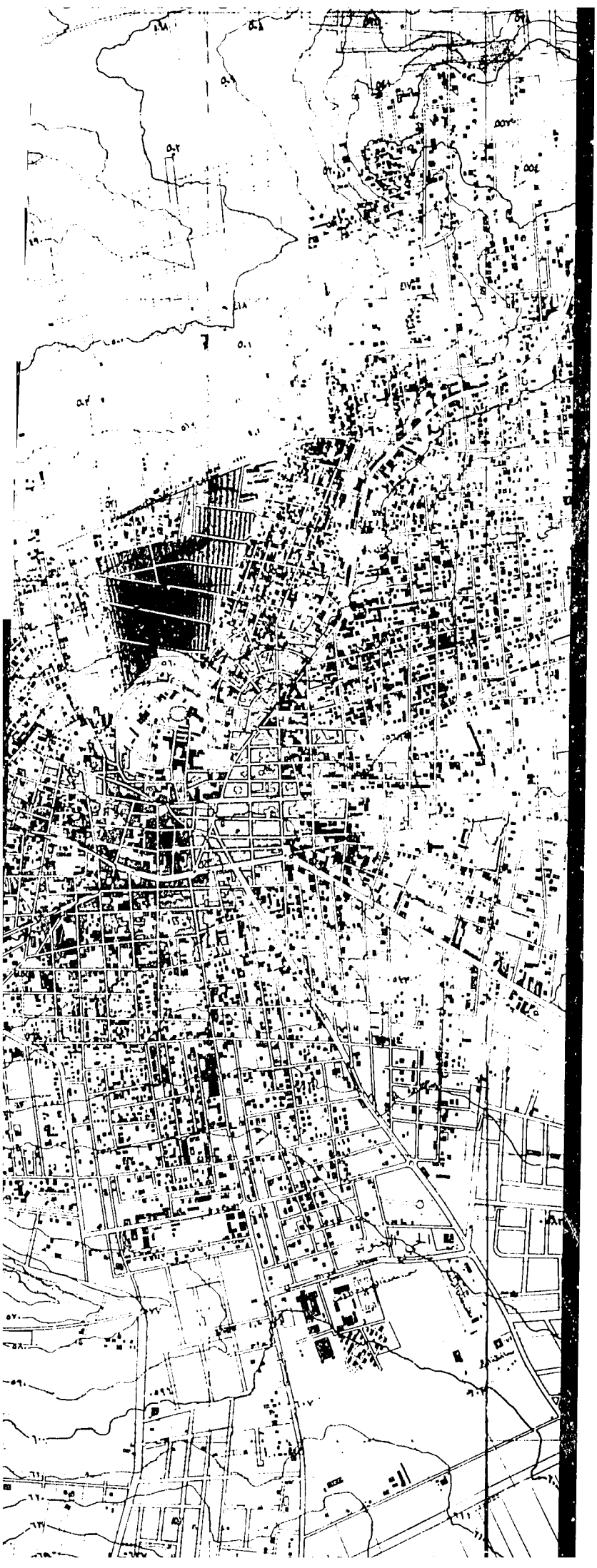

PRELIMINARY
DESIGN
REPORT

WASTEWATER
TREATMENT
FACILITIES

IRBID MUNICIPAL WATER DISTRIBUTION, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

SUBMITTED THRU

MINISTRY OF MUNICIPAL, RURAL AND ENVIRONMENTAL AFFAIRS - EXECUTING AGENCY

TO THE

NATIONAL PLANNING COUNCIL - THE HASHEMITE KINGDOM OF JORDAN

November 1980

By
WESTON INTERNATIONAL, INC.

in association with
STANLEY CONSULTANTS, INC.
SIGMA CONSULTING ENGINEERS
MRM-CONSULTING ENGINEERS
CO., LTD.

PRELIMINARY DESIGN REPORT

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PRELIMINARY DESIGN REPORT

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SECTION 1

1.0 INTRODUCTION

In May 1979, the National Planning Council (NPC) of Jordan, through its executing agency, the Ministry of Municipal, Rural and Environmental Affairs (MMREA), gave authority to proceed with the feasibility and preliminary engineering phase of this project. The consultant group selected by NPC to provide services was WESTON INTERNATIONAL, INC., with its subcontractors; Stanley Consultants, Inc.; Sigma - Consulting Engineers, and MRM Consulting Engineers Co., Ltd.

A draft feasibility and preliminary engineering studies report was submitted in October 1979. The report was revised and resubmitted in March 1980. Additional comments were addressed and additional analyses were discussed in a report addendum submitted in August 1980. In September 1980 MMREA gave authority to proceed with Stage 2, detailed design of the facilities recommended in the feasibility study.

Major recommendations for wastewater treatment facilities contained in the feasibility report, as approved, include:

- Construction of an activated sludge wastewater treatment plant in the northeast portion of the Irbid Town planning area, adjacent to the existing municipal slaughterhouse.
- Construction of sand drying beds in an area north of the proposed treatment plant to dewater sludges produced by the treatment process.
- Construction of wastewater treatment facilities recommended to serve the needs of the City through the year 2000 in three implementation phases. One-third of the recommended treatment capacity is to be constructed immediately, followed by construction of the second third in 1985 and the remaining third in 1990.

This preliminary design report culminates the first step of the design process. The report sets forth the design criteria, provides a description of the wastewater treatment and sludge handling processes to be designed, and provides preliminary design drawings.

SECTION 2

2.0 DESIGN OBJECTIVES

2.1 Design Flows

The proposed Irbid Municipal Wastewater Treatment Facility is designed to treat the anticipated flow from the Irbid town plan area through the year 2000. This objective is to be met in two phases; (1) construction of the facilities required to treat anticipated wastewater flows through the year 1990 and (2) construction of the facilities required to treat anticipated wastewater flows through the design year, 2000. In addition, bid packages will be prepared to allow contracting and construction of the facilities required for Phase I in two stages. Listed below is a summary of the flows which the wastewater treatment facility is being designed to treat:

	Flows (cubic meters per day, m^3/D)		
	Phase I		Phase II
	Stage 1	Stage 2	
Average Daily Flows:	11,023	22,046	35,852
Peak Hourly Flow:	30,146	60,293	95,580

The peak hourly flows include an allowance for infiltration and inflow from the proposed sanitary sewer system.

Provision is made in the proposed facility to receive and treat septage. Septage will be collected from tank trucks and metered into the wastewater flow stream at a constant rate. It is assumed that septage hauling volumes during the summer will be twice as great as the hauling volume during the winter months. The design allowances for septage are as follows:

	Quantity (cubic meters per day, m^3/D)	
Year	1990	2000
Summer	713	1,086
Winter	352	535

These rates allow for treatment of septage from the unsewered areas within the Irbid town plan area as well as areas in the Irbid subdistrict outside of the town plan area.

2.2 Effluent Criteria

The treated effluent from the Irbid wastewater treatment facility will be discharged to the riverine system of the Wadi El Arab. The treated effluent will constitute a significant portion of the total flow to the Wadi Arab reservoir. The reservoir will be used for irrigation and possibly livestock watering.

The proposed effluent standards for the Irbid wastewater treatment facility are tabulated below.

SUGGESTED EFFLUENT LIMITATIONS

IRBID MUNICIPAL WASTEWATER TREATMENT PLANT

Parameter	7-Day Average	30-Day Average
BOD_5	45 mg/L	30 mg/L
Suspended Solids	45 mg/L	30 mg/L
Dissolved Oxygen	3 mg/L	3 mg/L
pH	6 - 9	6 - 9
Chlorine Residual	1.0 mg/L	0.5 mg/L

2.3 Construction Phasing

The proposed wastewater treatment facilities and sewage collection system are based on providing sewerage services for all residences expected to be located within the Irbid town plan area by the year 2000. A phased construction plan with two distinct construction phases was developed to achieve this objective.

Phase I of the sewerage system master plan is the largest and costliest phase. It includes construction of two-thirds of the proposed wastewater treatment capacity as well as construction of major portions of the proposed interceptor sewers, three pump stations and trunk sewers, and associated lateral sewers required to provide sewer collection service to those areas of the City of Irbid with the most urgent need.

Because of the size and cost of the proposed Phase I program it has been divided into two implementation stages. The major elements of the waste treatment facility to be constructed in each implementation stage are as follows:

Phase I - Stage 1

- All general site work including roads, fencing, grading, yard lighting, and the operations building.
- All required preliminary treatment facilities including grit chambers, bar screens, and flow measurement.
- One-third of the septage storage.
- One-third of the aeration basins.
- Two of four clarifiers. Note that the feasibility report originally proposed three clarifiers for the year 2000 facilities, viz, two for year 1990, and a third for year 2000. However, since the Phase I facilities are to be constructed in two stages, it is proposed, for versatility, to provide four smaller clarifiers to meet year 2000 requirements. Two of these clarifiers will be constructed during this initial stage. The clarifiers will be identical in size and capacity.
- One-third of waste sludge storage.
- One-third of sand drying beds.
- All required chlorination and reaeration facilities.
- Primary electrical switchgear for Phases I and II.
- Transformers, secondary switchgear and standby generators for Phase I, Stages 1 and 2.
- Motor control centers for Phase I, Stage 1.

Phase I - Stage 2

- One-third of the septage storage
- One-third of aeration basins.
- One clarifier.
- One-third of waste sludge storage.
- One-third of sand drying beds.
- Motor control centers for Phase I, Stage 2.

Phase II

- One-third of the septage storage.
- One-third of aeration basins.
- One clarifier.
- One-third of waste sludge storage.
- One-third of sand drying beds.
- Transformers, secondary switchgear, standby generator and motor control center for Phase II.

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WESTON INTERNATIONAL, INC.
DESIGNERS-CONSULTANTS
WESTON WAY • WEST CHESTER, PA 19380 • PHONE (215)692-3030 • TELEX: 83-5348

IRBID WASTEWATER TREATMENT PLANT

PRELIMINARY CONCEPT DESIGN

PRESENTATION AGENDA

Time	Agenda Item	By
1000 - 1030	Introductions	Coffee & Donuts
1030 - 1045	Project Overview	J.P. Miller, P.E. President, Weston International, Inc.
1045 - 1100	Concept Design Summary	D.P. Hunsinger, P.E. Project Manager
1100 - 1200	Presentation of Concept Design	P.J. Higgins, P.E. Design Manager
1200 - 1300	Lunch	
1300 - 1400	Tour of Weston Facilities	B.S. Cushing, P.E. Director of Design
1400 - 1430	Presentation Summary	J.P. Miller, P.E. & Staff

NTP - May, 1979 - $1,000,000 revised plans 70 days late; draft report 45 days late
Client: Northern Planning Council (NPC)
Comments by end Jan, 80
Problems:
1) Environmental Chapter - NPC wanted work minimized but Hunting didn't like it
2) Development & financial information model hard to understand
Stage I, A III Feasibility, finished 1987, Stage II to Design

Sewage plant - use extended aeration, simple mech. (screw pumps) requires little instrumentation, low maintenance

Stanley Engineering for sub-contractor for water & storm drainage

System size based on water demand, collection system mostly gravity flow

Design accepted 1/10/80 - Prelim. eng report done since then

Comments to Tr. NPC - early Dec.

Final design - late Feb, 1981

Construction pkgs.

Pre-qualif. - start Jan, 81 - to meet mid-81 construction beginning date -

Future IIBRD participation - (Steve Sindahl)

WWTP Train I - AID, future with IBRD money

3 phase const. pkg - need extra money by 1983 AID could put in $20 mill, needs $50 mill total

11,770 m³/day at each phase

Tertiary degree of treatment of effluent, beyond secondary treatment for use on crops + for animals

All equip 50 cycle 220 V.

SECTION 3

3.0 DESIGN CRITERIA

It is the intent of these criteria to provide an acceptable basis for final design; therefore, the codes, materials of construction, descriptions of structures and the design bases are listed below for review and comment by all affected parties. Additions and changes to these criteria shall be made, if required by design or code, as the work progresses.

3.1 Hydraulic Design Criteria

A. All forward flow process piping is to be reinforced concrete pressure pipe or ductile iron, with head loss calculations based on "Williams and Hazen" "C" = 100 (old pipe), and pipes flowing full.

B. Open flow channel head losses are calculated using "Manning's" formula "N" = 0.013.

C. The hydraulic profile through the treatment process is based on 22,046 m^3/D which is the average 24 nour flow for the year 1990. All pipes and channels have been sized to handle 95,580 m^3/D, peak flow for year 2000.

D. The plot plan has been developed for all the process equipment and tankage needed for the 1990 flows. Consideration has been given for future additions of tankage and equipment in the year 2000.

3.2 Mechanical Design Criteria

A. Major process pressure piping is to be ductile iron, with flanged or victaulic couplings above grade and mechanical or push-on joints below grade.

B. Drain piping is to be cast iron under all structures, with the plant drain system being reinforced concrete.

C. Water piping is to be galvanized steel inside the building and galvanized steel or cast iron below grade.

D. Heating, Ventilating, Air Conditioning (HVAC)

- Process area is to be heated to 13° C.
- Office and shop areas are to be heated to 20° C.

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- Design outside temperatures:

  Winter: 0° C and wind speed of 24.1 kilometers per hour

  Summer: 35° C wet bulb

- Process and shop areas, with the exception of the Chlorine Room, are to be ventilated at six air changes per hour (summer only).

- Chlorine Room is to be ventilated at twelve air changes per hour.

E. Plumbing shall be in accordance with the Building Officials Code Administrators (BOCA) Plumbing Code.

F. Head loss calculation for pumping systems is to be based on "Williams and Hazen" "C" = 100 (Old Pipe), plus 15% safety factor.

G. Process tanks are to have dewatering drains or pumpout sumps.

H. Mechanical equipment housed inside will be arranged to allow for means of mechanically lifting for purpose of removal.

I. Mechanical equipment requiring routine maintenance will have a minimum of 60cm clearance on all sides.

J. Sludge force main pipe will be steel, coated and wrapped for below-grade service.

K. Emergency generator will be provided for major process equipment, in case of electrical power failure.

3.3 Structural Design Criteria

A. Codes

- General - Basic Building Code, Seventh Edition 1978 by Building Officials Code Administrators, International, Inc. (BOCA), Chicago, Illinois, USA, 1980 Supplement.

- Reinforced Concrete - All foundations are assumed to be spread footings or mat slab subject to the recommendations of the soils report.

- Hydraulic Structures - Per ACI-318-63 "Building Code Requirements for Reinforced Concrete" and ACI-350R-77 "Concrete Sanitary Engineering Structures" (ACI- American Concrete Institute).

- Non-hydraulic structures - Per ACI-318-77 "Building Code Requirements for Reinforced Concrete."

  Note: Hydraulic structures include concrete tanks and other structures commonly used in water and waste treatment facilities where dense, impermeable concrete with high resistance to chemical attack is required.

- Structural Steel - Per Manual of Steel Construction, Eighth Edition, American Institute of Steel Construction (AISC).

- Metal Deck - Per Design Manual for Floor Decks and Roof Decks, Steel Deck Institute (SDI) Publication No. 23, 1978 Edition.

- American Society for Testing and Materials (ASTM), Latest Edition.

- Codes and Standards of National Fire Protection Association (NFPA), 1980 Edition.

