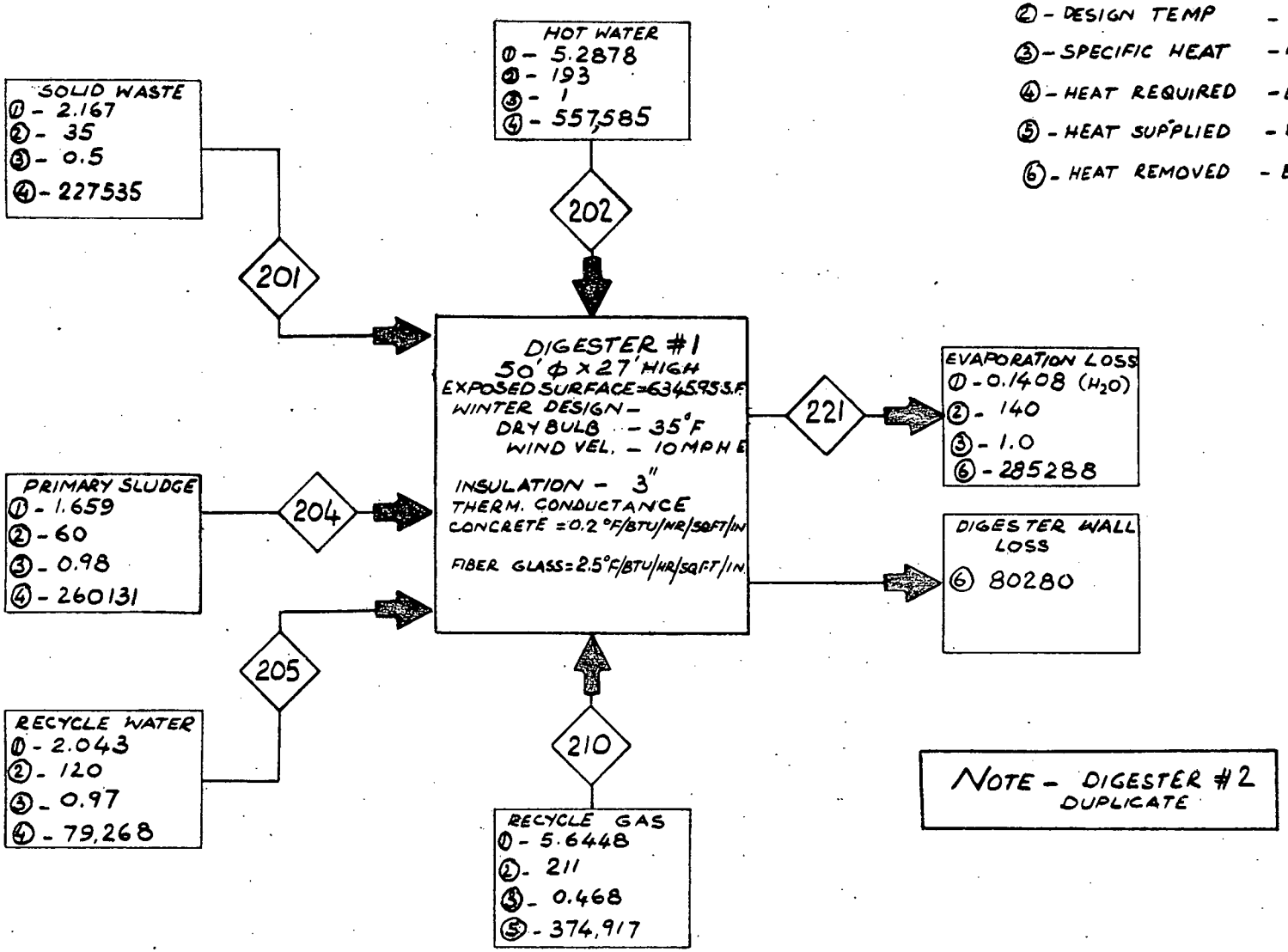
MATERIAL BALANCE PER DIGESTER



Revision #1

DIGESTER #1 HEAT BALANCE

(THERMOPHILIC DIGESTION)



① - FLOW RATE - TPH
② - DESIGN TEMP - °F
③ - SPECIFIC HEAT - BTU/#°F
④ - HEAT REQUIRED - BTU/HR
⑤ - HEAT SUPPLIED - BTU/HR
⑥ - HEAT REMOVED - BTU/HR

NOTE - DIGESTER #2 DUPLICATE

$$\underset{④}{\text{HEAT REQUIRED}} + \underset{⑥}{\text{HEAT REMOVED}} = \underset{⑤}{\text{HEAT SUPPLIED}}$$

$$(227535 + 260131 + 79268) + (285288 + 80280) = (557585 + 374917)$$

$$566934 + 365568 = 932502$$

JACOBS CONSTRUCTORS INC.

CALCULATION SHEET

BY T.G./W.D. DATE 1-7-76 SUBJECT ASEF SOLID WASTE TO METHANE GAS SHEET NO. OF

CHKD. BY DATE JOB NO. 05-1372

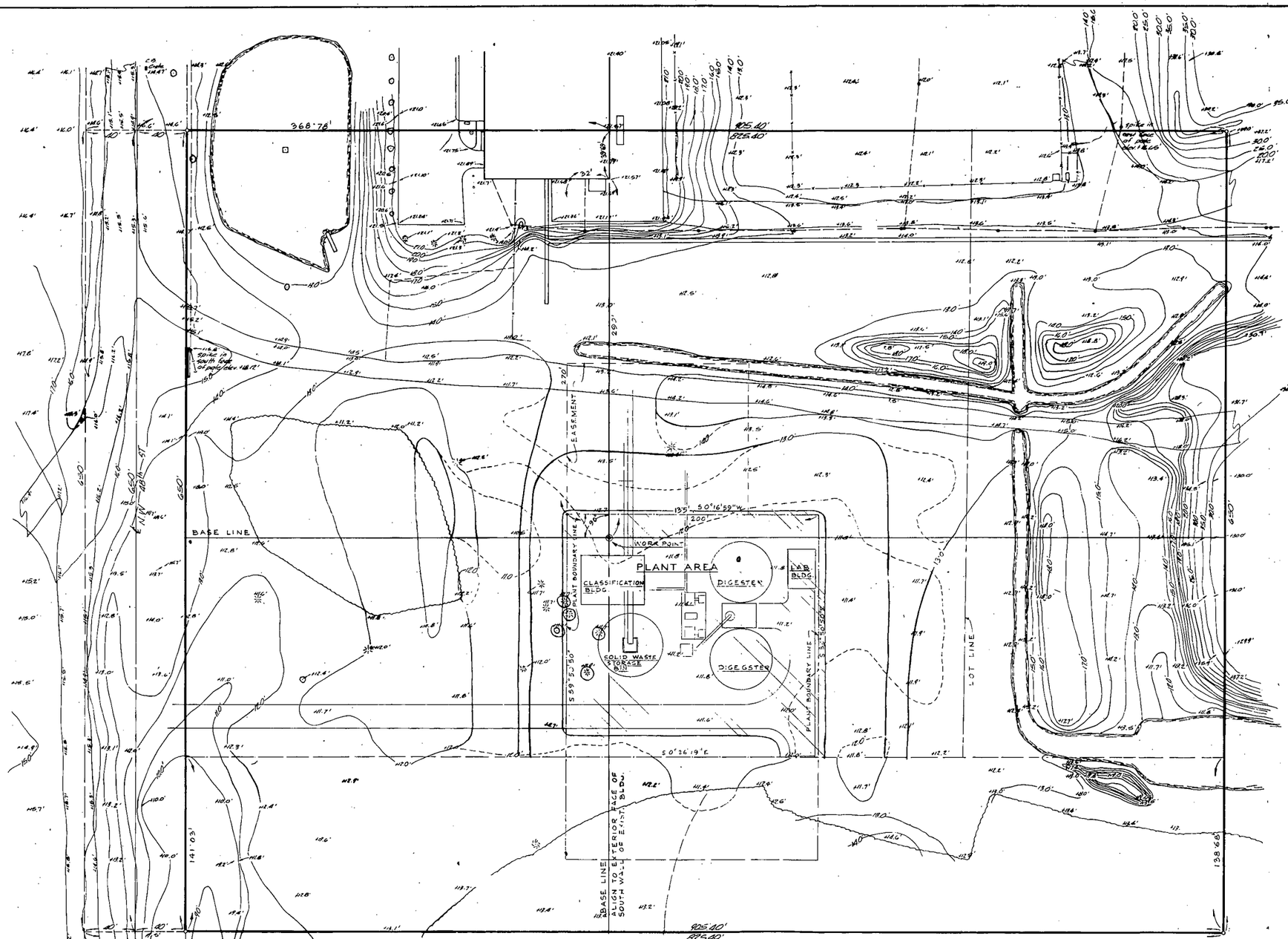
Revise per Notes of March 18 meeting

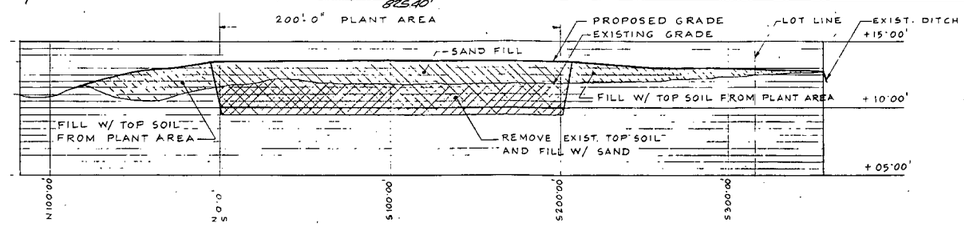
Revision #1

ISSUE AND DISTRIBUTION RECORD														
DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT (NPH)						1-19-76										
FIELD																
BID																
E.R.D.A.						1-19-76										

LEGEND:

- 13'0" — EXIST'G GRADE ELEVATION
- 13'0" — NEW GRADE ELEVATION
- 13'0" — EXIST'G CONTOUR TO BE REVISED
- LOT LINE
- PLANT AREA BOUNDARY LINE
- AREA TO BE EXCAVETED TO REMOVE ORGANIC TOP SOIL & TO BE SAND FILLED (IN PLAN)
- EXIST'G TREE TO BE REMOVED





N-S CROSS SECTION

SCALE: HORIZ. 1" = 40'-0", VERT. 1" = 5'-0"

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	1-19-76	ISSUED FOR TITLE I	WD	

A.S.E.F. SOLID WASTE TO METHANE GAS

WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER

POMPANO BEACH, FLORIDA

FOR — UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR

Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654 8800

JACOBS CONSTRUCTORS, INC.

PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION	APPROVED FOR ISSUE	
	By WMI	By ERDA

DRAWING TITLE

SITE PREPARATION PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
P. ACHARYA	P. A.	J. CAPPOZZO JR.	
SCALE 1" = 40'-0"	PROJECT NUMBER 05-1372	DRAWING NUMBER AD-2	REVISION 0
DATE 1.5.76			

REPORT OF SUBSOIL INVESTIGATION

OF

PROPOSED METHANE GAS FROM SOLID WASTES PROJECT

Pompano Beach, Florida

For

Jacobs Constructors, Inc. of
Chicago, Illinois

Order No. 7868

November-1975

5000-1-2 R1

S C O P E

The intention of this Report is to present an analysis of an investigation conducted by Florida Testing & Engineering Co. of the subsoil materials underlying the site of the proposed Methane from Solid Wastes Project, in the City of Pompano Beach, Florida.

This Report will also include the recommendations as to the development of structural design.

GENERAL CONDITIONS:

The site of the proposed Plant is as indicated on Jacobs Constructors CD-10 Site Plan, dated October 10, 1975. The topography of the proposed site is generally level, having a variation from the average of one foot (1'), and, at the time of investigation, was covered for the most part with water (2 to 3').

It is understood that the proposed structural loading is as follows:

a. Resource Recovery: 40' x 80' with 25 k column loads

b. Storage Silo: 50' diameter bin with peripheral load of approx. 11 k/lineal foot.

c. Digestor: 50' diameter with 25. k/sq. ft. on full area

d. Storage Tanks: 14' diameter with 1.5 k/sq. ft.

INVESTIGATION PROCEDURES:

This subsoil investigation was conducted by Florida Testing & Engineering Co. of Ft. Lauderdale in November, 1975. It is understood that these borings were obtained through standard approved drive techniques and samples taken every two feet by means of a two-inch o.d., two-foot split tube sampler, driven by a 140-lb. hammer, with a free fall of 30 inches. A description of the soil and ground water conditions was noted and the hammer blows for each six inches of penetration of the sampler and each foot of casing

were recorded.

These borings, plus criteria developed in this area, form the basis for the recommendations included in this Report.

INVESTIGATION RESULTS:

Generally speaking, the borings indicate that throughout the area, directly beneath the water , a highly organic topsoil (muck) was encountered from the surface to a depth of 1' to 2' below the surface. Underlying this muck, a medium fine sand was encountered to terminal depth of borings. Geologically speaking, this sand is classified as PAMLICO SAND. This sand is a deposit of marine origin and blankets the coastal area from north Broward County as far south as Coral Gables. It unconformably overlies, underlies, and fills cavaties in the rock formation in this area. This sand is chiefly a quartz sand, ranging in color from brown to gray, depending on the amounts of iron oxide or carbonaceous material. The sand ranges in size from very fine to coarse, the medium-sized grains predominating. The formation density, as encountered at this elevation, in this area, ranges between medium to very loose. This zone was indicated to terminal depth of borings.

From a structural standpoint, the sand strata ranges in bearing value from 1500 p.s.f. to 2000 p.s.f. in the top 20' and from 3000 p.s.f. to 4000 p.s.f. 20 to 30' below the surface.

CONCLUSIONS & RECOMMENDATIONS:

On the basis of this study, we wish to offer the following conclusions and recommendations relative to the planned installations: Loading criteria have been based upon a net settlement of one inch and a factor of safety of two against failure in shear has been considered.

After the surface water has been drained, the muck encountered should be stripped from all proposed building areas, plus an additional 5' around the perimeter. The areas should then be compacted, using a large, vibratory compactor, to a density of 95% of Modified Proctor, to a vertical depth of 24" below stripped grade. Approved fill may then be placed in layers not to exceed 18" and compacted to 95% of Modified Proctor.

If the above criteria is adhered to, a uniform design bearing capacity of 3000 p.s.f. may be utilized.

Respectfully Submitted,
FLORIDA TESTING & ENGINEERING CO.

J. V. Winterholler, Jr., P.E.
Registered Engineer No. 6893
State of Florida

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes #05-1372
LOCATION as shown on Drawing C-D 10, Revision Z

DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 1
DATE STARTED Nov. 3, 1975
DATE COMPLETED Nov. 3, 1975

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
					2	
+10.02	3.0'	Standing water			3	
+9.02	1.0'	Dark gray medium fine silica sand with roots and organics	1	2/4	4	2
+8.02	1.0'	Tan limerock and silica sand	2	5/6	5	3
				4/5	6	5
				5/7	7	9
+5.52	2.5'	Tan-gray medium fine silica sand; some limerock and shell	3	6/6	~~8~~	~~11~~
				5/8	9	10
+3.02	2.5'	Tan-gray medium fine silica sand with some limerock and shell	4	7/5	10	12
				3/4	11	8
				4/5	12	13
					13	19
					14	23
-1.98	5.0'	Tan-gray medium fine silica sand and shell	5		15	28

Boring continued on Page 2....

Note: 3' of standing water Standing

Water level: _____' below surface at 8:30am Date 11/3/75

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By _____
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT see page 1.
LOCATION see page 1.
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 1 (Page 2.)
DATE STARTED 11/3/75
DATE COMPLETED 11/3/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
				3/5	16	16
				5/7	17	27
					18	35
					19	43
-6.98	5.0'	Tan-brown fine to medium silica sand	6		20	51
				9/11	21	16
				16/23	22	27
					23	34
					24	50
-11.98	5.0'	Tan-brown fine to medium silica sand	7		25	61
				10/12	26	23
				15/19	27	35
					28	42
					29	47
-16.98	5.0'	Tan-brown fine to medium silica sand	8		30	51
				11	31	23
				19/23	32	
-19.98	3.0'	Tan-brown fine to medium silica sand	9	18/18	33	

Boring completed.

Water level: See page 1. below surface at _____ date _____

Copies: Client; Original & 5 copies

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By J. V. Winterholler

J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes #05-1372
LOCATION as shown on Drawing CD-10, Revision Z

DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 3
DATE STARTED Nov. 5, 1975
DATE COMPLETED Nov. 5, 1975

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.02	2.0'	Standing water			2	
+9.52	1.5'	Dark gray muck with silica sand and roots	1	1/1	3	1
				2/2	4	2
+8.02	1.5'	Tan-gray medium fine silica sand; trace of roots and silica sand	2	2/4	5	4
				2/1	6	4
+6.02	2.0'	Tan fine-medium silica sand with marl & roots	3	2/2	7	3
				2/3	8	5
+4.02	2.0'	Tan fine-medium silica sand with marl & roots	4	3/3	9	7
+3.02	1.0'	Tan-gray fine to medium silica sand with some shell	5	4/3	10	7
				4/4	11	5
				5/6	12	8
					13	10
					14	13
-1.98	5.0'	Tan-gray medium fine silica sand with some shell	6		15	16

Boring continued on Page 2.....

sc

Note: 2' of standing water

Water level: Standing ' below surface at 11:30 am date 11/5/75

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By J. V. Winterholler

J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT see page 1.
LOCATION see page 1.
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 3 (Pg.2)
DATE STARTED 11/5/75
DATE COMPLETED 11/5/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
				5/5	16	8
				7/8	17	12
					18	17
					19	26
-6.98	5.0'	Tan-brown fine to medium silica sand	7		20	30
				9/11	21	12
				10/12	22	18
					23	29
					24	41
-11.98	5.0'	Tan-brown fine to medium silica sand	8		25	46
				10/14	27	26
					28	37
					29	44
-16.98	5.0'	Tan-brown fine to medium silica sand	9		30	55
				11/13	31	
-18.98	2.0'	Tan-brown fine to medium silica sand	10	16/22	32	
		Boring completed.				
	sc	see Page 1.				

Water level: _____' below surface at _____ date _____

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc. ORDER No. 7868
PROJECT Methane from Solid Wastes #05-1372 REPORT No. 1
LOCATION as shown on Drawing CD-10, Revision 2 HOLE No. 4
DATE STARTED 11/4/75
DRILLER Krapf & Gresser DRILL No. 2 DATE COMPLETED 11/4/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.02	2.0'	Standing water			2	
				1/1	3	1
+9.52	1.5'	Dark gray medium fine silica sand with organics and roots	1	2/3	4	3
+8.02	1.5'	Tan-brown medium fine silica sand	2	3/4	5	3
				3/5	6	6
+6.02	2.0'	Tan medium fine silica sand; some marl	3	4/5	7	8
				4/4	8	9
+4.02	2.0'	Tan-gray medium fine silica sand; some shell	4	6/5	9	11
+3.02	1.0'	Tan-gray medium fine silica sand; some shell	5	6/6	10	13
				5/5	11	8
				7/6	12	11
					13	16
					14	21
-1.98	5.0'	Tan-gray medium fine silica sand with some shell	6		15	27

Boring continued on Page 2...

Note: 2' of standing water
Standing Water level 3:05 pm 11/4/75 below surface on date

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Boring & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT see Pg.1
LOCATION see Pg.1
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 4 (Pg.2)
DATE STARTED 11/4/75
DATE COMPLETED 11/4/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				3/4	16	9
				4/5	17	13
					18	23
					19	28
-6.98	5.0'	Tan-light brown fine medium silica sand	7		20	37
				10/11	21	12
				13/17	22	17
					23	27
					24	38
-11.98	5.0'	Tan-brown fine to medium silica sand	8		25	46
				9/13	26	14
				16/19	27	25
					28	39
					29	46
-16.98	5.0'	Tan-brown fine to medium silica sand	9		30	52
				10/12	31	
-18.98	2.0'	Tan-brown fine to medium silica sand	10	12/14	32	

Boring completed.

See Page 1.

Water level: _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By _____
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes - #05-1372
LOCATION as shown on Drawing CD-10, Revision Z
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 6
DATE STARTED 11/3/75
DATE COMPLETED 11/3/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
+12.02	1.0'	Tan-dark gray silica sand with wood shavings and some organics	1		1	
				1/1	2	1
+10.02	2.0'	Tan-dark gray silica sand with roots and organics	2	2/4	3	2
				3/5	4	5
+8.02	2.0'	Tan-brown medium fine silica sand	3	4/6	5	8
				3/4	6	9
+6.02	2.0'	Tan medium fine silica sand with some marl	4	4/5	7	7
				6/7	8	10
+3.52	2.5'	Tan-gray medium fine silica sand with limerock; some shell	5	7/7	9	13
+3.02	0.5'	Tan-gray silica sand;limerock;some shell	6	6/5	10	18
				4/4	11	11
				7/8	12	13
					13	18
					14	26
-1.98	5.0'	Tan-gray medium fine silica sand & shell	7		15	30

Boring continued on Page 2...

Water level: Standing ' below surface at 11:30 am date 11/3/75

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors
PROJECT see page 1.
LOCATION see page 1.
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 6 (Pg.2)
DATE STARTED 11/3/75
DATE COMPLETED 11/3/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				3/3	16	14
				5/6	17	23
					18	34
					19	41
-6.98	5.0'	Tan-brown fine to medium silica sand	7		20	47
				12/14	21	17
				17/21	22	28
					23	41
					24	53
-11.98	5.0'	Tan-brown medium fine silica sand	8		25	62
				9/11	26	21
				14/18	27	29
					28	37
					29	40
-16.98	5.0'	Tan-brown medium fine silica sand	9		30	42
				10/12	31	
-18.98	2.0'	Tan-brown medium fine silica sand	10	16/22	32	

Boring completed.

See Page 1.

Water level: _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By _____
J. V. Winterholler, P.E.

TEST BORING REPORT

ENT. Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes - #05-1372
LOCATION as shown on Drawing CD-10, Revision Z
DRILLER Krapf & Gresser. DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 8
DATE STARTED 11/3/75
DATE COMPLETED 11/3/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.52	1.5'	Standing water		~~1~~/1	~~2~~	~~1~~
+10.02	1.5'	Dark gray medium fine silica sand with organics and some muck	1	1/2	3	1
				2/3	4	2
+8.02	2.0'	Tan-gray medium fine silica sand	2	3/2	5	3
				2/4	6	3
+6.02	2.0'	Tan fine medium silica sand with marl	3	3/4	7	4
				4/4	8	6
+4.02	2.0'	Tan fine to medium silica sand with trace of marl	4	3/4	9	8
+3.02	1.0'	Tan-gray fine to medium silica sand with some shell	5	3/5	10	8
				3/4	11	4
				5/5	12	7
					13	11
					14	12
-1.98	5.0'	Tan-gray medium fine silica sand with some shell	6		15	15

Boring continued on Page 2....

Water level: Standing ' below surface at 2:45 pm date 11/3/75

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors
PROJECT see page 1.
LOCATION see page 1.
DRILLER Krapf & Gresser. DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 8(Pg.2)
DATE STARTED 11/3/75
DATE COMPLETED 11/3/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				4/4	16	9
				6/7	17	13
					18	16
					19	24
-6.98	5.0'	Tan-brown fine to medium silica sand	7		20	32
				8/12	21	11
				15/16	22	17
					23	25
					24	37
-11.98	5.0'	Tan-brown fine to medium silica sand	8		25	40
				9/13	26	14
				15/17	27	28
					28	36
					29	43
-16.98	5.0'	Tan-brown fine to medium silica sand	9		30	49
				10/14	31	
-18.98	2.0'	Tan-brown fine to medium silica sand	10	17/20	32	
		Boring completed.				

See Page 1.
Water level: _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By _____
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc. ORDER No. 7868

PROJECT Methane from Solid Wastes - #05-1372 REPORT No. 1

LOCATION as shown on Drawing CD-10, Revision Z HOLE No. 9

DATE STARTED 11/5/75

DRILLER Krapf & Gresser DRILL No. 2 DATE COMPLETED 11/5/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.52	1.5'	Standing water			2	1
				-/1		
+10.02	1.5'	Dark gray medium fine silica sand w/organics	1	2/2	3	2
				3/4	4	4
+8.02	2.0'	Tan medium fine silica sand	2	4/4	5	4
				3/4	6	5
+6.02	2.0'	Tan medium fine silica sand	3	3/3	7	7
				2/3	8	9
+4.02	2.0'	Tan medium fine silica sand with marl	4	3/3	9	11
+3.02	1.0'	Tan-gray medium fine silica sand	5	3/4	10	10
				2/2	11	5
				3/4	12	8
					13	11
					14	14
-1.98	5.0'	Tan-gray medium fine silica sand and some shell	6		15	16

Boring continued on Page 2...

Water level: Standing ' below surface at 8:30am Date 11/5/75

sc

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors
PROJECT See page 1.
LOCATION see page 1.
DRILLER Krapf & Gresser. DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 9 (Pg.2)
DATE STARTED 11/5/75
DATE COMPLETED 11/5/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				3/4	16	10
				7/8	17	15
					18	18
					19	23
-6.98	5.0'	Tan-light brown fine medium silica sand	7		20	31
				8/10	21	16
				12/12	22	27
					23	35
					24	42
-11.98	5.0'	Tan-light brown fine medium silica sand	8		25	54
				9/12	26	25
				15/18	27	37
				-	28	31
					29	58
-16.98	5.0'	Tan-light brown fine medium silica sand	9		30	67
				11/10	31	
-18.98	2.0'	Tan-light brown fine medium silica sand	10	13/17	32	
		Boring completed.				

See Page 1....
Water level: _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes - #05-1372
LOCATION as shown on Drawing CD-10, Revision Z
DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 11
DATE STARTED 11/5/75
DATE COMPLETED 11/5/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.52	1.5'	Standing water		~~-/1~~	~~2~~	~~1~~
+10.02	1.5'	Dark gray medium fine silica sand with wood shavings & organics; some muck	1	1/2	3	1
				3/3	4	2
+8.02	2.0'	Tan medium fine silica sand	2	4/6	5	5
				5/5	6	7
+6.02	2.0'	Tan medium fine silica sand	3	4/4	7	7
				3/4	8	6
+4.02	2.0'	Tan medium fine silica sand; some marl	4	3/2	9	6
+3.02	1.0'	Tan-gray medium fine silica sand	5	2/3	10	9
				3/3	11	4
				4/5	12	9
					13	12
					14	16
-1.98	5.0'	Tan-gray medium fine silica sand;some shell	6		15	17

Boring continued on Page 2.....

Standing Water level: _____' below surface at 3 pm date 11/5/75

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc. ORDER No. 7868

PROJECT see page 1. REPORT No. 1

LOCATION see page 1. HOLE No. 11 (Pg.2)

DATE STARTED 11/5/75

DRILLER Krapf & Gresser DRILL No. 2 DATE COMPLETED 11/5/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				4/5	16	8
				5/7	17	13
					18	17
					19	21
-6.98	5.0'	Tan-brown fine medium silica sand	7		20	26
				7/9	21	10
				11/13	22	16
					23	23
					24	34
-11.98	5.0'	Tan-brown fine medium silica sand	8		25	48
				10/10	26	12
				14/16	27	18
					28	32
					29	44
-16.98	5.0'	Tan-brown fine medium silica sand	9		30	51
				11/14	31	
-18.98	2.0'	Tan-brown fine medium silica sand	10	16/18	32	
		Boring completed.				

See Page 1....

Water level: _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property or designing of structures.

Florida Testing & Engineering Co.

By J. V. Winterholler

J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes - #05-1372
LOCATION as shown on Drawing C D-10, :Revision Z
DRILLER Krapf & Gresser DRILL No. 2

ORDER No.: 7868
REPORT No. 1
HOLE No. 14
DATE STARTED 11/4/75
DATE COMPLETED 11/4/75

GROUND ELEVATION +13.02 M.S.L.

		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.52	1.5'	Standing water		~~/1~~	~~2~~	~~1~~
+10.02	1.5'	Dark gray muck with silica sand and some roots	1	1/2	3	1
				3/4	4	4
+8.02	2.0'	Tan-gray medium fine silica sand	2	4/6	5	4
				4/5	6	5
				5/7	7	6
+5.52	2.5'	Tan fine medium silica sand	3	~~5/8~~	~~8~~	~~8~~
				7/7	9	7
+3.02	2.5'	Tan fine medium silica sand	4	6/5	10	9
				3/3	11	5
				4/5	12	9
					13	11
					14	15
-1.98	5.0'	Tan fine medium silica sand	5		15	18

Boring continued on Page 2....

Standing Water level: _____' below surface at 11:45am Date 11/4/75

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT See Page 1.
LOCATION See Page 1.

DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 14 (Pg.2)
DATE STARTED 11/4/75
DATE COMPLETED 11/4/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				3/4	16	13
				4/5	17	20
					18	27
					19	38
-6.98	5.0'	Tan-brown fine medium silica sand	6		20	43
				8/10	21	14
				14/18	22	25
					23	36
					24	45
-11.98	5.0'	Tan-brown fine medium silica sand	7		25	58
				7/10	26	19
				12/16	27	31
					28	39
					29	40
-16.98	5.0'	Tan-brown fine medium silica sand	8		30	40
				9/9	31	
-18.98	2.0'	Tan-brown fine medium silica sand	9	14/17	32	
		Boring completed.				

Water level: See Page 1. Below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By _____
J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors, Inc.
PROJECT Methane from Solid Wastes - #05-1372
LOCATION as shown on Drawing CD-10, Revision Z

DRILLER Krapf & Gresser DRILL No. 2

ORDER No. 7868
REPORT No. 1
HOLE No. 17
DATE STARTED 11/4/75
DATE COMPLETED 11/4/75

GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
					1	
+11.02	2.0'	Standing Water			2	
				1/1	3	1
+9.02	2.0'	Dark gray medium fine silica sand with roots and organics	1	2/1	4	1
+8.02	1.0'	Tan-gray medium fine silica sand	2	3/4	5	3
				2/3	6	7
				3/4	7	10
+5.52	2.5'	Tan fine to medium silica sand	3			
				~~4/4~~	~~8~~	~~10~~
				3/5	9	11
+3.02	2.5'	Tan fine to medium silica sand	4	4/3	10	13
				1/1	11	6
				2/1	12	9
					13	13
					14	17
-1.98	5.0'	Tan fine to medium silica sand	5		15	22

Boring continued on Pg.2....