- Any Local Codes which may have jurisdiction of requirements more stringent than the above codes (to be furnished by MMREA).

B. Materials/Strength

- Concrete: Minimum 28 day compressive strength, f'c - 3000 psi (20.7 MPa), batch mixed and delivered to the project site.

  Batching facilities will require the review of the engineer for quality control of procedure and materials used to produce the concrete. Testing facilities will be required to monitor concrete mix during mix design and production. Concrete tests will be in accordance with current ASTM methods.

- Concrete Reinforcing Steel: ASTM-A615 "Deformed and Plain Billet - Steel Bars for Concrete Reinforcement" Grade 40; Yield 40,000 psi min. (276 MPa). Design Stress 20,000 psi Max. (138 MPa).

- Soils: To be determined upon receipt of soils investigation report.

- Cement Mortar: If locally manufactured of local materials, mortar will be in accordance with local specifications or laboratory test results; or: Per ASTM - C270 "Standard Specification for Mortar For Unit Masonry" (type shall be determined later dependent upon available materials).

- Concrete Masonry Units: If locally manufactured of local materials, masonry units will be in accordance with local specifications or laboratory test results; or: Per ASTM C90 "Standard Specifications for Hollow Load-Bearing Concrete Masonry Units"; per ASTM C129 "Standard Specifications for Non-Load-Bearing Concrete Masonry Units"; and per ASTM C145 "Standard Specification for Solid Load-Bearing Concrete Masonry Units."

- Structural Steel: Per ASTM A36 "Standard Specification for Structural Steel."

C. Live Loads

- Roof live load (snow or equivalent), minimum 20 psf (97.6 kgs per sq. m) on a roof slope having a rise not exceeding 4 (10.16cm) inches per foot (30.48cm).

- Floor Loading

  - Operations Building: General Live Load, minimum 100 psf (488.2 kgs per sq. m) plus major equipment. Maintenance area, 200 psf (976.4 kgs per sq. m).

  - Vibrating Equipment (unless otherwise recommended by equipment manufacturer), weight times impact factor.

  - Platforms and walkways, 75 psf (366.2 kgs per sq. m) plus any equipment weights, either temporary or permanent. Handrail and stair loads will be in accordance with minimum Occupational Safety and Health Administration (OSHA) standards.

  - No live load reductions will be applied.

D. Other Loads and Forces

- Foundation bearing value and active lateral earth pressure on vertical tank walls will be determined by the soils engineer upon review of the soils report.

- Wind load on vertical surfaces above finish grade, per basic building code, Table 712.1 subject to prevailing basic wind speed. Minimum wind pressure:

  Less than 30 ft (9.14m) 20 psf (97.6 kgs per sq. m)
  30' - 40' (9.14 - 12.2m) 25 psf (122.0 kgs per sq. m)

- Earthquake Loading: Assume not greater than Zone 1 (per Basic Building Code, Appendix L) - minor damage unless local experience or records do not show loss of life or property damage.

E. Building and Structure Descriptions

- Operations Building and Miscellaneous Equipment Buildings.

  Roof Construction - Insulated steel metal deck supported on steel sub-framing with built-up roofing membrane in accordance with recommendations of roofing system manufacturer.

  Floor Construction - Concrete slab on sub-grade.

  Foundations - Concrete

  Exterior Wall Construction - Insulated sandwich metal wall supported on steel sub-framing.

  Interior Walls - Hollow non-load bearing concrete block extending to above the ceiling line or to underside roof deck, or; prefabricated demountable partitions extending to underside of the ceiling.

- Tanks and other miscellaneous structures.

  Septage Tanks - Concrete slab and walls and cover - below grade.

  Influent Structure and Flow Distribution Box - Concrete slab and walls, with polyvinyl chloride (PVC) Parshall Flume.

  Electric Substation, Emergency Generator and Miscellaneous Motor Control Centers - Concrete slab on grade with prefabricated steel structure similar to operations building.

  Aeration Tanks - Multi-cell concrete construction with concrete slab, dividing, and exterior walls, and concrete bridge to each aerator support platform.

  Flow Splitter Box to Clarifiers - Concrete slab and wall construction.

  Sludge Holding Tanks - Multi-cell structures with concrete slab and walls.

  Clarifiers - Concrete slab and walls with concrete launder trough - below grade.

  Chlorine Feed Facility - Concrete slab on grade attached to or adjacent to the sludge holding tanks.

  Chlorine Contact Tank and Flume with Cascade - Concrete slab and wall construction - below grade.

3.4 Electrical Design Criteria

Electrical equipment will be designed and constructed according to NEMA or ANSI standards and carry U.L. labels where applicable. The electrical design will be in accordance with the 1981 Edition of the National Electrical Code.

The lighting design will incorporate energy efficient sources and the lighting levels will be in accordance with the latest recommendations of the U. S. Government to provide adequate lighting levels and conserve energy.

SECTION 4

4.0 TREATMENT PROCESS DESCRIPTION

The Feasibility Report prepared for the City of Irbid recommends the design and construction of a new wastewater treatment plant to treat the city's sewage and septage. The new treatment facilities will utilize the activated sludge process to achieve the effluent limitation of 30 mg/L BOD and 30 mg/L suspended solids (based on a 30-day average) and will be designed to handle 22,046 m^3/D average flow for the year 1990, with expanded flow of 35,852 m^3/D in the year 2000. The plant's hydraulics and key process units have been designed for the future expansion, as well as for both summer and winter flow and loading conditions.

Influent to the plant will flow through two 1.22m mechanically-cleaned bar screens to remove bulk solids. The bar screens will discharge solids into dumpster type containers for disposal in the City landfill. Mechanical cleaning of the bar screens will be actuated by a timer or differential pressure switch. A 1.22m manually-cleaned bar screen is also provided. Slide gates will be used to isolate or direct the flow to any particular bar screen.

Following the bar screens, flow passes through an influent Parshall flume, used for measuring flow, and then into aerated grit chambers. Two grit chambers will be provided. Centrifugal blowers, located adjacent to the grit chambers, will be used to supply air, through a swing diffuser, to the grit chambers. The grit chambers will have sloped sides with a troughed bottom to allow for grit removal by a "clam shell" bucket supported from an overhead monorail system. Following the grit chambers, effluent discharges into Flow Box No. 1 which splits the forward flow into four streams, two each to tanks T-3 and T-4. The flow box has been designed to be readily modified for future expansion. Sluice gates will be provided on each line leaving the flow box to allow for isolation of the aeration tank (T-3 and T-4).

Two aeration tanks will be provided, each containing two rows of 6 cells, a total of 12 cells per tank. Each cell will operate in parallel and will contain a 100 horsepower platform mounted surface aerator, a foam spray system, and a sludge return sump with an inclined screw pump. The recycled sludge will flow by gravity from the return sludge well to the sump in each aeration cell where it will then be lifted approximately 2m, by a screw pump, and will discharge into the basin inlet. The screw pump flow rate will be adjustable by controlling the submergence of the feed end of the pump. This will allow for individual recycle flow control for each cell. Forward flow into cells will be by an external side trough feeding each row of six cells. Effluent from each cell will discharge into a central channel which flows to Flow Box No. 2. Each cell will have an adjustable influent and effluent weir.

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Both aeration tanks will discharge into Flow Box No. 2, where the flow will be equally divided prior to flowing to the three clarifiers. Flow Box No. 2 is designed to allow for future addition of a fourth clarifier.

The clarifiers are 27.6m diameter and equipped with hydraulic sludge removal and scum removal mechanisms. Sludge from all clarifiers will be collected in the sludge return well, from which it will flow, by gravity, to each aeration cell. Waste sludge will also flow by gravity to the sludge holding tank screw lift pumps. These pumps will elevate the waste sludge to a center distribution channel and in turn into the holding tank.

The overflow from clarifiers will be combined in the chlorine mix tank where a 5 HP mechanical mixer will mix the wastewater with the chlorine solution. From the mix tank, the flow is split into two, end-around baffled, chlorine contact tanks. A pump well has been provided at the end of the chlorine contact tank for installation of both the spray water and utility water pumping systems. The spray water system will provide effluent water for foam control, if needed, in each aeration cell. Utility water will be used for chlorination and miscellaneous plant wash down. The utility water system will be a constant pressure system using vertical turbine pumps and regulating valves to maintain the pressure.

An effluent Parshall flume is used for flow measuring, prior to re-aeration. A cascade re-aerator chamber is provided tc raise the effluent D.O. to more than 3 mg/L before discharging to the Wadi El Hamam.

Four sludge holding tanks are provided in Phase I and two additional holding tanks are provided in Phase II for waste sludge storage prior to transferring sludge to the drying bed site. Each tank will have a submerged turbine aeration system consisting of a platform mounted aerator and a bottom air sparger ring to provide mixing and to maintain dissolved oxygen in the tank. A package positive displacement blower will be mounted on the aerator platform to provide air for the sparger ring. A decant system is provided in each tank. Prior to pumping waste sludge to the drying beds, the mixer will be shutoff and clear supernatent will be returned to the aeration basins.

Sludge will be withdrawn from holding tanks and pumped across the road to the drying beds. Sludge pumping will be accomplished by the use of two triplex plunger pumps working in parallel. Two, 200mm diameter force mains will be provided to transport sludge to the drying beds. Although two pipes are provided only one will be used. The second is a complete spare to be utilized to relieve possible difficulties which can occur when pumping sludge a long distance. The pumping system is designed to be operated six days per week, twelve hours per day. The two force mains will be connected to create a loop and a water-flushing system, using plant effluent, will be provided to scour the pipes and minimize buildup of deposits. The flushing system will be manually connected at the completion of each pumping cycle.

Twenty-eight sludge drying beds will be provided for the year 1990, with a total of 42 for year 2000. Each bed will be 30m x 75m with 200mm of sand over 400mm of gravel. The beds will have a perforated P.V.C. piping network under the gravel to collect the "underdrainage" and will discharge in a lined earthen pond. The pond will also collect stormwater from the beds, and local runoff. Discharge from the pond will be by gravity back across the road to the treatment plant, discharging into the "Plant Drain Pumping Station" for conveyance to the head end of the treatment facilities. An adjustable slide gate will be used to control the rate of discharge from the pond.

Septage handling facilities have been provided to store the waste prior to pumping it, at a controlled rate, to the head end of the treatment facilities. The septage haulers will empty their trucks, by gravity, into one of two in-ground tanks to be provided for the Phase I facilities. (A third tank will be provided for Phase II.) Each tank will be covered, and equipped with a mechanical mixer. An odor control system will be provided on the tank vents to eliminate the possibility of offensive odors. Since the tanks are in-ground it will be necessary to pump the septage to the influent structure. This will be accomplished by using two screw pumps that lift the septage to an elevation from which it can flow by gravity to mix with the treatment plant influent. A coarse, manually cleaned, bar rack will be provided at the septage truck discharge manhole for removal of large solids.

The chlorination feed facilities will consist of two separate systems. One system will be a complete spare. The normally operating system will feed chlorine solution for disinfection. The spare system will be designed to allow for auxiliary chlorination at the septage holding tanks, influent structure, and/or return sludge system if necessary, as well as a back-up to the primary disinfection system. Each system will have a capacity of 800 kg/D and consist of an evaporator and chlorinator with a cabinet-mounted ejector. The chlorine feed rate will be paced automatically by the plant effluent flow rate. The chlorine facilities will be housed in the sludge transfer pumping station.

SECTION 5

5.0 MAJOR EQUIPMENT LIST

INFLUENT BAR SCREEN ME 1a & b

Number	Two
Width	1.22m
Type	Catenary, mechanical cleaned
Remarks	One manually cleaned bar screen to be provided as back-up to mechanical cleaned

INFLUENT MEASUREMENT

Number	One
Type	Parshall
Size	900m
Construction	Fiberglas flume cast in concrete channel

GRIT REMOVAL CHAMBER T-1a & b

Number	Two
Type	Aerated
Size	3m wide x 10m long x 3m deep
Remarks	Grit removal by overhead "clam shell"

AERATION GRIT BLOWERS ME 2a, b, c

Number	Three
Type	Centrifugal
Size	8.5 m^3/min. each

SEPTAGE HOLDING TANK T-2a & b

Number	Two and one future
Size (each)	9.15m x 9.15m x 3.05m SWD to 0.61m F.B.
Working Volume	255 m^3
Construction	Concrete with cover
Function	To receive and store septage prior to pumping to treatment facilities.
Mixer	

SEPTAGE TRANSFER PUMPS P 1a & b

Number	One operating and one spare and one future
Capacity	24.1 m^3/hr.
Type	Screw Pumps
Size	365mm
Lift	3.66m

FLOW SPLITTER BOX FB-No. 1

Number	One
Size	6.70m x 6.09m x 3.65m
Construction	Concrete
Function	To split forward flow equally to six aeration trains

AERATION BASIN P-3a to 31
P-4a to 41

Number	24 and 12 future
Dimension (each)	16.55m x 16.55m x 3.75m SWD + 1m F.B.
Flow per Basin	948 m^3/D Average yr. 1990
Detention Time	1 day @ average flow
Construction	Concrete
Remarks	A total of three separate aeration structure for the year 2000 flows will be provided. Each structure will contain 12 aeration basins (two rows of 6 cells) with common effluent troughs. Each basin will contain a foam spray water system to control foam buildup.

AERATOR M-3a to 31
M-4a to 41

Number	24, one per cell
Type	Platform mounted mechanical surface aerators
Size	100 HP each
Drive	Single speed
Oxygen Requirements	132 Kg/hr. at standard condition
Minimum D.O.	2 mg/L
Remarks	Aerator will be supplied with baffles mounted on platform.

SLUDGE RECYCLE PUMPS P-3a to 31
P-4a to 41

Number	One per Aeration Cell. Total - 24
Type	Screw Pumps
Flow	0 to 64.85 m^3/hr.
Control	Adjustable Submergible device
Drive	3 HP constant speed
Size	400mm Ø
Function	To return sludge to each aeration cell.
Remarks	Sludge will be returned to a compartment within each aeration basin by gravity, from which the screw pump will take suction and will discharge to the basin inlet.

SPLITTER BOX FB No. 2

Number	One
Size	6.70m x 5.48m x 3.65m
Construction	Concrete
Function	To collect the mixed liquor from the two aeration structures (three in the future) and equally split the flow to three (four in the future) clarifiers.

CLARIFIER T-5a, b, c

Number	Three plus one future
Size	27.44m Ø x 4.3m SWD + 0.60m FB
Construction	Concrete, inboard launders and scum pit.

CLARIFIER MECHANISMS ME-2a, b, c

Number	One per tank, total of three
Type	Center pier supported with hydraulic sludge removal and scum skimming
Drive	One HP

SCUM PUMPS P-5a, b, c

Number	Total three (one per clarifier)
Size	18 m^3/hr. at 4.5m TDH
Type	Submersible

SLUDGE RETURN WELL T-10

Number	One
Size	6.0m x 4.0m x 4.0m
Construction	Concrete
Function	To collect sludges from clarifiers and split return flow to aeration basin and serve as wet well for sludge wasting pumps.
Remarks	Sludge return well will be constructed as part of FB - using common walls.