SC

Water level: Standing ' below surface at 8:15 am date 11/4/75

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

TEST BORING REPORT

CLIENT Jacobs Constructors — ORDER No. 7868

PROJECT see page 1. — REPORT No. 1

LOCATION see page 1. — HOLE No. 17 (Pg.2)

DATE STARTED 11/4/75

DRILLER Krapf & Gresser — DRILL No. 2 — DATE COMPLETED 11/4/75

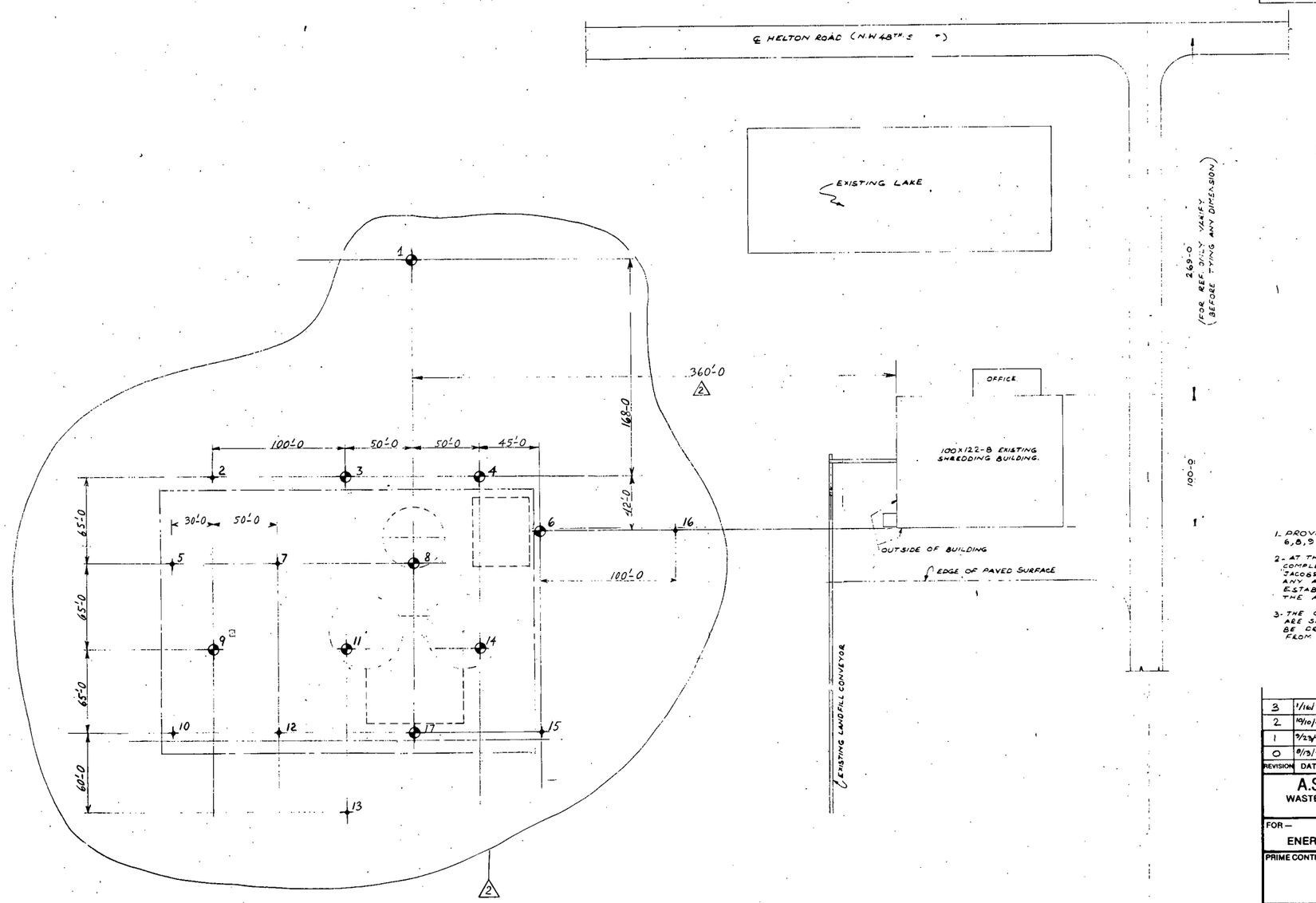
GROUND ELEVATION +13.02 M.S.L.		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
				5/6	16	10
				8/8	17	14
					18	19
					19	24
-6.98	5.0'	Tan-brown medium fine silica sand	6		20	27
				7/9	21	13
				11/14	22	18
					23	29
					24	35
-11.98	5.0'	Tan-brown medium fine silica sand	7		25	41
				10/14	26	21
				13/16	27	33
					28	40
					29	41
-16.98	5.0'	Tan-brown medium fine silica sand	8		30	40
				9/12	31	
-18.98	2.0'	Tan-brown medium fine silica sand	9	15/20	32	
		Boring completed. see page 1.....				
		Water level: _____' below surface at _____ date _____				
	SC					

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.

By _____
J. V. Winterholler, P.E.

ISSUE AND DISTRIBUTION RECORD														
DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT(WMI)						9/5	9/23	10/10	1/16							
FIELD																
BID						8/12										
IEC SOILS TESTING						9/5	9/23	10/10								
ERDA								10/10	1/16							



GENERAL NOTES

1. PROVIDE 9 (NINE) TEST BORINGS MARKED ◔ 1,3,4 6,8,9,11,14 & 17 TO A DEPTH OF 30'-0
2. AT THE TIME OF ABOVE BORINGS ARE ABOUT TO BE COMPLETED THE SOILS ENGINEER SHALL CONTACT JACOBS CONSTRUCTORS INC. IN CHICAGO TO CONFER IF ANY ADDITIONAL BORINGS MAY BE REQUIRED TO ESTABLISH THE PROPER SOIL CHARACTERISTICS OF THE AREA.
3. THE OTHER 8 LOCATIONS MARKED ◆ 2,5,7,10,12,13,15&16 ARE SHOWN FOR DISCUSSION PURPOSE ONLY & SHALL NOT BE DE'LED PRIOR TO ADDITIONAL AUTHORIZATION FROM JACOBS CONSTRUCTORS INC.

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
3	1/16/76	REVISED TITLE BLOCK	E.T.B.	
2	10/10/75	REVISED LOCATION & ARRANGEMENT OF BORING	A.G.	
1	9/23/75	REVISED LOCATION & ARRANGEMENT OF BORINGS.	A.G.	
0	9/13/75	ISSUED FOR CONSTRUCTION	W.D.	

A.S.E.F. SOLID WASTE TO METHANE GAS

WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER

POMPANO BEACH, FLORIDA

FOR — UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR

Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.

PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION	APPROVED FOR ISSUE	
	By WMI	By ERDA

DRAWING TITLE

SOIL TESTING SITE PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
WIL DAS	WIL DAS	WIL DAS / A.G.	WIL DAS /
SCALE 1" = 40'-0"	PROJECT NUMBER 05-1372	DRAWING NUMBER CD-10	REVISION 3
DATE 8-11-75			

GAS MIXING EXPERIMENTAL PROGRAM REPORT

10% SLURRY OF SHREDDED REFUSE

A.S.E.F. SOLID WASTE TO METHANE GAS

POMPANO BEACH, FLORIDA

NOVEMBER, 1975

WASTE MANAGEMENT, INC.

JACOBS CONSTRUCTORS, INC.

PROJECT NO. 05-1372

TABLE OF CONTENTS

Revision #1

1.0 INTRODUCTION

This report documents a gas mixing experiment conducted to determine the mixing characteristics of a solid waste slurry in a consistency of 8% to 15% solids. Since the initial contacts with equipment vendors of conventional mechanical mixers had given no indication that standard mixers could adequately mix a 10% refuse slurry in the proposed 50 ft. diameter x 27 ft. deep fixed cover digester, it was decided to use gas in the mixing mechanism. JCI/WMI proposed this experiment since there is little or no experience, and consequently no available design data, for mixing this type of slurry. Gas mixing has been successfully used to mix sewage sludge at 3% to 5% solids, but there is little experience with mechanical or gas lift mixing in the range of 8% to 15% solids. The success of the proposed A.S.E.F. depends upon adequate mixing of shredded refuse with seed sludge, nutrients and water at 8% to 15% solids content.

Appendix A discusses the mixing of sewage sludge.

The experimental program was conducted during November 17 through November 24, 1975 at the proposed project site in Pompano Beach, Florida. This site has an existing shredding and landfill facility owned and operated by Waste Management, Inc.

1.0 Introduction - continued

The general purpose of this test was to evaluate the feasibility of gas mixing or other mixing alternatives, and if feasible, to develop pratical design criteria for their application at the A.S.E.F. More specifically, the objective of the test was to determine whether the gas lift principle used in sewage sludge digesters could be extended to the mixing of refuse in a 8% to 15% solids slurry.

Another purpose of the experiment was to provide field experience in the mixing of refuse slurry by any mechanical means which might be proposed by suppliers of commercial mechanical mixers. The following eight firms were invited to furnish equipment for testing. Although no mechanical mixing devices were furnished, firms marked with * responded and sent a representative to witness the tests.

Chemineer, Inc.	- Chicago, Illinois
Cleveland Mixer Corp. *	- Bedford, Ohio
Mixing Equipment Co., Inc.	- Des Plaines, Illinois
Fairfield Engineering Co. *	- Marion, Ohio
Philadelphia Mixers Corp.	- Philadelphia, Pennsylvania
Envirex, Water Quality Control *	- Des Plaines, Illinois
Dorr-Oliver, Inc.	- Elmhurst, Illinois
Envirotech Corporation	- Palatine, Illinois

2.0 DESIGN CRITERIA

2.1 Gas Mixing Principles

In the gas mixing of sewage sludge CH_4-CO_2 mixture resulting from anaerobic digestion of sewage solids is collected under a gas-tight cover and compressed to a pressure exceeding

2.0 DESIGN CRITERIA

2.1 Gas Mixing Principles - continued

that of the equivalent liquid head in the digester. Ideally, the compressed gas is released at multiple points in the bottom of the digester, causing a gas lift effect by reducing the density of the sludge column overlying the injection points. As the rising slurry column reaches the surface, the slurry spreads laterally and the gas is released in the gas space under the cover. Only a fraction of the "total gas" production is compressed and recirculated and none of the recirculated gas is lost. In gas mixing sewage sludge, a few hours operation each day provides adequate turnover. Although some applications include gas injection in a draft tube to induce circulation from bottom to top, that method is only appropriate for 3% to 5% solids sewage slurries.

2.2 Basic Design

Anaerobic digestion of organic material depends upon the intimate mixing of properly sized feed stock with a substrate containing active bacteria and nutrients under proper conditions of moisture and temperature, all in the absence of oxygen. In laboratory experiments by Dr. John Pfeffer, shredded municipal solid wastes were mixed in a 100 gallon

2.0 DESIGN CRITERIA

2.2 Basic Design - contiued

pilot scale digester with a conventional mechanical (propeller) mixer at slurry concentrations approximating 10% consistency. On the basis of Pfeffer's experiments and from general experience in the mixing of anaerobic sewage sludge digesters (as discussed in Appendix A), mechanical mixing was proposed for the full scale demonstration project, being developed for ERDA by WMI/JCI, for recovery of Methane Gas from municipal solid wastes.

Past experience with gas mixing of heavy solids in sewage sludge digesters suggests its application to the mixing of wet municipal solid wastes, particularly since gas used in the mixing is produced in the digestion process itself. Because gas mixing requires no moving parts within the digester, it seems to offer maintenance advantages in the elimination of seals, iternal bearings and digester-mounted drive mechanisms. In the absence of operating data from large scale gas mixing of fibrous material at slurry concentrations greater than about 5%, an experimental mixing program was proposed.

3.0 SPECIFIC GOALS OF THE EXPERIMENT

1. To determine whether gas mixing can be effective in the lateral and vertical mixing of a 8% to 10% colids slurry of shredded municipal refuse.

2. To determine the most effective gas mixing pattern for a circular tank, for example, center rise and peripheral fall; peripheral rise and center fall; one side rise-other side fall; etc.
3. To determine the gas volume requirements for effective gas mixing.
4. To make available a facility in which other mixing devices can be pilot tested in the actual slurry to be mixed.

4.0 EXPERIMENTAL EQUIPMENT

To permit visual observation of the mixing pattern, an open top vertical wall tank was installed outdoors on a concrete slab adjacent to the shredder building at Pompano Beach, Florida. To avoid the hazards of gas handling and storage, and to keep the experiment fairly simple, compressed air was substituted as the mixing element.

The tank was of welded steel construction, 10 feet in diameter with 15 feet sidewalls, and a hopper bottom of 18 inches deep, truncated to a 54 inch diameter level center. Steel cross members and two observation platforms were provided. Four clear plastic observation windows were provided in the shell at mid-height and four at the bottom of the shell opposite and directly above peripheral and radial diffusers and their connecting pipes.

Diffuser piping was mounted at the tank bottom in four quadrants, each supplied by a valved header. The diffuser pattern included a single

peripheral air header diffuser with anominal diameter of 8 feet and twelve 30" long radial diffusers extending along the floor slope toward the center. A 3 foot diameter clear zone at the center contained no diffusers. Each quarter segment of peripheral diffuser and its three radial diffusers were connected to a 1½ inch drop pipe supplied by a 2 inch header feeding two quadrants.

Each diffuser consisted of 1½ inch steel pipe drilled with ¼ inch horizontal holes at 6 inch intervals along the total length of pipe and covered with 2 inch unlined linen fire hose clamped at both ends.

Quadrants 1 and 2 were supplied through a 2 inch air riser outside the tank, fitted with an Ellison type 723 annubar flow element (range 0 to 250 SCFM). Air was supplied by a 25 HP stationary compressor rated at 109 CFM, 200 PSIG. Quadrants 3 and 4 were similarly arranged and metered, but air was supplied by a portable 150 CFM, 100 PSIG gas engine driven compressor. The quadrant numbering system is shown by a sketch on Table I. Each air riser was fitted with a pressure gauge and blow-off valve ahead of the meter, to permit variable air flow rates to the diffuser quadrants. The tank was fitted with an 8 inch horizontal drain, arranged for opening by pivoting a blind flange on a single bolt. Layout and details are shown as arrangement #2 on JCI drawing, "Digester Gas Mixing Experiment" (SK75-08-29).

5.0 EXPERIMENT PROCEDURES

1. Test equipment and diffusion pattern with two feet of clean water over the diffusers and adjust diffuser porosity to achieve maximum gas diffusion over a wide range of air rates from 0.5 cu. ft. to 2.5 cut. ft. of free air per sq. ft. of tank bottom areas.
2. Prepare typical 10% slurry of shredded refuse, nutrients and water, to a 12-ft. depth in the 15-ft. high tank.
3. Apply compressed air in selected patterns and at vaious rates, observing the directions, intensity and thoroughness of vertical and lateral mixing for each set of conditions.
4. Record the air volume, pressure, diffuser pattern in use and observe mixing performance for each set of conditions.
5. Invite suppliers of mechanical mixers to install and test proprietary mixers under similar conditions as for gas mixing.

6.0 PREPARATION OF EQUIPMENT AND REFUSE FEED

Testing of the air diffusion patterns using 2 feet of water over the diffusers on November 19 and 20 revealed major air leaks, which were corrected by the subcontractor. Air flow meters were installed and checked on November 20. To permit reasonable air flow and to faciliate release of water trapped witnin the diffuser hoses, each radial diffuser was perforated withtwenty-two 1/8 inch holes. The air diffusion pattern with two feet of water in the tank was then checked visually and found to be satisfactory for proceeding with the test.

Section 6.0
Preparation of Equipment and Refuse Feed

On November 21st, 9,280 pounds of shredded refuse, which had been previously hand classified (glass bottles, metals and large plastics removed) were delivered to a loading platform. Of this total, 8,000 pounds had been shredded to a size typical of Waste Management, Inc. normal existing operation, using 36 hammers in the Shredder. There was little uniformity of size, and the "typical" material contained unshredded articles of clothing, plastic refuse bags, flattened plastic containers and many items exceeding the 4 inch nominal size in one or more directions. The remaining 1,280 pounds, which had been reshredded to an unspecified finer grind, still contained stringy material and many pieces over 4 inches.

7.0 TANK FILLING & REFUSE FEEDING

While feeding 28 SCFM air to combined quadrants 1 and 2, and 86 SCFM to combined quadrants 3 and 4, the tank was filled to a sidewater depth of 11 feet, with a noticeable roll at the surface toward quadrants 1 and 2. Shredded refuse was added in 1,000 pound batches by portable conveyor over the top of the tank. Applying 1,000 pounds in a few minutes resulted in a massive island which had to be picked apart manually and submerged with rakes. After 4,000 pounds had been added, it was noted that with 86 SCFM of air being applied in quadrants 3 and 4, refuse had settled against the lower windows on that side. Five gallons of 16N-8P-4K liquid fertilizer was added, along

with two 1,000 pound batches of shredded refuse. At this point, the tank contained roughly 61,230 pounds of slurry at a calculated 9.8% concentration as received (7.35% dry basis).

8.0 EVALUATION OF MIXING

November 22, 1975, seventeen hours after adding refuse, the slurry pH was 6 (measured by test paper). After seventeen hours of gentle mixing in quadrants 1 and 2, the depth of bottom deposits were measured at the sidewall of each quadrant and at the center. See Teat No. 1 in Table I, which compares the bottom deposits after various mixing patters and air rates were tried. During Test No. 1, no movement of bottom deposited solids was noted throught the bottom window, although good surface roll was occurring. Air flow could not be measured, due to condensation in the meters, but based on later observations, the air to 1 and 2 together was recorded at 28 SCFM.

Air was then applied at 86 SCFM in quadrants 3 and 4 together, and bottom deposits were measured after one hour. Results are shown in Test No. 2, Table I. These results show increased accumulations in quadrants 1, 2 and center, but no lifting of deposited solids from quadrants 3 and 4.

Air was then applied at 53 SCFM in quadrant 3 alone, and bottom deposits were measured after about 30 minutes, as reported under Test

No. 3, Table I. During all the depth measurements it was necessary to remove and discard stringy and rope-like debris which wrapped around the probing device.

Finding no lifting of deposited solids in quadrants 2 and 3, the header pressures of all separate quadrants were checked. When header pressure of 28 and 38 psi were found for quadrants 1 and 4, respectively, and 15 and 8 psi for quadrants 2 and 3, it was assumed that major blowouts had occurred in the diffuser piping of quadrants 2 and 3. However, the diffuser piping in quadrants 1 and 4 remained sound throughout the test period.

Because time did not permit draining the system, the testing was continued largely by observing solids accumulations under various combinations of active quadrants.

It was evident that the partially digested and thoroughly mixed slurry circulated more readily than the raw material observed on November 21. Air was then turned off in quadrants 2 and 3 and left on in quadrants 1 and 4. After 35 minutes, the bottom deposits were as shown in Test No. 7, Table I. Grab Sample No. 2 from the top foot of quadrant No. 1 immediately following Test No. 7 showed 1.2% dry solids suspended in the slurry.

A minor shifting of solids from quadrant 1 to quadrant 2 shows that 28 SCFM in 35 square feet of active bottom is sufficient to lift deposits in the active quadrant. Comparing Tests 6 and 7, circulating solids appeared to settle in the idle quadrant without being returned to the rising column of the active quadrant.

9.0 EVALUATION OF SLURRY WITHDRAWAL

On November 25th, the 8 inch blind flange serving as a closure for the 8 inch diameter x 30 inch long tank drain was rotated on a single bolt, with air agitation maintained in the vicinity of the drain. The 9.8% slurry (as received basis) drained readily through the 8 inch pipe, but closure of the opening was difficult due to the stringy nature of the material, particularly the rolled plastic sheets. Dependable control of flow rates by a conventional sharp edge throttling valve seems unlikely with this material.

10.0 MIXING OF HIGHER SLURRY CONCENTRATION

On November 24th, after drawing the tank level down 16 inches, two 750 pound batches of shredded refuse were added, resulting in a computed slurry solids of 12.3%, as received, and 10.4% on a dry basis.

With 86 SCFM total air in quadrants 1 and 4, it was necessary to submerge the dry refuse manually. About 30 minutes after submerging the new material it was noted that refuse was packed against the mid-height observation windows, with no evidence of movement.

After a 16 hour shutdown without mixing, the bottom deposits were measured, as reported for Test No. 8, Table I.

A thin layer of persistent, floatable matter was observed on the surface and some suspended matter was present in the liquid. A total of 170 SCFM air was then applied (28 SCFM in quadrants 1 and 2 and 86 SCFM in 3 and 4). After 45 minutes, the bottom deposits were as reported in Test No. 9, Table I.

There was no movement of solids at the bottom windows, but there was circulation observed in the tank at 114 SCFM total air supply.

11.0 ESTIMATION OF MIXING GAS RATE REQUIREMENTS

Because gas introduced at the bottom mixes the entire column above it, the active tank bottom area has been used as a measure for computing mixing gas requirements. Active bottom area in the experimental tank was 70 square feet. Lifting of solids in the 7.35% solids slurry was observed at 28 SCFM in two quadrants, or at the rate of $\frac{28}{35}$ = 0.8 SCFM per square foot of active bottom area. With 114 SCFM total air in four quadrants (Test No. 9), bottom deposits in a slurry of about 12.4% solids were barely lifted at an air rate of $\frac{114}{70}$ = 1.63 SCFM per square foot of active bottom area.

11.0 ESTIMATION OF MIXING GAS RATE REQUIREMENTS - continued

It is therefore concluded that 0.8 to 1 SCFM per square foot of active bottom area can effectively be used for mixing a 10% solids slurry of shredded refuse.

12.0 ESTIMATED POWER REQUIREMENTS

It was noted during these tests that air header pressures for the fine bubble diffusers varied from 28 to 45 psig, whereas a full scale gas diffusion system would be designed with larger openings. For a 22 ft. liquid depth, a header pressure of 14 to 15 psi appears reasonable.

Using 93 BHP as the gas compression requirement for diffusing 1,500 CFM against a back pressure of 15 psi, the power requirement per 1,000 sq. ft. of active tank bottom was 62 BHP when applying 1 SCFM per active square foot.

In terms of liquid volume being mixed, the power requirement was $\frac{62}{22}$ = 2.8 BHP per 1,000 cubic feet.

13.0 CONCLUSIONS AND RECOMMENDATIONS

1. With a 7.35% (dry basis) slurry of coarsely shredded, undigested solid waste, gas mixing resulted in adequate circulation of slurry in the active mixing zone at 0.8 SCFM per sq. ft. The deposits at the bottom indicate improper diffuser location.

2. With a 10.4% slurry of coarsely shredded undigested solid waste, gas mixing at 1.63 SCFM per sq. ft. of active bottom area resulted in local circulation in the active mixing zones, but the deposits on the bottom increased, indicating a tendancy for

13.0 CONCLUSIONS AND RECOMMENDATIONS - continued

2. Continued

formation of dead spots for slurries with higher than 15% solids concentration.

3. With 0.8 to 1 SCFM per square foot of active bottom area, mixing of a 10% solids slurry of shredded refuse can effectively by accomplished.

4. For successful handling, mixing and dewatering of solid waste slurries, close control of particle size and uniformity is essential. Secondary shredding of classified material to a minus 1½ inch particle size in any direction will be required.

5. Provisions will be required for periodic removal of persistent floating material from the liquid surface of a shredded refuse digester.

6. Positive means must be provided for submerging dry feed in an actively mixing slurry zone.

7. Only smooth edged flow control devices such as decanting overflows or pinch valves could be used for controlling refuse slurries.

8. Diffusers would have to be provided over the entire bottom of a gas mixed digester so as not to leave any dead spots.

9. At slurry consistencies above 7% solids, continuous gas mixing would have to be employed over the entire active bottom of the digester. Quadrant mixing in sequence is not recommended.

13.0 CONCLUSIONS AND RECOMMENDATIONS - continued

10. Mechanical Mixing should be further investigated to develop a positive mixing mode at 10% solids slurry, since this experiment has not formed any conclusive design data.

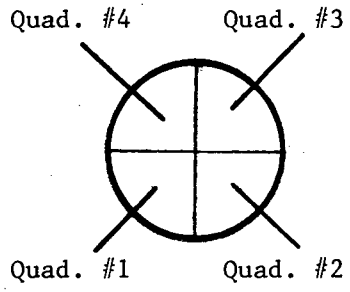
TABLE I

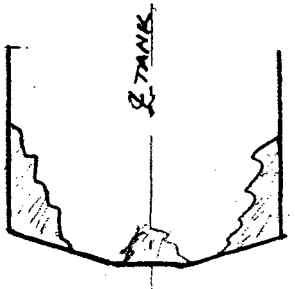
Revision #1

SUMMARY OF BOTTOM DEPOSITS IN TANK AFTER GAS MIXING UNDER VARIOUS CONDITIONS

Test No.	Date	Condition & Gas Flow	Thickness of Bottom Deposits in Inches*				
			Quad. 1	Quad. 2	Quad. 3	Quad. 4	Center
1	11/22/75	Est. 28 SCFM in 1+2 for 17 hours.	17.5	26	28	16	37
2	11/22/75	Est. 28 SCFM in 1+2 & est. 53 SCFM in 3+4	21.5	45.5	27	14.5	41.5
3	11/22/75	53 SCFM in quad. 3 alone (8 psi)	14	45	36	17	41
4	11/22/75	86 SCFM in quad. 4 alone (28 psi)	18	32	36	22	37
5	11/22/75	28 SCFM in 1 and 86 SCFM in 4	17	21	23	16	30
6	11/24/75	28 SCFM in (1+2), 55 SCFM in (3+4)	19	13	17	12	27
7	11/24/75	28 SCFM in (1+4), no air in 2 or 3	13	17	17	13	27
8	11/25/75	After adding 1500 lbs. new refuse & standing 16 hours with no air	90	74	66	53	90
9	11/25/75	28 SCFM in (1+2) at 21 psi & 81 SCFM in (3+4) at 45 psi	92	72	63	47	62

*Measured at tank wall near air pipe for each quadrant, and as depth in hopper at center.





BOTTOM DEPOSIT PATTERN

APPENDIX A

MIXING OF SEWAGE SLUDGE DIGESTERS

Richard D. Pomeroy
Pomeroy, Johnston and Bailey
Pasadena, California

August 25, 1975

In sludge digestion tanks the fluid is thixotropic and often quite viscous, and there are significant density differences. One practice used in an effort to mix digesters is to withdraw liquid and pump it back in or let it fall into the top. The kinetic energy in the returning stream is small, and very little general mixing occurs.

In the 1930's, mechanical mixers were introduced, initially designed particularly to break up the scum layer. They generally fell short of expectations and did not provide any significant mixing of the digester contents.

A type of mechanical mixer that has been used somewhat in recent years has a propeller on a vertical shaft extending into the scum layer. The general experience is that this type does no more than stir a cylindrical cell a few feet in diameter.

Gas mixing was first used for scum control in sewage sludge digesters at Washington, D. C., as reported by R. E. Fuhrman, page 453, Vol 26, No 4, Sewage and Industrial Wastes, April, 1954. The application of a sufficient flow of gas over an area of suitable size causes a gas lift effect from the bottom of the tank to the top, and causes such an upsurge that the tank contents can be overturned.

Gas mixing of digesters is a common practice. An illustrative application is at Palm Springs, California. The tank is 70 ft in diameter, with a 30-ft sludge depth. The compressor is designed to deliver 248 cfm at a pressure of 15 psig. There are six gas injection points, which are only open-ended pipes. They are used one at a time. Mixing is done for about 3 hours a day.

The Palm Springs digester, although unheated, gives excellent results. The sewage is somewhat sandy, and there is no grit removal at the beginning of the plant, yet after 14 years of service there is no evidence of excessive scum or grit accumulations.

There is no way that the mixing of any body of fluid can be accomplished without the expenditure of energy. The energy requirement increases with density differences and with viscosity. In a digester processing refuse with a high paper content, it would be difficult to apply mechanical mixing without substantial energy losses due to friction between the moving parts and the sludge. A gas lift, by contrast, will be quite effective from

the energy standpoint. The bubbles will move through the mass less readily than through water, so the gas lift effect would be more efficient than in clear water.

The power efficiency of mechanical mixing and gas mixing cannot be compared on the basis of the costs of existing installations, because different installations differ enormously in effectiveness.

At Palm Springs a 20-HP compressor at a power cost of 3¢/KWH would cost 45¢ per hour to mix a 114,000 cu ft digester.

Pomeroy, Johnston and Bailey / *Specialists in water and waste technology*

660 SOUTH FAIR OAKS AVENUE, PASADENA, CALIFORNIA 91105 · TELEPHONE (213) 795-7553 · 681-4655

December 31, 1975

TO: Carl B. Johnston

SUBJECT: ERDA-WMI Gas Mixing Experiment (05-1372)
Slurry Samples No. 2 and 3

You have submitted 1-quart Mason jars marked No. 2 and No. 3 for determination of percent solids (dry basis) in slurries of solid waste collected November 24, 1975, at Pompano Beach, Florida.

200 ml of each macerated sample were weighed, vacuum filtered on GFA (glass fiber) paper and the solids were dried @ 105°C overnight.

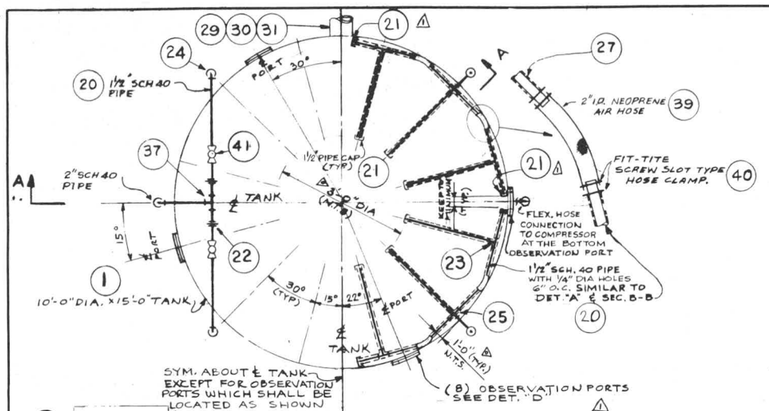
	Sample No. 2 11-24-75 1605	Sample No. 3 11-24-75 1730
Weight of 200 ml	199.7 grams	199.4 grams
Weight of dry solids	2.4128 grams	2.9344 grams
Dry Solids, milligrams/kg	12,082	14,716
Dry Solids, lb/lb	0.012	0.0147
Dry Solids, percent (wt)1	1.21	1.47

F. J. Baumann, Laboratory Director

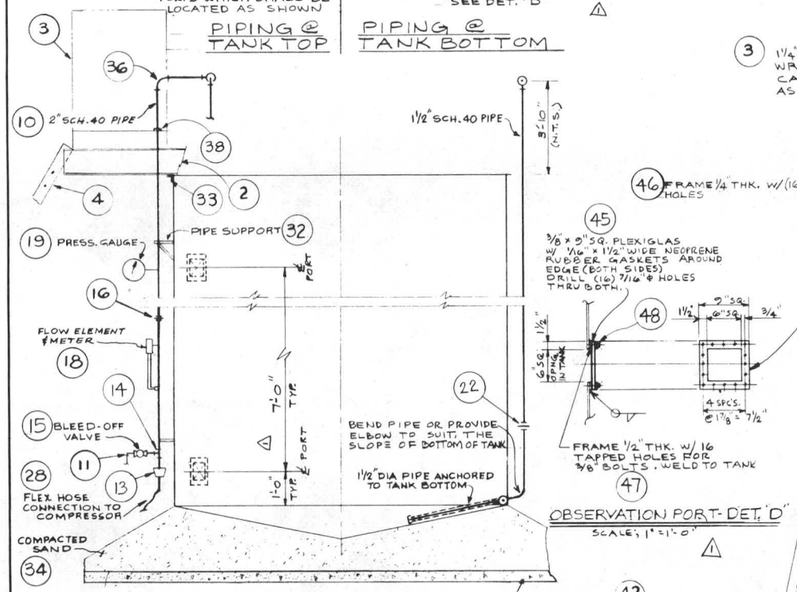
FJB:kh

Note:

1) Dry Solids % (wt) reported above do not reflect correct data due to slurry sample not being representive of the total mass dispersion.