SLUDGE WASTING PUMPS P-9a & b

Number	One operating plus one spare and one future
Size	500mm
Type	Screw
Drive	3 HP constant speed
Control	Adjustable depth control
Capacity	0 - 108 m^3/hr.
Remarks	Waste sludge will flow by gravity from sludge return well to lift station where 500mm screw pumps will lift to digestors.

CHLORINE MIX TANK T-7

Number	One
Size	3m x 3m x 3.3m SWD + 0.60m FB
Detention Time	1 Min. @ Average Flow Yr. 2000
Function	Provide mixing of chlorine solution and wastewater stream to insure disinfection.

CHLORINE MIXER M-2

Number	One
Type	Platform Mounted
Materials	Rubber coated steel
Drive	5 HP Constant speed
Remarks	Chlorine solution to be introduced into mix tank through diffuser on bottom of tank.

CHLORINE CONTACT TANK T-8a & b

Number	Two
Dimension (each)	17m x 10.5m x 3.3m SWD + 0.60m FB
Detention Time @ Peak	15 Min.
Hydraulic Flow	
Construction	Concrete with end around baffle walls.

CHLORINE FEED SYSTEM ME 200 & 201

Number of Systems	Two
Capacity per System	800 Kg/Day
Dosage Rate	8 mg/L
Chlorine Supply	
Size	Ton cylinders
Evaporator ME 200b & 201b	
Number	One per system
Capacity	800 Kg/Day
Type	Cabinet mounted
Chlorinator ME 200c & 201c	
Number	One per system
Capacity	800 Kg/Day
Type	Cabinet mounted
Remarks	One chlorination system will be used for disinfection, with the spare system being used for pre-chlorination and septage chlorination, if necessary. The chlorine feed system will be housed in the sludge transfer pumping station.

CHLORINE CONTACT TANK PUMP SUMP T-9

Number	One
Size	10m x 3m x 3.3m SWD + 0.6m FB
Construction	Concrete
Function	Provide wet well for foam spray water pumps and utility water pumps.

FOAM SPRAY WATER PUMPS P-7a & b

Number	One operating and one spare
Size	306 m^3/hr. x 10m TDH
Type	Wet well centrifugal
Drive	20 HP constant speed
Function	To provide spray water for foam control in aeration basins.

UTILITY WATER PUMPING SYSTEM P-8a & b

Size	45.4 m^3/hr. @ 45m TDH
Number of Pumps	One operating and one spare
Type	Vertical wet pit, constant pressure system.
Drive	10 HP constant speed

EFFLUENT MEASUREMENT

Number	One
Size	900mm
Type	Parshall flume
Construction	Fiberglass flume cast in concrete channel.

REAERATION STRUCTURE

Number	One
Type	Stepped cascade
Vertical Drop	4.27m
D.O. Increase	3.0 mg/L
Function	To reaerate effluent to 6.0 mg/L before discharging to the Wadi.

PLANT DRAIN PUMPING STATION P-2a & b

Number of Pumps	Two
Capacity	90 m^3/hr.
Type	Wet well/dry well
Wet Well Size	2m Ø x 3.75m Deep
Function	To receive & transfer discharge from internal Plant Drain System and overflow from "Storm water & Sludge Drying Bed Underdrain Basin"
Drive	10 HP constant speed
Construction	Concrete

SLUDGE HOLDING TANK T-11a, b, c & d

Number	4 and 2 future
Size	16.55m x 16.55m x 3.75m SWD + 1m FB
Volume	1027 m^3
Construction	Concrete/common walls
Function	To store and thicken (by decanting) waste sludge prior to pumping to sludge drying beds.

AERATORS M-5a, b, c & d

Number	One per tank, total of 4
Type	Platform mounted submerged turbine, with air blowers
Drive	15 HP constant speed

AERATION BLOWER ME-4a, b, c & d

Number	4
Type	Positive displacement
Capacity	20 m^3/Min
Drive	20 HP Constant speed

SLUDGE TRANSFER PUMPS P-6a, b & c

Number	Two operating and one spare
Capacity (each)	83 m^3/Hr. @ 46m
Type	Plunger - triplex
Drive	40 HP constant speed
Function	To transfer sludge from holding tank to sludge drying bed site.

SLUDGE FORCE MAIN

Number	Two
Size	200mm
Materials	Steel
Length	1000m

SLUDGE DRYING BED

Number Yr. 1990	28
Yr. 2000	42
Size	30m x 75m
Construction	Concrete wall with sand and gravel base. Bed will have piped under drain system and will be compartmented.

STORM WATER AND UNDER DRAIN POND

Number	One
Size @ Top	37.64m x 37.64m x 3m SWD + 0.6m FB
Side Slope	2:1
Capacity	2270 m^3
Eff. Control	Adjustable slide gates
Construction	Earthen with liner
Function	To store sludge bed under drain and storm runoff prior to transfer to wastewater treatment plant.

SECTION 6

6.0 ELECTRICAL/INSTRUMENTATION

6.1 Electrical Distribution

The electrical system will provide reliable power to operate the wastewater treatment plant's mechanical equipment. The system to be installed in Stage 1 of Phase I will have capacity to power the equipment installed under the two current bid packages (Stages 1 and 2) and in addition there will be primary switchgear capacity for the planned expansion (Phase II) for the year 2000.

Electrical power will be received from the utility company at 11.33 KV, 3Ø, 50 Hz on the south side (Irbid side) of the wastewater treatment plant. The utility company will provide power via an aerial line and will extend it to within fifteen meters of the primary switchgear. The service and primary switchgear will be designed to handle the year 2000 power requirement which is 4300 KVA.

The primary switchgear will consist of a line-up of 15 KV fused load break switches. The line-up will be "non-walk-in type" outdoor switchgear as manufactured. There will be a main fused load break switch and lightning arrestors, utility company metering compartment, two feeder compartments each with fused load break switches and space for a future feeder compartment.

Each feeder compartment will feed a 1500 KVA, 3Ø, 50 Hz, OA-FA rated transformer. The transformer will be connected Δ-Y_N with a secondary voltage of 380, 3Ø, 50 Hz. The transformers will be of the oil type and located outdoors.

Immediately adjacent to the transformers will be the line-up of 380 volt secondary switchgear. The switchgear will be of the outdoor walk-in type and be connected to the transformer by means of 3000 ampere enclosed busway. There will be a main breaker rated 3000 amperes surge, and lightning protection, and four feeder breakers rated 800 ampere. The breakers will be draw-out air type with static trips including ground fault protection. The feeder breakers will be of the fused type to limit fault currents available to downstream devices. Downstream of the main breaker will be an automatic transfer switch rated 3000 amperes to transfer automatically to standby power on a loss of utility service power.

Standby power will be provided by 840 KW diesel generating sets. There will be one set for each lineup of secondary switchgear. These sets will provide enough power to maintain flow through the plant and provide adequate treatment during the temporary outages. Temporary power will be provided to handle the following loads:

QUANTITY	DESCRIPTION
1	Bar Screen
1	Grit Blower
12	Aerators
3	Clarifiers
1	Chlorinator
2	Septage Mixers
2	Sludge Holding Tank Mixers
2	Sludge Holding Tank Aeration Blowers
12	Sludge Recycle Pumps
1	Chlorine Mixer
1	Plant Drain System Pump Station
	Operations Building Power and Lighting

Each of the secondary switchgear feeder breakers will feed a motor control center rated 800 amperes at 380 volts, 3Ø, 50 Hz. The motor control centers will be located in the electrical room at the operations building. Power will be supplied to equipment motors through combination motor starters in the motor control centers. The combination motor starters will consist of fused disconnect switches in conjunction with magnetic contactors.

All electrical equipment will be designed according to NEMA or ANSI standards and carry U.L. labels where applicable. The electrical design will be in accordance with the 1981 Edition of the National Electrical code. The largest motors at the facility are the aerator motors which are 100 HP. These motors will be started using autotransformer reduced voltage motor starters. The use of these starters will reduce the inrush on start-up of the equipment and will allow the use of smaller standby generators.

Illumination in the operations building will be provided through the use of fluorescent fixtures with energy efficient lamps and ballasts.

The exterior lighting will be through the use of high pressure sodium fixtures controlled either by timers or photo cells.

The sludge drying beds, which are located approximately 1200 meters from the treatment plant, will also be lighted. A separate service from the utility company will be provided. This service will be of the secondary type at 220 volts, 1Ø, 50 Hz. A local weatherproof switching center will be provided. The total load for the present and future lighting at this site will be approximately 20 KW.

6.2 Instrumentation

The basic instrumentation philosophy is simplicity through metering and manual process control.

Influent flow is measured by a Parshall flume. The head representing flow is sensed by a non-contacting (sonic) transducer. The transducer output is converted to a unit of flow. A local readout in flow and head are provided at the flume. Signals proportional to flow rate are integrated, totalized, and transmitted to the main control panel where they are displayed on a recorder and counter respectively. The main control panel will be located in the operations building.

Effluent flow is measured in the same manner, and is recorded and totalized. The effluent flow rate signal is re-transmitted to the chlorinator for use as a pacing signal. The pacing signal proportions the chlorine flow rate to effluent flow. The ratio of chlorine to flow is determined from a grab sample and lab test.

Septage and plant drain recycle flow is measured by flumes recorded and totalized similiar to Plant influent.

Liquid levels are sensed and alarms activated when they exceed set maximum values in the following locations: 1) upstream channel of each bar screen; b) clarifier scum pits; and c) plant utility water well.

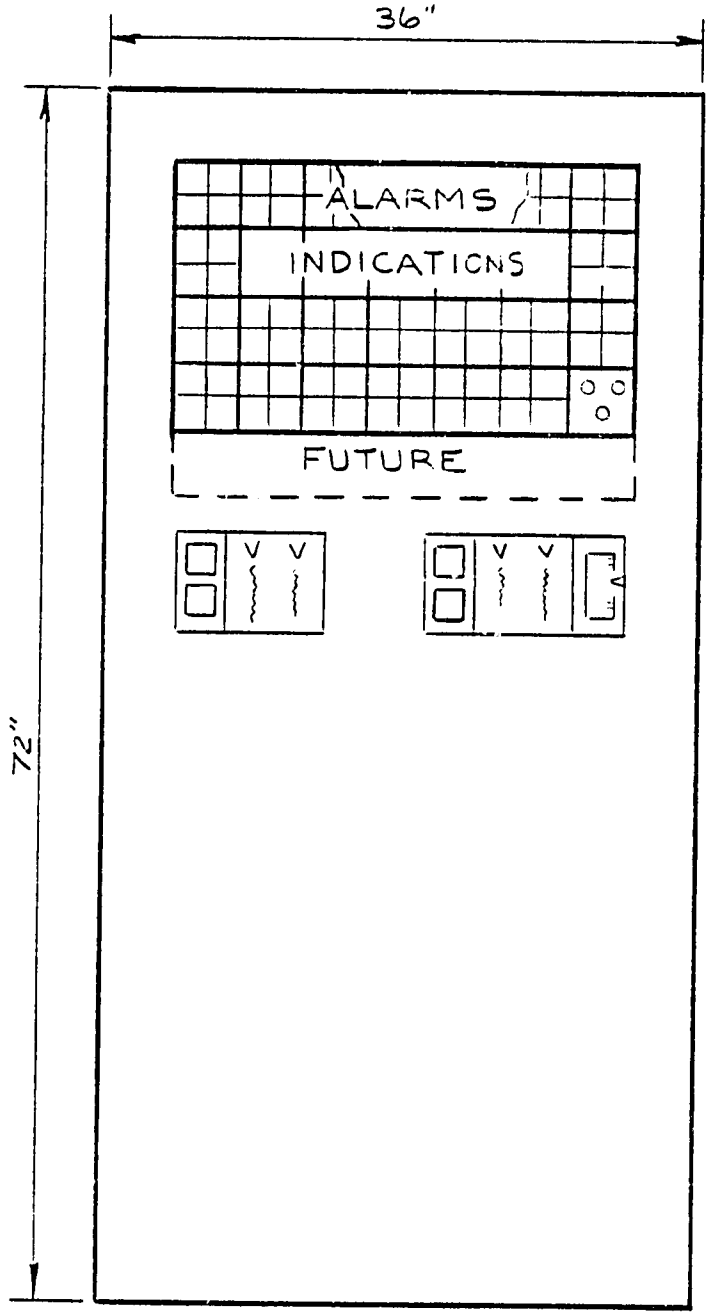
Operation alarms are provided to warn of a malfunction of the following equipment:

- Mechanized Bar Screens
- Clarifiers (high torque)
- Chlorine Systems.

Operation of all of the primary equipment is monitored and indication of its status (off or on) is displayed on the main control panel.

The main control panel is for monitoring only with no control from this point. The monitoring consists of alarm functions, status monitoring of equipment operation, recording of influent and effluent flow rate, flow totalizing, and chlorine ratio setting. The panel layout is shown on the next page.

Sludge recycle flow is controlled manually by positioning each screw pump discharge end and checking the discharge rate by manual measurement of flow over a weir. Activated sludge waste rates are controlled by time meters on the waste sludge pumps. Dissolved oxygen (D.O.) in each aeration basin will be measured with a portable unit as required.



SCALE: 1" = 1'-0"

WASTEWATER TREATMENT FACILITIES PROCESS MONITORING PANEL IRBID, JORDAN	ROY F. WESTON, INC. WESTON ENVIRONMENTAL CONSULTANTS-DESIGNERS			
DRAWN P. WHITEMAN	DATE 11-17-80	DES. ENG.	DATE	W. O. NO.
CHECKED		APPROVED		DWG. NO.

K&E 19 1253 6-80 MC1111e

SECTION 7

7.0 BUILDING RECOMMENDATIONS

7.1 Operations Building

The single story prefabricated steel building will be a steel sandwich wall panel and insulated roof panel construction connected to a steel frame, designed to sustain all design loads including wind, roof loads (such as snow or equivalent), lighting and piping loads, ceiling loads, and building heating and ventilating equipment loads, if any. The building foundation will be primarily a slab on grade with perimeter grade beams, subject to the recommendations of the soils report. Any major interior equipment will be founded on individual foundations.

Benefits to be derived from use of a prefabricated steel building include:

1. Rapid erection time once foundations are in place

2 The use of an enclosed area for storage of other equipment as delivered to the site;

3. The structure would be provided by a sole supplier and erected complete in place by a contractor acquainted with that type of construction and recognized by the supplier.

The building package would be specified to be furnished and erected by a sole supplier and his agent/erector to include all required materials and hardware. The building will be designed to be readily available through various prefabricated building manufacturers as sole supplier.

7.2 Plant Equipment Foundations and Process Tankage

Materials of construction for equipment foundations and process tankage will be poured-in-place concrete with steel reinforcement placed in form-work and constructed to the dimensions shown on the engineering drawings.

The site will be graded as required to provide the required grades above the equipment foundations and process tankage. Excavations will be made to elevations shown for bottom of concrete foundations.

7.3 Miscellaneous Equipment Enclosures

Miscellaneous equipment enclosures will be specified to provide weather protection and general security to such equipment that may have need for protection. Equipment, set on individual concrete foundations, will include, but not be limited to, process pumps, blowers, electrical substations and motor control centers, located in the vicinity of process tanks and miscellaneous equipment.

The enclosures will be prefabricated steel construction to match, as closely as possible, the finish of the operations building. The enclosure will be designed to sustain the same loading as the operations building, and will be secured to the concrete foundation for the equipment.

SECTION 8

8.0 IRBID SPECIFICATIONS LIST (PRELIMINARY)

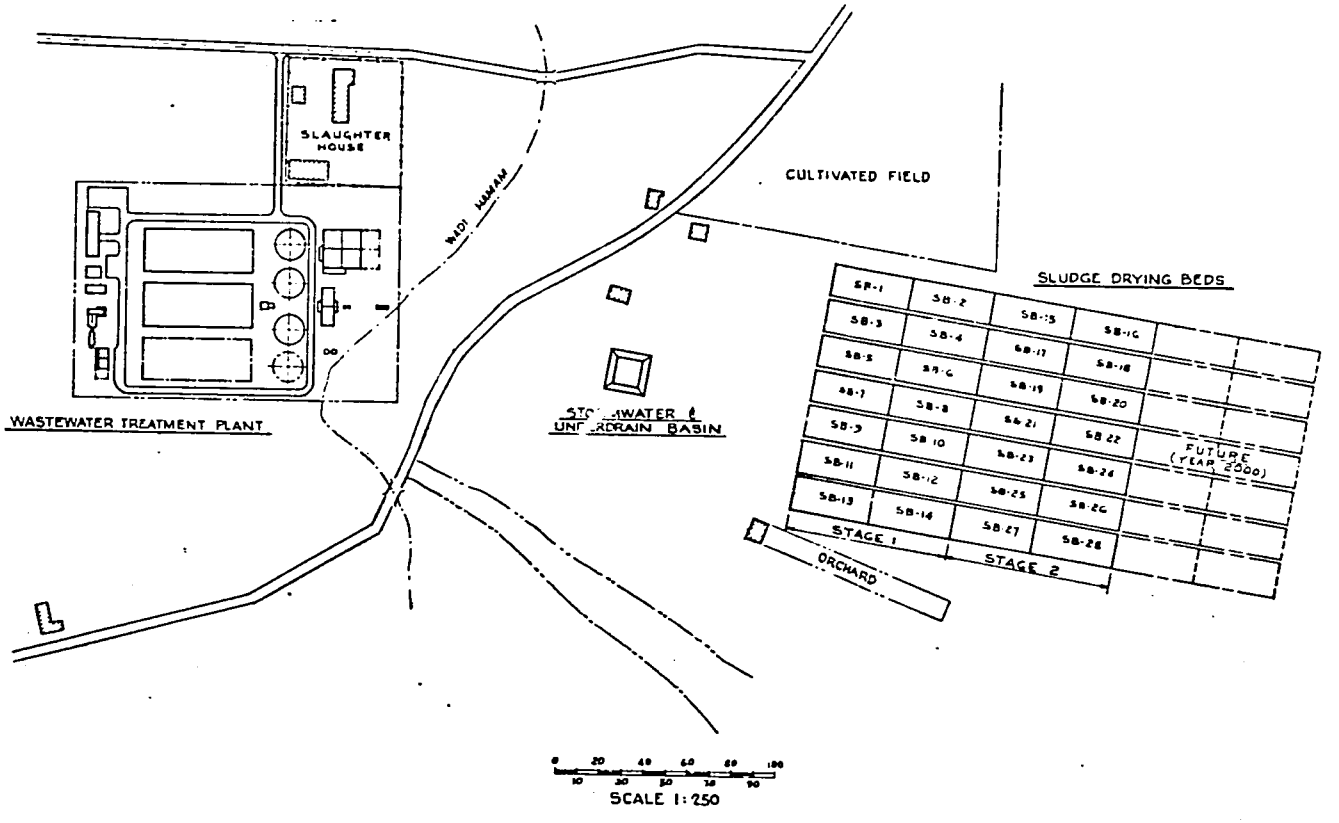
Section	Title
00700	General Conditions
00800	Supplementary Conditions
01010	Summary of Work
01011	Drawings
01015	General Conduct of Work
01080	Applicable Codes
01090	Abbreviations
01100	Substitution of Equipment and Materials
01150	Measurement and Payment
01300	Construction Progress and Schedules
01330	Survey Data
01340	Shop Drawings, Samples and Project Data
01400	Quality Control
01500	Temporary Facilities
01560	Maintenance of Work Site
01562	Dust Control
01580	Project Identification
01600	Materials and Equipment
01710	Cleaning Up
01730	Operation and Maintenance Data
02102	Grubbing and Stripping
02220	Excavation and Backfill

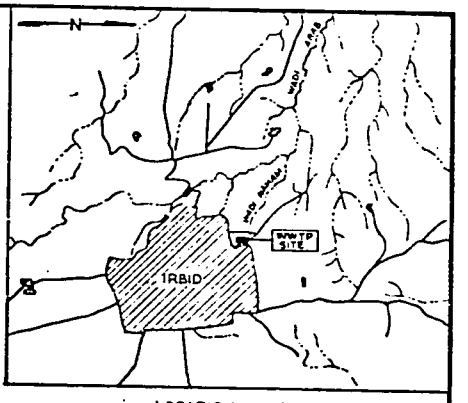
Section	Title
02260	Screened Gravel
02280	Crushed Gravel
02290	Selected Backfill
02540	Erosion Control
02575	Manholes
02612	Bituminous Paving
02711	Chain Link Fence
02820	Lawns and Planting
02821	Seeding
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
03315	Sanitary Structure Concrete
03600	Grout
04100	Mortar
04200	Masonry
05120	Structural Steel
05500	Miscellaneous Metals
06100	Rough Carpentry
07160	Bituminous Dampproofing
07951	Sealants and Caulking
08210	Doors and Door Frames
08360	Overhead Doors

Section	Title
08710	Finish Hardware
08800	Glass and Glazing
09310	Ceramic Tile
09330	Quarry Tile
09650	Resilient Flooring
09900	Painting and Coatings
10165	Toilet and Shower Compartments
10166	Toilet Room Accessories
10390	Miscellaneous Specialties
10500	Metal Lockers and Benches
11010	Mechanical Equipment - General
11061	Screw Pumps
11062	Centrifugal Pumps
11063	Plunger Pumps
11065	Submersible Pumps
11071	Mechanical Bar Screens
11075	Aerated Grit Removal System
11080	Mechanical Aerators
11083	Blowers
11160	Slide and Sluice Gates
11260	Chlorination System

Section	Title
11373	Centrifugal Blowers
11550	Tools and Equipment
11600	Laboratory Equipment
11866	Conveyors
11930	Utility Water System
11945	Mixers
11953	Final Clarifiers
12610	Office Furniture
13120	Prefabricated Building
13440	Instrumentation - General
13441	Instrumentation Functional Descriptions
13442	Instrumentation Equipment
13443	Instrument and Control Panel
13444	Field Instrumentation Installation
14300	Monorail and Hoist Equipment
14560	Utility Vehicles
15010	Mechanical General
15050	Piping Material Classifications
15060	Piping Installation
15173	Flow Measuring Devices
15400	Plumbing
15450	Plumbing Fixtures

Section	Title
15800	Heating, Ventilating and Air Conditioning
16000	Electrical Work
16010	Electrical General
16050	Typical Details - Electrical and Instrumentation
16111	Conduit
16114	Cable Tray
16120	Wire and Cable
16131	Pull, Junction, Termination Boxes and Wiring Troughs
16134	Panelboards
16140	Switches and Receptacles
16150	Low Voltage Induction Motors
16160	Dry Type Transformers
16210	Generating Sets
16310	Substations
16320	Switchgear
16450	Grounding
16500	Lighting Fixtures and Lamps
16920	Motor Control Centers
	Electrical System Control Devices
	Manholes and Handholes





LOCATION MAP
SCALE 1:4000

NO	DATE	APP'D	REVISION

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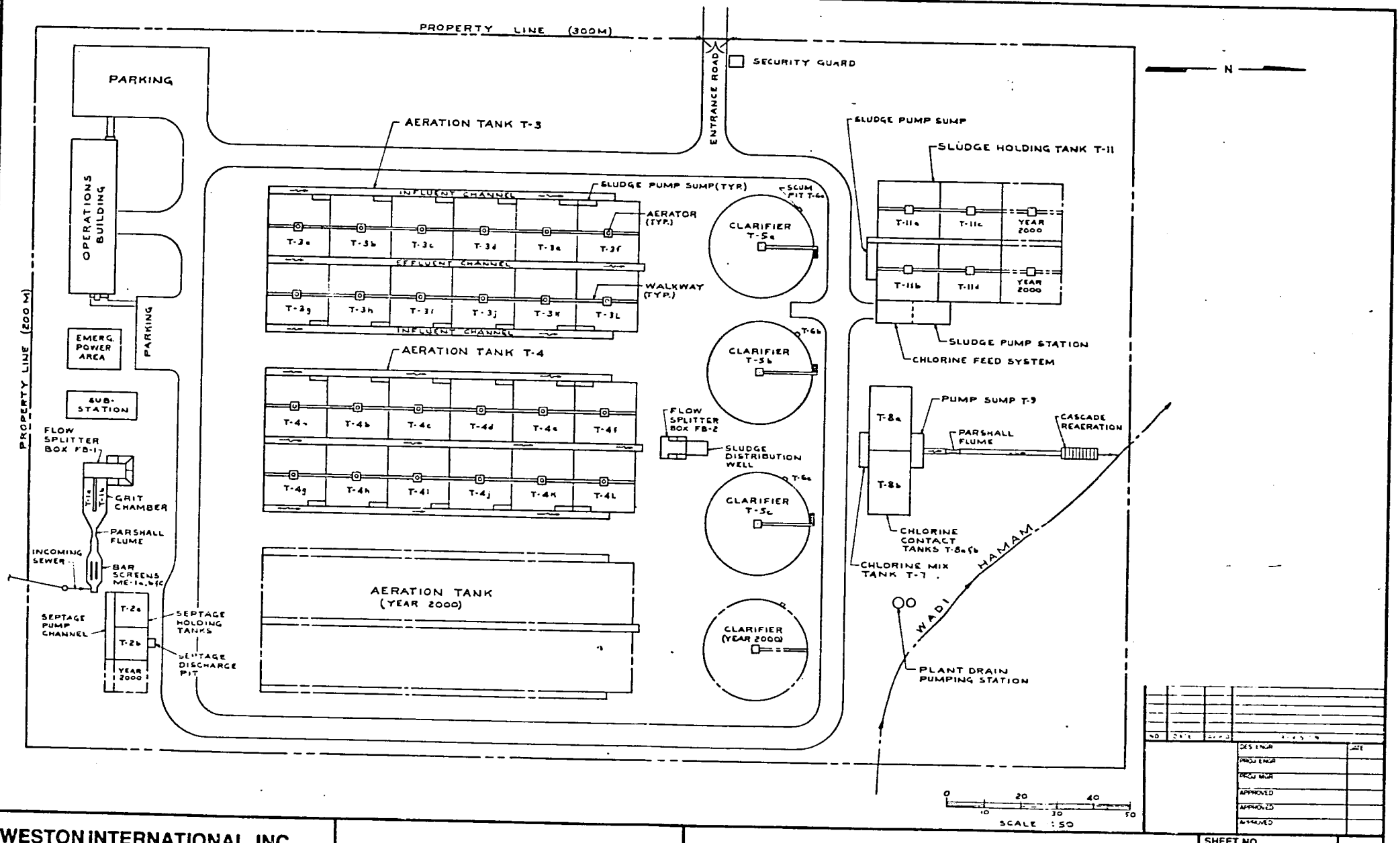
APPROVED	

WESTON INTERNATIONAL, INC.
IN ASSOCIATION WITH STANLEY CONSULTANTS, INC.,
SIGMA CONSULTING ENGINEERS
MRM CONSULTING ENGINEERS CO., LTD

IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

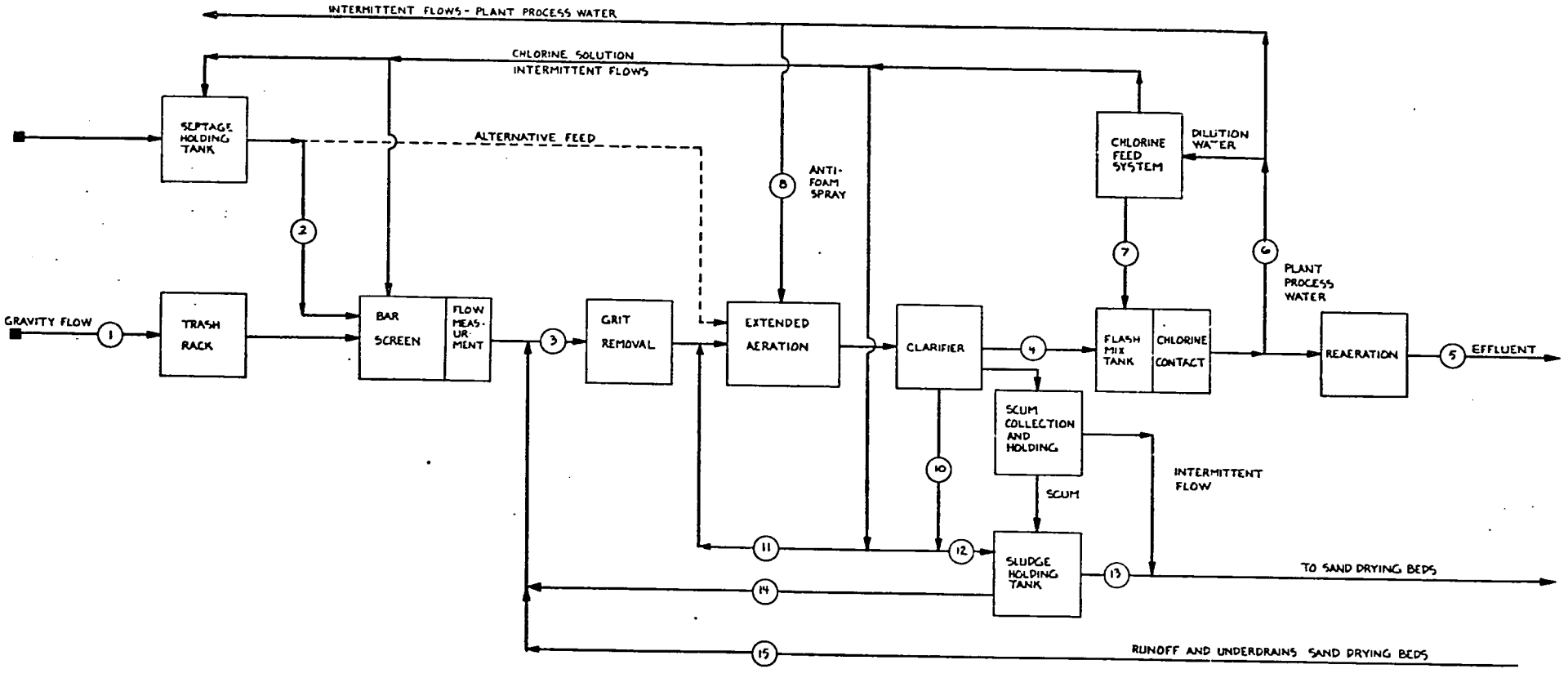
OVERALL PLOT PLAN
WASTEWATER TREATMENT FACILITIES