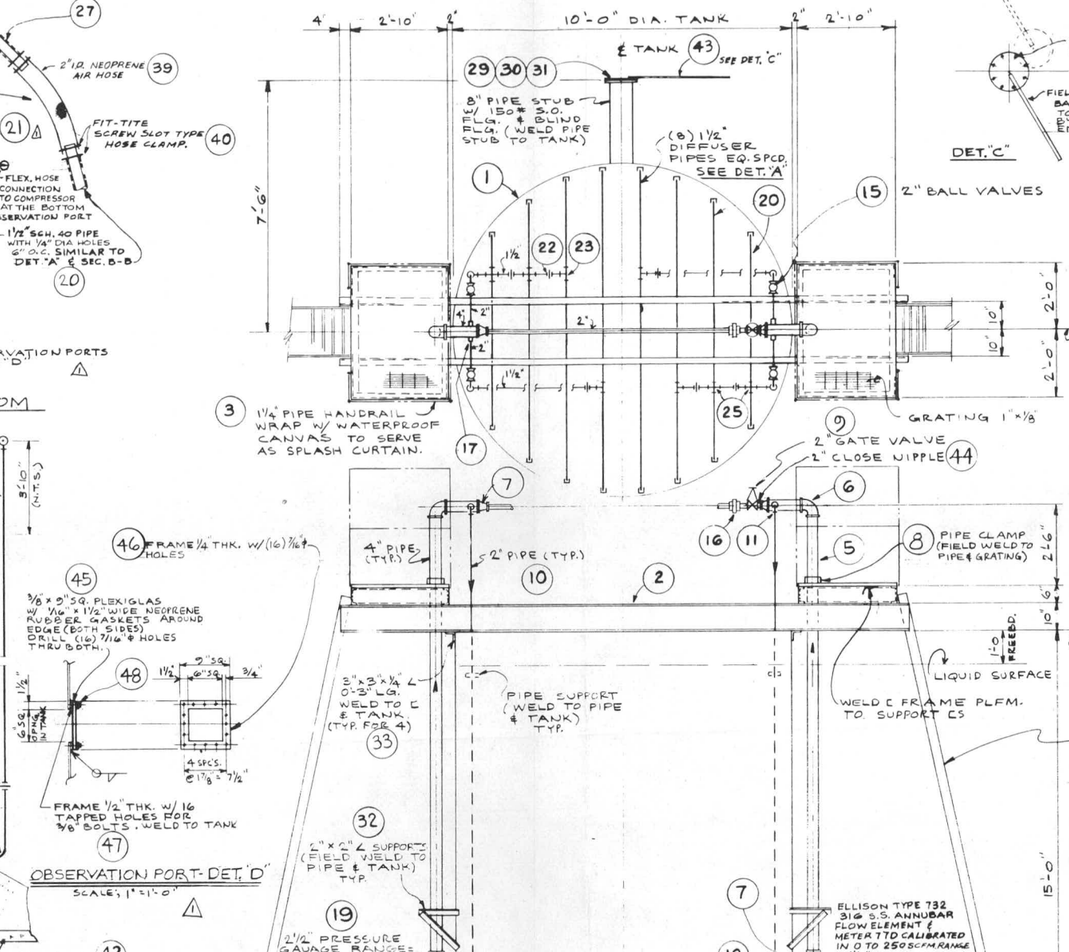


PIPING @ TANK TOP | PIPING @ TANK BOTTOM



PARTIAL SECTION A-A

(ALTERNATE ARRANGEMENT #2)



ELEVATION OF TANK ARRANGEMENT #1

OBSERVATION PORT - DET. "D"

SCALE; 1" = 1'-0"

DET. "A"

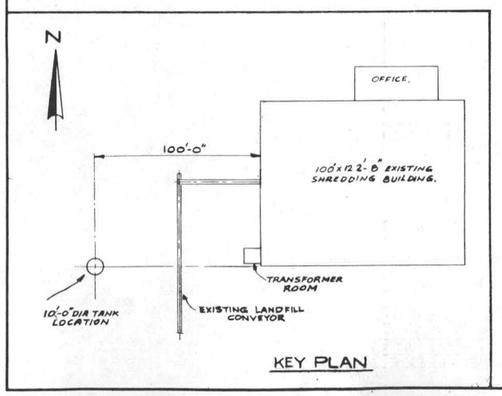
SCALE; NONE

SEC'T. "B-B"

NOTE:

FOR DETAILS NOT SHOWN ON ALTERNATE ARRANGEMENT #2 REFER TO ARRANGEMENT #1, AND EXCEPTIONS AS SHOWN IN BILL OF MATERIAL.

(ARR'GT. #2 USED FOR ACTUAL CONSTRUCTION)



KEY PLAN

NOTE:

1. ITEMS SHOWN ON THIS DWG. ARE TO BE FURNISHED & ERECTED BY CONTRACTOR EXCEPT AS NOTED (L) BY M.
2. ALL PIPE SHALL BE SCH. 40 WELDED, BLACK W/ THREADED ENDS UNLESS NOTED.
3. ALL FITTINGS SHALL BE 150# M.I. SCREWED, BLACK & BANDED U.L.

ITEM	QTY. IN ARR'GT.#1	QTY. IN ARR'GT.#2	DESCRIPTION	REMARKS
1	1	1	TANK. 10'-0" DIA x 15'-0" HIGH.	
2	2	2	C 10 x 15.3. 16'-8" LG.	
3	2	2	2'-10" x 4'-0" PLATFORM. CG x 10.5 FRAME WITH 1" GRATING, 1¼" PIPE HANDRAIL & CANVAS AROUND HANDRAIL.	
4	2	2	ALUMINUM EXTENSION LADDER. 20'-0" HIGH	
5	30'-0"	—	4" SCH. 40 PIPE.	
6	2	—	4" - 90° ELBOW	
7	4	—	4" x 2" REDUCER.	
8	2	—	4" PIPE CLAMP	
9	1	—	2" GATE VALVE SCREWED, 125#	
10	88'-0"	45'-0"	2" SCH. 40 PIPE.	
11	6	2	2" STREET ELL - 90°	
12	4	—	2" x 1½" REDUCER	
13	2	2	2" x ¾" REDUCER	
14	2	2	2" TEE	
15	6	2	2" BALL VALVE, SCREWED, 125#	
16	1	2	2" UNION	
17	4	—	2" COUPLING	
18	2	2	2" FLOW ELEMENT & METER	
19	2	2	2½" PRESSURE GAUGE, 0 TO 125 PSIG.	
20	80'-0"	150'-0"	1½" SCH. 40 PIPE.	
⚠1 21	16	20	1½" CAP	
22	10	8	1½" UNION	
⚠1 23	4	8	1½" TEE.	
⚠1 24	4	4	1½" - 90° ELL	
25	4	4	1½" CROSS	
26	32	—	1½" HOSE CLAMP	
27	65'-0"	65'-0	2" THIN WALL UNLINED LINEN FIRE HOSE	
28	2	2	¾" AIR HOSE WITH COUPLINGS. 25'-0" LG.	
29	2'-6"	2'-6"	8" SCH. 40 PIPE.	
30	1	1	8" SLIP-ON FLANGE - 150# W/ BOLTS, NUTS & L.W.	
31	1	1	8" BLIND FLANGE - 150#	
32	12'-0"	12'-0"	L 2" x 2" x ¼".	
33	1'-0"	1'-0"	L 3" x 3" x ¼".	
34	17 CU.YDS.	17 CU.YDS.	SAND	BY OTHERS
35	2	2	AIR COMPRESSOR, 125 P.S.I., 100 C.F.M.	BY OTHERS
36	—	2	2" - 90° ELL	
37	—	2	1½" x 1½" x 2" REDUCING TEE	
38	—	2	2" PIPE CLAMP	
⚠1 39	—	8	2" I.D. NEOPRENE AIR HOSE, 0'-8" LG.	
⚠1 40	—	88	FIT-TITE SCREW SLOT TYPE HOSE CLAMP	
41	—	4	1½" BALL VALVE, SCREWED, 125#	
42	AS REQ'D.	AS REQ'D.	CONCRETE SLAB	BY OTHERS
43	1	1	¼" x 1" x 3'-0" LG. BAR	
44	1	—	2" CLOSE NIPPLE	
⚠1 45	—	8	⅜" x 9" SQ. PLEXIGLAS W/ GASKETS	
⚠1 46	—	8	¼" x 1½" FRAME - H.R. ST'L.	
⚠1 47	—	8	½" x 1½" FRAME - H.R. ST'L.	
⚠1 48	—	128	⅜" x 1" LG. SQ. HD. BOLTS & L.W.	

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
2	1-12-76	REVISED TITLE BLOCK	E.S.	
1	10-29-75	OBSERVATION PORTS ADDED & BILL OF MAT'L. TABLE ENG'D.	W.D.	
0	10-24-75	ISSUED FOR CONSTRUCTION	W.D.	
A	9-26-75	ISSUED FOR BIDS	E.S.	

A.S.E.F. SOLID WASTE TO METHANE GAS

WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER

POMPANO BEACH, FLORIDA

FOR — UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR: Waste Management, Inc. 900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.

PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION — APPROVED FOR ISSUE: By WMI | By ERDA

DRAWING TITLE: DIGESTER GAS MIXING EXPERIMENT

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
WIL DAS	E.T.S. & A.M.	WIL DAS	

SCALE	PROJECT NUMBER	DRAWING NUMBER	REVISION
½" = 1'-0" & A.N.	05-1372	SK-75-08-29	2

DATE: 8-29-75

MAIL AND DISTRIBUTION RECORD

MAIL TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9
CLIENT WMI	WMI					WMI	WMI	WMI							
FIELD															
ERD	ERDA														
CONSTRUCTION (SITE & PLANT)						WMI	WMI								
CONSTRUCTION (TANK & FITTING)						WMI									
E.R.D.A						WMI	WMI	WMI							

University of Illinois at Urbana-Champaign

DEPARTMENT OF CIVIL ENGINEERING · URBANA, ILLINOIS 61801 · (217) 333-3812

December 11, 1975

Mr. Jim Wesley
Jacobs Engineering Company
22 West Madison Street
Chicago, Illinois 60602

Dear Jim:

We have completed the dewatering tests with the Rotostrainer. The unit we used had the following characteristics:

Screen diameter - 25 inches
Screen width - 18 inches
Screen openings - 0.040 inches
Screen speed - variable

This screen was too large to obtain an accurate measure of the flow rate. Based on the time required to transfer a known volume of slurry from a barrel to the screen, the estimated flow rate was 7.5 gpm with the screen operating at 2.0 RPM. We could not discern any difference in the flow rate for the different feed sludges.

A roller constructed of 4 inch diameter plastic pipe was positioned on the screen about 6 inches above the doctor blade and covered the width of the screen. The roller weighed 4.07 kg. The slurry used for this test consisted of the effluent from the 400 liter fermentation unit. Dewatered fibers were added to some of this slurry to adjust the feed solids concentration. The slurry was hand dipped into a head tank which fed the screen at a uniform rate.

The results of three runs are shown in the following table.

Results of the Dewatering Tests

Run	Feed Solids	Filtrate Solids - g/ℓ			Cake Solids*
	%	Tot. Sol.	Sus. Sol	Dis. Sol.	%
1a	3.97	-	-	-	10.39
1b	3.97	19.18	13.83	5.35	12.32
2	5.30	33.6	26.66	6.95	12.20
3a	7.94	26.2	20.34	5.86	13.03
3b	7.94	34.83	28.50	6.33	12.31

*Average of two samples.

Run 1, 2 and 3a were conducted with the drum operating at 2 RPM

while 3b was operated at 3 RPM. All runs except 1a had the roller inplace. The data speaks for itself. At 12 and 13 percent solids, the cake contained a significant amount of free water. A slower drum speed and a more efficient roller might increase the cake to about 15 percent solids. Solids capture is very poor with the filtrate containing a substantial quantity of fine suspended solids.

We can discuss these numbers the next time we get together.

Sincerely yours,

John T. Pfeffer
Professor of
Sanitary Engineering

oh

cc: Dr. E.J. Nesselson
Mr. Carl Johnston

Section IV

PROCESS DESCRIPTION

SECTION 4.0
PROCESS DESIGN

4.1 General

The process design/development parameters for this Advanced System Experimental Facility have been outlined in Section 3.0, DESIGN CRITERIA. This data has been supplied by: Dr. J. Pfeffer, Professor, University of Illinois; Dr. E. Nesselson, Director, Technical Development, Waste Management, Inc.; equipment vendor recommendations and process design experience within Jacobs.

The process design has been divided into a dry-end flow diagram (KD-2), and two wet-end flow diagrams (KD-3 and KD-4). The dry-end encompasses the functions of: primary shredded refuse storage; magnetic separation; secondary shredding; air classification; and pneumatic transport to the digesters. The wet-end functions consist of: anaerobic digestion; mixing by recycling digester gases; residue dewatering; nutrient addition; filtrate recycle; and gas flaring.

4.1 General - continued

The design basis for operating this facility is 7 days/week, 16 hours/day, (equipment and material balance based on 14 hours/day operation) with a processing capacity of 50 to 100 tons/day of shredded solid waste.

The digester design will incorporate capabilities for investigation thermophilic and mesophilic modes of anaerobic fermentation covering a total retention time span of 4 - 20 days.

4.2 Primary Shredder Production and Interface Point

WMI will expand their shredding facility in 1977 with the addition of a new 50 tons/hour capacity shredding machine, bringing the total primary shredder waste production to 65 tons/hour with a particle size of 70% minus three inches. The WMI facility will normally operate at 8 to 10 hours/day, 5 days/week.

Sixty-five (65) tons/hour of primary shredded waste will be delivered to an interface point 149 feet west of WMI's existing shredder building. An adequate diverter mechanism at this point will feed either an

4.2 Primary Shredder Production and Interface Point - continued

A.S.E.F. feed conveyor or WMI's discharge conveyor to the load out to landfill building. WMI will provide a primary magnet preceding this transfer point to remove most of the ferrous fraction of the primary shredded waste.

4.3 Feed Conveyor

From the interface point, a 60 inch wide inclined belt conveyor rated at 65 TPH will deliver primary shredded waste to a storage silo. This belt conveyor will operate for one to three hours/day to maintain a surge capacity required for feeding the process 16 hours/day, 7 days/week.

4.4 Storage

A live bottom storage silo, with 175 tons at 10 lb./cu. ft. of total effective storage capacity, will be provided to feed the A.S.E.F. take-off conveyor at a maximum controlled rate of 6.78 TPH. The surge capacity will provide stored feed material to the process for weekend operation or to accommodate any down time in the primary shredding operation. The silo will have a high/low level alarm system to prevent overfeed or starvation of the silo.

4.5 Classification/Secondary Shredding

An 'S' type elevating belt conveyor will deliver the primary shredded waste to a vibratory feeder. Suspended over the conveyor will be a self-cleaning secondary ferrous fraction which passed through the primary magnet point. The vibratory feeder feeds at a maximum rate of 6.66 TPH to the trommel screen.

A 6 foot diameter x 20 foot long trommel screen will have replaceable drum sleeves for a different mesh size of 1/2" - 1/4" along the length of the screen for best removal of inorganic grit from the primary shredded waste. The trommel will incorporate slope adjustments to vary retention time. The grit fraction will be conveyed back to WMI's landfill conveyor. TPH at 5.9 of oversized solid waste will be conveyed from the trommel screen to the secondary shredder by a 24" belt conveyor.

The secondary shredder will provide a uniform and controlled particle size with provision to vary the

4.5 Classification/Secondary Shredding - continued

particle size between minus 3 to minus 1-1/2 inch. This shredder will be rated at a maximum of 10 TPH throughput. The secondary shredded waste will be transported by a 24" belt feeding an air classifier system through a vibratory feeder. This feeder will spread and disperse the feed, providing a more uniform classifier feed.

The air classifier will separate the heavy fraction from the light fraction with provisions to vary the heavy/light fraction split, and pneumatically convey the lighter fraction into a cyclone. The classifier capacity is rated at 7 TPH. A dust collector will recover fine dust from the cyclone discharge and vent clean air to the atmosphere. The heavies from the classifier and fines from the dust collector will discharge onto the return conveyor for delivery to WMI's landfill conveyor.

4.6 Feed to Digesters

The secondary shredded waste will discharge from the cyclone through a rotary airlock into a bifurcated feed spout having manual slide gates controlling the even flow of material to either weigh feeder. The weigh feeders, rated at 1.5 to 2.5 TPH, will weigh

4.6 Feed to Digesters

and record the amount of material being fed to the digester feed screw spouts.

The screw feed spout on the digesters will be the nerve center for the feedstock to the digester.

All the constituents of the feed will pass through this spout undergoing partial solid-liquid phase mixing and heat transfer before being force-fed under the liquid level in the digester by a reduced pitch screw feeder. The breakdown of feed constituents is as follows:

Material	TPH to each Digester
Metered Shredder Waste at 23% Moisture	2.166
Primary Sludge at 5% Solids	1.659
Hot Water (make-up)	5.288
Nutrients (dry) Ammonium Chloride Potassium Dl-H Phosphate	as required
Recycle Filtrate	2.043
Water from Compressor	.6
	11.756 TPH

4.6 Feed to Digesters - continued

The primary sludge will be delivered to the site by tank truck from a waste treatment facility about 20 miles away. A receded impeller-type slurry pump will unload the primary sludge from the truck and discharge at a rate of 30 GPM into the screw feed spout located on the digester.

The water for the facility is supplied from deep well at a maximum rate of 100 GPM. A water heater with 2.5×10^6 BTU/hr. capacity will provide hot make-up water at 10.57 TPH and 193°F to maintain optimum operating temperature for thermophilic mode of digestion.

The water heater will be chemically treated to minimize deposits on the heat transfer surfaces once every two weeks or as required.

4.6 Feed to Digesters - continued

the digesters. The storage of the nutrients and lime for pH control will be located on grade level under the weigh feeder structure tower.

The filtrate discharge from the dewatering screen will be collected in a 2000 gallon recycle holding tank. The filtrate liquid will be pumped at 18 to 200 GPM at 120°F back to the screw feed spout for recycle make-up liquid in the digesters. The recycled filtrate process is designed to handle 50% to 100% of the filtrate produced from the dewatering screen. When not recycling, the filtrate can be spray irrigated onto the landfill and handled through the landfill leachate control and treatment system or a package treatment unit could be utilized for onsite pollution control, achieving an effluent suitable for direct discharge to a watercourse.

4.6 Feed to Digesters - continued

Under normal operating conditions of the digesters, the effervescent gases of the digesters will be recycled as a main source of fuel in the water heater. The anticipated heat value of digester gases is expected to be about 500 BTU/cu. ft. However, for start-up, a supplementary supply of No. 4 fuel oil will be available until enough digester gases are available to effect an efficient changeover from fuel oil to gas. A standby 5000 gallon storage tank for No. 4 fuel oil will be provided.

Chemical nutrients will be manually loaded into the feed spout on the digester. A 1/4 ton hoist will be provided to lift the bags up to the weigh feeder platform level. The ammonium chloride and potassium Dl-H phosphate nutrients are added at .0106 TPH to make-up deficiencies of nitrogen and phosphorous in the solid waste fed to

4.7 Digesters Operation

There will be two, 50-foot-diameter concrete tanks equipped with fixed cover, a 23 foot operating level and a capacity of 340,000 gallons in each unit.

These digesters will be operated in two modes of anaerobic fermentation for production of Methane Gas - mesophilic and thermophilic.

Basis of Mesophilic Operation

1. Feed -3" Shredded, Classified Organics.
2. Recycle - 100% Recovered Water.
3. Sewage sludge to refuse ratio - 0.025 to 0.05 (dry solids basis).
4. Nutrients - Ammonium Chloride - 0.009 TPH
   Potassium Dl-H Phosphate - 0.001 TPH.
5. pH - 6.8 $\pm$ 0.2.
6. Feed solids concentration - 8% to 15%
7. Variables to be evaluated.

4.7 Digesters Operation - continued

a. Temperature - 95° to 112°F.

b. Retention time - 10 to 20 days

c. Level of mixing

Basis of Thermophilic Operation

1. Feed preparation - -3" Shredded, Classified Organics.

2. Recycle - 100% Recovered Water.

3. Sewage sludge to refuse ratio = 0.025 to 0.05 (dry solids basis).

4. Nutrients - Ammonium Chloride - 0.009 TPH
   Potassium Dl-H Phosphate - 0.001 TPH.

5. pH = 6.8 ± 0.2.

6. Feed solids concentration - 8% to 15%

7. Variables to be evaluated.

   a. Temperature - 122° to 140°F.

   b. Retention time - 4 to 10 days

   c. Level of mixing

4.7 Digesters Operation - continued

The two modes of operation will be demonstrated in Phase III of the project.

The solids concentration in the slurry will be in a range of 8 to 15%. The slurry will be continuously mixed to eliminate pockets of inactivity, and to induce process stability and efficient microbial utilization of the organic substrate. Due to thixotropic properties of the slurry, the mixing will result in reduction of particle size and separation of fibers, giving a more fluid slurry.

A 250 HP gas compressor will be fed with 3926 SCFM of effervescent gases - approximately 50% methane and 50% carbon dioxide - produced by the digesters. The gas will be recycled back into the digesters through a series of pipes on the floor creating the mixing requirement needed for this consistency of solids. (See 4.10.2 Alternate B - Mechanical Mixing.)

4.7 Digesters Operation - continued

The digester will be provided with an interior launder for the removal of floatable (plastic, etc.) fraction. The removal of the floatables will be a once a week operation lasting two hours. The floatables will be collected into the launder by raising the operating level of the slurry up to 24 feet and directing the stream into the weir for removal. A draft-tube-type mixer will force this fraction out, allowing it to flow to a liquid vibratory screen. The liquid will be recycled back into the system and the floatable solids will discharge on the return conveyor for delivery to WMI's landfill conveyor.

The digested slurry will be gravity fed from the bottom of the digester to an overflow weir box. A manually adjustable weir plate will adjust the

4.7 Digesters Operation - continued

level in the digester and the flow rate to the filter screen.

The pH level in the digester will be monitored and maintained at 6.8 $\pm$ 0.2.

Level, temperature, pressure and flow instruments are provided to monitor and maintain an operable anaerobic fermentation process producing Methane Gas.

4.8 Gas Production

The estimated rate of gas production in each digester, based on 6.6 SCF per pound of volatile solids fed to the digester, is 22,968 SCFH (383 SCFM). Each digester dome provides a gas holding volume of 10,753 cu. ft. The gas will be recycled at a rate of 1963 SCFM to the gas compressor and for fuel for the process water heater.

4.8 Gas Production - continued

A stream of 6454 SCFH (107 SCFM) will be provided as a fuel supply to the water heater. The balance of the Methane Gas produced will be burned in a flare at 659 SCFM.

4.9 Liquid/Solid Separation

From the 50 GPM overflow weir box, the digested slurry is gravity fed to a dewatering screen. A perforated 3 feet diameter x 10 feet long rotating drum filter screen, rated at 10.7 TPH, will be provided at each digester. This filter will dewater the slurry giving a 10 - 15% solids cake. (See 4.10.3 Alternate C - Other Dewatering Techniques.) The filtrate will be recycled into a 2000 gallon holding tank.

The cake is discharged to the return conveyor for delivery to WMI's landfill conveyor.

4.10 Alternates to the Process

4.10.1 Alternate 'A' - Wet Feed Preparation

A total dry feed preparation system is presented in this report with supply of primary shredded solid waste interfaced with WMI's shredding facility. Although this is a proven and efficient method of feed preparation for various applications, a wet feed preparation as an alternate is worth mentioning. Based on experience gained at the Franklin, Ohio Resource Recovery Facility, it is feasible to use a wet pre-processing system which would eliminate such processes as primary shredding, trommel screening, secondary shredding, air classifying and all related conveying. A covered, as received solid waste storage area with adequate feed conveyor to a hydro-pulping system would comprise the front end of the wet front-end system; a tramp and heavies removal, liquid slurry thickener to achieve required

4.10.1 Alternate 'A' - continued

solids concentration and all connected slurry pumping and piping would constitute process functions of such a system.

Current indications re that the wet pre-processing system does not present either capital or operating cost savings. Such a system does, in addition, pose certain problems such as excess process water treatment requirements, added drying requirements and does not permit the use of dry aluminum recovery techniques.

4.10.2 Alternate 'B' - Mechanical Mixing

During the initial preparation of this report, it was assumed that the mixing of the digester contents would be accomplished by recycling and compressing digester gases to a pressure counteracting the static head of liquid slurry plus all pipe losses. This recommendation was based on the data obtained from "Gas

4.10.2 Alternate 'B' - continued

Mixing Experiment" conducted in Pompano Beach in November, 1975. Due to the mechanical mixing equipment vendors' general lack of familiarity with the mixing of solid waste slurries with high solids concentrations, a final recommendation as to the use of mechanical mixing could not be made at the time this report was prepared. However, at least one leading vendor has indicated an interest in performing the necessary experiments which would lead to the development of design criteria for an agitator which would perform the desired solid waste slurry mixing. Such development work would lead to a performance guarantee by the equipment vendor. It is anticipated that if reliable mechanical mixing equipment can be developed for this application with expected performance guarantees, during the detail design

4.10.2 Alternate 'B' - continued

phase of this project, such equipment will be specified and incorporated in the design, provided the cost can be adequately justified. This type of mixing is recommended to be incorporated into the process design of the project.

4.10.3 Alternate 'C' - Other Dewatering Techniques

A perforated rotating drum screen dewatering experiment was conducted in Dr. Pfeffer's laboratory in early December, 1975 to demonstrate this method of dewatering a solid waste slurry to produce a filter cake containing 10-12% solids. A higher solids concentration can be obtained using the vacuum filter, or a basket or bowl centrifuge. A vacuum filter can be used for this application with expected performance guarantees. During the detail design phase of this project, such equipment will be specified and incorporated in the process design provided the cost can be adequately justified.

4.10.3 Alternate 'C' - continued

with expected performance guarantees. During the detail design phase of this project, such equipment will be specified and incorporated in the process design provided the cost can be adequately justified.

A vacuum filter is recommended to be incorporated into the process design of the project.

If the cake is to be incinerated at some future time or put to some other use calling for higher solids concentration, alternate means of dewatering, such as a centrifuge, may be considered provided the increased cost of equipment can be justified.

X-2301
BURNER
CAPACITY; 300 S.C.F.M.

K-801
BURNER BLOWER
CAPACITY; 300 S.C.F.M.
MOTOR; 1 1/2 HP

MX-2001 & MX-2002
MIXER
TYPE; MARINE IMPELLER
MOTOR; 1/3 HP
MATERIAL; C.S.

T-1301 & T-1302
DIGESTER TANKS
SIZE; 50' DIA. x 27' HIGH
CAPACITY; 340,000 GAL.
MATERIAL; CONCRETE

MS-2501 & MS-2502
DIGESTER FEEDER SCREWS
SIZE; 24" ø
CAPACITY; 2.167 T.P.H.
MOTOR; 5 HP
MATERIAL; C.S.

F-1202
FLOATABLES SCREEN
SIZE; 24" x 24"
CAPACITY; 0.5426 T.P.H.
MOTOR; 1/2 HP
MATERIAL; C.S.

MF-2704 & MF-2705
DIGESTER OVERFLOW WEIR
CAPACITY; 50 G.P.M.
MATERIAL; FRP

F-1203 & F-1204
SCREEN FILTER
SIZE; 3' ø x 10'
CAPACITY; 10.743 T.P.H.
MOTOR; 1/2 HP
MATERIAL; C.S.

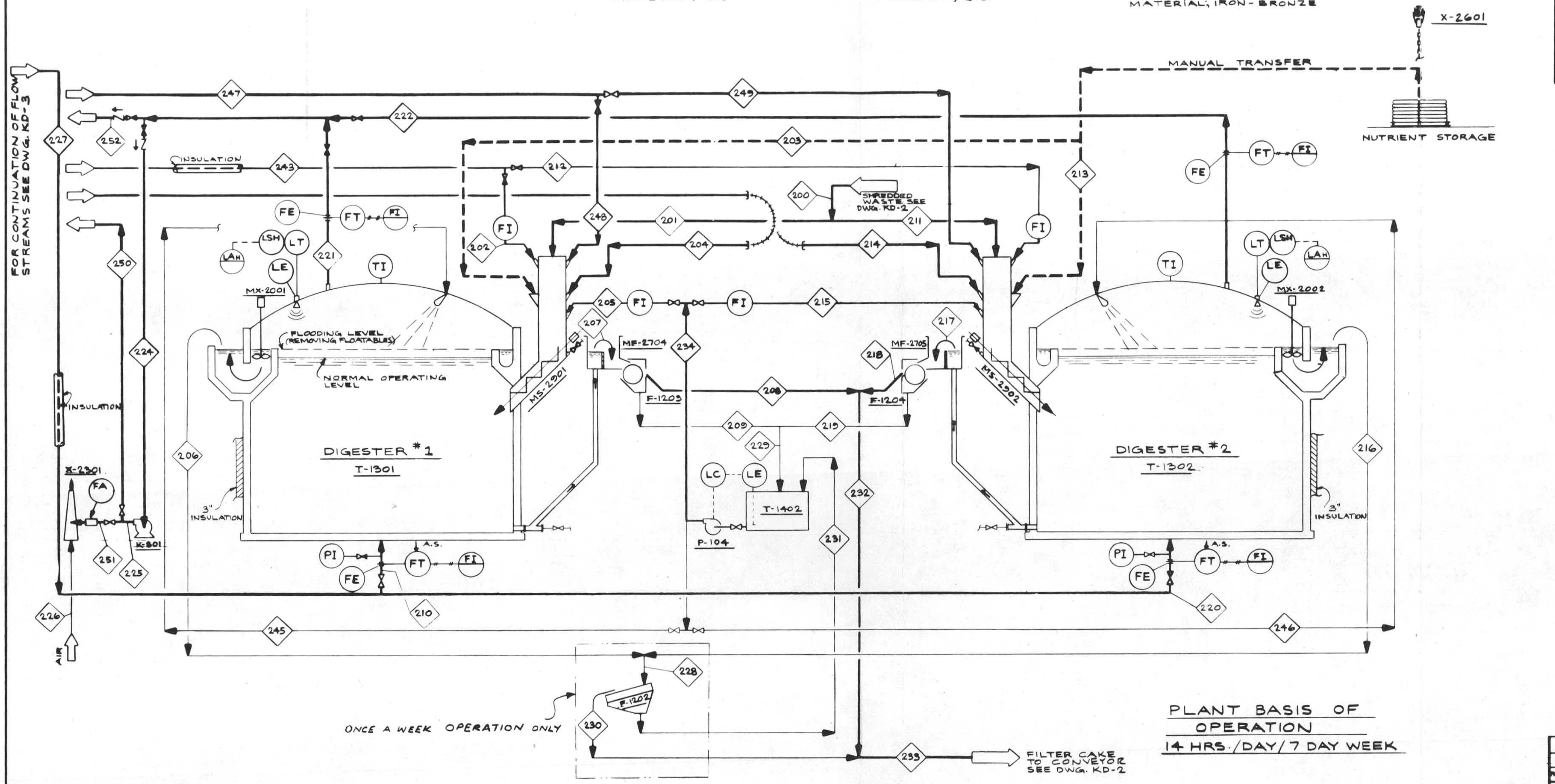
T-1402
RECYCLE WATER TANK
CAPACITY; 2000 GAL.
SIZE; 5' DIA. x 15' HIGH
MATERIAL; C.S.

P-104
RECYCLE WATER PUMP
CAPACITY; 18-200 G.P.M.
HEAD; 60 FT. T.D.H.
S.G. 0.97
MOTOR; 7 1/2 HP
MATERIAL; IRON-BRONZE

X-2601
TROLLEY-HOIST
CAPACITY; 500 LBS.
CHAIN OPERATED TROLLY.
MOTOR OPERATED HOIST.
MOTOR : 1/4 H.P.

ISSUE AND DISTRIBUTION RECORD

ISSUE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT W.M.I.																
FIELD																
BID																
E.R.D.A.																
PFEFFER																



PLANT BASIS OF OPERATION
14 HRS./DAY/7 DAY WEEK

NOTE; STREAM NUMBER 223 NOT USED.