SHEET NO.	100
DATE: 11/13/80	BY:
W.O. NO. 1010-01-03	CHKD:



WESTON INTERNATIONAL, INC. IN ASSOCIATION WITH STANLEY CONSULTANTS, INC., SIGMA CONSULTING ENGINEERS MRM CONSULTING ENGINEERS CO., LTD	IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT	TREATMENT PLANT PLOT PLAN WASTEWATER TREATMENT FACILITIES

SHEET NO.	101
DATE: 11-12-80	BY: P BARRY
W.O. NO. 1970-C1	CHKD:



NO	DATE	APP'D	REVISION

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WESTON INTERNATIONAL, INC.
IN ASSOCIATION WITH STANLEY CONSULTANTS, INC.,
SIGMA CONSULTING ENGINEERS
MRM CONSULTING ENGINEERS CO., LTD

IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

MASS BALANCE - BLOCK DIAGRAM
WASTEWATER TREATMENT FACILITIES

SHEET NO. 900	
DATE: 11-17-80	BY: WJW
W.O. NO 1970-01-03	CHKD:

WINTER CONDITION

FORWARD FLOW AND PROCESS WATER FLOW STREAMS

STREAM NO	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AVERAGE FLOW m^3/DAY	22,046	352	24,023	27,041	22,170	5,416	545	4,871
PEAK HYD. FLOW m^3/DAY	60,293	352	62,295	67,166	62,295	5,416	545	4,871
MIN. FLOW m^3/DAY	8,818	352	9,170	9,170	9,170	545	545	0
TSS mg/L	921	2,349	899	20	20	20	20	20
TSS kg/day	20,299	827	21,606	541	443	108	11	97
VSS mg/L	697	500	659	14	14	14	14	14
VSS kg/day	15,365	176	15,834	379	310	76	8	68
BOD_5 mg/L	805	4,801	810	20	20	20	20	20
BOD_5 kg/day	17,742	1,690	19,447	541	443	108	11	97
pH					6-9			
D.O.					3.0			

SUMMER CONDITION

FORWARD FLOW AND PROCESS WATER FLOW STREAMS

STREAM NO	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AVERAGE FLOW m^3/DAY	22,046	713	24,552	27,380	22,509	5,418	545	4,871
PEAK HYD FLOW m^3/DAY	55,115	713	56,625	81,496	56,625	5,416	545	4,871
MIN. FLOW m^3/DAY	8,818	713	9,531	9,531	9,531	545	545	0
TSS mg/L	921	2,350	916	20	20	20	20	20
TSS kg/day	20,299	1,676	22,48*	548	450	108	11	97
VSS mg/L	697	500	6.	14	14	14	14	14
VSS kg/day	15,365	356	16,077	383	315	78	8	68
BOD_5 mg/L	805	4,800	863	20	20	20	20	20
BOD_5 kg/day	17,742	3,442	21,180	548	450	108	11	97
pH					6-9			
D.O.					3.0			

SLUDGE HANDLING

STREAM NO.	(10)	(11)	(12)	(13)	(14)	(15)
AVERAGE FLOW m^3/day	28,059	26,206	1,853	1,235	618	1,007
PEAK FLOW m^3/day	35,405	35,405	0	0	0	1,850
MINIMUM FLOW m^3/day	-	-	0	0	0	0
DESIGN TSS %	1.0	1.0	1.0	1.5	.07	-
DESIGN TSS mg/L	10,000	10,000	10,000	14,600	741	22
DESIGN TSS kg/day	280,590	262,060	18,532	18,074	458	22
DESIGN VSS %	0.7	0.7	0.7	1.02	.05	-
DESIGN VSS mg/L	7,000	7,000	7,000	10,200	518	15
DESIGN VSS kg/day	196,413	193,442	12,972	12,651	321	15
						-

SLUDGE HANDLING

STREAM NO.	(10)	(11)	(12)	(13)	(14)	(15)
AVERAGE FLOW m^3/day	28,671	26,628	2,043	1,362	681	1,112
PEAK FLOW m^3/day	36,067	36,067	0	0	0	1,850
MINIMUM FLOW m^3/day	-	-	0	0	0	0
DESIGN TSS %	1.0	1.0	1.0	1.5	.07	-
DESIGN TSS mg/L	10,000	10,000	10,000	14,600	711	22
DESIGN TSS kg/day	286,710	266,628	20,433	19,949	484	24
DESIGN VSS %	0.7	0.7	0.7	1.02	.05	-
DESIGN VSS mg/L	7,000	7,000	7,000	10,200	498	15
DESIGN VSS kg/day	200,697	186,640	14,303	13,964	339	17

NO	DATE	APP'D	REVISION

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APPROVED
APPROVED
APPROVED

WESTON INTERNATIONAL, INC.
IN ASSOCIATION WITH STANLEY CONSULTANTS, INC.,
SIGMA CONSULTING ENGINEERS
MRM CONSULTING ENGINEERS CO., LTD

IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

MASS BALANCE – SCHEDULE I (YR. 1990)
WASTEWATER TREATMENT FACILITIES

SHEET NO. 901

DATE: 11-11-80 | BY:

W.O. NO 1970-01-03 | CHKD:

WINTER CONDITION

FORWARD FLOW AND PROCESS WATER FLOW STREAMS

STREAM NO.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AVERAGE FLOW m^3/DAY	35,852	713	39,126	43,548	36,238	7,854	545	7,309
PEAK HYD. FLOW m^3 DAY	85,580	713	97,765	105,074	97,765	7,854	545	7,309
MIN. FLOW m^3 DAY	14,341	713	15,054	15,054	15,054	545	545	0
TSS mg/L	882	1,763	860	20	20	20	20	20
TSS kg/day	31,627	1,257	33,632	871	725	157	11	146
VSS mg/L	667	374	630	14	14	14	14	14
VSS kg/day	23,928	267	24,651	610	507	110	8	102
BOD_5 mg/L	762	3,602	765	20	20	20	20	20
BOD_5 kg/day	27,317	2,568	29,915	871	725	157	11	146
pH					6-9			
D.O.					3.0			

SUMMER CONDITION

FORWARD FLOW AND PROCESS WATER FLOW STREAMS

STREAM NO.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AVERAGE FLOW m^3/DAY	35,852	1,086	39,726	43,856	38,547	7,854	545	7,309
PEAK HYD. FLOW m^3 DAY	89,630	1,086	91,954	89,263	81,954	7,854	545	7,309
MIN. FLOW m^3/DAY	14,341	1,086	15,427	15,427	15,427	545	545	0
TSS mg/L	882	2,350	880	20	20	20	20	20
TSS kg/day	31,627	2,552	34,976	877	731	157	11	146
VSS mg/L	667	500	636	14	14	14	14	14
VSS kg/day	23,928	543	25,273	614	512	110	8	102
BOD_5 mg/L	762	4,800	820	20	10	20	20	20
BOD_5 kg/day	27,317	5,213	32,561	877	731	157	11	146
pH					6-9			
D.O.					3.0			

SLUDGE HANDLING

STREAM NO.	(10)	(11)	(12)	(13)	(14)	(15)
AVERAGE FLOW m^3/day	45,668	42,781	2,887	1,924	963	1,598
PEAK FLOW m^3/day	57,646	57,646	0	0	0	1,850
MINIMUM FLOW m^3/day	-	-	0	0	0	0
DESIGN TSS %	1.0	1.0	1.0	1.5	.07	-
DESIGN TSS mg/L	10,000	10,000	10,000	14,600	736	22
DESIGN TSS kg/day	456,680	427,810	28,866	28,157	709	35
DESIGN VSS %	0.7	0.7	0.7	1.02	05	-
DESIGN VSS mg/L	7,000	7,000	7,000	10,200	515	15
DESIGN VSS kg/day	319,673	299,467	20,206	19,710	496	25

SLUDGE HANDLING

STREAM NO.	(10)	(11)	(12)	(13)	(14)	(15)
AVERAGE FLOW m^3/day	46,396	43,217	3,178	2,118	1,060	1,728
PEAK FLOW m^3/day	58,404	58,404	0	0	0	1,850
MINIMUM FLOW m^3/day	-	-	0	0	0	0
DESIGN TSS %	1.0	1.0	1.0	1.5	.07	-
DESIGN TSS mg/L	10,000	10,000	10,000	14,600	723	21
DESIGN TSS kg/day	463,960	432,170	31,739	30,974	765	37
DESIGN VSS %	0.7	0.7	0.7	1.02	.05	-
DESIGN VSS mg/L	7,000	7,000	7,000	10,200	506	15
DESIGN VSS kg/day	324,772	302,519	22,217	21,681	536	26

NO	DATE	APP'D	REVISION

		DATE
DES ENGR		
PROJ ENGR		
PROJ MGR		
APPROVED		
APPROVED		
APPROVED		

WESTON INTERNATIONAL, INC.
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MRM CONSULTING ENGINEERS CO., LTD

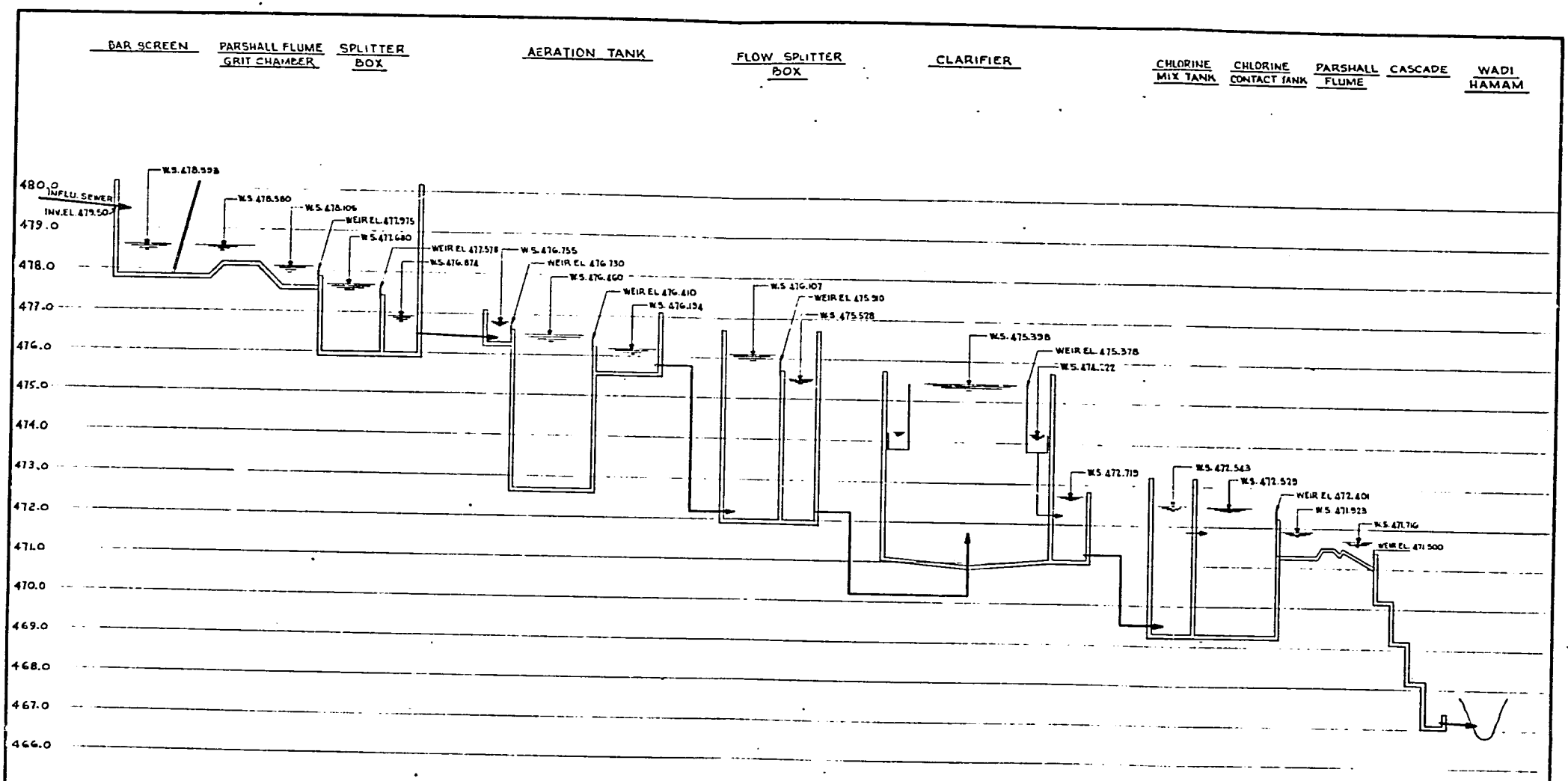
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

MASS BALANCE – SCHEDULE II (YR. 2000)
WASTEWATER TREATMENT FACILITIES

SHEET NO. 902

DATE: 11-19-80 | BY:

W.O. NO 1970-01-03 | CHKD:



NOTE
WATER SURFACES (W.S.) AS SHOWN ARE BASED UPON AVERAGE FLOWS FOR THE YEAR 2,000 C.

ALL ELEVATIONS SHOWN ARE IN METERS.

WESTON INTERNATIONAL, INC.
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IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

HYDRAULIC PROFILE
WASTEWATER TREATMENT FACILITIES

SHEET NO. 903
DATE: 11/10/80 BY: J.W.
W.O. NO. CHKD:

LINES

- OPEN CHANNEL
- PROCESS LINE
- AUXILIARY AND UTILITY LINES
- ELECTRICAL LINE
- CAPILLARY LINE
- PNEUMATIC INSTRUMENT LINE
- HYDRAULIC LINE
- SONIC OR RADIATION SIGNAL
- PROCESS LINE - BELOW GRADE

VALVE BODIES

- GATE VALVE
- GLOBE VALVE
- GLOBE VALVE 'V' PLUG TYPE DISC
- BALL VALVE
- VEE BALL VALVE
- PLUG VALVE
- NEEDLE VALVE
- KNIFE GATE VALVE
- BUTTERFLY VALVE
- 3 WAY VALVE
- SWING CHECK VALVE
- SIGHT FLOW CHECK VALVE
- SAFER CHECK VALVE
- SAFETY RELIEF VALVE
- AIR RELEASE VALVE
- PRESSURE-REDUCING VALVE
- FLAP VALVE
- FLOAT CONTROL VALVE
- DIAPHRAGM VALVE
- BALL CHECK VALVE
- MUD DRAIN VALVE
- PET COCK VALVE
- CUSHIONED SWING CHECK VALVE
- TELESCOPING VALVE (WITH OPERATOR)
- BACK PRESSURE VALVE
- PINCH VALVE

NOTE: ALL VALVE BODIES ARE LINE SIZE UNLESS OTHERWISE NOTED

PIPING

- FLEXIBLE CONNECTION
- QUICK DISCONNECT COUPLING
- STRAINER Y TYPE
- EDUCTOR OR EJECTOR
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- HOSE CONNECTION
- BLIND FLANGE
- EQUIPMENT INSULATED
- EQUIPMENT HEAT TRACED AND INSULATED
- DRAIN
- EXPANSION JOINT
- FLANGED ADAPTER
- COUPLING
- INSULATED
- HEAT TRACED AND INSULATED
- PIPE UNION
- SHOCK ABSORBER OR SURGE SUPPRESSOR
- LINE CAP
- AIR FILTER
- SILENCER

GATES

- DAMPER
- STOP PLATE
- SLUICE GATE
- ROTARY LOCK
- SLIDE GATE

AIR MOVING EQUIPMENT

- CENTRIFUGAL COMPRESSOR
- POSITIVE DISPLACEMENT BLOWER
- FAN (CENTRIFUGAL)
- FAN (AXIAL)

PUMPS

- CENTRIFUGAL PUMP
- METERING PUMP
- DIAPHRAGM PUMP
- VACUUM PUMP
- PROGRESSIVE CAVITY PUMP
- POSITIVE DISPLACEMENT PUMP
- SCREW PUMP
- VERTICAL CENTRIFUGAL PUMP
- VERTICAL TURBINE PUMP

SPECIAL EQUIPMENT

- SCREW CONVEYOR
- FILTER
- BACK FLOW PREVENTER
- COMMINUTOR
- VARIABLE SPEED (EXAMPLES VARIABLE SPEED MOTOR)
- VARIABLE SPEED PUMP
- PULSATION DAMPENER

ABBREVIATION

I A S	-	INSTRUMENT AIR SUPPLY
N C	-	VALVE NORMALLY CLOSED
N O	-	VALVE NORMALLY OPEN

EQUIPMENT NUMBERING

B-1	BASIN LAGOON
C-1	CONVEYING EQUIPMENT
F-1	COMPRESSOR BLOWER
FB-1	FLOW BOX
GF-1	GRAVITY FILTER
M-1	MIXER AERATOR
ME-1	OTHER MECHANICAL EQUIPMENT
MH-1	MANHOLE
P-1	PUMP
PF-1	PRESSURE FILTER
T-1	TANK SUMP
VF-1	VACUUM FILTER

LINE DESIGNATION

PF -	FORWARD (PROCESS) FLOW
SL -	SLUDGE
ST -	SUPERNATANT
FL -	FILTRATE
FB -	FILTER BACKWASH
BY -	BYPASSES OVERFLOWS
SW -	SCUM
DN -	DRAINS
SN -	BUILDING SANITARY
UW -	UTILITY WATER
PW -	POTABLE WATER
AR -	AIR
OX -	OXYGEN
PR -	POLYMER
AN -	ALUM
ML -	METHANOL
LM -	LIME
FC -	FERRIC CHLORIDE
CL -	CHLORINE
AM -	AMMONIA
SH -	CAUSTIC
PA -	PHOS ACID

15" - PF - 01 - 1100

15" = LINE SIZE; PF = TYPE OF FLOW; 01 = LINE NUMBER; 1100 = MAX FLOW (GPM)

ACTUATORS

- PNEUMATIC ACTUATOR
- MOTOR OPERATED VALVE
- SOLENOID OPERATED VALVE
- CYLINDER OPERATED VALVE

FLOW ELEMENTS

- ORIFICE
- VENTURI FLOW ELEMENT
- FLOW ELEMENT (* SIZE IN INCHES)
- FLUME (* SIZE IN INCHES)
- WEIR
- ROTAMETER

INSTRUMENTS & ELECTRICAL

- NOTE - 2; INSTRUMENT - LOCALLY MOUNTED; NOTE - 1
- INSTRUMENT BOARD MOUNTED (LOCAL LOCATION NOTE - 6 PANEL)
- INSTRUMENT - BOARD MOUNTED (MAIN PANEL)
- INSTRUMENT - BACK OF MAIN PANEL
- INSTRUMENT - DUAL ELEMENT IN SINGLE ENCLOSURE
- EQUIPMENT MFR SUPPLIED DEVICE
- COMPLEX INTERLOCK (BACKWASH)
- SIMPLE INTERLOCK
- PURGE; * A-AIR, B-WATER
- TO * T-TELEMETERING
- FROM C-COMPUTER
- PRESSURE (VACUUM) GAGE P S I RANGE
- PRESSURE GAGE W SEAL
- ELECTRIC MOTOR
- OPERATING LIGHT; * COLOR OR GD = GRAPHIC DISPLAY

INSTRUMENT TERMINOLOGY

UPPER CASE LETTER	FIRST LETTER PROCESS VARIABLE	MODIFIER (A) OR SECOND LETTER TYPE READING OR FUNCTION	THIRD FOURTH LETTER FUNCTION
A	ANALYZER (NOTE 3)	ALARM	ALARM
B	BURNER FLAME	-	-
C	CONDUCTIVITY	CONTROL	CONTROLLER
D	DENSITY	CONTROLLER DIFFERENTIAL (Δ)	DISC
E	ELECTRICAL (EMF)	ELEMENT	ELEMENT
F	FLOW RATE	RATIO (FRACTION) (Δ)	-
G	GAGING (DIMENSIONAL)	GLASS	GLASS
H	HAND	HAND	HIGH
I	CURRENT (ELECTRICAL)	INDICATING INDICATOR	INDICATOR
J	POWER	SCAN (Δ)	-
K	TIME	-	-
L	LEVEL	LIGHT (PILOT)	LOW
M	MOISTURE (HUMIDITY)	-	-
N	-	-	-
O	OPERATION	ORIFICE	-
P	PRESSURE VACUUM	PRESSURE	-
Q	INTEGRATE	TOTALIZER (Δ)	-
R	RADIOACTIVITY	RECORDING-RECORDER	RECORDER
S	SPEED STOP	SWITCH (NOTE-5)	SWITCH
T	TEMPERATURE	TRANSMITTER	TRANS-MITTER
U	MULTIFUNCTION	-	-
V	VISCOSITY	VALVE DAMPER LOUVER	VALVE
W	WEIGHT	WELL	-
X	TORQUE	-	-
Y	-	RELAY (NOTE-2 5)	RELAY
Z	POSITION	DRIVE	-

NOTES:

1. THE FOLLOWING ABBREVIATIONS FOR ANALYSIS READING OR FUNCTION DESCRIPTIONS ARE TO BE PLACED OUTSIDE THE LOWER RIGHT QUADRANT OF THE BALLOON SYMBOL

ABBREVIATION	DESCRIPTION
CB	COMBUSTIBLES
CL	CHLORINE
DO	DISSOLVED OXYGEN
ORP	OXIDATION REDUCTION POTENTIAL
pH	ACID ALKALINE SCALE 1-14
TC	TOTAL CARBON
TOC	TOTAL ORGANIC CARBON
Tu	TURBIDITY
O	OXYGEN

2. TYPICAL DESIGNATIONS FOR INPUT OUTPUT SIGNAL SOURCES ARE TO BE PLACED OUTSIDE THE UPPER RIGHT QUADRANT OF THE BALLOON SYMBOL

ABBREVIATION	DESCRIPTION
A	ANALOG
D	DIGITAL
E	VOLTAGE
H	HYDRAULIC
I	CURRENT (ELECTRICAL)
M	ELECTROMAGNETIC OR SONIC
P	PNEUMATIC
R	RESISTANCE (ELECTRICAL)
S	SUMMATOR
S-D	ON-OFF
	HIGH SELECTOR
	LOW SELECTOR

3. INSTRUMENT DESIGNATIONS SHOWN ON FLOW DIAGRAMS REPRESENT INSTRUMENT FUNCTIONS NOT INSTRUMENT HARDWARE.
4. ALL INSTRUMENT IDENTIFICATIONS ARE BASED UPON ISA (INSTRUMENT SOCIETY OF AMERICA) STANDARDS FOR FURTHER INFORMATION REFER TO ISA STANDARDS
5. THE FIRST ELEMENT IN A LOOP IS A SWITCH. SUBSEQUENT DEVICES ARE RELAYS
6. LOCATION OF LOCAL PANEL IF MORE THAN ONE IS USED
   - MCC - MOTOR CONTROL CENTER
   - PF - PRESSURE FILTER
   - GF - GRAVITY FILTER
   - VF - VACUUM FILTER

WESTON INTERNATIONAL, INC.
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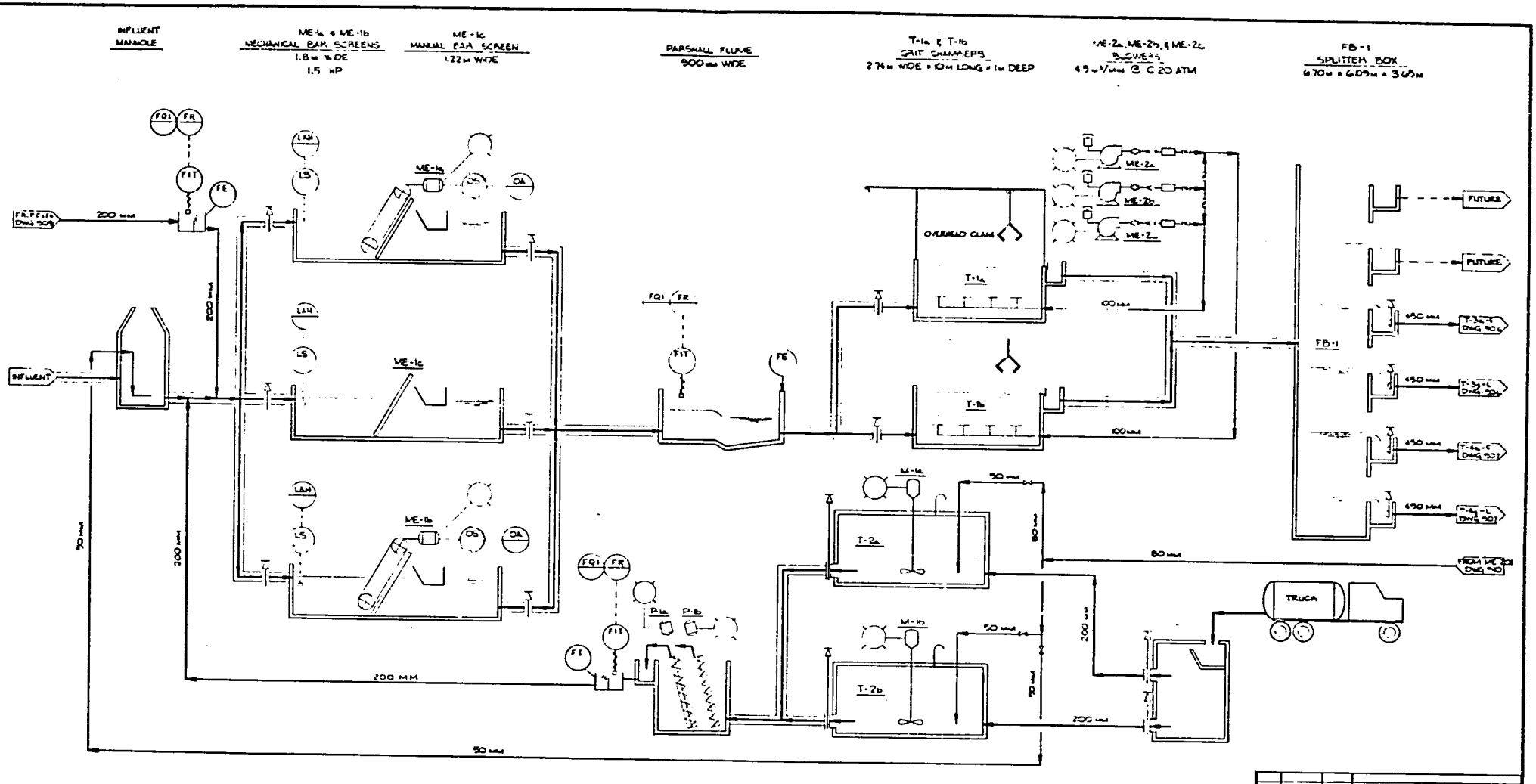
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

LEGEND
PROCESS & INSTRUMENTATION
SYMBOLS

SHEET NO. 904

DATE: | BY:

W.O. NO | CHKD:



P-1a & P-1b
SEPTAGE SCREW PUMPS
24.1 M³/H
300 mm ø

T-2a & T-2b
SEPTAGE HOLDING TANKS
9.15m x 9.15m x 3m

SEPTAGE DISCHARGE PIT

M-1a & M-1b
MIXERS

NOTE EQUIPMENT SHOWN ON FLOW DIAGRAMS REPRESENTS COMPLETE DESIGN FOR YEAR 1990.

NO	DATE	APPD	REVISION

DESIGN	DATE
DRAFTING	
PROJECT MGR.	
APPROVED	
APPROVED	
APPROVED	

WESTON INTERNATIONAL, INC.
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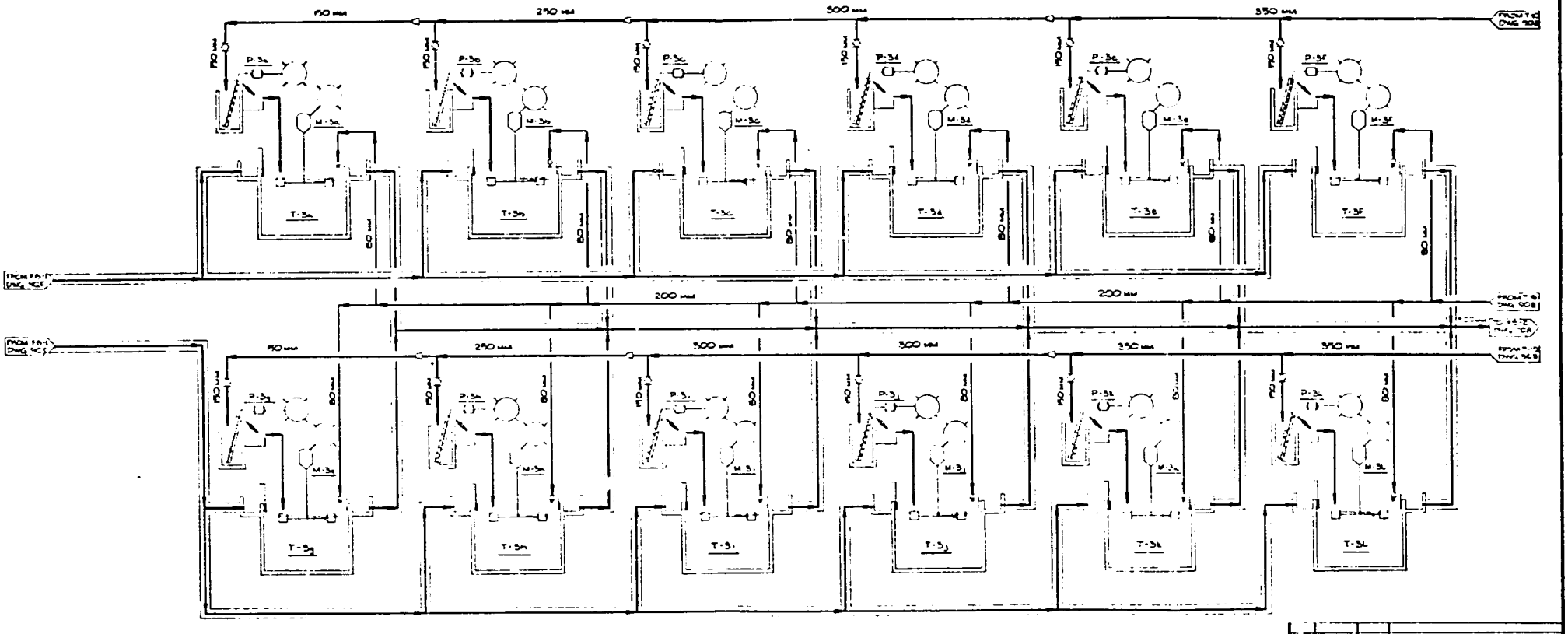
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM I
WASTEWATER TREATMENT FACILITIES

SHEET NO.	905
DATE:	BY: BROWN
W.O. NO.	CHKD:



RECYCLE SLUDGE SCREW PUMPS
P-3a TO P-3L
≤4.85 m³/h
600 mm ø
5 HP

T-3 AERATION TANK
CELLS T-3a TO T-3L
16.99 m × 16.99 m × 3.75 m SWD + 1.0 m F.B.