STREAM NUMBER	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
STREAM DENOMINATION	SHRED. WASTE	METER. WASTE	HOT WATER	NUTRIENT	PRIMARY SLUDGE	RECYCLE WATER	FLOAT-ABLES	SLURRY	FILTER CAKE	FILTRATE	RECYCLE GAS	METER. WASTE	HOT WATER	NUTRIENT	PRIMARY SLUDGE	RECYCLE WATER
WASTE (T.P.H.)	3.318	1.659					ONCE A WEEK OPERATION					1.659				
MOISTURE (T.P.H.)	1.016	0.508										0.508				
SOLIDS (T.P.H.)					0.083			0.87	0.87						0.083	
WATER (T.P.H.)			5.288		1.576	2.043		9.873	7.83	2.043	0.7225		5.288		1.576	2.043
CARBON DIOXIDE (T.P.H.)											3.6095					
METHANE (T.P.H.)											1.3125					
AMMONIUM CHLORIDE (T.P.H.)				0.0089										0.0089		
POTASSIUM DI-H PHOSPHATE (T.P.H.)				0.00175										0.00175		
WELL WATER (T.P.H.)																
FUEL OIL #4 (T.P.H.)																
FLOW G.P.M.			21		14	8.16		43		8.2			21		14	8.16
FLOW SCFM(1) SCFH(2)											1963.45(2)					
AIR (T.P.H.)																
TEMPERATURE (°F)	35	35	193	35	60	120		140	90	120	211	35	193	35	60	120
TOTAL (T.P.H.)	4.334	2.167	5.288	.0106	1.659	2.043		10.743	8.7	2.043	5.6445	2.167	5.288	0.0106	1.659	2.043

STREAM NUMBER	216	217	218	219	220	221	222	224	225	226	227	228	229	230	231	232	233	234	243	245	246	247	248	249	250	251	252
STREAM DENOMINATION	FLOAT-ABLES	SLURRY	FILTER CAKE	FILTRATE	RECYCLE GAS	GAS	GAS	GAS TO BLOWER	GAS FROM BLOWER	AIR TO BURNER	COMPRES. GAS	FLOAT TO SCREEN	FILTRATE	FLOAT-ABLES	FILTRATE FROM FLOATS	FILTER CAKE	CAKE TO DISPOSAL	RECYCLE WATER	HOT WATER	RECYCLE WATER	RECYCLE WATER	WATER FROM COMPRES.	WATER FROM COMPRES.	WATER FROM COMPRES.	GAS TO WATER HEATER	GAS TO BOILER	GAS TO COMPR.
WASTE (T.P.H.)	ONCE A WEEK OPERATION											ONCE A WEEK OPERATION		ONCE A WEEK OPERATION	ONCE A WEEK OPERATION												
MOISTURE (T.P.H.)																											
SOLIDS (T.P.H.)		0.87	0.87													1.74	1.74										
WATER (T.P.H.)		9.873	7.83	2.043	0.7225	0.8633	0.8633	0.2816	0.2816		1.445		4.086			15.66	15.66	4.086	10.576	VARIABLE BALANCE OF STREAM 205 UP TO 2.043	VARIABLE BALANCE OF STREAM 215 UP TO 2.043	1.2	0.6	0.6	0.0395	0.242	1.445
CARBON DIOXIDE (T.P.H.)					3.6095	4.3132	4.3132	1.4074	1.4074		7.219														0.1978	1.209	7.219
METHANE (T.P.H.)					1.3125	1.5684	1.5684	0.5118	0.5118		2.625														0.0719	0.4399	2.625
AMMONIUM CHLORIDE (T.P.H.)																											
POTASSIUM DI-H PHOSPHATE (T.P.H.)																											
WELL WATER (T.P.H.)																											
FUEL OIL #4 (T.P.H.)																											
FLOW G.P.M.		43		8.2									16.32					16.32	42			4.8	2.4	2.4			
FLOW SCFM(1) SCFH(2)					[illegible]	[illegible]	140,777(2)	[illegible]	[illegible]		39263.5(1)														6454(2)	16514(2)	3926.55(1)
AIR (T.P.H.)										7.3166																	
TEMPERATURE (°F)		140	90	120	211	[illegible]	140	[illegible]	[illegible]	35	211		120			90	75	120	193	120	120	140	140	140	140	140	140
TOTAL (T.P.H.)		10.743	8.7	2.043	5.6445	6.7449	6.7449	2.2008	2.2008	7.3166	11.289		4.086			17.40	17.40	4.086	10.576	2.248	2.248	1.2	0.6	0.6	0.3093	1.8915	11.289

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
1	10-15-76	CORRECTED & UPDATED	W.D	
0	1-19-76	ISSUED FOR TITLE I	W.D.	

A.S.E.F. SOLID WASTE TO METHANE GAS
WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

FOR — UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR
Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION
APPROVED FOR ISSUE
By WMI
By ERDA

DRAWING TITLE
FLOW DIAGRAM
WET END - #2

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
T.G./W.D	E.T.	WIL DAE	
SCALE: NONE	PROJECT NUMBER: 05-1372	DRAWING NUMBER: KD-4	REVISION: 1
DATE: 12-31-75			

K-201
AIR COMPRESSOR
CAPACITY: 10 ACFM
PRESSURE: 115 PSIG
MOTOR : 2 HP
MATERIAL: C.S.

V-2703
WATER TREATMENT TANK
CAPACITY : 5 GAL.
MATERIAL : C.S

K-202
GAS COMPRESSOR
CAPACITY: 4000 SCFM
PRESSURE: 16 PSIG
MOTOR : 250 HP.
MATERIAL : C.S.

X-203 & X-204
SILENCER

P-101
WELL PUMP
CAPACITY: 100 GPM @ 160 Ft T.D.H.
MOTOR : 7½ H.P.
MATERIAL: BRONZE FITTED-C.S.

V-3601
WATER TREATMENT TANK
CAPACITY: 55 GAL.
MATERIAL : C.S.-P[redacted]THYLENE LI[redacted]

A- 3602
TANK AGITATOR
MOTOR : ¼ H.P. @ 1125 RPM
MATERIAL : 316 S.S.

P-3603
METER PUMP
FLOW RANGE: 0-0.1 GPM.
MOTOR : ½ H.P.
MATERIAL : 316 S.S.

H-1701
WATER HEATER
CAPACITY: 2.5 MM BTU/HR.
MATERIAL : C.S.

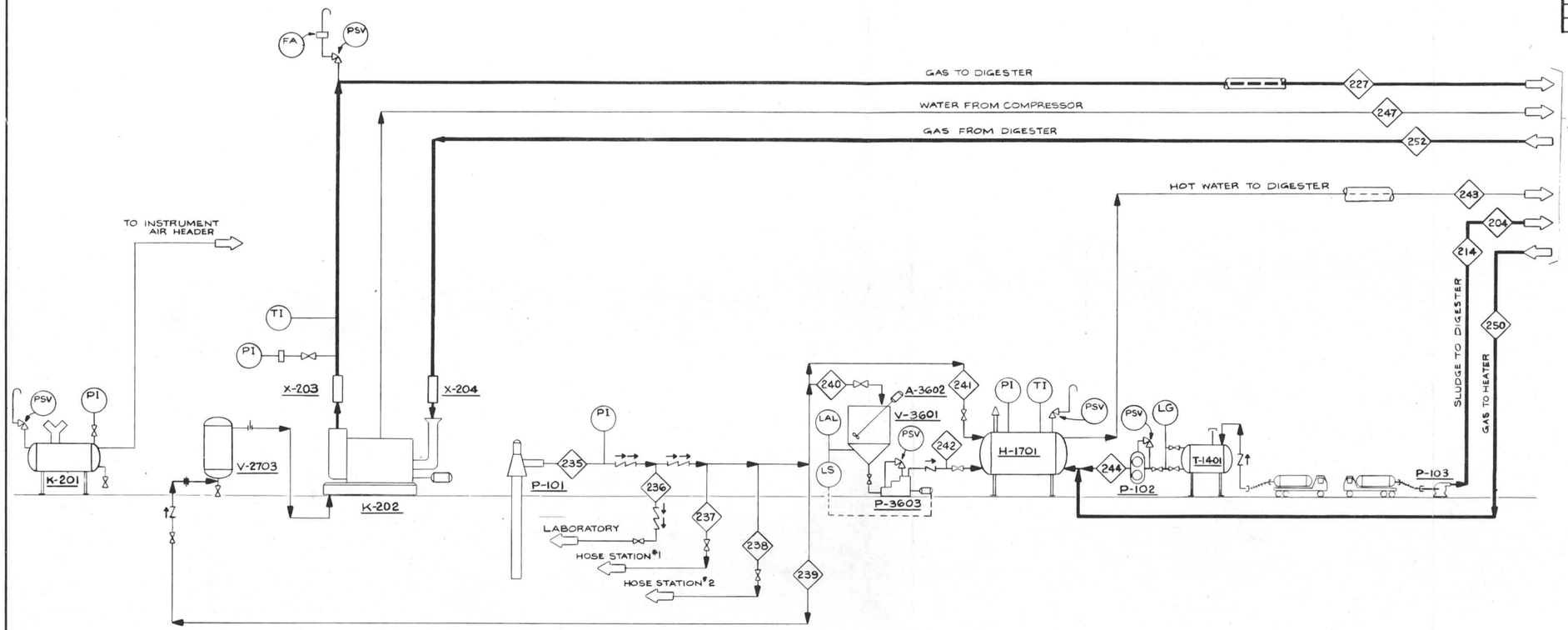
P-102
GEAR PUMP
CAPACITY: 0.4 G.P.M.
MOTOR : ½ H.P.
MATERIAL : C.S.

T-1401
FUEL OIL STORAGE TANK
CAPACITY: 5000 GAL.
SIZE : 8'-0"Φ x 12'-0"
MATERIAL: F.R.P.

P-103
SLUDGE UNLOADING PUMP
CAPACITY : 30 GPM @ 50 FT. T.D.H.
MOTOR : 1½ H.P.
MATERIAL: C.S.

ISSUE AND DISTRIBUTION RECORD

DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT W.M.I.	10-75						10-15-76									
FIELD							10-15-76									
BID																
E.R.D.A.							10-15-76									
PFEFFER	10-75															



STREAM NUMBER	204	214	227	235	236	237	238	239	240	241	242	243	244	247	250	252
STREAM DENOMINATION	PRIMARY SLUDGE	PRIMARY SLUDGE	COMPRESSED GAS	WELL WATER	WATER TO LABORATORY	WATER TO HOSE STA.#1	WATER TO HOSE STA.#2	COOLING WATER TO COMPRESSOR	WATER TO CHEM. TRET.	WATER TO HEATER	CHEMICAL TREATMENT	HOT WATER	OIL TO WATER HEATER	WATER FROM COMPRESSOR	GAS TO WATER HEATER	GAS TO COMPRESSOR
WASTE (TPH)																
MOISTURE (TPH)																
SOLIDS (TPH)	0.083	0.083														
WATER (TPH)	1.576	1.576	1.445								0.0025	10.576		1.2	0.0395	1.445
CARBON DIOXIDE (TPH)			7.219												0.1978	7.219
METHANE (TPH)			2.625												0.0719	2.625
AMMONIUM CHLORIDE (TPH)																
POTASSIUM DI-H PHOSPATE (TPH)																
WELL WATER (TPH)				11.7884	VARIABLE 0.2144	VARIABLE 0.1787	VARIABLE 0.1787	1.2	0.0025	10.576						
FUEL OIL #4 (TPH)													0.085			
FLOW (GPM)	14	14		100	4	20	20	4.8	0.01	42	0.01	42		4.8		
FLOW SCFM(1) SCFH(2)			3926.99(1)												6454(2)	3926.99(1)
AIR (TPH)																
TEMPERATURE (°F)	60	60	211	76	76	76	76	76	76	76	76	200	35	140	140	140
TOTAL (TPH)	1.659	1.659	11.289	11.7884	VARIABLE 0.2144	VARIABLE 0.1787	VARIABLE 0.1787	1.2	0.0025	10.576	0.0025	10.576	0.085	1.2	0.3092	11.289

NOTE; STREAM NUMBER 223 NOT USED

BASIS OF OPERATION
7 DAYS/WEEK
@
14 HOURS/DAY

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
1	10-15	CORRECTED & UPDATED	WD	
0	1-19-76	ISSUED FOR TITLE I	WD.	

A.S.E.F. SOLID WASTE TO METHANE GAS
WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

FOR — UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR
Waste Management, Inc.
900 Jorie Boulevard - Oak Brook, Illinois 60521 - 312/654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION
APPROVED FOR ISSUE
By WMI
By ERDA

DRAWING TITLE
FLOW DIAGRAM WET END #1

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
T.G. / W.D.	A. MANDAL	MTL DAS	
SCALE: NONE	PROJECT NUMBER: 05-1372	DRAWING NUMBER: KD-3	REVISION: 1
DATE: 12-30-75			

ISSUE AND DISTRIBUTION RECORD														
DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT WMI	4-76					10-76										
FIELD																
IND																
E.R.D.A.						11-76										
PFEFFER	4-76															

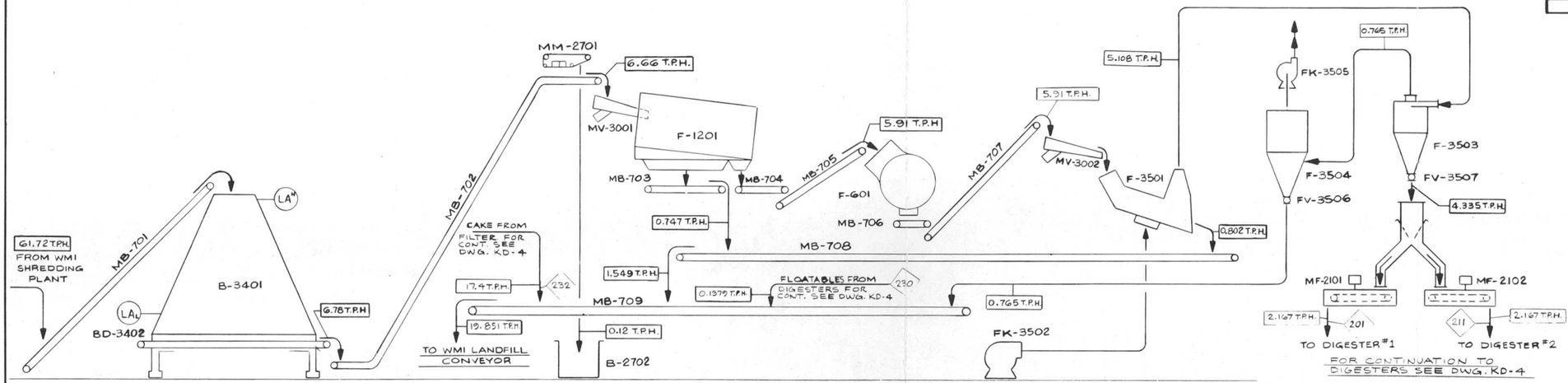
B-3401
STORAGE BIN
CAPACITY: 175 TONS @ 15 #/CU.FT.
VOLUME; 24,000 CU. FT.
MOTORS; 2 @ 15HP = 30 HP

MV-3001
VIBRATORY FEEDER
SIZE ; 48" x 3' LG.
CAPACITY: 10 T.P.H.
ELECTRICAL CHARACTERISTICS;
TOTAL POWER - 4 MAGNETS @ 125 = 500 WATTS
TOTAL CURRENT - 4 MAGNETS @ 4 = 16 AMPS

B-2702
DUMP HOPPER
CAPACITY: 2 CU. YD.

MV-3002
VIBRATORY FEEDER
SIZE : 30"
CAPACITY: 7 T.P.H.
ELECTRICAL CHARACTERISTICS;
TOTAL POWER - 2 MAGNETS @ 125 = 250 WATTS
TOTAL CURRENT - 2 MAGNETS @ 4 = 8 AMPS

F-3503
CYCLONE
SIZE - 8'ϕ



MB-701
BELT CONVEYOR
SIZE : 60" x 230 FT. LG.
CAPACITY: 75 T.P.H.
MOTOR : 15 H.P.

F-1201
TROMMEL SCREEN
SIZE ; 6' ϕ x 20'
CAPACITY : 10 T.P.H
MOTOR : 20 HP

F-601
SHREDDER
SIZE:
CAPACITY: 10 T.P.H.
MOTOR: 100 HP

F-3501
AIR CLASSIFIER
CAPACITY: 7 T.P.H.
MOTOR : 1 HP

F-3504
DUST COLLECTOR
CLOTH AREA; 1400 SQ.FT.
SHAKER MOTOR; ½ HP

FV-3507
ROTARY AIRLOCK
SIZE; 42" x 42"
MOTOR; 10 HP

BD-3402
DRAG CONVEYOR
SIZE : 30"
CAPACITY: 10 T.P.H.
MOTOR: 5 HP

MB-703
BELT CONVEYOR
SIZE : 14" x 13 FT. LG.
CAPACITY: 1 T.P.H
MOTOR : ½ H.P.

MB-706
BELT CONVEYOR
SIZE : 24" x 10 FT. LG.
CAPACITY: 7 T.P.H.
MOTOR : ½ H.P.

FK-3502
BLOWER
CAPACITY: 14,000 C.F.M.
MOTOR : 50 HP

FK-3505
FAN
CAPACITY: 14,000 C.F.M.
MOTOR : 7½ HP

MF-2101 & MF-2102
WEIGH FEEDER
WIDTH: 24"
CAPACITY: 0-5 T.P.H.
MOTOR: 1½ HP

MB-702
BELT CONVEYOR-ELEVATOR
SIZE : 48" x 40 FT. LG.
CAPACITY: 10 T.P.H.
MOTOR : 5 HP

MB-704
BELT CONVEYOR
SIZE : 24" x 10 FT. LG.
CAPACITY: 7.5 T.P.H.
MOTOR: ½ H.P.

MB-707
BELT CONVEYOR
SIZE : 24" x 33 FT. LG.
CAPACITY: 7 T.P.H.
MOTOR : 1 H.P.

MB-708
BELT CONVEYOR
SIZE : 24" x 80 FT. LG.
CAPACITY: 2 T.P.H.
MOTOR : 2 H.P.

FV-3506
ROTARY AIR LOCK
SIZE; 12" x 12"
MOTOR: 1½ H.P.

MM-2701
MAGNETIC SEPARATOR
SIZE
CAPACITY:
MOTOR : 2 HP
ELECTRICAL CHARACTERISTICS;
MAGNET TOTAL POWER - 3,350 WATTS.

MB-705
BELT CONVEYOR
SIZE : 24" x 40 FT. LG.
CAPACITY: 7.5 T.P.H.
MOTOR : 1 H.P.

MB-709
BELT CONVEYOR
SIZE : 24" x 245 FT. LG.
CAPACITY: 20 T.P.H.
MOTOR : 3 H.P.

PLANT DESIGN BASIS FOR DRY END

664.72 TONS/WEEK
@ 14 HRS./DAY/7 DAY WEEK
= 6.78 T.P.H.

COMPOSITION OF SOLID WASTE DELIVERED TO FACILITY	
TYPE	AVERAGE %
FOOD	4.2
GARDEN	5.8
PAPER	54.6
PVC, RUBBER, LEATHER	4.4
TEXTILES	2.2
WOOD	2.6
FERROUS METALS	7.2
NON-FERROUS METALS	1.1
OTHER METALS	0.1
GLASS, CERMICS	12.0
ROCK, DIRT, ASH	0.1
FINES	5.7
	100.0

REVISION	DATE	DESCRIPTION	NO. PREPARED BY	APPROVED BY
0	1-19-76	ISSUED FOR TITLE I		

A.S.E.F. SOLID WASTE TO METHANE GAS
WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

FOR — UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR
Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION
APPROVED FOR ISSUE By WMI By ERDA

DRAWING TITLE
FLOW DIAGRAM DRY END

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
W.D.	E.T.S. & A.M.	MOL & AS	
SCALE NONE	PROJECT NUMBER 05-1372	DRAWING NUMBER KD-2	REVISION 0
DATE 12-19-75			

Section V

FACILITIES DESCRIPTION

SECTION 5.0
FACILITIES DESCRIPTION

5.1 General

The selected site for the A.S.E.F. Solid Waste to Methane Gas Facility is located on an existing receiving, shredding and landfill plant owned and operated by WMI in Pompano Beach, Florida. The parcel of land, which has been dedicated for this project facility, is 200 feet by 280 feet or 1.3 acres within the existing property. The east boundary line is 270 feet west of the existing shredding building and the north boundary line is 296 feet south of the existing WMI's north property line. The primary solid waste interface feed point is located 149 feet west of the shredding building. This interface point location has been established by the proposed WMI shredder expansion to their existing operation.

Section 5.0
Facilities Description

5.2 Site Development

In the proposed site location, the upper two feet of organic topsoil (muck) will be stripped from the area of about 180 feet x 200 feet. This area will only be stripped when all surface water has been drained. The area will then be compacted to a density of 95% of modified proctor, in a vertical depth of 24 inches below the stripped grade. This total site will be sand filled with approved off site material. The fill will be placed in 18" layers and compacted to 95% of modified proctor, bringing the site elevation up to 13.6 feet. All unusable stripped soil will be disposed of at the adjoining landfill site at a location designated by WMI.

In the original proposal, there was a dense tree area to be cleared for this facility. As of this date, this clearing has been completed by WMI's plant

5.2 Site Development - continued

personnel. Some trees and scrub underbrush still require clearing for this site arrangement of the facility.

An asphalt roadway will be provided from NW 48th Street into the site. A truck unloading point will be provided.

5.3 Buildings/Structures

There are two buildings and four process structures comprising this facility. These are defined on the site key plan and the general plant layout and described herein. All building and structure designs are covered by the South Florida Building Code, AEC Manual Appendix 6301, dated 11/20/75; and ERDA Manual Appendix 6301, dated 7/23/75.

5.3 Buildings/Structures - continued

5.3.1 Storage Silo Structure

The storage silo structure will store 175 tons of primary shredded solid waste. The approximate dimensions of the silo are 50 feet diameter by 50 feet high. This structure will be a prefabricated steel tapered wall unit, field erected on a concrete foundation.

5.3.2 Classification Building

The classification building will be a prefabricated, structural steel unit provided with metal sides. A concrete floor slab will be provided to supply a foundation for the classifying equipment. If necessary, separate foundations will be provided for heavy equipment.

5.3 Buildings/Structures - continued

5.3.3 Weigh Feed Structure

The weigh feed structure is located between the two digesters. This structure will be constructed with structural steel and provided with two levels of platforms. At grade, prefabricated side walls and the metal deck roof will enclose an area housing the gas compressor unit and dry chemical storage. The second and third levels of platforms are provided to service the feeding of nutrients and directing the feed of solid waste to the feed screw spout on the digesters.

5.3.4 Digester Structures

Each digester tank structure will be 50 feet in diameter by 27 feet high, with a side water depth of 23 feet and capacity of 340,000

5.3 Buildings/Structures - continued

5.3.4 Digester Structures

gallons. These structures will be constructed with a reinforced concrete floor slab, pre-stressed composite walls, interior launder and fixed gunnite dome cover. The digester floor will be piped to provide a diffuser pattern that effects mixing by recycling compressed digester gas. The side walls will be insulated to minimize heat loss, especially for the thermophilic mode of digestion.

5.3.5 Dewatering Structure

The dewatering structure is located on the north side of the digester. This steel structure will be provided with an operating platform for the screens. It will support two filter screens and a liquid vibrating

5.3 Buildings/Structures - continued

5.3.5 Dewatering Structure - continued

screen. Concrete foundations will be provided at each leg of this support structure.

5.3.6 Laboratory Building

The laboratory building will be a prefabricated structural steel and steel siding unit. This building will be erected on a 25 feet x 30 feet concrete slab. The building will house a water heater, treatment tank, motor control center, monitoring control panel and a fully equipped laboratory for such analytical measurements as: pH, wet chemistry procedures, suspended solids, and such other sanitary analyses as may

5.3 Buildings/Structures - continued

5.3.6 Laboratory Building - continued

be required. The laboratory portion of the building will be provided with a window type air conditioner.

5.4 Electrical

The existing electrical service to the shredding plant will have to be supplemented with a new 1500 KVA, 480V/227V, 3HP, 60HZ transformer, furnished and installed by Florida Power and Light Co. This transformer replaces a 500 KVA located in WMI's substation vault. Power distribution is broken into two motor control centers; the one for dry-end equipment is located in the classification building and the one for wet-end equipment is located in the laboratory building. All outside and building lighting will be supplied with mercury vapor fixtures, while the laboratory will be provided

5.4 Electrical - continued

with fluorescent fixtures.

5.5 Utilities

5.5.1 Domestic Water

The water requirement for this facility will be supplied from a 100 GPM deep well and pump. The system will consist of: a deep well, a 7½ HP pump, and a water meter. The well will be located in the southeast corner of the site.

5.5.2 Fuel Oil

A 5000 gallon fuel oil storage tank and gear pump will accommodate the anticipated start-up fuel requirements for the water heater. The tank will be located adjacent to the laboratory building.

5.5 Utilities - continued

5.5.3 Water Heater

A package hot water heating system sized for 2.5×10^6 BTU per hour at 140° F. rise will supply the process with the necessary heat requirement.

5.5.4 Instrument Air

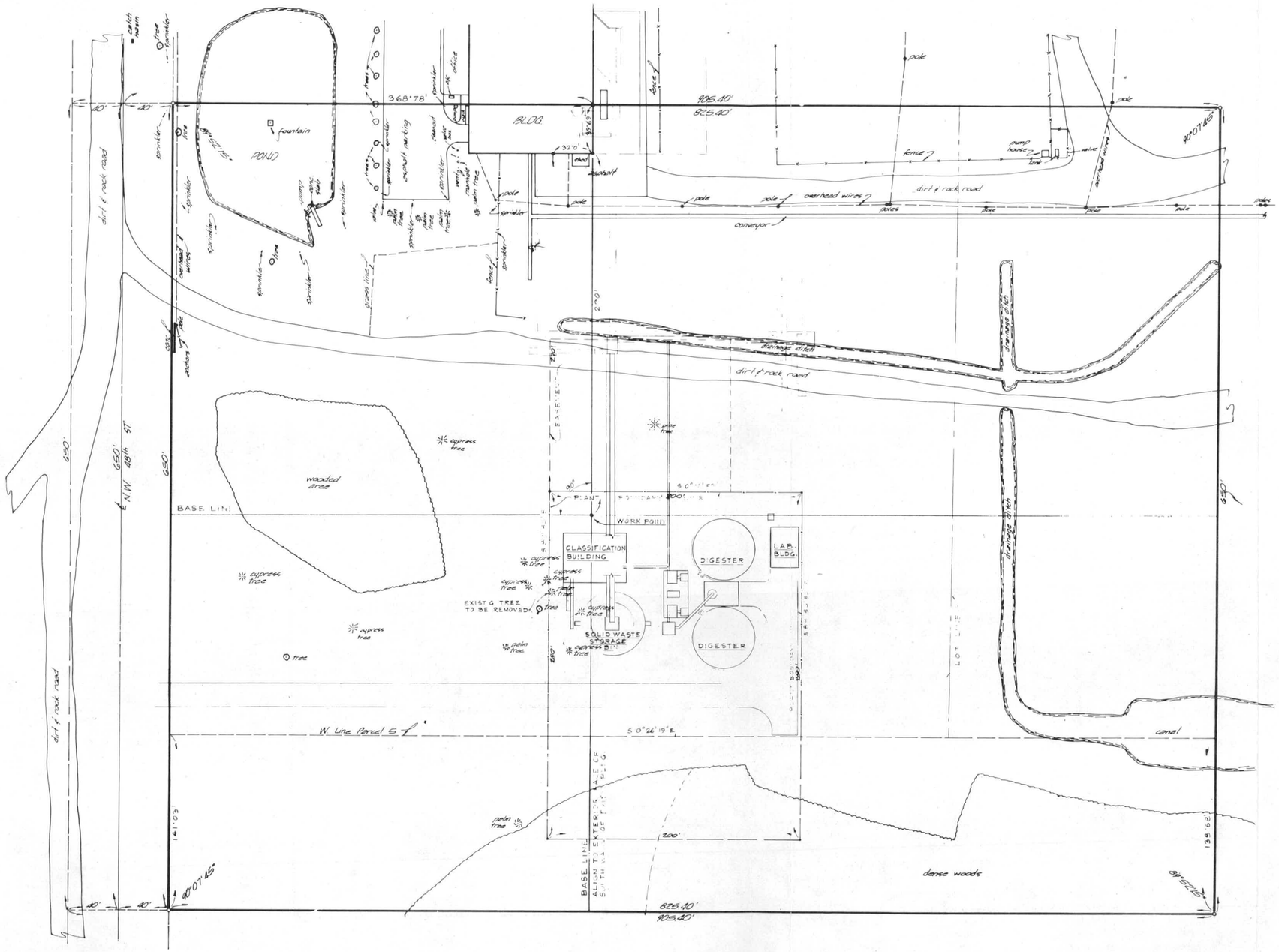
A package instrument air compressor will be provided to supply 10 ACFM @ 115 psig dry air for all instruments.

5.6 Wastewater/Sludge Cake Disposal

Except for the moisture lost in the sludge cake off the screen, the system is designed to recycle 100% recovered water, thus minimizing make-up water and heat requirement.

The sludge cake and the recovered floatables, along with fines dust from the dust collector, will be transported to WMI's landfill conveyor for disposal. This will be in compliance with the State of Florida and Broward County Pollution Codes.

ISSUE AND DISTRIBUTION RECORD																
DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT (WMI)						1976										
FIELD																
IND																
E.R.D.A.						1976										



REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
C	11-3-76	ISSUED FOR TITLE I	WD.	JWH

A.S.E.F. SOLID WASTE TO METHANE GAS
WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

FOR — UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR
Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312-654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

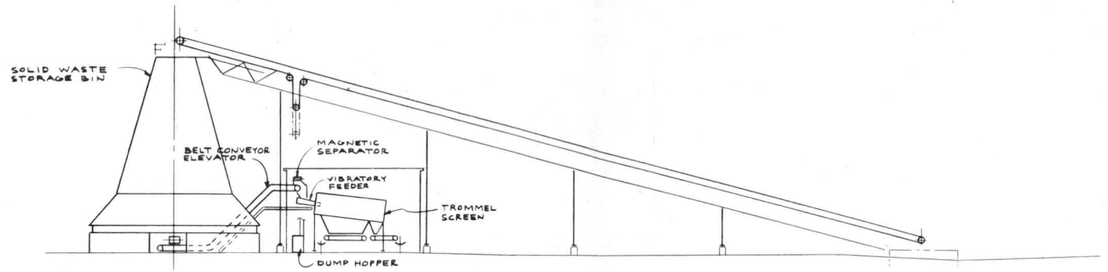
ISSUED FOR CONSTRUCTION

APPROVED FOR ISSUE
By WMI
By ERDA

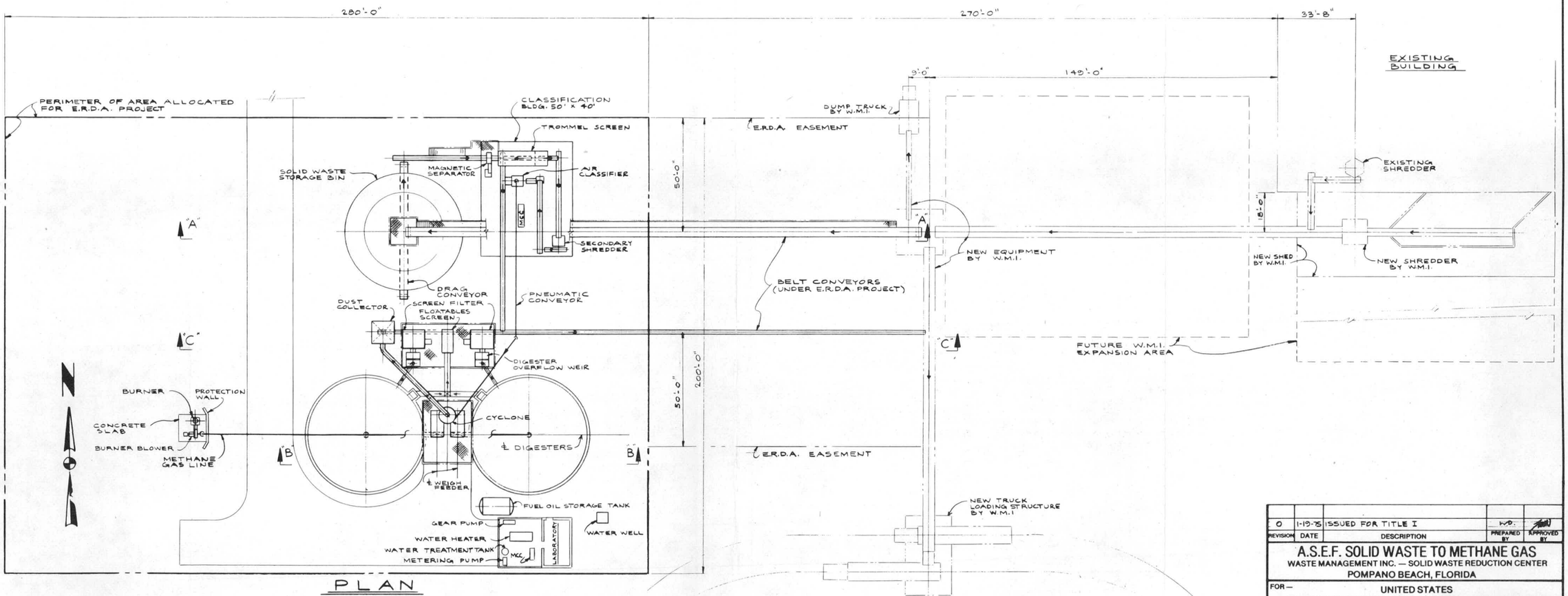
DRAWING TITLE
PLOT PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
P. AZUMA	P.A.	J. CAPOZZO JR.	
SCALE 1" = 40'-0"	PROJECT NUMBER 05-1372	DRAWING NUMBER KD-6	REVISION 0
DATE 1.5.76			

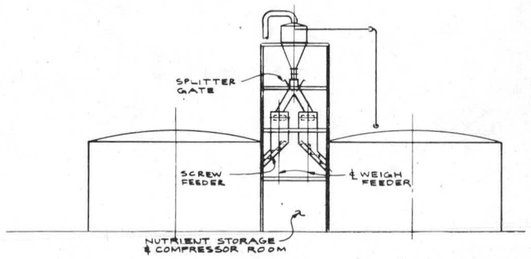
ISSUE AND DISTRIBUTION RECORD																
DATE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT W.M.I.	12-75					1-19-75										
FIELD																
BID																
E.R.D.A.						1-19-75										
PFEFFER	12-75															



ELEVATION "A-A"



PLAN



ELEVATION "B-B"

ELEVATION "C-C"

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	1-19-75	ISSUED FOR TITLE I	W.D.	

A.S.E.F. SOLID WASTE TO METHANE GAS

WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

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ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR

Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION

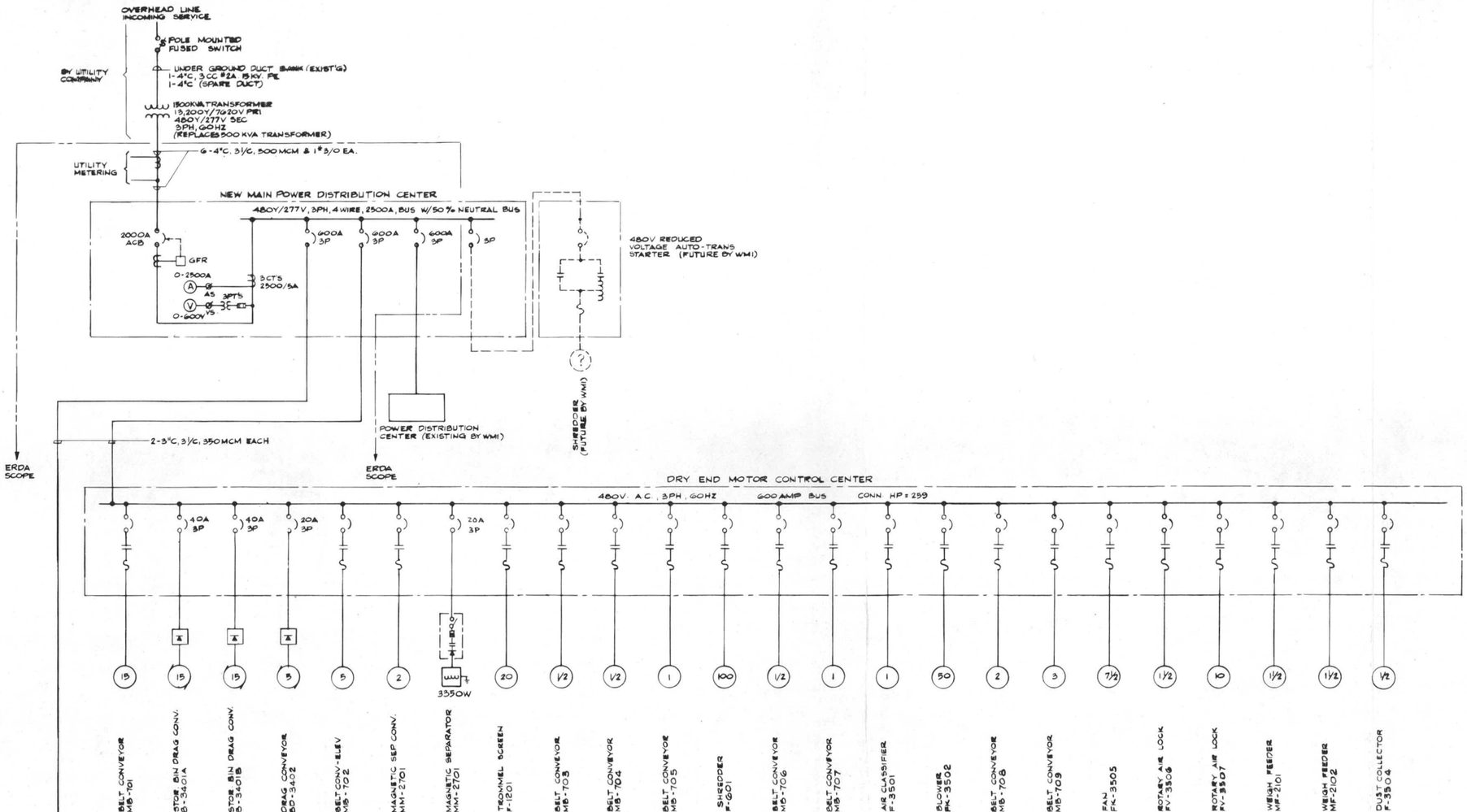
APPROVED FOR ISSUE
By WMI
By ERDA

DRAWING TITLE

GENERAL PLANT LAYOUT

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
WYL DAE	E.T.S.	WYL DAE	
SCALE 1"=20'-0	PROJECT NUMBER 05-1372	DRAWING NUMBER KD-5	REVISION 0
DATE 12-19-75			

ISSUE AND DISTRIBUTION RECORD															
ISSUE TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT (WMI)						1-19-76										
FIELD																
END																
ERDA						1-19-76										



REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	1-19-76	ISSUED FOR TITLE I	WD.	

A.S.E.F. SOLID WASTE TO METHANE GAS

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POMPANO BEACH, FLORIDA

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ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR

Waste Management, Inc.
900 Jorie Boulevard - Oak Brook, Illinois 60521 - 312/654-8800

JACOBS CONSTRUCTORS, INC.

PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION

APPROVED FOR ISSUE
By WMI
By ERDA

DRAWING TITLE

SINGLE LINE DIAGRAM

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
C.G. JOHNSON	F.A.V.		
SCALE: NONE	PROJECT NUMBER: 05-1372	DRAWING NUMBER: ED-1	REVISION: 0
DATE: 1-12-76			

Section VI

ESTIMATE

SECTION 6.0
ESTIMATE

6.1 General

This estimate is classified by JCI's standards as a preliminary capital cost type estimate and is suitable for budget appropriation. It is based on the flow diagrams (KD-2,-3 and 4), the site key plan (KD-6) and the equipment facility arrangement drawing (KD-5).

The estimate includes: site work, classifying building, storage silo, construction of two (2) digesters, with two equipment structures, laboratory building and all required process equipment. There are fifty-five new pieces of equipment.

All items were priced on December, 1975 and January, 1976 to obtain costs of equipment, materials and subcontract labor. Allowance for unforeseen and escalation are itemized separately and indicated at the bottom of the estimate.

6.1 General - continued

The original preliminary estimates (5/16/75 and 10/24/75) were used as a guideline in developing unit costs for material, labor and escalation.

Paragraphs 6.2 through 6.28 define the development of the estimate by major accounts.

6.2 Equipment

Virtually 100% of the equipment was priced according to telephone and personal vendor contacts. Verbal inquiries were based on general description of capacity and service performance design data indicated on the flow diagrams and equipment index. No written inquiries were issued for this equipment estimate. The equipment vendors supplied their best recommendations and cost estimate for the item described. Written confirmation of all verbal inquiries were requested and have been received for backup to this estimate. These quotes are

6.2 Equipment - continued

a preliminary budget type with a range of +5 to +15%.

All equipment is defined on the flow diagrams and equipment index. The three equipment package systems of the estimate are defined as follows:

Package A - Storage Silo Package

Package B - Air Classifier Package

Package C - Water Treatment Package

6.3 Subcontracts

The subcontract costs are a developed cost which includes labor, material, overhead, profit, payroll insurance and taxes, small tools and consumables. At this point, no detailed drawings have been prepared to submit for subcontractor quotes. The labor costs are based on JCI's in-house data, unit manhours, and subcontract experience in the State of Florida. Labor costs

6.3 Subcontracts - continued

used were per existing agreements and current wage rates. The various direct craft labor rates will expire in the second quarter of 1976. Their increase appears to be in a range of 10% to 20%. All direct craft labor rates beyond June of 1976 are included within the escalation. All equipment installation, instrumentation, site preparation, concrete, structural steel, buildings, electrical, piping, insulation, painting and any other specialties will be subcontracted in the specified activity or grouped by jurisdiction. This has been developed for the proposed method of accomplishment of this project (Subcontract Scope Intent) in Section 7.0 of the report. At the end of the section, an estimate breakdown by the subcontract bid packages has been developed along the activities in the scope intent.

6.4 Instrumentation

This has been based on the instruments indicated on flow diagrams and priced by telephone for current unit costs. The labor and materials of installation were factored from the instrument cost according to JCI's historical data.

6.5 Site Preparation

This includes clearing and grubbing, stripping and compacting the site, soil testing, roadways, and dewatering of the site. Lineal and area take-offs were made from the site plan. The fill material cost was priced by telephone.

6.6 Concrete

The concrete material was based on cubic yard quantities taken off from the site plan, general equipment arrangement and sketches for equipment/ building foundations/floor slabs and equipment pads. The concrete was separated by category such as slabs on grade foundations, etc., and priced accordingly. A special wear resistent topping for the storage silo floor is included in this account. Labor and material quantities were calculated from JCI experience. The overall unit costs were checked with local sub-contractors of the area.

6.7 Structure Steel

The structural steel requirement for the weigh feeder and filter structures were based on a take-off of tons of steel from preliminary sketches. This account also includes equipment/pipe supporting

6.7 Structure Steel - continued

steel and all miscellaneous items for platforms, handrail, ladders, etc. The cost was based on unit quotes per ton of steel erected.

6.8 Prefab Buildings

This includes the classifying and laboratory buildings; the take-off was on a square foot unit cost according to a local supplier of prefabricated buildings.

6.9 Electrical

The electrical subcontract costs are based on the development of the single line diagram and a take-off from the equipment arrangement drawings for conduit and wire, switchgear, yard/building lighting, controls and motor control centers. The electrical account was separated by category

6.9 Electrical - continued

of material and current unit costs were applied for material and labor. These units were checked with the local subcontractors in the area. The other hardware was priced by telephone.

6.10 Process Piping

A conceptual take-off was made from the flow diagrams and equipment arrangement for lineal feet of pipe, and number and size of valves. Fittings were factored for this type of installation. Material was priced on current unit costs. The labor and materials of installation were developed from JCI's historical data in the State of Florida.

6.11 Insulation

The insulation for pipe covering and the walls was based on a take-off and priced according to current material and labor costs, per JCI data.

6.12 Painting

This includes structural/miscellaneous steel, non-insulated pipe, touch up of shop painted equipment and prefabricated buildings, and painting of non-shop painted equipment.

6.13 Laboratory Equipment

This includes a complete laboratory for monitoring such factors as: pH; any required wet chemistry procedures; suspended solids; composition of shredded material, etc. The equipment pricing was checked by telephone.

6.14 Unallocable Labor

The unallocable labor account will include a security guard service, surveying and layout, and general clean-up of the site at the end of construction. The cost used for surveying is an actual expenditure due to services required for Title I.

6.15 Insurance, Taxes & Permits

The all risk insurance and building permits required are included to cover construction permits. This account includes sales/use tax for equipment and materials procured for the project.

6.16 Construction Equipment

This account includes equipment rental for sub-contractors, including operators, and will be allocated to the respective subcontracts.

6.17 Temporary Construction

This includes temporary field office, power and lighting and OSHA requirements as required.

6.18 Experimental Program

The experimental program was performed to develop a positive means of mixing the contents in the digesters. This includes actual expenditures for a used tank, piping fabricator services and tank erection.

6.19 Professional Service Title I

This includes all basic design engineering of the process flowsheets, equipment general arrangement, and other supporting preliminary activities. The costs used are actual expenditures for this report.

6.20 Professional Service Title II

This includes all detailed engineering design, procurement of all equipment and long delivery material items, the preparation of subcontract bid packages, and the preparation of an operation and maintenance manual.

6.21 Professional Service Title IIA & B

This includes all checking, approval of vendor shop drawings, and on-site field inspection during construction.

6.22 Construction Management

This includes all the services to supervise the construction of the project, award all subcontracts, expedite and inspect the equipment, as necessary, to meet the schedule, project cost control, pay all invoices, as well as other accounting functions to service the client and provide property records.

6.23 Reimbursables Titles I, II, IIIA & B

This includes all project related travel for engineering personnel, blueprinting, printing of documents for bids, purchase orders, long distance telephone calls, telexes and per diem of field inspector. The Title I costs are actual expenditures and Title II and IIIA & B are estimates for the balance of Phase I.

6.24 Reimbursables Construction Management

This includes all travel for personnel involved in project management, purchasing, cost control and

6.24 Reimbursables Construction Management - continued administration services related to the project site, expediting, blueprinting, printing of purchase sub-contracts, long distance telephone calls and telexes.

6.25 Allowance for Unforeseen

This is an allowance based on the definition of the various elements that were priced for this preliminary budget estimate. It is considered an actual cost anticipated to cover unforeseen costs, excluding scope changes. ERDA has given guidelines of 15%.

6.26 Escalation

ERDA has given guidelines of 14% for 1975, 10% for 1976 and 8% for 1977.

The estimated elapsed calendar time during which certain fractions of the equipment or subcontracts are placed are as follows:

6.26 Escalation - continued

Equipment	- 30%:	January, 1976 to March, 1976
	- 20%:	March, 1976 to June, 1976
	- 50%:	June, 1976 to October, 1976
Subcontracts	- 100%:	June, 1976 to June, 1977

Direct labor rates used in the estimate are based on prevailing Florida labor rates and until June of of 1976.

6.27 Fee

The fee percentage covering engineer/construction management for the project are:

10% Phase I - Professional Services Activities

4½% Phase II - Construction Management and Construction Activities

ERDA has given guidelines to be used; however, final number will be negotiated.

6.28 Prime Contractor Cost

This cost item includes WMI's services and costs for a project manager, contract administration, in-house consultants, accounting/secretarial, outside consultants, labor overhead, transportation, per diem, general and administrative expense and fee.

6.29 Quantitative Analysis

6.29.1 Equipment

55 new pieces

6.29.2 Site Preparation

1.3 acres (cut and fill)
1100 square yards paving (asphalt)
5135 cubic yards sand fill

6.29.3 Concrete

278 cubic yards

6.29.4 Structural/Miscallaneous Steel

15 tons of steel

Section 6.0
Estimate

6.29 Quantitative Analysis

6.29.5 Buildings Prefab

Classifying Building 2000 SF
Laboratory Building 750 SF

6.29.6 Electrical

535 HP connected

6.29.7 Piping

3800 Lineal Feet
Average Pipe Size of 5"

6.29.8 Insulation

160 Lineal Feet of 1½" for Pipe Covering
9100 Square Feet 3" for Equipment

6.30 Exclusion to Estimate

Piling

Underground Obstructions

Fencing

Fire Protection

Power Transformer

Section 6.0
Estimate

6.30 Exclusion to Estimate

Advertising of Subcontract Bid Packages

Printing of more than twenty (20) Bid Packages per inquiry.

Overtime Premium

Section 6.0
Estimate

6.31 Estimate Summary

Item No.	Description	Qty.	Material	Sub-contracts	Total Cost
P-102, 103, 104	Pumps	3	9,500	1,200	10,700
K-201, 202	Compressors	2	62,100	1,600	63,700
F-601	Shredder	1	16,000		16,000
MB-701 thru 709	Belt Conveyors	9	222,500	12,200	234,700
K-801	Blower	1	1,600	1,000	2,600
F-1203, 1204	Filters	2	59,500	8,300	67,800
T-1301, 1302	Digesters	2		187,500	187,500
T-1401, 1402	Tanks	2	6,500	500	7,000
H-1701	Heater	1	10,300	800	11,100
MX-2001, 2002	Mixers	2	2,100	200	2,300
MF-2101, 2102	Weigh Feeder	2	12,300	1,000	13,300
X-2301	Flare	1	10,800	1,200	12,000
X-2601	Trolley Hoist	1	900	200	1,100
MM-2701, B-2702, V-2703, F-2704, 2705	Misc. Equip.	5	7,600	3,500	11,100
MS-2901, 2902	Screw Feeders	2	12,300	600	12,900
MV-3001, 3002	Vibrating Feeders	2	5,700	600	6,300
B-3401, BD-3402	Equip. Pkg. A	2		273,500	273,500
F-1201, 1202	Screens	2	41,900	6,600	48,500
	Sub-Total		$481,600	$500,500	$982,100

Revision #1

Section 6.0
Estimate

6.31 Estimate Summary - continued

Item No.	Description	Qty.	Material	Sub-contracts	Total Cost
(Sub-Total forwarded from previous page)			738,900	961,600	1,700,500
	Professional Serv. Title I				115,500
	Reimbursables Title I				12,500
	Professional Title II				172,375
	Reimbursables Title II				7,300
	Professional Serv. Title IIIA & B				53,619
	Reimbursables Title IIIA & B				8,350
	Construction Management				70,467
	Reimbursables Const. Mgt.				13,458
	Allowance for Unforeseen				244,931
	Escalation				196,300
	Fee Phase I				40,370
	Fee Phase II				98,620
	JCI Total Cost				$2,734,290
	WMI Total Cost				143,656
	Project Cost Phase I & II				$2,877,946

Revision #1

6.31 Estimate Summary - continued

Item No.	Description	Qty.	Material	Sub-contracts	Total Cost
(Sub-Total forwarded from previous page)			481,600	500,500	982,100
F-3501, FX-3502 F-3503, F-3504, FK-3505, FV-3506 FV-3507	Equip. Pkg. B	5	103,800	10,600	114,400
V-3601, A-3602, P-3603	Equip. Pkg. C	2	1,800	500	2,300
	Instrumentation		11,400	5,600	17,000
	Site Prep.			42,800	42,800
	Concrete			45,100	45,100
	Struct. Stl.			40,800	40,800
	Prefab Bldg.			27,300	27,300
	Electrical		30,400	129,800	160,200
	Process Piping		50,500	71,400	121,900
	Insulation			7,400	7,400
	Painting			11,700	11,700
	Lab Equipment		15,000		15,000
	Unall. Items & Labor			22,800	22,800
	Sales Tax & Ins.		44,400		44,400
	Construction Equip.			18,000	18,000
	Temp. Construction			15,400	15,400
	Experimental Prog.			11,900	11,900
	Sub-Total		$738,900	$961,600	$1,700,500

Revision #1

6.32 TITLE II - ESTIMATED PROJECT DIRECT LABOR & OVERHEAD BREAKDOWN

6.32.1 FOR DETAIL DESIGN

Direct Labor Costs

Personnel:	Manhours	Rate	Total
Engineering Manager	120	$16.00	$ 1,920
Project Manager	480	14.00	6,720
Project Engineer	300	11.50	3,450
Process/Environmental	120	14.50	1,740
Piping	868	10.45	9,070
Mechanical	900	10.45	9,405
Structural	1,150	10.45	12,017
Civil/Architectural	324	10.45	3,385
Electrical	948	10.45	9,906
Instrumentation	106	10.45	1,107
Purchasing	300	10.35	3,105
Secretarial	150	4.55	683
Cost Control	20	9.35	187
Estimating	100	9.35	935
Scheduling	40	9.35	374
Secretarial	200	4.55	910
Accounting	100	6.75	675
Total Manhours	6,226		
Total Direct Costs			$65,589

Labor Overhead Costs

Overhead 80%			$81,986
Fringes 25%			
Total Professional Services Title II - Detail Design			$147,575

6.32 TITLE II - ESTIMATED PROJECT
DIRECT LABOR & OVERHEAD BREAKDOWN

6.32.2 PREPARATION OF AN OPERATIONS & MAINTENANCE MANUAL

Direct Labor Costs

Personnel:	Manhours	Rate	Total
Project Manager	100	$14.00	$ 1,400
Project Engineer	230	11.50	2,645
Support Engineering & Technical Writers	500	11.50	5,750
Secretarial	270	4.55	1,228
Total Manhours	1,100		
Total Direct Cost			$ 11,023
Labor Overhead Costs			
Overhead 80% Fringes 25%			$ 13,777
Total Professional Services Title II - O/M Manual			$ 24,800
Detail Design	6,225		$147,575
O/M Manual	1,100		24,800
Grand Total Professional Services Title II	7,325		$172,375

Revision #1

6.32 TITLE II - ESTIMATED PROJECT
DIRECT LABOR & OVERHEAD BREAKDOWN

6.32.3 REIMBURSABLE COST BREAKDOWN

	Totals
Travel - Site trips, meeting at ERDA for Project Manager, Project Engineer, Administration Personnel, JCI's in-house consultants.	
Air Fares:	
2 round trips Chicago to Washington at $125 each	$ 250
4 round trips Chicago to Fort Lauderdale at $202 each	$ 808
1 round trip Mountainside, N.J. to Fort Lauderdale at $188 each	$ 188
1 round trip Pasadena, Calif. to Fort Lauderdale at $344 each	$ 344
2 round trips Pasadena, Calif. to Chicago at $280 each	$ 560
	$2,150
Car Rental:	
Approximately $25 per day at 15 days	$ 375
Lodging & Food:	
Lodging $25 per day, food $20 per day or $45 per day at 15 days	$ 675
	$1,050
Printing	
Prints for Bid & Buy Documents	$1,450
Specifications	$ 750
Purchase Order	$ 300
	$2,500
Communications	
Long Distance Telephone Expense	$1,500
Telexes	$ 100
	$1,600
Total	$7,300

6.33 TITLE IIIA - ESTIMATED PROJECT DIRECT LABOR & OVERHEAD

6.33.1 CONSTRUCTION RELATED SERVICES

Direct Labor Costs	Manhours	Rate	Total
Personnel:			
Project Engineer	120	$11.50	$ 1,380
Instrumentation	24	10.45	250
Structural	50	10.45	522
Piping	60	10.45	627
Mechanical	100	10.45	1,045
Electrical	30	10.45	313
Architectural	20	10.45	209
Material Control	100	6.70	670
Estimating	100	9.35	935
Total Manhours	604		
Total Direct Cost			$ 5,951
Labor Overhead Costs			
Overhead 80% Fringes 25%			$ 7,438
Total Professional Services Title IIIA - Related Services			$ 13,389

6.33 TITLE IIIB - ESTIMATED PROJECT DIRECT LABOR & OVERHEAD

6.33.2 INSPECTION OF CONSTRUCTION

	Manhours	Rate	Total
Project On-Site Inspector	1,200	$10.40	$ 12,480
Project On-Site Clerk	1,200	4.50	5,400
Total Manhours	2,400		
Total Direct Cost			$ 17,880
Labor Overhead Costs			
Overhead 80% Fringes 25%			$ 22,350
Total Professional Services Title IIIB - Inspection of Construction			$ 40,230

6.33 TITLE IIIA & B - ESTIMATED PROJECT DIRECT LABOR & OVERHEAD

6.33.3 REIMBURSABLE COST BREAKDOWN

	Totals
IIIA - Printing	
Operations & Maintenance Manual	$ 500
Vendor Equipment Prints	$ 250
Sub-Total IIIA	$ 750
IIIB - Per Diem	
On-Site Inspector & Clerk	$7,600
Total	$8,350

Revision #1

6.34 PHASE II - CONSTRUCTION MANAGEMENT
ESTIMATED PROJECT DIRECT LABOR
& OVERHEAD COST BREAKDOWN

6.34.1 IN-HOUSE CONSTRUCTION SUPPORT

Direct Labor Costs

Personnel:	Manhours	Rate	Total
Engineering Manager	40	$16.00	$ 640
Construction Manager	200	12.60	2,520
Project Manager	950	14.00	13,300
Project Engineer	200	11.50	2,300
Purchasing	550	10.35	5,692
Secretarial	200	4.55	910
Cost Control	200	9.35	1,870
Scheduling	80	9.35	748
Material Control	60	6.70	402
Secretarial	200	4.55	910
Accounting	300	6.75	2,025
Total Manhours	2,980		
Total Direct Cost			$31,317

Labor Overhead Costs

Overhead 80% Fringes 25%	$39,150
Total Construction Management - Phase II	$70,467

6.34 PHASE II - CONSTRUCTION MANAGEMENT
ESTIMATED PROJECT TEAM

6.34.2 REIMBURSABLE COST BREAKDOWN

		Totals
Travel - Site trips, meeting at ERDA for Project Manager, Purchasing, Cost Control, Administration personnel.		
	Air Fares:	
	2 round trips Chicago to Washington at $125 each	$ 250
	16 round trips Chicago to Fort Lauderdale at $202 each	$3,232
	4 round trips Pasadena, Calif. to Fort Lauderdale at $344 each	$1,376
		$4,858
	Car Rental:	
	Approximately $25 per day at 30 days	$ 750
	Lodging & Food:	
	Lodging $25 per day, food $20 per day or $45 per day at 30 days	$1,350
		$2,100
Printing		
	Prints for bid and buy documents	$3,500
	Purchase Orders	500
	Progress/Cost Reports	250
	Miscellaneous	$ 100
		$4,350
Communications		
	Long Distance Telephone Expense	$2,000
	Telexes	$ 150
		$2,150
Total		$13,458

Section 6.0
Estimate

6.35 Prime Contractor Cost for Phase I, Title I, II, III and Phase II

	Total
Direct Labor 6528 Hours	$ 61,440
Labor Overhead at 10%	6,144
Transportation	17,336
Per Diem	16,460
Consultants	
Dr. Pfeffer	10,000
Arthur Anderson Co. Accounting & Systems Inputs	10,000
General & Administrative Expense Direct Labor at 15%	9,216
	$130,596
Fee 10%	13,060
	$143,656

Section VII

SCHEDULE

SECTION 7.0
SCHEDULE

7.1 General

The Overall Project Summary Schedule presented in this report is an activity schedule indicating the major professional service tasks for Phase I and the proposed method of accomplishment for construction during Phase II. This project will be implemented on a turnkey basis with engineering, purchasing and construction management.

Phase I includes detailed design; construction related services and on-site inspection of construction. An estimate of professional service hours of 10,329 hours to complete Phase I.

Phase II will include construction management (in-house construction support) and construction by subcontracting these activities. It is estimated that 2980 hours for construction management and the subcontract activities will take 19,600 manhours over a six (6) month period of construction.

7.2 Phase I

This Phase of the project will be monitored by work task activities for each Title on the JCI Engineering and Design Progress Schedule. This schedule will indicate by an "S" curve the percent complete; the hours expended per period and the weighted percent complete for each task activity.

Title II Tasks

Project Management
Project Engineering
Design Calculation
Drawings
Specifications
Bid Package Preparation
Bid Analysis
Purchasing Equipment
Definitive Estimate
O/M Manual

Title IIIA Tasks

Project Engineering
Approval Equipment Drawings
Approval Material Drawings
Material Control

7.2 Phase I - continued

Title IIIB Tasks

On-Site Inspection

Inspection Equip. Received
Inspection of Subcontractor Performance
Inspection of System Testing

A total of forty-five (45) detail drawings, twelve (12) instrumentation loop and detail sheets, thirty-nine (39) equipment specifications and seventeen (17) general specifications will be prepared during Title II, Detail Design. The preparation of equipment and subcontract bid packages and the procurement of all process equipment is included in the task activities to complete this Title. In Title IIIA, construction related services will be defined with task activities of vendor equipment/material drawings for approval. Title IIIB, on-site inspection includes the inspection of sub-

7.2 Phase I - continued

contractors performance of construction activities; the inspection of process equipment received at the site; the inspection of system testing before start-up of the process.

7.3 Phase II

The construction management task activity includes the following in-house tasks for awarding subcontracts, coordinating and monitoring all construction activities.

Construction Management

Project Management
Coordination Engineering w/Construction
Purchasing Subcontracts
Bid Analysis
Coordination of Const.
Progress Reports
Accounting
Final Testing/Acceptance

The construction activities are divided into eight (8) major subcontracts covering: site survey; soil testing; site preparation and paving; concrete; steel (fabrication/erection) digester erection and painting;

7.3 Phase II - continued

electrical; piping equipment installation and insulation; prefabricated buildings; and fabrication/ erection of the storage silo. The "Subcontract Intent" outline defines the construction task activities of each package to accomplish the construction. The soil testing and site survey activities have been completed during Title I. The site survey activity will be required again during Phase II to establish the work point and base lines for layout of this facility.

JCI has interviewed local subcontractors to qualify them for competitive lump sum bidding of all construction activities as outlined in the "Subcontract Intent." A subcontract bidders list has been prepared by JCI with more than three bidders for each bid package.

7.4 Project Monitoring

A detailed bar schedule will be prepared indicating all task activities for detailed design, procurement and construction. This bar schedule will implement the use of JCI's standards for monitoring a project of this magnitude.

All task activities will be indicated showing early start dates, length of duration and early finish dates for these activities. Circles, triangles, squares and letter symbols will indicate: the issue for approval, inquiry, award and construction of all engineering and purchasing documents for the project.

An overall time/cost "S" curve has been prepared indicating the cash flow through the completion of Phase II. The curve shown is the forecasted early start valuation curve.