AERATORS
M-3a TO M-3L
100 HP EACH

NO.	DATE	APP'D	REVISION

DES'N ENGR	DATE
PROJ ENGR	
PROJ MGR	
APPROVED	
APPROVED	
APPROVED	

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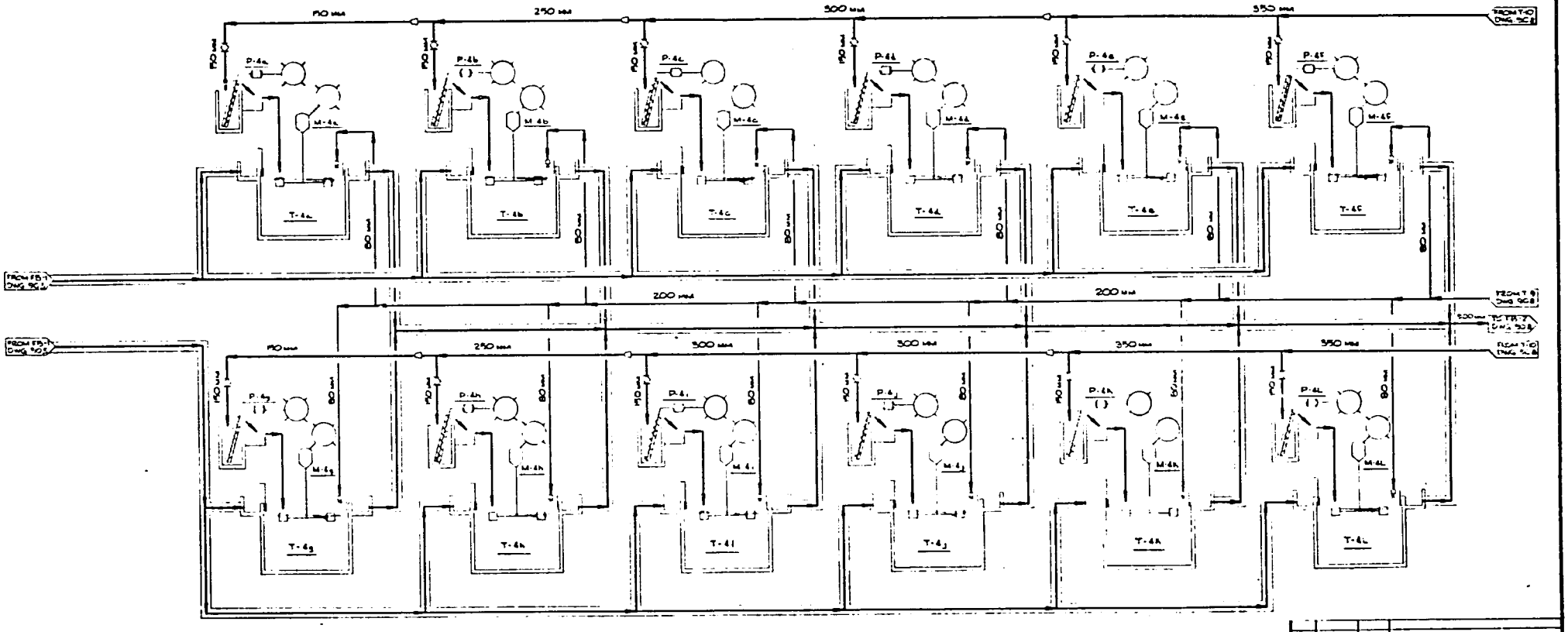
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM II
WASTEWATER TREATMENT FACILITIES

SHEET NO. 906

DATE: 1/6/90 BY: PROJ

W.O. NO. 90-0-03 CHK'D:



RECYCLE SLUDGE SCREW PUMPS
P-4a TO P-4L
65.85 m³/h @ 2m TDH
400 mm ϕ
5 HP

T-4
AERATION TANK
CELLS T-4a TO T-4L
16.99m × 16.99m × 3.75m SWD + 1.0m F.B.

AERATORS
M-4a TO M-4L
100 HP EACH

NO	DATE	APP'D	REVISION

DES ENGR	
PROJ ENGR	
PROJ MGR	
APPROVED	
APPROVED	
APPROVED	

WESTON INTERNATIONAL, INC.
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MFJM CONSULTING ENGINEERS CO., LTD

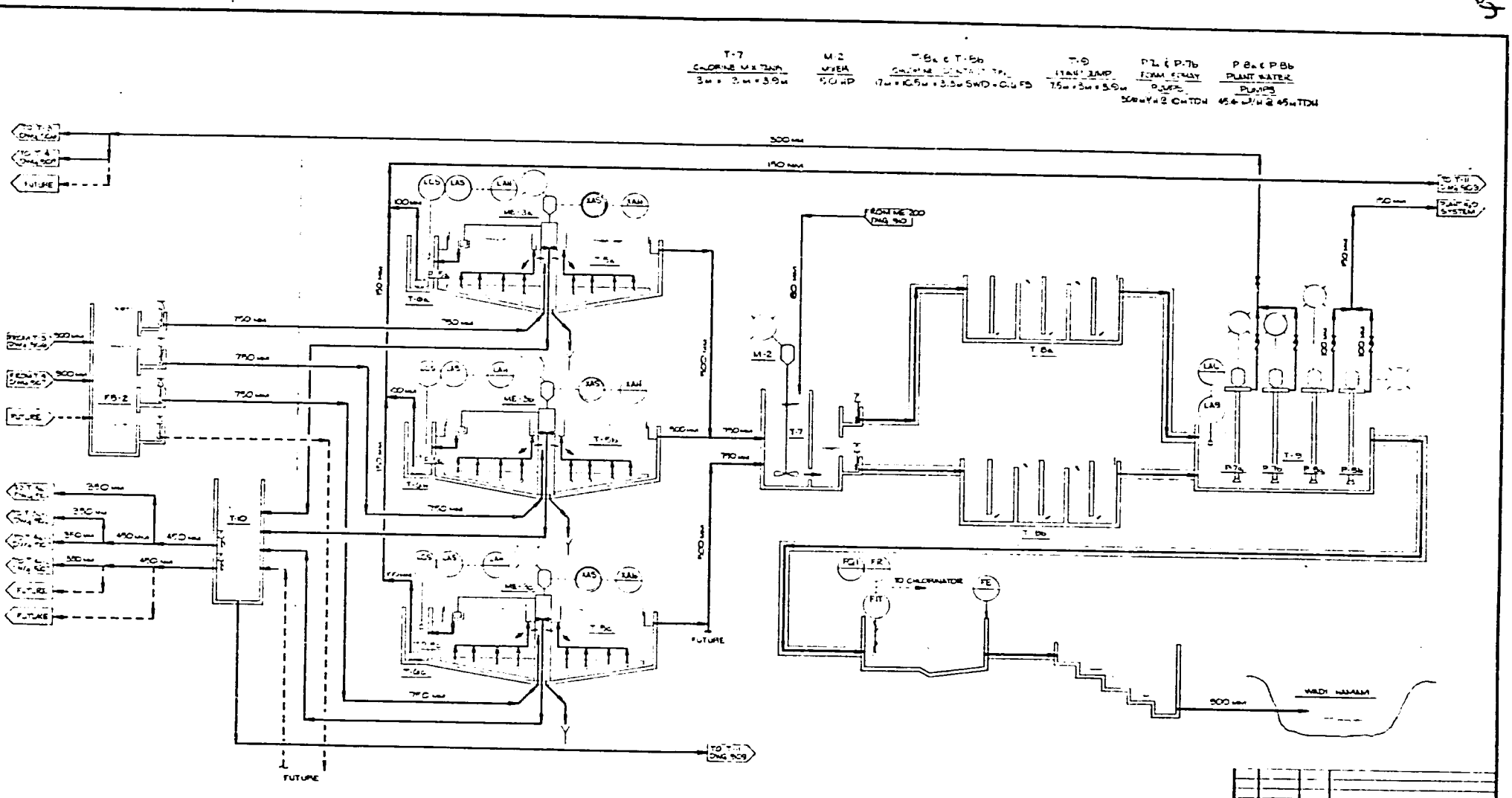
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM III
WASTEWATER TREATMENT FACILITIES

SHEET NO. 907

DATE: 12/80 BY:

W.O. NO. CHKD:



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SIGMA CONSULTING ENGINEERS
MRM CONSULTING ENGINEERS CO., LTD

IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM IV
WASTEWATER TREATMENT FACILITIES

SHEET NO. 908
DATE:
BY:
W.O. NO.
CHKD.

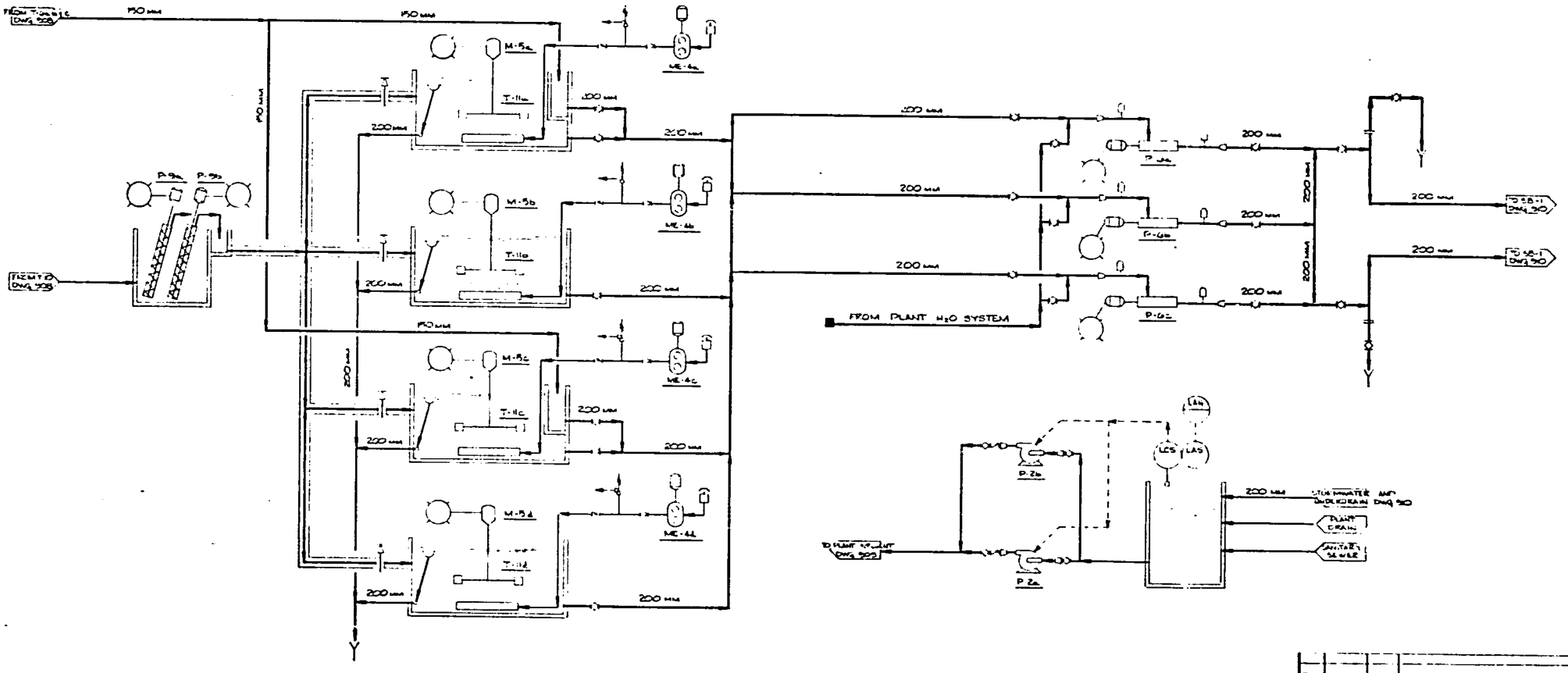
P-9a & P-9b
SLUDGE WASTING PUMPS
[illegible] m³/H, 2 HP
400 mm

T-11
SLUDGE HOLDING TANK
CELLS T-11a TO T-11d
6.95m x 6.95m x 3.75m SWD + 1m FB

AERATORS
M-5a TO M-5d
15 HP

AERATION BLOWERS
ME-4a TO ME-4d
20 m³/H, 20 HP

P-6a, P-6b & P-6c
SLUDGE TRANSFER PUMPS
65 m³/H
40 HP



P-2a & P-2b
PLANT DRAIN PUMPING STATION
90 m³/H
10 HP

NO.	DATE	REVISION	BY
		SYSTEM	
		PROJECT	
		PROJECT MGR.	
		APPROVED	
		APPROVED	
		APPROVED	

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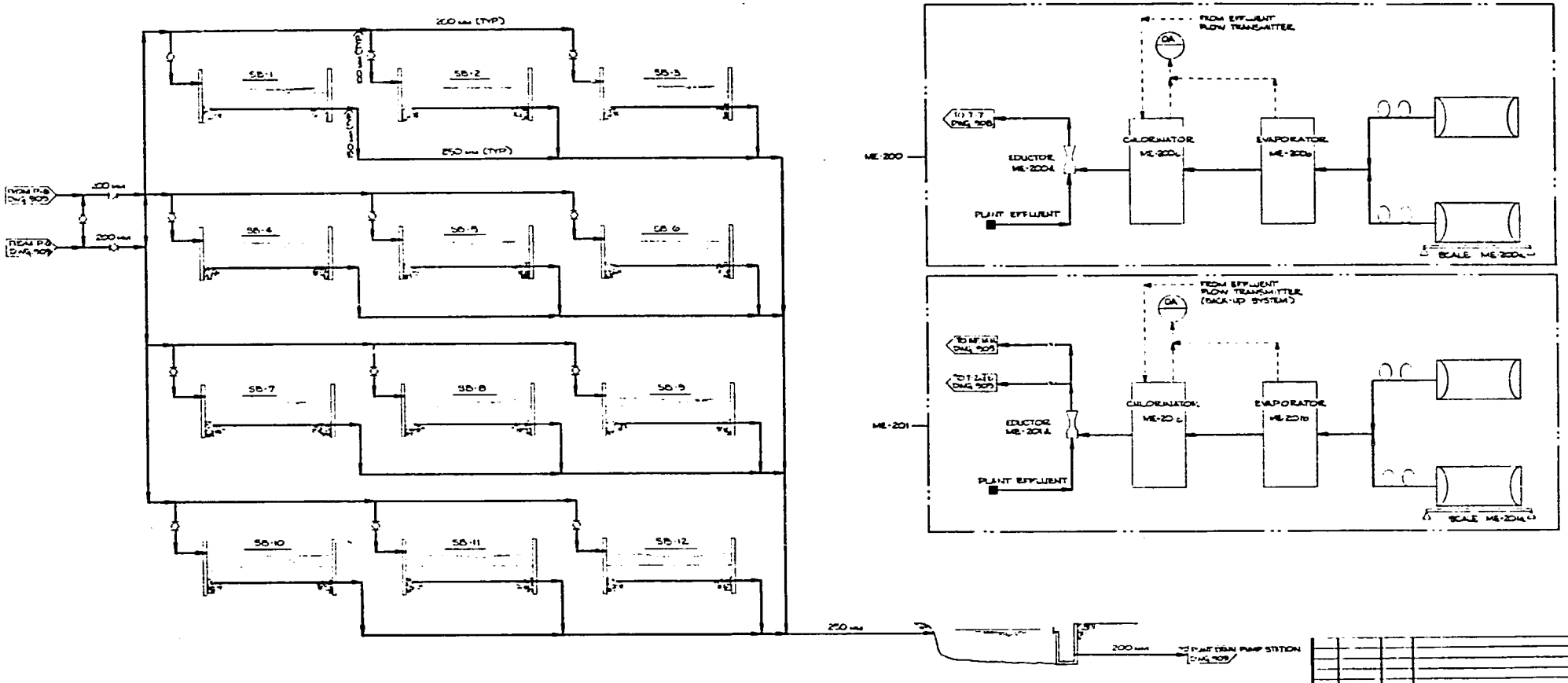
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM V
WASTEWATER TREATMENT FACILITIES