JACOBS CONSTRUCTORS, INC

1 OF 2

OVERALL PROJECT SCHEDULE

SUMMARY

CUSTOMER — WMI / ERDA
TYPE OF UNIT — SOLID WASTE TO METHANE GAS
JOB NUMBER — D - 1372
ORIGINAL ISSUE — 1/26/76 BY: JWJ
REVISION — 2 DATE — 3/15/76

LEGEND

INQUIRY ---- PURCH. PLACE ORDER (A) DELIVERY
ORIGINAL PROJECTED PERIOD
CURRENT PROJECTED PERIOD
ACTUAL PERIOD

I INQUIRY
A APPROVAL
BS BID SUMMARY
S/C SUBCONTRACT

ITEM	DESCRIPTION	MONTH	JAN 7	FEB 8	MARCH 9	APRIL 10	MAY 11	JUNE 12	JULY 13	AUGUST 14	SEPT 15	OCT 16	NOV 17	DEC. 18	JAN 19	FEB 20	MARCH 21	APRIL 22	MAY 23	JUNE 24	JULY	AUGUST	PERCENT COMPLETE	
		WEEK ENDING	2 9 16 23 30	6 13 20 27	5 12 19 26	2 9 16 23 30	7 14 21 28	4 11 18 25	2 9 16 23 30	6 13 20 27	3 10 17 24	1 8 15 22 29	5 12 19 26	3 10 17 24 31	7 14 21 28	4 11 18 25	4 11 18 25	1 8 15 22 29	6 13 20 27	3 10 17 24	1 8 15 22 29	5 12 19 26		
		NO OF WEEKS	1 2 3 4 5	6 7 8 9	10 11 12 13	14 15 16 17 18 19	20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45	46 47 48 49	50 51 52 53 54	55 56 57 58	59 60 61 62	63 64 65 66	67 68 69 70 71	72 73 74 75	76 77 78 79	80 81 82 83	84 85 86 87	WT	%
	TITLE I REPORT		A																					
	APPROVAL TITLE I by ERDA				(A)→																			
	START DETAIL - TITLE II																							
	RESTUDY & REDESIGN																							
	PROJECT MANAGEMENT																							
	DRAWINGS																							
	SPECIFICATIONS																							
	BID PACKAGE PREP																							
	PURCH. EQUIP.																							
	O/M MANUAL																							
	TITLE III A																							
	APPROVAL DRAWINGS																							
	EQUIP / MATERIAL																							
	TITLE III B																							
	ON-SITE INSPECTION																							
	INSPECTION SYS. TESTING																							
	MAJOR EQUIP ITEMS																							
F-102, 103, 104	PUMPS							A—I----BS																
K-2101, 2102	COMPRESSOR					A—I----BS																		
F-601	SHREDDER							A—I----BS																
MB 1101, 1102	BELT CONVEYORS							A—I----BS																
F-1201	SCREENS						A—I----BS																	
F-1204	FILTERS						A—I----BS																	
F-1301, 02	DIGESTERS	IN SUBCONTRACT PACKAGE "D"																						
H-1701	HEATER							A—I----BS																
MF 2101, 02	WEIGH FEEDERS							A—I----BS																
X-2301	FLARE							A—I----BS																
2701, 2702	MISC. EQUIP.							A—I----BS																
MS 2901, 02	SCREW FEEDERS							A—I----BS																
MV 2001, 02	VIBRATORY FEEDERS							A—I----BS																
B-3401	EQUIP. PACKAGE - A					A—I----BS																		
F-3501	EQUIP. PACKAGE - B					A—I----BS																		

311-8A

JACOBS CONSTRUCTORS, INC.

OVERALL PROJECT SCHEDULE

SUMMARY

LEGEND
INQUIRY ---- PURCH ---- PLACE ORDER △ ---- DELIVERY ○
ORIGINAL PROJECTED PERIOD
CURRENT PROJECTED PERIOD
ACTUAL PERIOD

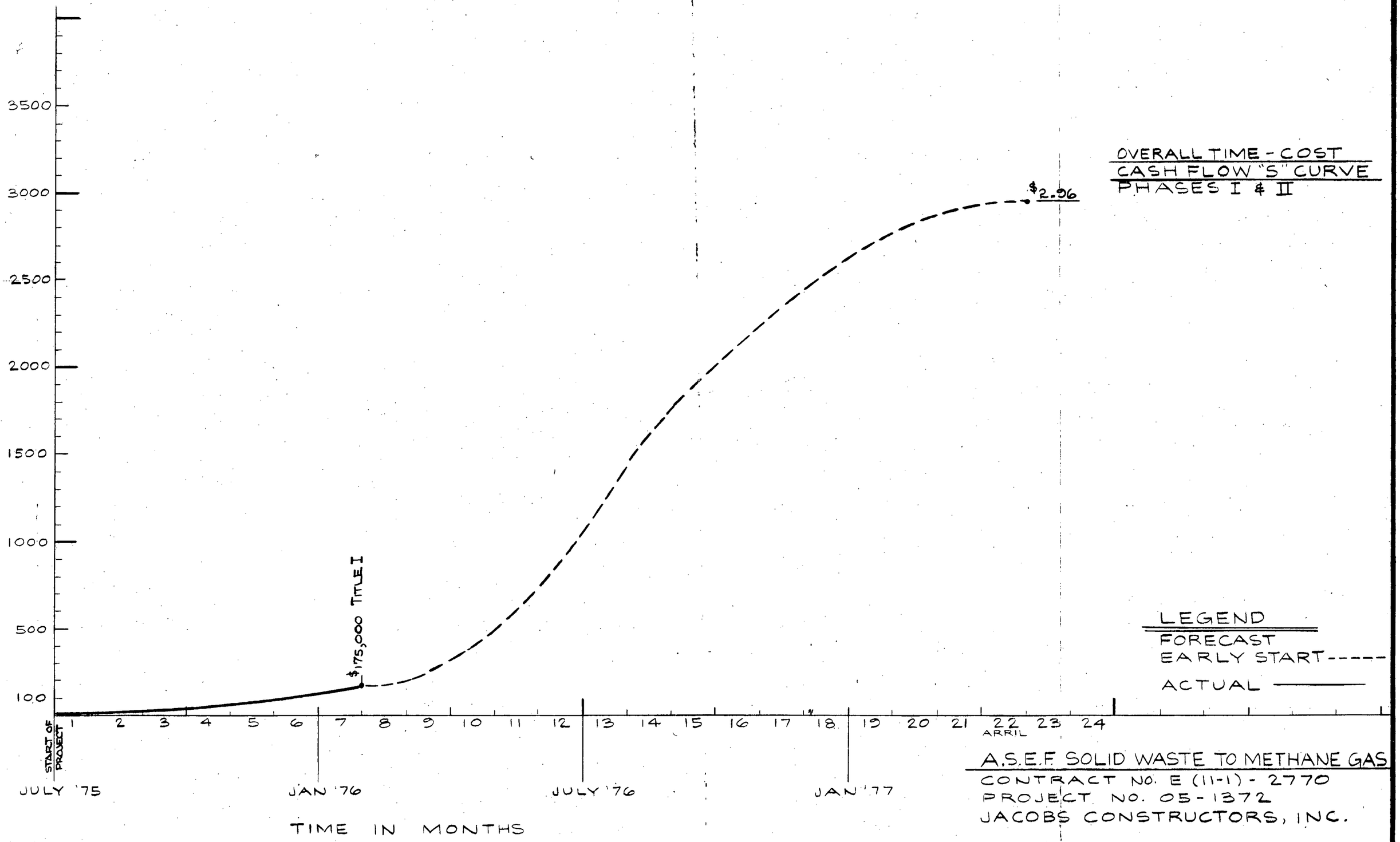
CUSTOMER: WMI / ERDA
TYPE OF UNIT: SOLID WASTE TO METHANE GAS
JOB NUMBER: 05-1372
ORIGINAL ISSUE: 1/26/76 BY: JWW
REVISION: 2 DATE: 2/15/76

ITEM	DESCRIPTION	MONTH	1976 JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC.	1977 JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	PERCENT COMPLETE
		WEEK ENDING	2 9 16 23 30 6 13 20 27 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9 16 23 30 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 3 10 17 24 31 7 14 21 28 4 11 18 25 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26																				
		NO OF WEEKS	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 WT																				%
	PHASE II																						
	CONSTRUCTION MANAGEMENT																						
	COORINATION																						
	AWARD SUBCONTRACTS																						
	CONSTRUCTION																						
	FIELD MOBILIZATION																						
B	SITE SURVEY																						
A	SOIL TESTING	IF ADDITIONAL TESTING REQUIRED																					
C	SITE PREP. & PAVING																						
D	CONCRETE																						
	STEEL FAB/ERECT																						
	DIGESTER ERECTION																						
	PAINTING																						
E	PREFAB BUILDINGS																						
F	ELECTRICAL																						
G	PROCESS/UTILITY PPING																						
	EQUIP. INSTALLATION																						
	INSULATION																						
H	SOLID WASTE STORAGE SILO FAB / ERECT																						
	SUBMIT DRAWINGS BUILDING PERMITS																						
	INFOR TO F.P.L. TRANSFORMER																						
	WMI EXPANSION COMPLETE INTERFACE FEED POINT																						
	FINAL TESTING/ACCEPTANCE																						
	START-UP																						
	PREPARE DIGESTERS																						
	OPERATION OF FACILITY																						

OPERATION FOR 2 YEAR DURATION

311-2A

OVERALL TIME - COST CASH FLOW "S" CURVE PHASES I & II



A.S.E.F SOLID WASTE TO METHANE GAS

CONTRACT NO. E (11-1) - 2770

PROJECT NO. 05-1372

JACOBS CONSTRUCTORS, INC.

SUBCONTRACT INTENT OUTLINE

January, 1976

Project No. 05-1372

WASTE MANAGEMENT, INC.

POMPANO BEACH, FLORIDA

A.S.E.F. Solid Waste to Methane Gas

JACOBS CONSTRUCTORS, INC.
22 West Madison Street
Chicago, Illinois 60602

A. SOIL TESTING

Spec. No. _____
Scope of Work No. 1372-50-2

1. Furnish all soil testing, as required, per specification.
2. Furnish analysis of all soil testing.
3. Provide recommendations of foundations in report form.

B. SITE SURVEY

Spec. No. _____
Scope of Work No. 1372-50-1

1. Provide required survey drawing of the area as per specified.
2. On drawing, indicate all topography lines, roads, existing buildings, utilities and vegetation of the area.
3. Provide bench mark and base lines.
4. Site drawing to be certified by a Florida registered Land Surveyor.
5. Provide platting of property for Broward County approval.

C. SITE PREPARATION & PAVING

5100-1
Spec. No. 5000-3
Scope of Work No. 1372-50-3

1. All rough grading, stripping and clearing of area.
2. Furnish and compact all fill required for the site.
3. Furnish and compact all subgrade fill for roads, etc.

C. SITE PREPARATION & PAVING - continued

4. Provide unit prices for additional fill and compacting.

5. Furnish hauling of any excess materials either on site or off site.

6. Provide all finish grading of existing sub-base for roads.

7. Furnishing and installing of all additional sub-base material required.

8. Furnish and install all bituminous paving as per specification.

4200-1
4900-1
5200-1
5400-1
5400-2
5600-1

D. CONCRETE, STEEL FABRICATION/ERECTION, MISC. CARPENTRY — Spec. No. 5900-1

Scope of Work No. 1372-52-1

1. Furnish and install all concrete for work required.

2. Provide all necessary formwork.

3. Provide dewatering where necessary.

CONCRETE, STEEL FABRICATION/ERECTION,
D. MISC. CARPENTRY - continued

4. This subcontractor shall provide the concrete for the following items:
   - Pipe Supports
   - Footings
   - Piers
   - Foundation Walls
   - Equipment Foundations & Pads
   - Slabs on Grade
   - Concrete Curbs & Covers
   - Floor & Wall & Cover
   - Concrete Finishes
   - Sealing & Caulking of Concrete items

5. Furnish and install all necessary reinforcement such as reinforcing bars, chairs, ties, straps, dowels, wire mesh, etc.

6. Furnish and install all embedded anchor bolts complete with washers and nuts required for structural steel members and equipment, as required.

7. Furnish and install all angles, channe , plates, sleeves, etc., embedded in concrete poured by this subcontractor.

8. Prime all exposed embedded metal as per specification.

9. Furnish and install all required damproofing, waterproofing, waterstops, and vapor barriers, as required.

10. Furnish and install all expansion control and construction joints.

11. Provide the proper finish and slopes on all concrete work, as required.

STEEL FABRICATION & ERECTION - continued

24. Furnish and install metal decking required for weigh feed structure.

E. PRE-FAB BUILDING

Spec. No. 5600-1
Scope of Work No. 1372-56-1

1. Furnish and install a complete pre-fab building, as per specifications.

2. Provide all shop prime painting and field touch-up of weld points after erection.

F. ELECTRICAL

Spec. No. 6100-3
Scope of Work No. 1372-61-1

1. Furnish and install all grounding, as required.

2. Furnish and install all above and below ground electrical conduits and wire.

3. Furnish, install and connect all light fixtures, including lamps.

4. Connect all control and power wiring to all equipment, as furnished by JCI, or equipment furnished and installed under other divisions of associated specifications.

5. Install, connect all electrical equipment such as motor, control centers and switchgear, as furnished by JCI.

6. Furnish and install miscellaneous electrical hardware.

7. Provide and install, as required, any communication systems, telephone and fire alarm systems.

8. Provide all electrical connections for instrumentation.

D. CONCRETE, STEEL FABRICATION/ERECTION, MISC. CARPENTRY - continued

12. Cure all concrete as per specification.

13. Provide all required sealers and hardeners.

14. Provide all field engineering layout required (bench marks and base lines will be provided by JCI).

15. Provide all excavation for foundation.

16. Install all pipe and equipment sleeves in concrete floors and walls, as required.

17. Provide all concrete test cylinders and reports of all concrete, as required.

18. Furnish and install special floor topping for storage silo, as specified.

STEEL FABRICATION & ERECTION

19. Provide all shop drawings, as required, for approval.

20. Furnish and install all structural steel, pipe bridges, platforms and miscellaneous steel, as specified.

21. Furnish all miscellaneous equipment supports and architectural steel.

22. Provide all chute work, spout work, and any miscellaneous spouts.

23. Provide all shop prime painting.

F. ELECTRICAL - continued

9. Furnish and install all required miscellaneous supports.

10. Furnish, install and connect complete, ready for operation, all motor starters contactors, relays, receptacles and pushbuttons, etc.

11. Furnish, install and connect control panels, as required.

12. Furnishing, installing and connecting a 480/277 volt service from new pad mounted transformer that is furnished and installed by utility company.

13. Complete wiring system for lighting and power, as shown on drawings, including panel board, conduits, wires, outlets, wiring, devices, etc., for a complete and fully operable lighting and power system.

14. Complete connection of all motors, apparatus and electrically operated devices, as shown on electrical and mechanical drawings, unless otherwise indicated. Verify mechanical drawings before submitting bid.

15. Trenching, backfilling and compacting for electrical work.

16. Adjustments and testing of the electrical work.

6200-1
6200-2
6200-3
6200-4
6300-1

G. PROCESS & UTILITY PIPING & EQUIPMENT INSTALLATION

Spec. No. 6600-1

Scope of Work No. 1372-62-1

1. Install, as per specification, all pipe, valves, fittings required for complete piping system.

   NOTE: All specialties, pipe, valves, instruments by JCI.

2. Install all instrumentation and instrumentation piping, as required.

3. Install all pipe supports.

4. Provide all hoisting, scaffolding and shoring, as required.

5. Furnish and install all wood blocking in hangers and sleeves to pot pipes at required elevations for pipe insulation.

6. Set, align and level all equipment that falls under the jurisdiction of pipefitters.

7. Furnish and install pipe sleeves in masonry walls.

8. Furnish and install all necessary counter-flashing, as required.

9. Provide initial start-up flushing and testing of all systems.

G. PROCESS, UTILITY PIPING & EQUIPMENT INSTALLATION - continued

10. Provide all excavation, compaction and backfill for all underground pipe.

11. Furnish and install a complete new water well with pump.

12. Unload, store, protect, assembly set, shim, align, fasten grout all process equipment conveyors, screens, feeders, magnets, pneumatic system, etc., as shown on drawings.

13. Install all chute work, spout work, and any miscellaneous spouts.

    NOTE: Spouts provided by JCI.

14. Install all steel equipment supports and hangers.

    NOTE: Equipment supports by JCI.

15. Provide all hoisting, scaffolding and shoring; as required.

16. Set, align and fasten in place the mobile laboratory.

    NOTE: Laboratory furnished by JCI.

17. Provide all testing, run-in and start of all equipment.

18. Furnish and install fire hose stations, as required.

INSULATION

19. Furnish and install all pipe insulation in accordance with specification.

20. Furnish and install all equipment insulation in accordance with specifications.

21. Furnish and install all covering and jackets for all insulation.

H. PAINTING

Spec. No. 6500-1
Scope of Work No. 1372-65-1

1. Provide all finish painting on pipe and equipment.

2. Provide all sealing of concrete block walls.

3. Provide all cleaning and priming before finish coat, as required.

I. SOLID WASTE SOTRAGE SILO

Spec. No. _____
Scope of Work No. 1372- -1

1. Furnish and install complete storage silo with all mechanical equipment, as per specifications.

2. Furnish complete electrical controls and accessories.

3. Provide design and load requirements for foundation design.

NOTE: Foundation design by JCI. Foundation by concrete subcontractor.

Section VIII

APPENDIX

SECTION 8.0
APPENDIX

Attachments	Description	
1	Equipment Index	7 pages
2	Drawing Index	KD-1-0
3	Specification Index Listing	8 pages
4	Outline Equipment Specifications for Item Number:	
	MB-701, B-3401 (Equip. Pkg. A), MB-702, F-1201, F-601, F-3501 (Equip. Pkg. B), K-201, P-101, V-2703, K-202, P-102, P-103, V-3601 (Equip. Pkg. C), H-1701, F-1203 and F-1204, P-104, K-801, X-2301	
5	General Outline Design Specification for:	
	Site Preparation	2 pages
	Electrical	3 pages

CUSTOMER W.M.I.
LOCATION POMPANO BEACH, FLA.

EQUIPMENT INDEX

PROJECT 05-1272
REV.
DATE 1-13-76 BY E.T.L.

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
MB-704	TROMMEL HEAVIES DISCHARGE CONVEYOR	KD-2		BELT CONVEYOR; 24" WIDE, 7.5 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 1/2 HP MOTOR.		
MB-705	TROMMEL HEAVIES TO SECONDARY SHREDDER	KD-2		BELT CONVEYOR; 24" WIDE, 7.5 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 1 HP MOTOR.		
F-601	SECONDARY SHREDDING	KD-2		SHREDDER; ? SIZE, CAPACITY 10 T.P.H. W/ DRIVE, DRIVE GUARD, & 100 HP MOTOR.		
MB-706	SECONDARY SHREDDER DISCHARGE CONVEYOR.	KD-2		BELT CONVEYOR; 24" WIDE, 7 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 1/2 HP MOTOR.		
MB-707	SECONDARY SHREDDER TO AIR CLASSIFIER FEED CONVEYOR.	KD-2		BELT CONVEYOR; 24" WIDE, 7 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 1 HP MOTOR.		
MV-3002	FEEDER TO AIR CLASSIFIER	KD-2		VIBRATORY FEEDER; 30" WIDE, 7 T.P.H., WITH (2) MAGNETS - TOTAL POWER 250 WATTS		
F-3501	AIR CLASSIFICATION OF SHREDDED WASTE GARBAGE.	KD-2		AIR CLASSIFIER; 7 T.P.H. CAPACITY @ A MAXIMUM OF -3" PARTICLE SIZE, W/ DRIVE & 1 HP MOTOR.		
FK-3502	AIR CLASSIFIER AERATION FAN	KD-2		BLOWER - 14,000 CFM W/ DRIVE, DRIVE GUARD, & 30 HP MOTOR		FURNISHED WITH ITEM NO. F-3501

CUSTOMER W.M.I.
LOCATION POMPANO BEACH, FLA.

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-15-76 BY E.T.L

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
MB-701	SHREDDED WASTE CONVEYOR FEEDING STORAGE BIN	KD-2		BELT CONVEYOR; 60" WIDE, 75 T.P.H. W/ 20° TROUGHING IDLERS, TAKE-UP, WALKWAY, CONTINUOUS HOOD, SUPPORT BENTS, LOADING SKIRT, DISCHARGE CHUTE, REDUCER, DRIVE, DRIVE GUARD & 15 HP MOTOR.		
B-3401	SHREDDED WASTE STORAGE BIN	KD-2		175 TON DIVERGENT CONE LIVE BOTTOM STORAGE BIN CAPACITY 24,000 CU.FT. (2) MOTORS @ 15 HP = 30 HP TOTAL.		
BD-3401	SHREDDED WASTE STORAGE RECLAIM CONVEYOR	KD-2		DRAG CHAIN CONVEYOR; 30" WIDE 10 T.P.H. W/ ENCLOSURE, CHAIN, SPROCKETS, TAKE-UP, CHAIN DRIVE, DRIVE GUARD, REDUCER, 5 HP MOTOR, & SUPPORTS.		FURNISHED WITH ITEM NO. B-3401
MB-702	SHREDDED WASTE FEED TO CLASSIFICATION BUILDING	KD-2		"S" TYPE ELEVATOR-CONVEYOR; 48" WIDE 10 T.P.H. CLEATED BELT W/ FLEXIBLE SIDEWALLS, IDLERS, TAKE-UP, WALKWAY, CONTINUOUS HOOD, SUPPORT STRUCTURE, LOADING SKIRT, DISCHARGE CHUTE, REDUCER, DRIVE, DRIVE GUARD, & 5 HP MOTOR.		
MM-2701	FERROUS METALS REMOVAL FROM SHREDDED WASTE	KD-2		SELF CLEANING SUSPENDED MAGNET (PERMANENT) W/ BELT, PULLEYS, FRAME, REDUCER, DRIVE, DRIVE GUARD, & 2 HP MOTOR. TOTAL MAGNET POWER - 3,350 WATTS		
MV-3001	SHREDDED WASTE FEEDER TO TROMMEL SCREEN	KD-2		VIBRATORY FEEDER; 48" WIDE x 8'-0" LG. CAPACITY 10 T.P.H. WITH (4) MAGNETS - TOTAL POWER; 500 WATTS		
F-1201	SHREDDED WASTE CLASSIFICATION	KD-2		TROMMEL SCREEN; 6' DIA. x 20' LG. ROTARY SCREEN, 10 T.P.H CAPACITY, W/ TRUNNION ROLLERS, ROLLED TIRE BASE, DISCHARGE HOPPERS, SUPPORTING STRUCTURE, V-BELT DRIVE, DRIVE GUARD, REDUCER & 20 HP MOTOR		
MB-703	TROMMEL FINES DISCHARGE CONVEYOR	KD-2		BELT CONVEYOR; 14" WIDE, 1 T.P.H., W/ 20° TROUGHING IDLER LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 1/2 HP MOTOR		

CUSTOMER W.M.I.
LOCATION POMPANO BEACH, FLA.

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-13-76 BY E.T.B.

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
F-3503	CLASSIFIER CYCLONE SEPARATOR	KD-2		CYCLONE 8'-0" DIA. W/ TANGENTIAL INLET FLANGED, FLANGED CONE DISCHARGE, FLANGE AIR OUTLET, INLET LINER, & SUPPORT STAND.		FURNISHED WITH ITEM No. F-3501
F-3504	DUST COLLECTOR	KD-2		FABRIC COLLECTOR; CONTINUOUS CLEANING TYPE 14,000 C.F.M. @ 1400 SQ. CLOTH AREA, W/ DUST HOPPER, SUPPORTING STRUCTURE & 1/2 HP SHAKER MOTOR		FURNISHED WITH ITEM No. F-3501
FK-3505	DUST COLLECTOR VACUUM FAN	KD-2		BLOWER - 14000 CFM WITH V-BELT DRIVE, DRIVE GUARD, 7½ HP MOTOR, INLET & OUTLET DUCTWORK		FURNISHED WITH ITEM No. F-3501
FV-3506	DUST COLLECTOR AIRLOCK	KD-2		ROTARY AIRLOCK; SIZE 12"x12" WITH FLEXIBLE TIPPED VANES, DRIVE, & 1½ HP MOTOR.		FURNISHED WITH ITEM No. F-3501
FV-3507	CYCLONE AIRLOCK	KD-2		ROTARY AIRLOCK; SIZE 42"x42" WITH FLEXIBLE TIPPED VANES, DRIVE, & 10 HP MOTOR.		FURNISHED WITH ITEM No. F-3501
MB-708	TROMMEL FINES & AIR CLASSIFIER HEAVIES TRANSFER CONVEYOR	KD-2		BELT CONVEYOR; 24" WIDE, 2 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, 2 HP MOTOR, & CONV. HOOD.		
MB-709	RESOURCE RECOVERY CONVEYOR TO LANDFILL CONVEYOR	KD-2		BELT CONVEYOR; 24" WIDE, 2 T.P.H., 20° TROUGHING IDLERS, LOADING SKIRT, DISCHARGE CHUTE, SUPPORTING STRUCTURE, REDUCER, V-BELT DRIVE, DRIVE GUARD, 3 HP MOTOR, & CONVEYOR HOOD.		
MF-2101 MF-2102	DIGESTER WEIGHFEEDER	KD-2		FEEDER BELT CONVEYOR W/ WEIGHING DEVICE; 24" WIDE, 0 TO 5 T.P.H., TOTALLY ENCLOSED HOUSING W/ INLET & OUTLET FLANGED CONNECTION, SUPPORT LEGS, DRIVE, DRIVE GUARD, & 1½ HP MOTOR.		
B-2702	FERROUS METALS RECOVERY FROM MAGNET	KD-2		DUMP HOPPER WITH WHEELS; CAPACITY 2 CU. YD.		

CUSTOMER WMI
LOCATION POMPANO BEACH, FLA.

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-13-76 BY E.T.B.

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
K-201	INSTRUMENT AIR & PLANT AIR	KD-3		AIR COMPRESSOR 115 PSIG @ 10 ACFM WITH RECEIVER, PRESSURE GAGE, SAFETY VALVE, INTAKE FILTER, V-BELT DRIVE, GUARD, & 2 HP MOTOR W/SLIDE BASE		
V-2703	WATER TREATMENT TANK	KD-3		WATER TREATMENT TANK 5 GAL. CAPACITY W/INLET & OUTLET NOZZLES, & COVER.		
K-202	COMPRESSED GAS FOR DIGESTER	KD-3		GAS COMPRESSOR TO COMPRESS 4000 SCFM @ 0°C & 760 mm Hg W/ V-BELT DRIVE, DRIVE GUARD, & 250 HP MOTOR W/ SLIDE BASE		
X-203 X-204	DIGESTER GAS COMPRESSOR SILENCER	KD-3		SILENCER		
P-101	SERVICE WATER PUMP	KD-3		WELL PUMP 100 GPM @ 160 FT. T.D.H. VERTICAL TURBINE TYPE, AUTOMATIC FOOT VALVE STRAINER, & 7 1/2 HP MOTOR		
V-3601	WELL WATER TREATMENT	KD-3		WATER TREATMENT TANK 55 GAL. CAPACITY W/ DISSOLVING BASKET, AND LOW LEVEL ALARM.		
A-3602	WELL WATER TREATMENT TANK AGITATOR	KD-3		TANK AGITATOR W/ MOUNTING BRACKET, SHAFT, IMPELLER, & 1/4 HP MOTOR.		FURNISHED WITH ITEM NO. V-3601
P-3603	WELL WATER TREATMENT TANK TO WATER HEATER	KD-3		METERING PUMP 0-6 G.P.H. @ 100 P.S.I.G. W/ DIAPHRAGM HEAD, INTERNAL RELIEF VALVE, & 1/2 HP MOTOR.		FURNISHED WITH ITEM NO. V-3601

CUSTOMER WMI
LOCATION POMPANO BEACH, FLA

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-13-76 BY E.T.S.

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
H-1701	HEAT WELL WATER FOR DIGESTERS	KD-3		WATER HEATER 2.5 MM BTU/HR., W/ DUAL BURNER FOR GAS & OIL, "ON" INDICATORS, LOW WATER ALARM AND SHUT OFF, AND INTEGRAL EXPANSION TANK. WATER "IN" TEMP. = 76°F WATER "OUT" TEMP. = 200°F WATER FLOW = 42 GPM		
P-102	FUEL OIL STORAGE TANK TO HEATER	KD-3		GEAR PUMP 0.4 GPM. @ 50 P.S.I.G. W/ 1/4 HP MOTOR.		
T-1401	WATER HEATER FUEL OIL STORAGE TANK	KD-3		FUEL OIL STORAGE TANK 5000 GAL. CAPACITY 8'-0 x 12'-0" LG. W/ INLET & OUTLET NOZZLES, MANHOLE, VENT, GAGE GLASS, & SUPPORTS		
P-103	SLUDGE TANKER TO DIGESTERS	KD-3		SLUDGE UNLOADING PUMP 30 G.P.M. @ 50 FT. T.D.H. "NO-CLOG" TYPE PUMP. W/ COUPLING GUARD, BASEPLATE & 1 1/2 HP MOTOR		

CUSTOMER W.M.I.
LOCATION POMPANO BEACH, FLA

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-13-76 BY E.T.L

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
X-2901	DIGESTER GAS BURNER	KD-4		GAS BURNER - CAPACITY 300 S.C.F.M. OF METHANE & CARBON DIOXIDE MIXTURE.		
K-801	BURNER GAS BLOWER	KD-4		BURNER BLOWER - 300 S.C.F.M. @ S.P. W/ DRIVE, DRIVE GUARD, 1½ HP MOTOR & SLIDE BASE		
MX-2001 MX-2002	DIGESTER FLOATABLES MIXER	KD-4		MIXER W/ MARINE TYPE IMPELLER INCLUDING MOUNTING BRACKET, SHAFT & ⅓ HP MOTOR.		
T-1301 T-1302	DIGESTER TANKS	KD-4		INSULATED DIGESTER TANK 50 FT. I.D. X 27 FT. HIGH W/ DOMED ROOF, FLOATABLES REMOVAL COMPARTMENT, INTERIOR PERIPHERAL TROUGH FOR FLOATABLES, GAS INLET & OUTLET NOZZLES, SLURRY OUTLET NOZZLE, MISC. INSTRUMENT NOZZLES AT ROOF, FEEDER SCREW FLANGED CONN.) & MANHOLES W/ COVERS		
MS-2901 MS-2902	FEED OF DRY AND WET MATERIAL TO DIGESTER	KD-4		DIGESTER FEEDER SCREWS 24" DIA. W/ INLET CHUTE & NOZZLES, TROUGH, CONN. FLANGE TO DIGESTER, REDUCER, V-BELT DRIVE, DRIVE GUARD, & 5 HP MOTOR		
E-1202	DIGESTER FLOATABLES SEPARATION	KD-4		LIQUID VIBRATING SCREEN 24"x24" W/ FEED FLUME, LIQUID COLLECTING HOPPER, MOTOR SUPPORT, V-BELT DRIVE, DRIVE GUARD, SLIDE BASE, & 1½ HP MOTOR.		

CUSTOMER W.M.I.
LOCATION POMPANO BEACH, FLA.

EQUIPMENT INDEX

PROJECT 05-1372
REV.
DATE 1-13-76 BY E.T.S

ITEM NO.	SERVICE	P&ID	SPEC	DESCRIPTION	SUPPLIER	REMARKS
MF-2704 MF-2705	SLURRY FEED TO SCREEN FILTER	KD-4		DIGESTER OVERFLOW WEIR BOX WITH ADJUSTABLE WEIR, INLET & OUTLET NOZZLE, & OPEN TOP.		
E-1203 E-1204	DIGESTER SLURRY SEPARATION	KD-4		CYLINDRICAL SCREEN FILTER 3' DIA. X 10' LG. W/ SOLIDS DISCHARGE DOCTOR BLADE, DIRECT COUPLED SPEED REDUCER, 1 1/2 HP MOTOR, WELDED STEEL CHASSIS, HEAD BOX SECTION W/ INLET PIPE, & BOTTOM DISCHARGE.		
T-1402	SCREEN FILTER RECYCLE WATER HOLD TANK	KD-4		RECYCLE WATER TANK 2000 GAL. CAPACITY 5'-0" DIA. X 15'-0" HIGH, W/ OPEN TOP, & OUTLET NOZZLE		
P-104	RECYCLE WATER USE LINES	KD-4		RECYCLE WATER PUMP 18 TO 2000 GPM @ 60 FT. T.D.H. W/ 7 1/2 HP MOTOR		
X-2601	HOISTING OF NUTRIENT BAGS ON PALLETS.	KD-4		1/4 TON CAPACITY HOIST, MOTOR OPERATED, HOOK MOUNTED, 40 FT. LIFT, W/ PUSHBUTTON CONTROL CORD STD. LENGTH, AND HAND GEARED TROLLEY W/ OPERATOR CHAIN STD. LENGTH.		

GENERAL TITLE-I	
KD-1	DRAWING INDEX SHEET
KD-2	FLOW DIAGRAM - DRY END
KD-3	FLOW DIAGRAM - WET END #1
KD-4	FLOW DIAGRAM - WET END #2
KD-5	GENERAL PLANT LAYOUT
KD-6	PLOT PLAN
AD-2	SITE PREPARATION PLAN
ED-1	SINGLE LINE DIAGRAM
CD-10	SITE BORING PLAN
SK-75-06 -29	DIGESTER GAS MIXING EXPERIMENT

ARCHITECTURAL TITLE-II	
AD-1	SITE SURVEY PLAN
AD-2	SITE PREPARATION PLAN (INCLUDED IN TITLE-I)
AD-3	PUMP HOUSE PLAN & ELEVATION
AD-4	WALL SECTIONS & DETAILS

MECHANICAL TITLE-II	
MD-1	GENERAL ARRANGEMENT - PLAN AIR CLASSIFICATION BLDG.
MD-2	GENERAL ARRANGEMENT - MISCELLANEOUS PLAN & SECTIONS
MD-3	GENERAL ARRANGEMENT - SECTION & LONGITUDINAL ELEVATION
MD-4	GENERAL ARRANGEMENT - PLAN, STORAGE & RECLAIM
MD-5	GENERAL ARRANGEMENT - SECTION, STORAGE & RECLAIM
MD-6	GENERAL ARRANGEMENT - PLAN, PUMP & FILTER HOUSE
MD-7	GENERAL ARRANGEMENT - SECTION, PUMP & FILTER HOUSE
MD-8	MISCELLANEOUS DETAILS - CHUTES & SUPPORTS

STRUCTURAL TITLE-II	
CD-1	FOUNDATIONS FOR BELT CONVEYORS & TRANSFER TOWER
CD-2	RESOURCE RECOVERY BUILDING FOUNDATION - PLAN
CD-3	RESOURCE RECOVERY BUILDING SECTIONS & EQUIPMENT FDNS.
CD-4	WASTE STORAGE BIN FOUNDATION PLAN
CD-5	WASTE STORAGE BIN FOUNDATION DETAILS TUNNEL & ENTRANCE
CD-6	SLUDGE TANKS, DUST COLLECTOR & PUMP FOUNDATION
CD-7	DIGESTER TANK & PUMP HOUSE PLAN
CD-8	DIGESTER TANK REINFORCING DETAILS
CD-9	PUMP HOUSE REINFORCING DETAILS
SD-1	PLATFORM BETWEEN DIGESTERS & STAIRS TO GRADE
SD-2	SUPPORTS FOR OVERHEAD PIPELINES
SD-3	MISCELLANEOUS EQUIPMENT SUPPORTS

ELECTRICAL TITLE-II	
ED-2	PLOT PLAN - INCOMING SERVICE & GROUNDING
ED-3	SCHEMATIC DIAGRAM SHEET #1
ED-4	SCHEMATIC DIAGRAM SHEET #2
ED-5	POWER LAYOUT SHEET #1
ED-6	POWER LAYOUT SHEET #2
ED-7	POWER LAYOUT SHEET #3
ED-8	LIGHTING LAYOUT SHEET #1
ED-9	LIGHTING LAYOUT SHEET #2
ED-10	FIXTURE & PANELBOARD SCHEDULES & SYMBOL LIST

PIPING TITLE-II	
PD-1	PIPE GUIDES & ANCHORES
PD-2	RIGID & ADJUSTABLE PIPE SUPPORTS
PD-3	DUMMY EXTENSION SUPPORTS
PD-4	PIPE BRACKETS, GUIDES & SUPPORT LUGS
PD-5	FIELD SUPPORTS
PD-6	HOSE RACK DETAILS
PD-7	PIPING PLAN - DIGESTER #1 & FLARE STACK
PD-8	PIPING PLAN - DIGESTER #1 & #2 & FILTER/PUMP HOUSE
PD-9	PIPING PLAN - SLUDGE STORAGE AREA
PD-10	PIPING DETAILS & SECTIONS - DIGESTERS #1, #2 & FILTER/PUMP HOUSE
PD-11	PIPING DETAILS & SECTIONS - DIGESTERS #1, #2 & FLARE STACK
PD-12	PIPING DETAILS & SECTIONS - SLUDGE STORAGE AREA
PD-13	MISCELLANEOUS DETAILS
PD-14	UNDERGROUND PIPING PLAN & DETAILS

INSTRUMENTATION TITLE-II	
IA-1	INSTRUMENT LOOP SHEET
IA-2	INSTRUMENT LOOP SHEET
IA-3	INSTRUMENT LOOP SHEET
IA-4	INSTRUMENT LOOP SHEET
IA-5	INSTRUMENT LOOP SHEET
IA-6	INSTRUMENT LOOP SHEET
IA-7	NOT USED
IA-8	NOT USED
IA-9	NOT USED
IA-10	NOT USED
IA-11	INSTALLATION DETAILS
IA-12	INSTALLATION DETAILS
IA-13	INSTALLATION DETAILS
IA-14	INSTALLATION DETAILS
IA-15	INSTALLATION DETAILS
IA-16	INSTALLATION DETAILS

ISSUE AND DISTRIBUTION RECORD

ISSUED TO	A	B	C	D	E	0	1	2	3	4	5	6	7	8	9	10
CLIENT (WMI)						WMI										
FIELD																
EO																
E.R.D.A.						ERDA										

REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	1-19-76	ISSUED FOR TITLE I	MD	

A.S.E.F. SOLID WASTE TO METHANE GAS
WASTE MANAGEMENT INC. — SOLID WASTE REDUCTION CENTER
POMPANO BEACH, FLORIDA

FOR — UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

PRIME CONTRACTOR
Waste Management, Inc.
900 Jorie Boulevard · Oak Brook, Illinois 60521 · 312/654-8800

JACOBS CONSTRUCTORS, INC.
PASADENA, CALIF. CHICAGO, ILL. MOUNTAINSIDE, N.J.

ISSUED FOR CONSTRUCTION

APPROVED FOR ISSUE
By WMI
By ERDA

DRAWING TITLE
DRAWING INDEX SHEET
PHASE-I

DESIGNED BY	DRAWN BY	REVIEWED BY	APPROVED BY
E.T.A.	A.K.MANDAL	NIL DAS	

SCALE	PROJECT NUMBER	DRAWING NUMBER	REVISION
NONE	05-1372	KD-1	0

DATE 11-19-75

SPECIFICATION

&

SCOPE OF WORK

INDEX LISTING

Project No. 05-1372

WASTE MANAGEMENT, INC.

POMPANO BEACH, FLORIDA

A.S.E.F. SOLID WASTE TO METHANE GAS

JACOBS CONSTRUCTORS, INC.
22 West Madison Street
Chicago, Illinois 60602

SPECIFICATION & SCOPE OF WORK INDEX LISTING

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
100-1	Deep Well	P-101
100-B	Centrifugal Pump	P-104 P-103
100-2	Gear Pump	P-102
200-2	Gas Compressor	K-202 X-203 X-204
200-1	Instru. Air Compressor	K-201
700-1	Belt Conveyors	MB-701 MB-702 MB-703 MB-704 MB-705 MB-706 MB-707 MB-708 MB-709

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
600-1	Shredder	F-601
800-1	Gas Blower	K-801
1000-1	Screen Filter	F-1001 F-1002
1200-1	Trommel Screen	F-1201
1200-2	Liquid Vibrating Screen	F-1202
1300-1	Digester Tank	T-1301 T-1302
1400-1	Fuel Oil Storage	T-1401
1400-2	Recycle Water Storage Tank	T-1402
1700-1	Water Heater	H-1701
2000-1	Mixer	MX-2001 MX-2002
2100-1	Weigh Feeder	MF-2101 MF-2102
2300-1	Gas Flare	X-2301
2600-1	Hoist	X-2601

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
2700-1	Ferrous Magnet	MM-2701
2700-2	Dump Hopper	B-2702
2700-3	Water Treatment Tank	V-2703
2700-4	Overflow Weir	F-2704 F-2705
2900-1	Digester Feeder Screw	MS-2901 MS-2902
3000-1	Vibrating Feeder	MV-3001 MV-3002
3400-1	Storage Silo w/Drag Conveyor	B-3401 BD-3402
3500-1	Air Classifier System	F-3501 FK-3502 F-3503 F-3504 FK-3505 FV-3506 FV-3507

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
3600-1	Water Treatment System	V-3601 A-3602 P-3603
4002-1	Thermometers	
4003-1	Pressure Indicators	
4005-1	Differential Transmitters	
4005-2	Rotameters	
4005-3	Locally Mounted Flow Instruments	
4005-4	Receiver Gauges	
4007-1	Level Transmitters	
4007-2	Field Mounted Controllers	
4010-1	Pressure Relief Valve	
4010-2	Flame Arrester	
4012-1	Scam Type Annunciator	
4200-1	Siding and Decking	

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
4900-1	Architectural Building Specialties	
5000-1	Sitework	
5100-1	Paving	
5200-1	Concrete	
5400-1	Structural Steel	
5400-2	Miscellaneous Steel	
5600-1	Prefab Building	
5700-1	Air Condition Window Unit	
5800-1	Duct Work	
5900-1	Special Floor Topping	
6100-1	Electrical	
6200-1	Process Piping	
6200-2	Above Ground Pipe Fabrication/Erection	
6100-2	Motor Control Centers	
6100-3	Control Panel	

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

EQUIPMENT SPECIFICATION NO.	TITLE	ITEM NO.
6200-3	Pipe Testing	
6200-4	Pipe Construction	
6300-1	Insulation Equipment/Pipe	
6500-1	Painting Building Equipment Pipe	
SCOPE OF WORK		
6600-1	Underground Pipe	
7000-1	Laboratory Equipment	
1372-50-1	Site Survey	
1372-50-2	Soil Testing	
1372-50-3	Site Preparation & Paving	
1372-52-1	Concrete, Steel, and Painting	T-1301, 1302
1372-61-1	Electrical	
1372-62-1	Piping, Insulation & Equipment Installation	
1372-56-1	Prefabricated Buildings	

SPECIFICATION & SCOPE OF WORK INDEX LISTING
(continued)

SCOPE OF WORK	TITLE	ITEM NO.
1372-34-1	Solid Waste Storage Silo Fabrication/ Erection	B-3401 BD-3402
1372-86-1	Gas Mixing Experiment (Fabrication)	
1372-86-2	Gas Mixing Equipment (Erection)	

JACOBS CONSTRUCTORS INC. [redacted]

SPECIFICATION SHEET

BELT CONVEYOR MB-701 — NO. UNITS REQUIRED 1 (ONE)

TYPE 20 TROUGHED BELT CONVEYOR

FROM WMI INTERFACE

TO STORAGE SILO B-102

MATERIAL SHREDDED SOLID WASTE

WEIGHT 5-10 LBS./CU.FT. — MATERIAL TEMP. 75 °F. — TEMP. AMBIENT 70 °F

SIZE -6" NOMINAL SIZE WITH OVERSIZE RAGS & PLASTICS.

CHARACTERISTICS FIBROUS STINGY WITH 50% PAPER

DESIRED CAPACITY 75 SEE T.P.H. — % MOISTURE 23 NOM.

CORRECTED T.P.H. — DESIGN FACTOR — REQ'D. DESIGN T.P.H.

SERVICE 2 (HRS./DAY) 5 (DAYS/WK.)

OPERATION CHARACTERISTICS INTERMITTENT TO KEEP SILO FULL

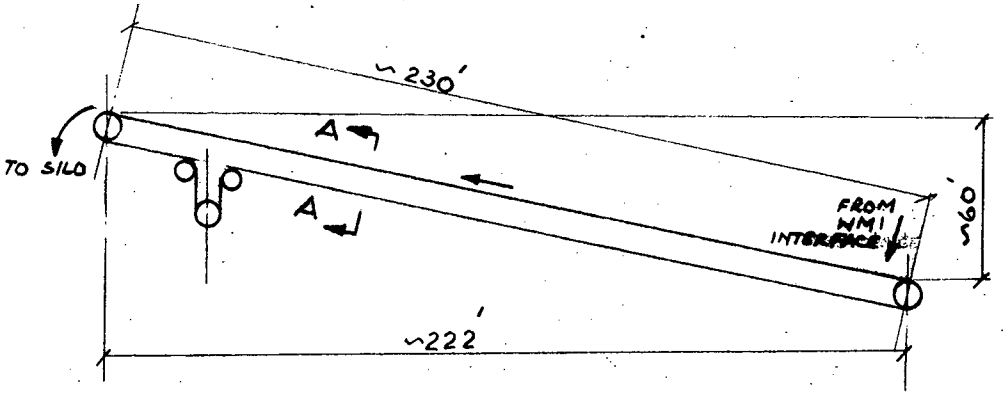
BELT SPEED 150 F.P.M.

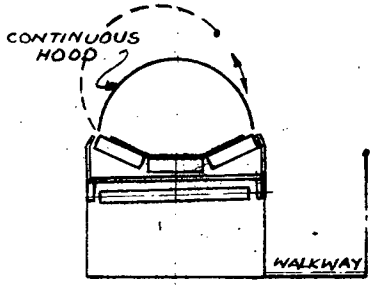
REMARKS: 60" WIDE BELT, COMPLETE WITH BELT IDLERS, TRAINING IDLERS, GRAVITY TAKE UP DRIVE REDUCER, MOTOR, COUPLING, GUARDS, CONTINUOUS CONVEYOR HOOD, ONESIDE WALKWAY GANTRY & SUPPORTING BENTS.

REFERENCE
DWG. NO.
MFG.

COMPONENTS

- (1) DRIVE ASSEMBLY: ✓ DRIVE, ✓ REDUCER, ✓ MOTOR
- (2) ✓ IDLERS
- (3) ✓ PULLEYS
- (4) ✓ SHAFTS
- (5) ✓ BEARINGS
- (6) ✓ TAKEUP
- (7) ✓ HOLDBACK
- (8) ✓ LUBRICATION
- (9) ✓ WALKWAY
- (10) ✓ BELTING
- (11) ✓ ACCESSORIES, TRAINING IDLERS, IMPACT IDLERS, CONTINUOUS HOOD.





SECTION-A

ELEVATION

CUSTOMER WASTE MANAGEMENT INC.

PROJECT ASEF SOLID WASTE TO METHANE GAS

FACILITY POMPANO BEACH, FLORIDA.

ORDER NO.

ACCOUNT NO.	ITEM	SPEC. SHEET NO.	REV	REQUISITION NO.		
	BELT CONVEYOR		△		P 1 OF	BY / APPD

ISSUE TO	NO.	PRELIM. ISSUE	NO.	APPV'D. ISSUE	REVISIONS 1	2	3
ENG.							
P.E.							
PURCH.							
VEND.							
FIELD							
CUST.							

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM B-3401
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Storage of Primary Shredded Solid Waste	BY WD	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

A live bottom non-bridging type storage bin to store:

Material:	Unclassified primary shredded solid waste
Particle Size:	6" nominal with oversize plastics and rags, shredded glass and non-ferrous matls.
Characteristics:	Stingy, sluggish.
Moisture:	25% max. (inherent)
Temperature:	Material comes out of primary shredder and travels about 300' on belt conveyor going thru three transfer points and is cooled to almost ambient temp. of 70°F.
Service:	The bin will be fed @ 65 T.P.H. max. on a day-to-day as needed basis during week days. On weekends, storage bin will supply on a 14 hrs. draw off no feed basis. Draw off rate @ 5-10 T.P.H., 14 hrs/day, 7 days a week.
Instantaneous Combustion:	Vendor shall make recommendation to avoid instantaneous combustion if any.
Bridging Problem:	Anti-bridging devices shall be incorporated into bin design.
Live Bottom System:	Shall ensure positive reclaim system. Draw off conveyor shall be part of the bin system and shall be designed for variable discharge rate of 5-10 T.P.H.
Capacity:	175 tons
Bulk Density:	4#/cu. ft. conveyed; 10-15#/cu. ft. stored

REMARKS

NOTE: Total bin system shall be supplied complete with bin structure, mechanical material reclaim system, draw off conveyor, motor drives reducers and control system.

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS INC. [redacted]

SPECIFICATION SHEET

BELT CONVEYOR MB-702 — NO. UNITS REQUIRED 1 (ONE)

TYPE S TYPE ELEVATOR CONVEYOR WITH CLEATED BELT

FROM STORAGE BIN DISCHARGE

TO TROMMEL SCREEN FEEDER

MATERIAL SHREDDED SOLID WASTE

WEIGHT 5-10 LBS./CU.FT. — MATERIAL TEMP. AMBIENT 75 °F — TEMP. AMBIENT 70 °F

SIZE -6" NOMINAL SIZE WITH OVERSIZE RAGS & PLASTICS

CHARACTERISTICS FIBROUS STINGY WITH 50% PAPER

DESIRED CAPACITY _____ DRY T.P.H. — % MOISTURE 25% MAX

CORRECTED T.P.H. _____ — DESIGN FACTOR _____ — REQ'D. DESIGN T.P.H. 10

SERVICE 14 (HRS./DAY) 7 (DAYS/WK.)

OPERATION CHARACTERISTICS CONTINUOUS FOR 14 HRS

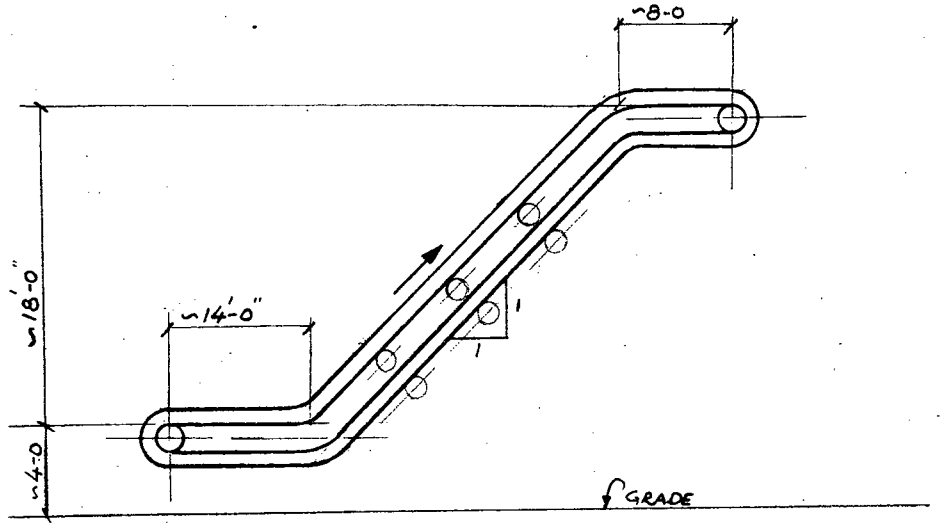
BELT SPEED 150 (MAX) F.P.M.

REMARKS: THE BELT SHALL BE "FLEXOWELL" BOX TYPE BELT AS MANUFACTURED BY FLEXOWALL CORP. OF NEW YORK OR ACCEPTED EQUAL. THE BELT SHALL CONSIST OF BASE, FLEXIBLE RECESSED SIDES & CLEATS. CONVEYOR TO BE SUPPLIED WITH ITS OWN SUPPORT STRUCTURE & MAINTENANCE WALKWAY

REFERENCE
DWG. NO. _____
MFG. _____

COMPONENTS

- ✓ (1) DRIVE ASSEMBLY — ✓ DRIVE, ✓ REDUCER, ✓ MOTOR
- ✓ (2) IDLERS
- ✓ (3) PULLEYS
- ✓ (4) SHAFTS
- ✓ (5) BEARINGS
- ✓ (6) TAKEUP
- ✓ (7) HOLDBACK
- ✓ (8) LUBRICATION
- X (9) WALKWAY
- ✓ (10) BELTING
- ✓ (11) ACCESSORIES — BELT CLEANER "BEATER TYPE"



ELEVATION

CUSTOMER WASTE MANAGEMENT INC.

PROJECT ASEF SOLID WASTE TO METHANE GAS

FACILITY POMPANO BEACH, FLORIDA

ORDER NO.

ACCOUNT NO.	ITEM	SPEC. SHEET NO.	REV	REQUISITION NO.		
	BELT CONVEYOR		△		P 1 OF	BY / APPD

ISSUE TO	NO.	PRELIM. ISSUE	NO.	APPV'D. ISSUE	REVISIONS △1	△2	△3
ENG.							
P.E.							
PURCH.							
VEND.							
FIELD							
CUST.							

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372 ITEM	F-1201
LOCATION	Pompano Beach, Florida	DATE 1/13/76 JOB	
SERVICE	Trommel Screen for Shredded Waste	BY WD PAGES	PAGE

NO SIZE 6'-Ø LENGTH 20'-0 CODE SPECIFICATION

Trommel Screen for following application:

Material:	Ferrous Free Shredded Solid Waste.
Feed Size:	6" nominal with oversize rags and plastics.
Screen Mesh:	Expected 3/4" with provision to replace drum sleeves for different mesh size along the length of the screen.
Capacity:	6 - 10 T.P.H.
Screen Thrus:	Approx. 10-12% of in feed rate consisting of dust, ash, shredded glass and ceramics.
Bulk Density:	10-15 #/cu ft stored; 4-7.5 #/cu ft conveyed

NOTE:

1. Trommel to have provision for slope adjustment to vary retention time of material.

2. Fines collection hopper and carry away conveyor shall be part of trommel screen.

3. No dust shrouding is anticipated at this time but vendor to make provision for future hood installation, if needed.

4. Unitto be complete with tires, trunnion, mounting base plate drive reducer, sheaves and motor.

5. All rotating hazardous parts to be protected by guards as per "OSHA" requirements.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372 ITEM	F-601
LOCATION	Pompano Beach, Florida	DATE 1/13/76 JOB	05-1372
SERVICE	Secondary Shredding of Solid Waste	BY WD PAGES	

NO	SIZE	LENGTH	CODE	SPECIFICATION

Secondary Shredder for following application:

Material: Ferrous free primary shredded solid waste containing glass, ceramics, oversize rags and non-ferrous metals.

Capacity: 7 - 10 TPH

Feed Size: 6" nominal with oversize rags and plastics.

Outfeed Size: 100% pass - 3" to 2" with possible adjustments to control and vary the particle size.

Note:

1. The particle size is of prime importance in this application. The sizing and type of shredder shall guarantee a homogenous controlled particle size output of material under all operating conditions.

2. Shredder shall include all drives, reducer, motor and guards in compliance with OSHA requirements.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM See Below
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Air Classification System	BY WD	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

Air Classification System covering Item No. F-3501, FK-3502, F-3503, F-3504, FV-3505, FV-3506 and FV-3507, for following application:

Material:	Secondary Shredded Solid Waste
Rate of Infeed:	5-7.5 T.P.H.
Particle Size:	100% - 3" with 60-70% paper, glass fines & shredded non-ferrous.
Characteristics:	Fluffy, with some stringy material and abrasive glass dust.
Bulk Density:	2-4#/cu. ft. conveyed 7-10#/cu. ft. stored

The system shall consist of:

1. Effective air classification device to separate out heavies with fine adjustments to vary degree of classification as desired.

2. Adequate conveying power to convey material a horizontal distance of approx. 180′ and vertical 50′ thru 3-90° elbows.

3. A mechanical separation system with air lock to discharge into a diverting spout feeding weigh feeders.

4. A dust collector for dust removal and a clean air discharge to atmosphere.

REMARKS

NO	DATE	REVISION

Revision #1

FORM 129

JACOBS CONSTRUCTORS INC

DATA SHEET FOR CENTRIFUGAL COMPRESSORS 1

PURCHASER WASTE MANAGEMENT INC MANUFACTURER HOFFMAN
DESTINATION POMPANO BEACH, FLORIDA TYPE AND SIZE
UNIT GAS COMPRESSOR SERIAL NO.
ITEM NO. K-202 NO. REQUIRED 1 QUOTE NO. DATE 1-7-76
SERVICE PURCHASER ORDER NO. DATE
PROJECT 05-1372

PROCESS REQUIREMENTS

	Normal	Rated	Other Conditions A	B	C
GAS HANDLED	$CO_2 + CH_4 + H_2O$				
BAROMETER, psia	14.7				
STD CU FT PER MIN (14.7 psia—60 F—Dry) OR WEIGHT FLOW, lb per min	4000 CO_2 245.0 CH_4 = 89.0 H_2O = 50.0				
INLET CONDITIONS Pressure, psia	14.7				
Temperature, deg F	140				
Relative Humidity, per cent	SATURATED				
Molecular Weight (M)	27.66				
Cp/Cv (K_1)					
Compressibility (Z_1)					
Inlet Volume, cu ft per min	5961				
DISCHARGE CONDITIONS Pressure, psia	30.7				
Temperature, deg F MINIMUM	211				
Cp/Cv (K_2)					
Compressibility (Z_2)					
ELECTRIC	460/3/60				
HORSEPOWER REQUIRED BY DRIVER	250				
SPEED, rpm					
ESTIMATED SURGE, ICFM (At Speed Above)					
ADIABATIC HEAD (Hg)					
PERFORMANCE CURVE NO.					

CORROSIVENESS AND REMARKS REGARDING GAS TRACES OF H_2S

Revision #1

JACOBS [redacted]
CONSTRUCTORS, INC.

Project No 05-1372

FANS AND BLOWERS

WASTE MANAGEMENT INC POMPANO BEACH, FLORIDA

SERVICE BURNER BLOWER

ITEM NO. K-801

OPERATING CONDITIONS:

Gas Handled	$CO_2 + CH_4 + H_2O$ VAPOR + H_2S TRACES
Barometer, PSIA	14.7
Weight Flow, lb./min.	CO_2 = 46.94 CH_4 = 17.06 H_2O = 9.38
Std. cu. ft./min. (14.7 PSIA, 60F - Dry)	383
Inlet Pressure, PSIA	14.7
Inlet Temperature, °F.	140
Relative Humidity, (%)	SATURATED
Molecular Weight	27.66
Inlet Volume, CFM	439.7
Discharge Pressure	10" WG
Operating Horsepower	3

DESIGN:

Manufacturer	ROOTS
Model	615
Type	
Speed RPM	
Outlet Velocity	
Rotation (viewed from shaft end)	
Casing Material	CAST IRON
Impeller Material	"
Shaft Material	STEEL
Inlet Nozzle Size	4"
Discharge Nozzle Size	4"
Discharge Position (observed from shaft end)	

DRIVE:

Type (direct, v-belt, etc.)	DIRECT
Guard	YES

DRIVER BY:

Type	
Manufacturer	
Mounted By	VENDOR
Horsepower	5
RPM	
Enclosure	OPEN DRIP PROOF
Volts/Phase/Cycles	460/3/60

ACCESSORY EQUIPMENT:

Revision #1

FORM NO. 101

JACOBS CONSTRUCTORS, INC. [redacted]

RECIPROCATING COMPRESSOR DATA SHEET

CUSTOMER WASTE MANAGEMENT, INC. PROJECT 03-1372

LOCATION POMPANO BEACH, FLORIDA DATE 1/6/76 BY EHH

SERVICE INSTRUMENT & PLANT AIR ITEM NO. K-201

MFG'R-SIZE & MODEL WORTHINGTON 2SJ6 OR EQUAL NO. UNITS ONE (1)

TYPE TANK MOUNTED, AIR COOLED, SINGLE STAGE TYPE DRIVER ELECTRIC MOTOR

DESIGN REQUIREMENTS

GAS	AIR	CAPACITY, LBS/HR			
MOL. WEIGHT	29	CAPACITY, MMSCFD			
"N" VALUE		CAPACITY, CFM at SUCT	10.0		
COMP at SUCT		SUCTION PRESS. PSIA	14.7		
COMP at DISCH		SUCTION TEMP. °F	68		
ALTITUDE, FEET	~100	DISCHARGE PRESS. PSIA	115		

FURNISHED BY	MFGR	OTHER
INTERCOOLER		
INTERSTAGE PIPING		
CONTROL	✓	
DRIVER	✓	
INTAKE FILTER	✓	
V-BELT DRIVE & GRD	✓	
GEAR, BASE, CPLG, GRD		✓
OUTLET DRAIN VALVE	✓	

COMPRESSOR PERFORMANCE & MATERIALS

STAGE	1
NUMBER OF CYLINDERS	2
BORE X STROKE	3 5/8 x 1 5/8
SPEED, RPM	
PISTON SPEED, FT/MIN.	
PISTON DISPLACEMENT, CFM	
COMPRESSION RATIO	
VOLUMETRIC EFFICIENCY, %	
SUCTION PRESSURE, PSIA	14.7
SUCTION TEMPERATURE, °F	68
DISCHARGE PRESSURE, PSIA	115
DISCHARGE TEMPERATURE, °F	
ACTUAL CAP. CFM at SUCT.	10.0
CAPACITY, MMSCFD	
BRAKE HORSE POWER	
ROD LOADING, ACTUAL, LBS	
ROD LOADING, MAXIMUM, LBS	
VALVE VELOCITY, FT/MIN	
MATERIALS: CYLINDER	
CYLINDER LINER	
VALVES	
VALVE SEATS	
PISTON	
PISTON ROD	
PISTON ROD PKG	
NO. FIXED VOL. CLEAR. POCKETS	
NO. VAR. VOL. CLEAR. POCKETS	
NO. SUCTION VALVE LIFTER	
AUTOMATIC CONTROL (DESCRIBE)	MFG. STD. START-STOP

ARRANGEMENT SKETCH

OVERALL LENGH	50"
OVERALL WIDTH	21"
OVERALL HEIGTH	40"
DIST. REQ'D TO PULL RODS	
TOTAL WT WITH DRIVER	500 LBS

UTILITIES REQUIRED

CONTROL VOLTAGE	VOLTS
INSTRU. AIR	PSIG

COOL. WTR. PSI NORM/MAX

	GPM	°F IN	°F OUT
COMP. CYLS			
INTERCOOLER			
ENGINE CYLS			
OIL COOLER			

FURNISH UNIT W/60 GALLON CAPACITY HORIZONTAL ASME NATIONAL BOARD RECEIVER, PRESSURE GAGE & SAFETY VALVE

DRIVER DESCRIPTION

2 HP, 1750 RPM, TYPE & MAKE: SQUIRREL CAGE INDUCTION GE OR EQUAL

460 VOLTS, 3 PH, 60 CYCLE °RISE

ENCL. OPEN DRIP PROOF

FRAME NO. WT.

STM INLET	PSIG	°F.T.T.
STM EXH	PSIG	
STM RATE		LB/HP/HR
FRAME		WT.

CYLS	"BORE X "STK
FT/MIN. PIST. SPD.	BMEP
FUEL L.H.V.	BTU/CU.FT.
FUEL CONSUMP.	BTU/HP/HP

GEAR (IF USED) HP SPEED AGMA SERVICE RATING CLASS GEARS

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM V-2703
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Water Treatment Tank	BY TG	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

Bypass chemical feeder with 3/4" IPT inlet and outlet nozzles and 1/4" IPT for petcock and 3-1/2" opening with cover for loading briquette treatment with integral screen. Carbon steel construction.

Capacity 5 gallons.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC. [redacted]

PAGE ____ OF ____ PAGES

CENTRIFUGAL PUMP DATA SHEET

NOTE: O = INFORMATION TO BE COMPLETED BY PURCHASER; ☐ BY VENDOR

PROJECT NO. 05-1372 ITEM NO. P-101

SPECIFICATION NO. ____

ESIGN O : API 610 ____, AVS O, OTHER ____

DATE 1-7-76 REVISION ____

FOR WASTE MANAGEMENT INC SITE POMPANO BEACH, FLORIDA

UNIT WELL PUMP SERVICE WELL WATER

NO. PUMPS REQ'D 1 NO. MOTORS REQ'D 1 ITEM NO. ____ PROVIDED BY ____ MTD BY ____

NO. TURBINES REQ'D ____ ITEM NO. ____ PROVIDED BY ____ MTD BY ____

PUMP MFR LAYNE & BOWLER SIZE AND TYPE 1140 L63E1 SERIAL NO. ____

OPERATING CONDITIONS, EACH PUMP

LIQUID WELL WATER U.S. GPM at PT, NOR 100 RATED 100

____ DISCH. PRESS., PSIG 1

PT, F, NOR. ____ MAX. ____ SUCT. PRESS., PSIG MAX. ____ RATED ____

SP.GR. at PT 1 DIFF. PRESS., [redacted] 160' TDH

VAP. PRESS. at PT, PSIA ____ DIFF. HEAD, FT 50

VIS. at PT, Ssu ____ CP ____ NPSHA, FT ____

CORR/EROS. CAUSED BY NONE HYD. HP ____

PERFORMANCE

PROPOSAL CURVE NO. ____

RPM ____ NPSHR (WATER) ____

EFF ____ BHP RATED ____

MAX. BHP RATED IMP ____

MAX. HEAD RATED IMP ____

MIN. CONTINUOUS GPM ____

ROTATION (VIEWED FROM CPLG END) ____

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION				
DISCHARGE				

CASE-MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) ____

SPLIT: ☐ AXIAL ☐ RAD; TYPE VOLUTE ☐ SGL ☐ DBL ☐ DIFFUSER

PRESS: ☐ MAX. ALLOW. ____ PSIG ____ °F; ☐ HYDRO TEST ____ PSIG

CONNECT: ☐ VENT ☐ DRAIN ☐ GAGE

IMPELLER DIA.: ☐ RATED ____ ☐ MAX. ____, ☐ TYPE: SEMI-OPEN

MOUNT: ☐ BETWEEN BRGS ☐ OVERHUNG

BEARINGS-TYPE: ☐ RADIAL ____ ☐ THRUST ____

LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE

COUPLING: ☐ MFR ____ ☐ MODEL ____ O GUARD ____

DRIVER HALF MTD BY: O PUMP MFR O DRIVER MFR O PURCHASER

PACKING: ☐ MFR & TYPE ____ ☐ SIZE/NO. OF RINGS ____

MECH. SEAL: ☐ MFR & MODEL ____ API CLASS. CODE ____

☐ MFR CODE ____

SHOP TESTS

O NON-WIT. PERF. O WIT. PERF.

O NON-WIT. HYDRO O WIT. HYDRO

O NPSH REQ'D. O WIT. NPSH

O SHOP INSPECTION

O DISMANT. & INSP. AFTER TEST

O OTHER ____

MOTOR DRIVER

HP 7 1/2 RPM ____ FRAME ____

MFR ____

TYPE ____ INSUL ____

ENC ____ TEMP RISE C ____

VOLTS/PHASE/CYCLES 460/3/60

BEARINGS ____ LUBE ____

FULL LOAD AMPS ____

LOCKED ROTOR AMPS ____

O VHS O VSS ____

VERT. THRUST CAP., LB. ____

MATERIALS

CASE/TRIM CLASS O ____ (SEE API 610)

I –CAST IRON
B –BRONZE
S –STEEL
C –11-13% CHROME
A –ALLOY
h –HARDENED
f –FACED
X –

CASE	I
IMPELLER	B
INNER CASE PARTS	
SLEEVE (PACKED)	
SLEEVE (SEAL)	
WEAR PARTS	
SHAFT	410 AISI-S

BASEPLATE: ☐ NONE

VERTICAL PUMPS

PIT OR SUMP DEPTH O 30'

MIN. SUBMERGENCE REQ'D. ☐ 30'

COLUMN PIPE: ☐ FLANGED ☐ THREADED

LINE SHAFT: ☐ OPEN ☐ ENCLOSED

BRGS: ☐ BOWL ☐ LINE SHAFT ____

BRG. LUBE ☒ WATER ☐ OIL ☐ GREASE

FLOAT & ROD O C.S. O S.S. O BRZ O NONE

FLOAT SWITCH ☐ ____

PUMP THRUST, LB ☐ UP ____ ☐ DOWN ____

FOOT VALVE STRAINER TO BE AUTOMATIC

AUXILIARY PIPING

O C.W. PIPE PLAN ____ O CU; O S.S.; O TUBING, O PIPE ____

☐ TOTAL COOLING WATER REQ'D, GPM ____ O SIGHT F.I. REQ'D ____

O PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG

O SEAL FLUSH PIPE PLAN ____ O C.S. O S.S. O TUBING O PIPE ____

O EXTERNAL SEAL FLUSH FLUID ____ ☐ GPM ____ ☐ PSIG ____

O AUXILIARY SEAL PLAN ____ O C.S. O S.S. O TUBING O PIPE ____

O AUX. SEAL QUENCH FLUID ____

APPROX. WT, PUMP & BASE ____

MOTOR ____ TURBINE ____

FORM 104 FORM NR 104

Jacobs CONSTRUCTORS, INC. [redacted]

SPECIFICATION SHEET
ROTARY PUMPS

SHEET NO. _____ REV. _____
DATE 1-7-76
BY T.G CHK'D _____

ITEM NO. P-102 SERVICE GEAR PUMP JOB NO. 05-1372
NO. REQ'D. 1 MOTOR DRIVEN, AND _____ TURBINE DRIVEN MFR. VIKING
LIQUID PUMPED FUEL OIL # 4 ARRANGEMENT (HORIZ. VERT.) HORIZ
CORROSION OR EROSION FACTORS _____ PUMP SIZE & TYPE 1/4"-C 32D

OPERATING CONDITIONS

PUMPING TEMP.	35 °F	DISCHARGE	50 PSIG	NPSH AVAIL.	NPSH REQ'D (WATER)
CAPACITY @ P.T.	0.4 GPM	SUCTION	PSIG	RPM	1800 EFF.
SPEC. GR. @ P.T.	0.9	DIFFERENTIAL	PSI	BHP @ RATING	MAX. BHP FOR FRAME
VISCOS. @ P.T.	CP 400 SSU	HEAD	50 FT.	RECOMMENDED HP DRIVER	1/4 HP
V.P. @ P.T.	PSIA	HYDRAULIC HP			

MATERIALS

	BRINNELL HARDNESS
OUTER CASE IRON	
SIDE PLATE	
LINER	
ROTOR OR GEARS STEEL	
ROTATING VANE	
IDLER	
TIMING GEAR	
GASKETS	
STUDS & NUTS	
SHAFT STEEL	
SHAFT SLEEVES	
STUFFING BOX	
PACKING GLAND BRONZE	
GLAND STUDS	
LANTERN RING	
THROAT BUSHING	

CONSTRUCTION

CASE SWP _____ PSIG @ _____ °F HYD. TEST (MAX.) _____ PSIG
MIN. THICKNESS _____ IN. CORR. ALLOW. _____
SUPPORT TYPE _____ SPLIT (HORIZ.) (VERT.) _____
ROTOR OR GEAR OVERHUNG (YES) (NO) _____
DIAMETER SIZE _____ IN. TYPE _____
TYPE GEAR ___(SPUR) ___(HELICAL) ___(HERRING BONE) _____
ROTATION FACING PUMP CPLG. (CW: CCW) _____
RELIEF VALVES (INT.) (EXT.) PRESS. SETTING INTEGRAL PSIG
CLEARANCE (DIAM.) _____ IN. SIDE PLATE _____ IN.
COUPLING MFR. _____ (SINGLE) (SPACER) GUARD _____
STUFFING BOXES BORE _____ IN. DEPTH _____
JACKETED (YES) (NO) _____ SMOTHERING GLAND (YES) (NO) _____
PACKING NO. RINGS _____ SIZE _____ IN. SQ. _____ IN. I.D. _____
MECH. SEAL MAKE & TYPE _____
MAT'L. ROT. FACE _____ STAT. FACE _____ SEAL GASK. _____
BASE PLATE TYPE _____

BEARINGS

THRUST (BALL: SLEEVE) (OIL GREASE) (INT EXT) TYPE _____
RADIAL (BALL: SLEEVE) (OIL GREASE) (INT EXT) TYPE _____

DRAWINGS

SERIAL NUMBER _____
PERFORMANCE CURVE _____
OUTLINE DRAWING _____
CROSS SECT. DWG. OR BULLETIN # & PAGE # _____

COOLING WATER

THRUST BRG. (YES) (NO) _____ GPM _____
RADIAL BRG. (YES) (NO) _____ GPM _____
STUFF. BOX (YES) (NO) _____ GPM _____

CONNECTIONS

Nozzles	Size	Rating	Facing	Location
SUCTION				
DISCH.				
VENTS				
DRAINS				
COOL WATER				

DRIVER

MOTOR

MAKE _____
ENCLOSURE OPEN DRIP PROOF
FRAME NO. _____
HP 1/4 RPM 1800
VOLTS 115 PHASE 1 CYCLES 60
START (LOW VOLT: X LINE) _____
BRG. TYPE _____
BRG. LUBE _____

TURBINE

MAKE _____
TYPE _____
HP _____ RPM _____
PRESS. @ THROTTLE _____ PSIG
TEMP. _____ °F
EXHAUST PRESS. _____ PSIG
WATER RATE _____
NO. HAND VALVES _____

SPEED REDUCER

MAKE _____
CASE MAT'L. _____ GEAR MAT'L. _____
TYPE _____ CLASS _____
SPEED RATIO _____ SERVICE FACTOR _____

TESTING

WITNESS PERF. TEST (YES) (NO) ___ CERTIFIED CURVE ___ (YES) (NO) _____
WITNESS HYDRO. TEST (YES) (NO) ___ TEST. PRESS. _____ PSIG
SUBMERGENCE TEST ___ (YES) (NO) ___ SHOP INSPECTION _____
WTS. PUMP _____ LBS. BASE _____ LBS. DRIVER _____ LBS.

REMARKS: _____

FORM 437-5

JACOBS CONSTRUCTORS, INC. [redacted]

PAGE ____ OF ____ PAGES

CENTRIFUGAL PUMP DATA SHEET

NOTE: O = INFORMATION TO BE COMPLETED BY PURCHASER; ☐ BY VENDOR

PROJECT NO 05-1372 ITEM NO. P-103

SPECIFICATION NO. ____

DESIGN O : API 610 ___, AVS ___, OTHER ____

DATE 1-7-76 REVISION ____

FOR WASTE MANAGEMENT INC SITE POMPANO BEACH, FLORIDA

UNIT SLUDGE UNLOADING PUMP SERVICE PRIMARY SLUDGE

NO. PUMPS REQ'D 1 NO. MOTORS REQ'D 1 ITEM NO. ____ PROVIDED BY VENDOR MTD BY VENDOR

NO. TURBINES REQ'D ____ ITEM NO. ____ PROVIDED BY ____ MTD BY ____

PUMP MFR WEMCO SIZE AND TYPE 1x1x5 1/4 SERIAL NO. ____

OPERATING CONDITIONS, EACH PUMP

LIQUID SLUDGE U.S. GPM at PT, NOR. 30 RATED ____

____ DISCH. PRESS., PSIG ____

PT, F, NOR. ____ MAX. ____ SUCT. PRESS., PSIG MAX. ____ RATED ____

SP.GR. at PT 1 DIFF. PRESS., PSI 50' TDH

VAP. PRESS. at PT, PSIA ____ DIFF. HEAD, FT ____

VIS. at PT, Ssu ____ CP ____ NPSHA, FT ____

CORR/EROS. CAUSED BY ____ HYD. HP ____

PERFORMANCE

PROPOSAL CURVE NO. ____

RPM ____ NPSHR (WATER) ____

EFF. ____ BHP RATED ____

MAX. BHP RATED IMP ____

MAX. HEAD RATED IMP ____

MIN. CONTINUOUS GPM ____

ROTATION (VIEWED FROM CPLG END) ____

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION				
DISCHARGE				

CASE-MOUNT: ☐ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) ____

-SPLIT: ☐ AXIAL ☐ RAD; TYPE VOLUTE ☐ SGL ☐ DBL ☐ DIFFUSER

-PRESS: ☐ MAX. ALLOW. ____ PSIG ____ °F; ☐ HYDRO TEST ____ PSIG

-CONNECT: ☐ VENT ☐ DRAIN ☐ GAGE

IMPELLER DIA.: ☐ RATED ____ ☐ MAX. ____, ☐ TYPE: OPEN RECESSED

MOUNT: ☐ BETWEEN BRGS ☐ OVERHUNG

BEARINGS-TYPE: ☐ RADIAL ____ ☐ THRUST ____

LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE

COUPLING: ☐ MFR ____ ☐ MODEL ____ O GUARD ____

DRIVER HALF MTD BY: O PUMP MFR O DRIVER MFR O PURCHASER

PACKING: ☐ MFR & TYPE ____ ☐ SIZE/NO. OF RINGS ____

MECH. SEAL: ☐ MFR & MODEL ____ API CLASS. CODE ____

☐ MFR CODE ____

SHOP TESTS

O NON-WIT. PERF. O WIT. PERF.

O NON-WIT. HYDRO O WIT. HYDRO

O NPSH REQ'D. O WIT. NPSH

O SHOP INSPECTION

O DISMANT. & INSP. AFTER TEST

O OTHER ____

MOTOR DRIVER

HP 1 1/2 RPM ____ FRAME ____

MFR ____

TYPE ODP INSUL ____

ENC ____ TEMP RISE C ____

VOLTS/PHASE/CYCLES 230/1/60

BEARINGS ____ LUBE ____

FULL LOAD AMPS ____

LOCKED ROTOR AMPS ____

O VHS O VSS ____

VERT. THRUST CAP., LB ____

MATERIALS — CASE/TRIM CLASS O ____ (SEE API 610)

I –CAST IRON
B –BRONZE
S –STEEL
C –11-13% CHROME
A –ALLOY
h –HARDENED
f –FACED
X –

CASE	I
IMPELLER	I
INNER CASE PARTS	
SLEEVE (PACKED)	B
SLEEVE (SEAL)	
WEAR PARTS	
SHAFT	S
BASEPLATE: ☐	YES

VERTICAL PUMPS

PIT OR SUMP DEPTH O ____

MIN. SUBMERGENCE REQ'D. ☐ ____

COLUMN PIPE: ☐ FLANGED ☐ THREADED

LINE SHAFT: ☐ OPEN ☐ ENCLOSED

BRGS: ☐ BOWL ____ ☐ LINE SHAFT ____

BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE

FLOAT & ROD O C.S. O S.S. O BRZ O NONE

FLOAT SWITCH ☐ ____

PUMP THRUST, LB ☐ UP ____ ☐ DOWN ____

AUXILIARY PIPING

O C.W. PIPE PLAN ____ O CU; O S.S.; O TUBING, O PIPE ____

☐ TOTAL COOLING WATER REQ'D, GPM ____ O SIGHT F.I. REQ'D ____

O PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG

O SEAL FLUSH PIPE PLAN ____ O C.S. O S.S. O TUBING O PIPE ____

O EXTERNAL SEAL FLUSH FLUID ____ ☐ GPM ____ ☐ PSIG

O AUXILIARY SEAL PLAN ____ O C.S. O S.S. O TUBING O PIPE ____

O AUX. SEAL QUENCH FLUID ____

APPROX. WT, PUMP & BASE ____

MOTOR ____ TURBINE ____

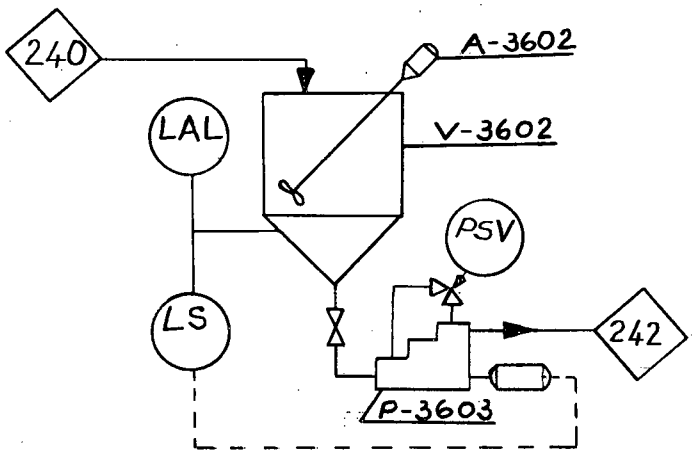
COUPLING GUARD TO BE PROVIDED

FORM 104 FORM NO 104

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM See Below
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Chemical Solution Metering	BY EHH	PAGES 3 PAGE 1

NO	SIZE	LENGTH	CODE	SPECIFICATION



Equipment Description: Packaged chemical feed system for metering water treatment chemicals comprised of the following:

Manufacturer/Model No.: Milton Roy Company
mRoy Packaged Chemical Feed System, or equal.

Item No.: V-3601
Name: Water Treatment Tank
Capacity: 55 Gallons

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT	05-1372	ITEM	See Below
LOCATION	Pompano Beach, Florida	DATE	1/13/76	JOB	05-1372
SERVICE	Chemical Solution Metering	BY	EHH	PAGES 3	PAGE 2

NO	SIZE	LENGTH	CODE	SPECIFICATION

Materials of Construction:	Polyethylene Lines Steel w/Hinged Cover.
Accessories:	Perforated 316 SS dissolving basket, 1/4" hole size, and low level alarm and pump shutoff.
Item No.:	A-3602
Name:	Tank Agitator
Description:	1/4 HP TENV, 115V, 60 Cycle, 1725 RPM w/316 SS Shaft and Impellor top entering w/mounting bracket.
Item No.:	P-3603
Name:	Meter Pump
Description:	Positive displacement controlled volume pump w/diaphragm head, top mounted, w/ internal relief valve, complete w/electric drive.
Type:	Simplex
Material of Construction:	
Liquid End:	PVC
Ball Checks:	Pyrex Glass
Diaphragm:	Teflon
Solution Metered:	EDTA Type Water Treatment
Flow Rate:	0-6 GPH
Temperature:	70°F.
Specific Gravity:	1.0
Discharge Pressure:	100 psig
Capacity Control:	0-100%, Micrometer Adjusted.
Discharge Connection:	1/4" NPT.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372 ITEM	See Below
LOCATION	Pompano Beach, Florida	DATE 1/13/76 JOB	05-1372
SERVICE	Chemical Solution Metering	BY EHH PAGES	3 PAGE 3

NO	SIZE	LENGTH	CODE	SPECIFICATION

Motor Driver: Constant Speed 1/4 HP, TENV, 115V, 60 cycle, Mfg. Std., Integral Mounting.

Accessories: Toggle type motor starting switch w/overload protection to be provided for:

a) Pump, One (1) Required
b) Agitator, One (1) Required

1/4" NPT safety valve, PVC construction, set for 150 psig, one (1) required.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM H-1701
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Water Heater	BY T.G.	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

Water heater capacity 2.5 MM BTU/Hr. Unit to have dual burner for fuel oil #4 and gas with the following composition by volume:

50% CO_2 and 50% CH_4 actual weight composition of gas is:

0.0395 lbs/hr water vapor
0.1978 lbs/hr carbon dioxide
0.0719 lbs/hr Methane

Unit to have the following combustion features:

Power on indicator, ignition on, gas on, oil on, low fire or proportioning; low water alarm and shut off; and integral expansion tank.

Performance

Water in	76°F
out	200°F
Water flow	42 GPM

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM F-1203&1204
LOCATION	Pompano Beach, Florida	DATE 1-13-76	JOB F-161&F-162
SERVICE	Screen Filter	BY T.G.	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

Solids dewatering self-cleaning screen rotostrainer or approved equal. Unit to consist of: 304 SS chassis with integral headbox with weir; 4" influent nozzle; base discharge with 4" effluent nozzle; 304 SS cylinder; solids discharge doctor assembly motor 460/3/60 Ten V.

Performance:

Unit to filter 10.743 TPH of slurry consisting of 0.87 T of macerated shredded waste and 9.873 T of water.

Maximum particle size of solids 4"
Liquid flow 43 GPM
Temperature 140°F.

REMARKS

NO	DATE	REVISION

FORM 129

JACOBS CONSTRUCTORS, INC. [redacted]

PAGE ____ OF ____ PAGES

CENTRIFUGAL PUMP DATA SHEET

NOTE: ○ = INFORMATION TO BE COMPLETED BY PURCHASER; ☐ BY VENDOR

SIGN ○ : API 610 ___, AVS ___, OTHER ___

PROJECT NO. 05-1372 ITEM NO. P-104
SPECIFICATION NO. ___
DATE 1-7-76 REVISION ___

FOR WASTE MANAGEMENT INC SITE POMPANO BEACH, FLORIDA
UNIT RECYCLE WATER PUMP SERVICE FILTRATE FROM SLURRY
NO. PUMPS REQ'D 1 NO. MOTORS REQ'D 1 ITEM NO. ___ PROVIDED BY ___ MTD BY ___
NO. TURBINES REQ'D ___ ITEM NO. ___ PROVIDED BY ___ MTD BY ___
PUMP MFR WEMCO SIZE AND TYPE 2x2x5¼ SERIAL NO. ___

OPERATING CONDITIONS, EACH PUMP

LIQUID FILTRATE WATER U.S. GPM at PT, NOR. 18-200 RATED 18-200
___ DISCH. PRESS., PSIG ___
°F, NOR. 120 MAX. 140 SUCT. PRESS., PSIG MAX. ___ RATED ___
SP.GR. at PT 0.8-1 DIFF. PRESS., PSI 60' TDH
VAP. PRESS. at PT, PSIA ___ DIFF. HEAD, FT ___
VIS. at PT, Ssu ___ CP ___ NPSHA, FT ___
CORR/EROS. CAUSED BY ___ HYD. HP ___

PERFORMANCE

PROPOSAL CURVE NO. ___
RPM ___ NPSHR (WATER) ___
EFF. ___ BHP RATED ___
MAX. BHP RATED IMP ___
MAX. HEAD RATED IMP ___
MIN. CONTINUOUS GPM ___
ROTATION (VIEWED FROM CPLG END) ___

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION				
DISCHARGE				

CASE-MOUNT: ☐ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) ___
-SPLIT: ☐ AXIAL ☐ RAD; TYPE VOLUTE ☐ SGL ☐ DBL ☐ DIFFUSER
-PRESS: ☐ MAX. ALLOW. ___ PSIG ___ °F; ☐ HYDRO TEST ___ PSIG
-CONNECT: ☐ VENT ☐ DRAIN ☐ GAGE
IMPELLER DIA.: ☐ RATED ___ ☐ MAX. ___, ☐ TYPE: OPEN RECESSED
MOUNT: ☐ BETWEEN BRGS ☐ OVERHUNG
BEARINGS-TYPE: ☐ RADIAL ___ ☐ THRUST ___
LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
COUPLING: ☐ MFR ___ ☐ MODEL ___ ○ GUARD ___
DRIVER HALF MTD BY: ○ PUMP MFR ○ DRIVER MFR ○ PURCHASER
PACKING: ☐ MFR & TYPE ___ ☐ SIZE/NO. OF RINGS ___
MECH. SEAL: ☐ MFR & MODEL ___ API CLASS. CODE ___
☐ MFR CODE ___

SHOP TESTS

○ NON-WIT. PERF. ○ WIT. PERF.
○ NON-WIT. HYDRO ○ WIT. HYDRO
○ NPSH REQ'D. ○ WIT. NPSH
○ SHOP INSPECTION
○ DISMANT. & INSP. AFTER TEST
○ OTHER ___

MOTOR DRIVER

HP 7½ RPM ___ FRAME ___
MFR ___
TYPE ___ INSUL ___
ENC ___ TEMP RISE ___
VOLTS/PHASE/CYCLES 460/3/60
BEARINGS ___ LUBE ___
FULL LOAD AMPS ___
LOCKED ROTOR AMPS ___
○ VHS ○ VSS ___
VERT. THRUST CAP., LB. ___

MATERIALS

CASE/TRIM CLASS ○ ___ (SEE API 610)

I –CAST IRON
B –BRONZE
S –STEEL
C –11-13% CHROME
A –ALLOY
h –HARDENED
f –FACED
X –

CASE	I
IMPELLER	I
INNER CASE PARTS	I
SLEEVE (PACKED)	B
SLEEVE (SEAL)	
WEAR PARTS	
SHAFT	S
BASEPLATE: ☐ YES	

VERTICAL PUMPS

PIT OR SUMP DEPTH ○ ___
MIN. SUBMERGENCE REQ'D. ☐ ___
COLUMN PIPE: ☐ FLANGED ☐ THREADED
LINE SHAFT: ☐ OPEN ☐ ENCLOSED
BRGS: ☐ BOWL ___ ☐ LINE SHAFT ___
BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE
FLOAT & ROD ○ C.S. ○ S.S. ○ BRZ ○ NONE
FLOAT SWITCH ☐ ___
PUMP THRUST, LB ☐ UP ___ ☐ DOWN ___

AUXILIARY PIPING

○ C.W. PIPE PLAN ___ ○ CU; ○ S.S.; ○ TUBING, ○ PIPE ___
☐ TOTAL COOLING WATER REQ'D, GPM ___ ○ SIGHT F.I. REQ'D ___
○ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG
○ SEAL FLUSH PIPE PLAN ___ ○ C.S. ○ S.S. ○ TUBING ○ PIPE ___
○ EXTERNAL SEAL FLUSH FLUID ___ ☐ GPM ___ ☐ PSIG ___
○ AUXILIARY SEAL PLAN ___ ○ C.S. ○ S.S. ○ TUBING ○ PIPE ___
○ AUX. SEAL QUENCH FLUID ___

APPROX. WT, PUMP & BASE ___
MOTOR ___ TURBINE ___

COUPLING GUARD TO BE PROVIDED

FORM 104 FORM NO 104

JACOBS CONSTRUCTORS, INC.

CUSTOMER	Waste Management, Inc.	PROJECT 05-1372	ITEM X-2301
LOCATION	Pompano Beach, Florida	DATE 1/13/76	JOB 05-1372
SERVICE	Burner	BY T.G.	PAGES PAGE

NO	SIZE	LENGTH	CODE	SPECIFICATION

Burner to burn 300 SCFM @ 0°C and 760 mm Hg of the following gas mixture:

9.10 lbs. H_2O
32.296 lbs. CO_2
11.746 lbs. CH_4

Gas inlet pressure 0.5 psig

Burner to have automatic ignition and built to aspire necessary combustion air.

REMARKS

NO	DATE	REVISION

FORM 129

Specification No. 5000-3

The work covered by this section is the preparation of site for construction of plant facilities for "A.S.E.F. Solid Waste to Methane Gas, Waste Management, Inc.

1.0 GRADING AREA

Grading Area and work to be performed shall be as indicated by new grading points as shown on SITE PLAN.

2.0 PUBLIC UTILITIES

Prior to construction, site should be inspected for all existing public utilities in and around the site and necessary adjustments shall be made to the utilities to perform work specified.

3.0 OPERATIONS

A. Clearing & Grubbing

All vegetations shall be removed from the plant area and all other areas as required for grading work and roadway construction.

B. Surface Water

Any standing surface water shall be completely drained out off the construction area before proceeding with site preparation operation.

C. Excavation & Fill - Plant Area

The upper two feet of dark gray organic top soil of the plant area as indicated on drawings, shall be completely excavated and removed. The underlying areas shall then be compacted using a large vibratory compactor to a density of 95% of modified proctor, to a vertical depth of 24" below stripped grade. The area shall then be filled with approved sand fill brought from off-site source in layers not exceeding 18" and compacted to 95% of modified proctor per ASTM specification D-1557-70.

Specification No. 5000-3

3.0 OPERATIONS (continued)

D. Rough Grading - Other than Plant Area

The rough grading shall include cut and fill for entire area as shown but only as indicated by new grades. Fill material, is to be brought from approved off site source; on site material may be available from owner.

E. Excavation & Fill - Roadways, Etc.

All areas to be prepared as shown on drawings shall be cleared, grubbed and stripped of top soil and if any, of unsuitable material, and to be replaced by fill material as specified under Item 3C above.

F. Surplus Materials

All surplus material of any type left over from any of the above operations and all rejected materials from above operations shall be disposed of in the low areas of the existing property, not designated for future construction.

G. Base Course - Roadways, Etc.

Crushed stone base course shall be installed with required thickness to be specified by engineer for all roadways, parking and driveways.

4.0 PROPERTY MARKERS

After completion of the grading, licensed land surveyor will determine the exact location of property lines from his original survey plat and drawings, and permanent property markers if required at all corners of the property and any deviations from straight line between corners shall be installed.

Waste Management, Inc. Methane Gas from Solid Wastes Pompano Beach, Florida	GENERAL ELECTRICAL	JCI Project No. 05-1372 Engineering & Construction Management

Electrical — Specification #6100-1

The electrical 480 volt, 3 phase service to the ERDA facility originates at Florida Power & Light Company transformer, which is then routed to a new Main Power Distribution Center and from which feeds two Motor Control Centers, one being reserved for the Dry End System and the second servicing all the 480 volt motors for the Wet End System. Each Dry End and Wet End System will be controlled from its respective control panel.

1.0 All A.C. motors rated 1/2 HP and above will be serviced at 480 volt, 3 phase, 60 hertz. Motors rated below 1/2 HP will be fed from a 120 volt, single phase source.

2.0 The motor control centers shall consist of vertical steel sections, 15 inches deep, 20 inches wide and 90 inches high, all joined together to form a rigid free-standing, completely dead-front, Nema 1A steel enclosed control assembly, suitable for indoor mounting. The MCC's shall be rated 480 volts and shall include air circuit breakers, combination magnetic motor starters, etc., completely factory assembled, tested, boxed or crated and shipped ready for installation. The 480 volt power will be distributed by means of a continuous copper bus, while the 120 volt control voltage shall originate from individual control transformers with fused secondaries.

2.0 continued

The external operating handle of the circuit breaker or of the air circuit breaker of the combination motor starter shall be interlocked with the compartment door so that the handle must be in the Off position before the door can be opened. This handle shall be arranged for padlocking either in the On or Off position.

3.0 Each of the control panels, one designated for the Dry End System and the second for the Wet End Process, would be a cabinet type of enclosure, designed for outdoor protection use against rain and dust. Each enclosure will be equipped with a single hinged door that will have mounted oil tight pushbutton stations and indicating lights for the various motor controls. A subpanel will be mounted within cabinet for the use of mounting the necessary electrical controls and accessories such as relays, timers and control terminal boards. Each cabinet would be prewired from control components to the terminal boards for wire connections to all externally mounted electrical items such as Motor Control Centers, etc.

4.0 The Main Power Distribution Center shall consist of two vertical sections, joined together to form a rigid free-standing, completely dead-front, steel enclosed control assembly, suitable for indoor mounting. One section will house an air circuit breaker for the main 480V/277 volt, 3 phase, 60 hertz incoming service from the utility company transformer. This same section will contain ground fault protection, as required, by the National Electrical Code plus metering devices, such as, ammeter and voltmeter and its associated metering transformers. The adjoining section as bussed to the incoming section will contain three feeder air circuit breakers, one to provide service to the existing Power Distribution Center, and the remaining two air circuit breakers to serve as separate feeders to the Dry End MCC and the Wet End MCC.