SHEET NO. 909
DATE: 1/18/85
BY: [illegible]
W.O. NO. 90-012-
CHKD:

SB-1 THRU SB-28
SAND DRYING BEDS
SB-13 THRU SB-28 NOT SHOWN

ME-200 & ME-201
CHLORINATOR PACKAGE SYSTEMS



STORMWATER & UNDERDRAIN POND

NO	DATE	APP'D	REVISION

DESIGN	DATE
DRAWN	
CHECKED	
APPROVED	
APPROVED	
APPROVED	

WESTON INTERNATIONAL, INC.
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MRM CONSULTING ENGINEERS CO., LTD

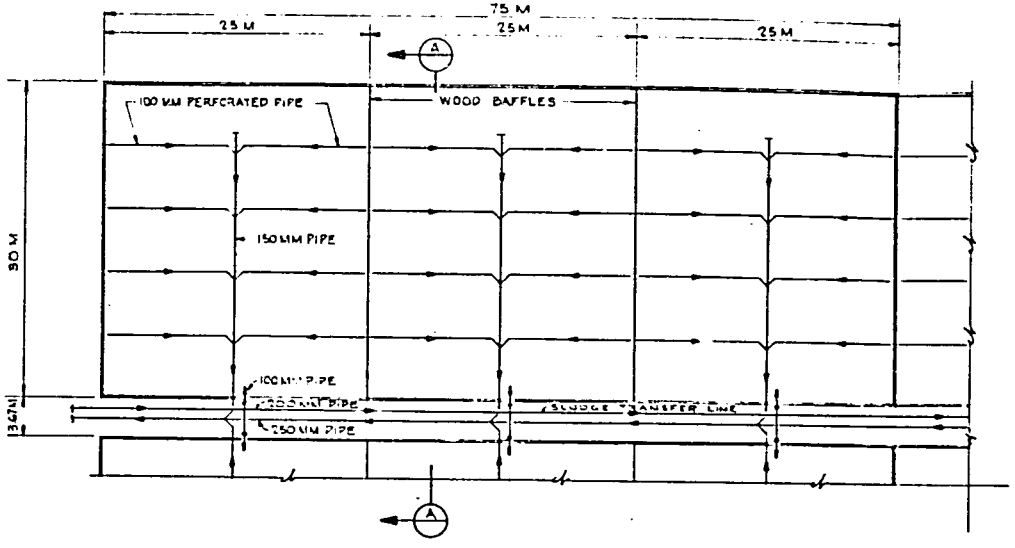
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

FLOW DIAGRAM VI
WASTEWATER TREATMENT FACILITIES

SHEET NO. 910

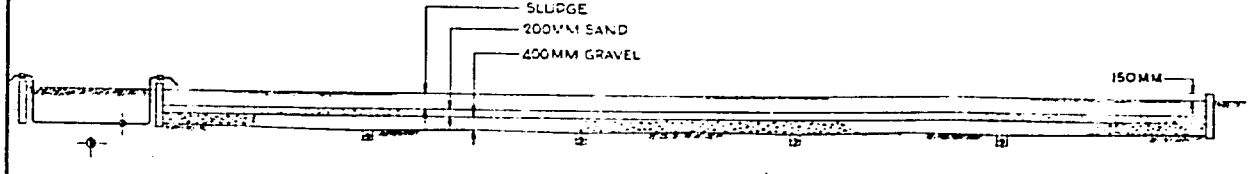
DATE: 1/4/85 BY: SHOWN

W.O. NO. 79-0-[illegible] CHK'D:



PLAN TYPICAL SLUDGE DRYING BED

SCALE 1:25



SECTION A-A

SCALE 1:75

0 10 20

SCALE 1:25

NO	DATE	APP'D	REVISION

DESIGN	ALE
PROJ ENGR	
PROJ MGR	
APPROVED	
APPROVED	
APPROVED	

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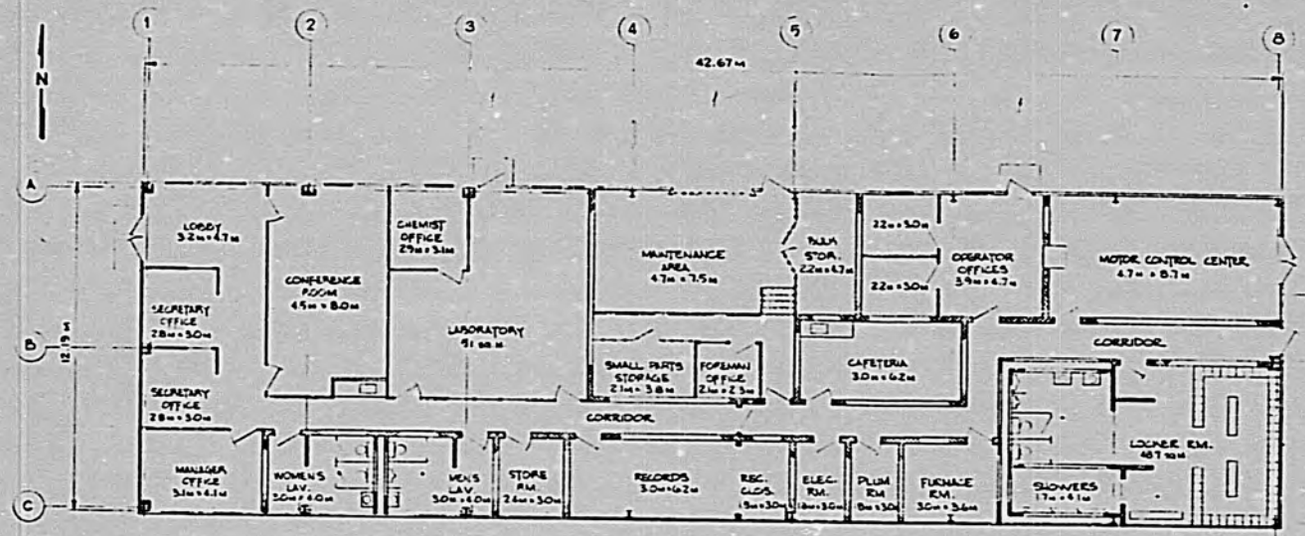
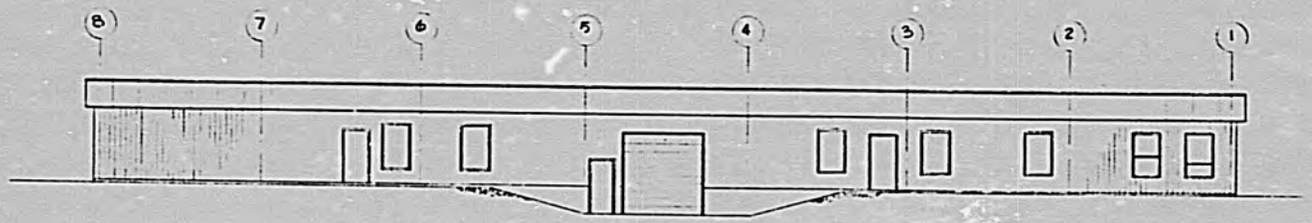
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

SLUDGE DRYING BEDS PLAN & SECTIONS
WASTEWATER TREATMENT FACILITIES

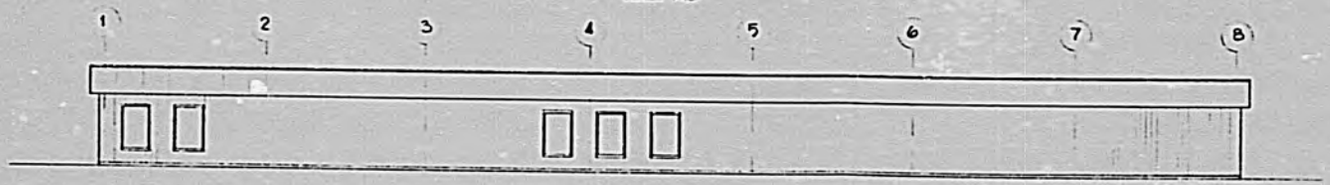
SHEET NO. 210	
DATE: 11/10/83	BY: J.A.
W.O. NO	CHKD:



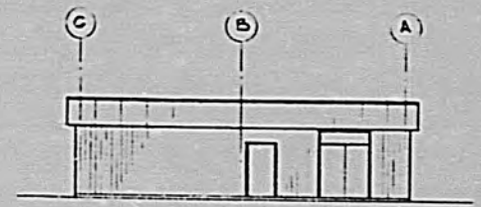
PLAN
SCALE 1:10



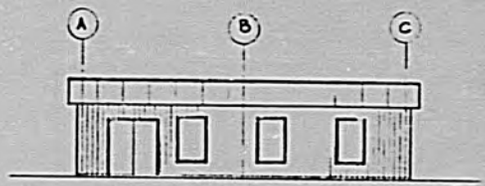
NORTH ELEVATION
SCALE 1:10



SOUTH ELEVATION
SCALE 1:10



EAST ELEVATION
SCALE 1:10



WEST ELEVATION
SCALE 1:10

0 1 2 3 4 5
SCALE 1:10

NO	DATE	APP'D	REVISION
			DESIGNED
			FROM ENGR.
			FROM MGR.
			APPROVED
			APPROVED
			APPROVED

WESTON INTERNATIONAL, INC.
IN ASSOCIATION WITH STANLEY CONSULTANTS, INC.,
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MRM CONSULTING ENGINEERS CO., LTD

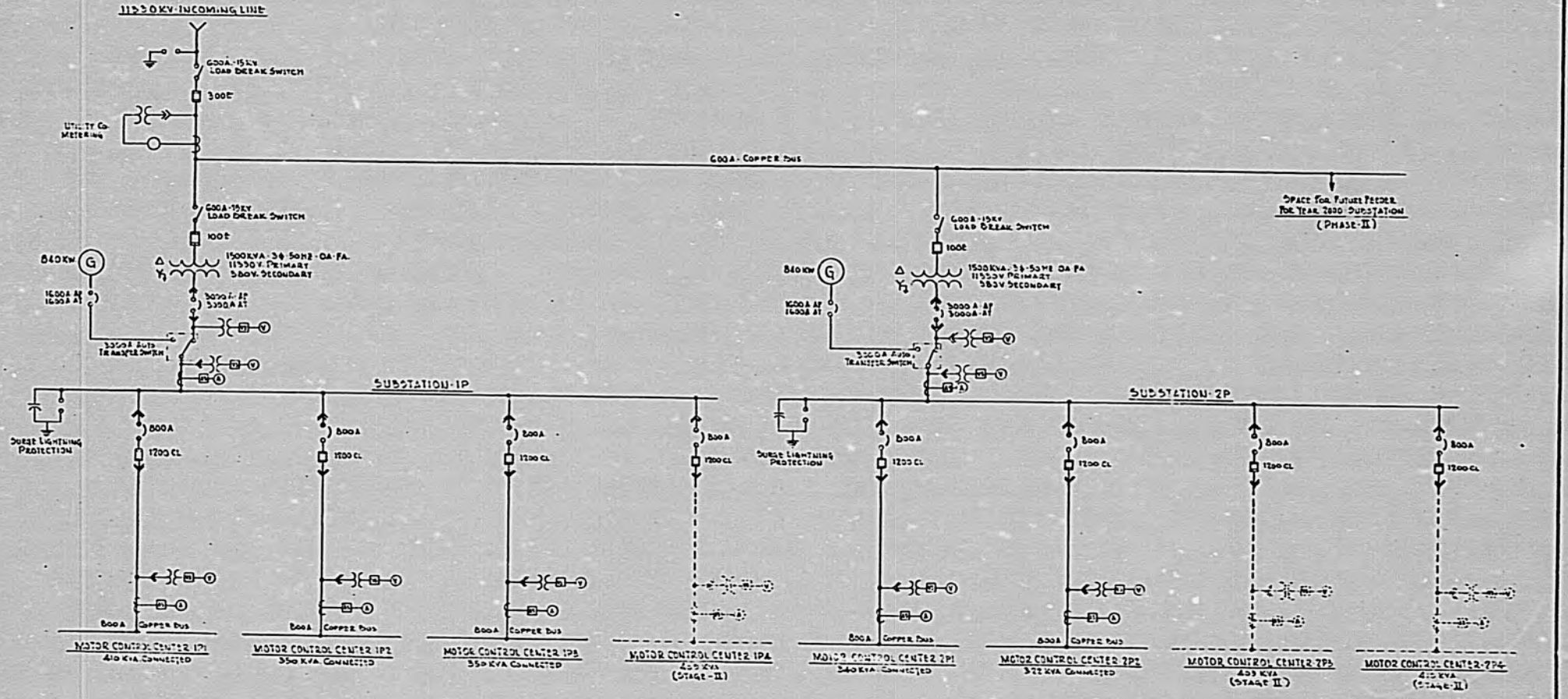
IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

OPERATIONS BUILDING
WASTEWATER TREATMENT FACILITIES

SHEET NO. 300

DATE: 11/4/80 BY: BROWN

W.O. NO. [illegible] CHKD:



NO	DATE	APP'D	REVISION

DES ENGR	
PROJ ENGR	
PROJ MGR	
APPROVED	
APPROVED	
APPROVED	

WESTON INTERNATIONAL, INC.
IN ASSOCIATION WITH STANLEY CONSULTANTS, INC.,
SIGMA CONSULTING ENGINEERS
MRM CONSULTING ENGINEERS CO., LTD

IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

ELECTRICAL SINGLE LINE DIAGRAM
WASTEWATER TREATMENT FACILITIES

SHEET NO. 700

DATE: [illegible] BY: [illegible]

W.O. NO. [illegible] CHKD: