7.0 WATER POLLUTION CONTROL AND MANAGEMENT PROJECT IN EGYPY

7.0 Water Pollution Control and Management Project in Egypt

7.1 General

In Egypt, the prevention and improvement of environmental pollution has been handled on a project-by-project basis, and many projects have been executed with the assistance of foreign countries. In view of the above situation, this chapter summarizes the major projects by Overseas Donors and by the Egyptian Government.

7.2 Major Projects by Overseas Donors

Major environmental projects by Oversea Donors related with Egyptian Environmental Affairs Agency (EEAA) are shown in Table 7.1.

Table 7.1 Major environmental projects and by Oversea Donors related with EEAA

Donor	Project Title	Budget	Duration
USAID (U.S.A.)	Cairo Air Improvement Project (CAIP)	US$ 35 mil. (planned US$ 60 mi.)	1995-
	Integrated Environmental Program for the 10th of Ramadan City		
	U.S Egyptian Partnership for Economic Growth and Development - Lead Exposure Abatement Plan (LEAD)		
	Program for Eco-Tourism Development in Egypt		
	Egyptian Environmental Policy Plan (EEPP)		
DANIDA (DENMARK)	Environmental Education and Training Program (EETP)	DKK 10,197,996	1995-
	Organization Support Program (OSP)	Phase 1: DKK 13.5 Million (approx. LE 7 Million) Phase 2: DKK 23.6 Million (approx. LE 12 Million)	1993-
	Environmental Information and Monitoring Program (EIMP)		1996-
	North Sinai Governorate Environmental Action Plan		1994-1997
	Development of a National Integrated Coastal Zone		
	Design of Economic Instruments Project (DEIP)	(Potential)	
	Pilot Project for Hospital Waste Management Program for Specified Hospitals in Cairo, Phase 1 & 2		1995 -
	Technical Support to the Shore Protection Authority (TSSPA)		
	Training in Urban Sewer Modeling (TUSM)		
	Aswan Governorate Environmental Management Unit (AGEMU)	(Potential)	
	Industrial Waste Management and Energy Conservation For Aswan Fertilizer Complex of the Egyptian Chemical Industries	(Potential)	
	Establishment of Shore-Based Oil Water Treatment Facilities in Suez and Alexandria.	(Potential)	
	Updating of the National Oil Spill Contingency Plan.	(Potential)	
	Preparation of Safe Landfill for Hazardous Residuals from Industrial Production.	(Potential)	

Table 7.1 Major environmental projects and by Oversea Donors related with EEA A (continued)

Donor	Project Title	Budget	Duration
DANIDA (DENMARK)	Technical Assistance to Coastal Research Institute and Hydraulic Research Institute	(Potential)	
	Environmental Non-Governmental Organizations (ENGO) Support Program	(Potential)	
	Community Action for the Environment (CAFE)		
	Environmental Business Egypt (EBE)		
CIDA (CANADA)	Egyptian Environmental Information System (EEIS)	CD $ 11,200,000	1997-2002
	Egyptian Environmental Initiatives Fund (EEIF)		
UK DFID (U.K.)	Support to Environmental Assessment and Management Program		2000-2004
	6th of October Abatement Initiative	(Potential)	
	National Industrial Pollution Prevention Program (NIPPP)	(Potential)	
FINNIDA (FINLAND	The Egyptian Pollution Abatement Project (EPAP)		1997-2002
	Hazardous Waste Management Project in Alexandria	(Potential)	
DGCS (ITALY)	Enhancement of the Organization and Capabilities to Preserve Cultural Heritage Assets of Egypt	(Potential)	
	Decision Support for Agricultural Water Resource Planning Based on Ecological Balance	(Potential)	
	Environmental Protection in Siwa and Fayoum Oases	(Potential)	
WORLD BANK	Pollution Abatement Fund for industry	$ 20 million from IBRD $ 15 million from IDA $ 5.5 million from Finland $ 19 million from the European Investment Bank	
KFW (GERMANY)	Environmental Protection Facility for Public sector Industries	$33.5 million	
JICA (JAPAN)	Environmental Monitoring Training Project		1997-2002

7.3 USAID (US Agency for International Development)

USAID provides resources for environmental protection activities focused in the areas of water/wastewater, air pollution and eco-tourism.

7.3.1 Water and Waste Water

Since 1975, USAID has invested over US$ 2 billion in urban water and wastewater infrastructure. In 1996, several projects were completed with the following results:

- Two million residents in the Cairo neighborhoods of the Pyramids and Embaba received sewer system hook-ups

- More than 500,000 residents in Suez were connected to the new wastewater treatment plants funded by USAID
- In Cairo, the three major potable water reservoirs serving the heart of the city of Darassa were put into service providing improved water supplies to three million people.

Major activates and/or projects are as follows:

- Secondary Cities Development
  .1 Amount: US$ 82 million (US$ 215 million planned)
  .2 Initiated: 1994
  .3 Objective: An expansion of water and wastewater infrastructure investment to reach the communities of Mansoura, Nuweiba, Luxor, and the Aswan group of Nars City, Kom Ombo and Darawo City
- Cairo Water Supply II
  .4 Amount: US$ 145 million
  .5 Initiated: 1988
  .6 Objective: Installation of 53 km of distribution and transmission pipe in central Cairo, construction of 4 ground level concrete reservoirs, construction of two pumping stations, rehabilitation of 4 pumping stations, establishment of central water quality laboratory, etc.
- Canal Cities Water and Wastewater II
  .7 Amount: US$ 380 million
  .8 Initiated: 1987
  .9 Objective: Construction of wastewater treatment facilities for Suez, Ismaila and Port Said and construction of a pump station at Qantara along with related institutional development and training
- Cairo Sewerage II
  .10Amount: US$ 771 million
  .11Initiated: 1984
  .12Objective: Finance wastewater collection, treatment and disposal facilities, and institutional support to the Cairo General Organization for Sanitary Drainage
- Provincial Cities Development
  .13Amount: US$ 104.14 million
  .14Initiated: 1981
  .15Objective: Improvement of water and wastewater systems in 3 provincial cities
- Alexandria Wastewater System
  .16Amount: US$ 425 million
  .17Initiated: 1977
  .18Objective: Finance the design, construction, and start-up of a sewerage system

7.3.2 Air Pollution

USAID industrial energy and environment activities are helping reduce the discharge of industrial pollutants and promote energy conservation. Energy efficiency activities have eliminated the following accumulated pollutants from urban air.

- 25,200 tons of sulfur oxide
- 4,000 tons of nitrogen oxide
- 7,800 tons of carbon monoxide

The Cairo Air Improvement Project (CAIP) shown in the Table 8.1 is working with the Government of Egypt in the following areas.

- Reducing lead emissions from local smelters and in gasoline
- Instituting a vehicle emissions testing and certification program
- Introducing natural gas-fueled buses to reduce diesel emission particulate pollution, etc.

7.3.3 Sustainable Tourism

Protecting the environment is also vital to sustain Egypt's tourism industry, which is the second largest foreign exchange earner. Under the U.S.-Egyptian Partnership for Economic Growth and Development, USAID has been helping the Government of Egypt through the following projects.

- Promotion of Environmentally Sustainable Tourism
  - 7.3.3.1 Amount: US$ 5.35 million
  - 7.3.3.2 Initiated: 1995
  - 7.3.3.3 Objective: Pilot activities designed to foster sustainable growth in tourism while protecting the natural and culture sites
- Preservation and Restoration of Egyptian Antiques
  - 7.3.3.4 Amount: US$ 15 million
  - 7.3.3.5 Initiated: 1994
  - 7.3.3.6 Objective: Administrating program to conserve Egyptian antiquities

7.4 DANIDA (Danish International Development Agency)

As shown in Table 7.2, a basic strategy for the Danish – Egyptian Development Cooperation is concentrated in the following three sectors.

- Environment (support pollution control)
- Energy, in particular renewable energy and energy conservation
- Water supply and sanitation in Upper Egypt

The Danish-Egyptian cooperation on environmental issues began in 1991. The aim of this cooperation has been to support the Egyptian government's efforts in promoting environmentally sustainable development and to minimize the harmful effects of pollution. Specifically, the efforts have been focusing on the following three fields.

- Continuous Support to EEAA (DANIDA is already a Lead Donor to EEAA)

- Coastal Environmental Protection
- Handling of Hazardous Waste

Table 7.2 Financial Framework Sectorial Break-Down

(Unit: DKK)

Sector	1996	1997	1998	1999	2000
Environment	40	50	50	50	50
Energy	50	50	50	50	50
Water/Sanitation	10	35	35	40	40
Health	10	10	5	5	5
Industry	20	10	10	20	20
Industry including Agro Industry	50	40	35	20	20
Democracy/WID	20	15	15	15	15
Total	200	215	200	200	200

Source: Homepage of Ministry of Foreign Affairs of Denmark

In addition to the above three areas, it is planned to execute programs including demonstration and pilot-type projects to reduce pollution in selected industries where the expertise of Danish resources is particularly strong.

7.5 CIDA (Canadian International Development Agency)

The following two projects were executed with the assistance from CIDA.

7.5.1 Egyptian Environmental Information System (EEIS)

The goal of the project is to assist the decision maker of the Government of Egypt formulate and implement timely and appropriate environmental policies, legislation, program and projects affecting water and land resources in the country. The EEIS-specific purpose is to enhance the capacity of EEAA in retrieving, processing, analyzing and disseminating environmental information for environmental decision-making purposes. It is expected that the EEIS will:

1 Increase the capability of EEAA to make decisions regarding environmental protection and management;
2 Enhance the availability and accessibility of environmental data to EEAA and other national government agencies and academic institutions;
3 Establish a sustainable linkage between EEAA and all other organizations (ministry departments, other related projects, NGO's and academic institutions);
4 Develop an EEIS network infrastructure to connect EEAA (as a central facility) and nodes in several key agencies to facilitate the access and exchange of environmental information.

The major components of EEIS project are:

1 Design and implementation of the EEIS technical system, which includes the system requirement analysis, system design, database design, applications development, testing and operation;
2 Capacity building, which includes environmental information strategy development, provision of management, technical and environmental training and seminars, development of environmental indicators, establishing a documentation and training center, developing standards and conducting research and special studies;
3 Project management and administration, which includes preparation of annual work plans, schedules, budgets, activity/progress reports, convening management and PSC meetings, and the implementation of computerized project management and tracking systems

7.5.2 Egyptian Environmental Initiatives Funds (EEIF)

The Egyptian Environmental Initiatives Funds (EEIF) is a joint assistance program by Egyptian and Canadian over several years to support environmental initiatives to all small and medium enterprises, NGOs, Egyptian NGOs, and community groups. The EEIF project is made up of four major components:

1 A fund of money is set aside for small and medium scale enterprises and businesses to access and obtain Innovative Environmental Management and Technical Expertise.
2 A second fund of money earmarked for NGOs, ENGOs, and Community Based Organizations (CBOs) to execute self-determined environmental initiatives.
3 A third fund is to assist small and medium entrepreneurs set up green business.
4 A communication and awareness-raising component, which will promote the funds and explain criteria for their access, raise environmental awareness amongst target groups and encourage collaboration and cooperation among the project constraints.

The project in intended to promote sustainable and sound environmental practices by the Egyptian private and voluntary sectors and to ensure the conservation of Egypt's natural resources with special emphasis on soil and water. The objectives of the project are as follows:

- To strengthen the capacity of Egyptian small and medium enterprises improve the environmental efficiency of their production process
- To promote adoption of sound environmental management and increased environmental consciousness among private, non-governmental and community organizations of Egypt
- To promote the development of environment-friendly goods and services by Egyptian private sector
- To strengthen the capacity of the Government to design and implement programs for the conservation of natural resources

- To address gender specific needs and roles in environmental issues

7.6 UK DFID (Department for International Development)

UK DFID is funding the Support for the Environmental Assessment and Management (SEAM) Project. The outline of the SEAM is described in Section 8.3.

7.7 World Bank and FINNIDA (The Finnish Ministry of Foreign Affairs)

The Egyptian Pollution Abatement Project (EPAP) is relying on the financial support of the World Bank and the European Investment Bank. FINNDA and EEAA are cooperating on the implementation of EPAP's technical and industrial support to the stakeholders. The outline of the EPAP is mentioned in Section 8.3.

7.8 KFW (Kreditanstalt Fur Wiederaubau)

KFW is providing a fund and technical assistance to the project of Environmental Protection Facility to mitigate the environmental impact of the Egyptian Public Sector industries and utilities. Section 8.3 describes this project.

7.9 JICA (Japan International Cooperation Agency)

JICA made the plan to establish environmental monitoring network system on the whole of Egypt, and is undertaking Environmental Monitoring Training Project (EMTP) to establish laboratory in CCC (Cairo Central Center) and eight RBOs (Regional Branch Office).
CCC has the role of the reference laboratory and the general training center for each RBO, while RBOs have the role of the executive organization for Law No.4 (1994) conducting an on-the-spot inspection and the analytic organization for environment, and will have the role of the training center for some prefectures and nongovernment.

The purposes of EMTP are CCC and RBOs will be capable of conducting ambient and point sources monitoring on water, air and monitoring on industrial solid wastes.
Long-term experts (leader, administrator, experts of water monitoring and air monitoring) and short-term experts (experts of maintenance for equipment and air) were dispatched from Japan.
The scope of work is to transfer knowledge and technology of monitoring, pollution control, analysis, training and information system to C/P.

7.10 Industrial Wastewater Pollution Abatement by the Government

The Government of Egypt has implemented the following programs and projects for industrial wastewater abatement:

- Nile River Clean Up Program
- The Egyptian Pollution Abatement Project (EPAP)

- Support for Environmental Assessment and Management (SEAM)
- Environmental Protection Facility for Public Sector Industries
- Compliance and Enforcement Program

A discussion of the above programs is presented below.

7.10.1 Nile River Clean Up Program

The Ministry of State for Environmental Affairs (MSEA) decided in early 1997 that the prevention of industrial pollution to the Nile is a top priority in the 1998 environmental agenda. For both environmental and health reasons, preventing industrial pollution to the Nile was regarded as a top priority issue. This issue attracted the attention of the public, regulatory agencies, and responsible industries. Consequently, the MSEA initiated a national program to prevent direct discharge of industrial wastewater into the Nile. The Nile Pollution Prevention Program (NPPP) was officially launched in July 1997, with a firm deadline to complete all program activities by 31 December 1998.

The initial phase of NPPP, which focused on the identification of industrial sources that discharge effluents in the Nile, was completed in July 1997. Soon after, a crash program involving diagnostic environmental audits was initiated in order to formulate specific PP Project proposals that were cost-effective, feasible, and relevant to the needs of the 34-targeted industries. This fast track activity was successfully accomplished by the end of September 1997.

The 34 major industries allocated about 350 million Egyptian pounds to stop the direct discharge of 100 million cubic meters/year of polluted industrial wastewater into the river Nile and to implement effective environmental alternatives by December 1998.

7.10.2 The Egyptian Pollution Abatement Project (EPAP)

The EPAP is designed to reduce industrial pollution and enhance industrial compliance with the environmental laws and regulations in Egypt. Accordingly, the project aims at establishing sustainable mechanisms for environmental planning in industry; at enhancing capabilities of all relevant authorities to handle industrial pollution; and at promoting the community's active role in industrial pollution issues.

The Egyptian Pollution Abatement Project (EPAP) was established in early 1997 to create sustainable mechanisms for industrial environmental management. Through this six-year project, industrial investments in environmental protection will benefit from soft financing provided by the World Bank and the European Investment Bank. The Finnish Ministry of Foreign Affairs (FINNIDA) and the Egyptian Environmental Affairs Agency (EEAA) are cooperating in the implementation of EPAP's technical and institutional support to the stakeholders.

EPAP will strengthen organizations involved in the environmental planning for industry, and will establish procedures required for environmental management, financing, monitoring and enforcement. This will be accomplished by transferring relevant experience and know-how to all entities involved, such as regulating authorities, industrial enterprises and organizations, providers of environmental services, as well as local banks and financial institutions. The project will also target NGOs and the media to encourage their participation in raising public awareness of industrial pollution control issues. Accordingly, EPAP's plan of action encompasses the following activities:

- Training and developing staff capabilities at the Environmental Management Units (EMUs) within the four governorates of Cairo, Alexandria, Qalyoubia and Suez and at the EEAA's Regional Branch Offices (RBOs) to manage industrial pollution issues, by developing procedures and guidelines, and by providing basic facilities necessary for monitoring and supervision;
- Developing Governorate Industrial Pollution Abatement Plans (GIPAPs);
- Promoting the reduction of industrial pollution by helping fifty major polluting industries by:
    a) Develop Pollution Abatement Action Plans (PAAPs),
    b) Identify cleaner production alternatives and environmentally sustainable investments and,
    c) Progress towards compliance with the requirements of environmental laws;
- Assisting banking institutions in the identification of mechanisms to evaluate environmental financing applications and develop financing procedures and opportunities; and
- Building the capacity of NGOs and the media to raise environmental awareness, enhance participation, and mobilize public opinion for a safe and healthy industrial environment.

7.10.3 Support for Environmental Assessment and Management (SEAM)

SEAM is the acronym of Support for Environmental Assessment and Management. This is a three-year project being funded by the UK Department for International Development (DFID) and undertaken by the Egyptian Environmental Affairs Agency (EEAA) through the Technical Cooperation Office for the Environment (TCOE), and Entec, a UK engineering and environmental consultancy firm. The wider objectives of the SEAM project are to support the implementation of the National Environmental Action Plan as a way of reducing the adverse environmental effects of new and existing developments. The immediate objectives are as follows:

- To show, through demonstration projects, the benefit of improved environmental practices;
- To develop the capacity of a range of national and regional institutions in environmental management and assessment;
- To improve the capacity of Egyptian organizations in undertaking environmental work, and
- To improve the awareness, understanding, and the benefits of sound environmental

management.

The SEAM Project is made up of 5 components, focusing on environmental management issues. These include:

1. Industrial Pollution Prevention/Cleaner Production,
2. Environmental Impact Assessment
3. Solid Waste Management
4. Environmental Action Plans, and
5. Development of an Environmental Database.

The component of industrial pollution is intended to show that significant financial savings and environmental improvements can be made by relatively low-cost and straightforward interventions. These consist of pollution prevention through good housekeeping waste minimization, process modification and technology changes. This approach has two benefits

1. Valuable materials are recovered rather than wasted and
2. Factories are moved towards legislative compliance.

This work is being undertaken in support of the National Industrial Pollution Prevention Program (NIPPP) and has focused on three sectors: textiles, food and oil & soap.

Industrial auditing of 32 factories identified a large number of low cost/no cost pollution prevention measures. Commonly occurring issues were then developed as demonstration projects for each sector, whose aims were to show the financial and environmental benefits of the pollution prevention approach.

Fifteen demonstration projects are being implemented in 23 sites as follows:

A. Textile Sector

1 Eco-friendly Processing for International Certification.
2 Water and Energy Conservation.
3 Dyebath Reuse.
4 Combined Processing: Scour and Bleach.
5 Bleach Clean-Up using Enzymes.
6 Sulphide reduction in Sulphur Dyeing.

B. Food Sector

1 Minimize in-plant Milk Losses
2 Water and Energy Conservation.
3 Reducing Wastage by Improved Quality Control.

4 Use of hey for Animal Feed.

C. Oil & Soap Sector

1 Integrated Water Management System.
2 Improving Effluent Quality by Waste Minimization.
3 Oil and Fats Recovery.
4 Wastewater Segregation, Reuse and Treatment.

Outputs from these projects will include industry workshops and seminars, Guidance Notes and Manuals (to enable other factories implement similar projects themselves), cost-benefit analysis to demonstrate feasibility, detailed Sector Reports and revised Audit Guidelines.

Additional work is also being carried out to identify technologies which could be implemented across the sectors, the so-called "hub technologies".

Training has been an integral part of this component to introduce the pollution prevention concept to factory personnel and consultants. This was of key importance, as it emphasized the importance of factory commitment and cooperation. Additional pollution prevention workshops will be provided for the metal finishing, pharmaceuticals and pulp & paper sectors, as well as the financial institutions.

The SEAM project will also fund a number of demonstration projects in industrial pollution control with emphasis on the identification of zero and low cost solutions in public or private sector companies in three sectors being audited. Funding is likely to be in parallel with financial contributions from the industrial operator.

7.10.4 Environmental Protection Facility for Public Sector Industries

The objective of this project is to finance investments for mitigating environmental impact of the Egyptian Public Sector industry and utilities. The Kreditanstalt Fur Wiederaubau (KFW) funds the project. This is providing also technical assistance for the preparation of the investment projects.

In the start-up phase of the project, finance was concentrating on the reduction and/or treatment of wastewater at the plant level of companies. Public and private sector commercial banks in the country are used as agents.

Grant for financing for investment projects

Extending funds to credit-worthy, end users of public industrial sector and utilities (clients) as a

grant to cover:

1 Up to 50% of investment cost when supporting a specific end-of-the-line environmental project (e.g. waste water treatment)
2 Up to 25% in case of support to investment in more modern production technology, which would, in addition, substantially improve the environmental situation (integrated measures).

Terms and conditions of the finance are as follows:

1) Grant: Non-repayable, interest free grant, with handling fee charged by the agent bank.
2) Credit: The grant is combined with a credit component extended by the participating bank to cover the remaining part of the investment cost.
3) Conditions of credit portion:
   1 Interest: At the lower end of the market.
   2 Duration: 3 to 5 years.
   3 Grace Period: 12 months.
   4 Self-financing: Contribution from the client from its resources.

Eligible clients are:

1 Public sector companies
2 Companies In need to improve environmental protection,
3 Companies with an appropriate credit standing, and
4 Companies with distinct chances for a longer-term economic sustainability of their activities
5 Companies in the public utilities sector are considered on a case-by-case basis

Grant for study and expert component (Accompanying Measures)

This scheme is intended to finance the following activities:

1 Subequatorial pre-screening (project identification),
2 Studies to prepare or review anti-pollution projects envisaged to be presented for support under the above facility, including assessments of the active plant with regard to environmental protection,
3 Consultants and additional expert services.

Agency: Egyptian Environmental Affairs Agency (EEAA) through the services of Industrial Compliance Unit of EEAA and the Coordinating Consultant involved in the pre-screening, identification and preparation phases of projects and project studies.

Consultant: Coordinating Consultant for pre-screening, evaluation of projects, environmental assessments, assistance to EEAA with the facility.

7.10.5 Compliance and Enforcement Program

The inspection of more than 50% of a total of 200 industrial facilities with capital investment exceeding L.E. 2 million was completed since March 1st, 1998.

Joint teams representing EEAA, Ministry of Manpower and Public Works, and Water Resources undertook the inspection.

An additional 400 factories will be inspected during 1999.

Inspection reports are shared with other industries. In addition, follow up on the implementation of environmental interventions is conducted.

8.0 WASTEWATER SURVAY AND DESIGN FOR W. W. T.

8.0 WASTEWATER SURVEY and DESIGN for W.W.T.

The Conceptual design, basic design for W.W.T. demonstration plant (hereinafter demo-plant) was carried out based on the industrial wastewater survey.

The EGYPTIAN IRON and STEEL CO. (EIS) was selected preliminary as the demonstration plant factory. However, the construction of Demonstration plant (Phase 2) was suspended due to insufficient funds allocated in the Japanese budget as well as other reasons related to the basic design.

In the meetings between the Egyptian side and the Study Team, contents of survey were revised as Fig. 8-1 shown on next page.

(1) Industrial Wastewater Survey

Hearing of factory outline and industrial wastewater survey was carried out about the following 5 candidate factories;

1) Delta Steel Mill Co. (DSM)
2) Egyptian Ferroalloys Co. (EF)
3) El Nasr Co. for Steel Pipes and Fittings (NSP)
4) Mansoura Co. for Resins and Chemicals (MRC)
5) Egyptian Iron and Steel Co. (EIS)

The main survey item are as follows;

(a) Visit each factory and collect various available information
(b) Survey of wastewater sources, wastewater treatment plants
(c) Wastewater Survey (Flow rate, qualities, obtain samples)

(2) Conceptual Design

The conceptual design of wastewater treatment plant for selected wastewater in 5 factories was carried out based on the results of the factory survey. The conceptual design included the following:

1) Planning of treating System for W.W.T.
2) Design of major equipment
3) Develop Plot Plan.
4) Construction Cost, etc.

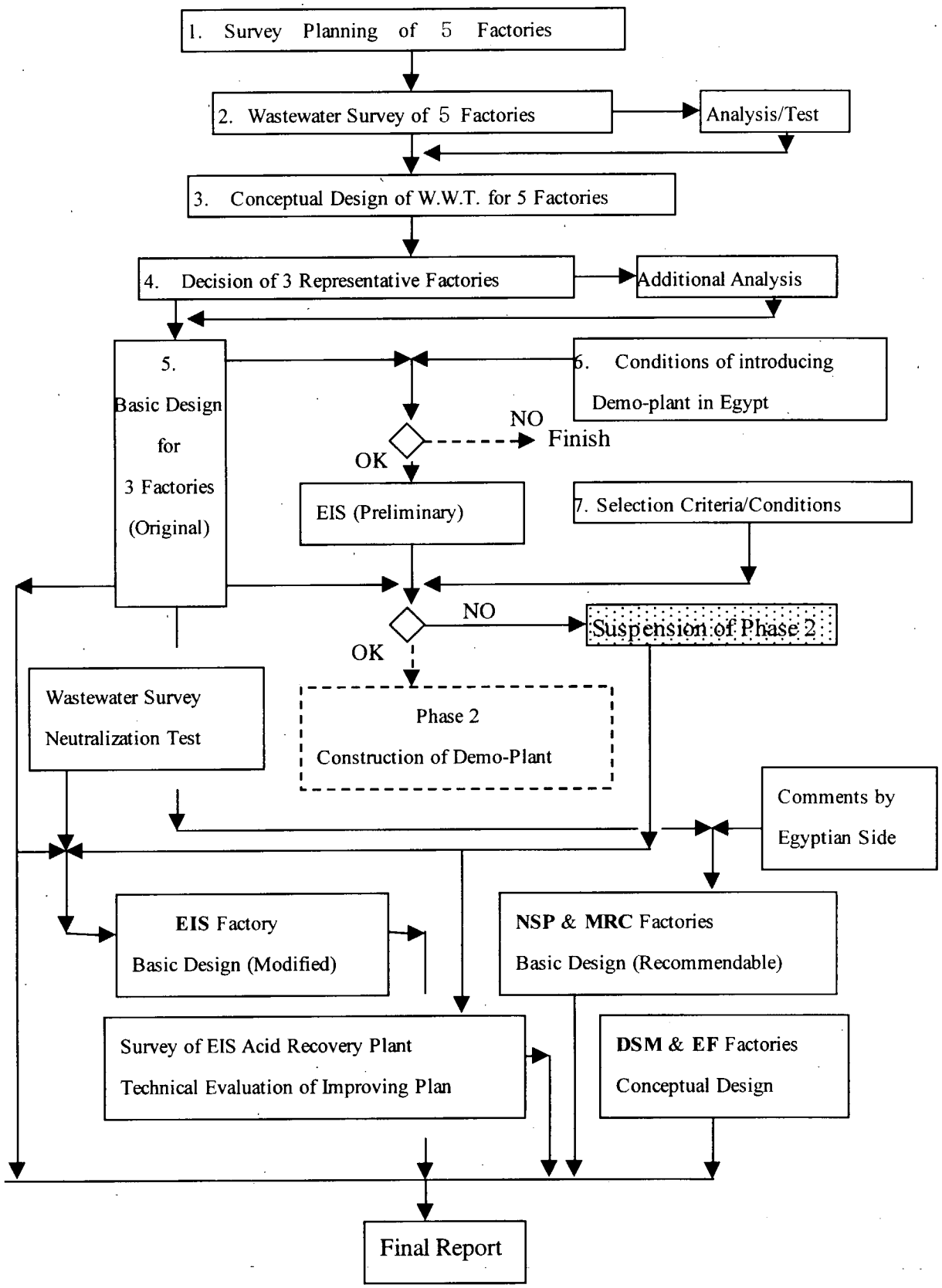


Fig. 8-1 Flow of Survey and Design (Phase 1)

(3) Selection of 3 Representative Factories

Based on the survey results and the conceptual designs of the 5 candidate factories, 3 representative factories were selected by evaluating the applicability of the selection criteria as specified on the minutes of meeting (June 2. 1999).

[Selection Criteria for 3 representative factories]

The selection criteria for the three representative factories were aimed at selecting factories that meet the following conditions:

1) Factories that are in need of improvement in their anti-pollution measure;
2) Factories that are typical so that the recommended wastewater treatment systems can be expected to be diffused to other factories in Egypt;
3) Factories that are Interested in designing and upgrading their wastewater management;
4) Factories that are financially able (either self-financing or other financial resources) to adept the recommendations of the appropriate wastewater treatment systems;
5) Factories in which similar projects by other donors are not under way;

As a result of the study, JICA Study Team selected preliminarily the following three Factories as the representative factories. These factories were then formally confirmed as the representative factories during the meeting with the Steering Committee.

In the detail selection study, the study team prepared its owns selection criteria of 71 item, grouped in 13 categories. The study team then evaluated and selected the factories using the criteria shown in the attached tables;

Attached Table 8.3-1 Comparison of Representative Factories
Attached Table 8.3-1(1/4)-(4/4) Evaluation Table

Based on the evaluation, the selected three representative factories were as follows;

El Nasr Co. for Steel Pipes and Fittings (NSP)
Mansoura Co. for Resins and Chemicals (MRC)
Egyptian Iron and Steel Co. (EIS)

(4) Basic Design

The basic design for the 3 representative factories was developed based on the conceptual design and the additional wastewater analysis.

The basic design included the following:

1) Process Flow Diagram
2) Engineering Flow Diagram
3) Layout
4) Skeleton Drawing of Major Equipment
5) Equipment List, Instrument List, Motor List
6) Single Line Diagram for Motor Control Board
7) Plant Construction Cost, Running Cost, etc.

(5) Possibility of Introducing Demonstration Plant

The possibility of introduction a demonstration plan in Egypt was studied based on the selection criteria. And, it was agreed mutually on the meeting that a demonstration plant for wastewater treatment could be able to introduce in one of three representative factories.

[Selection Criteria for Demonstration Factory by SW]

1) The cost for Demo-Plant will not exceed JICA's budgetary limitations;
2) The system doesn't produce sludge containing toxic substances which can not be treated properly.
3) The Demonstration Factory will prepare a sufficient and appropriate site for installation of Demo-Plant;
4) The demonstration Factory, with support of its holding company, will bear the local costs necessary for the installation and operation of the Demo-Plant.

[Selection Criteria for Demonstration Factory by the Study Team]

The Study Team prepared its own selection criteria for the demonstration plant factory. The major points are as follows;

(a) Products of Basic Design
(b) Operation and maintenance
(c) Wastewater management

(d) Effectiveness of demonstration

(e) Location of construction site

(f) Convenience of traffic, etc.

(6) Abandonment of Implementation of Demonstration Plant

EIS Factory was selected preliminarily as the demonstration factory based on the results of basic design and the above selection criteria.

However, it was found by the detail basic that the implementation of the demonstration plant was impossible due to lack of sufficient funds in JICA's budget, so that Phase 2 was abandoned unwillingly.

The Egyptian Side hoped eagerly to implement the demonstration plant in EIS. But, after several meetings, the Egyptian Side agreed reluctantly not to implement the demonstration plant in Egypt.

As a result, it was decided that this project would be completed at the end of Phase 1 (completion of the basic design).

(7) Contents of Revised Study

Based on the original plan of this Project, and since the implementation of a demonstration plant was canceled, the Study Team would not perform the detail design of the plant. As an alternative, the Study Team would prepare a proposal for the environmental policy and would hold a seminar for technical transfer.

However, and during a meeting between the Japanese and Egyptian delegates, the Egyptian Side strongly requested to the Study Team that the project be modified as follows (the Study Team agreed):

1) The seminar for technical transfer was cancelled
2) The detail designs for the wastewater treatment plant for 3 representative factories including EIS were not needed. Concerning to the basic design of EIS, it should be executed under the condition that the existing SSAR facility should be improved (so called the modified basic design).
3) The field survey for the existing spent sulfuric acid recovery (SSAR) facility should be executed.
4) The study and review for the improvement plan of the existing SSAR facility should be executed.

(8) Modified Basic Design for EIS

In order to design the suitable wastewater treatment plant for EIS, the wastewater survey around the pickling plant facility was carried out. In the survey, the exact flow rate, water qualities and operation status were confirmed, and it was revealed that leakage acid water should be treated in addition to the rinsing water.

Therefore, 2 basic case designs were carried out, one is the original basic design and the other is the modified basic design.

(9) Compilation of Design Documents

The design documents prepared in this Project were compiled as follows:

1) Delta Steel Mill Co.
   - Conceptual design package (with the calculation sheet)

2) Egyptian Ferroalloys Co.
   - Conceptual design package (with the calculation sheet)

3) El Nasr Co. for Steel Pipes and Fittings
   - Conceptual design package
   - Basic design package (with the study report/calculation sheet)

4) Mansoura Co. for Resins and Chemicals
   - Conceptual design package (with the calculation sheet)
   - Basic design package (with the study report/calculation sheet)

5) Egyptian Iron and Steel Co.
   - Conceptual design package (with the calculation sheet)
   - Basic design package (original) with the study report/calculation sheet
   - Basic design package (modified) with the study report/calculation sheet

9.0 DETAIL OF FACTORY SURVEY AND DESIGN FOR W.W.T.

9. Detail of Factory Survey and Design for W.W.T.

In this section, the results of factory survey and the design of wastewater treatment plant for 5 candidate factories are described. The design document for each factory was compiled in the factory survey reports and the attached design packages.

9.1 DELTA STEEL MILL CO. (DSM)

9.1.1. Factory Survey

(1) Factory Profile

1) Address: 18-Emad el-Deen St. Cairo
2) Type of Industry: Metallurgical Industries
3) Type of Operation: Government Owned
4) Capital Amount: 35 million Egyptian Pound (LE)
5) Total Sales Amount: 156 million LE
6) Gross Profit before Tax: 475,000 LE
7) No of Employees: 2,500
8) Main Products: Steel Bars, Steel Sections, Drawn Wires, Wire Meshes
St & CI Casting, Sanitary Pipes
9) Factory (Structure) Area: 336,000 m^2 (120,000 m^2)
10) Holding Company: HCMI (Holding Company for Metallurgical Industries)

(2) Environmental Impact

There are two adverse environmental consequences to the process and equipment situations at this factory:

1) Air pollution is occurring due to the dust exhaust gas emanating from both EA furnaces. We understand that the dust collection system of both EA furnaces does not work and consequently, dust is discharged directly to the environment.
2) Water pollution is also occurring due to the relatively large amount of leaked oil from the rolling mill process. In our opinion, the function of the existing oil and suspended solids (SS) separation units is inadequate to address this issue.

(3) Industrial Wastewater at Present

The factory survey was carried out in September 1999. The major results of the survey are as follows:

1) Industrial Water Supply

(a) 700 m^3/h of water is obtained mainly from the branch canal of River Nile is used for process cooling water and partly from recycled washing water after treatment to remove suspended solids.

(b) 200 m^3/h of city water is also used for sanitation/domestic water and make-up water of cooling water in the factory.

(c) Intake water fee is about 50,000 LE.

2) Existing Wastewater Treatment Facility

Refer to the attached Design Drawings DWG NO. DS-CD-15-01

(a) Wastewater is discharged to the Mostorod drainage canal and sanitary wastewater is discharged to the public sewage, respectively.

(b) The canal is extremely polluted by the wastewater discharged in the canal by several factories located in the vicinity of Delta Steel Mills.

(c) The major wastewater treating units consist of a Neutralization Unit (for acid pickling wastewater) and a simple type Oil Separator. It seems that the operation and maintenance of the treating units are inadequate, for example the removal of floating oil in the oil separator appears incomplete.

(d) The cooling water from Electrical Arc Furnaces No.5 (625m^3/h) and No.6 (625m^3/h) is reused in the cooling towers.

(e) In our opinion, the production plants and water / wastewater systems are superannuated and those are not always in suitable operation and maintenance conditions.

3) Taxation to water

(a) Unit tax of wastewater discharged to the public sewer = 0.36 LE/m^3

(b) Total monthly tax of wastewater in the factory=168,000 LE

(4) Wastewater Survey

1) No. of Sampling Locations: 5 points

2) Duration: 1 day (24 hours), every 6 hours x 4 times

3) Field measurement:

(a) Flow Rate is measured by a propeller type flow meter.

(b) Water qualities: Measurement in the field was made for the following parameters: pH. Electrical conductivity, Turbidity, Salt contents, and water temperature. Also, COD_{Mn} was performed by the conventional pack test.

(c) Laboratory Analysis:

At each sampling location (except No.6), a water sample was obtained every 6 hours during a 24-hour period. The four samples from each location were mixed to obtain a composite sample for further laboratory analyses.

The laboratory analysis included the following 10 major items (including CODcr) specified by the Egyptian Regulation.

[pH, BOD, CODcr, TDS, SS, S^{2-}, Oil & Grease, PO_4^{3-}, N, Phenol]

The results of water analysis are presented in the following attached table:

Attached Table 9.1-1 「Wastewater Qualities Analysis Data」

9.1.2 Conceptual design

(1) Wastewater Flow Rate and Water Qualities

The wastewater from the air supply facility was selected as a candidate wastewater for treatment in the demonstration plant (Candidate). Wastewater flow rate and water qualities are shown on the following table and the existing wastewater sewer system is shown on the attached drawing:

Attached Drawing 9.1-1 DWG NO. DS-CD-15-01

「SCHEMATIC DIADRAM OF WASTE WATER FLOW」

Table 9.1-1 Wastewater Flow Rate and Water Qualities

Item	Design		
	Wastewater from the air Supply Facility		Egyptian Regulation
Flow rate [m^3/h]	Max 120		-
Water Qualities	Raw Water	Treated Water	-
p H [mg/l]	6-7	6-9	6?9
COD [mg/l]	30	15	30
BOD [mg/l]	20	10	20
Suspended Solids[mg/l]	200	2	30
Oil and Grease [mg/l]	1,000	5	5

The quality of the treated water meets to the wastewater discharge regulation in Egypt (Law No. 84/82 Underground Reservoir & Nile Branches/Canals). Also, the treated wastewater can be reused.

Refer to the attached table.

Attached Table 9-1 Wastewater Discharge Regulations in Egypt

(2) Wastewater Treatment System

The wastewater treatment system consists of the following units (Refer to the attached drawings:)

Drawing 9.1-2 DWG. NO. DS-CD-15-01 BLOCK FLOW DIAGRAM OF W.W.T.

Drawing 9.1.3 DWG. NO. DS-CD-15-03 CONCEPTUAL DESIGN OF W.W.T.)

1) Pre-treatment Unit

(a) Equalization Pond

The pond is provided to equalize wastewater quantity and quality through air bubbling. As a result, wastewater can be treated steadily.

(b) API Type Oil Separator

- Oil contained in the wastewater is separated by gravity in the basin designed using the API (American Petroleum Institute) design manual.
- The floated oil is skimmed and reused as fuel in the factory after removing the water completely.
- The separator unit consists of an oil separator basin (RC: Reinforced concrete), recovered oil tank (CS: Carbon steel) and pumps.

2) Primary Treatment

[Clarifier (Flocculation/Sedimentation) Unit]

- Suspended solids (SS) and a portion of oil, color and some metals are removed in this unit.
- Chemicals such as an alum, polymer are injected in the water and mixed. After coagulation /flocculation, the flocs containing SS are settled in the sedimentation tank.
- As a result, the supernatant of the sedimentation tank will be clear, and flocs contained SS settles on the bottom of sedimentation tank.
- Sludge accumulated on the bottom is discharged to the dewatering unit automatically, periodically.
- The Clarifier Unit consists of a coagulation/flocculation tank (CS with epoxy coating), a sedimentation tank (CS with epoxy coating), and a chemical dosing unit (tanks with mixers and pumps).

3) Advanced Treatment

[Rapid Sand Filter]

- The remaining SS in the supernatant of the sedimentation tank is removed completely by rapid sand filters.
- The filter is a vertical, cylindrical, gravity type filter, in which both sands and anthracites are filled up as filter media.
- The filter is backwashed with air and water automatically, periodically (once a day normally).
- The sand filter unit consists of two filters (CS with epoxy coating) and backwashing unit (pumps, blowers, water basins)

4) Sludge Treatment Unit

- Sludge containing SS is produced in the flocculation/sedimentation unit and the filter unit.
- SS contents of sludge is too low (approximately 0.5-2%), so that a thickening and dehydrating process is used to condense density and decrease sludge volume.
- Supernatant of the thickener and separated water by the centrifuge are returned to the equalization

pond for re-treatment.

- The sludge treatment unit consists of a sludge thickener with a sludge rake, a centrifuge and a chemical dosing unit (tanks with mixers, pumps).

5) Disposal of Sludge

- Pollutants in the wastewater are finally discharged from the centrifuge as a sludge cake. Wastewater in DSM factory may not contain any harmful materials such as heavy metals and organic chlorine compounds; therefore dewatered sludge cake can be dumped in a specified site in the near desert under management supervision.

(3) Plot Plan

Location of the demonstration plant (Candidate) was selected in the Southwest part of the factory.

Refer to the following drawing:

Attached drawing 9.1-4 DWG NO. DS-CD-12-01

CONCEPTUAL DESIGN OF W.W.T. DEMONSTRATION PLANT

Approximate required area is 30m x 52m (1,560m^2).

(4) Estimated Cost of Demonstration Plant (Candidate)

The estimated cost of the wastewater treatment demonstration plant (Candidate) at Delta Steel Mill Co. is shown below, along with the cost share allocation between Japan (yen) and Egypt (LE).

Table 9.1-2 Estimated Cost of Demonstration Plant (Candidate)

Item	Paid in Japan (1000yen)	Paid in Egypt	
		Egyptian (1000 LE)	Japanese (1000 yen)
1. Equipment, Instrument			
(1) Machinery	101,030		
(2) Electrical, Instrumentation	49,224		
(3) Packing and Ocean Freight	28,800		
Subtotal	179,054		
2. Field Work			
(1) Civil Work		1,114	
(2) Installation, Piping, Painting		812	
(3) Electrical & Instrumentation		660	
(4) Test Run Operation		7	
Subtotal		2,593	88,150
3. Indirect Cost			
(1) Construction Expenses		648	22,040
(2) Cost associated with Supervision		294	10,000
Total	299,210,000 Japanese yen		

Note 1. Exchange Rate 1 Egyptian Pound (LE) =34 yen

2. Indirect Contractor Cost = Direct Cost x 0.25
3. Cost of Supervision by Japanese Consultant is not included in the above estimate.
4. Cost of establishing local registration of the Japanese Consulting Company is not included in the above estimate. Local tax, if any, on this Company is not included above.

(5) Construction schedule

The overall standard schedule for implementation of the demonstration plant is shown on the attached table.

Attached Table 9-2 Overall Schedule for Implementation of demonstration Plant (Preliminary)

(6) Recommendation for Improvement of Wastewater Treatment

1) Improvement of the existing oil separator / sedimentation basins

The floating oil and settled sludge in the existing oil separator / sedimentation basins should be removed manually. The recovered oil can be used as fuel.

2) Routine maintenance work of W.W.T. Operation

(a) Routine maintenance work is very important, not only to observe the instruments but also the appearance of both raw water and treated water.

Appearance includes color, turbidity/cleanness, odor, floated matters and scum, etc.

(b) If an abnormal appearance is found, a suitable countermeasure should be taken as soon as possible.

3) Spare parts and Maintenance

The flow indicators and pressure gages around pumps should be always equipped as design, and be always maintained to work as intended.

4) The electrodes of pH meters should be cleaned and calibrated once a week.

5) In order to improve the discharge water quality to Mostorod Drainage Canal, it may be possible to reuse the industrial water and thus reduce discharge water quantity. The following wastewater treatment units are required to achieve this objective:

(a) API Type oil separator
(b) Clarifier (Flocculation/Sedimentation) Unit
(c) Sand Filter
(d) Softener (which remove hardness)

6) Note:

The drawings of wastewater pollution improvement plan had been prepared by EGITALEC Co. in Cairo that joined additionally as a counterpart for this study.

The major treating units of the plan are 1st, 2nd sedimentation basins with dewatering unit and rapid filtration of approx. 10 filters. We were informed that the estimated cost is approx. 10 million LE.

(7) Recommendations for Improvement of Process

The following items are recommendations for simple improvement of the onsite facility and utility facility.

1) Execution of proper maintenance works
2) Countermeasure of dust collection from EA furnaces
3) Countermeasure of air pollution
4) Cleaning around the equipment, proper arrangement of raw materials, products, equipment and tools, etc. in the whole factory.
5) Installation of oil sump pits for leakage oil and collection of oil layer in pits
6) Save water consumption and reduction of pollutant load.

(8) Conclusion

This factory has been in operation for a long time and almost all of its facilities are old except some area. From the environmental and productive points of view, maintenance activities, systems for production equipment and environmental protection equipment are quite important for factory operation and those are required urgently, not only for pollution prevention but also for increasing productivity.

9.2 EGYPTIAN FERROALLOYS CO. (EF)

9.2.1 Factory Survey

(1) Factory Profile

1) Address of Headquarter: 33 Kasr El Nil St. Cairo
Factory: City of Edfu

2) Foundation: Middle of 1970s
Ferro-Silica was built in 1986.

3) Type of Industry: Metallurgical Industries

4) Type of Operation: Government operated

5) Holding Company: Holding Company for Metallurgical Industries (HCMI)

6) Capital Amount: 100 million Egyptian Pound (LE)

7) Total Sales Amount: 130 million LE

8) Gross Profit before Tax: 10 million LE

9) No. of Employees: 1570

10) Main Products: Ferro-Silica (50,000 ton/year)
Silica-Fume as by-product (15,000-18,000 ton/year)

11) Factory (Structure) Area: 149,000 (45,000) m^2

(2) Environmental Impact at Present

1) Water Pollution

(a) Oil spill is found in the wastewater from the transformer yard.

(b) A large amount of river water is taken from River Nile and discharged back in the river because of a lack of a cooling water facility.

(c) The washing facility of crushed quartz was not in operation during the survey. Therefore, no sampling or any observations of the wastewater with suspended solids were made.

(d) The discharged water (out of End of Pipe) to the Nile appeared very clear.

2) Air pollution

(a) Although the existing filters are reducing the dust concentration, the concentration of dust in the released gases is still slightly higher than that required by the regulation.

(b) Due to Operation conditions at the existing OTEAF, the temperature of the exhaust gas can sometimes exceed the safe limit of the dust bag house (160℃). Direct discharge of exhaust fume can therefore occur without filtering.

(c) Material handling in the open storage yards is causing uncontrolled emissions to the environment.

3) Impact on Personnel Safety

The workers at the open-top EA furnaces are exposed to hazardous open flames and extremely high ambient temperature. The factory is following some safety precautions to minimize the adverse impact on its personnel health. However, a detailed and serious evaluation of the ambient environment to the workers around the furnaces is a very urgent task at this factory. The objective of this evaluation would be to implement stringent working procedures around the furnaces to protect the workers from both short-term and long-term effects.

(3) Wastewater Survey

The industrial wastewater survey was carried out on September 22nd, 23rd 1999.

The outline results are as follows:

1) Industrial Water Supply

Water source: Nile River

2) Quantity of Intake Water

1,900 m^3/hour (including 1,450 m^3/h of cooling water)

16,32 million m^3/year

3) Existing Wastewater Treatment System

The existing wastewater sewer systems and treating units are shown on the attached drawing:

Drawing 9.2- 1 DWG. NO. EF-CD-15-01

SCHEMATIC DIAGRAM FOR WASTE WATER FLOW

(a) Cooling water from EA furnaces (1,450 m^3/h):

The cooling water of No.1 and No.2 furnaces is discharged to River Nile directly.

And the cooling water of No.3 and No.4 furnaces is recycled through the cooling towers and filters.

(b) The wastewater from the transformer yard (60 m^3/h), the quartz crush facility (200 m^3/h), air facility and workshop (190 m^3/h) are collected and recycled.

(c) The water for the domestic use is used Nile River water after treatment in the drinking water treatment unit. The domestic wastewater is discharged to a sludge bed to either evaporate or penetrate in the ground.

4) Taxation of wastewater

(a) Unit tax of wastewater to River Nile = 0.0025 LE

(b) Total annual tax = 22,500 LE

(3) Wastewater Survey

1) No. of Sampling Location: 8 points

The quartz crush plant was not working during our survey; therefore only 7 samples were taken.

2) Duration: 1 day (24 hours), every 6 hours x 4 times

3) Field measurement:

(a) Flow rate was measured by a propeller type flow meter

(b) Water qualities: Field measurements were made for pH, Electrical conductivity, Turbidity, Salt contents, and Water Temperature. In addition, COD_{Mn} was performed by pack test

4) Laboratory Analysis:

At each sampling location (except No. C), a water sample was obtained every 6 hours during a 24-hour period. Then, the four samples from each location were mixed to form a composite sample before further analysis.

The items of water quality analysis are the following14 items (including CODcr) specified by the Egyptian Regulation.

[pH, BOD, CODcr, TDS, SS, Oil & Grease, PO_4^{-3}, N, NO_3, NO_2, NH_3, SiO_2, T.H.M, T-Alk]

The results of water analysis is referred to the following attached table:

Attached Table 9.2-1 Wastewater Qualities Analysis Data

9.2.2 Conceptual Design

(1) Wastewater Flow Rate and Water Qualities

The wastewater from the air supply facility was selected as a candidate wastewater to treat by a demonstration plant. Wastewater flow rate and water qualities are shown on the following table 9.2-1 and the existing wastewater sewer system are shown on the attached drawing;

Attached Drawing 9.2-1 SCHEMATIC DAIGRAM FOR WASTE WATER FLOW

The treated water quality can be reused, and it meets to the wastewater discharge regulation in Egypt (Law No.82/84 Underground Reservoir & Nile Branches/Canals) that is the most stringent regulation in Egypt.

Attached Table 9-1 Wastewater Discharge Regulation in Egypt

Table 9.2-1 Wastewater Flow Rate and Water Qualities

Item		Design		
Wastewater		Wastewater from Transformer Fac., Quartz Crush Fac. Air Supply Fac. and Work Shop		Regulation in Egypt Law48/82
Flow rate	[m^3/h]	Max. 260		-
Water Qualities		Raw Water	Treated Water	-
pH	[mg/l]	6.5-8	7-8	6-9
COD	[mg/l]	3-30	<30	30
BOD	[mg/l]	<5	<5	20
Suspended Solids	[mg/l]	30-700	10	30
Oil & Grease	[mg/l]	0-20	<2	5
SiO_2	[mg/l]	30	<10	-
Water Temperature	[℃]	20-35	20-35	<35

Note: The regulation values shows for Underground Reservoir & Nile Branches/Canals.

(2) Wastewater Treatment System

The wastewater treatment system for the demonstration plant (Candidate) consists of the following simple units because of low level of pollutants.

Referred to the attached drawing:

Attached Drawing 9.2-2 DWG NO. EF-CD-15-03

「SCHEMATIC FLOW DIAGRAM FOR W.W.T. DEMONSTRATION PLANT」

1) Equalization Pond

The pond is provided to equalize wastewater quantity and quality through air bubbling. As a result, wastewater can be treated steadily.

2) Flocculation / Sedimentation Unit

- In order to remove suspended solids (SS) and a portion of oil, a flocculation / sedimentation unit is supplied.
- Chemicals such as an alum, polymer are injected in the wastewater and mixed. After coagulation / flocculation, the flocs containing SS are settled in the sedimentation basin tank.
- As a result, the supernatant will be clear, and flocs containing SS will form a condensed sludge on the bottom of the tank.
- The flocculation / sedimentation unit consists of a coagulation / flocculation tank, a sedimentation tank and a chemical dosing unit (tanks with mixers and pumps).

3) Rapid Sand Filter

- The remaining SS in the supernatant of the sedimentation tank is removed completely by a rapid sand filter.

- The filter is vertical, cylindrical, gravity type filter, in which sands and anthracites are filled up as filter media.
- The filter is backwashed with air and water automatically, periodically (once a day normally).
- The sand filter unit consists of 4 sets of filters (CS with epoxy coating) and backwashing unit (pumps, blowers and water basins).

4) Sludge Treatment Unit

- Sludge containing SS is produced in the sedimentation tank and the filters.
- SS concentration of sludge is too low (approx. 0.5-2%), so that a thickening and dehydrating process is used to condense density and to decrease sludge volume.
- The sludge treatment unit consists of a sludge thickener (CS with epoxy coating), a centrifugal machine and a chemical dosing unit (tanks with mixers and pumps).

(3) Plot Plan

Refer to the following drawing:

Attached drawing 9.2-3 DWG No. EF-CD-12-02

PLOT PLAN FOR CONCEPTUAL DESIGN OF W.W.T. DEMONSTRATION PLANT

The approximate required area for the demonstration plant (Candidate) is 40m x 42m ($1,680 m^2$).

(4) Estimated Cost of Demonstration Plant

The estimated cost of the wastewater treatment demonstration plant (Candidate) at Egyptian Ferroalloys Co. is shown on below, along with the cost share allocation between Japan (yen-portion) and Egypt (LE-portion).

Table 9.2-2 Estimated Cost of Demonstration Plant

Item	Paid in Japan (1000 yen)	Paid in Egypt	
		Egyptian (1000 LE)	Japanese (1000 yen)
1. Equipment, Instrument			
(1) Machinery	105,000		
(2) Electrical, Instrument	57,100		
(3) Packing, Ocean Freight	22,400		
Subtotal	184,800		
2. Field Works			
(1) Civil Works		1,608	
(2) Installation, Piping, Painting		1,134	
(3) Electrical, Instrumentation		536	
(4) Test Run Operation		6	
Subtotal		3,284	111,670
3. Indirect Cost			
(1) Construction Expenses		821	27,920
(2) Cost associated with Supervision		294	10,000
Total	334,390,000 as Japanese yen		

Note 1. Exchange Rate: 1 Egyptian Pound (LE) =34 yen

2. Indirect Contractor Cost = Direct Cost x 0.25

3. Cost of Supervision by Japanese Consultant is not included in the above estimate.

4. Cost of establishing local registration of the Japanese Consulting Company is not included in the above estimate. Local tax, if any, on this Company is not included above.

(5) Construction Schedule

The overall standard schedule for implementation of the demonstration plant is shown on the attached table:

Attached Table 9-2 Overall Schedule for Implementation of Demonstration Plant (Preliminary)

(6) Recommendations for Improvement of Wastewater Treatment

1) Before countermeasure of oil spill from the transformer yard, it is recommended to survey the causes of contamination of oil.

2) The wastewater from the transformer yard should be separated from other wastewater streams (i.e., from the air supply facility, the quartz crush facility, and the workshop).
Also, oil should be removed using an oil separator in the first place.

3) In order to reduce water consumption (intake and discharging water), the cooling water of No.1 & No.2 EA furnaces should be recycled by means of installation of the cooling towers.

4) The segregation system of wastewater sewers should be studied considering each wastewater qualities.

(7) Recommendation for Improvement of Process Units

1) Production Process

(a) It is recommended to implement countermeasure to minimize the dispersion of silica dust.

(b) It is also recommended to implement countermeasures to minimize the high exhaust gases temperature.

2) Utility Facility

(a) It is recommended to provide oil sump pits for leakage oil from the cooling water pumps.

(b) It is also recommended to survey the causes of oil leakage in the various places and to provide countermeasure for the leakage.

(c) A study should be performed to reduce the intake water from the Nile River. It saves not only intake water quantity but also energy consumption in the factory.

9.3 EL NASR CO. for STEEL PIPES and FITTINGS (NSP)

9.3.1 Factory Survey

(1) Factory Profile

1) Address: Ain Helwan, Box 6, Helwan

2) Type of Industry: Metallurgical Industries

3) Type of Operation: Government Owned
(in privatization)

4) Capital Amount: 90 million Egyptian Pound (LE)

5) Total Annual Sales Amount: 172 million LE

6) Gross Profile before Tax: 2.2 million LE

7) No. of Employees: 2,632

8) Main Products:

Longitudinally Welded Pipes (0.5"－4":black and galvanized steel),

Spirally Welded pipes (6"－60"), Fittings (0.5"－4"), Epoxy Coating

9) Factory (Structure) Area: 570,000 (270,000) m^2

10) Holding Company: Holding Company for Metallurgical Industries (HCMI)

(2) Environmental Impact

The factory is located in Helwan Industrial District. The industrial wastewater is discharged to the public sewer since the wastewater discharge regulations are not very strict. As a consequence, the existing wastewater treatment facilities are hardly managed, and the following observations can be made:

1) Oil spill in the wastewater is discharged to the public sewer without suitable removal.

2) The acid wastewater including flux is discharged to the public sewer without complete neutralization.

(3) Industrial Wastewater Situation at Present

The industrial wastewater survey at this factory was performed in the period from September 8th to 13th, 1999. Water sampling and flow measurement were performed on September 11th and 12th, 1999.

1) Water Sources

(a) Industrial water is supplied by Helwan Water Works. The daily water consumption is 3,900m^3/d.

(b) Approximately 40% of the whole industrial water is recycled.

(c) Unit price of industrial water is 0.6 LE.

The industrial water cost is 2,340 LE daily and 854,100 LE annual.

2) The existing Wastewater Treatment facility

Refer to the attached drawing.

Attached Drawing 9.3-1 DWG NO. ST-CD-15-01

「SCHEMATIC DIAGRAM OF EXISTING WASTEWATER FLOW」

The major wastewater flows are as follows;

(a) The acid wastewater from the pickling plant (used HCl) is discharged to the public sewer after neutralization.

(b) The cooling water is treated to remove some scales in the scale pit. The water then flows into the oil separator. In the oil separator, floating oil in the wastewater is removed by gravity.

The treated water of the oil separator flows to the cooling towers and this water is recycled back to the factory after cooling.

The skimmed oily water of the oil separator is discharged to the public sewer.

(c) The wastewater including sanitary from the foundry factory is discharged to the public sewer through a simple sedimentation pit. The treatment in this pit is limited to some scum and sludge removal.

(4) Wastewater Survey

1) No. of Sampling Location: 5

2) Duration: 1day (24hours), every 6 hours x 4 times

3) Field measurement:

(a) Flow rate is measured by a propeller-type flow meter.

(b) Water qualities: Field measurements were made for pH, Electrical Conductivity, Turbidity, Salt contents. COD_{Mn} was analyzed using by a conventional pack test.

4) Laboratory Test:

At each sampling location, a water sample was obtained every 6 hours during 24-hour period. Then, the four samples from each location were mixed to form a composite sample before further analysis is done.

The items of water quality analysis are the following 16items (including CODcr) specified by the Egyptian Regulation.

[pH, BOD, CODcr, TDS, SS, S^{2-}, Oil & Grease, PO_4^{3-}, N, F, T.H.M., Pb, Cd, As, Cu, Zn, MPN]

The results of water analysis is referred to the following attached table:

Attached Table 9.3-1 「Wastewater Qualities Analysis Data」

9.3.2 Conceptual Design

(1) Wastewater to be treated

The existing wastewater sewer system is shown on the attached drawing;

Attached Drawing 9.3-1 [SCHEMATIC DIAGRAM OF EXISTING WASTE WATER FLOW]

The followings were selected as the wastewater to be treated by a demonstration plant (Candidate).

1) Acid wastewater neutralized by the existing neutralization facility

2) Skimmed oily water of the oil separator

(2) Wastewater Flow Rate and Quality

The wastewater flow rate and water qualities are shown on the following table;

The treated water can be reused. The treated water also meets the wastewater discharge regulation in Egypt (Law No.84/82 Underground Reservoir & Nile Branches/Canals).

Table 9.3-1 Wastewater Flow Rate and Water Qualities

Item	Design			
Wastewater	Skimmed oily water of oil separator	Neutralized acid water of Neutralization	Treated Water	Regulation in Egypt Law48/82
Flow Rate [m^3/h]	Max. 30	Max. 70	100	-
Water Qualities				-
pH [−]	7-8	6.5-8	6.5-8.5	6-9
COD [mg/l]	194	200	30	30
BOD [mg/l]	90	100	20	20
SS [mg/l]	174	200	20	30
Oil & Grease [mg/l]	6,985	5	1	5
Pb [mg/l]	0.03	<0.05	<0.05	-
Zn [mg/l]	Nil	27	<1	1
Water Temp. [℃]	27.9	27	20-35	<35

Note: The regulation value shows the most stringent regulation in Egypt (Underground Reservoir & Nile Branches/Canals).

(3) Wastewater Treatment System

The wastewater treatment system consists of the following units: (Refer the attached drawings:

Attached Drawing 9.3-2 DWG NO. ST-CD-15-03

「BLOCK FLOW DIAGRAM OF W.W.T. DEMONSTRATION PLANT」

Attached Drawing 9.3-3 DWG. NO. ST-CD-15-04

「CONCEPTUAL DESIGN FOR SCHEMATIC DIAGRAM OF WASTE WATER」

1) Pre-treatment

(a) Oil Separator

· Floating oil in the skimmed oily water from the existing oil separator is removed by gravity.

· The oil separator will be designed based on the API (American Petroleum Institute) standard manual.

(b) Equalization Tank

· Two different wastewater of flow and qualities are stored in the equalization tank, and equalized by air bubbling in it.

· As a result, wastewater can be treated steadily.

· The equalizing unit consists of a equalization tank (CS with epoxy lining), blowers and an air distributing piping).

2) Primary treatment

[Chemical Clarifier (Flocculation/Sedimentation) Unit]

· In order to remove suspended solids and oil spill in wastewater, a chemical clarifier is applied.

· Coagulant chemicals (such as alum,polymer) are injected in the wastewater from the equalization tank.

· Flocs are formed in the process of coagulation / flocculation, and then settled on the bottom of sedimentation basin by gravity.

· The accumulated sludge on the bottom is discharged automatically, periodically (once two-hour).

· The chemical clarifier unit consists of a coagulation/ flocculation tank (CS with epoxy coating), a sedimentation basin (RC with epoxy coating) and a chemical injection unit (tanks with mixers and pumps).

3) Secondary treatment

[Activated Sludge Treatment (biological treatment) Unit]

· In order to remove organic matters in the water from the sedimentation basin, an activated sludge treatment unit is applied, which is a conventional biological treatment.

· The organic matters are oxidized and decomposed by aerobic micro bacteria in the aeration basins.

· The nutrients (nitrogen, phosphorus) are injected in the inlet of the aeration basin.

· The activated sludge treatment unit is consists of aeration basins (RC), a sedimentation basin (RC), a chemical injection unit (tanks with mixers and pumps) and an air supply unit (blowers and air distribution piping with diffusers).

4) Advanced Treatment

[Rapid Sand Filter Unit]

· In order to remove micro flocs in the treated water from the activated sludge treatment unit, a sand filter is applied.

· The filter is vertical, cylindrical, gravity type filter, in which sands and anthracite are filled up as a filter media.

· The filter is backwashed with air and water automatically, periodically (once a day normally).

· The filter unit consists of 3 sets of filters (CS with epoxy coating) and a backwashing unit (pumps, blowers and water basin).

5) Sludge Treatment Unit

- Sludge is generated from the chemical clarifier unit, the activated sludge treatment unit and the rapid sand filter unit.
- The SS contents of the sludge is rather small (0.5－2.0%). Therefore the thickening and dehydrating process must be applied to condense density and to reduce sludge volume.
- In this process, chemicals such as coagulant and filter aid are used.
- The sludge treatment unit consists of a sludge thickener (CS with epoxy coating), centrifugal machines, and a chemical injection unit (tanks with mixers and pumps).

(4) Plot Plan

Refer to the following drawing:

Attached Drawing 9.3-4 DWG NO. ST-CD-12-02

「PLOT PLAN FOR CONCEPTUAL DESIGN OF W.W.T. DEMONSTRATION PLANT」

A required area for the demonstration plant (Candidate) is approximate 40m x 40m (1,600m^2).

(5) Estimated Cost of Demonstration Plant

The estimated cost of the wastewater treatment demonstration plant (Candidate) at El Nasr Co. for Steel Pipes and Fittings is shown on below, along with the cost allocation between Japan(yen) and Egypt (LE).

Table 9.3-2 Estimated Cost of Demonstration Plant (Candidate)

Item	Paid in Japan (1000yen)	Paid in Egypt	
		Egyptian Pound (1000LE)	Japanese Yen (1000yen)
1. Equipment, Instruments			
(1) Machinery	105,000		
(2) Electrical, Instruments	78,000		
(3) Packing and Ocean Freight	24,000		
Subtotal	207,000		
2. Field Works			
(1) Civil Works		1,349	
(2) Installation, Piping, Painting		976	
(3) Electrical, Instrumentation		719	
(4) Test Run Operation		7	
Subtotal		3,051	103,740
3. Indirect Cost			
(1) Construction Expense		763	25,940
(2) Cost associated with Supervision		294	10,000
Total	346,680,000 Japanese Yen		

Note 1. Exchange Rate 1 Egyptian Pound = 34 Japanese yen

Note 2. Indirect Contractor Cost = Direct Cost x 25%

Note 3. Cost of Supervision by Japanese Consultant in not included in the above estimate.

Note 4. Cost of establishing local registration of Japanese Consulting Company is not included in the above estimate. Local tax, if any, on this Company is not included above.

(6) Construction Schedule

The overall standard schedule for implementation of the demonstration plant is shown on the attached table.

Attached Table 9-2 「Overall Schedule for Implementation of Demonstration Plant (Preliminary)」

(7) Recommendation for Improvement of Wastewater Treatment

1) Oil Separator

(a) The skimmed oily water separated from the recycling cooling water in the existing oil separator is discharged to the public sewer directly. The oil in the skimmed oily water should be recovered in the tank, then reused as fuel oil.

(b) The oil skimming is not always operating adequately; that is, a large amount of water is coming into the skimming pipes. The floating oil should be collected periodically and effectively.

(c) The level of the skimming pipes and the outlet weir should be adjusted to skim the oily layer in the basins equally.

(d) The waste oil is accumulated in the scale pit in front of the oil separator. It is recommended to install a vertical type of belt oil skimmer to remove it.

2) Neutralization Plant for Rinsing Wastewater

(a) The old instruments (pH meter, etc.) are not working properly. It is recommended to replace or repair them after maintenance, if needed.

(b) The electrodes of the pH meters should be cleaned and calibrated once a week.

(c) It is possible to evaluate the efficiency of the neutralization process (i.e., whether lime injection rate is optimum) by observing the color of water. Therefore, the operators should periodically observe the watercolor in the neutralization basins every hour as routine work. The following correlation between color and pH can be used:

- Wastewater pH < 3 almost clear, transparent
  pH 3 − 8 dark green (ferrous)
  pH > 8 Brown (ferric)

3) Routine Works

(a) Appearance (i.e. color, clearness, smell, floating particles and scum) of inlet water should be visually checked as a routine work, and suitable actions should be taken, if a significant degradation in the appearance is observed.

(b) The sewer ditches should be routinely cleaned of accumulated sludge and floating debris.

(8) Recommendations for Improvement of Process

1) Oil contamination in the wastewater must be minimized as practically as is possible.

2) It is recommended to reduce coolant oil consumption by installation a recycling system of coolant at 4"－8" ERW old line.

3) The waste HCl and the flux discharged at the pickling plant should be taken out by a special recovery trader.

9.3.3 Basic Design

(1) Description

1) Basic Design and Additional Wastewater Survey

After a decision was made regarding the selection of the 3 representative factories, the basic design of wastewater treatment for the demonstration plant (Candidate) commenced by developing the conceptual design.

In order to design the plant suitably, an additional wastewater survey was carried out of the 2-wastewater streams to be treated.

The survey results of wastewater qualities were shown on the following attached tables:

Attached Table 9.3-2 (1/2) and 9.33-2 (2/2)

2) Comments on Conceptual Design by the Egyptian Side

The Egyptian Authorities suggested that the following comments on the conceptual design of the demonstration plant (Candidate) at NPF be taken into consideration. Those comments were originated by NSP.

(a) The design assumption of treated water quality indicated that it would meet the requirement of River Nile (Law 48/82 Underground Reservoir & Nile Branches/Canals) although the water would be discharged to the public sewer. Therefore, a less stringent treatment criterion can be followed.

(b) Also, the salinity in the treated water is likely to remain at high concentrations even after treatment.

(c) If the factory decides to reuse the water, the capacity of the demonstration plant (Candidate) would only treat about 45% of the total factory need. Considerations should be given to treating the entire factory need.

3) Unsuccessful Candidate Factory

At the final stage of basic design, a meeting was held to select the demonstration plant factory. In this meeting, it was decided that NSP factory was unsuccessful for the demonstration plant factory, because

NSP factory would be out of control of HCMI after privatization in the near future.

4) Revision of Basic Design Conditions

Two comments by the Egypt Side described the above (2)(a) and (c)) are against the design policy of the demonstration plant of JICA. However, since it was decided that the demonstration plant would not be built at NPF factory, and the basic design would be only the final product, JICA design policy should not restrict the basic design of W.W.T. plant at NSP.

The Study Team decided that the following comments by the Egypt Side would be implemented during the basic design:

(a) The wastewater treatment plant would treat the whole wastewater in NSP factory.

(b) The treated water quality of the plant would meet Law 48/82 「Non Potable Surface water (industrial)」 instead of 「Underground Reservoir & Nile Branches / Canals」

(c) Comment (2)(b)) above regarding the regulation of TDS is neglected.

The W.W.T. plant, designed considering the above design conditions, is referred to as the "recommended W.W.T. plant".

(2) Basic Design Conditions

1) Wastewater to be treated

(a) RW-1 : Outlet of Pit A (Wastewater from the neutralization plant for rinsing water + Sanitary water from foundry)

(b) RW-2 : Skimmed oily water from the oil separator

(c) RW-3 : Outlet of Pit B (Wastewater from the Foundry including sanitary water)

(d) RW-4 : Outlet of Collection Pit (Wastewater from the Spiral Welded Pipe Factory and Coating Factory)

2) Assumptions

(a) The existing wastewater treatment plants should be repaired and maintained at the original or modified situation.

(b) Professionals having a well-defined organization should manage the existing wastewater treatment plant.

(c) Routine observation and periodical maintenance should be carried out adequately.

3) Wastewater Flow Rate and Water Quality

The wastewater flow rate and water qualities to be treated are shown on the following table 9.3-3.

Water qualities of RW-3 are assumed the same as RW-4, because RW-3 had no flow during our survey. Both wastewater are mainly sanitary, domestic water.

4) Target of Treated Water Quality

In NSP factory, the wastewater is discharged to the public sewers, therefore the applicable wastewater discharge regulation is based on the Law 93/62 「Discharge to Sewer System (as modified by Decree 9/89)」 (Refer to the attached table 9-1).

The major item of regulations in Law 93/62 are as follows:

- BOD is less than 400 mg/l
- SS is less than 500 mg/l
- Oil & Grease is less than 100 mg/l

The above values are less restrictive than those in Law 48/82.

In NSP at present, only oil and grease concentration in the discharged wastewater exceeds to the regulation. Therefore, the target of the treated water quality at the recommended W.W.T. plant is based on the regulations in Law 48/82 「Non Potable Surface Water (Industrial)」 in stead of Law 93/62.

Table 9.3-3 Wastewater Flow Rate and Water Quality

		RW-1	RW-2	RW-3	RW-4	Treated Water	Regulation Law48/82
Flow Rate Max.	[m^3/h]	50	40	10	150	125	-
Ave.	[m^3/h]	40	30	5	50	100	-
pH	[-]	2-7	7-8	6.5-8	6.5-8	6.5-8	6-9
BOD	[mg/l]	100	100	30	30	<30	60
COD	[mg/l]	200	200	80	80	<80	100
SS	[mg/l]	250	200	50	30	10	60
Oil & Grease	[mg/l]	5	1,000	5	5	2	10
TDS	[mg/l]	5,800	400	390	390	-	2,000
Water Temp.	[℃]	25-35	25-35	25-35	25-35	20-35	35

Note 1: Regulation value shows for 「Non Potable Surface Water (Industrial)」 of Law 48/82.

2: Flow rate of treated water = T.W. of No.1 WWT + T.W. of No.2 WWT

(3) Wastewater Treatment System Design

1) Flow Scheme

Spiral Welded Pipe Factory and Coating Factory are located at the opposite side across the public road. Wastewater is discharged to a common public sewer that also receives wastewater from Military factory flows. Therefore, two wastewater treatment plants (No.1 & No.2 W.W.T.) will be installed as follows:

(a) No.1 W.W.T. is the main wastewater treatment plant installed near Transport department.

(b) No.2 W.W.T. is the separated wastewater treatment plant installed near the Coating Factory. And, the treated water of No.2 W.W.T. is discharged to the near public sewer, and only backwashed wastewater is sent to No.1 W.W.T. for treatment.

The wastewater flow scheme is shown on Fig. 9.3-1.

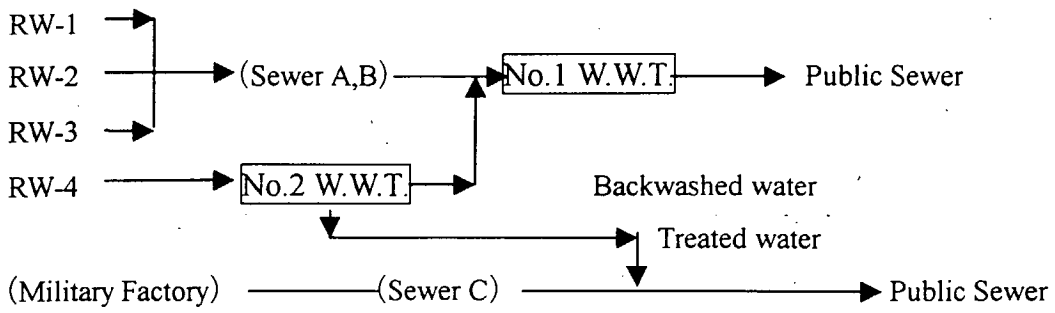


Fig. 9.3-1 Wastewater Flow Scheme

2) Wastewater Treatment System

Refer to the attached drawings.

Attached Drawing 9.3-5 DWG NO. SP-BD-15-01

「PROCESS FLOW DIAGRAM FOR W.W.T. DEMONSTRATION PLANT(1/2)」

Attached Drawing 9.3-5 DWG NO. SP-BD-15-02

「PROCESS FLOW DIAGRAM FOR W.W.T. DEMONSTRATION PLANT(2/2)」

(a) Pre-treatment / Primary Treatment

i) Neutralization Unit

- Based on the results of our survey, wastewater RW-1 may not be always neutralized at the existing neutralization plant. Therefore, the neutralization unit is installed for proper neutralization.
- The unit consists of a neutralization tank (CS with epoxy lining) and a lime injection unit (pumps and tanks with mixers)

ii) Oil Separator

- Wastewater RW-2 contains much oil, therefore a gravity type oil separator such as API (American Petroleum Institute) separator is installed to remove floating oil.
- The unit consists of an oil separator basin (RC) and a cone roof type of recovered oil tank (CS).

iii) Rapid Sand Filter Unit in No.2 W.W.T.

- Wastewater RW-4 contains a little of SS and oil, therefore a filter unit is installed.
- The filter is vertical, cylindrical, gravity filter, in which uniform sand and anthracite as are filled up as a filter media.
- The filters are backwashed with air and water automatically, periodically (once a day normally).
- The backwashed wastewater is sent to the equalization tank in No.1 W.W.T.
- The sand filter unit consists of two sets of filters (CS with epoxy coating) and a backwashing unit (pumps, blowers and water basins).

iv) Equalization Tank

- The 4 wastewater streams (RW-1, RW-2, RW-3 and RW-4) have different flow rate and quality, therefore a large tank is provided to store the above wastewater and to equalize water quality by air bubbling.
- The equalized water is then sent to a secondary treatment in as constant flow as is possible.
- The equalization unit consists of an open top tank (CS with epoxy coating) has an air supply unit (blowers and air bubbling devices).

(b) Secondary Treatment Unit

[Activated Sludge Treatment Unit]:

Same as Conceptual Design except treating capacity.

The unit consists of an aeration basin, sedimentation basin, and a chemical injection unit and an air supply unit.

(c) Advanced Treatment

[Rapid Sand Filter Unit]:

Same as Conceptual Design except treating capacity.

The unit consists of 3 sets of filters and backwashing unit (pumps, blowers and basins)

(d) Sludge Treatment Unit

Same as that in the conceptual design except treating capacity.

The unit consists of a sludge thickener, 2 sets of centrifuges and a chemical injection unit (pumps and tanks with mixers).

(4) Plot Plan

1) Location of W.W.T. plant

Refer to the attached drawing.

Attached Drawing 9.3-7 SP-BD-12-00

「LOCATION OF WASTEWATER TREATMENT PLANT」

2) Plant layout

(a) No.1 W.W.T.

Refer to the attached drawing.

Attached Drawing 9.3-8 DWG No. SP-BD-12-01

「PLOT PLAN FOR NO.1 W.W.T. RECOMMENDATION PLANT」

The required area for No.1 W.W.T. is 58m x 55m ($3,190m^2$) including a control room ($7m \times 14m = 98m^2$).

(b) No.2 W.W.T.

Refer to the attached drawing.

Attached Drawing 9.3-9 DWG No. SP-BD-12-02

「PLOT PLAN FOR NO.2 W.W.T. RECOMMENDATION PLANT」

The required area for No.2 W.W.T. is 25m x 16m ($400m^2$) .

(5) Major Equipment and Instruments

1) Skeleton Drawing of Major Equipment

The skeleton drawings of major equipment are prepared and those drawings are compiled in the appendix design package.

2) Lists

The following lists are prepared and those lists are compiled in the appendix design package.

- Equipment List SP-BD-L-01 (1/2) (2/2)
- Instrument List SP-BD-L-02 (1/4) – (4/4)
- Motor List SP-BD-60L- (1/3) – (3/3)

(6) Electrical Design

The drawing plan for main power cable, and the single line diagram of motor control board are prepared and compiled in the appendix design package.

- Configuration of Electrical & Instrumentation System
- DWG No. SP-BD-60-001-003 Single Line Diagram 380V Motor Control Board

(7) Construction Schedule

The overall standard schedule for implementation of the demonstration plant is provided in the attached table.

Attached Table 9-2

「Overall Schedule for Implementation of Demonstration Plant (Preliminary)」

(8) Estimated Construction Cost Summary

The estimated construction cost summary of the recommended W.W.T. plant is shown below.

The breakdown of the cost is shown on the attached table.

Attached Table 9.3-3

「ESTIMATION COST FOR EL NASR CO. for STEEL PIPES and Fittings」

(9) Maintenance Cost

The annual maintenance cost for the recommended W.W.T. plant operation is shown on Table 9.3-5.

The detailed maintenance cost is shown in the appendix design package.

· Running Cost EL NASR CO. FOR STEEL PIPES & FITTINGS

· Power Consumption

Table 9.3-4 Estimated Construction Cost Summary

Item	Paid in Japan [1000yen]	Paid in Egypt [1000LE]	Total
1. Direct Cost (1) Equipment (2) Field Works	 173,300 0	 0 5,071	
Subtotal	173,300	5,071	
2. Indirect Cost	28,100	3,349	
Total (1+2)	201,400	8,420	
Total [1000yen]	201,400	286,300	487,700
Total [1000LE]	5,923	8,420	14,343

Note: Exchange rate 1 Egyptian Pound = 34 Japanese yen

Table 9.3-5 Annual maintenance Cost

Item	Consumption [/h]	Unit Cost [LE/]	Amount	
			[LE/year]	[LE/m^3]
1. Chemicals	-	-	240,705	0.717
2. Filter Media	-	-	17,820	0.029
3. Electricity [kw]	2,120	0.12	83,952	0.138
4. Water [m^3]	50	0.7	11,550	0.019
5. Personal Expense	-	-	160,000	0.262
6. Maintenance *	-	-	352,940	0.579
Total			866,967	1.74

Note1: Maintenance * marked is assumed as 3% of plant construction cost (take 400million yen)

Note.2: Exchange Rate 1 Egyptian Pound = 34 Japanese yen

(10) Others

In the basic design, the following documents are prepared:

1) Basic Design Study Report

2) Calculation Sheet for Basic Design

(11) Special Note

The conceptual and basic design packages of W.W.T. for NSP described here are only reference. Therefore, the performance of the plant designed and constructed based on this design package can not be guaranteed by the Study Team.

9.4 MANSOURA CO. FOR RESINS AND CHEMICALS (MRC)

9.4.1 Factory Survey

(1) Factory Profile

1) Address of Headquarter: Sandoob, El Mansoura

2) Type of Industries: Chemical Industries

3) Type of Operation: Government Owned

4) Holding Company: Holding Company for Mining and Refractories

5) Capital Amount: 21,095,559 Egyptian Pound (LE)

6) Annual Sales Amount: 15,689,222 LE

7) Gross Profit before Tax: not available

8) No. of Employees: 350

9) Factory (Structure) Area: 113,000 (83,000) m^2

10) Main Products: Formaldehyde 10,000 ton/year

Phenol Formaldehyde Resin 1,000 〃

Urea Formaldehyde Resin (60%) 8,000 〃

〃 (85%) 4,000 〃

Phenol Formaldehyde Molding 1,500 〃

Furan Resin 300 〃

(2) Environmental Impact

1) Air Pollution (working environment)

The company has a relatively old production process that was designed and constructed by Sumitomo Bakelite Co. (Japan) about 30 years ago. Special countermeasures (such as purge gas washing system) to toxic gases exhausted from the process plants cannot provided at this stage. Therefore the working environment conditions in the factory are unfavorable.

2) Water Pollution

The Wastewater from the reacotrs contains a high concentration of phenol and formaldehyde. This wastewater is discharged to Mansoura Sewage directly without any further treatment. Almost all plants in the factory operates intermittently so that only a few wastewater streams flow constantly. It is a feature in this factory that wastewater flow rate is relatively small, however, the concentration of BOD (organic matters) is very high. As a result, the environmental impact by wastewater is rather strong despite the low flow rate.

(3) Industrial Wastewater Treatment at Present

The factory survey of MRC was carried out in September 13－20, 1999. The major results of survey are as follows:

1) Water Supply

(a) Industrial water is supplied from the city water of Mansoura water works.

(b) Daily water consumption is approximately less than 500 m^3 with 300 m^3 being a normal level.

2) Wastewater Treatment System

A part of the cooling water (normally 350 m^3/h) is recycled through an old-type cooling tower.

Other wastewater is discharged to the public sewage without any special treatment.

No fee for discharged wastewater is required.

Wastewater sewer system is shown on the following drawing:

Drawing 9.4-1 DWG NO. RC-CD-15-01

「SCHEMATIC DIAGRAM OF WASTEWATER FLOW」

(4) Wastewater Survey

The wastewater flow rate was measured and wastewater samples were taken by the Study Team in corporation with TIMS.

1) No. of Sampling Location: 5

2) Duration: 1 day (24 hours), every 6 hours x 4 times

3) Field Measurement:

(a) Flow rate is measured by a propeller type flow meter.

(b) Water qualities: field measurements were made for the following parameters: pH, Electrical Conductivity, Turbidity, Salt contents, and Water temperature. In addition, measurement of COD_{Mn} was made using a conventional pack test

4) Laboratory Analysis:

- At each sampling location, a water sample was obtained every 6 hours during a 24-hour period.
- Then, the four samples from each location were mixed to form a composite sample before analysis (4 composite samples and 1 grab sample).
- The items of water quality analysis are the following 12 major items (including CODcr) specified by Wastewater Discharge Regulation in Egypt.

  [pH, BOD, COD_{cr}, TDS, SS, Oil & Grease, PO_4^{-3}, N, Phenol, ABS, MPN, HCHO]
- The results of water quality analysis are presented in the following attached table:

  Table 9.4-1 「Wastewater Qualities Analysis Data」
- It should be noted that concentrations of 25,650 mg/l of phenol and 246 mg/l of formaldehyde were detected in the wastewater at the outlet of Novolk Unit.
- Total flow rate of discharged wastewater is only 2 m^3/h.

9.4.2 Conceptual Design

(1) Wastewater to be treated by Demonstration Plant (Candidate)

The wastewater streams for treatment in the potential demonstration plant (candidate) in MRC factory were selected based on the following considerations:

1) Quality: Wastewater should be as representative of as many streams as is possible.
2) Quantity: Flow rate (plant capacity) should be such that the cost of the plant is within JICA's budget, and the flow is as continuous as is possible.
3) The plants of the wastewater sources are operated as constantly as is possible.
4) A major assumption in the plant design is that both the "Regeneration waste" of the Formaldehyde Plant and the "Novolak solid Resin" of phenol formaldehyde are separated from the wastewater treatment system completely.

Based on the above considerations, the following wastewater streams was selected:

(a) Process wastewater

(b) Sanitary Water

The regeneration waste of the formaldehyde plant and Novolak solid resin of phenol formaldehyde shall be treated by the existing boiler or an incinerator, and must not be discharged into the wastewater streams to be treated.

(2) Wastewater Flow Rate and Quality

The wastewater flow rate and water qualities are shown on Table 9.4-1.

The target of the treated water qualities is based on the most stringent quality criteria in the Egyptian Regulation (Law No. 48/82 Underground Reservoir & Nile Branches/Canals).

Table 9.4-1 Wastewater Flow Rate and Water Qualities

Item	Design		
Wastewater	Process Water Sanitary Water	Treated Water	W.W. Discharge Regulation (Law 48/82)
Flow Rate [m^3/h]	Max. 30	30	-
pH [-]	6-7	6-9	6-9
COD [mg/l]	2,400	30	30
BOD [mg/l]	1,300	20	20
SS [mg/l]	100	1	30
Oil & Grease [mg/l]	20	1	5
Phenol [mg/l]	400	0.005	0.005
Water Temp. [℃]	35	30	<35

(2) Wastewater Treatment System Design

The following drawings were prepared in the conceptual system design.

Drawing 9.4-2 DWG NO. RC-CD-15-03

「BLOCK FLOW DIAGRAM OF WASTEWATER TREATMENT」

Drawing 9.4-3 DWG NO. RC-CD-15-04

「CONCEPTUAL DESIGN OF WASTEWATER TREATMENT」

1) Pre-treatment

[Equalization Tank]

- The process wastewater source will be from streams that vary greatly in flow rate and water quality. The wastewater to be treated in the potential demonstration plant (candidate) is mixed with the sanitary water.
- Therefore, the wastewater is stored in a 150-m^3 capacity tank and equalized uniformly by air bubbling in the tank. After mixing, the wastewater is fed to the next treating unit under as constant flow as is possible.

2) Primary Treatment

[Chemical Clarifier Unit]

- Before biological treatment, suspended solids (SS), free oil, color and some heavy metals are removed by a chemical clarifier (coagulation/flocculation and sedimentation).
- Flocs formed by coagulation and flocculation are settled in the sedimentation tank and become sludge on the bottom of the tank.
- Supernatant of the sedimentation tank is fed to the biological treatment unit. And, settled sludge on the bottom of the sedimentation tank is discharged to the dehydrating unit automatically, periodically (once 1-2 hours).

3) Secondary Treatment:

[Activated Sludge Treatment Unit]

- In order to remove organic matters (BOD, COD, phenol and formaldehyde, etc.) in the wastewater, activated sludge treatment process is applied as conventional biological treatment unit.
- In this unit, the organic matters are oxidized / decomposed and removed by aerobic micro bacteria.
- Slurry consisting of aerobic micro bacteria flocs are separated supernatant and sludge in the clarifier (sedimentation tank).
- Settled sludge on the bottom of the clarifier is returned to the inlet of the aeration pond, and a part of sludge is discharged to a dehydrating unit automatically, periodically.
- Treated water quality (supernatant of the clarifier) may meet the wastewater discharge regulation of River Nile (Law 48/82) except Total Dissolved Solids (TDS).

3) Advanced Treatment Unit

[Rapid Sand Filter]

- Rapid sand filter is applied to remove suspended solids (including BOD, COD depending on SS) in the effluent water from the clarifier of the activated sludge treatment unit.
- This rapid sand filter is aimed to prevent the activated carbon filter from clogging by solids.
- The filter is a vertical, cylindrical pressure type filter, in which both sand and anthracite are filled up as a filter media.
- The filter is backwashed with air and water automatically, periodically (once a day normally).
- Backwashed wastewater is returned to the equalization tank for re-treatment.
- Filter unit is not always required from a water quality point of view, it is provided as a demonstration unit process to polish the clarifier effluent of biological treatment

[Activated Carbon Filter]

- In order to meet the discharge regulation of phenol content of 0.005 mg/l, an activated carbon filter unit is provided. Organic matters including phenol, and COD are adsorbed on the activated carbon layer in the filter.
- The activated carbon is backwashed with water either periodically (once 1-2 days) or when differential pressure between top and bottom of filter layer reaches to the pre-specified pressure.
- Backwashed wastewater is returned to the Equalization tank for re-treatment.
- When an adsorption ability of activated carbon decreases, it will be replaced with new one by manual.

[Sterilization Unit]

- Before discharging to the public sewage, a bleaching powder is injected in the treated water for sterilization because wastewater includes sanitary water.

4) Sludge Treatment Unit

In order to condense its density and to reduce sludge volume, a sludge thickener and centrifuge are provided. The sludge is formed in the chemical clarifier, the activated sludge treatment unit and filter unit.

[Sludge Thickener]

- The solids content of sludge is too small (0.5－2.0%), therefore a thickener is used to thicken sludge before dehydration.
- The sludge thickener has a center driven type of sludge collecting rake.
- The thickened sludge is fed to the centrifuge, and supernatant is returned to the equalization tank.

[Centrifuge]

- The screw decanter type of centrifuge is applied as dehydrator. SS contents of sludge cake is expected 15-20% (85-80% water content)
- The unit is provided with a chemical injection unit (tanks with mixers, and pump).

5) Disposal of Sludge Cake

Pollutants in wastewater are collected as a sludge cake in the Centrifuge. Wastewater in MRC factory may contain formalin, phenol, and some chemicals, which may not have been removed completely. Therefore, such toxic chemicals in the effluent and sludge cake should be analyzed periodically.

If they are detected, the dewatered sludge cake should be dumped as ash after burning in an incinerator. If not detected, dewatered sludge cake can be dumped at the specified dumping site under management supervision.

6) Electrical and Instrument Design

(a) Electrical

- Electricity (380V-AC x 3 phase x 50 HZ) is received from Sub-station at the Formalin Factory Sub-station through buried cables along the existing access road. Cable length is more than 500 m.
- Approx. 200 KVA electricity is used for power, lighting, instrumentation control, and air conditioning in the control room.

(b) Instrument

- The main control panel board is installed in the W.W.T. control room.
- The indicators, recorders, alarms and sequence timer units are mounted on the panel.

(3) Plot Plan

1) Location

Location of Demonstration Plant (Candidate) was selected the left side of entrance gate. This area is currently being used for parking.

2) Layout of Equipment

Refer to the following drawing:

Attached Drawing 9.4-4 DWG NO. RC-CD-12-01

「PLOT PLAN FOR CONCEPTUAL DESIGN OF W.W.T. DEMONSTRATION PLANT」

Required area for the demonstration plant (Candidate) is approximately 31 m x 55 m ($=1,705 m^2$).

(4) Estimated Cost of Demonstration Plant (Candidate)

The estimated cost of the wastewater treatment demonstration plant (Candidate) at MRC factory is shown on the following table 9.4-2, along with the cost share allocation between Japan (yen-portion) and Egypt (LE-portion).

Table 9.4-2 Estimated Cost of Demonstration Plant (Candidate)

Item	Paid in Japan (1000yen)	Paid in Egypt	
		Egyptian Pound (1000LE)	Japanese Yen (1000yen)
1. Equipment, Instruments			
(1) Machinery	93,000		
(2) Electrical, Instruments	62,000		
(3) Packing and Ocean Freight	18,000		
Subtotal	173,000		
2. Field Works			
(1) Civil Works		1,796	
(2) Installation, piping, Painting		417	
(3) Electrical, Instrumentation		660	
(4) Test Run Operation		7	
Subtotal		2,880	98,000
3. Indirect Cost			
(1) Construction Expense		720	24,480
(2) Cost associated with Supervision		294	10,000
Total	305,480,000 as Japanese Yen		

Note 1: Exchange Rate Egyptian Pound (LE) = 34 Japanese Yen

Note 2: Indirect Contractor Cost = Direct Cost x 25%

Note 3: Cost of Supervision by Japanese Consultant is not included in the above estimate.

Note 4: Cost of establishing local registration of the Japanese Consulting Company in not in the above estimate. Local tax, if any, on this Company is not included above.

(5) Recommendations for Improvement of Wastewater treatment

1) Waste Liquid Treatment

The waste liquid (not wastewater) drained from the dehydrator in the resin production process contains too high a concentration of phenol and formaldehyde, which are very toxic in both liquid and gas forms.

(a) Phenol can be extracted using a solvent such as tri-chloro-ethylene and recovered.

(b) Waste liquid residuum recovered phenol should be burnt in the existing boiler or an incinerator. We were informed that an incinerator had been used for combustion for waste liquid but was scrapped due to corrosion. This system is not only required to reduce the environmental impact but

also for saving of energy.

2) Loss Reduction of Exhaust Steam

It was found at the factory that steam is exhausted into the sewer. As a result, water temperature was higher than 60 ℃. This situation is not only dangerous for workers, but also is a waste of usable energy.

3) Routine Works

The operators at the factory should include in their daily duties the following maintenance works:

(a) Operators should visually check the appearance (i.e. color, clearness, smell, floating particles and scum) of inlet and outlet water. Suitable actions should be taken if a significant degradation in the appearance is observed.

(b) Operators should routinely clean the sewer ditches of accumulated sludge, floating debris, and other floating objects.

(6) Recommendations for Improvement of Process

1) A Japanese contractor built the resin production facility about 30 years ago. At that time, he used the latest known technology, however, this technology, as well as the plant, are extremely outdated. It is recommended that the production plant should be modernized before taking significant mitigation measures against pollution.

2) Toxic gases such as phenol and formaldehyde are exhausted in the resin factory. A washing plant for exhaust gases should be provided to treat these toxic gases as soon as possible.

9.4.3 Basic Design

(1) Additional Wastewater Survey

After a decision was made for the selection of the 3 representative 3 factories, the basic design of wastewater treatment for the demonstration plant (Candidate) commenced by developing the conceptual design. In order to properly design the plant, an additional wastewater survey was carried out on November 18, 1999. The results of the water quality analysis are summarized on Table 9.4-3.

As shown on the table 9.4-3, the phenol concentration in the wastewater is extremely high, and the water temperature is also too high. Therefore, the effluent can be classified as liquid waste rather than wastewater.

Table 9.4. -3 Wastewater Qualities

Item	Unit	Analysis Result
pH	[-]	8.18
Electric Conductivity	[μ S/cm]	1,260
BOD	[mg/l]	985
COD	[mg/l]	30,305
Phenol	[mg/l]	480
Formaldehyde	[mg/l]	80
TDS	[mg/l]	1,580
Water Temperature	[℃]	56.6

(2) Development from the Conceptual Design

1) Comments by Egyptian Side to Conceptual Design

The Egyptian Authorities had the following comments on the conceptual design of the demonstration plant (Candidate) at MRC factory.

(a) The design assumptions of treated water quality indicated that it would meet the requirement for discharge in the River Nile, although the treated water would be discharged to a non-potable drainage sewer. The cost of the demonstration plant (Candidate) could be reduced if the treated water quality is less stringent.

(b) The demonstration plant (Candidate) should treat the formaline and Novolak resin waste.

The Study Team accepted comment (a) above. However, the comment (b) was not accepted because the waste liquid should be recovered and treated separately from wastewater.

2) Revised Design Conditions

The new basic design (Recommendable) was studied based on the following conditions changed from the conceptual design.

(a) Maximum Flow Rate

Basic Design: Max. 40 m^3/h, (Conceptual Design: Max. 30 m^3/h)

(b) Target of Treated Water Quality

Basic Design: Law 48/82 Non Potable Surface Water (Industrial)

(Conceptual Design: most stringent regulation 「Law 48/82 Underground Reservoir & Nile Branches/Canals」)

(2) Basic Design Conditions

The basic design proceeded under the following conditions:

1) Wastewater to be treated

(a) Process water:

Except for the regeneration waste of formalin plant and phenol formaldehyde of Novolak resin

solid resin.

(b) Sanitary water in the factory

2) Assumptions

(a) The existing wastewater treatment plants should be repaired and maintained at the original or modified situation.

(b) Professionals having a well-defined organization structure should manage the wastewater treatment plant.

(c) Routine observation and periodical maintenance should be carried out.

3) Wastewater Flow Rate and Water Quality

Refer to the table 9.4-4.

4) Target of Treated Water

The wastewater discharge criteria at MRC factory are based on the regulation of Discharge to sewer System because the wastewater of MRC is discharged to Mansoura Sewage. These regulations are rather tolerant for BOD (BOD concentration is up to 400 mg/l) and total suspended solids (TSS is up to 500 mg/l.). However, the regulation of phenol concentration is less than 0.005 mg/l, which is rather stringent.

Therefore in the basic design, the regulation of Law 48/82 Non Potable Surface Water (industrial) is applied because the regulation of non-potable sewage may be strengthened in the near future.

Table 9.4-4 Wastewater Flow Rate and Water Quality

Item	Design		
Wastewater	Process water Sanitary Water	Treated Water	Discharge Regulation (Law 48/82)
Flow Rate [m^3/h]	Max. 40 Ave. 30	40 30	-
Water Qualities			
pH [mg/l]	6-7	6-9	6-9
COD [mg/l]	2,400	30	100
BOD [mg/l]	1,300	20	60
SS [mg/l]	100	1	60
Oil & Grease [mg/l]	20	1	10
Phenol [mg/l]	400	0.005	0.005
Water Temp. [℃]	35	30	<35

(3) Wastewater Treatment System Design

The wastewater treatment system is the same as that in the conceptual design. Therefore, the description of treatment system is omitted here.

The following attached drawings are prepared:

Attached Drawing 9.4-5 DWG NO. RC-BD-15-01

「PROCESS FLOW DIAGRAM OF W.W.T. DEMONSTRATION PLANT」

Appendix Design Package DWG NO. RC-BD-16-01-03

「BASIC DESIGN OF WASTEWATER ENGINEERING FLOW DIAGRAM」

(4) Plot Plan

1) Location of Construction Site

Refer to the attached drawing.

Attached Drawing 9.4-6 DWG. NO. RC-BD-SK-01

「LOCATION OF RECOMMENDABLE W.W.T. PLANT」

2) Plot Plan

Refer to the attached drawing.

Attached Drawing 9.4-7 DWG NO. RC-BD-12-01

「BASIC DESIGN OF W.W.T. PLOT PLAN」

The required area for the recommendable W.W.T. plant is 41.5m x 50 m (2,075 m^2).

(5) Major Equipment and Instruments

1) Skeleton Drawing of Major Equipment

The skeleton drawings of the major equipment are prepared and those drawings are compiled in the appendix design package.

2) Preparation of Lists

The following lists are prepared and those lists are compiled in the appendix design package.

(a) Equipment List RC-BD-L-01 (1/5) – (5/5)

(b) Instrument List SP-BD-L-02 (1/3) – (3/3)

(c) Motor List

(6) Electrical and instrument Design

1) Electrical

- Electricity (380V AC x 3 phase x 50 HZ) is received from Sub-station at the Formalin Factory Sub-station. Cable length is more than 500 m.
- Approx. 200 KVA electricity is required for all electricity in the W.W.T.
- The drawing plan for main power cable, and the single line diagram of motor control board are prepared and compiled in the appendix design package.

(a) DWG. Configuration of Electrical & Instrumentation System

(b) DWG No. SP-BD-60-001－002

「Single Line Diagram 380V Motor Control Board」

2) Instrument

- The main control panel board is installed in the W.W.T. control room.
- The indicators, recorders, alarms and sequence timer units are mounted on the panel.
- The control valves are operated pneumatically with compressed air.

(7) Construction Schedule (Standard)

The overall standard schedule for implementation of the demonstration plant is applied. Refer to the attached table.

Attached Table 9-2 「Overall Schedule for Implementation of Demonstration Plant (Preliminary)」

(8) Estimated Construction Cost

The estimated cost of the recommendable W.W.T. for MRC is shown below:

The detail of estimated cost is shown on the attached table.

Attached Table 9.4-3

「ESTIMATION COST FOR MANSOURA CO. FOR RESINS & CHEMICALS」

Table 9.4-5 Estimated Construction Cost for W.W.T.

Item	Paid in Japan [1000yen]	Paid in Egypt [1000LE]	Total
1. Direct Cost (1) Equipment, Instruments (2) Field Work	 93,901 0	 0 2,484	
小 計	93,901	2,484	
2. Indirect Cost	23,500	1,704	?
Total (1 + 2)	117,401	4,188	
Total [1000yen]	117,401	142,400	259,801
Total [1000LE]	3,453	4,188	7,641

Note: Exchange Rate 1 Egyptian Pound (LE) = 34 Japanese Yen

(9) Maintenance Cost

The annual maintenance cost (estimated) for the recommended plant operation is shown below:

The base data used for the estimation and detail maintenance cost are shown in the appendix design package.

The unit maintenance cost for MRC factory is about 5.36 LE / 1m^3-wastewater. This value is rather high due to the use of activated carbon. About two third (2/3) of the maintenance cost is associated

with the activated carbon (material and replacement work).

(a) Running Cost: MANSOURA CO. FOR RESINS & CHEMICALS

(b) Electric Power Consumption

Table 9.4-6 Annual maintenance Cost

	Consumption [/d]	Unit Cost [LE/]	Amount	
			[LE/Year]	[LE/m^3]
1. Chemicals	-	-	50,763	0.214
2. Filter Media*1	-	-	863,359	3.634
3. Electricity [Kw]	1,244	0.12	49,248	0.207
4. Water [m^3]	5	0.528	871	0.004
5. Personal Expense	-	-	40,000	0.168
6. Maintenance Cost*2	-	-	269,541	1.134
Total			1,273,782	5.36

Note 1: *1 means Sand, Gravel, Anthracite and Activated Carbon

Note 2: *2 Cost = Total Construction Cost (take 300 million yen) x 3%

(10) Others

In the basic design of Recommendable W.W.T. Plant for MRC factory, the following documents are prepared and compiled in the appendix design package.

1) Basic Design Study Report

2) Calculation Sheet for Basic Design

(11) Special Note

The conceptual and basic design packages of W.W.T. for MRC described here are only reference. Therefore, the performance of the plant designed and constructed based on this design package can not be guaranteed by the Study Team.

9.5 EGYPTIAN IRON AND STEEL CO. (EIS)

9.5.1 Factory Survey

(1) Factory Profile

EIS Factory was established in 1954 as the biggest full-integrated steel manufacturing plant in Egypt. Additional information is provided below:

1) Address of Headquarter: El Tabbin Cairo, Egypt

2) Type of Industry: Metallurgical Industries

3) Type of Operation: Government operated

4) Holding Company: Holding Company for Metallurgical Industries

5) Capital Amount: 664.664,000 Egyptian Pound (LE)

6) Annual Total Sales: 1,089,600,000 LE

7) Gross Profit before Tax: 246,000 LE

8) No. of Employees: 19,500

9) Factory (Structure) Area: 6,485,900 (3,900,000) m^2

10) Main Products:

(a) Main by-product: Iron ore, Barite, Clay, Slag

(b) Non-prime materials: Cobbles, Hot rolled plates second choice

(c) Semi-finished steel products:

(d) Hot strip mill products: Hot rolled coils, Hot rolled strips, Plates

(e) Cold strip mill products: Cold rolled coils and strips, Cold rolled sheets

(f) Cold formed section: Equal angles, Cold formed channels

(g) Section mill products: Equal angles, Rebars, Squares

(h) Products for Railway authority: Rails, Fish plate, Sleepers, Clips

11) Main Raw Materials

- Iron Ore 2,773,900 ton/year
- Lime stone 673,126 〃
- Dolomaite 129,906 〃
- Cook Coal 932,175 〃

(2) Environmental Impact

From a wastewater viewpoint, almost all of the industrial water system goes through a closed circuit. Most of the water is recycled. The remaining environmental concerns are:

1) The relatively high Zinc content in the ore materials makes it impossible to reuse the recovered

sluged. Although scale in the wastewater sludge can be recovered, it can not be reused as raw material because the zinc contaminated in scale is harmful to furnace and products.

2) The capacity of the acid recovery system is insufficient to cope with the flow from normal operating condition in the cold rolling mill. Therefore, waste acid water is always discharged to a desert near the factory after neutralization. However the discharged effluent is troublesome since it contains dissolved salts, which are soluble in underground water.

(3) Wastewater Treatment System in Present

1) Supply Water

Industrial water is taken from River Nile.

2) Wastewater Treatment System

(a) Wastewater Recycling System

Prior to 1997, wastewater in EISCO was discharged in the River Nile without any treatment, with a flow rate of approx. 60,000 m^3 per day. After a new regulation was established in 1994, the recycling of wastewater started to reduce water consumption in 1997.

The wastewater treatment system consists of 3 major flows which are shown on the attached drawing:

Attached Drawing 9.5- 1 DWG NO. IS-CD-15-01

「SCHEMATIC DIAGRAM OF EXISTING WASTEWATER FLOW」

(b) Lagoon and Sludge Treatment Plant

The main feature in the wastewater recycling system at EISCO is a 120,000 m^3 capacity lagoon. The lagoon receives the industrial effluent from the following sources:

- Foundry
- Sintering Plant
- Scrubber water from Furnaces

i) The lagoon is used for as a collection basin and a settling basin. The overflow from the lagoon is fed to sand filters, and the treated water is recycled.

ii) The bottom sediments in the lagoon are dredged and then pumped to a special facility consisting of a classifier, clarifiers and filter presses. The filtrate of the filter presses is fed to the sand filters, and the treated water is returned to the process plants for reuse.

iii) EIS's intention is to recover scales in the sediment sludge. However, because the sludge contains relatively high zinc (Zn) content, currently the dredged sludge is discharged to a remote location in the Eastern Egyptian Desert about 10 km away from EISO after dewatering by filter presses.

iv) If the Zn content in the sludge is low, the sludge could be reused as raw material.

(c) Clarifier for Furnaces Scrubbers

There are 3 sets of clarifier to treat scrubber-washing water. The treated water is then recycled for reuse as cooling water. The bottom sludge is currently sent to the lagoon; and as a result, the bottom sediment in the lagoon is rich in Zn. Therefore, EISO. has an ongoing project in order to solve this problem by diverting the sludge directly to the desert.

(d) Acid Wastewater from Cold Rolling Mill

The pickling line is equipped with an acid recovery system and an acid neutralization system in the cold rolling mill facility. The neutralization unit located underground is operated manually by CaO injection. The existing two sets of acid recovery units have an insufficient capacity. Therefore it is impossible for these units to cope with the flow during normal operation conditions in the pickling plant. During normal operation conditions in the pickling plant, spent sulfuric acid is neutralized at the neutralization unit without recovery, and discharged directly to the desert.

The existing acid recovery system, neutralization system and pickling plant are outdated. We observed leakage of water, acid waste, and steam from the equipment and pipes.

(2) Wastewater Survey

The Wastewater survey at EISCO was carried out in cooperation with TIMS on September 13, 1999.

1) No. of Sampling Location: 7

2) Duration: 1 day (24 hours), every 6 hours x 4 times

3) Field Measurement:

(a) Flow rate is measured by a propeller type flow meter.

(b) Water qualities: Field measurements were made for pH, Electric Conductivity, Turbidity, Salt contents, and Water temperature. The concentration of COD_{Mn} was measured using a pack test

4) Laboratory Analysis:

(a) At each sampling location, a water sample was obtained every 6 hours during a 24-hour period. Then, the four samples from each location were mixed to form a composite sample before analysis. The items of water quality analysis are the following 15 major items (including CODcr) specified by the wastewater discharge regulation. in Egypt.

[pH, BOD, COD_{cr}, TDS, SS, Oil & Grease, PO_4^{-3}, N, F, THM, Pb, Cd, As, Cu, Zn]

The results of water quality analysis are provided in the following attached table:

Attached Table 9.5-1 「Wastewater Qualities Analysis Data」

(b) It should be noted that 75 mg/l of Zn and 76.7 mg/l of THM were detected in the supernatant of the lagoon.

(c) With regard to the qualities of neutralized wastewater discharged to the desert, pH (11.16) , Pb and Cd concentration did not meet the regulation.

9.5.2 Conceptual Design

(1) Design Base for Demonstration Plant (Candidate)

The wastewater to be treated by the demonstration plant (Candidate) is the acid wastewater from pickling plant at the cold rolling mill facility.

The wastewater flow rate and water quality are shown below:

The most stringent wastewater discharge regulations in Egypt [Law 48/82 Underground Reservoir & Nile branches/canals] was selected as the target concentrations of treated water.

Table 9.5.-1 Wastewater Flow Rate and Water Quality

Item	Design		
Wastewater	Acid Wash Water	Treated Water	Discharge Regulation (Law 48/82)
Flow Rate [m^3/h]	Max. 150	150	-
Water Quality			
pH [-]	1-2	7-8	6-9
COD [mg/l]	200	25	30
BOD [mg/l]	-	-	20
SS [mg/l]	50	20	30
Oil & Grease [mg/l]	<5	<5	5
Water Temp. [℃]	45	45	<35

(2) Wastewater Treatment System Design

The conceptual design of W.W.T. demonstration plant (Candidate) was carried out based on the design basis, and the following drawings were prepared:

Attached Table 9.4-1 DWG NO. IS-CD-15-02

「BLOCK FLOW DIAGRAM OF W.W.T. DEMONSTRATION PLANT」

Attached Table 9.4-2 DWG NO. IS-CD-15-03

「SCHEMATIC DIAGRAM OF W.W.T. DEMONSTRATION PLANT」

1) Primary Treatment

(a) Neutralization Unit

No.1 and No.2 neutralization tanks are provided. The wastewater in the existing neutralization tank is sent to No.1 Neutralization Tank, and is neutralized at around pH 3-5 by injection of lime or NaOH (primary neutralization). Then the wastewater is sent to No.2 Neutralization Tank, and is neutralized at pH 8-9 by injection of lime or NaOH (secondary neutralization).

The neutralization unit consists of two neutralization tanks and chemical (lime or NaOH) injection

unit (pumps and tanks with mixers).

(b) Oxidation Unit

Air is injected to the neutralized water in the oxidation tank. Ferrous compound is changed to ferric compound by aeration. The oxidation unit consists of an oxidation tank and air supply unit (blowers and air bubbling device).

(c) Chemical Clarifier

A polymer is injected to a slurry (ferric hydroxide) formed by neutralization/oxidation, and flocculation is promoted. As a result, slurry is separated and settled in the clarifier. The clarifier unit consists of a flocculation tank, a sedimentation tank and chemical injection unit.

2) Advance Treatment

[Rapid Sand Filter Unit]

- In order to remove SS in the effluent of the clarifier, filters filled with sand and anthracite are provided. The filter is a conventional gravity filter, it is backwashed with air and water automatically, periodically, when filter media is clogged with SS or once every about 24 hours.
- Backwashing wastewater is returned to the existing neutralization tank trough a water basin for re-treatment.

3) Sludge Treatment Unit

Sludge is generated from the sedimentation tank of clarifier unit and backwashing water of filters. But, SS content is rather small (0.5－2.0%), therefore a thickener and dehydrator are provided to reduce sludge volume.

The sludge unit is consists of a sludge thickener, centrifuges and chemical injection unit.

(3) Plot Plan

The layout plan of W.W.T demonstration plant (Candidate) at EIS is shown on the following drawing:

Attached Drawing 9.5-4 DWG. NO. IS-CD-12-01

「PLOT PLAN FOR CONCEPTUAL DESIGN OF W.W.T. DEMONSTRATION PLANT」

The required area for W.W.T demonstration plant (Candidate) is 20m x 30m ($600m^2$) .

(4) Estimated Construction Cost

The estimated construction cost summary for W.W.T. demonstration plant (Candidate) is shown below:

Table 9.5-2 Estimated Construction Cost Summary

Item	Paid in Japan (1000yen)	Paid in Egypt	
		Egyptian LE (1000LE)	Japanese yen (1000yen)
1. Equipment, Instruments			
(1) Machinery	83,000		
(2) Electric, Instruments	58,000		
(3) Packing, Ocean Freight	18,000		
Subtotal	159,000		
2. Field Works			
(1) Civil Works		684	
(2) Installation, Piping, Paint		697	
(3) Electric, Instrumentation		660	
(4) Test Operation		7	
Subtotal		2,048	69,640
3. Indirect Cost			
(1) Construction Expense		512	17、410
(2) Supervision Expense		294	10,000
Total	256,050,000 Japanese Yen		

Note 1: Exchange Rate Egyptian Pound (LE) = 34 Japanese Yen

Note 2: Indirect Contractor Cost = Direct Cost x 25%

Note 3: Cost of Supervision by Japanese Consultant is not included in the above estimate.

Note 4: Cost of establishing local registration of the Japanese Consulting Company in not in the above estimate. Local tax, if any, on this Company is not included above.

(5) Recommendations for Improvement of W.W.T.

In general, the neutralization unit and spent sulfuric acid recovery unit are too old and they treat strong acid wastewater. Therefore the units are outdated and are attacked by corrosion. It also appears that the units are inadequately maintained. Also, no instrumentation for controlling and monitoring can be found in the units. The units operate manually by abundant skilled operators.

During our survey, the existing neutralization unit and spent sulfuric acid recovery unit were stopped for a relatively long time due to a shut down in the pickling plant.

1) Facility

(a) All superannuated, corroded equipment and piping should be replaced or repaired.

(b) Control instruments should be provided in the system, such as pH meters, flow meter, level pressure and temperature gages.

(c) Upgrading the capacity or replacement of the spent sulfuric acid recovery unit is recommended.

(d) The existing neutralization plant is located below ground. Operability of the unit is unfavorable. If replaced, the new plant should be installed above ground.

(e) The pipe trench between the rinsing plant and the neutralization unit should be cleaned and leakage water (strong acid) in the trench should be minimized so as to repair some leakage points.

2) Management

(a) A suitable wastewater management system should be established and properly operated.

(b) An operation and maintenance manual for the neutralization unit should be prepared and used correctly.

(c) A suitable maintenance work should be conducted based the above manual.
(The spare parts, consumable materials should be always supplemented as specified in the above manual.)

(d) The floor around equipment should be always cleaned and arranged adequately.

(e) Education training for safety and environment protection should be implemented and attended by all operators.

(6) Recommendations for Improvement of Process

1) Enforcement of Acid Recovery Unit

Replacement or upgrading of the spent sulfuric acid recovery unit is urgently required in order to operate the pickling plant under normal continuous operation.

2) Reduction of Leakage

Exhaust gases and leakage acid waste from the pickling / rinsing basins are very common. Qualified personnel should inspect all sealing parts to repair faulty seals.

3) Indirect heating of Sulfuric Acid in Pickling Basin

In order to pickle steel plates effectively, sulfuric acid liquid in the pickling basins is heated up to around 70℃ by injecting steam to the basins directly. As a result, the sulfuric acid concentration in the basins is lowered and the quantity of the spent sulfuric acid recovery plant is increased.

4) Cleaning of the floor around the pickling plant and prevention of dust at the roll plate yard are always required.

9.5.3 Basic Design (Original)

(1) Additional Wastewater Survey

EIS was selected as one of the three representative factories. The basic design of wastewater treatment for the demonstration plant.(Candidate) was proceeded by developing the conceptual design.

Additional wastewater survey was carried out for the acid wash water (rinsing water) and waste acid (spent

sulfuric acid).

1) Additional Water Quality Analysis

Additional grab samples of acid wash water and waste acid were taken and analyzed at TIMS laboratory. The results of the analyses are summarized below:

Table 9.5-3 Wastewater Quality

Item		Acid Wash Water (Rinsing water)	Waste Acid (Spent sulfuric acid)
pH	[-]	3.05	1.04
Electric Conductivity	[mS/cm]	3.55	100
Water Temperature	[℃]	36	56.6
Turbidity	[unit]	6.5	260
Salinity	[%]	0.	4
Fe^{2+}	[mg/l]	520	61,514
Fe^{3+}	[mg/l]	660	660
Total Fe	[mg/l]	712	62,174
$FeSO_4$	[mg/l]	1,232	160,000
TDS	[mg/l]	(3,242 ?)	4,240
Acidity (as H_2SO_4)	[%]	0.24	17

2) Factory Survey

The neutralization plant and spent sulfur recovery plant was surveyed in detail during the second field survey. The wastewater flow scheme is as follows:

(a) Acid wash water (rinsing water) is collected in two 30m^3 wastewater tanks in the basement through a 12" (300mm) FRP. Flow through the pipes and to the tanks is under gravity. CaO mix is prepared and injected in the wastewater tank. Acid wastewater is neutralized by injection of CaO mix. The resulting treated wastewater is then discharged to the desert trough 12" FRP pipe (some segments of the pipe are of stainless steel). The discharge point of this pipe is about 10km away from the plant.

(b) The consumption of CaO is approx. 700 kg per 1,000 m^3 of wastewater.

(c) The other waste acid (spent sulfuric acid) pipe is parallel to the acid wash water pipe. The waste acid flows to two 7 m^3 of tanks (one operational, the other is a spare) located at the same level as that of the wastewater tanks.

(d) Waste acid is fed to the spent sulfuric acid recovery plant (SSAR plant). However, sometimes waste acid is fed to the wastewater tanks directly and is neutralized along with the acid wash water, and then discharged to the desert.

(e) SSAR unit consists of 2 trains. In the unit, deposited ferrous sulfate is recovered as by-product. It is sold as fertilizer in 50 kg packed bags.

The design production amount of ferrous sulfate is 20－25 ton per day. During our visit, however, only 10 ton per day was produced.

(f) In this survey, it is revealed that:

i) When the pickling plant operates in 3 shifts, the waste acid is treated with acid wash water by the neutralization plant. The waste acid is diverted through a switch valve located at the inlet of the 7-m3 capacity tanks. This unfavorable condition occurs because the existing SSAR plant does not have sufficient capacity to handle amount of the acid waste generated from continuous operation in the pickling plant.

ii) The waste acid should be treated in the neutralization plant once every day, not only during emergency situations.

(2) Major Revised Point from Conceptual Design

1)In the basic design, the demonstration plant (Candidate) was designed to treat only the acid wash water, so that acid load (H_2SO_4) was calculated without waste acid. It was assumed that even if waste acid were injected in an emergency, the total acid load would still be less than the design H_2SO_4 load present in acid wash water only.

2) It became clear, however, after our second field visit, that waste acid normally flows into the wastewater tank once a day. Therefore, the acid load in the waste acid must be taken into account in the basic design. This is a revision from the conceptual design.

The quantity of the waste acid is relatively small compared to quantity of acid wash water. However, the acid load is increased more than that calculated in the conceptual design. The flow rate and water quality of basic design conditions are shown below:

Table 9.5-4 Comparison Table of Conceptual / Basic Design

Item		Basic Design		Conceptual design	
		Acid Wash Water	Waste Acid	Acid Wash Water	Waste Acid
Flow Rate	[m^3/h]	Max. 170 Av. 150	1.67 ($40m^3/h$)	Max. 150	Emergency 0
pH	[-]	1-2	-	(1-3)	-
H_2SO_4	[mg/l]	2,500	120,000	(1,170mg/l)	0
$FeSO_4$	[mg/l]	3,500	170,000	-	0
SS	[mg/l]	100	-	50	-

(3) Basic Design (Original) Conditions

1) Wastewater to be treated

(a) Acid Rinsing Water (same as Acid Wash Water in the conceptual design)

(b) Spent Sulfuric Acid (same as Waste Acid in the conceptual design)

2) Assumptions

(a) The existing wastewater treatment plants should be repaired and maintained at the original or modified situation.

(b) Qualified personnel having a well-defined organization should managed the treatment plant.

(c) Routine observation and periodical maintenance should be carried out.

(d) The existing wastewater pipes and wastewater tanks ($30m^3$ x 2 sets) and wastewater feeding pumps ($200m^3/h$ x 3 sets) can be utilized without repair.

3) Wastewater Flow Rate and Water Quality

The flow rate and water quality of the wastewater to be treated by the demonstration plant (Candidate)is shown on the above table 9.5-4.

And, the results of additional analysis are shown on the attached tables (Attached Table 9.5-2(1/2) and 9.5-2(2/2)).

4) Target of Treated Water Quality

- In EIS Factory, the wastewater and sludge is discharged to the desert. Therefore and except for total dissolved solids (TDS) the most stringent wastewater discharge regulations in Egypt are applied (those of Law 48/82 Underground Reservoir & Nile Branches/Canals) except TDS.
  In these regulation, TDS (Total Dissolved Solids) in discharge water is specified as 800 mg/l which is very difficult to achieve in this situation.
- In Japan, TDS is not regulated in the wastewater item since Japan is surrounded by seas that already have high TDS concentration in the water.
- Industrial wastewater containing high TDS is not uncommon, especially in the case of neutralized acid / alkali water. In order to meet the TDS regulation of Law 48/82 , one either has to dilute the

wastewater with plenty of fresh water, or treat the wastewater in a desalination plant (such as Reverse Osmosis technology), which is extremely expensive.

- Therefore, in the basic design, TDS regulation of Law 48/82 was neglected.

(4) W.W.T. System Design

- EIS was selected as of the 3 representative factories for basic design. The wastewater stream to be treated is the acid wastewater (rinsing water and spent sulfuric acid) from the pickling plant at the cold rolling mill facility.
- The treatment system might be simple, and it could consist of a neutralization unit without a removing unit of organic matters (BOD/COD), which is important for industrial wastewater treatment.
- On the other hand, a significant sludge quantity, including gypsum ($CaSO_4$), would be formed in the system due to increasing the load of H_2SO_4 in the wastewater that comes from the spent sulfuric acid. Therefore, a gypsum recovery unit is provided in the W.W.T. demonstration plant (Candidate). The treatment system is designed as per the following drawing:

Attached Drawing 9.5-5 DWG. NO. IS-BD-15-01

「PROCESS FLOW DIADRAM OF W.W.T. DEMONSTRATION PLANT」

1) Pre-treatment

[Equalization Tank]

- Rinsing water and spent sulfuric acid are very different in quantity and quality. Therefore, in order to equalize the water, a large equalization tank is installed where wastewater is stored and mixed by air bubbling.
- Then neutralized wastewater is fed to the primary neutralization tank as constantly as is possible.

2) Primary Treatment

(a) Primary Neutralization Unit

- In the primary neutralization tank, lime (CaO) is injected and pH of wastewater is controlled at pH3－4 by adjusting injection rate. As a result, gypsum ($CaSO_4$) sludge will form, then it will settle in the sedimentation tank.
- The primary neutralization unit consists of a neutralization tank, a sedimentation tank and chemical (lime) injection unit.

(b) Secondary Neutralization / Oxidation Unit

- Lime and coagulant are injected to the supernatant of the sedimentation tank at primary neutralization unit, and also air is injected. Sludge formed by flocculation and oxidation settles in a sedimentation tank.
- The supernatant is fed to the sand filter unit, and sludge on the bottom of the 2nd sedimentation

tank is fed to the sludge treatment unit.

- The secondary neutralization unit consists of a neutralization tank, a sedimentation tank, a chemical injection unit and an air supply unit.

3) Advanced Treatment

[Rapid Sand Filter]

- In order to remove SS in the effluent from the 2nd sedimentation tank, filters are provided, which are filled with sand and anthracite.
- Filtered water may be used as make-up water for the rinsing plant, if possible.
- Filter must be backwashed automatically once every 24 hours or the filter media will clog with SS. Backwash wastewater is fed to the sludge treatment unit trough a water basin.
- Filter unit is consisted of 3 sets of filters (one is stand-by) and backwashing unit (pumps, blowers and water basins).

4) Gypsum Recovery Unit

The gypsum sludge from the 1st sedimentation tank is first dehydrated by centrifuge. After dehydration, the resulting sludge cake can be used for some structure material and as earth improving agent, etc.

5) Sludge Treatment Unit

- SS contents of the discharged sludge from 2nd sedimentation tank and filters is too low (0.5 −2.0%), therefore the sludge is thickened and dehydrated to reduce its volume.
- Sludge treatment unit consists of a sludge thickener, 2 sets of centrifuges and a chemical injection unit.
- Sludge will be disposed to the specified site in the Desert under management supervision.

(5) Material Balance

This wastewater treatment system generates a large quantity of gypsum and sludge because it is requires a large quantity of Lime to neutralize high H_2SO_4 concentration in the wastewater.

The chemical reaction formula is as follows:

1) Primary neutralization (formation of gypsum)

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$$

But, solubility of gypsum is approx. 2,000 mg/l, therefore approx. 2,000 mg/l gypsum remains in saturated conditions after removal of gypsum.

2) Secondary Neutralization (formation of ferric hydroxide)

$$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 + H_2SO_4$$

$$Fe(OH)_3 + H_2SO_4 + Ca(OH)_2 \rightarrow Fe(OH)_3 \downarrow + CaSO_4 \cdot 2H_2O \downarrow + H_2O$$

The effluent water from the 2nd sedimentation tank would also contain approx. 2,000 mg/l of

soluble gypsum.

3) The calculated amount of gypsum and sludge for Case 1 (Base case), Case 2 (Max. H_2SO_4 concentration proposed by EISO.) and Case 3 (non-spent sulfuric acid) are shown on tables 9.5-5 and 9.5-6.

4) Material balance sheets for Case 1, Case 2 and Case 3 are shown on the attached sheets

Attached Drawing 9.5-6

Case 1 : CHEMICAL REACTION and WATER BALANCE

Attached Drawing 9.5-7

Case 2 : CHEMICAL REACTION and WATER BALANCE

Attached Drawing 9.5-8

Case 3 : CHEMICAL REACTION and WATER BALANCE

Table 9.5-5 Formation Amount of Gypsum and Sludge

	Formation Amount	
	Kg/h (dry)	Kg/d (dry)
1. Primary Neutralization (Gypsum)	706	16,945
2. Secondary Neutralization (Sludge)	1,531	36,735
1) Gypsum	935	22,441
2) Ferric Hydroxide	580	13,929
3) Others	15	364
Total (1 + 2)	2,237	53,680

Note: SS contents of gypsum(1st neutralization) = approx.600kg/m^3

SS contents of sludge (2nd neutralization) = approx.200kg/m^3

Table 9.5-6 Case Study of Gypsum and Sludge formation

Case	Rinsing Water		Spent Sulfuric Acid		Sludge Amount [kg/h]		
	Flow[m^3/h]	Conc.[kg/m^3]	Flow[m^3/h]	Conc.[kg/m^3]	Gypsum	2nd Sludge	Total
Case 1	150	2.5	1.67	120	706	1,530	2,236
Case 2	150	12	1.67	120	3,207	1,530	4,737
Case 3	150	2.5	0	120	358	979	1,337

(6) Plot Plan

1) Construction Site

Attached Drawing 9.5-6

「LOCATION OF CONSTRUCTION SITE FOR W.W.T. DEMONSTRATION PLANT」

(a) Temporary Site

The construction site for the demonstration plant (Candidate) proposed by EIS personnel in charge of this study, was a vacant ground located on the north side of the pickling plant of the cold rolling mill facility. The site has enough area for the W.W.T demonstration plant (Candidate). Also, a high voltage cable is already present on the west side of the site.

(b) Approved Construction Site

EIS's top management did not approve the above site. Another site located in the scrap yard at the east side of the cold rolling mill facility was proposed as an alternative.

As a result of the field survey, the Study Team agreed that the site could be utilized for the demonstration plant (Candidate) after clearing the site of scraps.

2) Layout of W.W.T demonstration plant (Candidate)

Refer to the attached drawing.

Attached Drawing 9.5-7 DWG NO. IS-BD-12-01

「PLOT PLAN FOR W.W.T. DEMONSTRATION PLANT」

Required area for W.W.T. demonstration Plant (Candidate) is 50m x 70m (3,500m^2), that is about 6 times of that required in the conceptual design. The reason for the increase is that all treating equipment sizes must be increased due to high concentration of H_2SO_4 by addition of spent sulfuric acid, and the need to install a gypsum recovery unit.

(7) Major Equipment and Instruments

1) Skeleton Drawing of major Equipment

The skeleton drawings of the major equipment are prepared and those drawing are compiled in the appendix design package.

2) Preparation of Lists

The following lists are prepared and those lists are compiled in the appendix design package.

(a) EQUIPMENT LIST

(b) INSTRUENT LIST

(c) MOTOR LIST

(8) Electrical, Instrumentation Design

1) Electrical

- Electricity (380V AC x 3phase x 50HZ) is received from a Substation located at the cold rolling mill plant. Cable length may be more than 300m.
- Approx. 1000KVA electricity is required for all electricity in W.W.T. demonstration plant (Candidate). The drawing plan for main cable, and the single line diagram of motor control board

are prepared and compiled on the appendix design package.

(a) DWG. Configuration of Electrical &\ Instrumentation System

(b) DWG No. SP-BD-60-001－002

「Single Line Diagram 380V Motor Control Board」

2) Instrumentation

- The center control panel board is installed in the W.W.T. control room.
- The indicators, recorders, alarms and sequence timer units are mounted on the panel.
- The control valves are operated pneumatically using compressed air.

(9) Construction Schedule (Standard)

The overall standard schedule for the implementation of the demonstration plant is attached. Refer to the attached table.

Attached Table 9-2

「Overall Schedule for Implementation of Demonstration Plant (Preliminary)」

(10) Estimated Construction Cost

The construction cost for the demonstration plant (Candidate) at EIS was estimated based on the basic design drawing and the following unit costs:

● Equipment, Instrument : Estimated unit cost table (Japan)
Recent home data of CHIYODA Corp.

● Construction Works: Survey data in Egypt
CHIYODA home data used in Alexandria project

The estimated construction cost summary of the W.W.T. demonstration plant (Candidate) is shown on the following table 9.5-7, and the attached table in detail.

Attached Table 9.5-3 「ESTIMATE SUMMARY & DEMACATION」

(11) Annual Maintenance Cost

The annual estimated maintenance cost for the demonstration plant operation is shown below: The breakdown for maintenance cost as well as the base data used in the estimation are shown on the following table of appendix design package

● Running Cost: Egyptian Iron and Steel Co.

● Electric Power Consumption

Table 9.5-7 Estimated Construction Cost Summary

Item	Estimated Cost			Paid by	
	Paid in Japan [1000yen]	Paid in Egypt [1000LE]	Total	Japanese [1000yen]	Egypt [1000yen]
1. Direct Cost					
(1) Equipment	235,000 (9,000)	0 0		244,000	0
(2) Field Works	0	6,560 (1,130)		223,000	38,400
Subtotal	244,000	7,690		467,000	38,400
2. Indirect Cost	39,500 (500)	4,366 (108)			
Subtotal	40,000	4,474		122,400	69,800
Total (1+2)	284,000	12,164		589,400	108,200
Total [1000yen]	284,000	413,600	697,600	589,400	108,200
Total [1000LE]	8,353	12,164	20,517	17,335	3,182

Note1: Cost of ( ) shows the estimated cost of out of battery limit.

Note2: Exchange rate 1 Egyptian Pound (LE) = 34 Japanese ye

Table 9.5-8 Annual maintenance Cost

Item	Consumption [/d]	Unit Cost [LE/]	Amount	
			[LE/year]	[LE/m^3]
1. Chemicals	-	-	2,554,934	1.890
2. Filter Media	-	-	5,400	0.005
3. Electricity [Kw]	6,159	0.12	243,914	0.181
4. Water [m^3]	120	0.528	20,909	0.016
5. Maintenance *	-	-	570,000	0.423
6. Personal Expense	-	-	160,000	0.120
Total			3,545,516	2.635

Note1: Maintenance cost is assumed as 3% of construction cost (650 million-yen).

Note2: Exchange rate 1 Egyptian Pound (LE) = 34 Japanese yen

9.5.4 Basic Design (Modified)

(1) Implementation of Basic Design (Modified)

The results of W.W.T. demonstration plant (Candidate) for EIS did not met the selection criteria of Demonstration Plant described on M/M of SW. So that it has been decided regretfully not to introduce W.W.T. Demonstration Plant in Egypt.

On the meeting between the Egyptian side and the Study Team, it was decided that the basic design (Modified case) of W.W.T for EIS would be studied under the following condition:

- The existing spent sulfuric acid recovery (SSAR) unit should be improved so as to treat spent sulfuric acid from Pickling Plant completely.
- W.W.T. designed as the modified case should treat only acid wash water (rinsing water).

(2) Additional Wastewater Survey

1) Object

The design conditions of the basic design (original) was pointed out by EIS that H_2SO_4 concentration of acid wash water (rinsing water) is too low comparing to the data of EIS.

Therefore, before the basic design (Modified), wastewater survey was carried out to decide the design conditions of flow rate and quality.

2) Wastewater Survey

(a) Presentation, Pre-survey: February 8 – 10, 2000

(b) Wastewater Survey : February 12 – 17, 2000

3) Wastewater Sources

After this survey, the wastewater stream names were changed as follows:

- acid wash water → rinsing water
- waste acid → spent sulfuric acid

In this survey, an additional wastewater source was revealed. It was the leakage wastewater that collected in the sewer of the deep trench where the 2 wastewater pipes (rinsing water and spent sulfuric acid) were laid. But it was not clear where this leakage water came from exactly.

Also in this survey, attempts were made to measure the flow rate of supply water to the pickling and rinsing bathes.

4) Result of Flow Rate Measurement

The results of flow rate measurement are shown on the table 9.5-9. In spite of pickling / rinsing plant stoppage, supply water is not closed, therefore the wastewater flow rate is almost same as that during operation.

Table 9.5-9 Wastewater Flow Rate [m^3/h]

	Average	Min.-Max.	Maximum*
1. Rinsing Water	16.9	9.8-21.5	32.0*
2. Spent Sulfuric Acid	2.0	1.1-5.6	
3. Leakage Water	5.0	3-10	

Note1: Flow rate was measured using an electromagnetic-type flow meter.

Note2: 1. is average of 13 measurements, 2 and 3 are averages of 6 measurements each.

Note3: * mark refers to data recorded on the continuous flow recorder sheet.

5) Results of Water Quality

Water quality of rinsing water and leakage water is shown on table 9.5-10 and the quality of spent sulfuric acid is shown on table 9.5-11.

Table 9.5-10 Wastewater Quality

Item	Rinsing Water		Leakage Water	
	Average	Min.-Max.	Average	Min.-Max.
H_2SO_4 [mg/l]	3,300	1,000-7,600	43,600	22,700-66,100
[%]	0.33	0.1-0.76	4.63	2.27-6.61
$FeSO_4$ [mg/l]	4,100	500-10,700	31,700	8,700-61,200
[%]	0.41	0.05-1.07	3.17	0.87-6.12
T-Fe [mg/l]	681	169-1,350	26,158	3,102-55,800
Fe^{2+} [mg/l]	501	111-923	22,203	2,078-45,833
Fe^{3+} [mg/l]	180	38-595	3,955	1,024-13,300
TDS [mg/l]	2,940	720-7,725	-	-
pH [-]	1.17	0.65-1.53	2.20	1.00-3.75
Water Temp. [℃]	45.0	37.9-49.3	27.9	23.8-32.2

Table 9.5-11 Spent sulfuric Acid Quality

	Average	Min.-Max.	Remarks
H_2SO_4 [%]	16.41	11.81-20.09	
$FeSO_4$ [%]	17.94	14.31-22.17	
T-Fe [mg/l]	16.07	5,380-32,600	
Fe^{2+} [mg/l]	14,886	4,294-31,455	
Fe^{3+} [mg/l]	1,185	1,042-1,708	
pH [-]	0.55	0.11-1.00	
Water Temp. [℃]	65.0	43.0-85.0	

(3) Neutralization and Flocculation Test

Neutralization tests and flocculation tests were carried out using rinsing water of EIS at TIMS laboratory in cooperating with TIMS members in order to obtain data for the basic design and to achieve a technical transfer activity. The Jar Tester (Flocculation Test equipment) was used for the

following various tests:

1) Purpose of Test

(a) CaO consumption corresponding to pH = neutralization Curve

This test is used to determine the CaO dosing rate.

(b) Residue Fe^{2+} corresponding to pH

(c) Comparison of single stage separation versus two stages separation (specifically for the gypsum recovery)

(d) Effect of aeration (oxidation) after 2nd neutralization

(e) Selection of coagulant

(f) Dosing rate of coagulant

2) Neutralization

(a) Neutralization Curve for rinsing water changes quickly at around pH 3-4.

CaO dosing rate = approx. 3g –CaO / L-Wastewater

(b) pH 8.5 - 9 is required that Fe^{2+} in wastewater becomes insoluble.

CaO dosing rate = approx. 6g-CaO/L-wastewater

3) Effect of two-stage separation

It is possible to improve the settling velocity in the 2nd sedimentation tank (basin) by adopting a gypsum recovery unit at pH 3-4. However, a clear effect could not be found when comparing the results of the single versus the two-stage separation. Therefore, a two-stage separation (gypsum recovery) system in not applied in the modified basic design.

(a) The settling velocity of pH-9 slurry (at 2nd neutralization) is lower than that of gypsum slurry at pH 3-4 (at 1st sedimentation).

(b) The slurry (mainly gypsum) that settled at pH 3-4 includes Fe^{2+} ion, and has a dark green color. However, the dewatered sludge cake may change to brown in color at the surface by oxidation.

(c) In spite of being removed gypsum sludge at pH 3-4 (at 1st neutratization), a volume of pH-9 sludge (at 2nd neutralization) does not decrease so much. It means that a density of pH 9 sludge is smaller than rhat of gypsum sludge at pH 3-4.

(d) As a result, the surface area of sedimentation tank (basin) increased in size.

4) Effect of Aeration (Oxidation)

(a) At pH 8 slurry, residual Fe^{2+} is detected.

(b) At pH 8.5-9 slurry, residual Fe^{2+} can not be found by complete oxidation.

5) Selection of Coagulant

Coagulant such as alum is not necessary because ferrous / ferric sulfuric in the wastewater acts as a coagulant.

6) Effect of Polymer

After aeration, coagulation / sedimentation effect of pH 8.5-9 slurry was tested by injecting a polymer which was purchased locally (from Cairo).

(a) The effect of polymer is distinguished. Slurry injected with polymer becomes flocculated and it setting velocity increases. Also, the supernatant becomes clear after settling.

(b) Anion polymer is more effective than cation polymer.

(c) It was determined that the dosing rate of anion polymer is 0.05mg/L.

(4) Basic Design (Modified) Conditions

1) Assumptions

(a) SSAR unit is improved (renewed or reinforced).

(b) Even if SSAR can not treat spent sulfuric acid, the remaining acid should be treated independently from the modified design new plant, and disposed separately.

(c) The existing pickling / rinsing plant are well operated and are well maintained as per the original or revised design.

(d) The existing discharging pipe is utilized for feeding the wastewater to the equalization tank and for discharging of treated water to the desert (i.e. new pipes are not provided).

2) Wastewater to be treated

(a) Rinsing Water

(b) Leakage Water

It had not been leakage in the conceptual design and the basic design (original). However, since the plant is outdated, leakage water may come from various sources in basins and pipes. Therefore, countermeasures to mitigate the leakage may be difficult to implement and would be expensive as well as time consuming.

If the modified plant does not treat leakage water, EIS should operate the existing neutralization plant and the neutralized water should be discharged through the existing pipe. In this case, the modified plant should be provided with a new pipe to carry the influent to the equalization tank. Also, if the SSAR unit treats leakage water, the unit would be uneconomical because H_2SO_4 concentration in the leakage water is too low in comparison to that in the spent sulfuric acid.

- H_2SO_4 conc. of leakage water: 4.6%
- H_2SO_4 conc. of spent sulfuric acid: 16%

3) Wastewater Flow Rate and Quality

Design basis of wastewater flow rate and water quality are shown on table 9.5-12:

Table 9.5-12 Design Flow Rate and Quality

Item			Max. Flow Rate	Max. Conc.
Flow Rate		[m^3/h]	90	40
Water Quality	H_2SO_4	[mg/l]	4,300	9,500
		[kg/h]	380	380
	$FeSO_4$	[mg/l]	4,300	9,500
		[kg/h]	380	380

(4) Treated water quality

1) Oil & Grease, and others

- The discharge water quality in the basis design (modified) for EIS is to meet the requirements of the Egyptian No. Law 48/82 (Wastewater Discharge Regulations to Underground Reservoir & Nile Branches / Canals).
- Based on the water quality analysis results, the COD (134mg/l), oil and grease (18.1mg/l), and Pb (0.12mg/l) in rinsing water exceed to the allowable limits in the above law. After treatment by neutralization and chemical clarification, treated water quality can be treated less than the discharge regulation completely.

2) Total Dissolved Solids (TDS)

- TDS contents of rinsing water is average 2,940mg/l shown on the table 9.5-10 and this value will increase by addition of leakage water which is high acid concentration.
- As formerly described, in order to remove / reduce TDS, desalination process is required such as RO (reverse osmosis) which is very expensive in a construction cost and maintenance cost and also complicated in system.
- Therefore, in this basic design (modified), the target of treated water quality is applied except TDS.

5) Gypsum Recovery Unit

A Gypsum recovery unit is not provided in the modified basic design due to the following reasons:

(a) The amount of generated gypsum is not very large because the spent sulfuric acid of high H_2SO_4 concentration is not treated.

(b) The generated Gypsum may contain ferrous sulfate ($FeSO_4$). Therefore its quality may be inferior and its color may change to brown by oxidation.

(c) A treatment system that include a gypsum recovery plant becomes complicated.

(d) Both the construction cost and the maintenance costs are higher.

(e) The modified W.W.T. plant is not used for demonstration purposes.

(5) Plot Plan

1) Construction Site

Refer to the attached drawing.

Attached Drawing 9.5-8

「LOCATION OF WASTEWATER TREATMENT PLANT」

(a) Wastewater Collection Site (Area "A")

A receiving pit of concrete basin with pumps is provided next to the existing wastewater pipe trench.

(b) Wastewater Treatment Site (Area "B")

The site is located in a lot located on the East Side of the cold rolling mill facility, where it is used as a scrap yard. The existing discharging pipe of neutralized water and pipe rack can be utilized.

2) Plant Layout

The layout of W.W.T. plant was designed based on operability and maintenance works. The layout by basic design (modified) is shown on the attached drawing.

Attached Drawing 9.5-10 DWG. No. EIS-BD-12-01 (Modified)

「PLOT PLAN FOR WASTEWATER TREATMENT PLANT」

The required area for W.W.T. plant is 38m x 48m (1,824m^2) , that is about a half required area of the basic design (original).

(6) Wastewater Treatment System Design

W.W.T. system was designed as a modified case, and the following drawings were prepared:

Attached Drawing 9.5-9 DWG NO. EIS-BD-15-01 (Modified)

「PROCESS FLOW DIAGRAM OF WASTEWATER TREATMENT PLANT」

Appendix Design Package DWG NO EIS-BD-01－06 (Modified)

「ENGINEERING FLOW DIAGRAM FOR W.W.T. PLANT」

1) Equalization Tank

- Wastewater (rinsing water + leakage water) collected in the receiving pit is fed to the equalization tank using the raw water pumps.
- In the tank, wastewater is equalized in quality and quantity by air bubbling. Then a constant flow of wastewater is fed to the 1st neutralization tank.
- The equalization unit consists of an equalization tank with an air bubbling device, and an air supply unit.

2) 1st Neutralization Tank

- CaO is injected in wastewater at the inlet of the 1st neutralization tank. Wastewater is neutralized at pH 3-4 automatically. At pH 3-4, gypsum slurry is deposited.
- In order to deposit the gypsum easily, the sludge from the 2nd sedimentation tank (clarifier) is

returned to the inlet of tank as seeds of gypsum.

- The 1st neutralization unit is consisted of a neutralization tank, and a sedimentation tank with a center driven type of sludge collecting rake.

3) CaO Injection Unit

- CaO used at the existing neutralization plant is not uniform in size and contains lumps several cm in diameter. Therefore, a tower mill is provided to make lime milk after crushing the raw lime in a crusher.
- In order to prevent from clogging, the injection pipe is provided with a recycling line.

4) 2nd Neutralization Tank

- CaO is injected in the wastewater (slurry) neutralized in the 1st neutralization tank. Wastewater is neutralized at pH 8.5-9 automatically. and is also oxidized by air.
- All soluble Fe, H_2SO_4, $FeSO_4$ in wastewater become insoluble slurry including gypsum, ferric sulfate, ferric hydroxide and heavy metal.

5) Chemical Clarifier (Coagularion/Flocculation and Sedimentation)

- Settleability of slurry formed in the 2nd neutralization tank is not fast enough, therefore polymer is injected to accelerate flocculation.
- Then, slurry is separated the supernatant and sludge in the clarifier (sedimentation tank). The supernatant (treated water) is discharged to the lagoon, and sludge is fed to the sludge thickener.

6) Sludge Treatment Unit

(a)SS contents of sludge is low (0.5－2.0%), therefore sludge is dehydrated by 2 sets of centrifuges to reduce sludge volume after thickening by the sludge thickener.

(b) Dewatered sludge cake is stored in the elevated cake hopper, and transported by a truck to a proper disposal site.

(c) Supernatant of sludge thickener and filtered water of centrifuges are returned to the inlet of 1st neutralization tank for re-treatment

7) Structure

(a) W.W.T. Control House

- The W.W.T. control house is provided in the W.W.T. battery limit for plat operation.
- The main control panel room, motor control center room, mini-laboratory, rest room, toilet, warehouse and compressor room, etc. are provided in the house.

(b) Centrifuge Sheltor

A Shelter is provided for the centrifuges.

(8) Major Equipment and Instrument

1) Major Equipment

The skeleton drawings of the major equipment were designed and compiled on the appendix design package.

2) Lists

The following lists were prepared and compiled on the appendix design package.

(a) EQUIPMENT LIST

(b) INSTRUMENT LIST

(c) MOTOR LIST

(9) Electrical Design

Same as the basic design (original) basically.

(10) Construction Schedule (Standard)

The overall standard schedule for implementation of the demonstration plant is applied.

Refer to the attached table.

Attached Table 9-2 「Overall Schedule for Implementation of Demonstration Plant (Preliminary)」

(11) Estimation Construction Cost Summary

The estimated construction cost summary for W.W.T. plant of basic design (modified) is shown on the table 9.5-13. The breakdown of estimation cost is shown on the attached table.

「EGYPTIAN IRON & STEEL CO. (EIS) Estimated Cost Breakdown」

Table 9.5-13 Estimated Construction Cost Summary

	Paid in Japan [1000yen]	Paid in Egypt [1000LE]	Total [1000LE]
1. Direct Cost			
(1) Equipment, Instrument	209,270	0	6,155
(2) Field Works	0	5,906	5,906
Subtotal	209,270	5,906	12,061
2. Indirect Cost	29,500	3,058	3,930
Total (1+2)	238,770	8,964	15,991
Total [1000yen]	238,770	304,900	
	543,670		

Note1: Exchange Rate · 1 Egyptian Pound = 34 Japanese Yen

Note2* Field works shall be conducted by Japanese contractor.

Note3: Piping cost between the unit and lagoon is included.

(12) Annual maintenance Cost

The annual maintenance cost summary for W.W.T. plant is shown on table 9.5-14, and the following tables were used for estimation:

(a) Running Cost Egyptian Iron and Steel Co.

(b) Electric Power Consumption

Table 9.5-14 Annual maintenance Cost

Item	Consumption [/d]	Unit Cost [LE/]	Amount	
			[LE/year]	[LE/m^3]
1. Chemicals	-	-	942,821	1.323
2. Electricity [kw]	2,761	0.12	109,323	0.153
3. Water [m^3]	200	0.528	34,848	0.049
4. Maintenance Cost*	-	-	454,320	0.637
5. Personal Expense	-	-	160,000	0.220
Total			1,701,311	2.382

Note1: Maintenance* is assumed as 3% of plant construction cost (515 million yen).

Note2: Exchange rate 1 Egyptian Pound = 34 Japanese yen

(13) Others

In the basic design (modified) of W.W.T. for EISCO. factory, the following documents are prepared and compiled on the appendix design package.

1) Basic Design (modified) Study Report

2) Basic Design Calculation Sheet

(14) Special Note

The conceptual and basic design (original, modified case) packages of W.W.T. for EIS described here are only reference.

Therefore, the performance of the plant designed and constructed based on this design package can not be guaranteed by the Study Team.

10.0 SURVEY RESULTS ON CURRENT PICKLING LINE AND WASTE ACID REGENRATION SYSTEM IN EIS AND PROPOSAL FOR IMPROVEMENT

10.0 Survey Results on Current Pickling Line and Waste Acid Regenration System in EIS and Proposal for Improvement

In this chapter, the survey results on current pickling line and waste acid regeneration system in EIS(Egyptian Iron and Steel Co.) and proposal for improvement are described.

In this recommendation following contents are described,

(1) Analysis of current situation on operation and equipment of Pickling Line

(2) Analysis of current situation on operation and equipment of Acid Recovery System

(3) Analysis of current situation from acid concentration

(4) Comments on the EIS's plan for revamping of Acid Recovery System (Thyssen, 1998)

(5) Recommendation for improvements on operation and equipment of current Pickling Line and Acid Recovery System (ANNEX-1)

In this description,

(a). Indirect liquor heating system (ANNEX-2)

(b). Brain type Acid Recovery System (ANNEX-3)

are included.

10.1 Results of field survey

The Pickling Line in EIS is old styled H_2SO_4 system, and involving many issues such as problem on products quality, law reliability of operation and problem on treatment of waste water and acid. And on the point of products quality, current level is far from the international standard. Essentially, surface of adequately descaled steel sheet shows white silver color and that is the international standard, but current steel sheet pickled in EIS shows dark surface, so, this is insufficient for substrate of cold rolling or for out sales.

On the other hand, maintenance activity for improvement of equipment and performance is inadequate in EIS, so, many problems raised by lack of the maintenance can be seen at anywhere. Putting together with old system, this will accelerates the decrepitude of process performance.

For the radical modernization of process, revamping of the pickling Line with HCl system should be required, but in this report we describe the analysis of existing line and recommendation that can be adopted.

10.1.1 Analysis of current situation of Pickling Line (including Rising Unit)

Main problems on operation and equipment are as follows;

Recommendation for these shall refer to ANNEX-1.

(1) Current situation of operation

(a). Problem on concentration control of pickling liquor

Sampling and analysis of mother liquor are executing by one time a shift, but stable concentration of

liquor can not be obtained as supply of mother liquor is done by batch operation and without feed control. And at that time, volume of liquid over flow from No.1 tank is increased because mother liquor is fed regardless of liquor height level in pickling tank.

(b). Problem on temperature control of pickling liquor

No thermometer is installed on the pickling tank, therefore, heating is done on intuition based on the steam pressure of main steam pipe line.

(Steam is injected directly into the acid for heating, therefore, concentration of acid is lowered by concentrated steam and overflowed from the pickling tank)

(c). Problem on pickling operation

Threading of coil is done on intuition as no speed mater is installed. 3 of basic parameter, namely, concentration, temperature of pickling liquor and threading speed, are not controlled, therefore, pickled strip surface is not stable and not fine. This invites so often the scale defects on the surface of the cold rolled sheet, and so often of re-pickling causes law productivity and inclusion of oil into the pickling liquor.(In EIS, strip is oiled just after rinsed, and after that inspection is executed. Non acceptable strip is re-pickled as oiled)

(d) Problem on procedure at line stop

On the field survey we met so many times of line stop due to steam pressure drop, at that time, we found no fundamental procedure such as stoppage of washing water supply into rinsing tank and stoppage of purge air and warmed air into dryer that invite huge energy loss. This is the same as no engine stop of the car at parking. Furthermore every steam valve of pickling tank are opened.

(e) Problem on disarrangement of liquor cascade among No.4 tank through No.1 tank

The current concentration of liquor in each tank shows deviation against designed level, and this might invite low performance of pickling. Factor on management regarding item (a) through (c), and factor on equipment described later are considerable.

Designed range and current range of liquor cascade

Tank No	Designed range(%)		Current range(%)	
	H_2SO_4	Fe_2SO_4	H_2SO_4	Fe_2SO_4
#4	21-23	9-10	18-19	10
#3	18-20	11-12	16-19	11
#2	15-17	13-14	14-19	13
#1	8-12	15-20	11-17	14

(f) Problem on side water control

Side water is used for sealing of the cover and for washing acid drain from the cover, but the amount of side water seems rather large and it invites the increase of waste water to be neutralized. Fine adjustment shall be required.

(2) Current situation of equipment

(a) Problem on liquor heating system : → essential issue

Heat up of pickling liquor is done by direct injection of steam into the liquor, therefore, this invite many problems such as decrease of liquor concentration, increase of spent acid, lower of acid recovery efficiency due to leaning of return acid, by passed acid neutralize due to over load of acid recovery system, increase of load of waste water neutralize system, waste water pollution, pollution of operation area, and so on. Therefore, improvement to indirect heating system is very important and urgent theme.→ Refer to later description.

(b) Problem on the location and type of over flow pipe and steam injection pipe

Due to close location between over flow pipe and steam injection pipe, volume of acid over flow is increased by turbulence at steam injection. And over flow is raised due to liquor meniscus fluttering by strip threading as well, as no flow control valve is installed on over flow pipe.

(c) Problem on function of wringer roll

The wringer roll is installed at delivery side of No.4 pickling tank to squeeze carry over acid on the strip, but its function is insufficient due to poor maintenance. Carried over acid is squeezed insufficiently because the mechanism of roll position and pressure adjustment doesn't work and two rolls are not in parallel. Therefore high concentrated acid on the strip is carried into adjacent rinsing tank. Adequate maintenance of roll gap adjustment mechanism is required, and moreover, improvement into double wringer roll type, and installation of air blowing system are recommendable to decrease the amount of carried out acid.

(d) Problem on maintenance of steam injection pipes

Heavy corrosion at meniscus area on steam injection pipes are found and invites serious steam loss. Adequate maintenance is required.

(e) Problem on blowing air for dryer

Volume of blowing air for outlet of dryer. By checking of drying condition of strip surface, to narrow the width of slit nozzle and reduce air consumption seems to be available.

(f) Problem on main steam pipe

No steam trapping valve is installed on main steam pipe and instead of that 2 inches drain pipe is installed. Huge amount of steam is wasted out from the drain pipe and it invites steam pressure drop and energy loss. Essentially, plant manager shall check and improve these situation. Drain trapping valve shall be installed. And no insulation is installed on most of steam pipe, or dropped away, so this causes drop of steam pressure and loss of energy. During field survey, we observed that heating is stopped and acid temperature drop is occurred by the sudden drop of steam pressure during acid heating. But its cause is not investigated.

10.1.2 Analysis of current situation of existing Acid Recovery System

Main problems on operation and equipment are as follows;

Recommendation for these shall refer to ANNEX-1.

(1) Current situation of operation

(a) Problem on low operation ratio and low reliability

During last field survey, situation that every process are under operated normally has not be found and this seems due to drop of steam pressure and reason of inadequate maintenance. In this case, spent acid is introduced into neutralization unit and this invites increase of neutralize load and decrease of recovered acid. And at the same time, possibility of water pollution due to over load of neutralize unit is contained as well.

(b) Problem on low reaction efficiency

Due to non reach of temperature drop in No.20 through No.31 of reactor vessel up to designed point(10 ℃), crystallization of $FeSO_4$ is slowed and treatment of waste acid becomes insufficient. The cause is higher temperature of waste aid and concentration of $FeSO_4$ is lower than that of designed point(20%).

(c) Problem on make up of mother liquor

Mixing of recovered acid and new acid(98% of concentration) is done in No.30 of reactor vessel, but control of flow rate us not stable. And at the operation starting time, procedure of new water injection into the reactor vessel to keep liquid meniscus level was found. This procedure is not desirable as decrease of acid concentration is occurred.

(d) Problem on operation control of steam ejector

At actual operation, un-matching between concentration of $FeSO_4$ and crystallize temperature is occurred due to no control of steam volume and pressure for steam ejector. Namely, lack of temperature drop by vaporization invites lowering of capability of waste acid recovery. And insufficient steam supply is found as well.

(e) Problem on temperature raise of cooling water

In spite of water season, temperature of cooling water shows as high level of 29℃.

(f) Fe^{2+} is flowed into cooling water for condenser and raised up to 50ppm.
PH is lowered temporally as well.

(2) Current situation of equipment

(a) Problem on efficiency lowering due to inadequate maintenance

- Lowering of heat exchange rate due to clogging the condenser tube by scale.
- Insufficient sealing in acid recovery system brings longer lead time for vacuumize and lower capability.
- Capability of steam ejector is lowered.
- Due to lack of sealing in the reactor vessels, new water is injected into the vessels, and this invites low reaction.
- Leakage of acid from grand packing of acid pump brings lower acid recovery efficiency.

(b) Problem on lack of instrumentation

Due to no pressure meter, no thermometer and no vacuum meter on reactor vessels and tank for $FeSO_4$ slurry, it takes longer lead time to get balance of whole system.

10.1.3 Analysis of current situation from the concentration of waste acid

(1) Feb. 14, 14:00 H_2SO_4 : 20mg/l, $FeSO_4$: 6mg/l was in the wash water

Existence of H_2SO_4 and $FeSO_4$ means existence of corrosive components on the strips, and these situation cannot be allowable. It is recommendable to change wash water source from recirculation water to fresh water.

(2) Concentration in the washed water at delivery portion:

0.1%～0.75%/average 0.328% of H_2SO_4,

0.03～0.34%/average 0.165% of $FeSO_4$

Concentration of H_2SO_4 and $FeSO_4$ in the returned lean acid (neutralization shall be required) are higher level.

In Japan, we control these parameters by,

H_2SO_4 ≦0.1% and

$FeSO_4$≦0.01%.

This seems to be caused by insufficient wash water volume. Remains of acid on the strip surface by insufficient wash water will induces the corrosion of strip surface.

(3) Concentration in the waste acid:

H_2SO_4 : 11.81～20.09 % / average 16.4%

$FeSO_4$: 1.35～13.27 % / average 7.31%

Concentration of H_2SO_4 is high and $FeSO_4$ is low. Moreover, due to large deflection of acid concentration stable pickling can not be executed, this means quality of the strip is not stable. And efficiency of pickling is not good, this means consumption of new acid is large.

[Expected cause]

(a) Because of steam direct injection system, concentration control can not be achieved. (By steam drain)

(b) Supply of mother liquor is done by batch operation.

Due to no indication of meniscus of acid in the pickling tank, excess supply of mother liquor will be occurred then volume of waste acid is increased after mother liquor supply, increase of H_2SO_4 concentration and decrease of $FeSO_4$ concentration is occurred.

This invites over load of acid recovering system then over flowed waste acid is flowed into neutralization unit.

(c) Concentration of $FeSO_4$ is so much decreased compared with thedesign level.

This situation meets to the increase of new acid consumption.

And this will influence directly on the capacity of acid regeneration system planned to revamp.

Low concentration of $FeSO_4$ and increase of waste acid means that recovery on 3.6 tons/Hr of $FeSO_4 \cdot 7\ H_2O$ can not be achieved by current plan of system capacity.

(4) Leakage Fluid

Concentration in the leakage fluid from #1～#4 pickling tank:

H_2SO_4 : 2.27～6.61 % / average 4.36%

$FeSO_4$: 0.56～4.31 % / average 2.27%

Due to dilution by side water deflection of concentration and flow rate will be unavoidable, but concentration of H_2SO_4 and $FeSO_4$ are high, therefore, neutralization of leakage fluid is not proper.

This fluid shall be recovered to decrease the new acid consumption.

(5) Mother Liquor

Concentration of mother liquor is almost planned figure;

H_2SO_4 : 25.44 %

$FeSO_4$: 2.59 %

Therefore, automation of meniscus control of pickling tank and mother liquor supply by adoption of inverter control on supply pump will invite stable concentration control of H_2SO_4 and $FeSO_4$ in the

pickling acid and improvement of strip quality as well.

And it seems the capacity on revamping plan of acid recovery system seems to be able to shrink its capacity because the deflection of waste acid volume will be decreased.

Current waste acid volume : 18 m^3 / Hr (average 15 m^3 / Hr)

↓

Revised waste acid volume : 12 m^3 / Hr

(Drain ; 6 m^3 / Hr + Recovered acid ; 6 m^3 / Hr)

By this 30% of reduction on plant capacity will be available.

ANNEX - 1

Survey results of waste acid

1. Results of Waste acid volume and concentration analysis

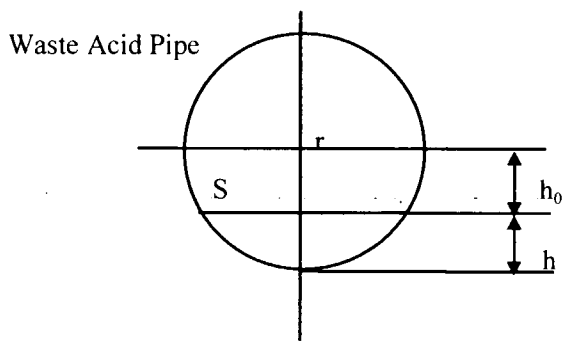
Date : Feb. 14～16, 2000.

(Date) Time	h (mm)	Sectioned Area (x $10^{-2}m^2$)	Velocity (x 10^{-2}m/s)	Flow Rate (m^3/Hr)	H_2SO_4 (%)	$FeSO_4$ (%)	remarks
(Feb.14)							
13:20	145	5.2	2.6	4.4			
13:36	140	4.9	2.1	3.7			ave. 4.2
14:05	140	4.9	2.1	3.7			m^3/Hr
14:50	150	5.5	3.3	6.6			
16:35	135	4.7	1.0	1.7			
17:33	145	5.2	2.6	4.5			
(Feb.15)							
13:40	155	5.7	3.5	7.2			
14:10	147	5.4	2.7	5.2			ave. 7.5
14:20	165	6.3	5.0	11.3			m^3/Hr
14:30	155	5.7	3.5	7.2			
15:00	150	5.5	3.3	6.6	19.0	6.22	
(Feb.16)							ave. 11.8
9:07	135	4.7	1.0	1.7	15.44	13.27	m^3/Hr
9:33	143	5.0	2.1	3.8			
10:00	153	5.7	3.3	6.8			
10:20	192	7.7	8.0	*22.2			
10:25	200	8.0	8.5	*24.6			

*unstable waste acid(big over flow by mother liquor supply)

Velocity : by electro-magnetic flow meter

Arced section area : $S = r^2(\cos^{-1}x - 2\cdot(1 - x)^{1/2})$ where $x = h_0 / r$



2. Comments on existing EIS's study for Acid Recovery System

EIS has recognized the improper functioning of its Spent Sulfuric Acid Recovery Unit (SSARU) which was originally designed by USSR and operated more than 30 years. Therefore, EIS considered its drastic refurbishment or new installation of the similar recovery unit. EIS requested one certain engineering firm in Germany to submit the proposal for rectification in 1998. After review of the proposal EIS submitted the financial application to KFW (Kreditanstalt fur Wiederaubau) in1999.

During the 2nd Site Survey EIS requested JICA Study Team for its technical advice for EIS' intended rectification. The information and data obtained from EIS were so descriptive and incomplete that any fruitful advice could not be made by the team.

Accordingly, JICA Study Team with cooperation of EIS made the intensive survey of such existing production systems and facilities as acid cleaning, subsequent rinsing system and SSARU during the 3rd Site Survey.

Following are our comments mainly based on our survey.

(1) Unclear designed specification

Quantitative description regarding designed specification is inadequate, therefore, technical evaluation is not available.

(2) No description of material balance

Especially new acid consumption for mother liquor, and acid recovering rate shall be guaranteed at least.

(3) Flexibility for deflection of waste acid volume and concentration is not clear

These deflection range shall be specified.

(These deflection range seems to be large due to direct steam injection system)

(4) Big risk to flow out H_2SO_4 and $FeSO_4$ into condenser cooling water

Therefore, red water is generated by $Fe(OH)_3$ after PH control using NaOH, it is necessary to remove the SS.(Filtering system is required.)

(5) It is easily to decrease the vacuum capability due to segregate on the steam jet of D1～D4.

Big man power is required. (Previously, we had the same experience in Japan.)

(6) Special skill will be required to keep the balance due to unstable vacuum and concentration at start point.(Skilled person will be required)

We can say that adoption of vacuum evaporation system is not suitable for EIS because pickling operation is unstable.

(7) By this system, decrease of steam pressure easily invites decrease of vacuum and decrease of

capacity.

(8) Due to the complex system flow, it takes long time for trouble shooting.

It is important to be simple system for waste acid recovering unit and has good maintainability.

3. Recommendation for operation and system of existing plant

3.1 Operation and system of Pickling Line

(1) Case-1: Modification to indirect heating system using outer heat exchanger

(a) System Flow : Refer to ANNEX-2

(b) Effect

(i) Improvement of concentration control for each pickling tank

(ii) Improvement of strip surface quality and decrease of claim

(iii) Decrease of re-pickling work

(iv) Decrease of new acid consumption ; 40 new acid kg/steel ton → 15 new acid kg/steel ton

(v) Decrease of waste acid ; about 8 m^3/Hr

(vi) Stable flow rate of waste acid ; Shrink of capacity of waste acid recovering system

(c) Line stop period for plant modification = 1 day

(2) Case-2': Modification to indirect heating system using small diameter tube heat exchanger

(a) System Flow : Refer to ANNEX-2

(b) Effect : Same as above

(c) Line stop period for plant modification = 10 days

(d) Installation of protector is required

(3) Installation of thermometer into the each pickling tank

Making operation standard using the thermometer, control the steam valve.

(4) Installation of acid meniscus meter into No1. and No.4 pickling tank

Control the mother liquor supply to keep the constant meniscus level of No.1 pickling tank.

(5) Modification the mother liquor supply pump to inverter control

Control the feeding rate to keep constant acid meniscus in the each pickling tank.

(6) Main steam valve shall be shut during long time (more than 1 Hr) line stop.

(7) Installation of control valve to the overflow pipe of No.1 pickling tank

At line stop ; Valve close

At line operation ; Control the overflow rate by $FeSO_4$ concentration

(8) Replace the steam injection pipe (outlet portion)

Insulation shall be installed on the main steam pipe as well.

(9) Installation of air blowing in front of the wringer roll

Reduce the carry over acid from No.4 pickling tank.

Effect ; Reduce the acid consumption

Improvement of strip surface quality (reduce the surface rust)

Reduce the acid concentration of washing water

(10) Improvement of acid concentration control for each pickling tank

Concentration of acid in No.4 tank: To keep H_2SO_4:21～23% $FeSO_4$:9～10%

Analysis frequency : increase the acid analysis frequency of No.4 tank from 1 time/shift to 2 times/shift

(11) Change the steam injection point at No.1 pickling tank

(in case of current heating system)

Keep distance from the overflow pipe to save overflow rate and overflow of high temperature acid.

(12)Change the gap of air nozzle after drier

Nozzle gap shall be changed to 2mm from 7mm to reduce pressured air consumption (save electricity)

(13)Improvement of operation procedure at line stop

(a)Stop rinse water

(b)Stop air blow

(c)Stop drier fan

(d)Stop main steam valve for drier

(14)Installation of drain trap valve into the main steam pipe

To prevent huge amount of steam evacuation

3.2 Operation and system of Spent Sulfuric Acid Recovery Unit(SSARU)

Following 4-cases are considerable for countermeasure

Case-A ; Repair of existing SSARU with installation of indirect heating system

Case-B ; Installation of additional one SSARU (3 units in total) under direct heating system

Case-C ; Current EIS's studied one system under indirect heating system

Case-D ; Installation of one brain system with installation of indirect heating system

Evaluate and compare these 4 Cases.
As a precondition, treatment for all of spent acid will be difficult by Case-B and Case-C due to big deflection of flow rate and concentration under current direct heating system.

3.2.1 Case-A

Stable flow rate and concentration of spent acid will be obtained by adoption of indirect heating system, so, some improvement of treatment capability will be expected. But recovery up to designed capacity will not be expected due to serious system inferiority.
(Indirect heating system shall refer to ANNEX-2)

Flow rate of spent acid ; 8 m3/Hr
Concentration of spent acid ; H_2SO_4:8～12% $FeSO_4$:15～20%

Contents of repair for existing SSARU

(a) Replacement of steam pipe

To keep;

Steam pressure ; more than 6 kg/cm^2

Flow rate ; more than 5 t/Hr

(b) Replacement of 4 condensers

All condensers shall be replaced due to serious system inferiority.

To get controllability by instrumentation for temperature and pressure.

(c) Installation of additional centrifugal separator

Additional one machine is required because only one is under operation.

(d) Others

Getting the cooling water flow rate : over 300 m^3/Hr at under 20℃

Repair of sealing portion

Repair of leakage from the pump (installation of mechanical seal)

3.2.2 Case-B

In this Case, treatment for all of spent acid will be difficult due to big deflection of flow rate and concentration under current direct heating system.

From the point of system, it will b available to absorb the deflection by 3 unit but flexible start up for

additional system will not be obtained.

To operate this system normally, absorb by the big volume of storage tank will be considerable.

Required volume of storage tank ; 25 m^3/Hr x 10 Hr = 250 m^3

3.2.3 Case-C

In this Case, treatment for all of spent acid seems to be difficult by current plan of capacity (18 m^3/Hr) due to big deflection of flow rate and concentration under current direct heating system.

Same as Case-B, to install big volume of storage tank and absorb the deflection of flow rate will be required.

Required volume of storage tank ; 25 m^3/Hr x 10 Hr = 250 m^3

3.2.4 Case-D

By adoption of indirect heating system, stable flow rate and concentration of waste acid can be obtained. And stable regeneration of sulfuric acid will be available by brain system that id not influenced by sealing.

(Brain cooling system shall refer to ANNEX-3)

Flow rate of spent acid ; 8 m3/Hr

Concentration of spent acid ; H_2SO_4:8～12% $FeSO_4$:15～20%

Features of brain system

(1)As normal pressure operation, so no decrease of system capability due to vacuum trouble.

(2)No. crystal and scale pile up on the heat exchange surface of crystallizer

(3)Uniform crystal can be obtained from stable concentration of liquor by uniform agitation.

(4)Easy start up and easy operation can be obtained by brain cooling system

(5)High heat exchange efficiency of cristallizer can be obtained.

By high speed flow of coolant along outer casing of crystallizer, high heat exchange rate is available.

(6)Easy maintenance and Long term stable operation

No risk to flow out H_2SO_4 and $FeSO_4$ into waste water as indirect cooling system, so no PH control is required.

3.3 Evaluation and comparison for each Cases

◎ : Best, ○ : Better, △ : Base

Item		Case - A	Case - B	Case - C	Case - D
Pickling Line	Strip Quality	◎	△	△	◎
	Spent Acid Volume	◎	△	△	◎
	Concentration Deflection	◎	△	△	◎
	New Acid Consumption	◎	△	△	◎
	Maintainability	○	◎	◎	○
	Running Cost	○	○	○	○
	System Cost	△	○	○	△
SSARU	Cooling Method	Evaporation	Evaporation	Evaporation	Evaporation + Brain
	Capability	All	Not All	Not All	All
	Quality of Crystal	○	○	○	○
	Maintainability	○	○	○	◎
	Running Cost	○	○	○	○
	System Cost	◎	○	△	○
Remarks		Stable Strip Quality and reduction of spent acid by indirect cooling. Use of existing system	Direct heating is staled system and big deflection	same as left column	Best system Stable operation and quality by indirect heating sysetm
Total Evaluation	Evaluation	◎	○	△	◎
	Priority	2	3	4	1

ANNEX-2

Study for Indirect Heating System

1. Heat Exchange Rate and Steam Consumption

Pickling Tank	Heat Exchange Rate (Kcal/Hr)	Steam consumption (Kg/Hr)	remarks
1	1,636,520	3,600	counted strip heat load
2	511,520	1,200	
3	511,520	1,200	
4	961,820	2,100	counted mother liquor load

Steam : 4 kg/cm^2 G-saturated

2. Tank inside installation type (small tube type)

(1) Device

Pickling Tank	Heat Exchange Tube	Unit Area (m^2) x device No
1	PFA(Teflon)-6/8_ Tube	165 x 15
2	〃	52 x 13
3	〃	52 x 13
4	〃	98 x 14

(2) Device Cost (Only device) : ¥ 70,000,000 Japanese yen

3. Outer installation type

(1) Device

Pickling Tank	Heat Exchanger(Area m^2)	Circulation Pump(m^3/Hr x KW x No)
1	Carbide - 34.2	96 x 19 x 2
2	〃 - 11.6	66 x 15 x 1
3	〃 - 11.6	66 x 15 x 1
4	〃 - 21.3	120 x 22 x 1

(2) Device Cost (Only device) : ¥ 55,000,000 Japanese yen

- Carbide indirect heat exchanger ; 4
- Circulation Pump ; 5
- Others

4. System Flow : Refer to ANNEX - 3.2

5. Required maintenance

(1)Repair of heat exchanger block ; 1 time / a year

- Work cost ; ¥250,000 Japanese yen / time
- Parts cost ; ¥200,000 Japanese yen / time

(2)Replacement of heat exchanger block ; 1 time / 4 years

- Work cost ; ¥1,000,000 Japanese yen / time
- Parts cost ; ¥700,000 Japanese yen / time

(3)Leak check method of heat exchanger

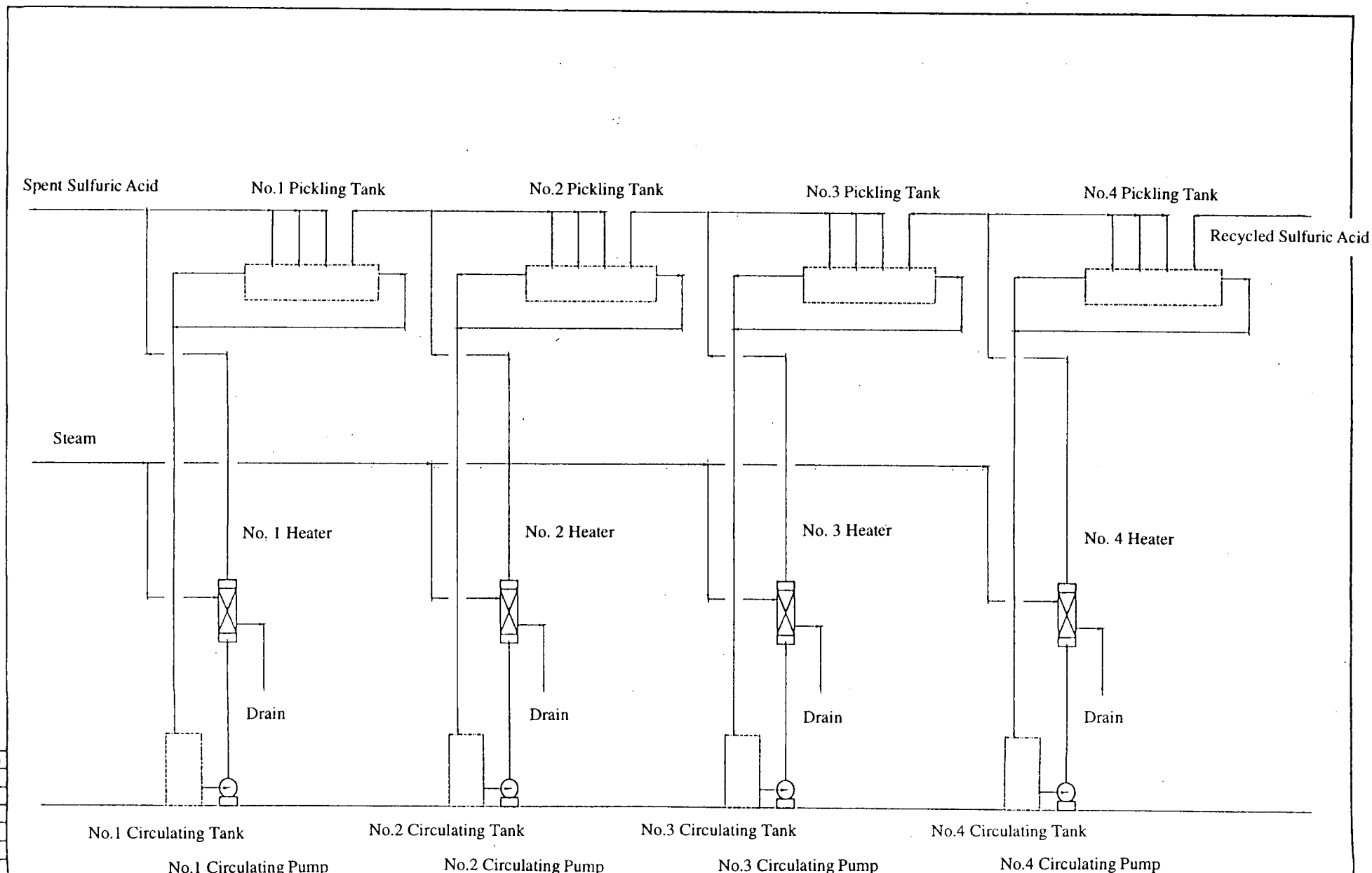
- By monitoring of pump delivery pressure

6. Comparison of indirect heating systems

There are two types of systems as _ Outer installation type_ and _ Inner installation type_ and comparison is as follows;

[Comparison] ◎:Best ○:Better △:Base

Item	Outer installation type	Inner installation type	remarks
Device Cost	US$ 500,000 ◎	US$ 640,000 △	device cost US$ 1.0 = ¥ 110
Maintenance	Check and parts change can be done easily ◎	Risk for break by strip Lower maintainability △	
Installation	Line Stop = 1 Day ◎	Line Stop = 10 Days △	
Liquid uniformity	Uniform temperature can be obtained by liquid circulation ◎	Some temperature deviation will be expected △	
Leak check	Visual inspection is available And monitor by pumping pressure is available ◎	Leak check is only during line stop time △	
Running Cost	Pump electricity is required. △	〃 is not required. ◎	
Total evaluation	◎	△	S Company is adopting outer installation type.



ISSUED TO

SUPL.
TOTAL

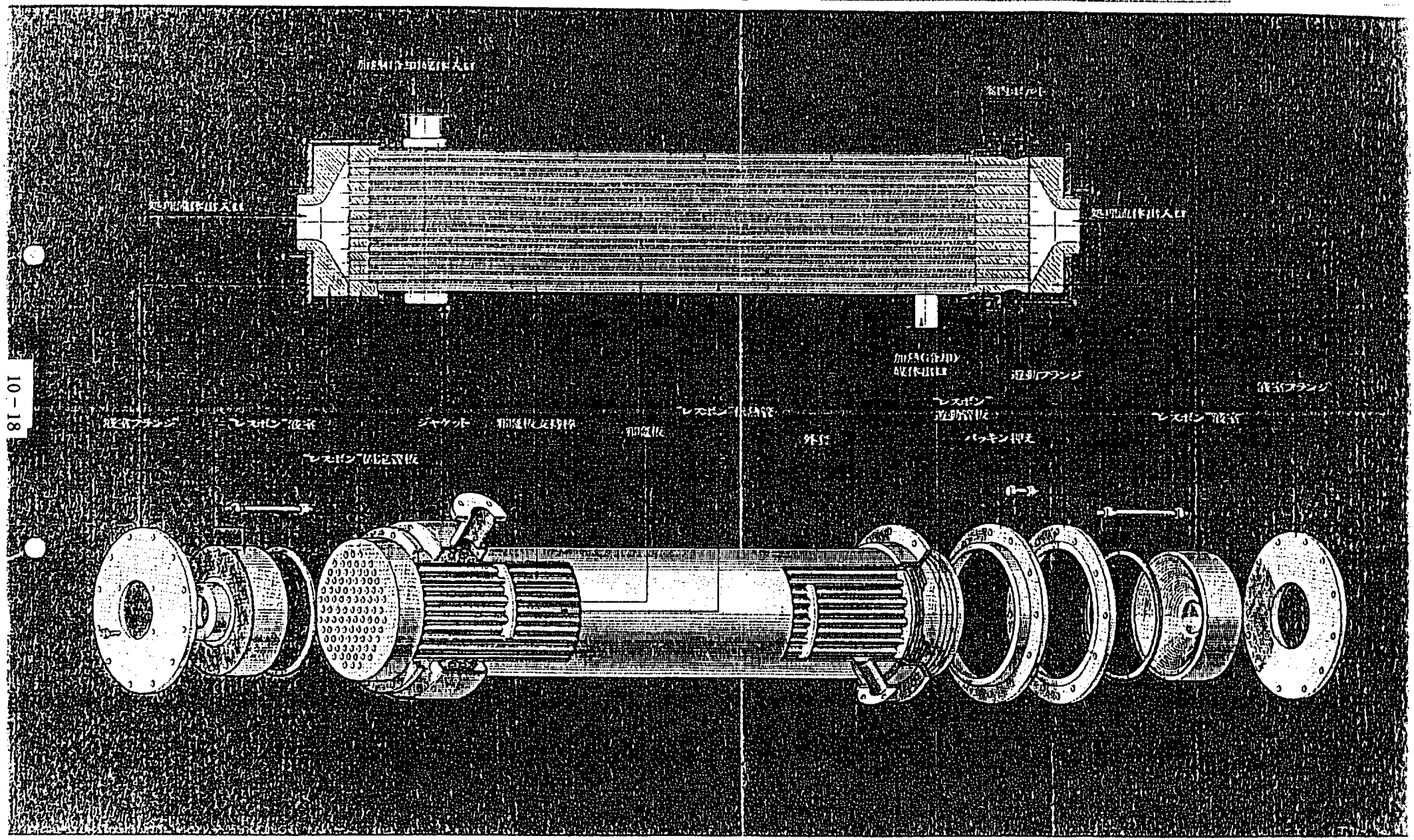
NO.	DATE	REVISIONS	MADE	CHKD.	APPR.

DATE 11－3－13
MADE M. KUBOTA
CHKD. M. TODA
APPR.

外部循環方式 間接加熱

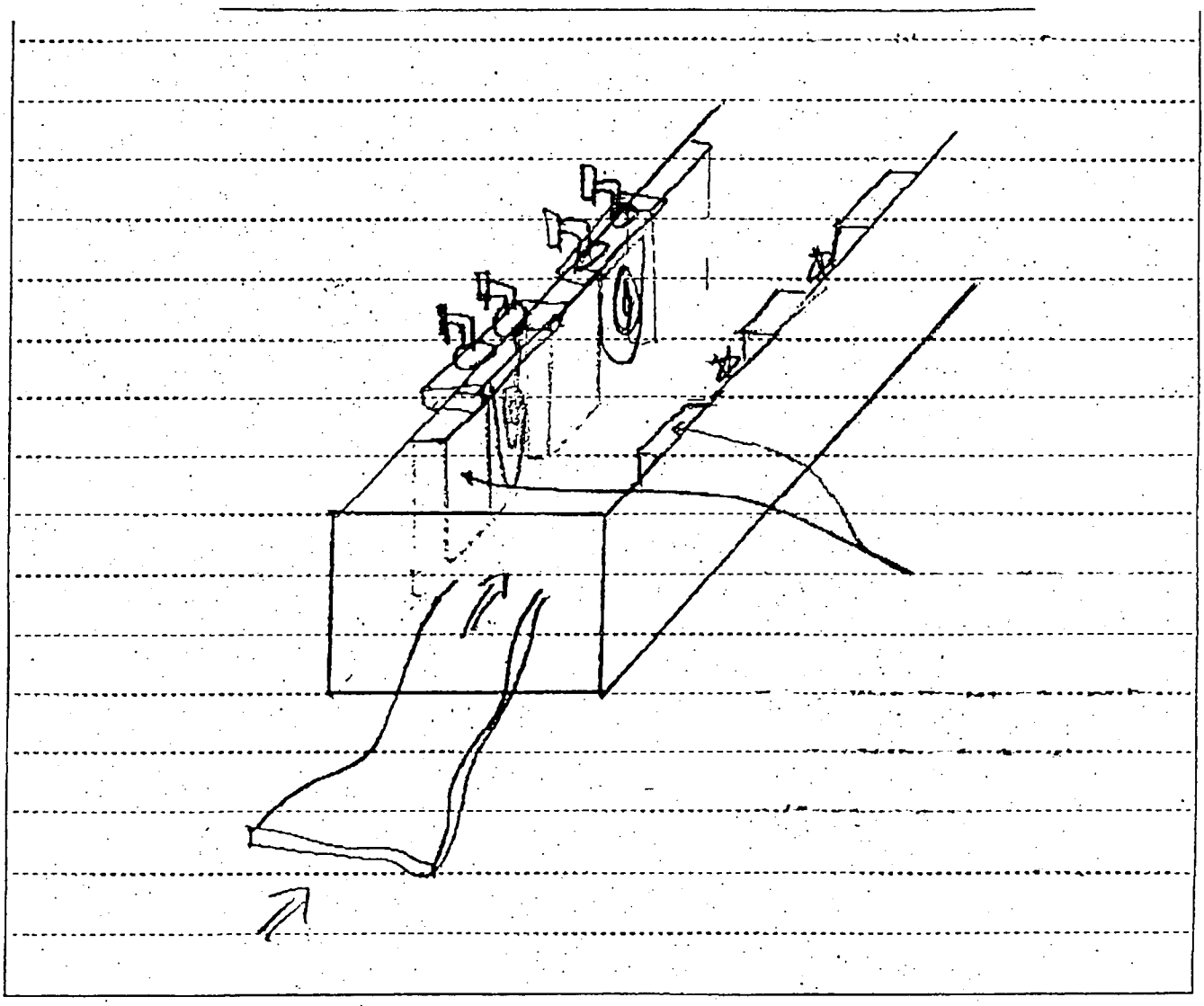
JOB NO. 2095508-B

二重管熱交換器構造分解図



2095508-B

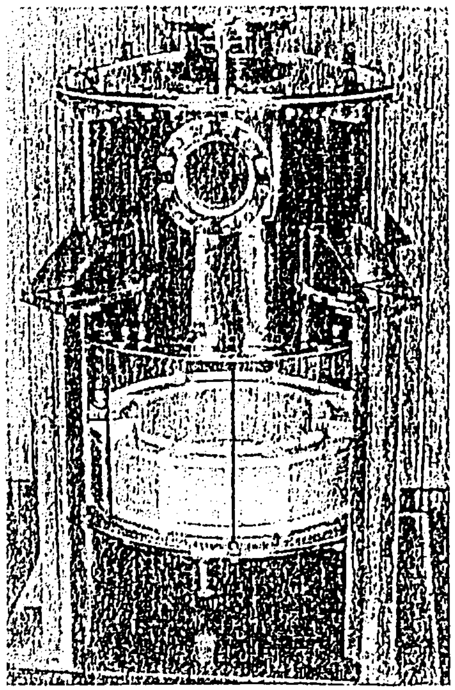
Typical setting method for
Inner Installation Types of Indirect Heat Exchange System

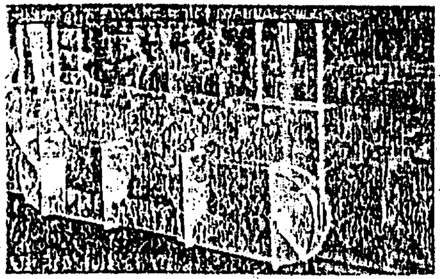


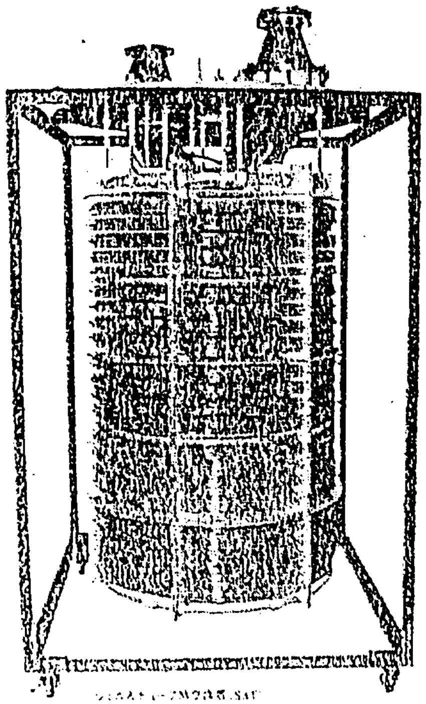
Heat Exchanger (Shell & Tube types, Panel type, Coil type)

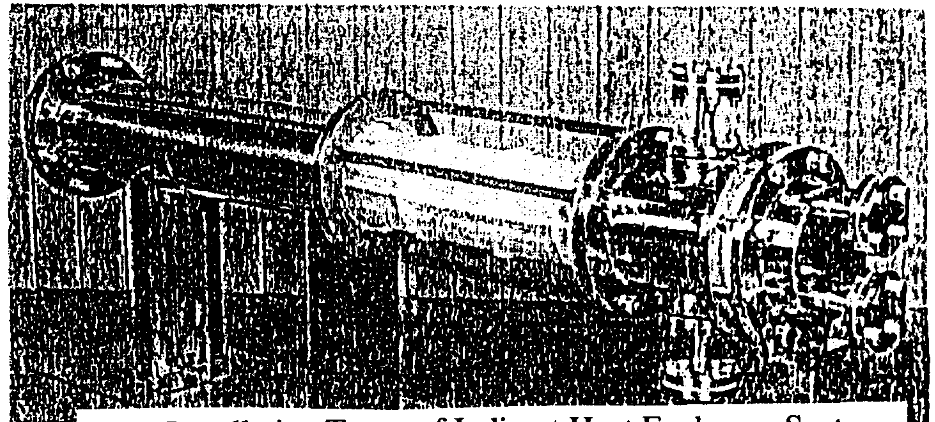
テフロン製熱交換器(シェル&チューブ型・パネル型・コイル型)

These Teflon Heat Exchangers developed by NC's unique technique are featured with the strong structure, high pressure resistance, resistance against the fluid and excellent heat conductivity by maximized use of Teflon properties; anti-corrosivity, heat resistance, non-sticking. Furthermore, they are applied to heating & cooling of corrosive fluid, chemicals of high grade purity and ultra deionized water and also to condensation of corrosive property of gases in many industry fields. Types are available in Shell & Tube, Coil and Panel types and applicable to large tanks and also small size and shape of required vessels, from 0.1ml to 200l.

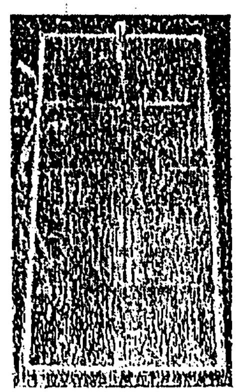


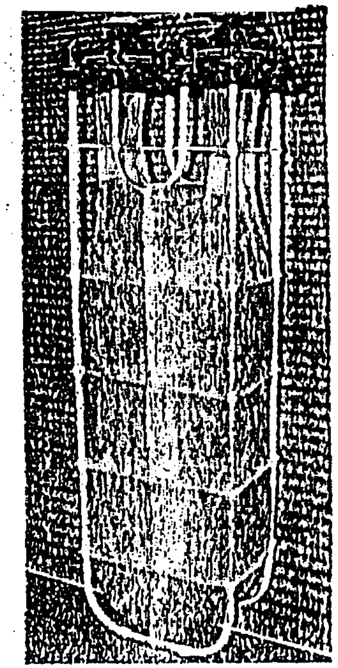






Inner Installation Types of Indirect Heat Exchange System





ANNEX - 3 Study for _Brain Type_ SSARU

1. Purpose and Capability

This system receives about 22,510 kg/Hr of spent sulfuric acid which consist of H_2SO_4:17% and $FeSO_4$:14.7% of concentration, and generates about 3,600 kg/Hr of $FeSO_4 \cdot 7H_2O$(W.B.) and about 18,910 kg/Hr of recovered sulfuric acid which consist of H_2SO_4:20% and $FeSO_4$:7.7% of concentration.

2. Outline of System

(1)This system receives spent sulfuric acid which consist of data gotten by field survey and cool down to around 5℃ indirectly by brain which has -15℃ of initial temperature, then crystallize $FeSO_4 \cdot 7H_2O$.

(2)After that the crystallized slurry is fed into centrifugal separator and regenerate sulfuric acid.

(3)Cooler has the water cooling type of chillier unit which uses freon (R-22) for coolant and for brain 50 wt% of solution is used.

3. Feature of system

(1)This system receives spent sulfuric acid which consist of data gotten by field survey and cool down rapidly using vertical type of crystallizer.

(2)No crystal and scale pile up on the heat exchange surface by continuous scraping can brings stable operation.

(3)Coolant flows on the outer casing of crystallizer and can get high heat exchange ratio.

(4)Uniform crystal can be obtained from uniform concentration of solution by using uniform agitation in the crystallizer.

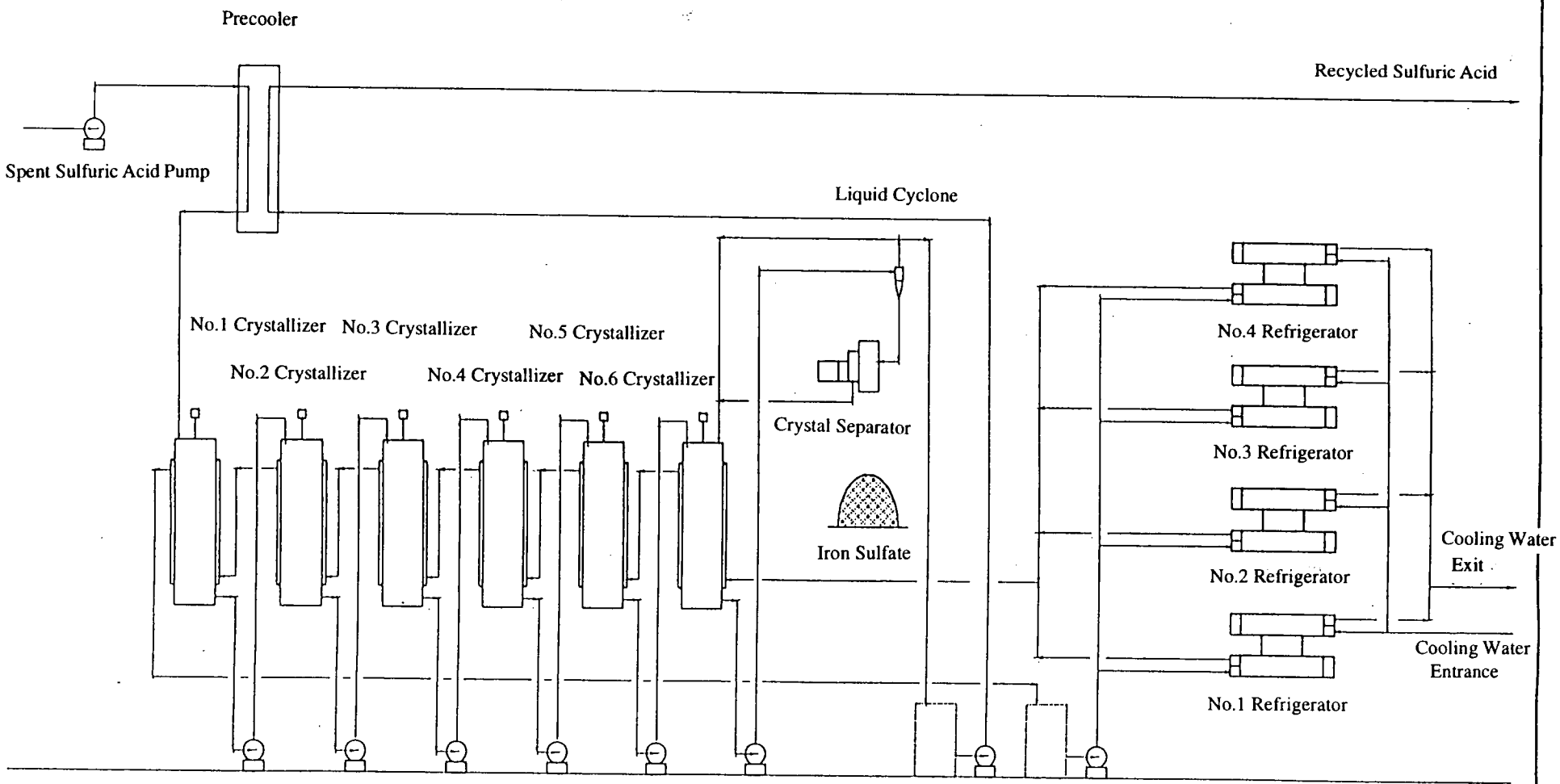
(5)Inner casing and agitator are made of miller surface finished stainless steel and carefully designed as corrosion and scale pilling free.

(6)This type of system has more than 100 of references.

4. Data for operation (Design Bases)

4-1	Design Bases		
	4-1-1	Spent sulfuric acid	
		Receiving rate	abt. 22,510 kg/Hr
		Concentration : H_2SO_4	abt. 17.0 wt%
		$FeSO_4$	abt. 14.7 wt%
		H_2O	bal.
		Specific weight	abt. 1.280
		Temperature	abt. 80 ℃
	4-1-2	Crysterllized $FeSO_4 \cdot 7H_2O$	
		Crysterllize rate	abt. 3,600 kg/Hr
		Wet percentage	abt. 7 wt%
		Temperature	abt. 5℃
	4-1-3	Recovered Acid	
		Recovery rate	abt. 18,190 kg/Hr
		Concentration : H_2SO_4	abt. 20.0 wt%
		$FeSO_4$	abt. 7.7 wt%
		H_2O	bal.
		Specific weight	abt. 1.243
		Temperature	abt. 60 ℃
4-2	Operation Data		
	4-2-1	Industrial Water 3.0kg/cm^2 x 30℃	abt. 1.2 m^3/Hr
	4-2-2	Cooling Water 3.0kg/cm^2 x 32℃→37℃	abt 200 m^3/Hr
	4-2-3	Electricity AC 380V x 50 Hz x 3 ϕ	abt. 670 KWH
		System Demand	abt 890KW

5. Flow Sheet



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TOTAL	

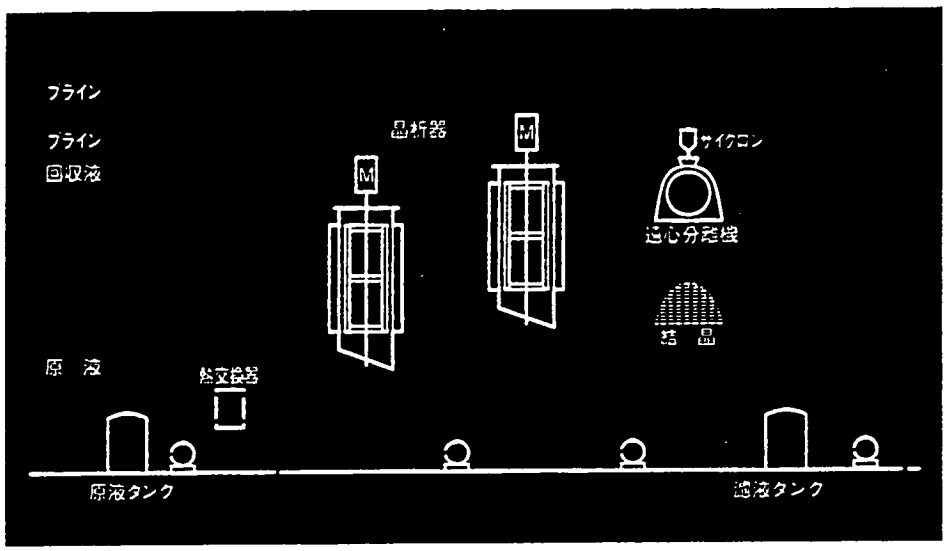
No.	DATE	REVISIONS	MADE	CHKD.	APPR.	APPR.
						DATE:
						MADE H. TODA
						CHKD. H. TODA

廃硫酸回収装置フローシート

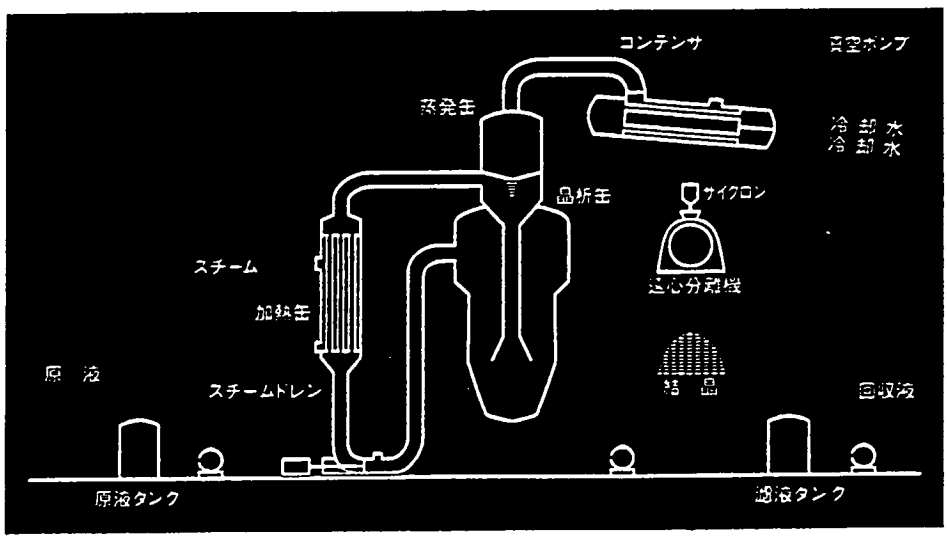
JOB No. 2095508

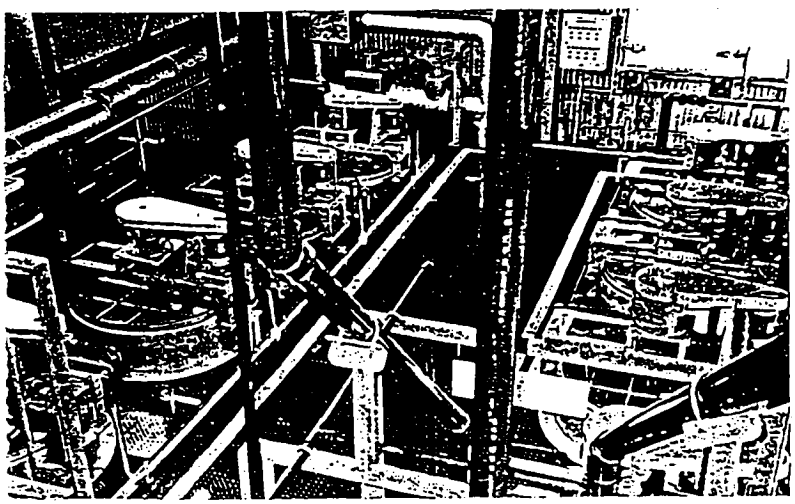
6. Reference chart and picture

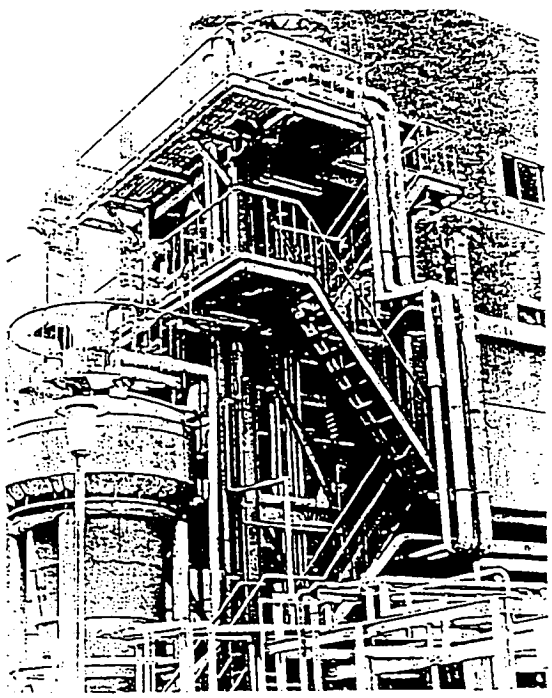
◎ Brine Cool Method Jacket Type



◎ Evaporative Crystallization Method (Kristal-Oslo Type)







7. Outline of _Brain Cooling Method_

7.1 Designed Specification

(1) Waste Acid Rate	;	$18m^3/Hr$		
(2) Concentration	;	H_2SO_4	;	15 - 18%
		Fe2+	;	70wt%($FeSO_4$; 14.7%)
		Temp.	;	80℃
(3) Utility	;	Steam	;	4 kg/cm^2
		Ind. Water	;	ditto
		Circulation water;		ditto

7.2 Purpose and Capacity

This system receives about 22,510 kg/Hr of spent sulfuric acid which consist of H_2SO_4:17% and $FeSO_4$:14.7% of concentration, and generates about 3,600 kg/Hr of $FeSO_4 \cdot 7H_2O$(W.B.) and about 18,910 kg/Hr of recovered sulfuric acid which consist of H_2SO_4:20% and $FeSO_4$:7.7% of concentration.

7.3 Outline of System

This system receives spent sulfuric acid which consist of data gotten by field survey and cool down to around 5℃ indirectly by brain which has -15℃ of initial temperature, then crystallize $FeSO_4 \cdot 7H_2O$.

After that the crystallized slurry is fed into centrifugal separator and regenerate sulfuric acid.

Cooler has the water cooling type of chillier unit which uses freon (R-22) for coolant and for brain 50 wt% of solution is used.

7.4 Budgetary Cost for System(by Japanese yen)

(1).Crystallize Complex	:	216,000,000
(2)Pump	:	7,200,000
(3)Others	:	72,000,000
Total	;	295,200,000

7.5 Recommendable Plant Manufacturer

(1)Company Name : Daido Chemical Engineering Co.

(2)Adress : post code 530-0053

3-3 Suehirocho Kitaku Osaka-shi Japan

Daido-Parkside Building 9F

Phone: 06-6312-6621

Fax : 06-6312-6626

(3)Window person : Mr. Hideo Kawasaki

General Manager Sales Dept.

11.0 RECOMMENDATIONON ON ENVIRONMENTAL MANAGEMENT POLICY OF EGYPT

11.0 Recommendations on Environmental Management Policy of Egypt

Japan had experienced many kinds of serious water pollution problems typified by the mercury poisonings in Minamata Bay and Agano River Basin. However, under the efforts of the government, industries and private citizens, Japan has successfully overcome these serious environmental problems within a relatively short period. This was accomplished by taking various countermeasures such as enactments and amendments of numbers of laws and regulations, investments in pollution control facilities, development of pollution control technologies, and development of administration system for pollution control. Private citizens also played an important role in the solution of environmental pollution problems.

Although the course of the environmental restoration in Japan was bumpy, Japan was able to develop a very advanced administration systems and effective pollution control technologies through such difficult obstacles. Under the basic policy that the accumulated experiences and technologies of Japan should be transferred to the nations around the world, particularly developing nations through ODA and other programs, Japan has been providing various kinds of assistances. For example, Japan has been offering technical training programs through JICA in cooperation with related governmental organizations. The expert dispatch services and project-type cooperation implemented by JICA have also greatly contributed to the technology transfer to developing countries.

In this chapter, a review is made of the water quality control administration in Japan, especially the history of fighting with the pollution problems caused by industrial wastewater, with aim of discussing both suitable administration systems and effective measures for water pollution control in Egypt.

12.1 Current Status and Problems of Industrial Water Pollution Control in Egypt

As described in Appendix 3, after many twists and turns, Japan has achieved to solve serious environmental pollution problems across the country by the efforts and cooperation of the central and local governments, business enterprises and citizen groups. The enterprises that have made large amounts of investments in the environmental pollution control have achieved to develop superior pollution control technologies. The core of such technologies is an improvement of efficiency in use of recourses and energy, and these technologies are called Cleaner Production (CP) Technologies. Under the dramatic changes of the social-economic situation and the direction of environmental conservation, the CP technologies are becoming important tools for the conservation of the global environment.

The key issues in the process of environmental restoration in Japan are summarized as follows:

1. Complaints of residents in the damaged areas against enterprises
2. Regulation of industrial effluent water by local governments and residents
   - Establishment of pollution control ordinance by local governments
   - Signing of agreement on environmental pollution control between local government (or residents) and enterprises
3. Regulation of industrial effluent water by central government (Water Pollution Control Law)
   - Unification of environmental administration by founding Environmental Agency
   - Establishment of ambient water quality standard as a target
   - Establishment of effluent standard as a national minimum regulation
   - Authorization of local government to act as a responsible organization for pollution control
   - Financial assistance and tax incentives to encourage the installation of pollution control facilities
4. Regulation of industrial effluent water matching the respective local conditions by local governments
   - Classification of public water area into categories of utilization purposes
   - Add-on control target over national standards
   - Area-wide total pollutant load control
   - Enforcement of industrial effluent water control against factories
   - Authority to enter and inspect the factory without prior notice and guidance
   - Penalty against violators of regulations
   - Water quality monitoring in public water area
5. Active engagement of enterprises for pollution control
   - Investment in pollution control facilities
   - Establishment of an organization for pollution control in each factory
   - Research and development of cost-effective and high-performance water pollution control facilities
6. Incentives for improvement of pollution control technology
   - Establishment of national qualification systems such as "Pollution Control Manager" and "Qualified Environmental Measurer"
   - Effectuation and optimization of industrial effluent administration by the use of qualified laboratories for environmental measurement
7. Enactment of Basic Environmental Law

- Change of environmental policy from "prevention of environmental pollution" to "reduction of pollution load"
- Change of pollution control measure from "End-of pipe technology" to "Cleaner production technology"
- Activation of environmental administration of Japan under the basic policy of "Sound Material Cycle", "Harmonious Coexistence", "Participation" and "International Activities"

Although the abovementioned process and/or history of Japan cannot be directly applied to Egypt, the environmental restoration process of Japan should be fully utilized in preparing the policy for water quality conservation in Egypt. The purpose of this section is as follows:

a. To describe the current situation,
b. To discuss problems faced by the administrative and industrial sectors of Egypt relating to industrial wastewater control
c. To provide a comparison to the key wastewater control issues in Japan.

11.1.1 Problems in Administrative Sector

1) Ambient Water Quality Standards

Ambient water quality standards of Egypt are legislated in Law No. 48/1982. The standards are classified into two categories: non-potable and potable surface water as shown in Table 11.1. However, the standards are not set for each category of water use purposes such as fishery, agriculture and industry.

Table11.1 (1) Ambient Water Quality Standard for Non-Potable Surface Water

Description	Standard Measures And Specifications
Temperature	Not more than 5 centigrade over the prevailing average
Dissolved Oxygen	Not less than 4 milligrams/liter at any time
Hydrogen (basis) exponent	Not less than 7, and not more than 8.5
Industrial detergents	Not more than 0.5 milligrams/liter
Phenol	Not more than 0.005 milligrams/liter
Sediment	Not more than 50 units
Dissolved solid substances	Not more than 650 milligrams/liter
Probable counting for the colon group in 100 cm^3	Not more than 5000

Table11.1 (2) Ambient Water Quality Standard for Fresh (Potable) Waterways

Description	Standard Measures (mg/l) unless Otherwise Mentioned
Color	Not more than 100 degree
Total solid materials	500 mg/l
Temperature	5 degrees over the normal
Dissolved oxygen	Not less than 5
Hydrogen exponent (pH)	Not less than 7, and not more than 8.5
Absorbent activated oxygen	Not more than 6
Consumed chemical oxygen	Not more than 10
Organic nitrogen	Not more than 1
Ammonia	Not more than 0.5
Greases and oils	Not more than 0.1
Total Alkalinity	Not more than 150, and not less than 20
Sulfate	Not more than 200
Mercury compounds	Not more than 0.001
Iron	Not more than 1
Manganese	Not more than 0.5
Copper	Not more than 1
Zinc	Not more than 1
Industrial detergents	Not more than 0.5
Nitrate	Not more than 45
Fluorides	Not more than 0.5
Phenol	Not more than 0.02
Arsenic	Not more than 0.05
Cadmium	Not more than 0.01
Chromium	Not more than 0.05
Cyanide	Not more than 0.1
Lead	Not more than 0.05
Selenium	Not more than 0.01

In Japan, ambient water quality standards consist of the standards for the protection of the human health, and for the preservation of the living environment as shown in Table-2. The former standards are applicable to the entire public water of the country. As for the latter, public water is classified into categories with respect to water use purposes so that different standards can be applied based on the categories of water area. Accordingly, it is recommended to set ambient water quality standards in Egypt for each categorized water area by introduction of a similar system to that of Japan.

Ambient water quality standard is a target value of the administrative sector, and a legislation of the target makes it possible to evaluate the current level of water quality. In case that current level is satisfying the target, it is possible to investigate the necessity of more stringent target. On the other hand, if concentration(s) of some pollutant(s) is higher than the standard, it is possible to discuss the definite countermeasures to satisfy the target. In this sense, it is recommended to legislate the ambient water quality standards in Egypt as soon as possible.

In instituting the ambient water quality standards in Egypt, the following points should be considered.

- Purpose of water use (irrigation, drinking water, industrial water, recreation, fisheries, etc.)
- Protection of important water sources
- Past and current status of environmental problems caused by water pollution
- Effluent standards
- Protection of ecological system
- Opinions of Stakeholders

2) Regulation of Industrial Effluent

As mentioned in Chapter 4, in Egypt water area is divided into coastal area, sewer system, branches of the Nile River, mainstream of the Nile River and other area, and a different effluent standard is applied to each area. In this classification, the purpose of water uses in each water area and type of industry are not considered.

The JICA Study Team investigated the characteristics of the effluent standards of Egypt through the following comparisons.

- Egyptian standard for a discharge to sewer system and same kinds of Japanese standard (Sewage water law, government ordinance No. 147)
- Egyptian standard for a discharge to main and branches of the Nile River and Japanese

standard for a discharge to public water bodies (Ordinance of Prime Minister's Office No. 35, established under the Water Pollution Control Law)

In this study, key parameters common to both Egyptian and Japanese standards are selected and comparisons are made to understand characteristics of Egyptian standards. However, exact comparison cannot be made due to the differences of parameters and/or measurement methods (refer to Tables 11.2 and 11.3).

Regarding an effluent standard applicable to sewage system, Egyptian regulations for BOD, Nitrogen and Phosphorus (these items are called items related to living environment in Japan) are equal or more stringent than those of Japan. Egyptian regulations for hazardous substances such as heavy metals are more stringent or lenient than those of Japan. As for an effluent standard applicable to the main course and branches of the Nile River, permissible concentrations for many parameters in Egypt are half to one-tenths of Japanese standard. In other words, Egyptian standard is much more stringent than that of Japan.

The reason of the above differences between Egyptian and Japanese effluent standards can be analyzed as follows:

- Wastewater to be directly discharged to the Nile River must be treated well, because water of the Nile River is used as a source of drinking water.
- Regulation applicable to the effluent water to be discharged to sewer system is not so severe, because wastewater discharged to sewer system will be treated to a proper quality at the sewage treatment plant.

However, it is reported that wastewater treatment facilities of many factories are not working well, and require modification and/or repair. As for small and medium scale factories, only a few factories have wastewater treatment facility, and many factories are directly discharging wastewater. These factories are the main sources of water pollution in Egypt.

Table 11.2 Comparisons of Egyptian and Japanese Effluent Standards of Sewage System

(Unit: ppm or mg/l, unless otherwise noted)

Parameter	Law 93/62: Discharge to Sewer System		Japanese standard (Sewage Water Law)
	as modified by Decree 9/89	as modified by Decree 44/2000	
BOD (5 day, 20℃)	<400	600	600mg/l
pH (units)	6-10	6-9.5	5-9
Oil & Grease	15	100	Content of n-hexane extract (mineral oils) 5 mg/l
TSS total Suspended Solids	<500	800	600mg/l
PO_4-P (Phosphorus)	30	25 (Total Phosphorous)	32 mg/l as Phosphorus
NH_3-N (Ammonia)	<100		240 mg/l as N
NO_3-N (Nitrate)	<30	100 (Total Nitrogen)	
Total Recoverable Phenol	<0.005	0.05	5mg/l
Fluoride	<1		15mg/l
Arsenic	n/a	2.0	0.1mg/l
Cadmium	<10		0.1mg/l
Chromium	Total metals: <10, <50 m3/d <5, >50 m3/d		2mg/l
Chromium Hexavalent		0.5	0.5mg/l
Copper		1.5	3mg/l
Iron			10mg/l
Lead		1	0.1mg/l
Manganese			10mg/l
Mercury	<10	0.2	Mercury, Alkyl Mercury and other Mercury Compounds 0.005mg/l
Zinc	<10		5mg/l
Cyanide	<0.1	0.2	1mg/l

n/a = not applicable

Table 11.3 Comparisons of Egyptian and Japanese Effluent Standards of Public Water Area

(Unit: ppm or mg/l, unless otherwise noted)

Parameter	Egyptian Effluent Standards		Japanese Standard (Water Pollution Control Law)
	Law48/82: Under Ground Reservoir & Nile Branches/Canal	Law48/82: Nile (Main stream)	
BOD (5 days, 20)	20	30	160 mg/l (Daily average: 120mg/l)
COD (Permanganate)	10	15	160 mg/l (Daily average: 120mg/l)
COD (Dichromate)	30	40	
PH (unit)	6 to 9	6 to 9	Public Water Area Other than Sea Area 5.8 to 8.6 Public Sea Area 5.0 to 9.0
Oil & Grease	5	5	Content of n-hexane extract (mineral oils) 5 mg/l
TSS: Total Suspended Solids	30	30	200 mg/l (Daily average: 150mg/l)
PO_4-P (Phosphorus)	1	1	16 mg/l as Phosphorous (Daily average: 8 mg/l
NH_3-N (Ammonia)	n/a	n/a	120 mg/l as Nitrogen (Daily average: 60 mg/l
NO_3-N (Nitrate)	30	30	
Phenol	0.001	0.002	5 mg/l
Fluoride	0.05	0.05	15 mg/l
Probable counting for Colon group/100 cm^3	2,500	2,500	No. of coliform Groups 3,000 (Daily average)
Arsenic	0.05	0.05	0.1 mg/l
Cadmium	0.01	0	0.1 mg/l
Chromium	n/a	n/a	2 mg/l
Chromium Hexavalent	0.05	0.05	0.5 mg/l
Copper	1	1	3 mg/l
Iron	1	1	10 mg/l
Lead	0.05	0.05	0.1 mg/l
Manganese	0.5	0.5	10 mg/l
Mercury	0.001	0.001	Mercury, Alkyl Mercury and other Mercury Compounds 0.005 mg/l
Zinc	1	1	5 mg/l
Cyanide	n/a	n/a	1 mg/l

n/a: not applicable

In a study at Ismaila City, 63 factories were investigated and it was found that 22 factories were discharging wastewater with higher concentration of BOD than effluent standard.

According to the Environmental Map of Egypt (1995), only 38 factories of 321 major public factories in whole of Egypt had wastewater primary treatment facility (6 other factories had under-construction treatment facility), and other factories were directly discharging wastewater into the Nile River.

As mentioned previously, the effluent standard of Egypt applied to the Nile River is more stringent than Japanese effluent standard uniformly applied to public water area. However, judging from the results of the above studies, it must be mentioned that many factories in Egypt are not following the regulation.

An evaluation of the effluent standard of the Nile River would indicate that a considerably lenient effluent standard is applied to discharge water to sewer system on the premise that factories would follow the regulations and that the sewage treatment plant would be performing out properly. However, the current situation is different from the above assumptions. Many factories are directly discharging wastewater to sewer system as mentioned above. Judging from such situations, it is concluded that the final sewage treatment plants are receiving wastewater exceeding design capacity, and are discharging wastewater to the Nile River that is not well-treated. In case the industrial wastewater contains toxic substances, these toxic substances can kill bacteria in activated sludge of sewage treatment plant. Considering the fact that many public factories are discharging improperly treated wastewater due to inappropriate operation and/or maintenance work, there is a fear that the final sewage treatment plants are also discharging water which does not meet the standard of the Nile River

In order to preserve the water quality of the Nile River, stringent effluent standards are established. However, it must be mentioned that the existing management and administration of the factories for pollution control does not appear sufficient. To prevent water pollution of the Nile River, it is necessary to take appropriate measures to improve the management capability of factories for pollution control.

3) Administrative Organization

3-1) Unification of Environmental Administration and Cooperation with Local Governments

Egyptian Environmental Affairs Agency (EEAA) is the principal organization established for

the prevention of water pollution and its major responsibilities are as follows:

a. Establish a national policy for environmental protection, and

b. Enact laws and regulations for environmental pollution control.

The Ministry of Irrigation Water Resources (MIWR) is the organization responsible for control of discharge of industrial wastewater into the Nile River and waterways. As for discharge of wastewater to public sewer system, the Ministry of Housing and Utilities (MHU) is the governing organization. The water quality monitoring of the Nile River has been conducted by organizations of the central government such as DRI, NRI and EMOHC. Cooperation between the above organizations should be improved and it must be said that the comprehensive plan for conserving the water quality of the Nile River is not well implemented.

EEAA is planning to set up 8 Regional Branch Offices (RBO) to strengthen the water quality control administration at 26 Governorates that are important for the water conservation of the Nile River. Cooperation with Governorates' governments is not proceeding smoothly due to the conflict of interests between concerned governmental organizations (information source: World Bank, Staff Appraisal Report 1997).

In Japan, at the time that environmental pollution was very serious, a unification of environmental administration was urgently required, and the Japan Environment Agency (JEA) was established in 1971 in response to such a request. The establishment of JEA, the single organization responsible for pollution control, was an epoch-making issue in the history of environmental restoration in Japan.

The environmental pollution administration of Japan were decentralized to most of concerned authorities including Economic Planning Agency, Ministry of Health and Welfare, Ministry of International Trade and Industry, Ministry of Agriculture, Forestry and Fisheries and Ministry of Construction. From around 1962, an administrative department for pollution control was established in the concerned authorities. As aspects of environmental pollution became complex and diversified in the 1970s, an environmental pollution control headquarter was established in the same year to take appropriate measures for the environmental pollution control. However, the headquarter was a provisional coordination organization although the establishment was determined based on a Cabinet meeting. As the jurisdiction of enforcement of environmental regulations was still decentralized to concerned authorities, the necessity of permanent administrative organization with the jurisdiction of enforcement of environmental regulations was recognized to perform an effective pollution control. In Western countries, there was also a growing need to establish an independent administration in charge of

environmental problems. Administrations such as Ministry of Environment and Environmental Agency were established in Sweden, USA and UK. Against the background described above, JEA was established in July 1971 as comprehensive coordination agency with the following jurisdictional responsibility in accordance with administrative promotion of environmental conservation:

- Unified jurisdiction for all basic affairs regarding pollution control including implementation;
- Preparation of basic policy of environmental protection including pollution control;
- Coordination of implementation related matters of concerned authorities including JEA.

In this sense, Egypt should also unify the administrative system and execute effective and comprehensive environmental conservation measures. This is required since many organizations participate in the water environment administration just like the pollution control administration of Japan in the past. Although local governments have played important roles to solve the environmental problems in Japan, in considering the fact that administrative capability of local government in Egypt is not so high, it is not realistic to take the same measures as Japan. In this sense, Egypt should set up the above-mentioned 8 RBOs as the first step and should utilize them as key stations for the environmental conservation administration reflecting local conditions.

3-2) Lack of Administrative Resources

The Government of Egypt has recognized the importance of environmental preservation and has enacted Law No. 4 of 1994. EEAA was established in accordance with Law No. 4 of 1994. EEAA's role is to perform comprehensive coordination of environment-related administration including pollution control, namely EEAA performs overall coordination of pollution control measures while other ministries implement measures relating to their respective jurisdictions. The Government of Egypt has been executing pollution control projects with the assistance of foreign countries, and public awareness on the importance of environmental preservation has been gradually rising.

Budget Allocation

The Government of Egypt has allocated LE26.5 billion within its National Plan for 1997 - 2000 for environmental preservation. This budget is managed by fifteen ministries. Substantial financial source and adequate allocation of budget are needed to undertake not only field of pollution control, but also development of environmentally friendly technology, the provision of environmental services and the establishment of sound environmental systems.

Shortage of Technical Capability

Research and development works such as investigation of the origin and mechanism of environmental pollution problems and a development of pollution prevention technology are some of the most important issues in environmental administration, and such works should be executed under the leadership of the central government.

In Egypt, GOFI (General Organization for Industrialization, Ministry of Industry) includes an environmental management unit as a part of its organization, which is responsible for the environment in general. However, according to the interview surveys at GOFI, many staff pointed out the shortage of financial and human resources. The factories selected in this study also mentioned that technical guidance and advices on wastewater treatment by administrative sector are not enough. Some other public institutes such as WRC, NRC and TIMS are engaging in research works relating to water pollution control. However, major themes of these institutes are domestic wastewater treatment and research works in the fields of industrial wastewater is very limited. In these institutes, shortage of the budget for research works has been covered by profits obtained from the analysis of wastewater. In other words, these institutes are functioning not as a research institute but as a contractor of wastewater analysis.

In Japan, National Environmental Research Institute has been founded to completely undertake the research works of related administrative organizations on environmental pollution control and to promote the wide range of research and development works. The Research Institute for Environmental Pollution has been founded for the purpose of education and technical training of staff of the Environmental Agency and local governments. Local governments are responsible for the technical guidance to factories and enterprises. The functions of the local government are not only limited to checking the effluent water of the factory by inspection. They are investigating the usage of water, condition of process water and operational condition of wastewater treatment facility of factories, and giving various kinds of technical advices and suggestions including consultations about change of raw materials, conversion of process and/or plant to more environmental friendly ones, improvement of water usage, recovery of solid materials from wastewater, if required. The governments of city, town and village and public health centers also have been providing technical guidance and assistance continuously. Technical advice on the selection of the most appropriate wastewater treatment facility, treatment and disposal of wastes from the wastewater treatment facilities are important functions of these organizations.

In an environmental administration, the officers of central government in charge of policy making are important. At the same time, recruitment and training of technical staff of local

governments, who check the quality of wastewater at factories and provide technical advice to them, are also very important. Judging from the results of field survey made by the JICA Study Team, even in case of public research institutes, only a few staff of the organization related to environmental management in Egypt have enough knowledge and experience to provide technical guidance and advice to the factories. Thus, in Egypt, it is very important to secure and foster technical staff with suitable capability for environmental pollution control.

4) Monitoring and Analysis of Water Quality

Information and computer department of EEAA has undertaken the project of Egyptian Environmental Information System (EEIS) to establish a network in EEAA, with the assistance from the Canadian International Development Agency (CIDA). It is expected that information obtained from the monitoring network will be managed by EEIS. However, information to be collected by EEIS is limited to the information from EEAA. At present, the water quality data in the Nile River monitored by MIWR and MOHP are not linked with EEIS. They put little emphasis on cooperation with other organizations due to mainly the difference of the monitoring purpose.

Since new data and information on quality of effluent water and pollution load to be used for the preparation of monitoring plan are limited, it is very important to:

a. Create a system that enables preparation of a comprehensive monitoring plan with the full cooperation of these institutes, and
b. Execute the system effectively.

Further, as for the data and information being held by each institute, it is necessary to share it by using a common data base system.

Data collected by monitoring should be used for various kinds of study and analysis. First of all, horizontal distribution of pollution and time series variation of it must be analyzed. In addition to the above, pollution mechanism should be clarified by analyzing correlations between monitored parameters, load variation, and evaluating effects of individual pollution source. The clarification of pollution mechanism enables to prepare specific counter-measures for pollution control. It is recommended to prepare the water quality simulation model and to use it effectively. For example, effect of each factor on water quality should be identified by sensitivity analysis. Effects of pollution load reduction measures on improvement of water quality also should be evaluated. It is important to reflect the results of the above study in administrative works.

In Japan, the Japan Environment Agency has been compiling the results of monitoring conducted by the local governments at the public water areas, and officially announcing results of evaluation of water quality level at public water area, data analyses and water pollution simulation. This data has been used as the basis of planning and executing pollution control measures. Egypt should also come up with effective environmental administrations by the concentration of environmental administration resources through measures such as promotion of better mutual understanding between relevant public organizations, mutual utilization of monitoring data, development of common data base system, and active utilization of data and information.

5) Incentives for the Introduction of Environmental Protection Technologies

From the beginning of 1990s, European countries and the USA have been providing financial and technical support to Egypt for the introduction of facilities and technologies for pollution control. The loans with favorable conditions and grants under the Program of KFW have been used in the improvement of the process and/or wastewater treatment facilities of public enterprises. In the National Program for Environmental-Friendly New Industrial Cities, loans with favorable conditions have been used on selected projects for pollution control (A. Hamza). However, these loans are designed for the public enterprises and/or relatively large-scale factories, and the terms and conditions of the loans are not suitable for small and medium scale local companies. In considering the financial, credit and technical capabilities of small and medium scale companies, loan conditions are very severe for example, repayment period of loan is usually set at 3 to 5 years.

The World Bank has established Pollution Abatement Fund as a component of the Egyptian Pollution Abatement Project (EPAP) to provide finance to sub-projects of mitigation of environmental pollution. The sub-projects would include waste minimization, pollution prevention, resource recovery, and adoption of clean technology and fuel substitution. The payback period of PAF is five to eight years with one- to two-year grace period. The conditions of PAF would be acceptable for small and medium enterprises. However, the PAF is intended to finance modification of existing facilities and would not finance new industrial plants and/or capacity expansion.

Although many Egyptian enterprises submitted the action plans for environmental protection including the installation of pollution control facilities to the Government in 1983, many of them were not implemented due to shortage of financial sources. In case of Japan, under the special financial assistance program of the government, loans with low interest rate and long-term repayment period have been provided to enterprises through governmental financial

institutes including Environmental Pollution Control Service Corporation. This system has greatly contributed in reducing the financial burden of the enterprises and has encouraged the installation of pollution control facilities.

Based on the Law No.4 of 1994, the Government of Egypt has begun to establish pollution charges and fees to diminish dust emissions from cement plants and pollutant levels in wastewater. In 1995, an annual surcharge of LE 5.0 was imposed on the sale price of a ton of cement sold. The cement fund has generated LE 80 million to finance the investments to reduce dust emissions in the cement plants.

Egypt should also create politically favorable circumstances for enterprises to install pollution control facilities by establishing a system of special loans to be easy to access with long-term of repayment to be used for the installation of wastewater pollution control facilities.

6) Development of Organization for Pollution Control at Factories and Enterprises

Although projects for the water pollution abatement in the Nile River such as NPPP and EPAP had been implemented as mentioned previously, many factories including those with wastewater treatment facilities have been discharging the wastewater exceeding the effluent standards. This is due to the insufficient capacity of wastewater treatment facilities and/or inappropriate operation and maintenance work. It is reported that education and training of technical staff, operators and other employees are not sufficient in many factories. The JICA Study Team found a similar situation at the investigated 5 factories. The Government of Egypt has been requesting the enterprises to introduce the environmental management system based on ISO 14000. However, according to a hearing survey at MDCI, only a few organizations well understand the meaning of wastewater management and introduction of environmental management system.

In Japan, factories and enterprises are obliged to develop the organization for environmental pollution control led by the Supervisor of Pollution Control. Under the leadership of the Supervisor, managers with national qualification such as "Manager of Pollution Control" and "Chief Manager of Pollution Control" have been engaged in pollution control in cooperation with administrative sectors and many factories and enterprises have achieved excellent results. Private companies, that were obliged to station the qualified persons, have provided assistances and incentives. For example, many companies paid examination fees on behalf of their employees, and provided special bonus, qualification allowances and promotion opportunities to the employees who have passed the examinations. Further, persons with these qualifications are socially approved as pollution control specialists. Under the above situation, many persons

have been actively studying many things related to environmental pollution control. National qualifications such as "Certified Environmental Measurer" and "Certified Consultant" have also greatly contributed in encouraging the education of employees.

Egypt should create good pollution control management system and improve the capability of employees by introducing systems and measures such as the qualification system of technical staff, introduction of environmental management system, enforcement of development of organization for environmental protection against factories and enterprises, etc.

7) Environmental Education and Awareness

Egypt should implement the educational and enlightening activities toward ordinary citizens in parallel with the education and training of the employees of the factories.

In Japan, the pressure from residents with a strong intention to protect the environment by themselves and from public opinions arisen through journalism has forced local governments to enact pollution control ordinances and to sign agreement on environmental pollution control with factories and enterprises. This pressure also forced the central government to enact laws and regulations for pollution control. Even now, many ordinary persons are engaging in the activities for the protection of environment. For example, residents are observing the factory in accordance with the agreements on environmental pollution control with the factory. Many persons are actively engaged in the activities for the restoration of local rivers. Many organizations established for natural conservation including NGOs and NPOs are carefully observing the activities of governments, private sector and ordinary citizens. Besides the above, in cooperation with administrative sectors, many persons are participating in the activities for environmental protection. Major activities of such persons are as follows:

- Delivery of pamphlets prepared by administrative sectors for increasing public awareness on environmental protection
- Cleaning-up of the beach and dry riverbed by local community
- Enlightenment works for the reduction of household effluents (water saving, collection of kitchen trash by filter, disposal of flying oil in a proper way, appropriate use of detergent, etc.)
- Delivery of booklets for environmental protection to pupils and students
- Providing opportunities for environmental study through events such as observation of natural sceneries at waterside or on boats

In Egypt, for increasing public awareness about the importance of environmental protection, EEAA and Ministry of Education have been executing the educational measures including preparation of instruction materials and education of students by using them under the assistance of Overseas Donors. For example, according to the Staff Appraisal Report of World

Bank 1997, CIDA has invested US$ 14.8 million to execute the "Environmental Technology & Management Fund Project (ENVIROTECH) for NGOs and Private Sectors". Also DANIDA is planning to execute the "Community Action for the Environment (CARE): Preparation of Environmental Community Action Plans".

Since close cooperation between industrial sectors, administrative sector and citizens is indispensable for effective execution of the environmental protection measures, projects and programs aimed at creation of public awareness should be implemented.

11.1.2 Problems in Industrial Sectors

As mentioned previously, administrative sector must play a leading role in the implementation of pollution control measures. However, in some ways, the role and responsibility of private sector is much bigger that those of administrative sector. First of all, private sector must follow the policy of the administrative sector. Further, private sector must recognize the importance of its role and function in pollution control, and take appropriate pollution control measures immediately. It seems that private companies of Egypt can take the followings measures immediately.

1) Development of Wastewater Management System

As mentioned previously, many factories and enterprises of Egypt have not been complying with the effluent standards. The reasons for this situation can be divided into the aspects of hardware and software. The biggest problem in the aspect of hardware is lack of wastewater treatment facilities. Mechanical troubles caused by decaying are also a major problem in some factories. As for the aspects of software, the inappropriate maintenance, management and operation of wastewater treatment facilities is the biggest problem. Shortage of well-trained or well-educated personnel is another big problem. Since investments in pollution control facilities require large amount of money and Egypt lacks a good financial assistance system, it is not realistic to force industrial sectors to install wastewater treatment facilities immediately. However, measures in the aspect of software can be applicable, because these measures do not needs large amount of money. It is expected that water pollution in Egypt can be greatly improved if business enterprises develop wastewater management systems immediately. Business enterprises of Egypt should take the following measures:

- To development organization for pollution control in every factory or enterprise
- To development the system for appropriate maintenance and repair of total facilities of the factory including wastewater treatment facility
- To provide environmental and technical education to operators and engineers

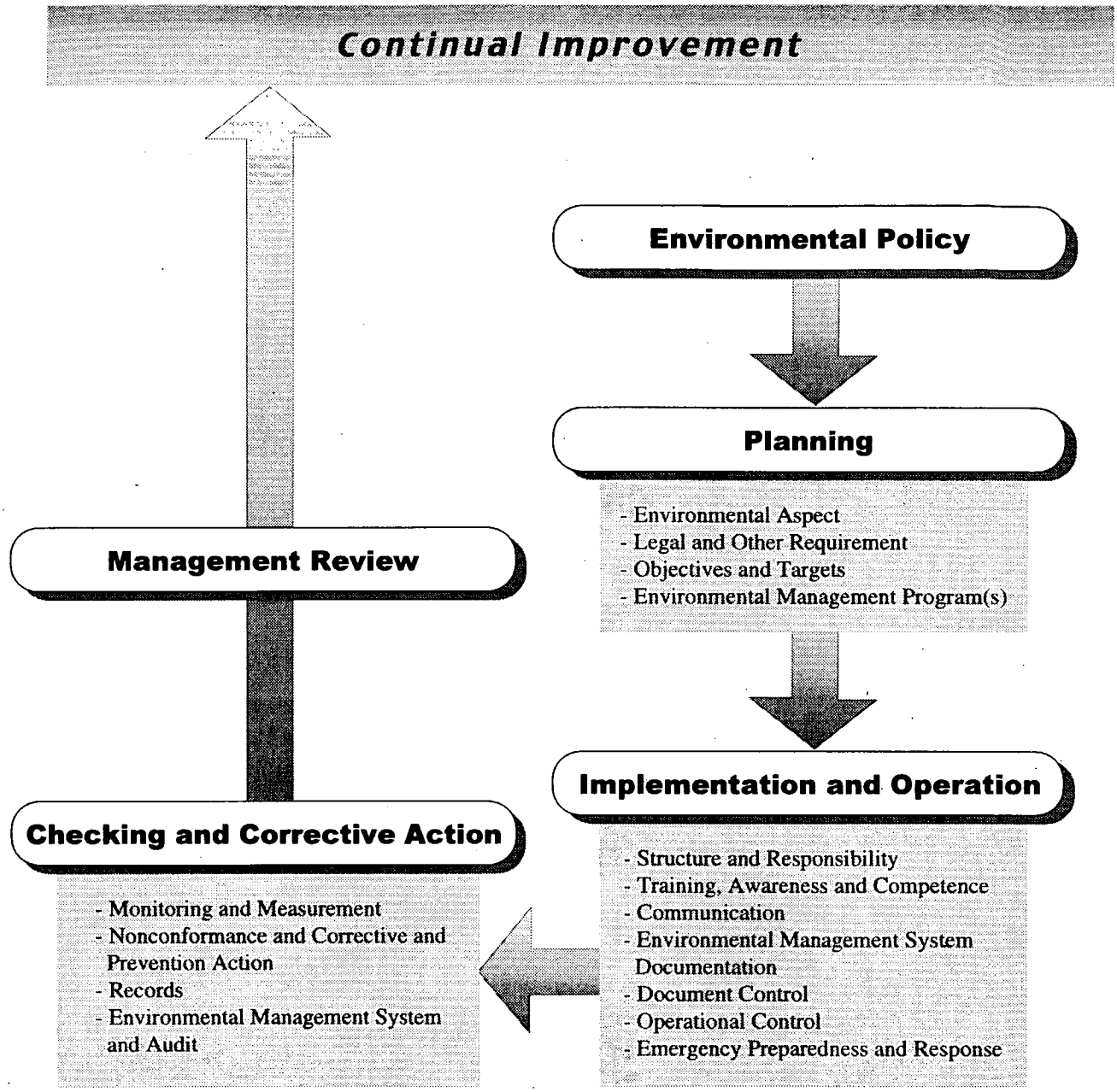
- To keep operational records including volume and quality of discharge wastewater
- To prepare operation and maintenance manuals
- To prepare emergency response manuals

At the same time, while taking the above measures and recognizing that business enterprise is a member of society, enterprises should work earnestly toward pollution control along with administrative sector and citizens, and should disclose the results of their efforts. The "Agreement on Environmental Pollution Control" has realized great results in Japan. The aim of this agreement is to conduct pollution control by prescribing obligations of enterprises such as the add-on (more stringent) effluent standard over the national standard and inspection right of the local government in the agreement to be signed between enterprise and local government (or residents), apart from laws and regulations. For the enterprise side, this system has the following merits:

(1) Increase in the opportunities to exchange opinions with local government
(2) Creation of close relationship with local residents
(3) Justification of capital investment in pollution control facilities
(4) Raising the awareness of employees on pollution control

Since these agreements, an original system of Japan, are a kind of gentleman's agreement and have no legal binding force, it is not practical to introduce same system in Egypt. On the other hand, the government of Egypt has been encouraging enterprises to introduce the ISO 14000 series. The ISO 14000 series is an international system in which enterprises decide to engage in pollution control as a company's policy, declare the decision to citizens, begin with the feasible measures and announce officially the results. The ISO 14000 series shall be a suitable system for Egypt.

The ISO 14000 series was established in September 1996 as an international standard. It consists of the standards of Environmental Management System, Environmental Audit, Environmental Labeling, Environmental Performance Evaluation and Life Cycle Assessment, and ISO 14001 (the Standard of Environmental Management System) is the core of it. In ISO 14001, continuous improvement is carried out as a result of Establishment of Environmental Policy → Planning → Implementation and Operation → Checking and Corrective Action → Management Review (refer to Figure11.1).



Source: Kankyo manejimento shisutemu ni kansuru kokusai hyo-junka no keiko ni tsuite [International standardization trend concerning environmental management system], Ministry of International Trade and Industry of Japan.

Figure 11.1 Concept of Environmental Management System

The important task of administrative sector is to emphasize the importance of water quality conservation to enterprises through educational and enlightenment activities. Further, administrative sector should support the seminars for the popularization of the ISO-14000 series, and invite actively enterprises to the seminar. In Japan, to diffuse the environmental management system to small or medium enterprises, central government has established financing system for the creation of environmental management system, and has been assisting in the acquisition of the ISO 14000 series certification and pollution control investment. Further, the Japan Small and Medium Enterprise Corporation has been organizing the seminars in many places and preparing the textbook for the creation of management system.

2) Joint Research and Development for Water Pollution Control

In Japan, the private sector has actively executed the research and development of technologies, capital investment, education of employees, development of organization for the pollution control, and administrative sector has provided the support to private sector. The efforts of Japan for pollution control of industrial wastewater have been functioning properly due to the efforts of private sector as well as administrative sector and availability of enough funds due to the rapid economic growth.

Since enterprises of Egypt cannot get financial and technical supports from the government as mentioned previously, in addition to the establishment of above-mentioned pollution control management system, they should take measures, which can be executed at relatively low cost, like research and development or investment jointly with other enterprises. Examples of these projects would

a. The development of low-cost water pollution technology for both running and investment costs,

b. The installation of joint wastewater treatment facility used only for industrial wastewater such as combined wastewater treatment facility for an industrial estate.

Technical and financial assistance of administrative sector is indispensable for the continuation and effectuation of ongoing activities of private sector such as development of technology or capital investments. It is therefore desirable to create a scenario where private sector and central government engage jointly in the development of wastewater pollution control technologies.

12.2 Recommendation of Policies and Institutions

In previous section, current status and major problems of industrial water pollution control in Egypt were reviewed in light of the history of environmental pollution control in Japan and required measures were discussed. This section describes the measures that should be taken by administrative sector and industrial sector of Egypt for executing industrial wastewater pollution abatement programs. Figure-4 shows the scheme of this description.

1) Strengthening of Administrative Organization for Water Pollution Control

In order to strengthen the capability of administrative organization, it is necessary to reexamine the procedures for budget allocation and the functions of relevant organizations, and to buildup the organizations and systems required for the smooth implementation of administrative works for pollution control. Further, to promote the unification of pollution control administration and the cooperation with local governments, joint project(s) to be executed by governmental organizations related with administration of water pollution control should be planned and executed. The formation of project team and the co-works at the execution stage are very useful for solving institutional problems and for creating closer relationships.

Considering the current situation of Egypt as shown below, the study team recommends the initiation of a joint project for the establishment of the target value of water quality.

- An establishment of target value of water quality (ambient water quality standard) is one of the most urgent issues for Egypt under the current system of water quality management.
- Joint works by relevant organizations are indispensable for the establishment of the target value.
- Establishment of continuous monitoring system by reorganizing current system with the cooperation of relevant organizations is very important.

< Objective of Joint Project for Establishment of Water Quality Target Value >

As mentioned previously, ambient water quality standards are used for water pollution control by establishing target values. The Nile River has no big incurrent rivers, and intakes and discharges of water have been carried out many times from Aswan to Mediterranean Sea. Drinking water is taken from this river, and industrial effluent water is discharged to this river. Some water areas are important as sources of drinking, agricultural and/or industrial water. At the city area, a large amount of household effluent water is flowing into the Nile River. At the industrial zone, large amount of Industrial effluent water is flowing into the River. Water quality of some specific area such as a scenic spot mustbe carefully conserved. In considering

the characteristics in each water area and differences of local conditions, water area should be divided into categories, and different target or standard should be applied.

A joint study team should establish the water quality target value. The team should consist of organizations concerned with water uses, after studying the natural environment and social and economic situations at the Nile River basin, with reference to the ambient water quality standards of other countries. In reviewing the standards of other countries, various aspects such as location, climatic conditions, and social conditions should also be investigated, in addition to the values itself. The following organizations should be included in this joint study:

a. The Egyptian Environmental Affairs Agency (EEAA): leading authority for pollution control,
b. The Ministry of Irrigation Water Resources (MIWR): organization responsible for water pollution control and water quality monitoring,
c. The Ministry of Health and Population (MOHP),
d. The Ministry of Industry (MOI),
e. The Ministry of Home and Utilities (MHU).

Participation of local governments, which have important water area from the viewpoint of water conservation, is also important. It is expected that these organizations recognize the importance of the establishment of target value with mutual collaborations, although collaboration between these organizations is not so close until now. Further, execution of this project by sharing cost, manpower, materials; existing data and information, etc. shall form the foundation of a unified environmental administration system.

After establishing water quality target value, the next step should be creating a new water quality monitoring plan and organization as the possibility of achieving the target value must be periodically reviewed based on the latest available data. For the monitoring plan, an effective and practical plan must be prepared by investigating various systems including automated monitoring system, centralized real-time monitoring system through on-line system and integrated database system. In case the target value is not attained, it is necessary to take effective measures for the attainment of the target value. This can be achieved by:

a. Comprehensively investigating the applicability and suitability of pollution control measures including a reduction of pollution load of each pollution source (factory) located at river side,
b. Restriction of water uses,
c. Reduction of discharge water by recycling and physical purification processes such as dredging and water conveyance.

In case the achievement of the target is deemed to be difficult, changes of the water utilization purpose of waste and/or re-examination of the target value should be considered. Basic data and information such as pollution load of each factory, pollutant load per unit activity, water uses, land uses and social and economic information including movement of population are required for the above investigation and judgment. Therefore, it is necessary to gather the latest data and information as a basis for establishment of measures for conservation of the water quality by revising the above data and information at regular intervals. The data and information are required to be opened to the public.

The target value for water quality conservation has been established in many countries and this target has been used for the investigation of required measures when the target is not attained. The project for establishment of water quality target value, recommended here, is aimed at strengthening the cooperation between relevant organizations and execution of careful administration for the conservation of the water quality pollution corresponding to local conditions. An establishment of water quality target value is an urgent need for Egypt and this project should be implemented immediately.

At present, under the scheme of the Basic Environment Law, administrative works for water pollution control of Japan have been conducted by the following organizations:

a. The Japan Environment Agency (JEA) which is the leading organization,
b. The Ministry of International Trade and Industry,
c. The Ministry of Construction,
d. The Ministry of Health and Welfare, the Ministry of Agriculture, Forestry and Fishery,
e. The Ministry of Transportation and local governments.

The functions and roles of these organizations are shown on Figure-5. In Japan, comprehensive administration for water quality conservation such as supervision of water quality monitoring at public water, investigations of environmental protection policy and measures based on the monitoring data, and enactments and modifications of laws and regulations are executed by the JEA. Monitoring works such as inspection of the factories and advice and guidance to factories are executed by local governments. The Ministry of International Trade and Industry (MITI) governs the financial and technical assistance to encourage the installation of pollution control facilities. Other organizations are executing works corresponding with their administrative function.

In case of Egypt, as shown in Figure 4-2 (Chapter 4), EEAA is responsible for comprehensive administration. Eight regional branch offices (RBO) of EEAA are executing water quality

monitoring works and providing advice and guidance. Since 1966, under the cooperation of JICA, Egypt has been developing the Cairo Central Center, which has a standard laboratory and training center, and eight RBOs in order to create the nationwide monitoring network. However, it is taking more time to start the full-scale operation due to mainly short time period after EEAA establishment, the shortage of manpower, materials and budget. On the other hand, organizations such as MIWR and MOHP have been conducting water quality monitoring for a long time and they have already developed relatively good water pollution control systems including monitoring system corresponding to their original function, in comparison to the systems of EEAA. Thus, in considering the financial difficulties of the central government and shortage of manpower, Egypt should:

a. Find the most suitable administrative system for water pollution control and the best assignment of roles and functions between relevant organizations through a joint project such as the one recommended in this study, and

b. Execute administrative works more effectively.

2) Capacity Building of Management for Industrial Wastewater

Management of industrial wastewater in Egypt, especially management of discharged water from factories is presently insufficient because of government and industry issues. The government issues include lack of administrative staff, technology and budget, and consciousness about the cooperation with other organizations. The industry issues include lack of understanding of value of environment, illegal discharges, defective facilities for wastewater treatment, and employees who are not properly educated and trained in terms of environmental issues as well as imperfect environmental management systems. This section provides our recommendations for measures to improve administrative ability to inspect and guide factories and to improve management capability of factories for their discharges.

2-1) Improvement of Administrative Capability to Inspect and Lead Factories

The role of administrative staff, which has knowledge and experience, is pivotal for governmental inspections and guidance for factories. However, in Egypt, appropriate inspection and guidance for factories and enterprises are not performed due to lack of technical experts in administration and incomplete system for inspection and guidance.

In Japan, Water Pollution Control Law stipulates delegation of authority to the local government as shown in Table 11.4. It covers everything from setting up more stringent standards by the local government, to ordering improvement or change of the specified facility and continuous monitoring of water pollution, to calling for reports from factories and business sites where effluents are discharged and inspections of officials. In order to strengthen inspection capability and guidance system of RBOs of EEAA in Egypt to the same level as that of Japan, it is basically required to keep the information mentioned below under control. It is also required to educate the persons in charge to the level that enables them to understand the information and direct the factories and enterprises for improvement. The information to be kept under control related to factories and business sites within its jurisdiction are:

a. Present conditions of specified facilities and wastewater treatment facilities,
b. Outline of the process,
c. Related facilities including machines or equipment connected to the specified facilities within the process,
d. Facilities for gray water,
e. Drainage trench/pipe to the discharging point, and crude materials to be used in the specified facilities.

In order to educate administrative officials who have a special knowledge, it is required to consolidate the education systems. This is not only for actual persons in charge of managing

regional factories and enterprises but also administration engineers who can educate and lead these actual persons in charge of the organization under jurisdiction of industrial wastewater treatment technology.

Table 11.4 Delegation of Authority to the Local Government Stipulated in Water Pollution Control Law

Title of law / Category	Water Pollution Control Law
Establishment of standards	Article 3-3 establishment of more stringent standards than the maximum permissible levels stipulated in the effluent standards as provided for under the Ordinance of the Prime Minister's Office Article 4-5-1,2 establishment of the total pollution load regulation standards
Order	Article 8, 8-2 order to change the structure or the way of use of the Specified Facility or the plan for the treatment of the polluted water, etc. Article 13-1, 13-3 order to improve the structure or the method of use of the facility or the method of treatment of the polluted water, etc. Article 18 order to reduce effluents for a specified period or to take other necessary measures
Guidance, etc.	Article 13-3 guidance, recommendation or advice to a person who does not discharge effluents from a Specified Factory within a Specified Region but who discharges polluted water, waste liquid or any other substance
Request and opinion	Article 24-2 request to offer necessary data and other cooperative measures, or state opinion on the prevention of water pollution in the Public Water Area Article 23-4 request the Chief of the Administrative Organ concerned to take measures
Acceptance of reports	Article 5, 6-1 acceptance of report on the installment of Specified Facility Article 6-3 acceptance of report on the state of pollution and quantity of effluents for each drainage system Article 7 acceptance of report on changes in the structure of a specified facility etc. Article 10 acceptance of report on changes in name of owner, etc. Article 11-3 acceptance of report on the status of the person who takes over or rents a Specified Facility Article14-3 acceptance of report on the method of measuring the pollution load Article 23-3, 23-5 acceptance of information from the chief of the national administrative organs of the measures which have been taken, etc. Article 4-3-1 establishment of a plan for reduction of total pollution load Article 9-2 shortening of the period of restrictions on installation of Specified Facility, etc. Article 15 continuous supervision of the state of water pollution in the Public Water Areas Article 16-1 establishment of a program for the measurement of water quality in the Public Water Area which belong to the prefecture Article 17 public announcement of the state of water quality in the Public Water Area within the prefecture Article 22-1,22-2 calling for a report on the discharge of effluent, the method of treatment of polluted water, etc.; or entry and inspection of the Specified Facility

Note: The work, which comes under the authority of the governors of the prefectures, may be entrusted to the city chiefs who are designated by the Cabinet Order (see the Water pollution control law, article 28).

More concretely, a strengthening of RBO is recommended. This is especially required to ensure a competent inspection of the pollution source and the enforcement of a clear statement for training of RBO officials. In order to properly manage the industrial wastewater issues, programs for education and development of not only the above mentioned knowledge regarding factory wastewater but also technologies for wastewater sampling and chemical analysis, related laws and regulations and general water pollution issues will be necessary. Also, consolidation of facilities for such education will be necessary.

Secondly, strengthening the capacity of EMUs of each governorate for supplementing the limited number of personnel is recommended. The role of EMUs is execution of necessary tasks under RBO, and EMUs actually conduct guidance and competence inspection of each enterprise. Therefore, education for EMUs officials is also required. At the same time, education for persons in charge of RBO to the level that they have enough knowledge and technologies that enable them to guide actual persons in charge of EMUs is also necessary.

Further, a consolidation of pollution source inventory is important. The consolidation includes adding information on pollution source to the constituting elements of environmental information system which is already under construction, constructing database of results of pollution source monitoring, and enabling to see relation between environmental monitoring data and pollution source data. An effective administrative guidance can be taken by integrating various kinds of information together.

2-2) Spread of CP (Cleaner Production) Technologies

The education of technical experts in administration is desired to introduce the concept of CP (Cleaner Production) technologies which reduce volume of wastewater and pollutant load to be treated, combining with EOP (End Of Pipe) technologies, and aiming at environmental load reduction and treatment cost reduction at the same time.

The CP technology is a generic term in the global environment era for energy saving, resource conservation, and waste volume reduction. It is an outcome of strengthening environmental regulations and energy crisis in the past. In order to overcome these problems, many enterprises made efforts for increasing the efficiency in the production process, seek alternative raw materials, reuse waste materials, benefication of byproducts, market development for pollution control equipment, and as a result of these efforts the technologies are accumulated. In advanced countries the CP is the main technology for wastewater treatment in combination with

the EOP technology, which realizes less environment load and minimum cost for wastewater treatment. The combination of appropriate CP and EOP technologies enables to reduce pollution load and environment counter-measure cost at the same time, and therefore special attention is paid to this in the developing countries where there is chronic lack of funds.

Since most of the factories in Egypt have superannuated facilities and old production processes, energy savings, resource conservation, reduction of waste volume, and reduction of pollution load can be easily obtained if appropriate CP and EOP technologies are combined. At the same time, it can greatly contribute to cost reduction for environmental counter-measures, which can be an incentive for enterprises to initiate voluntary action for environmental protection measures.

Therefore, spread of technologies for water pollution control based on CP and EOP technologies will promote voluntary action of enterprises for water pollution control and it will promote preservation of water environment. One method to spread the water pollution control technology based on these CP and EOP technologies is to establish an organization that provides and demonstrates information on CP and EOP technologies. Recently United Nations Industrial Development Organization ("UNIDO") and United Nations Environment Program ("UNEP") jointly established National Cleaner Production Center ("NCPC") in several countries, and NCPCs are presently executing program to provide funds, technologies, and information. Each NCPC is making efforts to spread CP technologies by providing recommendations for policy and information successfully to some extent. Therefore, establishment of a similar kind of organization in Egypt will promote introducing CP technologies. The CP technology for production activities will be realized by only applying technical know-how for all aspects of activities, and more effective introduction will be materialized by applying systematic and data based CP technologies. The database on CP technologies is presently consolidated by Industry and Environmental Program Execution Center, which is providing information to the developing countries. Education of technical experts in administration enabling them to master know-how of CP technologies and providing appropriate guidance to enterprises is necessary in order to introduce CP technologies and Organizations such as NCPC will be useful to educate and train technical experts in administration.

2-3) Assistance for Introducing Environmental Management System to Industries

One of the serious problems of industrial wastewater treatment in Egypt is inappropriate maintenance, management and operation of wastewater treatment facilities. The main reasons are no thorough inspection and guidance by the administration and inconsistent education for

employees and imperfect management system. Especially, site managers and site workers in charge of process management and facility operation at the production sites, which are mostly affected by the environmental counter-measures, do not have enough awareness of environmental issues and therefore they have many cases of ineffective environmental protection measures at the production sites.

In the advanced counties, environmental auditing by inside or outside specialists is performed to check environmental management of enterprises. During performance of the audits, the following points are audited for checking management of wastewater treatment facilities. Based on the results of the auditing, guidance to the employees and improvement of facilities are undertaken.

- Management of custody slip: operation records, inspection records, etc.
- Preparation of manuals and training of employees: operation, maintenance and management of facilities, management for hazardous materials, waste storage and treatment or disposal, emergency response, etc.
- Records of inspection by the administrative organization
- Compliance to the related laws and regulations: standards for discharge to be followed
- Complaints from neighbors and accident records

The above items can be materialized by voluntary actions of enterprises which would not be a large burden in terms of the funds compared to the large burden such as the investment for installation of the wastewater treatment facility. If in Egypt, appropriate management of wastewater treatment facilities at factories and enterprises is done, the pollution load will be drastically reduced. Therefore, it is necessary for the government to follow a policy to introduce environmental management system to enterprises.

The system to be introduced should be worldwide prevailing ISO14000 series, especially the environmental management system ISO14001, which is most appropriate. In order to introduce and propagate the system, seminars held on ISO14000 series would lead to acknowledgement of its importance in environmental management by enterprises, and would give them incentives for obtaining ISO14000 certification as mentioned below:

- Official commendation of enterprises which have obtained certification for ISO14000 and public announcement of the company name
- Green Consume by the government or NGOs (purchase products of enterprises voluntarily obtaining environmental management certification)
- Incentive in investment and tax related subjects

Based on the experience of advanced countries such as Japan, Europe and USA, merits of obtaining ISO 14000 certification for the enterprises are; the cost reduction following resource conservation, energy saving, and reduction of industrial wastes as a result of reconsideration of the production system. In European countries with high environmental concerns, products produced by the high environmental concern enterprises sometimes get a bigger market share compared to other more famous brands and products by enterprises not having environmental concerns. It is expected to enlarge opportunities of purchasing and raise competitiveness of the product following the promotion of green image of enterprises.

Recently in Japan, obtaining ISO14000 certification is one of the conditions for competitive bidding for the national government and local government offices. Therefore for enterprises that desire to develop internationally, obtaining ISO14000 certification may become one important condition, from a viewpoint of strengthening competitiveness in the market. It cannot be assumed, considering conditions of social economy of Egypt and environmental concerns of citizens, that obtaining ISO certification would result in strengthening of competitiveness in the market in Egypt. However, it is expected that obtaining ISO certification would give an edge to the enterprises for the future trend of globalization and rise in the environmental concerns of citizens.

In article 4.4.2 of ISO14001, the training that all the workers involved in "the work that could significantly affect the environment" must have is specified clearly as "consciousness and ability", and therefore appropriate training must be provided. Further, all the workers involved in "the work that could significantly affect the environment" are required to have ability based on appropriate education, training, and experience. The workers involved in "the work that could significantly affect the environment" include persons responsible for environmental management and auditors inside the enterprises.

Firstly, the person assigned for environmental management is required to acquire knowledge and technologies for pollution control. This is especially applicable to the person in charge of management technologies for pollution control related to water quality. Introduction of licensing system such as Japanese licensing system for manager in charge of pollution control will be effective for enterprises in order to hire staff who has professional knowledge on pollution control and for workers in order to develop their career.

Persons in charge of internal auditing of enterprises are to periodically perform the audit as "Inspection and Corrective Actions" of environmental management system shown in Figure-3. It is required for the auditor to have knowledge, technical capability and experience related to

environmental auditing in order to satisfy responsibility for the audit appropriately. Setting up registration system for license for the audit will give merit to the auditors.

At present, Egyptian government makes much effort to spread ISO14000 but it has not progressed too well. In order to analyze the present conditions related to the progress of the ISO14000 in Egypt and study effective policy and its execution for introduction of the system, some technical aid from overseas donors will need to be utilized.

2-4) Other Policy Measures to Promote Management for Industrial Wastewater

The following will be considered as the policy for management of discharged effluents from factories in addition to the above-recommended policies.

- Financial Support

Many enterprises continue to operate old and in-effective production facilities without taking enough environmental protection measures. Although the enterprises want to avoid any penalties, the costs of implementing environmentally sound procedures or installation of new wastewater treatment facilities and introduction of related technology are high and a burden for the enterprises. Another drawback is the inefficient administrative inspection system for discharge of pollutants. These are the reasons why the wastewater treatment technology is not spreading rapidly.

In order to increase the pace of introduction and subsequent implementation of wastewater treatment technologies in Egypt, it is necessary to give enterprises economical incentives for execution of thorough inspection and regulation under the penal provisions of the administration. These would include political consideration of incentives on taxation and long term loan facilities for upgradation of old production facilities, installation of new wastewater treatment facilities and introduction of the technology. Further, it is desired to expand financing for environmental investment such as PAF of Egyptian Pollution Abatement Project by the World Bank and Environment Facility/Public Industry by the KFW.

- Raising Awareness about Environmental Issues

Enterprises have many considerations about the product market, the money market, and the labor market other than environmental issues. If there is negligence in environmental concerns on part of the enterprises, they may have to face criticism of consumers and the sales of their products may fall down. The enterprises would want to reduce the environmental loads and tackle important issues in order to avoid backlash from the product market on account of environmental concerns. This approach of the consumer market is called "Green Consume".

The "Green Consume" would criticize enterprises that lack environmental friendly operations and would provide support to those with positive attitudes towards environmental concerns. In order to develop "Green Consume" culture in Egypt, the government should try to increase awareness about environmental issues among the citizens. In addition to this, the government should educate general public on important environmental issues.

At present education on environmental issues in Egypt is based on the support of European and American donors. In order to maintain and develop good quality of the water environment, cooperation of the people is mandatory. Positive political measures also need to be taken to raise awareness of citizens about the environment. In this connection, examples of education on environmental issues in Japan are as below:

- Distribution of pamphlets for environmental preservation
- Distribution of supplementary readings on environmental issues among school children and students of junior high school and high school
- Picking up garbage at the beach and the riverside
- Promote contact with nature by installing water-contacting facilities
- Encourage families to reduce water pollution (savings in water use, collection of kitchen refuse by filters, appropriate disposal of edible oil, appropriate use of detergent etc.)
- Encourage purchase of environmentally friendly products (public announcement of information on products and enterprises)
- Provide opportunities to learn environmental issues such as organizing meetings for nature observation on ships or watersides, and events for "water quality survey based on the existing aquatic organism species" or "outdoor school at shorelines"
- Arranging training courses for environmental education at Environmental Training Center of National Institute for Environment Studies

APPENDIX-1

DATA OF FACTORY SURVEY

AND DESIGN FOR W.W.T.

Attached Table 8.3-1 Comparison Table of Representative Factories

Cct. 4. 1999

Note: ○:Good, △:Acceptable, X: Not Acceptable

Selection Criteria	DSM Delta Steel Mill Co.	NPF El Nasr Steel pipes & Fittings Co.	EIS Egyptian Iron & Steel Co.	MRC Mansoura Resin & Chemicals Co.	EFC Egyptian Ferroalloys Co.
1 Factories that are need of improvement in their anti-pollution measures	○	○	△	○	△
2 Factories that are typical so that the recommended waste water treatment systems can be expected to be diffused to other factories in Egypt	△	○	△	○	X
3 Factories that are interested in designing or upgrading their waste water management	○	○	○	○	○
4 Factories that are financially able (either self-financing or from other financial resources) to adopt the recommendations on the appropriate waste water treatment system	△	○	○	△	○
5 Factories in which similar projects by other donors are not under way	△	○	○	○	○
Recommeded Representative Factories	X	○	○	○	X

(1)

Attached Table 8.3-2 (1/4) Selection Criteria 1999/10/13

Selection Criteria	Factor	Original Point DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian	Adjusted Point DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian
1. Production process											
(1) Not special, not complicated	1										
(2) Not old	1										
(3) Renewed, renovated appropriately	2										
(4) Operated continuously	3										
(5) Moderately facilitated	2										
1. Subtotal											
2. Waste water treatment by D/P											
2.1 Quality of waste water											
(1) Availability of suitable waste water	3										
(2) Moderate S/S	2										
(3) Moderate COD / BOD	2										
(4) No harmful sludge	1										
(5) Sufficient and continuous flow	3										
(6) No inhibitory effect on treatment	1										
2.1 Subtotal											
2.2 Existing facilities for waste water treatment											
(1) Appropriate facilities	-2										
(2) Appropriate pretreatment	-1										
(3) Appropriate configuration	-1										
(4) Drained without treatment	-3										
(5) Urgent need for Improvement	3										
(6) Appropriate operation	-1										
(7) Appropriate maintenance	-1										
(8) Well controlled and managed	-1										
(9) Keeping operation records	-1										
(10) Well understood by controller / operator	-1										
(11) Monitored periodically	-1										
(12) Appropriate sludge treatment / disposal	-1										
2.2 Subtotal											

(2)

Attached Table 8.3-2 (2/4) Selection Criteria 1999/10/13

Selection Criteria	Factor	Original Point					Adjusted Point				
		DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian	DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian
2.3 Saving, reuse of water											
(1) Appropriate reuse of cooling water	-1										
(2) No contamination of waste water into clean water	-1										
(3) Appropriate mitigation of water	-1										
(4) Segregation of sanitary waste water	-1										
(5) No disposal of fresh water / steam	-1										
2.3 Subtotal											
2.4 Applicability to other industries											
(1) Components of unit process technology	2										
(2) No need of advanced technologies	3										
(3) Easy maintenance and operation	3										
(4) Low investment	3										
(5) Low maintenance / operation cost	2										
(6) Compact configuration	2										
2.4 Subtotal											
2.5 Pollution control											
(1) Well organized	-1										
(2) Written direction exists	-1										
(3) Manuals are facilitated	-1										
(4) Corporate environmental policy	-1										
(5) Environmental education	-1										
2.5 Subtotal											
3. Factory as the candidate for D/P											
3.1 Location											
(1) Distance from the center of Cairo	3										
(2) Traffic condition to the factory	3										
(3) Surrounding environment	2										
(4) Security up to the location	1										
3.1 Subtotal											

Attached Table 8.3-2 (3/4) Selection Criteria

1999/10/13

Selection Criteria	Factor	Original Point					Adjusted Point				
		DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian	DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian
3.2 Site for D/P construction											
(1) Sufficient area	1										
(2) Stable ground	1										
(3) Easy access and sufficient temporary area	3										
(4) No obstacles surrounding	2										
(5) Easy transfer of waste water	3										
(6) Easy discharge or reuse of treated water	2										
(7) Easy electricity supply	1										
(8) Adequate control room can be constructed	1										
3.2 Subtotal											
3.3 Cooperation to the study											
(1) Answer to the questionnaire	1										
(2) Cooperation to JICA study	3										
(3) Necessity of JICA aid	2										
(4) Satisfaction to the conceptual design	3										
3.3 Subtotal											
3.4 Cooperation to construction / operation of the D/P											
(1) Availability of construction space	1										
(2) Assignment of engineers / operators	3										
(3) Easy entrance of construction personnel and D/P observers	1										
(4) Instructor / demonstrator and room	1										
(5) Rest room for operation supervisors	1										
3.4 Subtotal											
3.5 Financial capability											
(1) Financial status	3										
(2) Capability of sharing construction cost of D/P	2										
(3) Free charge supply of chemicals / utilities	2										
(4) Sharing administration cost and expenses during operation of D/P	2										
3.5 Subtotal											

Attached Table 8.3-2 (4/4) Selection Criteria

1999/10/13

Selection Criteria	Factor	Original Point					Adjusted Point				
		DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian	DSM Delta	NPF El Nasr	EIS Egyptian	MRC Mansoura	EFC Egyptian
3.6 Environmental / social troubles in the past											
(1) Instruction / fines from governing institute	-1										
(2) Claim from neighbors	-1										
(3) Observance of criteria to effluent water	-1										
(4) Observance of criteria to other pollution control	-1										
3.6 Subtotal											
3.7 Other topics											
(1) No aid from other donors	3										
(2) Construction capability of own resources and in-factory contractors	2										
(3) Maintainability of machines / instruments	3										
3.7 Subtotal											
All Total											

Wastewater Discharge Regulation in Egypt

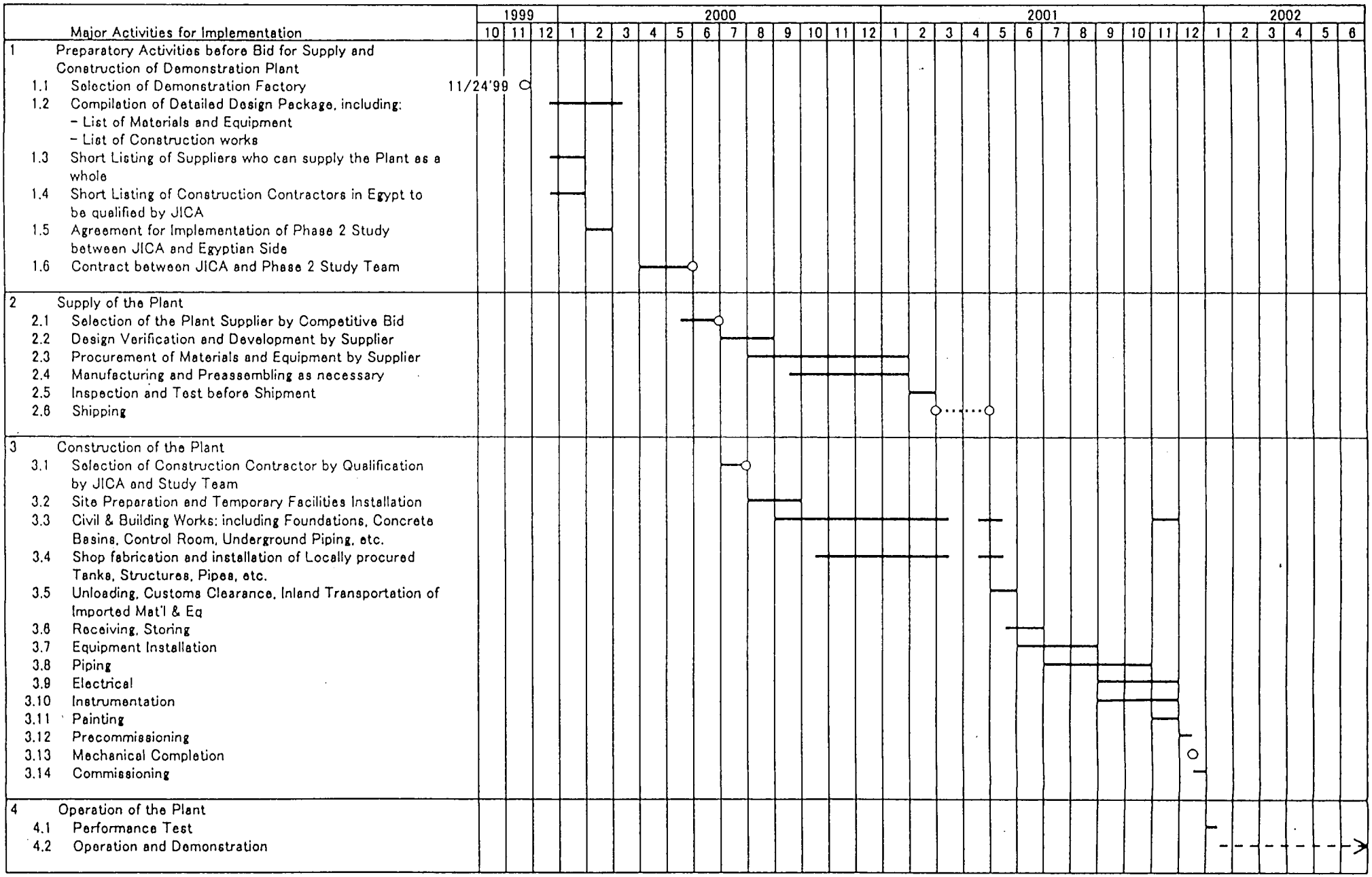
Parameter ppm or mg/L (unless otherwise noted)	Law 4/94: Discharge to Coastal Environment	Law 93/62: Discharge to Sewer System		Law48/82			
		as modified by Decree 9/89	as modified by Decree 44/2000	Underground Reservoir & Nile Branches /Canals	Nile (Main Stream)	Non Potable Surface Water	
						Municipal	Industrial
BOD (5 day, 20℃)	60	<400	600	20	30	60	60
COD (Permananate)	n/a	350		10	15	40	50
COD (Dichromate)	100	<700	1100	30	40	80	100
pH (units)	6-9	6-10	6-9.5	6-9	6-9	6-9	6-9
Oil & Grease	15	<100	100	5	5	10	10
Temperature (℃)	10 C>temp of receiving body	<40	43	35	35	35	35
TSS total Suspended Solids	60	<500	800	30	30	50	60
SS Settable Solids (ml/l)	n/a	n/a	10min - 8 30min - 15	n/a	n/a	n/a	n/a
TDS Total Dissolved solids	2000	2000		800	1200	2000	2000
PO_4	5	30	25 (Total Phosphorous)	1	1	n/a	10
NH_3-N (Ammonia)	3	<100		n/a	n/a	n/a	n/a
NO_3-N (Nitrate)	40	<30	100 (Total Nitrogen)	30	30	50	40
Total Recoverable Phenol	1	<0.005	0.05	0.001	0.002	n/a	0.005
Fluoride	1	<1		0.05	0.05	n/a	0.5
Sulphide	1	<10		1	1	1	1
Chlorine	n/a	<10		1	1	n/a	n/a
Surfactants	n/a	n/a		0.05	0.05	n/a	n/a
Probable counting for colon group/100 cm^3	5000	n/a		2500	2500	5000	5000
Aluminum	3	n/a		n/a	n/a	n/a	n/a
Arsenic	0.05	n/a	2.0	0.05	0.05	n/a	n/a
Barium	2	n/a		n/a	n/a	n/a	n/a
Beryllium	n/a	<10		n/a	n/a	n/a	n/a
Cadmium	0.05	<10		0.01	0.01	n/a	n/a
Chromium	1	Total metals: <10, <50 m^3/d <5, >50 m^3/d		n/a	n/a	Total concentration for these metals should be <1 for all flow streams	
Chromium Hexavalent	n/a		0.5	0.05	0.05		
Copper	1.5		1.5	1	1		
Iron	1.5			1	1		
Lead	0.5		1.0	0.05	0.05		
Manganese	1			0.5	0.5		
Mercury	0.005	<10	0.2	0.001	0.001	n/a	n/a
Nickel	0.1	<10	1.0	0.1	0.1	n/a	n/a
Silver	0.1	<10	0.5	0.05	0.05	n/a	n/a
Zinc	5	<10		1	1	n/a	n/a
Cyanide	0.1	<0.1	0.2	n/a	n/a	n/a	0.1
Total Metals	n/a	Total metals: <10, <50 m^3/d <5, >50 m^3/d	5	1	1	1	1
Organic Compounds	0	0		0	0	0	0
Pesticides	0.2	0		0	0	0	0
Colour	None	None		None	None	None	None

n/a = not applicable

Phase 1 Study

Overall Schedule for Implementation of Demonstration Plant (Preliminary)

Dec. 11, 1999



(2)

Attached Table 9-2

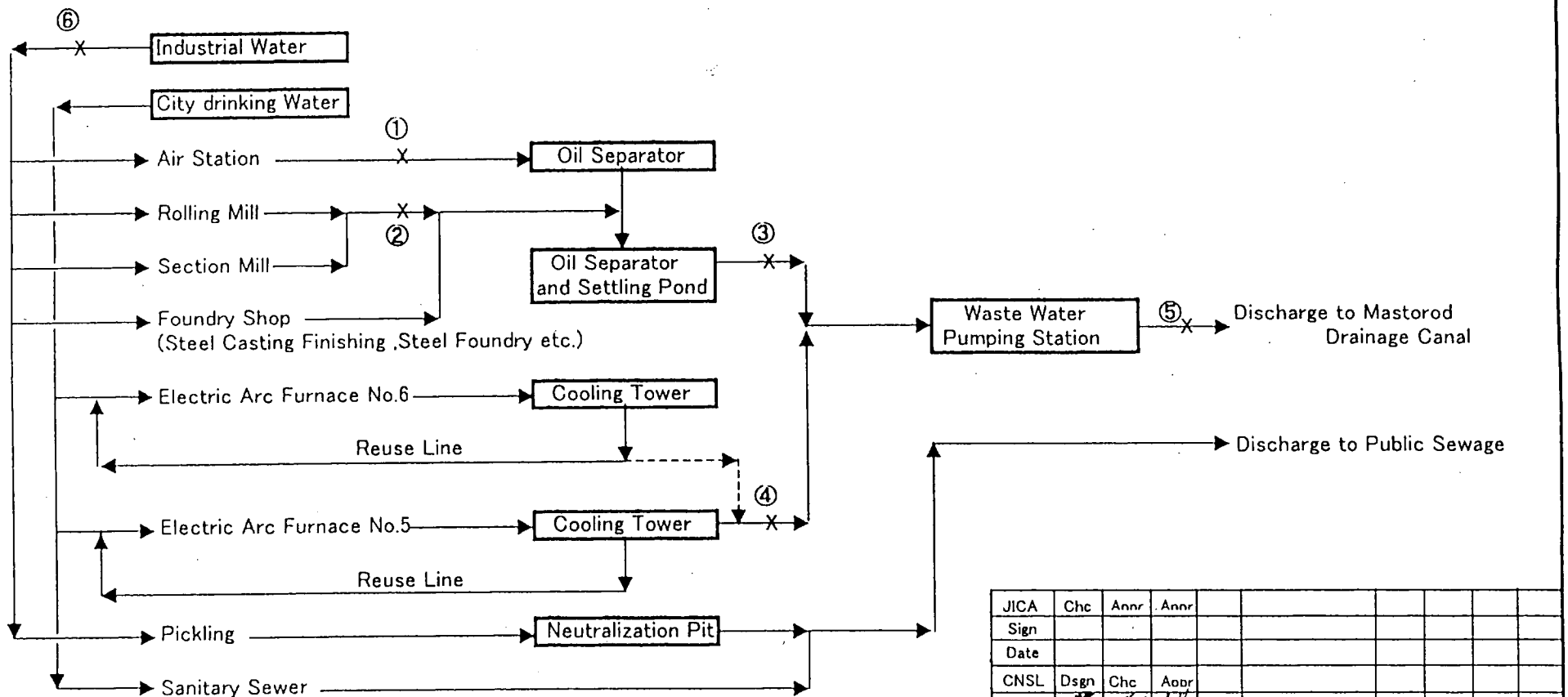
1. DELTA STEEL MILL CO.

Draft Table of Raw Data

Analytical Items	Flow	EC	Temp	Color	pH	COD ref.	BOD	COD	TDS	SS	S^{2-}	Oil	PO_4^{3-}	N^{-}	Phenol
Unit	m^3/d	Us/cm	°C	----	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Low 48/82 discharge into Nile Branches/Canal	---	---	<35	Free	6~9		20	30	800	30	1	5	1	30	0.001
Effluent Standards in Japan	---	---	---	---	5.8-8.6		120	120	---	150	---	5	8	60	5
Sample – 1 : Air Station outlet DSM-PW-01	102.12	0.34	31.33	SG.	7.54	5	15	23.24	220	22		2301	0.46	0.24	
Sample – 2 : Mixing of Rolling mill & Section mill DSM-PW-02	447.5	0.33	28.4	G.	7.51	17.5	12	50.36	230	64		154	0.16	0.44	
Sample – 3 : Mixing of Foundary , Rolling mill and Section mill DSM-PW-03	922.14	0.32	28.4	NO	7.61	8.75	10	34.86	210	56		35	0.18	0.26	
Sample – 4 : Cooling Wastewater of EAFs No. 5 & 6 DSM-EW-04	239.65	0.34	30	NO	7.72	10	6	34.75	210	18		1	0.37	0.34	
Sample – 5 :End of Pipe (Middle of Pit) DSM-EW-01	600	0.33	28.45	NO	7.72	16.25	15	29.05	260	34		8.88	0.09	0.18	
Sample – 6 : Intake Water DSM-IW-01		0.33	29	NO	7.8	10	Nil	15.44	190	13	Nil	Nil	0.15	Nil	0.039

(8)

Attached Table 9.1-1



Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦
Flow Rate	m^3/h	102	448	922	239	600**		
pH	—	7.54	7.51	7.61	7.72	7.72		
Conductivity	μS/cm	345	326	322	367	329		
Turbidity	NTU	106	28	33	19	23		
Water Temp.	℃	31.3	28.4	28.4	30	28.5		
Salinity	%	0.01	0.01	0.01	0.01	0.01		
COD_{Mn}	mg/L	5	18	9	10	24		

* : Field Measurement(Average)

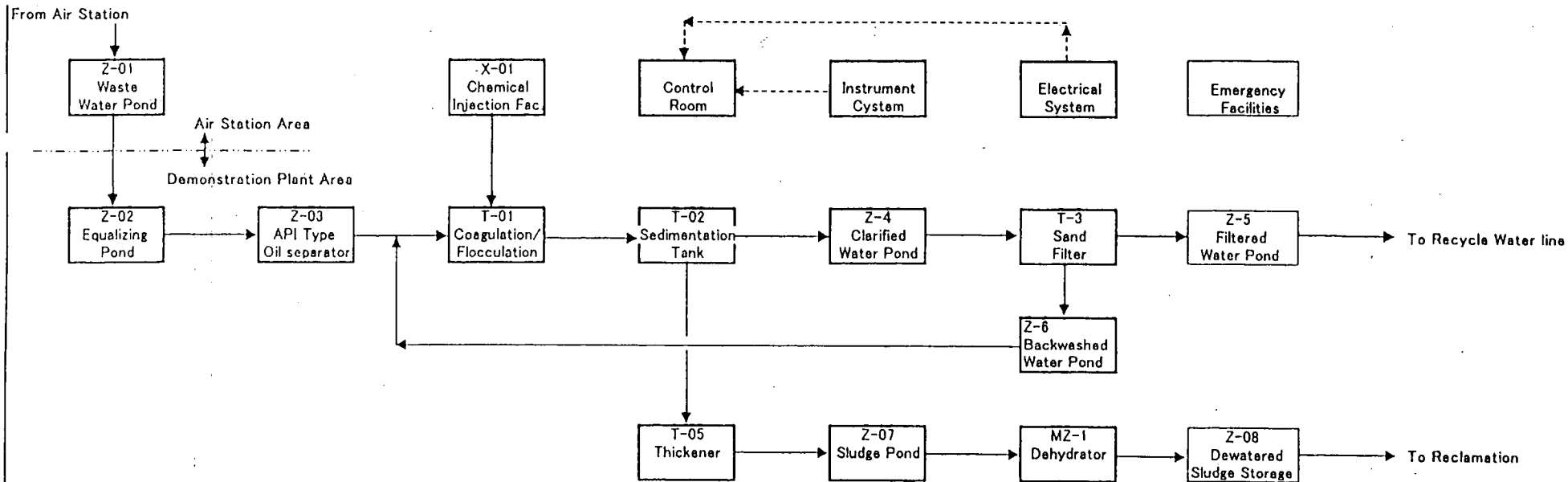
** Data by Factory Personal

JICA	Chc	Appr	Appr						
Sign									
Date									
CNSL	Dsgn	Chc	Appr						
Sign				Rev	Descrip	Dsgn	Chc	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR DELTA STEEL MILL CO. SCHMATIC DIAGRAM OF WASTE WATER FLOW
ISSUED	SCALE: NONE
DWG NO	DS-CD-15-01 REV. 0

(6)

Attached Figure 9.1-1

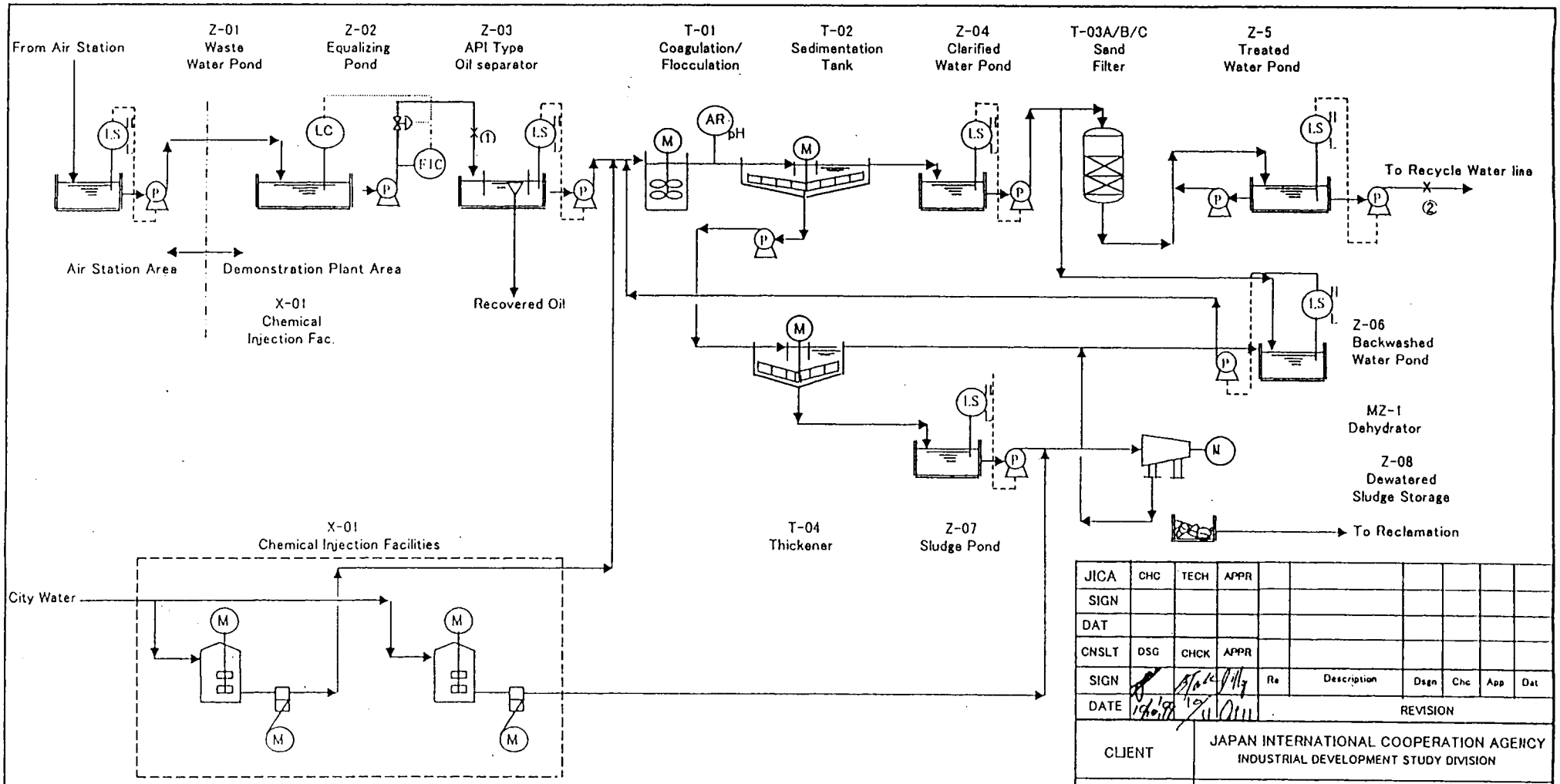


Component of Facilities

Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	Waste Water Pond	Equalizing Pond	API Type Oil Separator	Coagulation/ Flocculation	Sedimentation Tank	Clarified Pond	Biological Treatment	Sand Filter	Filtered Water Pond	Sterilization Tank/Pond
	○	○	○	○	○	○	×	○	○	×
Number	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Item	Thickener	Sludge pond	Backwashed Water Pond	Dehydrator	Dewatered Sludge Storag	Chemical Injection Fac	Emergency Facility	Instrument System	Electrical System	Control Room
	○	○	○	○	○	○	○	○	○	○
Number										
Item										

JICA	CHC	TECH.	APPR						
SIGN									
DAT									
CNSLT	DSGN	CHCK	APPR						
SIGN				Re	Description	Dsgn	Chc	Apo	Dat
DAT				REVISION					

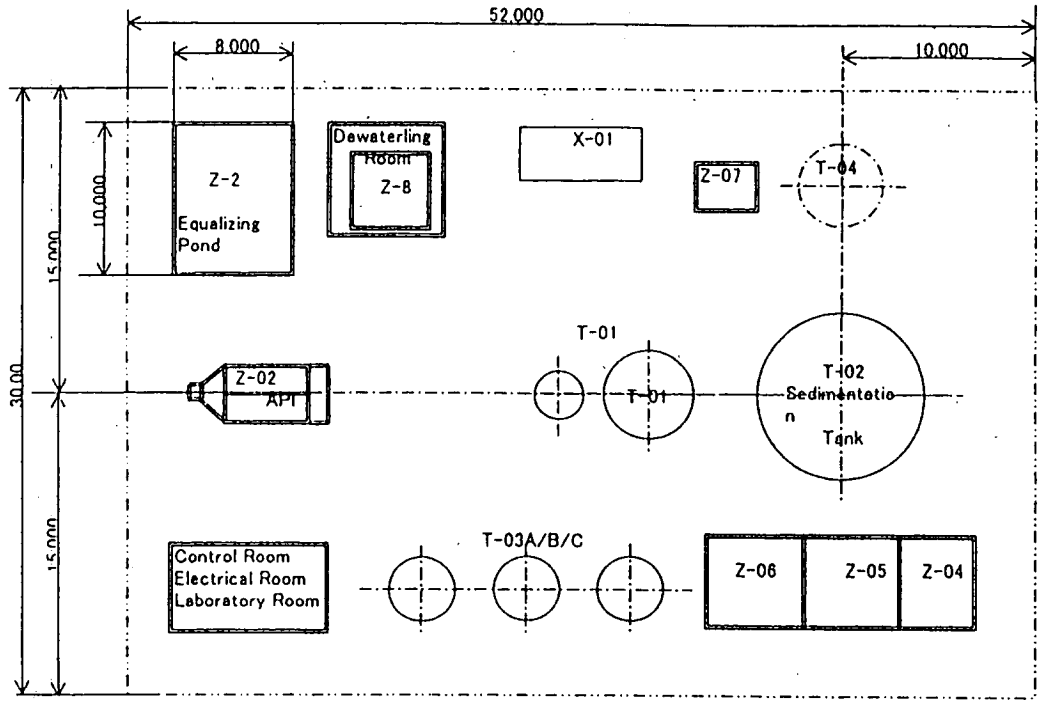
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN
TITLE	FOR DELTA STEEL MILL CO. BLOCK FLOW DIAGRAM OF WASTE WATER TREATMENT
ISSUED	SCALE: NONE
DWG: DS-CD-15-03	REV.: 0



Stream No. / Analytical Item	Unit	①	②	③	④	Nile Regulation
Flow Rate	m^3/h	120	120			
pH	—	6~7	7~8			6~9
Conductivity	μS/cm	340	350			-
SS	mg/L	200	2			30
Oil & Grease	mg/L	1,000	2			5
BOD	mg/L	20	20			30
COD_{Mn}	mg/L	30	20			40

JICA	CHC	TECH	APPR							
SIGN										
DAT										
CNSLT	DSG	CHCK	APPR							
SIGN				Re	Description	Dsgn	Chc	App	Dat	
DATE				REVISION						

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR DELTA STEEL MILL CO. CONCEPTUAL DESIGN OF WASTE WATER TREATMENT
ISSUED	SCALE: NONE
DWG NO	DS-CD-15-04 REV. 0



T-01	Congulation Tank	2,400$^{\phi}$×3,000^{H}×10 m^3
	/Flocculation Tank	& 4,770$^{\phi}$×5,000^{H}×60 m^3
T-02	Sedimentation Tank	8,000$^{\phi}$×4,500^{H}×180 m^3
T-03A/B/C	Sand Filter	3,200$^{\phi}$×4,000^{H}×32 m^3
T-04	Thickener	4,500$^{\phi}$×4,000^{H}×45 m^3
Z-01	Waste Water Pond	4,000^{W}×5,000^{L}×2,000^{H}×30 m^3
Z-02	Equalizing Pond	8,000^{W}×10,000^{L}×3,500^{H}×2
Z-03	API Type Oil Separator	3,400^{W}×5,600^{L}×1,500^{H}×25 m^3
Z-04	Clarified Water Pond	4,000^{W}×5,000^{L}×2,000^{H}×30
Z-05	Treated Water Pond	5,000^{W}×5,000^{L}×3,000^{H}×60
Z-06	Backwashed Waste Water Pon	5,000^{W}×5,000^{L}×3,000^{H}×60 m^3
Z-07	Sludge Pond	2,500^{W}×2,500^{L}×2,500^{H}×10 m^3
Z-08	Dewatered Sludge Storage	4,000^{W}×4,000^{L}×2,500^{H}×30 m^3
MZ-01	Dehydrator	
X-01	Chemical Injection	

JICA	CHC	TECH.	APPR						
SIGN									
DATE									
CNSLT	DSGN	CHCK	APPR						
SIGN				Re	Description	Dsgn	Chc	App	Da
DATE				REVISIO					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR DELTA STEEL MILL CO. PLOT PLAN FOR CONSEPTUAL DESIGN OF W. W. T. DEMONSTRATION PLANT

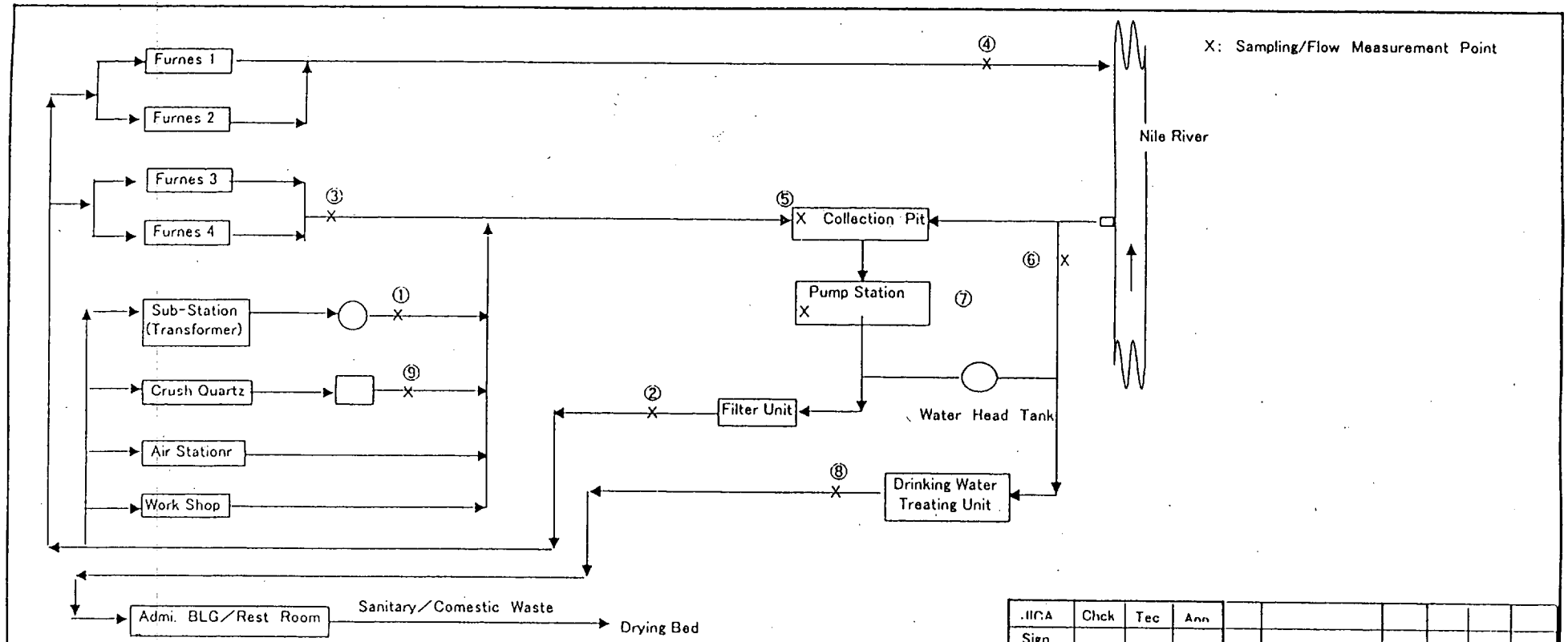
ISSUED		SCALE	1/250
DWG NO	DS-CD-12-01	REV.	0

5. EGYPTION FERRO ALLOYS Co.

Draft Table of Raw Data

Analytical Items	Flow	EC	Temp	Color	pH	COD ref.	BOD	COD	TDS	SS	S^{2-}	Oil	PO_4^{-3}	N	NO_3	NO_2	NH_3	SiO_2	T.H	T.Alk
Unit	m^3/h	uS/cm	°C	----	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Low 48/82 discharge into Nile Branches/Canal	---	---	<35	Free	6~9		20	30	800	30	1	5	1	30						
Effluent Standards in Japan	---	---	---	---	5.8-8.6		120	120	---	150	---	5	8	60						
Sample – 1 : Transformers outlet EFACO – PW – 01	60	0.3	34	NO	7.09	100	---	114	---	---		Nil	---	---	---	---	---	---	---	---
Sample – 2 : Strainer outlet EFACO – PW – 02	1900	0.3	31	NO	7.80	27	---	---	Nil	---		Nil	---	---	---	---	---	---	---	---
Sample – 3 : Cooling water outlet furnaces No. 384 EFACO – PW – 03	725	0.31	33	NO	7.88	16.67	3.6	19.29	90	13		Nil	---	---	---	---	---	6.88	---	---
Sample- 4: Cooling water outlet furnaces No. 182 EFACO – PW - 04	725	0.30	34	NO	7.88	16.67	9	24.12	110	30		Nil	---	---	---	---	---	6.47	---	---
Sample–5: Outlet F3&F4 +Trans. +Q, Wash EFACO – PW - 05	790	0.30	30	NO	7.75	24	---	14.47	70	60		---	---	---	---	---	---	6.62	102.2	---
Sample–6: Intake River Nile After pump EFACO – PW – 01	1900	0.30	25	NO	7.48	50	3.6	14.41	70	10		---	7.06	Nil	Nil	Nil	Nil	---	100	125
Sample–7 : Before pumping to strainer EFACO – PW – 06	---	0.30	29	NO	7.78	30	Nil	4.8	---	---		Nil	---	---	---	---	---	---	105	---
Sample–8: Drinking water after 1° treatment EFACO – PW - 01	72	0.30	28	NO	7.70	20	Nil	4.82	214	6		---	Nil	Nil	Nil	Nil	Nil	7.06	101	123
Sample–9 : Intake River Nile After pump EFACO – PW – 07a																				
Sample–10 : Quartz Wash EFACO – PW – 07b																				

- Note :
  Samples No. (9) and No. (10) have not been delivered by EFACO yet .



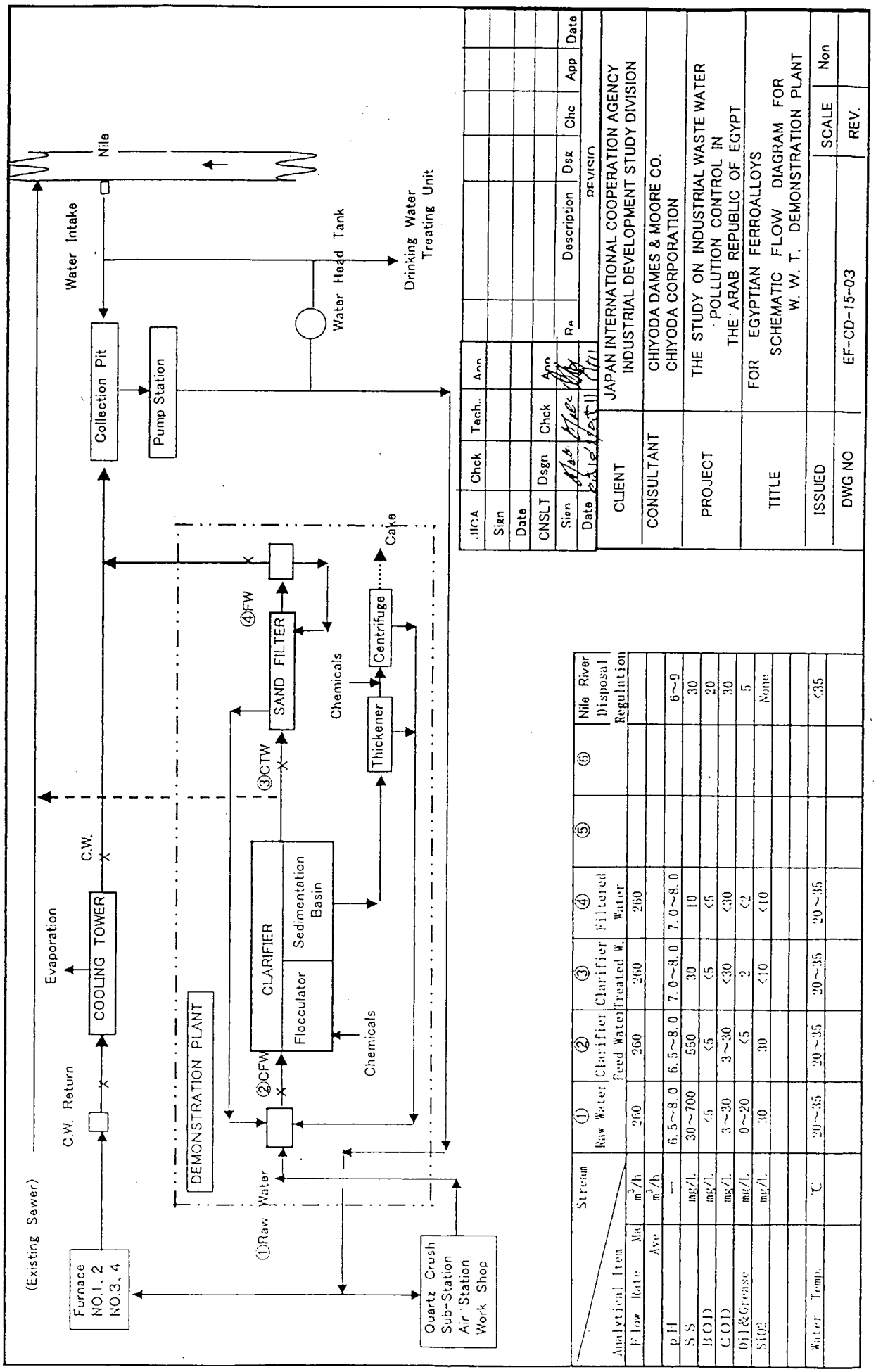
Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦	⑧	⑨1	⑨2
Flow Rate	m^3/h	60	1,900	725	725	790	1,900	~	72		
pH	—	7.1	7.7	7.93	7.8	7.7	7.48	7.75	7.65		
Conductivity	μS/cm	303	303	310	305	303	295	303	300		
Turbidity	NTU	0	0	0	10~90	0	0	0~90	0		
Water Temp.	°C	34	31.3	33.3	34.3	30	25	29	30		
Salinity	%	0	0	0	0	0	0	0	0		
COD_{Mn}	mg/L	20-100	10~20	10~20	10~20	5~50	50	20~50	20		

* : Field Measurement(Average)

JICA	Chck	Tec	App						
Sign									
Date									
CNSL	Dsgn	Chc	App						
Sign				Re	Descriptio	Dsg	Chc	App	Dat
Date				REVISIO					

CLIEN	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS SCHEMATIC DIAGRAM FOR WASTE WATER FLOW
ISSUED	SCALE: Non
DWG	EF-CD-15-01 REV.: 0

Attached Figure 9.2-1

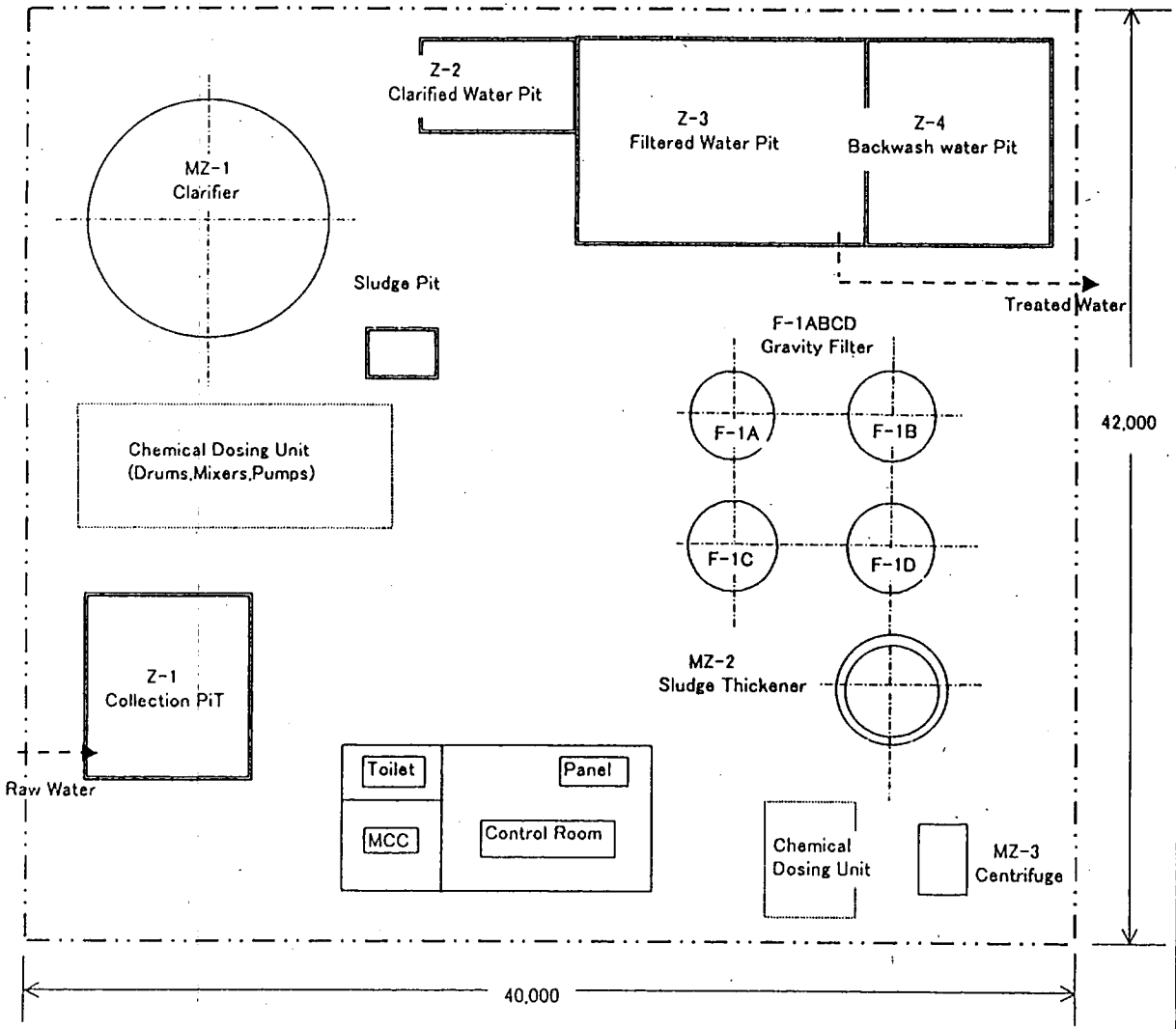


Analytical Item		Stream	① Raw Water	② Clarifier Feed Water	③ Clarifier Treated W.	④ Filtered Water	⑤	⑥	Nile River Disposal Regulation
Flow Rate	Max	m³/h	260	260	260	260			
	Ave	m³/h							
pH		—	6.5~8.0	6.5~8.0	7.0~8.0	7.0~8.0			6~9
SS		mg/L	30~700	550	30	10			30
BOD		mg/L	<5	<5	<5	<5			20
COD		mg/L	3~30	3~30	<30	<30			30
Oil&Grease		mg/L	0~20	<5	2	<2			5
SiO2		mg/L	30	30	<10	<10			None
Water Temp.		℃	20~35	20~35	20~35	20~35			<35

		Chck	Tech.	App
JICA	Sign			
	Date			
CNSLT	Dsgn	Chck	App	
	Sign			
	Date			

No.	Description	Dsg	Chc	App	Date
REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS SCHEMATIC FLOW DIAGRAM FOR W. W. T. DEMONSTRATION PLANT
ISSUED	SCALE: Non
DWG NO	EF-CD-15-03 REV.



Major Equipment:

Z-1	Collection Pit	6,500W x 8,000L x 3,000H
Z-2	Clarified Water Pit	4,000W x 6,000L x 3,000H
Z-3	Filtered Water Pit	8,000W x 13,000L x 3,000H
Z-4	Backwash water Pit	7,000W x 8,000L x 3,000H
MZ-1	Clarifier	9,800ID x 3,500H
MZ-2	Sludge Thickener	3,700ID x 2,400H
F-1ABCD	Gravity Filter	3,700ID x 4,500H
Control Room Building		6,000W x 12,000L

JICA	Chck	Tech	Appr						
Sign									
Date									
CNSLT	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS CO. PLOT PLAN FOR CONCEPTUA DESIN OF W. W. T. DEMONSTRATION PLANT
ISSUED	SCALE: No:
DWG NO	EF-CD-12-02 REV. 0

Attached Figure 9.2-3

2. El NASR STEEL PIPES & FITTINGS Co.

Draft Table of Raw Data

Analytical Items	Flow	EC	Temp	Color	pH	COD ref.	BOD	COD	TDS	SS	S^{2-}	Oil	PO_4^{-3}	N	F	T.H.M	Pb	Cd	As	Cu	Zn	ABS	MPN
Unit	m^3/h	uS/cm	°C	----	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
Low 48/82 discharge into Nile Branches/Canal	---	---	<35	Free	6~9		20	30	800	30	1	5	1	30	0.5	1	0.05	0.01	0.05	1	1	0.05	
Effluent Standards in Japan	---	---	---	---	5.8-8.6		120	120	---	150	---	5	8	60	15	---	0.1	0.1	0.1	3	5	---	
Sample–1:after neutralization unit NPF – PW - 01	132.25	26.6	29.18	Green to Yellow	6.06	>35	250	474	21720	840	Nil	4	Nil	2.32	Nil	190.147	0.045	0.083	0.004	0.015	190		
Sample – 2 : After oil separator Basin NPF – PW - 02	223.2	0.30	27.87	NO	7.62	66.67	90	194	300	174	Nil	6985	0.07	0.43			0.03	0.001	0.006	0.01	Nil		
Sample – 3: Longitudinal and spiral factory NPF – PW - 03	3008.4	0.39	30	Pale Green	6.87	20	17	69.5	240	20	0.55	3.0	0.98	0.96	Nil		Nil	0.014	Nil	0.055	Nil		
Sample – 4:Sanitary wastewater NPF – SW - 01	442.08	0.38	30	Pale Yellow	7.06	40	9	86	230	21	Nil	2.0	0.8	1.14								Nil	75000
Sample – 5 : End of Pipe NPF – EP – 01	953.3	5.38	34.8	Orange to Red	6.17	>100	420	540	4720	358	0.52	Nil	0.05	1.84	Nil		Nil	0.014	0.004	0.145	55.8		

E2RC

Energy and Environment Research Center

Company Name : El Naser Steel Pipes and Fitting co.(**NPF**)
Sampling Date : November 29th, 1999
Sample Name : Oil Separator (skimmed oil effluent)

Parameter	Unit	Results
pH	----	7.39
Conductivity	ms/cm	0.834
Temperature	°C	18.60
Dissolved Oxygen	mgO_2/L	10.07
Turbidity	NTU	76.00
Salinity	%	0.01
TDS	mg/L	200.00
BOD (5d, 20 °C)	mg/L	1300
CODcr	mg/L	24428
Oil & grease	mg/L	588
Fe^{2+}	mg/L	Nil
Fe^{3+}	mg/L	Nil
Total - Fe	mg/L	Nil
Sulfate (as SO_4)	mg/L	Nil
Acidity as H_2SO_4	mg/L	Nil

E2RC

Energy and Environment Research Center

Company Name : El Naser Steel Pipes and Fittings co.(**NPF**)
Sampling Date : November 29th, 1999
Sample Name : Acid Neutralization Waste Water

Parameter	Unit	Results
pH	----	2.45
Conductivity	ms/cm	11.70
Temperature	°C	18.50
Dissolved Oxygen	mgO_2/L	9.80
Turbidity	NTU	76
Salinity	%	0.66
TDS	mg/L	6800
BOD (5d, 20 °C)	mg/L	497
CODcr	mg/L	993
Fe^{2+}	mg/L	1565
Fe^{3+}	mg/L	60.90
Total - Fe	mg/L	1625.90
SO_4	mg/L	29.17
Acidity as H_2SO_4	mg/L	7154

ESTIMATION COST FOR EL NASR CO. for STEEL PIPES FITTINGS

		Yen Portion [¥1000]	LE Portion [LE]	Total
1	Direct Cost			
	1.1. Equipment & Materials			
	(1)Machinary	98,100		
	(2)Piping Materials	10,500		
	(3)Electrical Equipment & Materials	26,000		
	(4)Instrument & Materials	34,000		
	(5)Mini. Labo. Analizer & Others	4,700		
	1. 1 Sub-total	173,300	0	
	1.2. Field Work Cost			
	(1) Steel Tank & Drum		967,000	
	(2) Equipment Installation		142,000	
	(3) Piping		842,000	
	(4) Civil Work (Foundation, Pit, Pave)		1,494,000	
	(5) Building, Shelter, Steel Structure		541,000	
	(6) Lining, Coating, Painting		537,000	
	(7) Electrical, Instrumentation		498,000	
	(8) Commissioning/ Test		50,000	
	1. 2 Sub-Toatal	0	5,071,000	
2	Indirect Cost			
	(1) Export Packing, Ocean Transport	18,100		
	(2) Import Duty, Inland Transport*1		1,407,353	
	(3) Temporary Facilities*2		304,260	
	(4) Sub-contractor Expense*3		1,267,750	
	(5) Insurance, Social Tax*4		369,354	
	(6) Supervisor Expense	10,000		
	2. Sub-Total	28,100	3,348,717	
3	(1 + 2) Total	201,400	8,419,717	
	(1 + 2) Total [¥1000]	201,400	286,270	487,670
	[LE]	5,923,529	8,419,717	14,343,246

Note: Above cost includes outside battery except utilities supply.

*1: {(1.1Sub-total) + 2(1)} x 25%

*2: (1.2) x 6%

*3: (1.2) x 25%

*4:[{1.1)+(1.2)}+{2(1)+2(2)+2(3)+2(4)}] x 2.7%

Unit Cost for Estimation of W.W.T. Demonstration Plant (Reference)

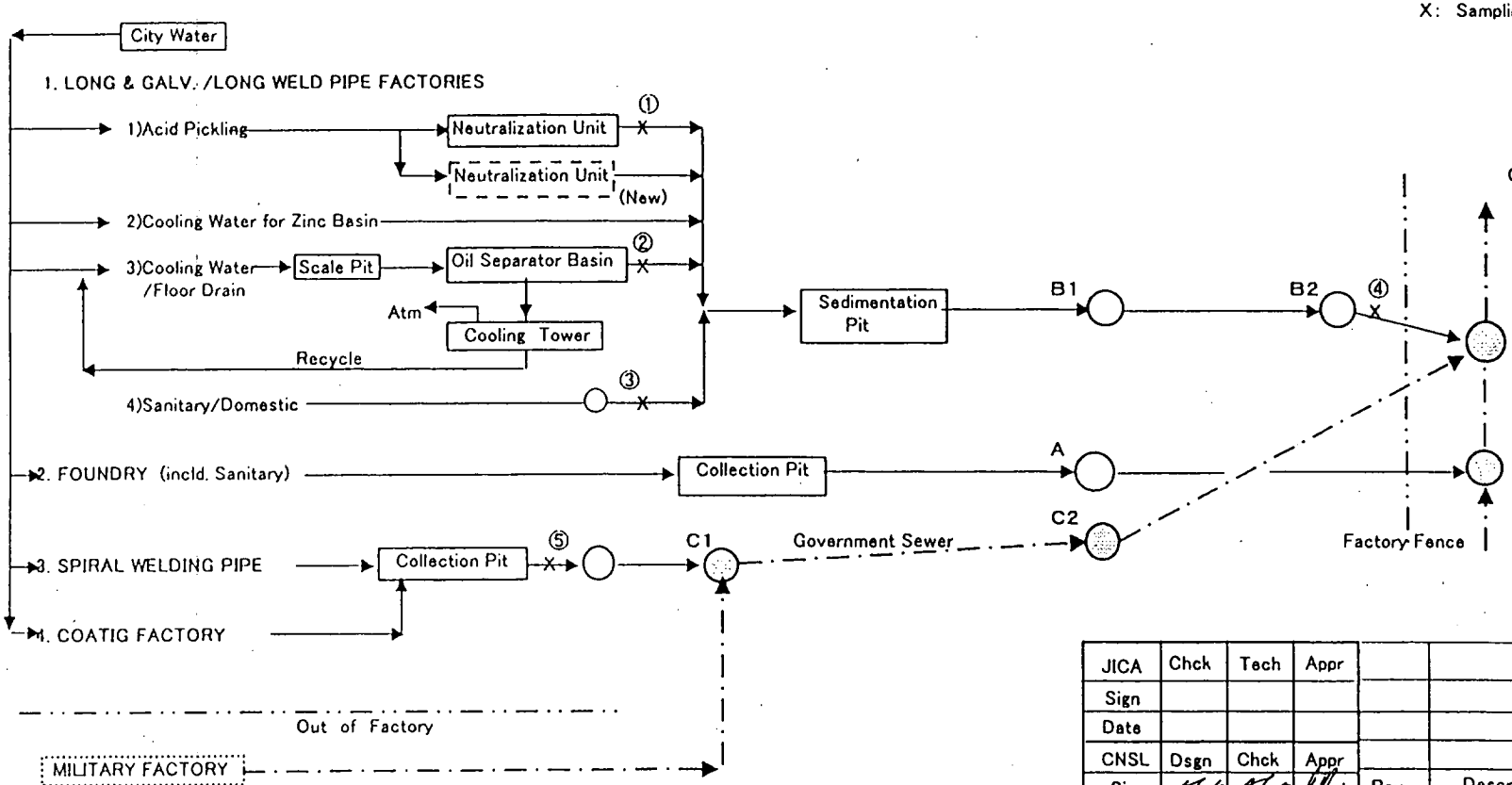
Factory Name: El Nasr Co. for Steel Pipes and Fittings.
Design Case: Basic Design

1. Major Equipment

Equipment Name	Unit Cost [x10^{3}Yen]	Note
(1) Acid water pumps	1,500	Material: SCS
(2) Filter	3,000	3 sets
(3) Sludge Rake	6,000	1 set
(4) Centrifuge	10,000	1 sets
(5) Motor Control Center	16,500	
(7) Center Control Panel	3,000	1 set

2. Field Work

Work Item	unit	unit Cost[LE]	Note
(1) Site Preparation	[m^2]	8	
(2) Civil (Earth Work)	[m^3]	34	
(3) RC Work	[m^3]	1,500	Foundation, Water Basin
(3) Storage Tank	[ton]	3,430	Equalization Tank, Chemical tank Neutralization Tanks
(4) Structural Steel	[ton]	2,000	Pipe rack, Operating Stage
(5) Equipment Installation	[ton]	400	Pumps, Clarifier rakes, Dehydrator
(6) Piping	[ton]	3,970	Except valves
	[in-m]	30	Except valves
(7) Painting	[m^2]	50	
(8) Local Building	[m^2]	2,600	W.W.T Control Room
(9) Electrical	[cable-m]	3	



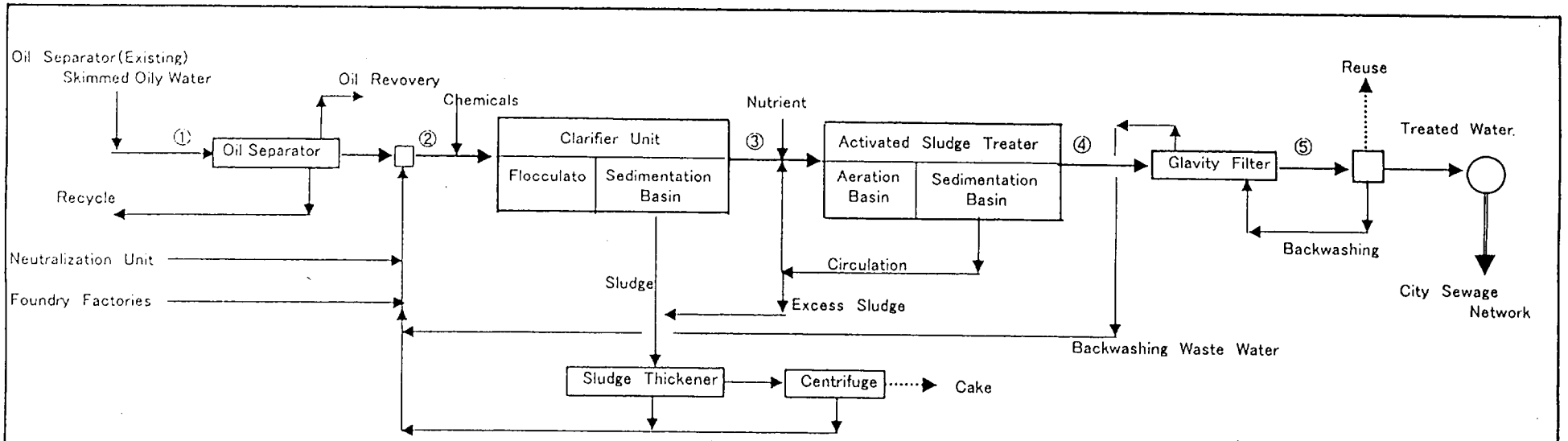
Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦
Flow Rate	m^3/h	9	14.4	21	47	132		
pH	—	6.06	7.62	7.06	6.17	6.87		
Conductivity	μS/cm	21,600	398	376	5,380	390		
Turbidity	NTU	328	50	46	307	37		
Water Temp.	℃	29.1	27.9	30.1	34.8	29.8		
Salinity	%	1.63	0.01	0.01	0.28	0.01		
COD_{Mn}	mg/L	33	57	40	>100	20		

* : Field Measurement(Average)

JICA	Chck	Tech	Appr						
Sign									
Date									
CNSL	Dsgn	Chck	Appr						
Sign				Rev.	Description	Dsgn	Chck	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EL NASR CO. FOR STEEL PIPES AND FITTINGS SCHEMATIC DIAGRAM OF EXISTING WASTE WATER FLOW
ISSUED DATE	SCALE: Non
DWG NO	ST-CD-15-01 REV.: 0

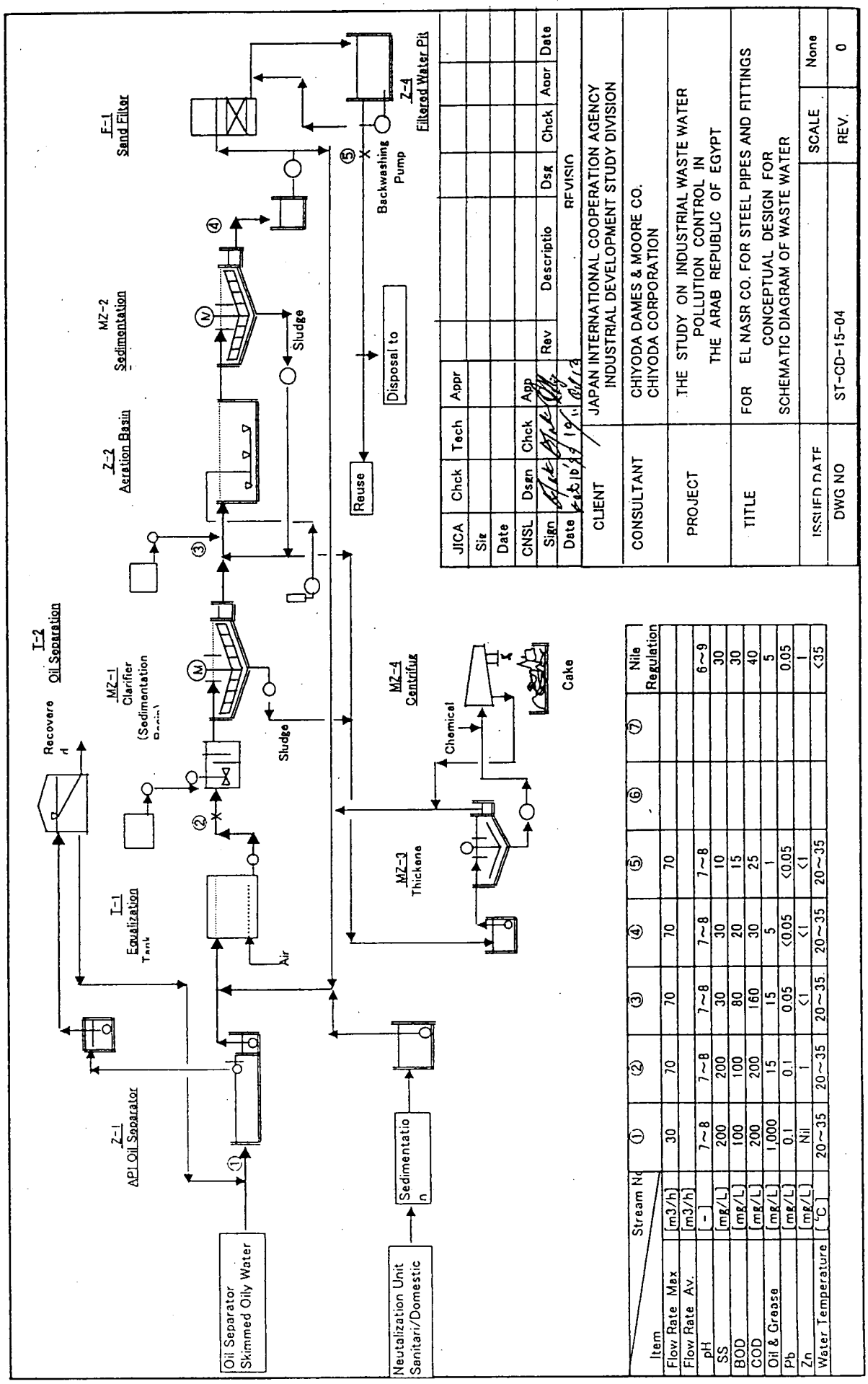
Attached Figure 9.3-1



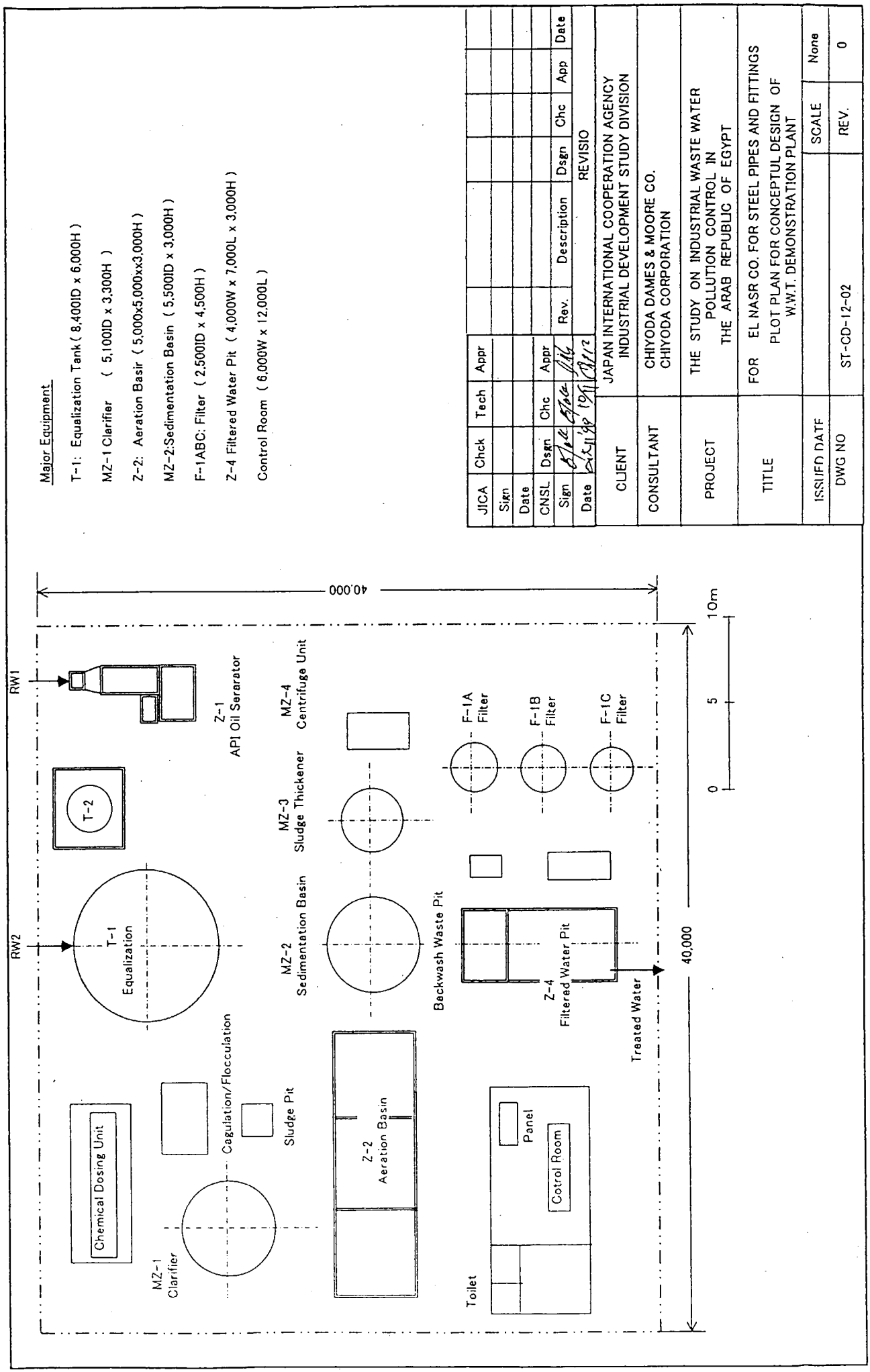
Item \ Stream		①	②	③	④	⑤	⑥	Nile Regulation
Flow Rate Max.	m3/h							
Ave.	m3/h	30	70	70	70	70		
pH	—	7~8	6.5~8	7~8	7~8	7~8		6~9
SS	mg/L	200	200	30	30	10		30
BOD	mg/L	100	100	80	20	15		30
COD	mg/L	200	200	160	30	25		40
Oil & Grease	mg/L	1,000	15	15	5	1		5
Pb	mg/L	0.1	0.1	0.05	<0.05	<0.05		0.05
Zn	mg/L	Nil	1	<1	<1	<1		1
Water Temperature	°C	20~35	20~35	20~35	20~35	20~35		<35

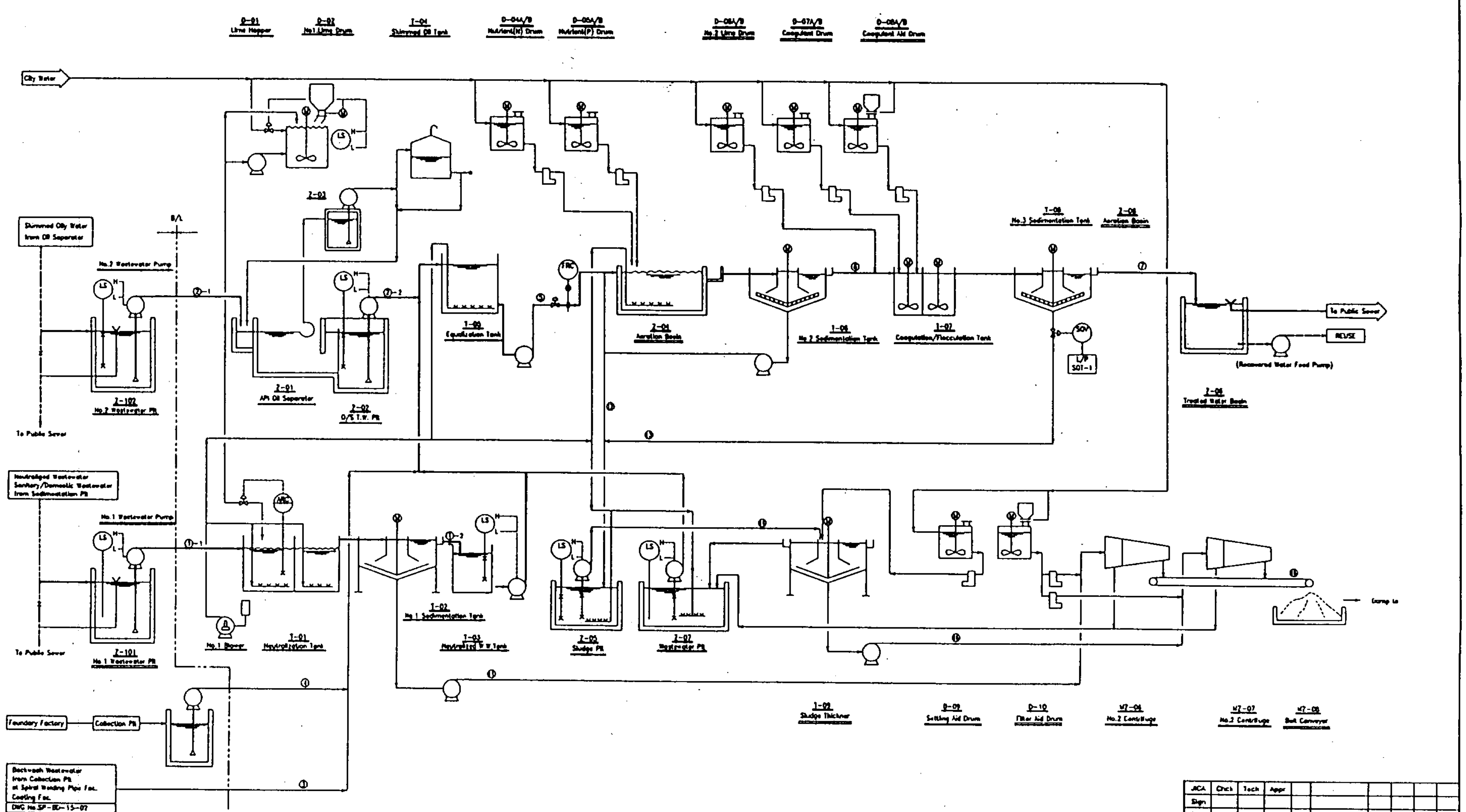
JICA	Chck	Tech	Appr						
Sign									
Date									
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Descriptio	Dsg	Chc	App	Date
Date	Dec 10 '99			REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EL NASR CO. FOR STEEL PIPES AND FITTINGS BLOCK FLOW DIAGRAM OF W. W. T. DEMONSTRATION PLANT
ISSUED DATE	SCALE: Non
DWG NO: ST-CD-15-03	REV.: 0



Item / Stream No		①	②	③	④	⑤	⑥	⑦	Nile Regulation
Flow Rate Max	[m3/h]	30	70	70	70	70			
Flow Rate Av.	[m3/h]								
pH	[-]	7~8	7~8	7~8	7~8	7~8			6~9
SS	[mg/L]	200	200	30	30	10			30
BOD	[mg/L]	100	100	80	20	15			30
COD	[mg/L]	200	200	160	30	25			40
Oil & Grease	[mg/L]	1,000	15	15	5	1			5
Pb	[mg/L]	0.1	0.1	0.05	<0.05	<0.05			0.05
Zn	[mg/L]	Nil	1	<1	<1	<1			1
Water Temperature	[°C]	20~35	20~35	20~35	20~35	20~35			<35

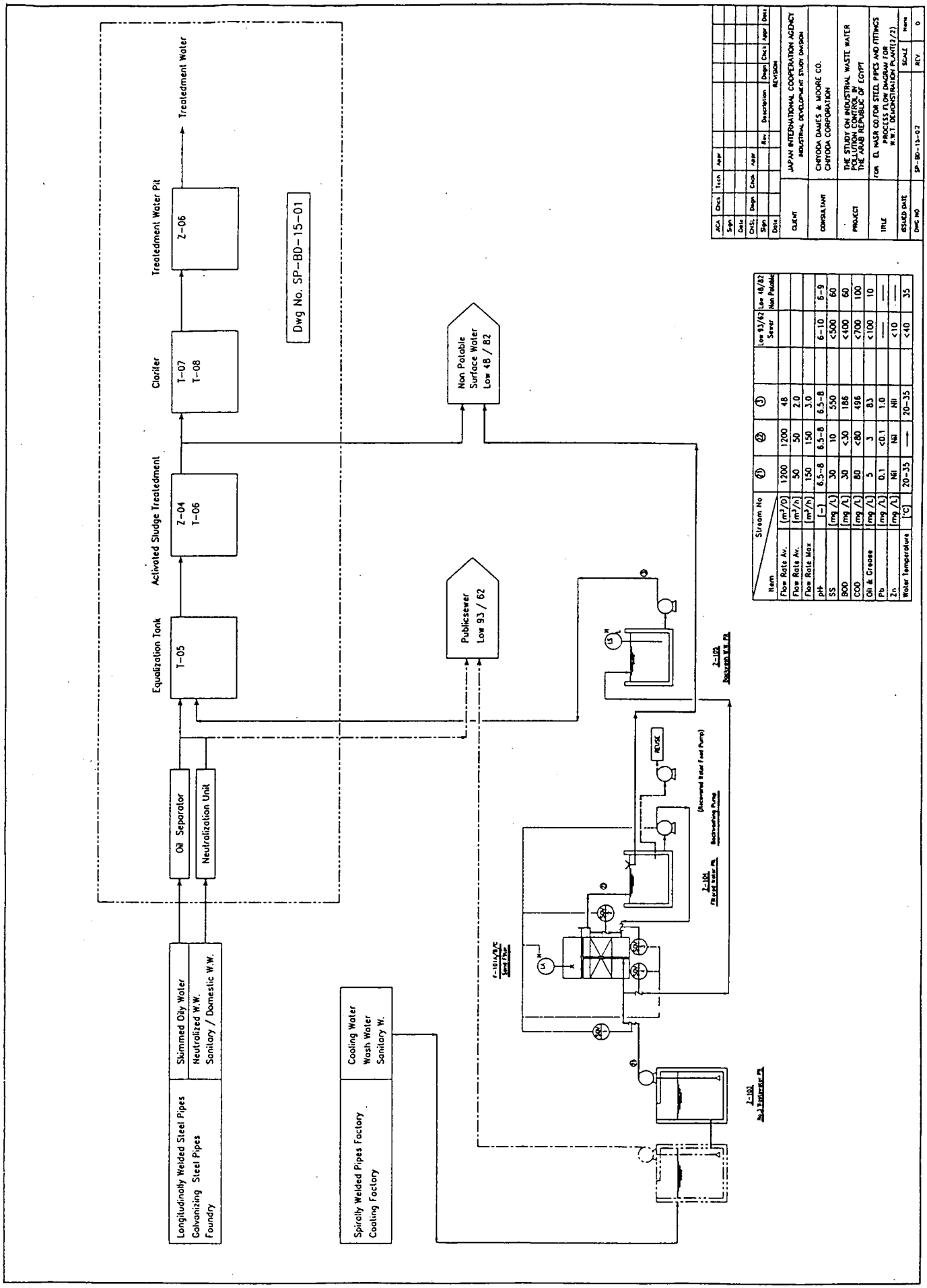

Major Equipment
T-1: Equalization Tank (8,400ID x 6,000H)
MZ-1 Clarifier (5,100ID x 3,300H)
Z-2: Aeration Basin (5,000x5,000x3,000H)
MZ-2:Sedimentation Basin (5,500ID x 3,000H)
F-1ABC: Filter (2,500ID x 4,500H)
Z-4 Filtered Water Pit (4,000W x 7,000L x 3,000H)
Control Room (6,000W x 12,000L)
JICA Chck Tech Appr
Sign
Date
CNSL Dsgn Chc Appr
Sign
Date
Rev. Description Dsgn Chc App Date
REVISIO
CLIENT
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
PROJECT
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE
FOR EL NASR CO. FOR STEEL PIPES AND FITTINGS
PLOT PLAN FOR CONCEPTUL DESIGN OF W.W.T. DEMONSTRATION PLANT
ISSUED DATE
SCALE None
DWG NO ST-CD-12-02
REV. 0
RW1
RW2
40,000
T-1 Equalization
T-2
Z-1 API Oil Serarator
MZ-3 Sludge Thickener
MZ-4 Centrifuge Unit
MZ-2 Sedimentation Basin
F-1A Filter
F-1B Filter
F-1C Filter
Backwash Waste Pit
Z-4 Filtered Water Pit
Treated Water
Chemical Dosing Unit
Cagulation/Flocculation
Sludge Pit
Z-2 Aeration Basin
MZ-1 Clarifier
Panel
Cotrol Room
Toilet
0
5
10m



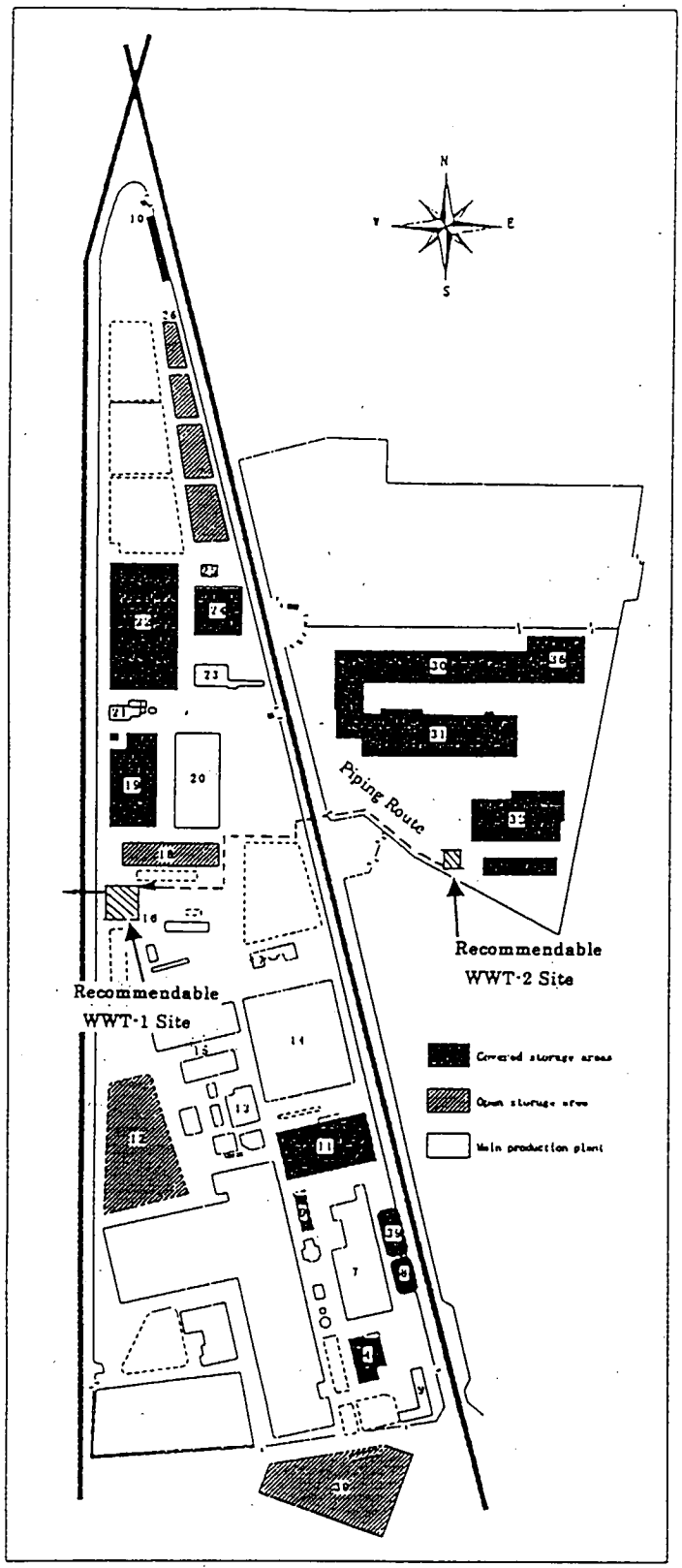
Stream No / Item		①-1	①-2	②-1	②-2	③	④	⑤	⑥	⑦	⑪	⑫	⑬	⑭	⑮	⑯		Low 93/62 Sewer	Low 48/32 Non Potable (Industrial)
Flow Rate Av.	[m³/D]	960	→	720	→	48	120	1848	→	→	24.0	51.1	5.5	56.6	11.4	4.5			
Flow Rate Av.	[m³/h]	40	→	30	→	2.0	5	77	→	→	3.0	2.13	0.23	2.4	1.9	0.7			
Flow Rate Max	[m³/h]	48	→	36	→	3.0	10	77	→	→									
pH	[-]	2-6	6.5-7.5	7-8	→	6.5-8	6.5-8	6.5-8	→	7-8	7-8	6.5-8	7-8	7-8	7-8	7-8		6-10	6-9
SS	[mg /L]	250	→	200	→	550	30	224	30	<30	5,000	8,000	10,000	8,200	40,000	200,000		<500	60
BOD	[mg /L]	100	→	100	→	186	30	98	30	<30								<400	60
COD	[mg /L]	200	→	200	→	496	80	200	50	<50								<700	100
Oil & Grease	[mg /L]	5	→	1000	30	83	5	17	5	3								<100	10
Pb	[mg /L]	0.1	→	0.1	→	1.0	Nil	→	→	→								—	—
Zn	[mg /L]	50	→	Nil	→	Nil	Nil	→	→	→								<10	—
Water Temperature	[°C]	20-35	→	20-35	→	20-35	20-35	→	→	→								<40	35

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EL NASR CO.FOR STEEL PIPES AND FITTINGS PROCESS FLOW DIAGRAM FOR W.W.T. DEMONSTRATION PLANT(1/2)
ISSUED DATE	SCALE: None
DWG NO: SP-BD-15-01	REV. 0

Revision block: JICA / Chck / Tech / Appr; Sign; Date; CHSL / Dsgn / Chck / Appr; Sign; Date; Rev / Description / Dsgn / Chck / Appr / Date; REVISION

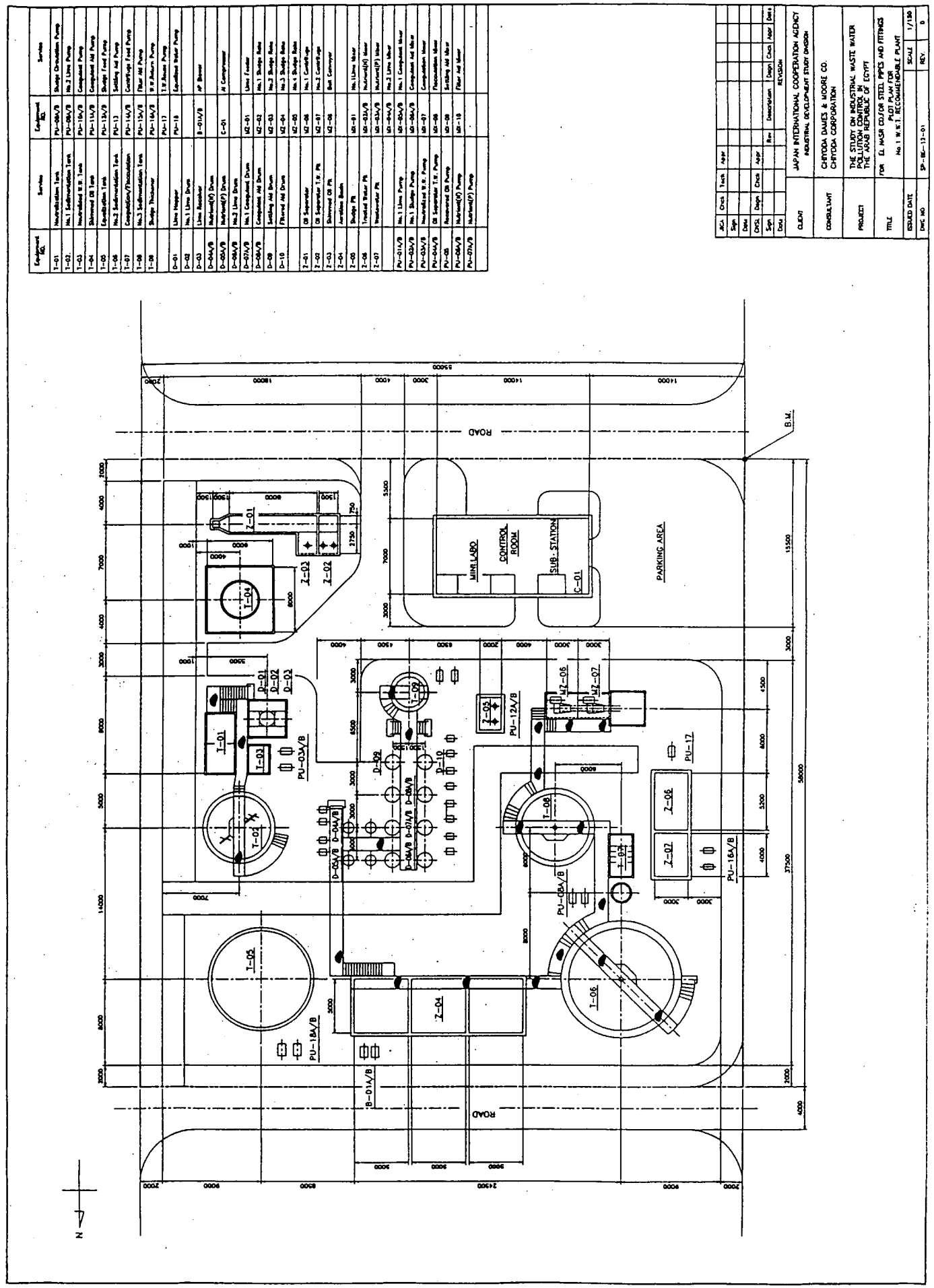


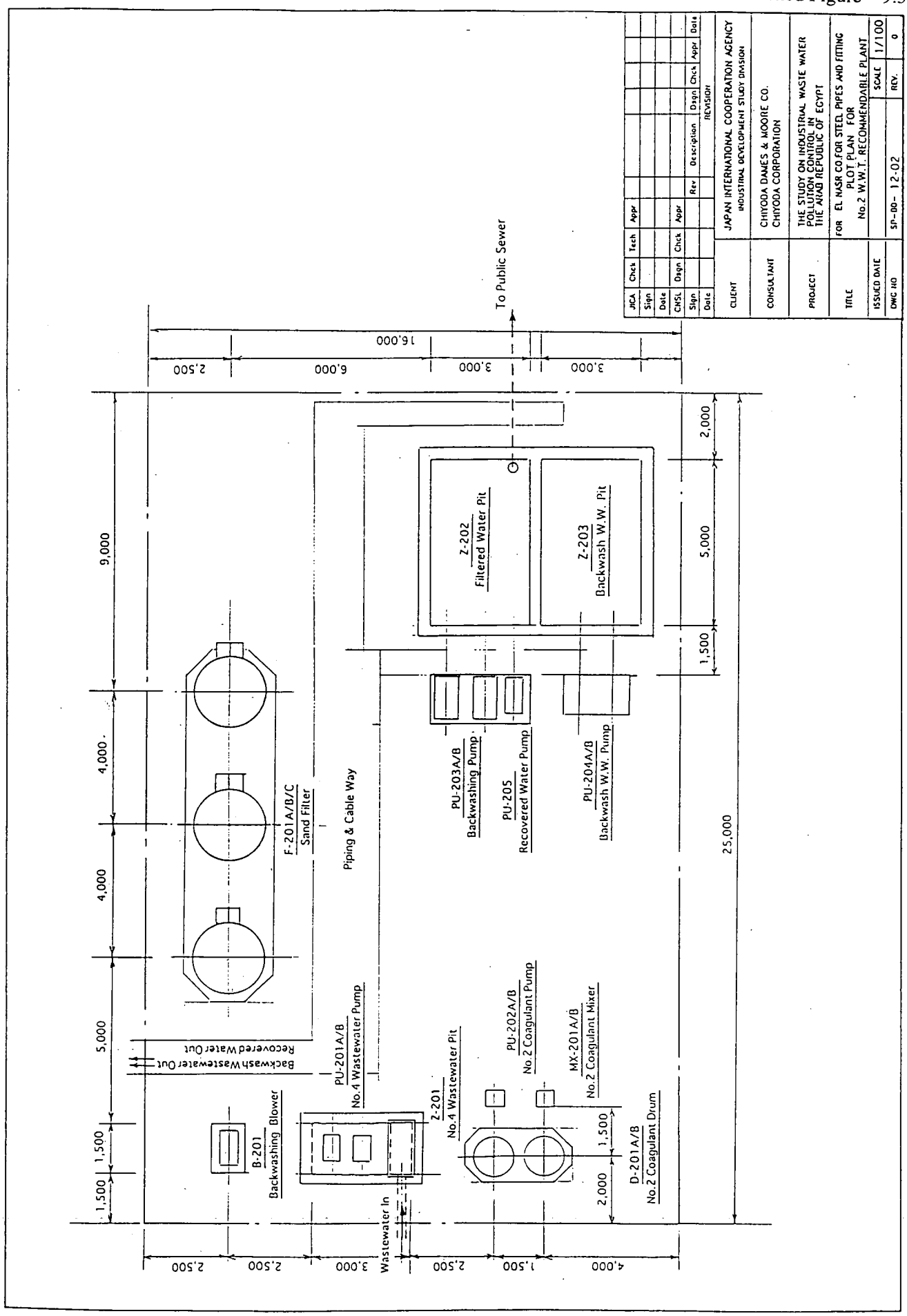
Item	Stream No	①	②	③	Low 93/62 Sewer	Low 48/82 Non Potable
Flow Rate Av.	[m³/D]	1200	1200	48		
Flow Rate Av.	[m³/h]	50	50	2.0		
Flow Rate Max	[m³/h]	150	150	3.0		
pH	[-]	6.5-8	6.5-8	6.5-8	6-10	6-9
SS	[mg/L]	30	10	550	<500	60
BOD	[mg/L]	30	<30	186	<100	60
COD	[mg/L]	80	<80	496	<700	100
Oil & Grease	[mg/L]	5	3	83	<100	10
Pb	[mg/L]	0.1	<0.1	1.0	—	—
Zn	[mg/L]	Nil	Nil	Nil	<10	—
Water Temperature	[°C]	20-35	—	20-35	<40	35

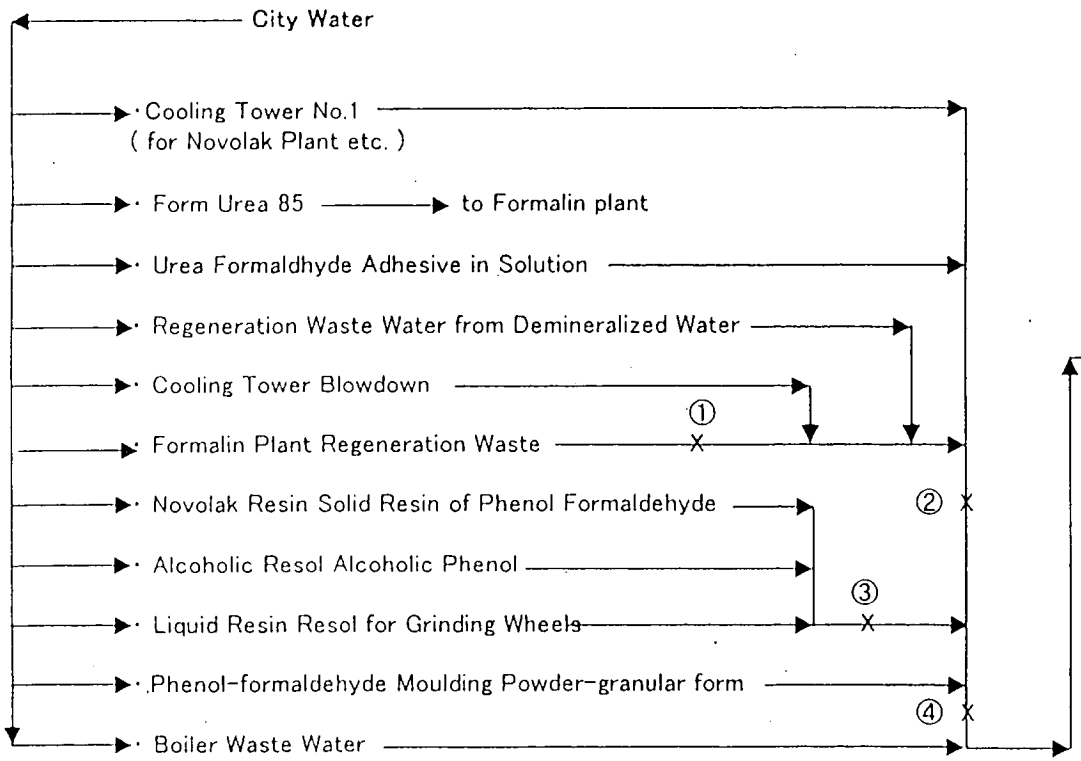


1. Galvanising plant (0.5-4 inch pipes)
2. Pipe workshop
3. 0.5-4 inch pipe mill
4. Main spare parts store
5. Administration
6. Electric substation
7. Small fittings foundry (includes chemical store)
8. Galvanising plant (small fittings)
9. Covered store for waste oils
10. Product store (0.5-4 inch pipe)
11. Store for foundry raw matrials
12. Product store (pipes) and scrap yard
13. Water cooling system (0.5-4 inch pipes
14. Garage (includes car workshop)
15. Workshop
16. Transport department
17. Clinic
18. Product store (pipe fitting)
19. Large fitting foundry
20. Large fittings finishing area/workshop
21. Coolong for foundries
22. Casting foundries
23. Administration
24. Central material store
25. Main electrical substation
26. Coke store, scrap and limestion
27. Raw material store (coils)
28. Raw material store (coils)
29. Product stores (2-8 inch and spiral pipes)
30. Spiral pipe mill (6-18 and6-60 inch)
31. 2-8 inch pipemill
32. Painting shop
33. Old spiral pipe mill (6-24 inch)
34. Raw material store (coils)
35. Fuel dispensing station
36. Oxygen plant
37. Central gas cylinder stire
38. Zinc dross distillation
39. Open yard for waste dry solids (core sand, slag, etc)

EL NASR CO. FOR STEEL PIPES & FITTINGS
LOCATION OF WASTEWATER TREATMENT PLANT
DWG. NO. SP-BD-12-00


ROAD
PARKING AREA
MINI LABO
CONTROL ROOM
SUB. STATION
C-01
B.M.
N
T-01
T-02
T-03
T-04
T-05
T-06
Z-01
Z-02
Z-03
Z-04
Z-05
Z-06
Z-07
D-01
D-02
D-03
D-04
D-05
D-06
D-07
D-08
D-09
D-10
MZ-06
MZ-07
PU-12A/B
PU-17
PU-03A/B
PU-16A/B
PU-08A/B
PU-18A/B
B-01A/B
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CHIYODA DAVES & MOORE CO.
CHIYODA CORPORATION
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
FOR EL NASR CO.FOR STEEL PIPES AND FITTINGS
PLOT PLAN FOR No.1 W.W.T. RECOMMENDABLE PLANT
SP-RE-13-01


To Public Sewer
16,000
2,500
6,000
3,000
3,000
9,000
4,000
4,000
5,000
1,500
1,500
25,000
2,000
5,000
1,500
Z-202
Filtered Water Pit
Z-203
Backwash W.W. Pit
PU-203A/B
Backwashing Pump
PU-205
Recovered Water Pump
PU-204A/B
Backwash W.W. Pump
F-201A/B/C
Sand Filter
Piping & Cable Way
Backwash Wastewater Out
Recovered Water Out
PU-201A/B
No.4 Wastewater Pump
Z-201
No.4 Wastewater Pit
PU-202A/B
No.2 Coagulant Pump
MX-201A/B
No.2 Coagulant Mixer
B-201
Backwashing Blower
D-201A/B
No.2 Coagulant Drum
Wastewater In
2,500
2,500
3,000
2,500
1,500
4,000
JICA
Sign
Date
CMSL
Sign
Date
Check
Design
Tech
Check
Appr
Check
Appr
Rev
Description
Dsgn
Chck
Appr
Date
REVISION
CLIENT
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
PROJECT
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE
FOR EL NASR CO.FOR STEEL PIPES AND FITTING
PLOT PLAN FOR
No.2 W.W.T. RECOMMENDABLE PLANT
ISSUED DATE
SP-DD- 12-02
SCALE
1/100
DWG NO
REV.
0



Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦
Flow Rate	m^3/h	0.6	36	0.08	40	52		
pH	—	7	6.83	6.53	7.45	7.7		
Conductivity	μS/cm	1,700	1,628	817	2,575	1,683		
Turbidity	NTU	40	33	330	60	60		
Water Temp.	℃	38	39	43	38	35		
Salinity	%	0.1	0.3		0.15			
COD_{Mn}	mg/L	>100	>100	>100	>100	>100		

* : Field Measurement(Average)

JICA	Chc	Appr	Appr						
Sign									
Date									
CNSL	Dsgn	Chc	Appr						
Sign				Rev	Descrip	Dsgn	Chc	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR MANSOURA CO.FOR RESINS AND CHEMICALS SCHMATIC DIAGRAM OF WASTE WATER FLOW
ISSUED	SCALE: NONE
DWG NO	RC-CD-15-01 REV. 0

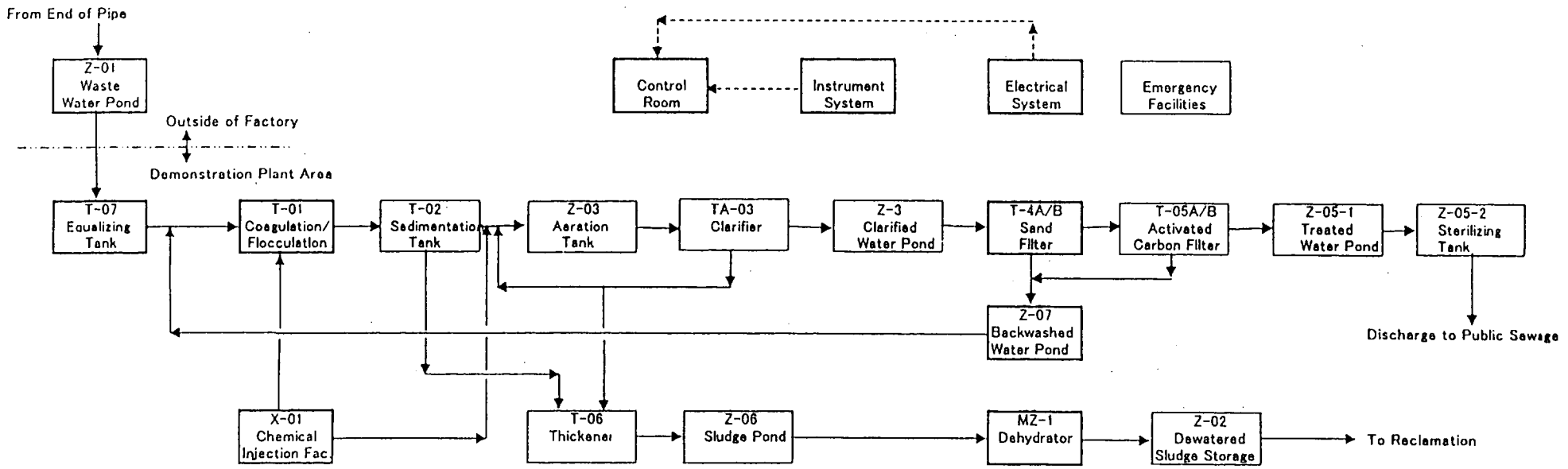
Attached Figure 9.4-1

MANSOURA CO. FOR RESINS AND CHEMICALS

Draft Table of Raw Data

Analytical Items	Flow	EC	Temp	Color	pH	COD ref.	BOD	COD	TDS	SS	Oil	PO_4^{-3}	N	Phenol	ABS	MPN	HCHO
Unit	m^3/ M	uS/cm	°C	----	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	Mg/l	mg/l
Low 48/82 discharge into Nile Branches/Canal	---	---	<35	Free	6~9		20	30	800	30	5	1	30	0.001	0.05	0.05	
Effluent Standards in Japan	---	---	---	---	5.8-8.6		120	120	---	150	5	8	60		---	---	
Sample – 1 : Formaline unit, outlet (MRC – PW - 01)		1.700	38	NO	7.00	>100		81280	320	2							
Sample – 2 : Condensation plant, outlet (MRC – PW - 02)	743.4	1.630	39	NO	7.40	>100		147783	2420	62	Nil			146			368
Sample – 3 : Novolak unit, outlet (MRC – PW - 03)	1.986	0.817	43.3	Brown	6.70	>100		127450	420	8	200			25650			246
Sample – 4 : Mix. of condensate & Novolak (MRC – PW - 03)	955	2.580	38.3	NO	7.450	>100		123153	3340	40	20			808			280
Sample – 5: End of pipe (MRC – PW - 03)	1268.16	1.680	34.8	Pale Yellow	7.70	>100	1260	2463	640	38	Nil	Nil	6	458	0.2	Nil	93

Attached Table 9.4-1



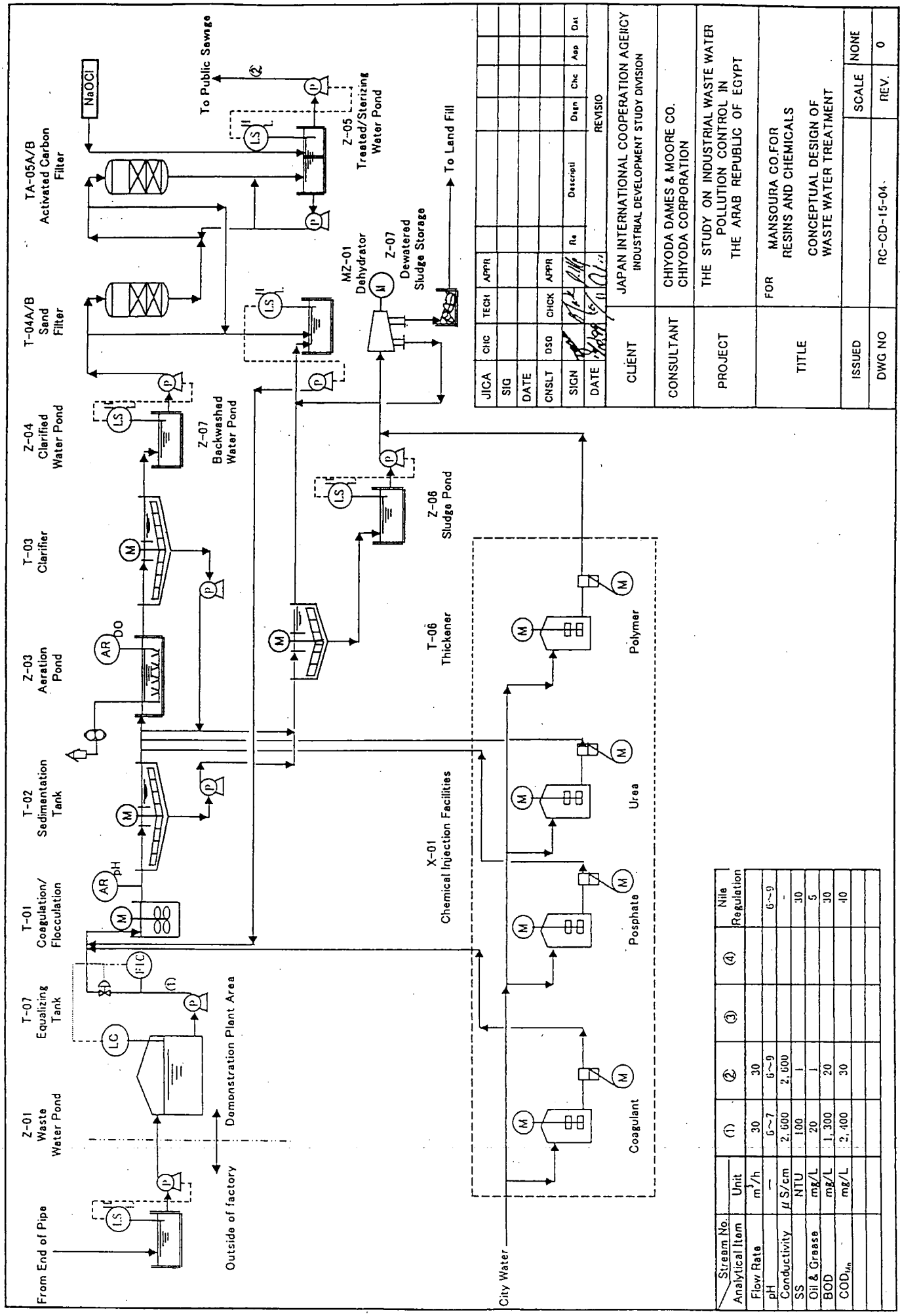
Component of Facilities

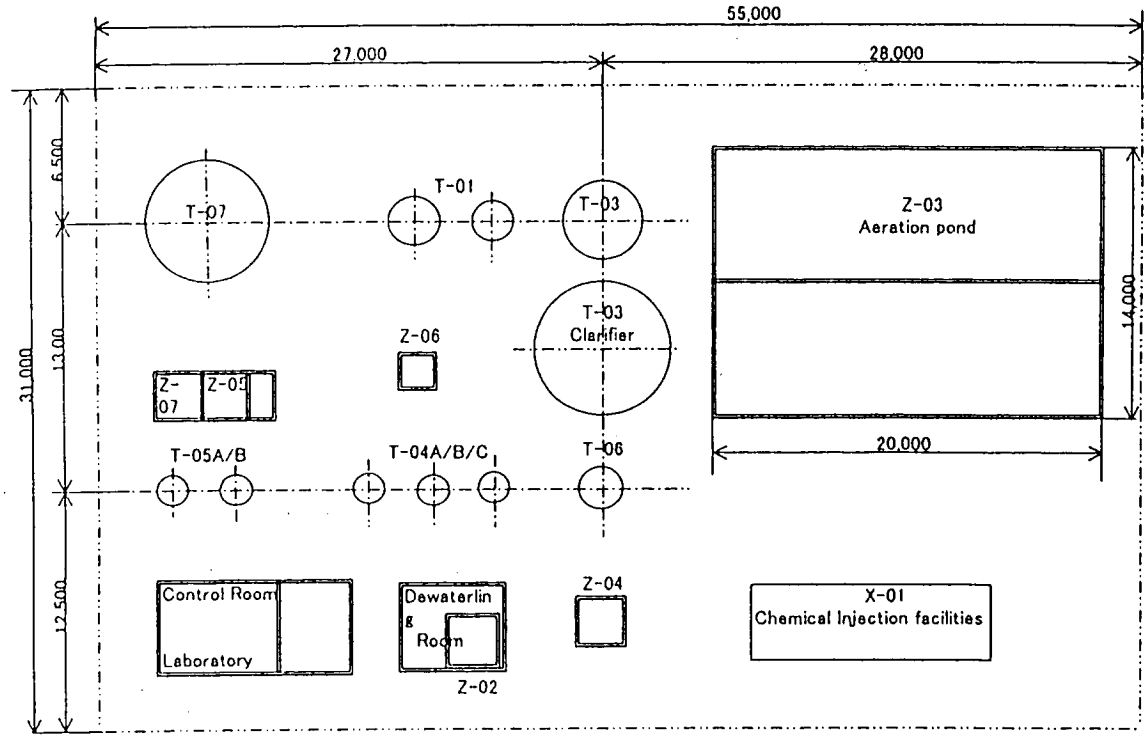
Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	Waste Water Pond	Equalizing Pond	API Type Oil Separator	Coagulation/ Flocculation	Sedimentation Tank	Oxidation Tank	Clarifier Treatment	Sand Filter	Filtered Water Pond	Sterilization Tank/Pond
	○	○	×	○	○	○	○	○	○	○
Number	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Item	Thickener	Sludge pond	Backwashed Water Pond	Dehydrator	Dehydrator	Chemical Injection Fac.	Emergency Facility	Instrument System	Electrical System	Control Room
	○	○	○	○	○	○	○	○	○	○
Number	21	22	23	24	25	26	27	28	29	30
Item	Activated Carbon Filter									
	○									

JICA	CHC	TECH	APPR							
SIGN										
DAT										
CNSLT	DSG	CHCK	APPR							
SIGN				Re	Descripti	Desi	Chc	App	Dat	
DAT				REVISIO						

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR MANSOURA CO. FOR RESINS AND CHEMICALS BLOCK FLOW DIAGRAM OF WASTE WATER TREATMENT
ISSUED	SCALE: NONE
DWG NO	RC - CD - 15 - 03 REV. 0

Attached Figure 9.4-2


From End of Pipe
Outside of factory
Demonstration Plant Area
Z-01 Waste Water Pond
T-07 Equalizing Tank
T-01 Coagulation/ Flocculation
T-02 Sedimentation Tank
Z-03 Aeration Pond
T-03 Clarifier
Z-04 Clarified Water Pond
T-04A/B Sand Filter
TA-05A/B Activated Carbon Filter
NaOCl
To Public Sewage
Z-05 Treated/Sterizing Water Pond
Z-07 Backwashed Water Pond
MZ-01 Dehydrator
Z-07 Dewatered Sludge Storage
To Land Fill
Z-06 Sludge Pond
T-06 Thickener
X-01 Chemical Injection Facilities
Coagulant
Posphate
Urea
Polymer
City Water
JICA
SIG
DATE
CNSLT
SIGN
DATE
CLIENT
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
PROJECT
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE
FOR MANSOURA CO.FOR RESINS AND CHEMICALS
CONCEPTUAL DESIGN OF WASTE WATER TREATMENT
ISSUED
SCALE NONE
DWG NO RC-CD-15-04
REV. 0
REVISIO
Stream No. / Analytical Item
Unit
① ② ③ ④ Nile Regulation
Flow Rate m³/h 30 30
pH — 6~7 6~9 6~9
Conductivity μS/cm 2,600 2,600 -
SS NTU 100 1 30
Oil & Grease mg/L 20 1 5
BOD mg/L 1,300 20 30
CODMn mg/L 2,400 30 40



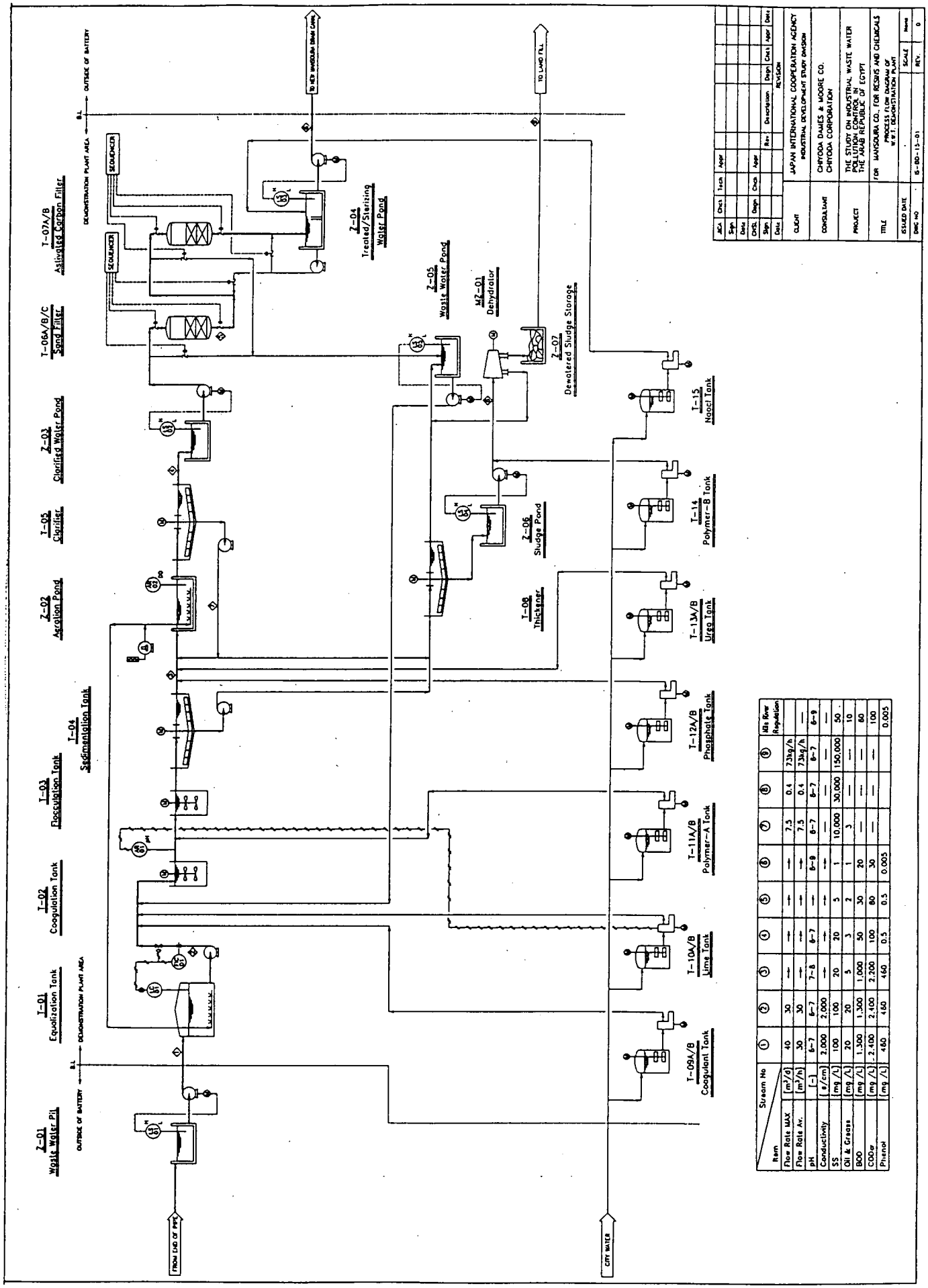
T-01	Coagulation Tank	1,430^{L}×2,000^{H}×3
	/Flocculation Tank	& 2,860^{L}×3,000^{H}×15 m^3
T-02	Sedimentation Tar	4,000^{L}×4,500^{H}×45 m^3
T-03	Clarifier	7,000^{L}×4,000^{H}×120 m^3
T-04A/B/C	Sand Filter	1,600^{L}×4,000^{H}×8 m^3
T-05A/B	Activated Carbon Filter	1,600^{L}×4,500^{H}×9m^3
T-06	Thickener	2,400^{L}×4,000^{H}×13 m^3
T-07	Equalizing Tank	5,811^{L}×6105^{H}×120 m^3
Z-01	Waste Water Pond	4,000^{W}×4,000^{L}×2,000^{H}×12(
Z-02	Dewatered Sludge Storage	3,000^{W}×3,000^{L}×2,000^{H}×14 m^3
Z-03	Aeration Pond	14,000^{W}×20,000^{L}×5,800^{H}×1,400 m^3
Z-04	Clarified Water Pond	2,000^{W}×2,000^{L}×3,000^{H}×8 m^3
Z-05	Treated/Sterilizing Water Pond	3,000^{W}×4,000^{L}×3,000^{H}×24
Z-06	Sludge Pond	2,000^{W}×2,000^{L}×3,000^{H}×8 n
Z-07	Backwashed Waste Water Pond	3,000^{W}×2,500^{L}×3,000^{H}×15
MZ-01	Dehydrator	
X-01	Chemical Injection	

JICA	CHC	TECH.	APPR						
SIGN									
DATE									
CNSLT	DSG	CHCK	APPR						
SIGN				Rev.	Description	Dsgn	Chc	App	Dat
DATE				REVISIO					

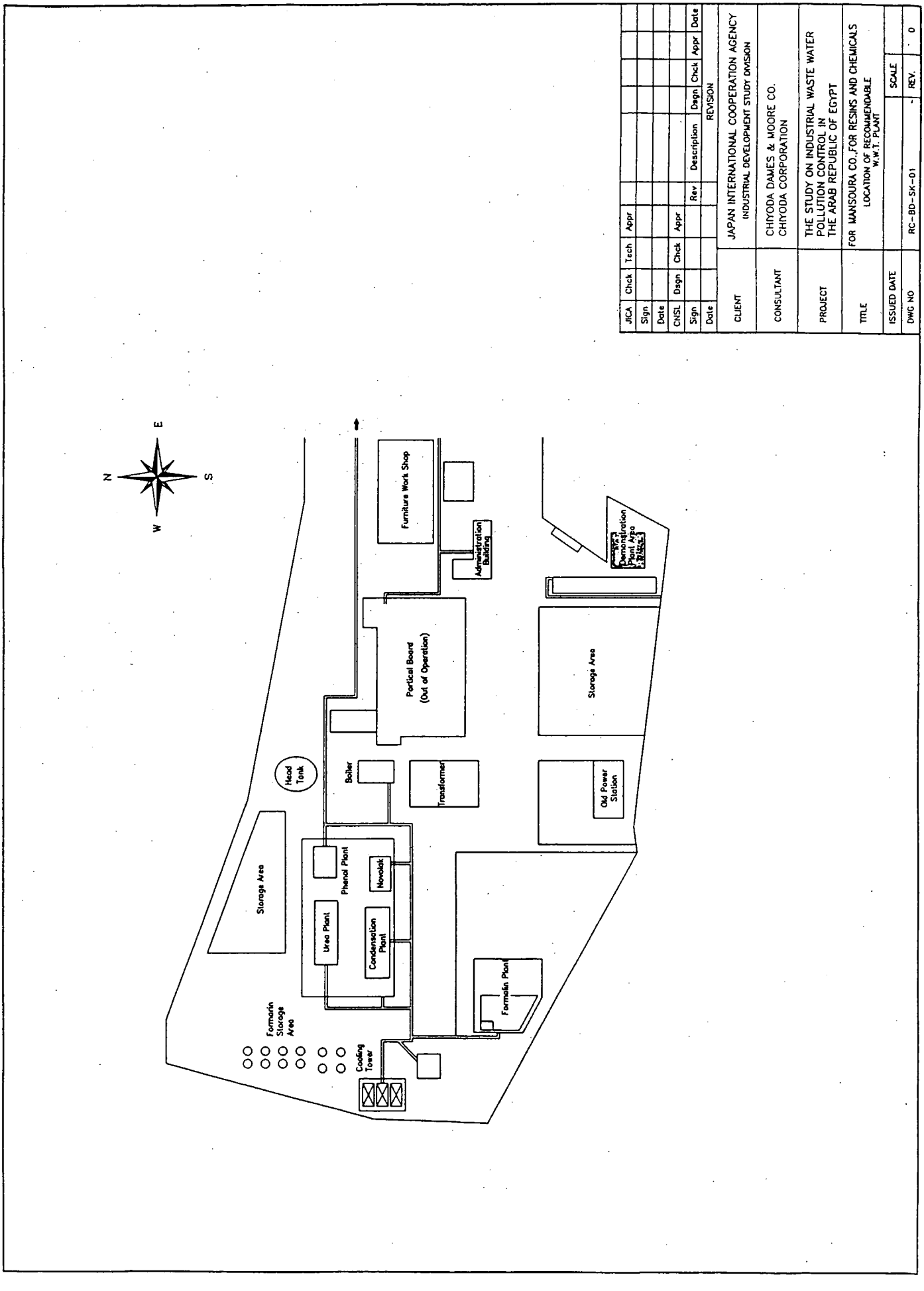
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR MANSOURA CO.FOR RESINS AND CHEMICALS PLOT PLAN FOR CONCEPTUAL DESIGN OF W. W. T. DEMONSTRATION PLANT		
ISSUED		SCALE	1/250
DWG NO	RC-CD-12-01	REV.	0

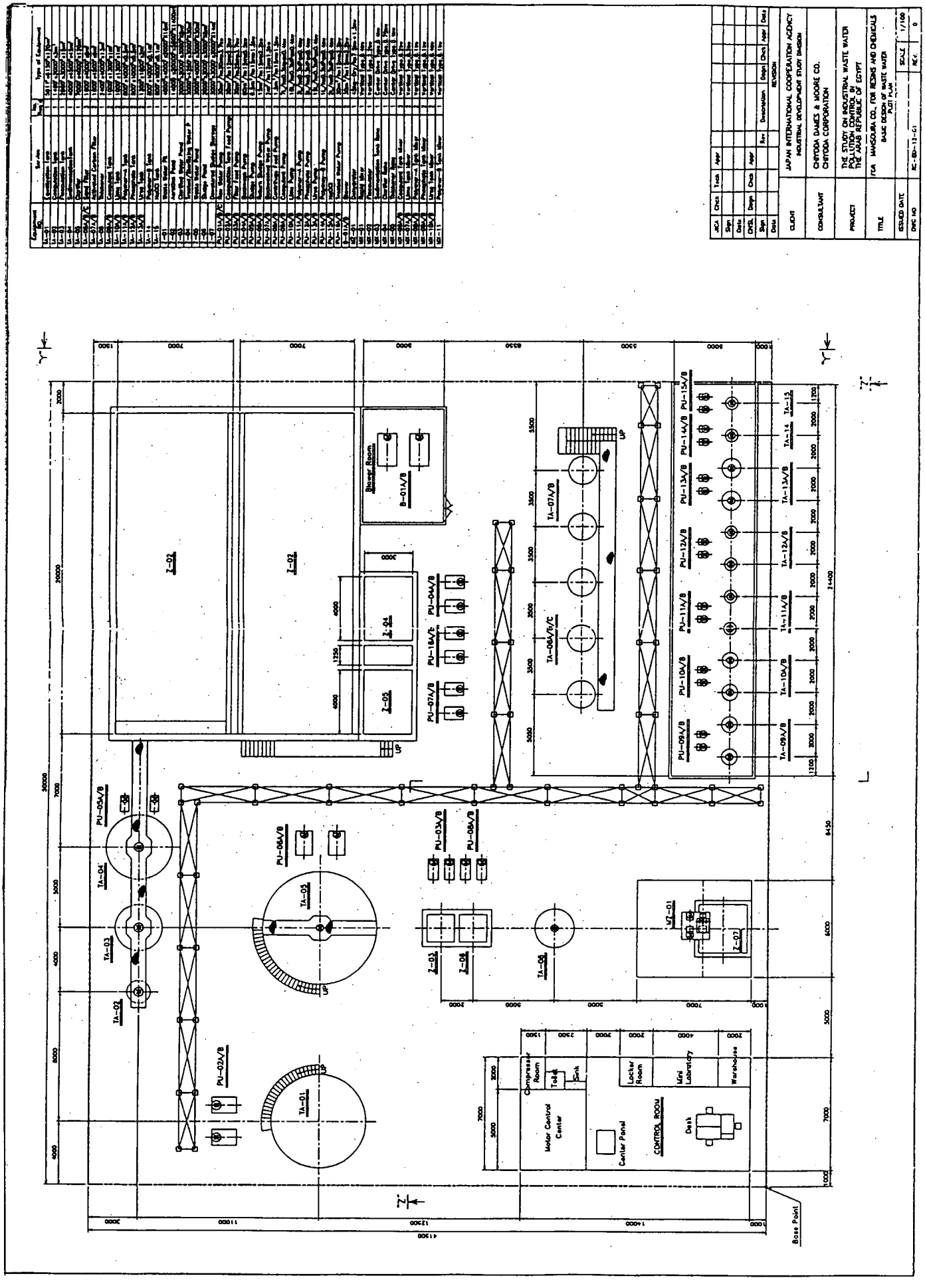
Attached Figure 9.4-4

Attached Figure 9.4-5



Item	Stream No	①	②	③	④	⑤	⑥	⑦	⑧	⑨	Mix flow Regulation
Flow Rate MAX	[m³/d]	40	30	—	—	—	—	7.5	0.4	73kg/h	
Flow Rate Av.	[m³/h]	30	30	—	—	—	—	7.5	0.4	73kg/h	—
pH	[-]	6~7	6~7	7~8	6~7	—	8~8	8~7	6~7	6~7	6~9
Conductivity	[μ/cm]	2,000	2,000	—	—	—	—	—	—	—	—
SS	[mg/L]	100	100	20	20	5	1	10,000	30,000	150,000	50
Oil & Grease	[mg/L]	20	20	5	3	2	1	3	—	—	10
BOD	[mg/L]	1,300	1,300	1,000	50	30	20	—	—	—	60
COD$_{Cr}$	[mg/L]	2,400	2,100	2,200	100	80	30	—	—	—	100
Phenol	[mg/L]	460	460	460	0.5	0.5	0.005				0.005


N
E
S
W
Furniture Work Shop
Administration Building
Partical Board (Out of Operation)
Storage Area
Head Tank
Boiler
Transformer
Old Power Station
Storage Area
Phenol Plant
Novolak
Urea Plant
Condensation Plant
Formalin Storage Area
Cooling Tower
Formalin Plant
JICA
Chck
Tech
Appr
Sign
Date
CNSL
Dsgn
Chck
Appr
Sign
Date
Rev
Description
Dsgn
Chck
Appr
Date
REVISION
CLIENT
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT
CHIYODA DAMES & MOORE CO.
CHIYODA CORPORATION
PROJECT
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE
FOR MANSOURA CO. FOR RESINS AND CHEMICALS
LOCATION OF RECOMMENDABLE W.W.T. PLANT
ISSUED DATE
SCALE
DWG NO
RC-BD-SK-01
REV.
0


Blower Room
B-01A/B
I-02
I-02
I-04
I-05
I-03
I-06
I-07
TA-07A/B
TA-06A/B/C
PU-04A/B
PU-16A/B
PU-07A/B
PU-15A/B
PU-14A/B
PU-13A/B
PU-12A/B
PU-11A/B
PU-10A/B
PU-09A/B
TA-15
TA-14
TA-13A/B
TA-12A/B
TA-11A/B
TA-10A/B
TA-09A/B
PU-05A/B
PU-06A/B
PU-03A/B
PU-08A/B
TA-04
TA-03
TA-08
TA-01
TA-02
PU-02A/B
W-01
Z-07
Compressor Room
Toilet
Sink
Locker Room
Mini Laboratory
Warehouse
Motor Control Center
Center Panel
CONTROL ROOM
Desk
Base Point

Demo-Plant in Mansoula Co., Resins & Chemicals: ESTIMATE SUMMARY & DEMARCATION

(Base Case) 1999. 12. 16

ITEM	IBL		OBL		Demarcation (Eq. ¥1000)	
	Yen Portion (¥1000)	LE Portion (LE)	Yen Portion (¥1000)	LE Portion (LE)	Japanese Side	Egyptian Side
1. Equipment & Materials						
(1) Machinery	50,290					
(2) Piping Materials	10,207					
(3) Instrument'n Eq. & Mtl's	16,950					
(4) Electrical Eq. & Mtl's	12,600					
(5) Testing Eq., Etc.	3,854					
1. Subtotal	93,901	0	0	0	93,901	0
2. Field Construction						
(1) Steel Tanks & Vessels		481,837				
(2) Acid-Proof Lining		0				
(3) Equipment Installation		60,500				
(4) Piping		128,980		17,600		600
(5) Foundations		75,000				0
(6) RC-made Reservoir/Structure		843,750				0
(7) Road/Pavement		30,000				0
(8) Building		361,760				0
(9) Platform, Piperack		30,000				0
(10) Painting		50,000				0
(11) Electrical Works		62,840		11,760		400
(12) Instrumentation		300,000				0
(13) Commissioning/Test		30,000				0
2. Subtotal	0	2,454,667	0	29,360	83,500	1,000
Direct Cost: 1 + 2 (Eq. ¥1000)	177,360		998			
3. Indirect Cost						
(1) Export Packing, Ocean Tra	13,500				13,500	0
(2) Import Duty, Inland Transportation*1		790,000		0		26,900
(3) Temporary Facilities*2		147,000		—	5,000	
(4) Subcontractor Expenses*3		613,667		—	20,900	
(5) Insurance, Social Tax*4		152,000		1,000	5,200	0
(6) Supervisor Expenses	10,000				10,000	
3. Subtotal	23,500	1,702,667	0	1,000	54,500	26,900
All Total: 1 + 2 + 3	117,401	4,157,334	0	30,360	231,901	27,900
All Total (Eq. ¥1000)	117,401	141,400	0	1,000		
IBL/OBL Total (Eq. ¥1000)	258,801		1,000			
Total Cost	259,801				231,901	27,900

*1 : (日本調達資材費+輸出梱包·海上輸送費) x25%
IBL=264,500千円x25%=66,125千円=1,945,000LE
OBL=9,500千円x25%=2,375千円=69,900LE

*2 : 現地工事費x6%=6,560,000LEx0.06=393,600LE

*3 : 現地工事費x25%=6,560,000LEx0.25=1,640,000LE

*4 : 1+2 (Superviser Feeを除く) x2.7%
IBL=7,142千円(210,000LE)+177,000LE=387,000LE
OBL=257千円(7,600LE)+30,500LE=38,100LE

Costs are Demarcated to Egyptian Side.

Unit Cost for Estimation of W.W.T. Demonstration Plant (Reference)

Factory Name: Mansoura Co. for Resins and Chemicals.
Design Case: Basic Design

1. Major Equipment

Equipment Name	Unit Cost [x10^{3}Yen]	Note
(1) Acid water pumps	600	Material: SCS
(2) Clarifier Rake	10,000	1 set
(3) Sedimentation Tank rake	8,000	1 set
(4) Thickener Rake	6,000	1 set
(5) Dehydrator	6,000	3 sets
(6) Motor Control Center	13,500	
(7) Center Control Panel	3,000	1 set

2. Field Work

Work Item	unit	unit Cost[LE]	Note
(1) Site Preparation	[m^2]	8	
(2) Civil (Earth Work)	[m^3]	34	
(3) RC Work	[m^3]	1,500	Foundation, Water Basin
(3) Storage Tank	[ton]	3,430	Equalization Tank, Chemical tank Neutralization Tanks
(4) Structural Steel	[ton]	2,000	Pipe rack, Operating Stage
(5) Equipment Installation	[ton]	400	Pumps, Clarifier rakes, Dehydrator
(6) Piping	[ton]	3,970	Except valves
	[in-m]	30	Except valves
(7) Painting	[m^2]	50	
(8) Local Building	[m^2]	2,600	W.W.T Control Room
(9) Electrical	[cable-m]	3	

3. EGYPTION IRON & STEEL Co.

Draft Table of Raw Data

Analytical Items	Flow	EC	Temp	Color	pH	COD ref.	BOD	COD	TDS	SS	Oil	PO_4^{-3}	N	Fe	T.HM	Pb	Cd	As	Cu	Zn
Unit	m^3/hr	uS/cm	°C	----	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Low 48/82 discharge into Nile Branches/Canal	---	---	<35	Free	6~9		20	30	800	30	5	1	30	0.5	1	0.05	0.01	0.05	1	1
Effluent Standards in Japan	---	---	---	---	5.8-8.6		120	120	---	150	5	8	60	15	---	0.1	0.1	0.1	3	5
Sample – 1 : Clarifier Inle	12112	0.838	32.3	Brown	9.81	30.0		33.5	987	18338	248	0.4	22.72		76.664	1.596	0.0189	0.0136	0.018	75
Sample – 2 : Sand filter Inlet		0.700	30.50	NO	9.81	30.5		58.25	406	34	16	0.11	1.13			0.02	0.1	0.005	0.031	Nil
Sample – 3 : Sand filter outlet		0.679	32.4	NO	9.76	10.0	Nil	9.71	360	12										136.70
Sample – 4 : Scrubbed Water before Clarifier	11.53	1.000	39.9	Grey	6.21	10	3	19.42	580	42				Nil						T=36 S=6
Sample – 5: Scrubbed Water bottom of Clarifier		0.920	38.2	Dark Grey	6.62	20		65.98	470	80										40
Sample – 6 : Neutralization Inlet		5.410	43.3	Green	2.52	>100		194.17	3210	42										
Sample – 7 : Neutralization outlet		7.390	38.4	NO	11.16	>100		16.24	4900	3860	5	0.12	91.44			0.076	0.035	0.009	0.0596	Nil
Sample – 8 : Desert (Additional Sample)								24.5								0.036	Nil	0.006	0.02	0.168

E2RC

Energy and Environment Research Center

Company Name : Egyptian Iron and Steel Company (**EISC**)
Sampling Date : November 18th, 1999
Sample Name : Waste Acid

Parameter	Unit	Results
pH	----	1.04
Conductivity	ms/cm	100
Temperature	°C	56.6
Dissolved Oxygen	mgO_2/L	---(*)
Turbidity	NTU	260
Salinity	%	4
TDS	mg/L	238500
Fe^{2+}	mg/L	61514
Fe^{3+}	mg/L	660
Total - Fe	mg/L	62174
Sulfate (as SO_4)	mg/L	160000
Acidity as H_2SO_4	%	17

(*): Dissolved Oxygen measurement is not required

E2RC

Energy and Environment Research Center

Company Name : Egyptian Iron and Steel Company (**EISC**)
Sampling Date : November 18th, 1999
Sample Name : Acid Wash

Parameter	Unit	Results
pH	----	3.05
Conductivity	ms/cm	3.55
Temperature	°C	36
Dissolved Oxygen	mgO_2/L	---(*)
Turbidity	NTU	6.5
Salinity	%	0.1
TDS	mg/L	31240
Fe^{2+}	mg/L	520
Fe^{3+}	mg/L	712
Total - Fe	mg/L	1230
Sulfate (as SO_4)	mg/L	2000
Acidity as H_2SO_4	%	0.24

(*): Dissolved Oxygen measurement is not required

DEMO-PLANT in EGYPTIAN IRON & STEEL CO.: ESTIMATE SUMMARY & DEMARCATION

(Base Case) 1999.12.15

ITEM	IBL		OBL		Demarcation (Eq.¥1000)	
	Yen Portion (¥1000)	LE Portion (LE)	Yen Portion (¥1000)	LE Portion (LE)	Japanese Side	Egyptian Side
1. Equipment & Materials						
(1) Machinery	177,000		3,000			
(2) Piping Materials	5,000		2,000			
(3) Instrument'n Eq. & Mtl's	17,000		500			
(4) Electrical Eq. & Mtl's	33,000		3,000			
(5) Testing Eq., Etc.	3,000		500			
1. Subtotal	235,000	0	9,000	0	244,000	0
2. Field Construction						
(1) Steel Tanks & Vessels		1,210,000				
(2) Acid-Proof Lining		1,000,000				
(3) Equipment Installation		150,000				
(4) Piping		510,000		850,000		28,900
(5) Foundations		690,000				0
(6) RC-made Reservoir/Structure		1,920,000		100,000		3,400
(7) Road/Pavement		100,000				0
(8) Building		500,000				0
(9) Platform, Piperack		110,000		100,000		3,400
(10) Painting		70,000		30,000		1,000
(11) Electrical Works		100,000		40,000		1,400
(12) Instrumentation		150,000		10,000		300
(13) Commissioning/Test		50,000				0
2. Subtotal	0	6,560,000	0	1,130,000	223,000	38,400
Direct Cost: 1 + 2 (Eq. ¥1000)	458,040		47,420			
3. Indirect Cost						
(1) Export Packing, Ocean Tra	29,500		500		30,000	0
(2) Import Duty, Inland Transportation*1		1,945,000		70,000		68,500
(3) Temporary Facilities*2		394,000		—	13,400	
(4) Subcontractor Expenses*3		1,640,000		—	55,800	
(5) Insurance, Social Tax*4		387,000		38,000	13,200	1,300
(6) Supervisor Expenses	10,000				10,000	
3. Subtotal	39,500	4,366,000	500	108,000	122,300	69,800
All Total: 1 + 2 + 3	274,500	10,926,000	9,500	1,238,000	589,400	108,200
All Total (Eq. ¥1000)	274,500	371,500	9,500	42,100		
IBL/OBL Total (Eq. ¥1000)	646,000		51,600			
Total Cost	697,600				589,400	108,200

*1 : (日本調達資材費+輸出梱包・海上輸送費) x25%
IBL=264,500千円x25%=66,125千円=1,945,000LE
OBL=9,500千円x25%=2,375千円=69,900LE

*2 : 現地工事費x6%=6,560,000LEx0.06=393,600LE

*3 : 現地工事費x25%=6,560,000LEx0.25=1,640,000LE

*4 : 1+2 (Superviser Feeを除く) x2.7%
IBL=7,142千円(210,000LE)+177,000LE=387,000LE
OBL=257千円(7,600LE)+30,500LE=38,100LE

Costs are Demarcated to Egyptian Side.

Unit Cost for Estimation of W.W.T. Demonstration Plant (Reference)

Factory Name: Egyptian Iron and Steel Co.
Design Case: Basic Design (Original Case)

1. Major Equipment

Equipment Name	Unit Cost [x10^{3}Yen]	Note
(1) Acid water pumps	2,000～4,000	Material: SCS
(2) Sludge Rake	8,000～12,000	3 sets
(3) Centrifuge	25,000	3 sets
(4) Lime feeder	16,800	1 set
(6) Motor Control Center	12,000	
(7) Center Control Panel	3,000	1 set

2. Field Work

Work Item	unit	unit Cost[LE]	Note
(1) Site Preparation	[m^2]	8	
(2) Civil (Earth Work)	[m^3]	34	
(3) RC Work	[m^3]	1,500	Foundation, Water Basin
(3) Storage Tank	[ton]	3,430	Equalization Tank, Chemical tank Neutralization Tanks
(4) Structural Steel	[ton]	2,000	Pipe rack, Operating Stage
(5) Equipment Installation	[ton]	400	Pumps, Clarifier rakes, Dehydrator
(6) Piping	[ton]	3,970	Except valves
	[in-m]	30	Except valves
(7) Painting	[m^2]	50	
(8) Local Building	[m^2]	2,600	W.W.T Control Room
(9) Electrical	[cable-m]	3	

Table ESTIMATED CONSTRUCTION COST FOR EISCO).

2000/3/23

ITEM	Inside B/L		Outside B/L		Paid by (1000yen)	
	Japan(Myen)	Egypt (LE)	Japan(Myen)	Egypt (LE)	Japan	Egypt
1. Equipment, Instruments						
(1)Machinery	164,500					
(2)Pipings	8,830					
(3)Electrical	15,400					
(4)Instruments	17,540					
(5)Test Equipment	3,000					
1. Subtotal	**209,270**	**0**	**0**	**0**	**209,270**	**0**
2. Field Works						
(1)Tank Installation		1,075,868				
(2)Corrosion Proof		474,792				
(3)Instal. Machines		46,900				
(4)Piping		453,127		1,814,336		61,700
(5)Foundation		532,758				0
(6)RC Basins		300,590				0
(7)Paving, Road		42,888				0
(8)Structure		611,567				0
(9)pipe Rack, Stage		55,271				0
(10)Painting		165,600				0
(11)Electrical		132,000				0
(12)Instrumentation		150,000				0
(13)Test Operation		50,000				0
2. Subtotal	**0**	**4,091,361**	**0**	**1,814,336**	**139,100**	**61,700**
(1+2)Total	**348,376 x1000yen**		**61,687 x1000yen**			
3. Indirect Cost						
(1)Packing, Ocean Freight	19,500				19,500	0
(2)Tax., In Transportation*1		1,779,000				60,500
(3)Temporary Works*2		245,482		---	8,300	
(4)Construction Expense*3		1,022,840		---	34,800	
(5)Insurance, Tax *4		9,406		1,666	300	100
(6)Supervisor Field Expense	10,000				10,000	
3. Subtotal	**29,500**	**3,056,728**	**0**	**1,666**	**72,900**	**60,600**
(1+2+3) Total	**238,770**	**7,148,089**	**0**	**1,816,002**	**421,270**	**122,300**
Total (1000yen)	**238,770**	**243,100**	**0**	**61,800**		
[IBL/OBL] Total (1000yen)	**481,870**		**61,800**			
Grand Total	**543,670**				**421,370**	**122,300**

Note*1 :(Equipment/Instruments + packing/Ocean Freight) x 25%
Note*2 : Field Works Cost x 6%
Note*3 : Field Works Cost x 25%
Note*4 :[1+2 (except Superviser Fee)] x 2.7%
Notes:(a) Piping Works except discharge pipeline is allocated in Inside B/L.
(b)The Cost is estemated as Japanese Contractor basis.

Unit Cost for Estimation of W.W.T. Demonstration Plant (Reference)

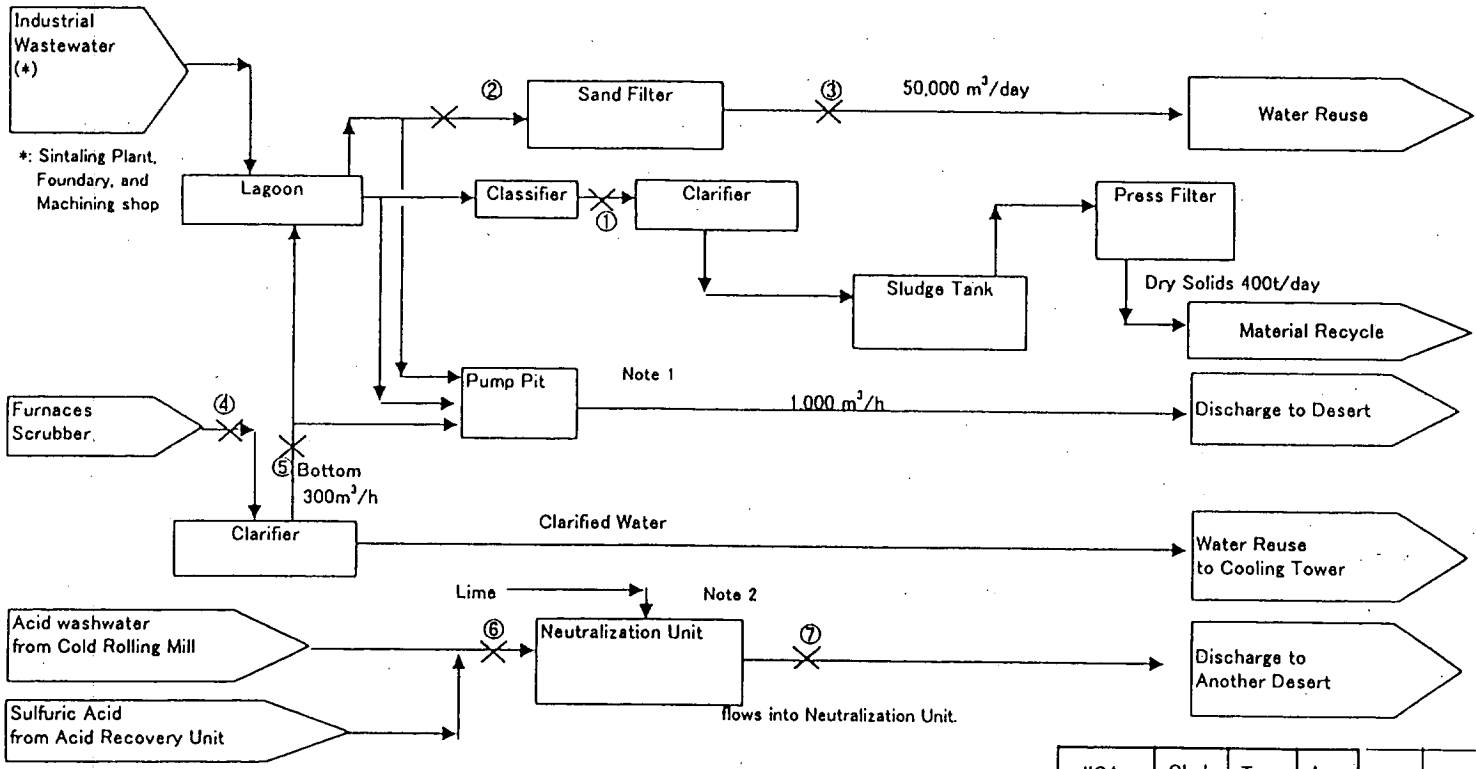
Factory Name: Egyptian Iron and Steel Co.
Design Case: Basic Design (Modified Case)

1. Major Equipment

Equipment Name	Unit Cost [x10^{3}Yen]	Note
(1) Acid water pumps	2,300～3,600	Material: SCS
(2) Clarifier Rake	15,000	1 set
(3) Thickener Rake	12,000	1 set
(4) Dehydrator	25,000	2 sets
(5) Limestone grinding System	19,000	1 set
(6) Motor Control Center	12,000	
(7) Center Control Panel	3,000	1 set

2. Field Work

Work Item	unit	unit Cost[LE]	Note
(1) Site Preparation	[m^2]	8	
(2) Civil (Earth Work)	[m^3]	34	
(3) RC Work	[m^3]	1,500	Foundation, Water Basin
(3) Storage Tank	[ton]	3,430	Equalization Tank, Chemical tank Neutralization Tanks
(4) Structural Steel	[ton]	2,000	Pipe rack, Operating Stage
(5) Equipment Installation	[ton]	400	Pumps, Clarifier rakes, Dehydrator
(6) Piping	[ton]	3,970	Except valves
	[in-m]	30	Except valves
(7) Painting	[m^2]	50	
(8) Local Building	[m^2]	2,600	W.W.T Control Room
(9) Electrical	[cable-m]	3	



Note
1. Pump Pit
Pumping water source is manually selected.

2. Neutralization Pit
- Neutralization Unit is located underground.
- Manual Neutralization
- Acid Recovery Unit is less capacity.
In the case of "3 shift full operation", sulfuric acid from Acid Recovery Unit

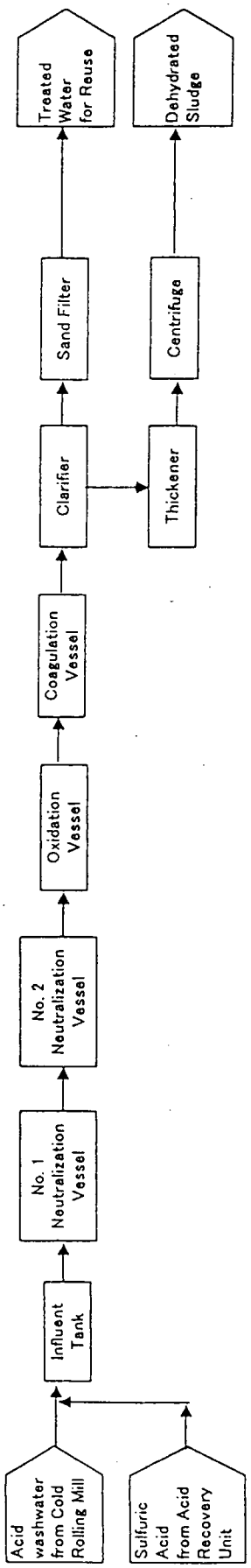
Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦
Flow Rate	m³/h	1000	3000	3000	2500	300	150	150
pH	—	9.85	9.81	9.76	6.21	6.62	2.59	11.2
Conductivity	μS/cm	833.000	700	679	1,000	920	6000	7000
Turbidity	NTU	523	65	5	54	386	65	995
Water Temp.	℃	32.3	30.5	32.4	39.9	38.2	43.5	39.5
Salinity	%	0.03	0.03	0.02	0.04	0.04	0.27	0.51
COD**	mg/L	33.5	58.3	9.7	19.4	66	194.1	16.2

* : Field Measurement(Average)
**: Lab. Analysis

JICA	Chck	Tec	Appr						
Siz									
Date									
CNSLT	Dsgn	Chc	Appr						
Sign	H.T.			Re	Descriptio	Dsgn	Chc	App	Dat
Date	Oct.10'97	10/11	Oct 12	REVISION					

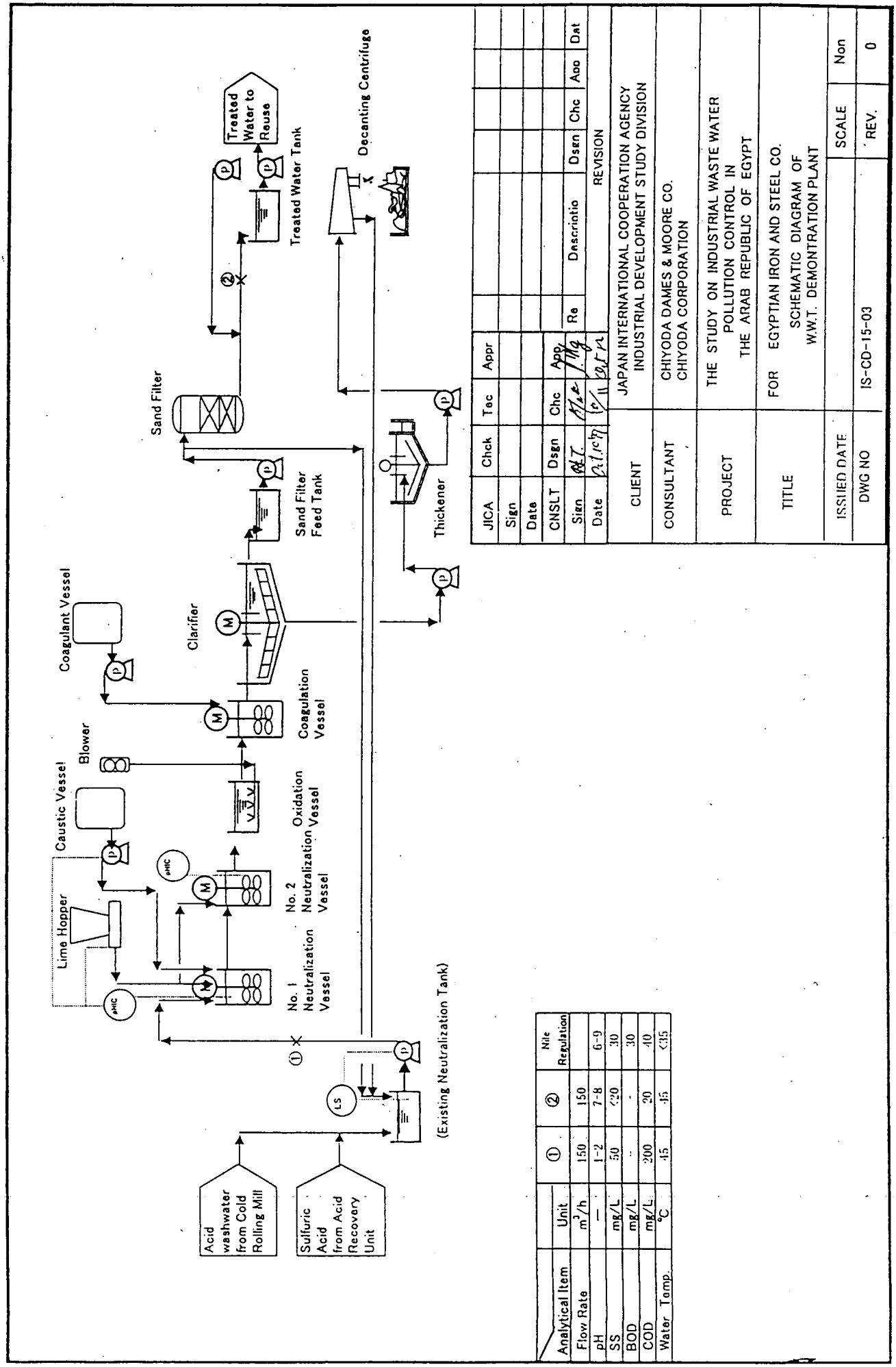
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. SCHEMATIC DIAGRAM OF EXISTING WASTE WATER FLOW
ISSUED DATE	SCALE Non
DWG NO	IS-CD-15-01 REV. 0

Attached Figure 9.5-1



JICA	Chck	Tec	Appr							
Sign										
Date										
CNSLT	Dsgn	Chc	App							
Sign	T.T.			Re	Description	Dsgn	Chc	Apo	Dat	
Date	6.1.1991	18/11	22/12	REVISION						

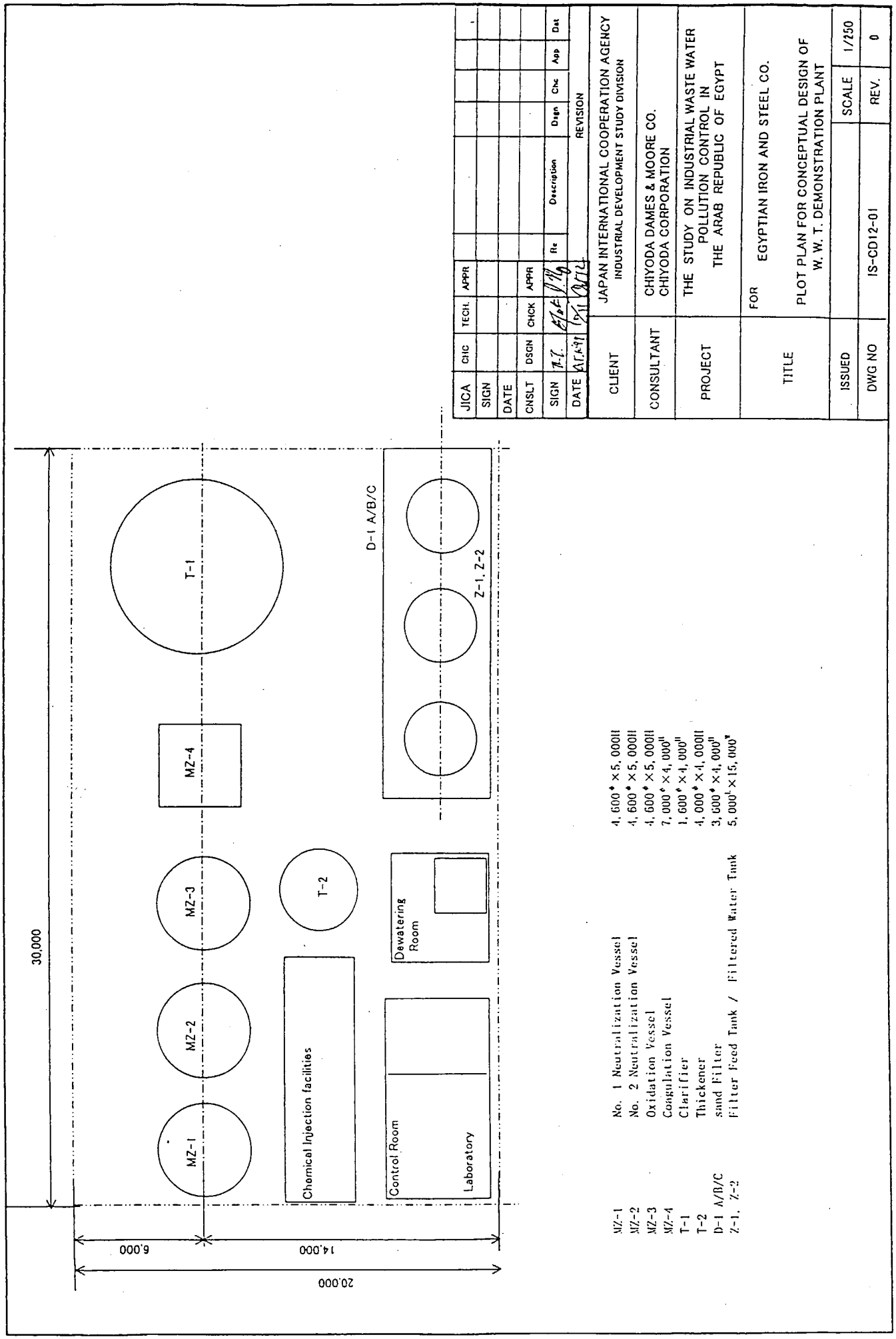
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. BLOCK FLOW DIAGRAM OF W.W.T. DEMONTRATION PLANT
ISSUED DATE	SCALE Non
DWG NO.	IS-CD-15-2 REV. 0

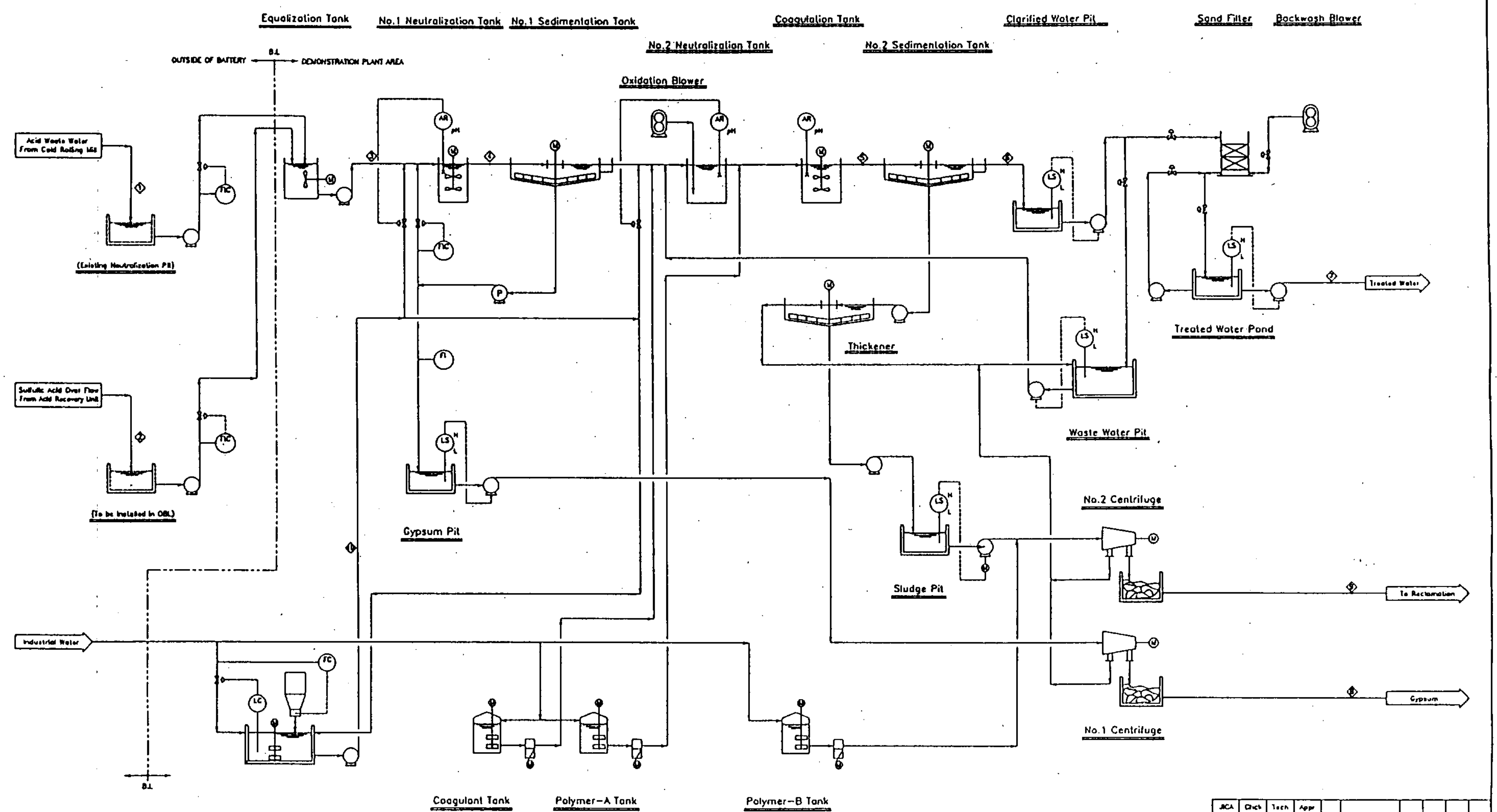


Analytical Item	Unit	①	②	Nile Regulation
Flow Rate	m^3/h	150	150	
pH	—	1-2	7-8	6-9
SS	mg/L	50	<20	30
BOD	mg/L	-	-	30
COD	mg/L	200	20	40
Water Temp.	°C	45	45	<35

JICA	Chck	Tec	Appr							
Sign										
Date										
CNSLT	Dsgn	Chc	App.							
Sign				Re	Descriptio	Dsgn	Chc	App	Dat	
Date				REVISION						

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. SCHEMATIC DIAGRAM OF W.W.T. DEMONTRATION PLANT
ISSUED DATE	SCALE Non
DWG NO	IS-CD-15-03 REV. 0

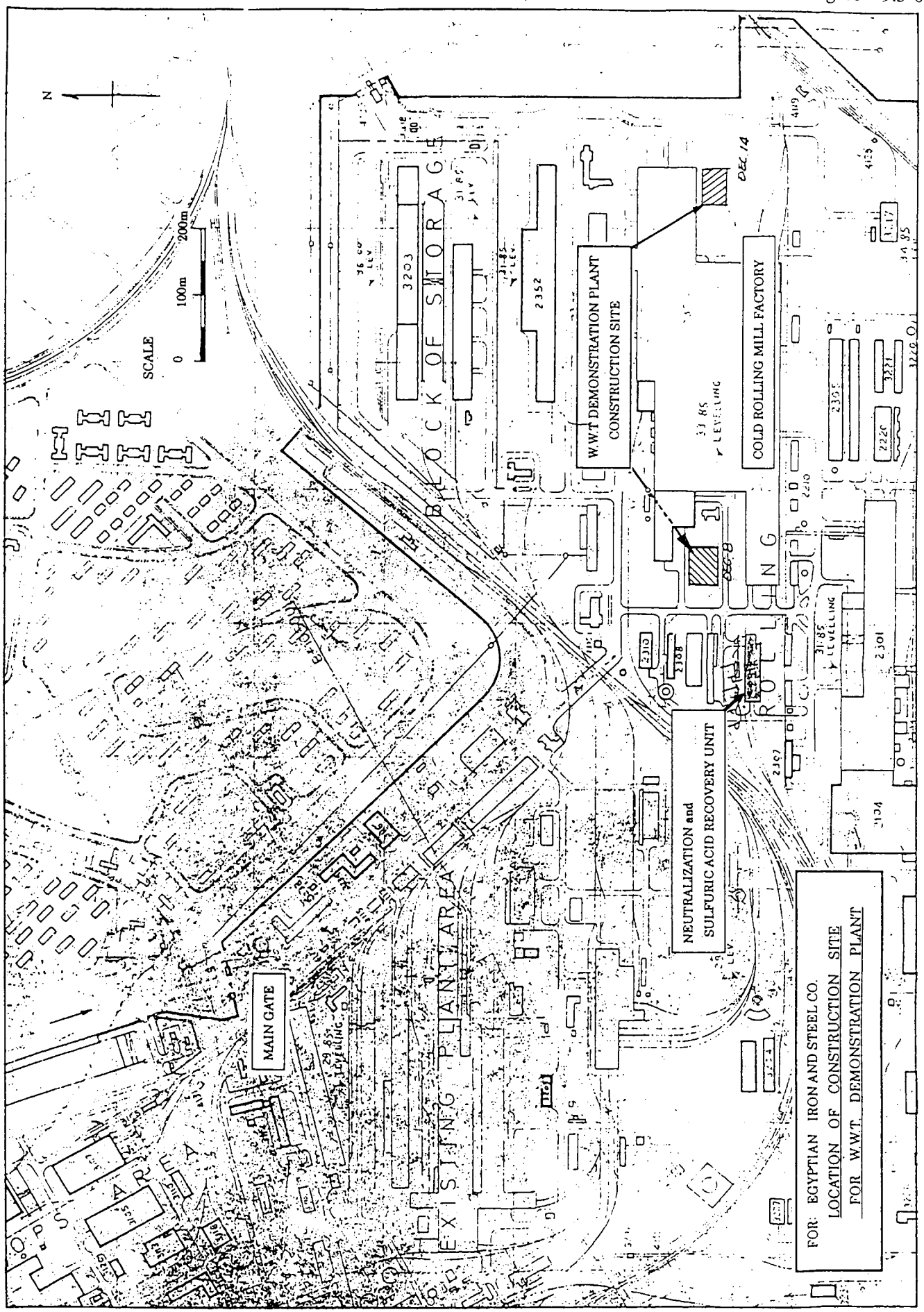

30,000
20,000
14,000
6,000
MZ-1
MZ-2
MZ-3
MZ-4
T-1
T-2
Chemical Injection facilities
Control Room
Laboratory
Dewatering Room
D-1 A/B/C
Z-1, Z-2
MZ-1 No. 1 Neutralization Vessel 4,600φ×5,000H
MZ-2 No. 2 Neutralization Vessel 4,600φ×5,000H
MZ-3 Oxidation Vessel 4,600φ×5,000H
MZ-4 Coagulation Vessel 7,000φ×4,000H
T-1 Clarifier 1,600φ×4,000H
T-2 Thickener 4,000φ×4,000H
D-1 A/B/C sand Filter 3,600φ×4,000H
Z-1, Z-2 Filter Feed Tank / Filtered Water Tank 5,000L×15,000W
JICA CHC TECH. APPR
SIGN
DATE
CNSLT DSGN CHCK APPR
SIGN T-T.
DATE
Re Description Dsgn Chc App Dat
REVISION
CLIENT JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE FOR EGYPTIAN IRON AND STEEL CO. PLOT PLAN FOR CONCEPTUAL DESIGN OF W. W. T. DEMONSTRATION PLANT
ISSUED SCALE 1/250
DWG NO IS-CD12-01 REV. 0

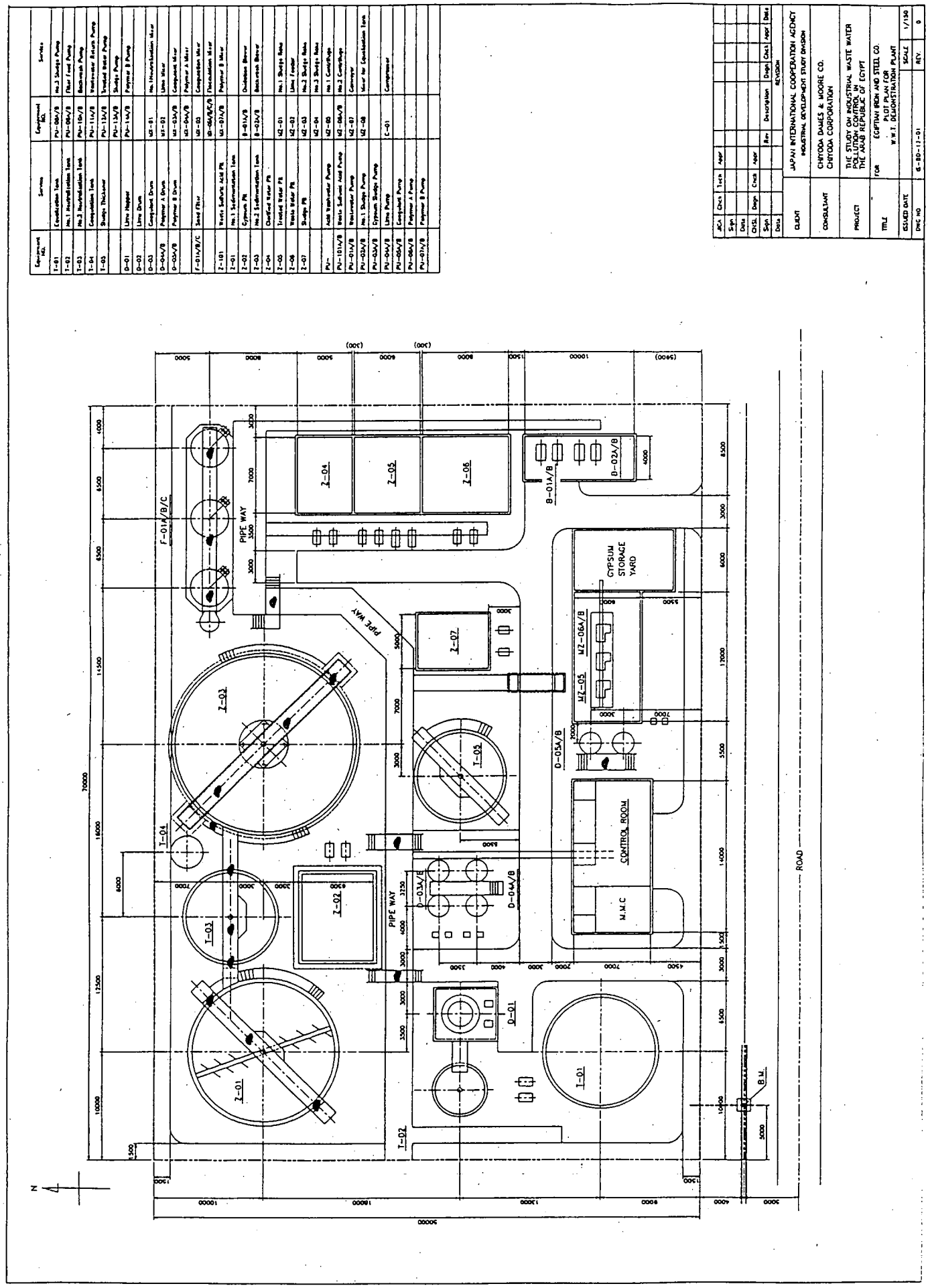


Item \ Stream No		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	Nile Branch Regulation
Flow rate Ave.	(m³/h)	150	1.67	151.67	162.07	225.48	159.17	151.21	1.18	7.65	8.37	—
Flow rate Max.	(m³/h)	170	40(m³/D)	171.67	182.07	246.53	180.22	171.21	2.36	7.65	8.37	6~9
pH	(s/cm)	0~2	0~2	0~2	4	7	7	7	4	7		—
SS	(mg /L)								600000	200000		30
Oil & Grease	(mg /L)	<5	<5					<5				5
BOD	(mg /L)	<20	<20					<20				20
COD	(mg /L)	<30	<30					<30				30
TDS	(mg /L)	4000	16000					>2000				800
											10% Ca(OH)₂ Slurry	

JICA	Chck	Tech	Appr						
Sign									
Date									
CHSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date					REVISION				

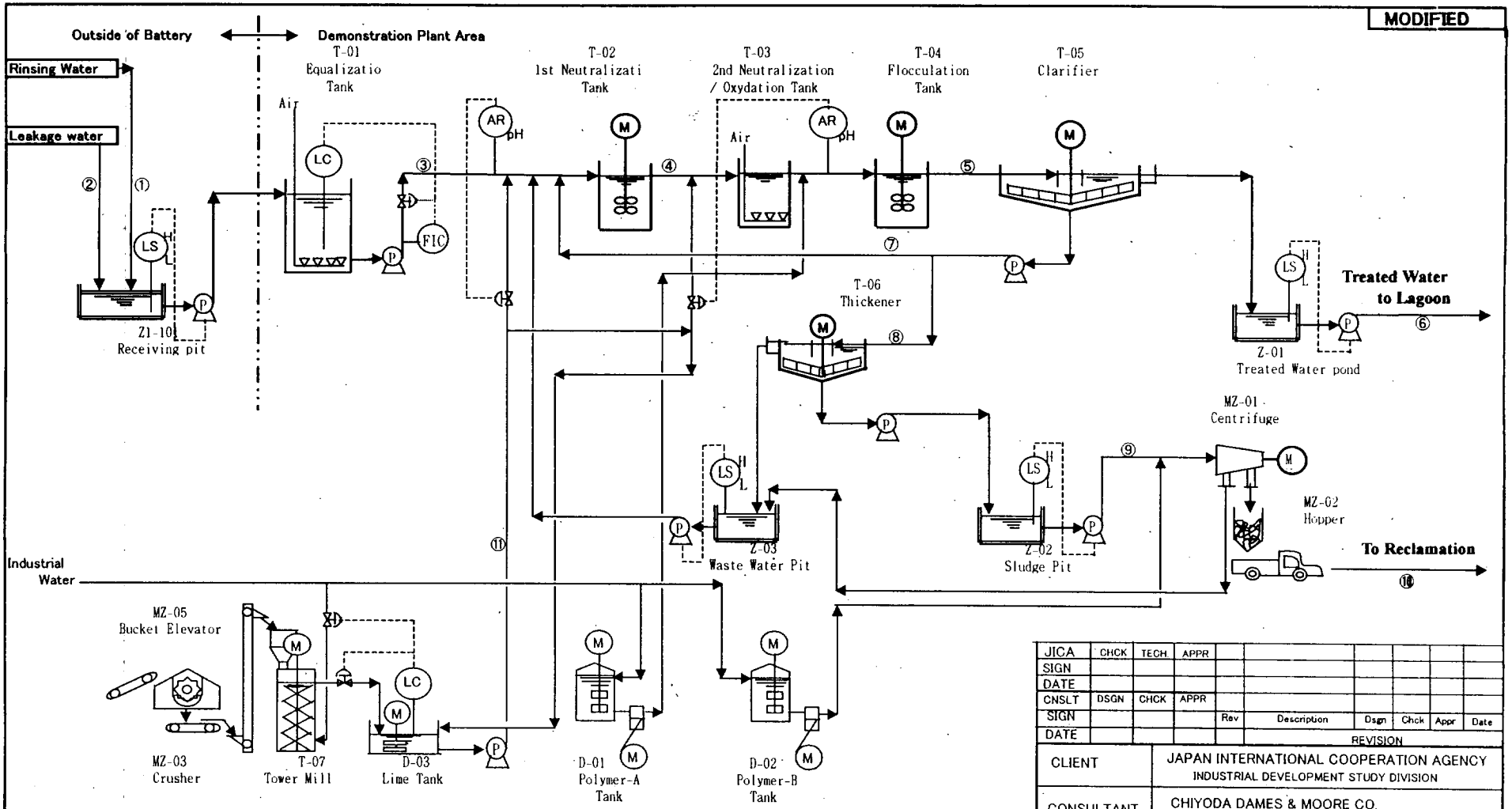
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PROCESS FLOW DIAGRAM OF W.W.T. DEMONSTRATION PLANT		
ISSUED DATE		SCALE	None
DWG NO	15-00-15-01	REV.	0


N
SCALE
0
100m
200m
MAIN GATE
EXISTING PLANT AREA
BLOCK OF STORAGE
W.W.T DEMONSTRATION PLANT CONSTRUCTION SITE
COLD ROLLING MILL FACTORY
NEUTRALIZATION and SULFURIC ACID RECOVERY UNIT
FOR: EGYPTIAN IRON AND STEEL CO.
LOCATION OF CONSTRUCTION SITE
FOR W.W.T. DEMONSTRATION PLANT


Z-01
Z-02
Z-03
Z-04
Z-05
Z-06
Z-07
I-01
I-02
I-03
I-04
I-05
D-01
D-02A/B
D-03A/B
D-04A/B
D-05A/B
B-01A/B
F-01A/B/C
M2-05
M2-06A/B
PIPE WAY
GYPSUM STORAGE YARD
CONTROL ROOM
M.N.C
ROAD
B.M.
N

MODIFIED
N
SCALE
0
100m
200m
BLOCK OF SMORAG
WASTEWATER TREATMENT PLANT
AREA " B
COLD ROLLING MILL FACTORY
WASTEWATER TREATMENT PLANT
AREA " A" RECEIVING PIT
NEUTRALIZATION and
SULFURIC ACID RECOVERY UNIT
MAIN GATE
EXISTING PLANT AREA
FOR: EGYPTIAN IRON & STEEL Co.
LOCATION OF
WASTEWATER TREATMENT PLANT

MODIFIED

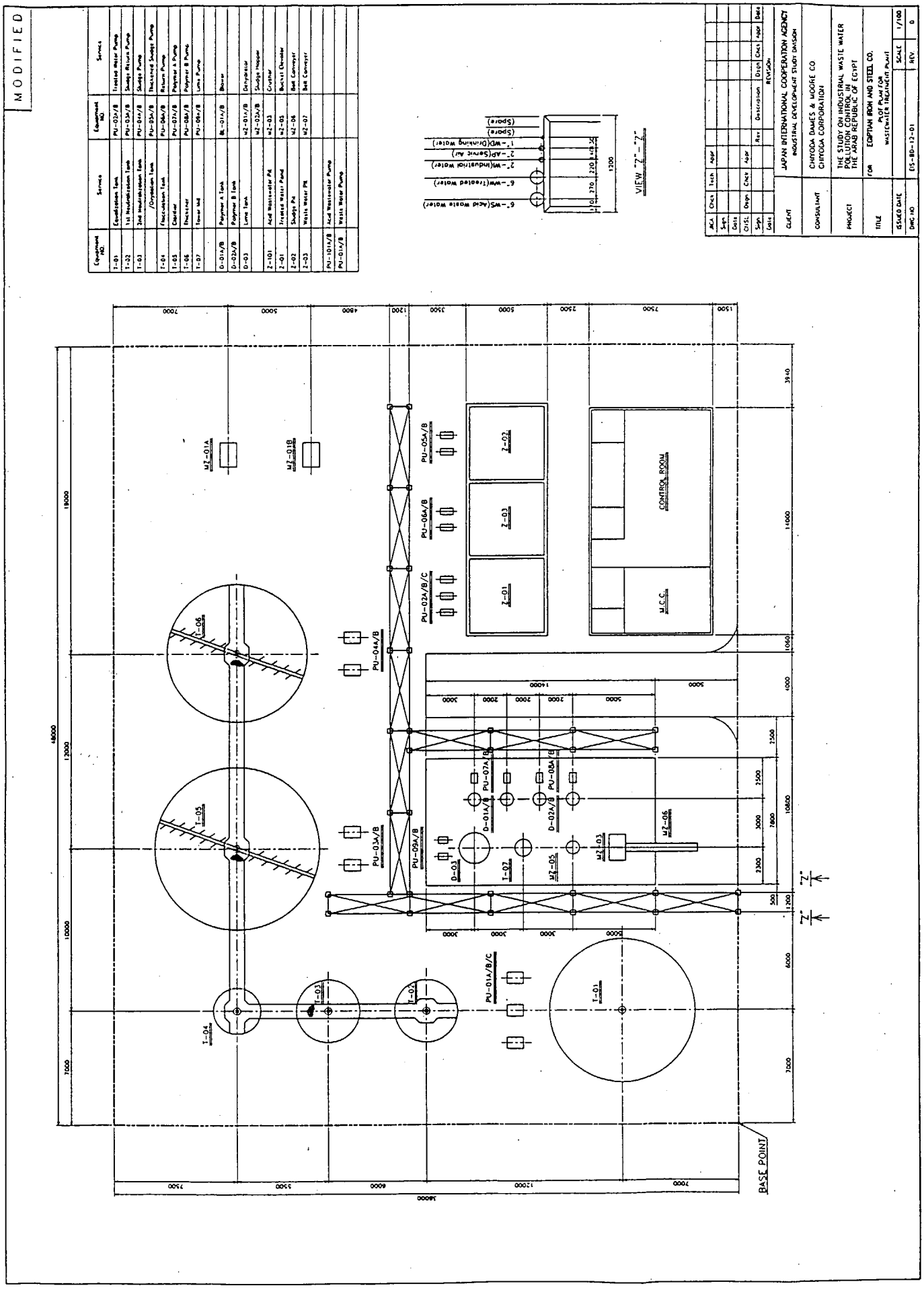


Stream No. / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	Law48/82 Regulation
Flow Rate(Max)	m^3/h	80	10	90	113	115	91	4	24	15	4 ton/h	5	-
Flow Rate(Nor)	m^3/h	35	5	40	63	65	41	4	24	15	4 ton/h	5	-
pH	—	0.5 - 2		0.5-2.0	4.0-5.0	8-8.5	8-8.5	8-8.5	8-8.5	8-8.5	8-8.5	-	6~9
H_2SO_4	mg/L	2,025	21,800	4,300	≒0	≒0	≒0	-	-	-	-	-	-
$FeSO_4$	mg/L	2,025	21,800	4,300	4,300	≒0	≒0	-	-	-	-	-	-
$CaSO_4 \cdot 2H_2O$	mg/L	-	-	-	6,000	9,700	2,000	38,750	38,750	62,000	930 kg/h	-	-
$Fe(OH)_3$	mg/L	-	-	-	-	2,400	≒0	11,250	11,250	18,000	270 kg/h	-	-
$Ca(OH)_2$	mg/L	-	-	-	-	-	-	-	-	-	-	100,000	-
SS	mg/L			-	4,000	10,100	<30	50,000	50,000	80,000	30 wt%	-	30

JICA	CHCK	TECH	APPR							
SIGN										
DATE										
CNSLT	DSGN	CHCK	APPR							
SIGN				Rev	Description	Dsgn	Chck	Appr	Date	
DATE				REVISION						

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PROCESS FLOW DIAGRAM OF WASTEWATER TREATMENT PLANT (without Spent Sulfuric Acid)
ISSUED DATE	SCALE
DWG NO	EIS-BD-15-01 REV.

Attached Figure 9.5-9


MODIFIED
Equipment NO. | Service | Equipment NO. | Service
T-01 | Equalization Tank | PU-01A/B | Treated Water Pump
T-02 | 1st Neutralization Tank | PU-03A/B | Sludge Return Pump
T-03 | 2nd Neutralization Tank | PU-04A/B | Sludge Pump
/Oxydation Tank | PU-05A/B | Thickened Sludge Pump
T-04 | Flocculation Tank | PU-06A/B | Return Pump
T-05 | Clarifier | PU-07A/B | Polymer A Pump
T-06 | Thickener | PU-08A/B | Polymer B Pump
T-07 | Treat Wat | PU-09A/B | Lime Pump
D-01A/B | Polymer A Tank | BL-01A/B | Blower
D-02A/B | Polymer B Tank | D-01 | Dehydrator
D-03 | Lime Tank | WZ-01A/B | Sludge Hopper
WZ-02A/B | Crusher
Z-101 | Acid Wastewater Pit | WZ-03 | Bucket Elevator
Z-01 | Treated Water Pond | WZ-05 | Belt Conveyor
Z-02 | Sludge Pit | WZ-06 | Belt Conveyor
Z-03 | Waste Water Pit | WZ-07
PU-101A/B | Acid Wastewater Pump
PU-01A/B | Waste Water Pump
6"-WS(Acid Waste Water)
6"-WW(Treated Water)
2"-WI(Industrial Water)
2"-AP(Service Air)
1"-WD(Drinking Water)
(Spare)
(Spare)
VIEW "Z"-"Z"
JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION
CHIYODA DAMES & MOORE CO
CHIYODA CORPORATION
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
FOR EGYPTIAN IRON AND STEEL CO.
PLOT PLAN FOR WASTEWATER TREATMENT PLANT
ISSUED DATE
DWG NO
EIS-BD-12-01
SCALE 1/100
REV. 0
CONTROL ROOM
M.C.C.
Z-01
Z-02
Z-03
T-01
T-02
T-03
T-04
T-05
T-06
T-07
BASE POINT
"Z"
"Z"

APPENDIX-2

OVERVIEW OF WATER POLLUTION CONTROL MEASURES IN JAPAN

Overview of Water Pollution Control Measures in Japan

1. History of Water Pollution Control Measures in Japan

1) Serious Water Pollution Problems during the Time of Rapid Economic Growth

The first recorded water pollution problem in Japan is the pollution of rivers caused by Ashio Copper Mine in 1887. Although this serious problem was discussed at the National Diet in 1891, no substantial measurers were taken because "Development of the Industry" was one of the major economic policies of Japan in those days. In 1911, "Factory Law" was enacted. However, this law was not useful for pollution control, because the aim of this law was the protection of labors.

After World War I, the development of heavy and chemical industries caused serious water pollution problems. The government action for such problems was to compensate for physical damage.

The industries destroyed during World War II quickly recovered to the same level as that of before the War, largely due to the emergency demands of US Army for the Korean War in 1950. From 1955, heavy and chemical industries of Japan rapidly developed due to active investments by both the public and private sectors. The exports also dramatically increased. Since heavy and chemical industries have characteristics to exhaust larger amounts of pollutants than other industries, the development of these industries (so-called pollution-generating industry) caused serious pollution problems. Under the export-oriented economic structure, products exceeding local demand have been produced in Japan, and huge amounts of pollutants had been exhausted. This is one of the biggest reasons why environmental pollution problem in Japan was far more serious than those of both USA and European countries are. Reclamation of coastal area, construction of large-scale industrial complexes on reclaimed areas and rapid concentration of population to industrial areas had rapidly aggravated the environmental pollutions in coastal areas.

Mercury poisoning at Minamata City in Kumamoto Prefecture and that at the mouth of Agano River in Niigata Prefecture caused by the effluent water of carbide factories are typical examples of health hazard caused by industrial effluents. Especially, mercury poisoning at Minamata is well known in the world as a "Minamata Disease" for its misery. Besides the above, from 1960's, many troubles such as offensive odor, death of large numbers of fishes and, contamination of river and lake water by hazardous substances have occurred in many places. Under the above situations, drinking water treatment plants at many places had been obliged to

stop their operation. Many fishermen had requested compensations for troubles from offensive odor fishes. Complaints and claims of citizens against factories and government had also increased all over the country.

2) Response of Administrative Sector, Industrial Sector and Citizens

Due to the rapid growth of the economy, serious water pollution problems had occurred in many places. The first social action against water pollution problems had been limited to compensating residents directly affected by water pollution damage. However, social anxiety about water pollution was heightened through reports on TV and newspapers about the serious troubles including the accumulation of hazardous substances in fishery products in markets. The central and local governments were urged to enact laws to control such environmental pollutions.

The first move of legal regulation for pollution control was the actions of residents living in the damage areas. Complaints and claims of residents were sent mainly to local governments, which had invited factories and enterprises for the development of regions. The local governments had been obliged to introduce their own regulations, because central government had taken no appropriate measures. In 1949, Tokyo metropolitan government established a pollution control ordinance. Kanagawa prefecture and Osaka prefecture established ordinances in 1951 and 1954, respectively. Other local governments also established ordinances for pollution control. However, these ordinances were not very useful for the prevention of water pollution because these ordinances emphasized only the procedures to get the approval of local government prior to construction of factories and/or plants and quantitative regulations for effluent control were not included.

In 1958, two water quality-related laws ("Water Quality Conservation Law" and "Factory Effluent Control Law") were enacted. In 1964, the government of Yokohama City signed the "Agreements on Environmental Pollution Control" with individual enterprises because the regulations defined in the above two laws were not sufficient to control water pollution in areas overcrowded by factories. After that, many local governments also signed the same type of agreements, one after another. In these agreements, the rights of local governments such as the add-on control target (more stringent) over national standard and inspection of the factory without prior notice were defined. Although these agreements are a kind of "gentleman agreements" and have no legal binding force, enterprises have kept the Agreements in consideration of the importance of the harmonious coexistence with local residents. The Agreement on Environmental Pollution Control has been playing an important role in environmental control as a supplement of laws and ordinances.

In 1964, through a Cabinet meeting, the central government founded the "Liaison Conference for the Promotion of Pollution Control" as an affiliated organization of the Prime Minister's Office to promote the cooperation with concerned administrative authorities. In 1965, the "Environmental Pollution Council" was established as a consultative body of the Minister of Health and Welfare. The following year, an Environmental Pollution Council submitted a report to the Minister and recommended that the Ministry take measures. These measures included the establishment of Ambient Water Quality Standard, clarification of responsibility of enterprises, identification of responsibilities of the central and the local governments, and the establishment of responsible organizations for pollution control. In response to this report, the Basic Law for Environmental Pollution Control was enacted in 1967.

Since serious pollution problems were not improved even after the enactment of the Basic Law for Environmental Pollution Control, the Pollution Countermeasures Headquarters was set up in 1970 as a leading policy-making organization. The 64th Diet held in 1970 is called as "Pollution Session". In this Diet, the Basic Law for Environmental Pollution Control was amended and 14 laws relating to pollution control including Water Pollution Control Law were enacted. The diet has decided to put priority on pollution control over economic development, to strengthen pollution control, to clarify the responsibilities of enterprises and to strengthen the authority of local government for pollution control. Further, the Environment Agency; the permanent organization responsible for pollution control was founded in 1971. In 1974, The National Institute for Environment Studies was founded as a general research institute for the pollution control.

3) Improvement of Water Pollution by Water Pollution Control Law

The Water Pollution Control Law was newly enacted, by amending the defects of the former 2 water quality-related laws (Water Quality Conservation Law and Factory Effluent Control Law). In this new law, local governments are approved as responsible organizations for execution of pollution control. The amendment of the "Basic Law for Environmental Pollution Control" and the enactment of the "Water Pollution Control Law" have enabled the following:

a. Setting of add-on local standard over national standards by local governments,
b. Establishment of surveillance system for prevention of water pollution,
c. Strengthening of penal regulations against violators,
d. Full development of financial assistance and the promotion of tax incentive systems to encourage the installation and modification of pollution control facilities.

As a result, the serious water pollution situation throughout the country has been markedly

improved. As for the items related to human health such as heavy metals, pollution has been reduced to a level that is lower than ambient water quality standard in almost all parts of Japan as shown in Figure-1.

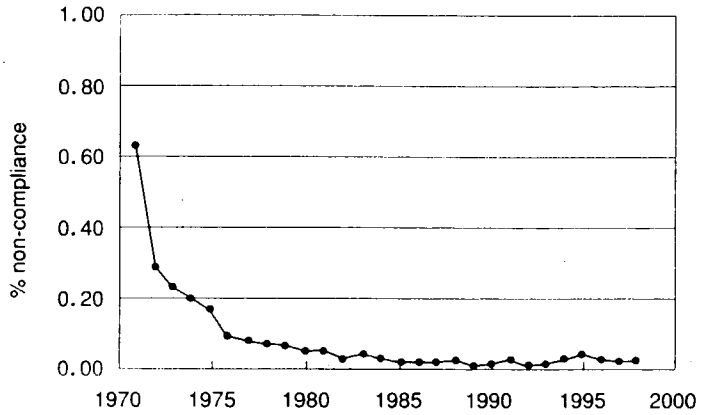


Figure-1 Change in Non-Attainment of Ambient Water Quality Standard for Human Health

As for the items related to living environment such as organic substances, phosphorus and nitrogen, Japan was able to decrease the discharge of these substances from the industrial sector. However, under the dramatic changes of life style and rapid urbanization, discharge of these substances from domestic and commercial sectors has rapidly increased, and pollution level of these substances has gradually increased as shown in Figure-2. This pollution has been especially severe in closed water body areas, such as Seto Inland Sea, Tokyo Bay and Ise Bay and other closed water areas like lakes. The water quality has decreased in these water bodies despite the enactment of stringent regulations against each factory and enterprise, and it is becoming an urgent issue to take comprehensive measures including the development of infrastructure such as sewage system both for industrial and domestic wastewater.

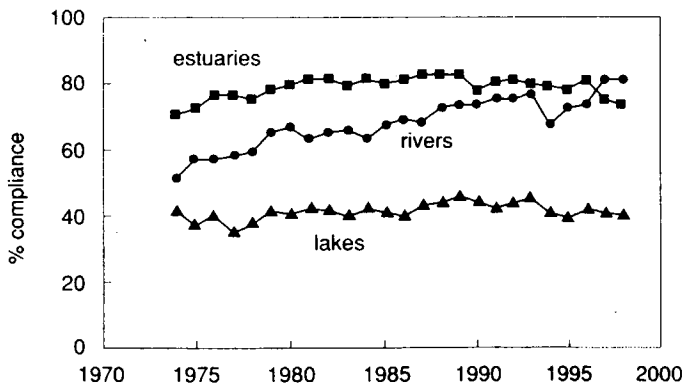


Figure-2 Change in Attainment of Ambient Water Quality Standard for Living Environment

Due to the above adverse situation, The Ambient Water Quality Standard for Total Nitrogen and Total Phosphorus for lakes and ponds was issued in 1982. A similar standard applicable to sea area was issued in 1993. In the early 1970s, The Law Concerning Provisional Measures for Conservation of the Environment of the Seto Inland Sea was enacted on the occasion of frequent occurrence of red tide in that sea. In this law, enterprises are obliged to get approval of the local government prior to constructing specified facilities that discharge a larger amount of wastewater than a specified volume. The regulation on COD concentration was also included in this law. In 1978, The Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea was enacted (the Law Concerning Provisional Measures for Conservation of the Environment of the Seto Inland Sea was revised and was made permanent). In the new law, and in addition to the concentration regulation of COD, total pollutant load control on COD and the regulation on phosphorus were introduced. The total pollutant load control was aimed to control the total volume of COD to be flown into specified closed water area. Tokyo Bay and Ise Bay have become the applicable area of the total COD volume control regulation. Besides the above, in 1984, the Law Concerning Special Measures for Conservation of Lake Water Quality, that is applicable to the lakes and ponds where pollution control is urgently required, was enacted. The major purpose of this law is to promote the water quality conservation works such as a development of sewage system and to take comprehensive regulative measures for each pollution source.

In 1984, for the prevention of groundwater pollution, The Provisional Guideline of Harmful Substances such as trichloroethylene was established. Since this guideline was not very effective, the Water Pollution Control Law was amended in 1989 to enforce the control of groundwater pollution. In 1996, Water Pollution Control Law was revised with provisions on groundwater purification. Under the revised law, the government has a right to order the decontamination of groundwater against the polluter.

4) From Basic Law for Environmental Pollution Control to Basic Environment Law

The environmental administration of Japan has been executed under the framework of the Basic Law for Pollution Control, and regulative measures suitable for specific local conditions taken by local governments have achieved great results. The measures taken by local governments are "Add-on effluent standard over national standard by Pollution Control Ordinance," "Surveillances of effluent water", "Administrative guidance toward factories and enterprises", "Signing of Agreement on Environmental Pollution Control between individual enterprise and governments of city, town or village", etc. It must be pointed out that enterprises of Japan have spontaneously implemented various measures such as investments in environmental pollution control facilities, development and installation of pollution control facilities, development of

environmental management system, education and training of staffs for abatement and prevention of environmental pollution, etc., under the recognition that pollution control is the social duty of business enterprises.

On the other hand, the recent life style of mass-production, mass-consumption and mass-disposal has been causing "urban and domestic pollutions" and global environmental problems. It is becoming obvious that ordinary regulatory procedure cannot cope with these new types of environmental problems. International cooperation for prevention of the global environment is becoming important. In 1992, a Global Summit was held in Brazil, and "Agenda 21" for the "Sustainable Development" was adopted.

Under such situation, the Basic Environment Law was introduced as a substitute for the Basic Law for Environmental Pollution Control. Table-1 shows the major differences between these two laws. In 1994, based on the basic principles and policy direction of Basic Environment Law, the "Basic Environment Plan" was adopted by the Cabinet to clarify the long-term objective of environmental policy of Japan. The long-term objectives of this plan are:

1. "Building a socioeconomic system fostering a sound material cycle",
2. "Harmonious coexistence between mankind and nature",
3. "Participation by all sectors of society", and
4. "Promotion of international activities".

The expected roles and activities of central government, local governments, enterprises, citizens and private organizations for achieving those objectives are described.

Table-1 Comparison of Basic Law for Environmental Pollution Control And Basic Environment Law

	Basic Law for Environmental Pollution Control	Basic Environment Law
Subject	Environmental Pollution	Environmental Pollution + Difficulties in Environmental Conservation
Characteristics of Problems	Environmental Problems at Specific Areas	Environmental Problems at Specific Areas + Global Environmental Problems
Purpose of Law	Prevention of Specific Environmental Pollution	Reduction of Pollution Load On Global Environment
Measures of Regulations	Regulatory Measures by End-of-Pipe Procedure	Self-motivated and Active Engagement

Source: The Japan Research Institute Limited

In the Basic Environment Plan, the importance of total measures to restore and maintain healthy water circulation throughout the whole natural environment is emphasized. In addition, the basic concept of environmental preservation is expanded from the "control of water quality" to the comprehensive measures expressed by keywords such as "Sound Material Cycle", "Harmonious Coexistence" and "Participation". Under the above basic concept, this law emphasized the importance of "Preservation of the benefit of water by taking the most suitable measures for each region and succession of it to future generations" as well as "Preservation of human health and living environment". Further, in recognizing the importance of conservation of quality and quantity of water, waterside area and accessible natural environment, comprehensive measures for the security of healthy water circulation is emphasized. From the viewpoint that voluntary participation of residents is indispensable for the preservation and restoration of rich water quality, measures to raise the public awareness about water quality conservation are also emphasized.

5) Moves after the enactment of Basic Environment Law

After the enactment of Basic Environment Law, in corresponding with the 4 keywords of the Basic Environment Plan; "Sound Material Cycle", "Harmonious Coexistence", "Participation" and "International Activity"; many steps have been actively taken. For reduction of disposals and promotion of recycling, the Container Packaging Recycling Law, the Specified Household Electric Appliances Recycling Law were enacted. The Energy Conservation Law was amended to promote the conservation of resources. For the reduction of environment risks, the Environment Impact Assessment Law was enacted, and Air Pollution Control Law and Water Pollution Control Law were amended. PRTR System was preliminarily introduced. Besides the above, to cope with the globalization of economic activities and preservation of global environment, an introduction of the Series of ISO14000 to enterprises and countermeasures for the reduction of greenhouse gases are investigated.

2. Countermeasures taken by Administrative Sector for Pollution Control of Industrial Wastewater

In the previous section, the history of environmental protection in Japan was reviewed by focusing on the pollution control of industrial wastewater. This section describes the countermeasures taken by administrative sector for the prevention of water pollution by industrial wastewater.

1) Ambient Water Quality Standard

The ambient water quality standard for water, established under the Basic Environment Law, is

divided into standards for human health (health item) and that for the conservation of living environment. The former is the general standard applicable to all public water areas. As for the latter, public water area is divided into the areas of rivers, lakes and coastal sea, and each area is further divided into categories based on the purpose of use so that ambient water quality standard can be applied depending on the categories. The governor of each prefecture has an authority to specify the category except in case that water area is extending over two or more prefectures. It is prescribed that the standard value must be always checked from scientific viewpoint, and should be modified whenever necessary. Until now, organic-chlorine compounds and pesticides were added to health item, and standard values of lead and arsenic were changed to more stringent values. Besides the items listed in ambient water quality standards, there are many harmful chemicals to be regulated. However, it was difficult to set the standard value for such chemicals due to their low detection limits. From such chemicals, 25 substances were selected to be carefully observed. After that, based on the results of scientific consideration, 3 of them were deleted from the list. Another 3 substances were shifted to the item of environmental standard, and 19 substances are still listed as ambient water quality standard for protecting the living environment. Table-2 shows the ambient water quality standards for river water and guidelines of ambient water quality standard for protecting the living environment for river water.

Table-2 (1) Ambient Water Quality Standard for Human Health (River water)

Item	Standard Value
Cadmium	0.01 mg/L or less
Total Cyanide	Not detectable
Lead	0.01 mg/L or less
Chromium (hexavalent)	0.05 mg/L or less
Arsenic	0.01 mg/L or less
Total Mercury	0.0005 mg/L or less
Alkyl Mercury	Not detectable
PCB	Not detectable
Dichloromethane	0.02 mg/L or less
Carbon Tetrachloride	0.002 mg/L or less
1,2-Dichloroethane	0.004 mg/L or less
1,1-Dichloroethylene	0.02 mg/L or less
cis-1,2-Dichloroethylene	0.04 mg/L or less
1,1,1-Trichloroethylene	1 mg/L or less
1,1,2-Trichloroethylene	0.006 mg/L or less
Trichloroethylene	0.03 mg/L or less
Tetrachloroethylene	0.01 mg/L or less
1,3-Dichloropropene	0.002 mg/L or less
Thiram	0.006 mg/L or less
Simazine	0.003 mg/L or less
Thiobencarb	0.02 mg/L or less
Benzene	0.01 mg/L or less
Selenium	0.01 mg/L or less
NO_3-N and NH_3-N	10 mg/L or less
Fluoride	0.8 mg/L or less
Boron	1 mg/L or less

Table-2 (2) Ambient Water Quality Standard for Living Environment (River Water)

Category	pH	BOD (Max.)	SS (Max.)	DO (Min.)	Number of Coliform Groups
AA	6.5-8.5	1mg/L	25mg/L	7.5mg/L	50MPN/100ml
A	6.5-8.5	2mg/L	25mg/L	7.5mg/L	1,000MPN/100ml
B	6.5-8.5	3mg/L	25mg/L	5mg/L	5,000MPN/100ml
C	6.5-8.5	5mg/L	50mg/L	5mg/L	--
D	6.5-8.5	8mg/L	100mg/L	2mg/L	--
E	6.5-8.5	10mg/L	Floating matters, garbage should not be observed	2mg/L	--

Note: Major purposes of use for each category are as follows:

1) AA: Drinking water after simple treatment such as filtration, and
   All purposes of A to E
2) A: Drinking water after normal treatment such as sedimentation,
   Fisheries (oligosaprobic and mesoraprobic fishes),
   Bathing, and
   All purposes of B to E
3) B: Drinking water after multistage treatment,
   Fisheries (oligosaprobic and mesoraprobic fishes), and
   All purposes of C to E
4) C: Fisheries (mesoraprobic fishes),
   Industrial water after normal treatment such as sedimentation, and
   All purposes of D to E
5) D: Industrial water after purification by chemicals,
   Agriculture, and
   All purposes of E
6) E: Industrial water after special purification

Table-2 (3) Guideline of Ambient Water Quality Standard for Protecting The Living Environment (River Water)

Items	Guideline	Note
Chloroform	0.06 mg/L or less	
Trans-1,2-Dichloroethylene	0.04 mg/L or less	
1,2-Dichloropropane	0.06 mg/L or less	
p-Dichlorobenzene	0.3 mg/L or less	
Isoxathion	0.008 mg/L or less	
Diazinon	0.005 mg/L or less	
Fenitrothion (MEP)	0.003 mg/L or less	
Isoprothiorane	0.04 mg/L or less	
Oxine-copper (Organic Cupper)	0.04 mg/L or less	
Chlorothanonil (TPN)	0.05 mg/L or less	
Propyzamide	0.008 mg/L or less	
EPN	0.006 mg/L or less	
Dichlorvos (DDVP)	0.008 mg/L or less	
Fenobucarb (BPMC)	0.03 mg/L or less	
Iprobenfos (IBP)	0.008 mg/L or less	
Chlornitrofen (CNP)	Deleted	
Toluene	0.6 mg/L or less	
Xylene	0.4 mg/L or less	
Diethylheyl phthalate	0.06 mg/L or less	
Nickel	Deleted	
Molybdenum	0.07 mg/L or less	
Antimony	Deleted	
NO_3-N and NH_3-N	1 mg/L or less	Moved to Ambient Water Quality Standard
Fluoride	0.8 mg/L or less	- ditto -
Boron	10 mg/L or less	- ditto -

The ambient water quality standards are administrative target, and penalty is not applied even in case that ambient water quality standard is not attained. On the other hand, Water Pollution Control Law has legal binding force with penal regulation, while grace period is given to factory or enterprise. Regarding the Ambient Water Quality Standards for Human Health, it is regulated that the standard must be attained immediately. However, as for the Ambient Water Quality Standards for Living Environment, 5 years' grace is given. In case that an attainment of the standard within this period is deemed difficult, factory or enterprise is obliged to set the tentative target value and to make the best effort to attain the target.

2) Water Pollution Control Law

Regulative measures under the Water Pollution Control Law consist of the Control based on the Effluent Standards applicable to public water area and Areawide Total Pollutant Load Control applicable to specified water area. Both an enactment of effluent standard by administrative sector and observance of it by enterprises are indispensable for pollution control.

In Water Pollution Control Law, the term "public water area" means the water areas of public use such as rivers, lakes and marshes, harbors, coastal sea, etc., including such waterways connected to public waterways, irrigation waterways and other waterways subject to public use (not including public sewers and river-basin sewers linked with final treatment plant).

In this law, as shown below, authorities and liabilities are transferred to the governor of prefecture and mayor of designated city in order to take the most suitable measures for each local condition.

1. Governor of prefecture and mayor of designated city shall take measures to regulate the effluent water from factories and enterprises to public water area, to prevent water pollution, and to preserve the public health and living environment. The governor shall decide the liability of enterprisers for compensation, in case human life or health is damaged.
2. The governor shall specify the facilities to be regulated.
3. The effluent standard for all public water area shall be established by the Ordinance of the Prime Minister's Office and is the maximum permissible amount. When the above standard is deemed insufficient, the local government shall establish more stringent effluent standard by enacting ordinance.
4. A person who plans to install a specified facility shall submit a report to the governor prior to construction of such facility. The governor shall order to change the structure or the way of use of the specified facility or the plant for the treatment of the polluted water. The governor may order to discontinue the discharge of polluted water, whenever required. Direct punishment is applicable to a person who violates shall effluent standard.

3) Effluent Standards

This law is applicable to the facilities (specified facility), which discharge polluted water or waste liquid that may cause damage to human health or to the living environment. The factory or enterprise, which has specified facility, is called the specified factory. The effluent standards are uniformly applied to all public water areas in the country, in principle. Even in the areas where pollution is not so serious, same effluent standard is applied in order to prevent water pollution in the future. As for the area where it is deemed that the national standard is not sufficient, more stringent standards are applicable by enacting prefectural ordinances. In case

that control of other substances than those regulated in national effluent standard is required, prefectures can add such substances to their own standard by enacting prefectural ordinances.

Table-3 shows the effluent standards of Kanagawa prefecture and Shiga prefecture, and national standard, as an example. As for the items that add-on control is not established, national standard is applied. Items not listed in national standard; Nickel, Boron and Antimony; are added to the effluent standard of Shiga prefecture. Effluent standards of nitrogen and phosphorus are also originally established for the prevention of eutrophication of public water areas.

3-1) Application

In the national standard, regulation is set by maximum permissible level. As for the items related to living environment such as BOD, COD and SS, daily average values are also established. The effluent standards for living environment are not applied to factories and enterprises, which are discharging water less than 50 m^3/day.

3-2) Provisional Measures

A lenient standard had been provisionally applied to factories and enterprises of certain specified industrial sectors. In 1976, these provisional standards were abolished, and new provisional standards for special industrial sectors including manganese industry were established. The newly established provisional standards were amended or abolished in 1979, 1981 and 1986. These provisional standards are applicable to small or medium enterprises and/or the specific industries for which the pollution control is technically difficult. In other words, a certain period of time is required to apply uniformly the same effluent standard to such industries and small enterprises.

Table-3 Comparison of Add-on Standard by Prefectural Ordinance and National Standard

Items				Shiga Prefecture	General Standard
	A - area	B - area	C - area		
Cadmium and its compounds	N.D.	/	/	0.01	0.1
Cyanides compound	-	/	/	0.1	
Organic phosphorus compounds	N.D.	0.2	0.2	N.D.	
Lead and its compounds	0.05	/	/	0.1	
Chromium (hexavalent) compounds	0.05	/	/	0.05	
Arsenic and its compounds	0.01	/	/	0.05	
Total mercury	/	/	/	0.005	
Alkyl mercury	/	/	/	N.D.	
PCB	/	/	/	0.003	
pH	/ /	/	5.8 to 8.6 5.6 to 8.6	6.8 to 8.5 /	
BOD	15 (10)	25 (20)	/	70 to 100	
COD	15 (10)	25 (20)	25 (20)		
SS	35 (20)	70 (40)	70 (40)		
n-hexane extract (mineral oil)	3	/	/		
n-hexane extract (animal and vegetable oils and fats)	3	5	5		
Phenol	0.005	0.5	0.5		
Copper	1	1	1		
Zinc	1	1	1		
Soluble ion	0.3	3	3		
Soluble manganese	0.3	1	1		
Chromium	0.1	/	/		
Fluorine	0.8	/	/		
Numbers of coliform groups	/	/	/		
Nickel	0.3	1	1		
Boron	/	/	/		
Antimony	/	/			

3-3) Enforcement to Observe Effluent Standard

The factories and enterprises that intend to discharge effluents to public water area must submit a report prior to the start of plant operation. When the governor of a prefecture deems that the effluents do not satisfy the effluent standard, he can order to change or abolish the plant. Further, the governor has a right to enter the factories or enterprises to check the quality of effluent water from specified plants and other plants without prior notice. In case that violation of effluent standard is found, the governor can order to discontinue the discharge of effluent water or to improve the facilities. Although a penalty is applicable to such violation, grace period of 6 to 12 months is usually provided. The purpose of this grace period is to encourage the factory or enterprise to take required measures. A penalty is not applied in case that quality of effluent water is improved to a level that meets with the standard within this grace period. On the other hand, any person who violates the order of the governor would be punished immediately.

Enterprises have obligations to measure the pollution level of the effluents by themselves and keep the records of measurements.

4) Total Pollution Load Regulation

It was observed that an improvement of water quality cannot be achieved by regulating only the concentration of each effluent at closed water areas near highly populated and/or factory overcrowded areas. Therefore, total-pollution-load regulation has been introduced to reduce the total volume of pollutants. At present, this regulation is defined as follows:

- Specified Water Area: Tokyo Bay, Ise Bay and Seto Inland Sea
- Specified Item: COD
- Specified Area: Areas that have pollution sources flowing into the specified water area (20 prefectures)

The standard for total pollution load regulation is applicable to the factory and enterprises that are discharging effluent water in excess of 50 m^3 per day and located in the specified area. Thepermissible amount for each enterprise is defined in terms of daily amount of pollutant.

5) Role of Local Governments

In the Water Pollution Control Law, the governments of local public bodies such as prefectures and designated cities, which have the closest relationships with factories and business enterprises in each region, are authorized as the responsible organization for pollution control. The most important roles and functions of the local governments are to supervise specified

facilities through inspection of such facilities and to provide guidance, advice and recommendation for pollution control. Continuous surveillance of water quality in concerned public water area is also an important role of the local governments.

Prior to providing guidance, recommendation or advice, the local government undertakes inspection to evaluate the state of water consumption in manufacturing process, quality of process water, operational condition of waste water treatment facility, quality of effluent water pollution load, etc. Detailed investigations such as the measurement of fluctuations of water quality and flow rate are conducted to study the suitability and/or applicability of various pollution control technologies, if necessary. Based on the results of the above inspections and investigations, the governor of the prefecture gives technical guidance, recommendation or advice for the reduction of pollutants and improvement of the quality of effluent water. The purpose of the water quality surveillance is to evaluate the state of attainment of the Ambient Water Quality Standard for Water Pollution. Since samplings and analyses for the above purpose should be made by the same procedure and method, procedures and methods of sampling and analysis are defined as a part of notification of Water Pollution Control Law.

6) Financial Assistance and Tax Incentives

In Japan, the Environmental Pollution Control Service Corporation was founded in 1965. It was renamed as the Japan Environmental Corporation to encourage the installation and improvement of wastewater treatment facilities. This corporation has been lending loans with low interest rate and long-term repayment. This funding system is called the "Pollution Control Facility Loan". In addition to the Environmental Pollution Control Service Corporation founded for the above special purpose, other governmental financing institutes have been providing special loans with low interest. These institutes include the Japan Development Bank (now Development Bank of Japan), Japan Finance Corporation for Small Business and People's Finance Corporation (now National Life Finance Corporation). Their financial support has greatly contributed to reduce the financial burdens of enterprisers for the investment in pollution control facilities. The features of the loan and tax incentives of Japan are summarized in the following sections. These systems have greatly contributed to encourage enterprisers to invest in pollution control facilities.

6-1) Financial Assistance

(a) Japan Finance Corporation for Small Business
- Loan for installation of water pollution control facilities, Period: 15 years, Amount: not exceeding 702 million Japanese Yen for each project

(b) Japan Small and Medium Enterprise Corporation

- Loan for leasing business of water pollution control facilities, Period: 15 years Interest Rate: 2.7% p.a., Amount: not exceeding 65% of total cost
- Loan for joint venture businesses on installation of water pollution control facility (approval of prefectural government is required), Period: less than 20 years, Interest Rate: zero, Amount: not exceeding 80% of total cost

(c) Development Bank of Japan
- Loan for water pollution facilities, Amount: not exceeding 40% of total cost

(d) Japan Environmental Corporation
- Construction and transfer program
- Loan for water pollution control facilities, Period: 15 years, Interest Rate: 2.3% p.a., Amount: not exceeding 80% of total cost

Note: The above two functions were transferred to the Development Bank of Japan.

6-2) Tax Incentives

(a) Special depreciation for specified facilities: 18% of the facility acquisition cost is applicable to pollution prevention facilities.

(b) Tax reduction at the movement of specified factory: In case that factory, located at the area where water pollution is serious, is moved to the area where water pollution is not serious, tax on the profit on selling asset can be reduced.

(c) Reduction of property tax: Fixed property tax on water pollution control facilities is reduced to 1/6 of standard tax rate.

(d) Exemption of special landholding tax: Special landholding tax on a land used for the installation of water pollution control facilities is exempted.

(e) Reduction of office tax: As for the pollution control facilities of enterprise installed by enterprise, 3/4 of corporation enterprise tax is exempted.

3. Pollution Control of Industrial Wastewater by Enterprises

The following section describes major measures taken by enterprises for the prevention of water pollution.

1) Investment in Research and Development Works for Water Pollution Control

After the Pollution Session of the Diet in 1970, the Water Pollution Control Law has been enacted and the central and local governments have enforced more stringent regulations. Public attention to environmental pollution control has been rising. Under the above situations, many enterprisers, which have recognized their social duties for pollution control, have signed Agreement on Environmental Pollution Control with governments of city, town or village or residents and have started the R&D works for pollution control technologies and an investment

in pollution control facilities. Mainly during 1970s, environmental remediation works including removal of contaminated sediments with high concentration of hazardous substances such as mercury and PCB were also conducted by enterprises, based on the Polluter-Pays Principle.

After that, and in order to comply with the amendment and strengthening of Effluent Standard, Environmental Standard and economic recessions caused twice by oil crises, many Japanese enterprises have made efforts to reduce the cost of pollution control through the development of superior pollution control technologies. An investment in pollution control facilities had been regarded as a waste of money for a long time. However, the rapid expansion of the market of pollution control facility under active investments by many enterprises throughout the country has created new business opportunities. For many companies, pollution control facilities have been becoming an important source of profit. This situation further encouraged the development of pollution control facilities with superior performance.

In response to the agreement of Global Summit held in Brazil in 1992, the Environment Basic Law was enacted in 1993. The objective of environmental administration has fundamentally changed from the "Prevention of environmental pollution" to the "Reduction of pollution load". The basic policy of enterprises for pollution control has also shifted from the treatment of pollutant at end of production process (End of Pipe: EOP technology) to the reduction of pollutant by other measures. These measures included the following:

1. Conversion of production process to low-pollution process,
2. Change of raw materials and sub-materials to low-pollution type materials,
3. Reduction of effluent water and saving of water consumption by recycling process water,
4. Recovery of valuable materials from wastewater, re-use of wastes and development of environmentally friendly production processes.

The above technologies are developed based on the know-how accumulated through the efforts of enterprises to develop high-performance and low-cost pollution control technologies under the enactment of more stringent regulations and economic recessions in 1970s. While these technologies are not systematized, they are called "Cleaner Production" technologies. The cleaner production technologies are noted as suitable technologies not only for developed countries that have been making efforts to harmonize industry and environment, but also for developing countries that are aiming for the development of economy.

2) Development of Organization for Pollution Control

Law Concerning the Improvement of Pollution Prevention System in Specified Factories was

enacted in 1971, and enterprises having specified facilities were obliged to develop the organization for pollution control. This organization consists mainly of a "Supervisor of Pollution Control", "Pollution Control Manager" and "Chief Pollution Control Manager". Usually, a representative of the enterprise such as a general manager of the factory is assigned to the Supervisor of Pollution Control, because no qualification is required. On the other hand, Pollution Control Manager who is responsible for pollution control of the factory as a technical specialist must be a qualified person by the government through examination. Qualifications are categorized into groups of air, water, noise, soot and dust, and vibration. Required qualifications for each factory are determined based on the type and size of individual factory, and every factory with specified facilities must designate the Pollution Control Manager(s) with qualifications of required categories. Only large-scale specified factories that discharge more than 10,000 m^3/day of wastewater are obliged to designate the Chief Pollution Control Manager. This manager also must be a person who has passed the qualifying examination. The examinations for certifying these managers have been held by Industrial Pollution Control Association of Japan (now Japan Environmental Management Association for Industry), under the authorization of the central government. Since academic background is not a condition of qualification for examination, anybody can take the examination.

The development of organization for pollution control led by qualified persons has greatly contributed to the spontaneous and systematic control and prevention of pollution by factories and enterprises. Qualification system has been acting as an incentive for employees to study pollution control technologies, because qualified persons are socially approved as specialists of pollution control and enterprises provide opportunities of promotion to such persons.

3) Effectuation of Effluent Water Analysis by Private Laboratories

As for the environmental measurement, the national qualification system of the "Certified Environmental Measurer" was established in 1974, but an enterprise has no obligation to station a person of this qualification. The qualified measurer can conduct the management works of environmental measurement such as measurement of water quality, certification of the accuracy of measurement, maintenance of measurement equipment, quality control of measurement, and improvement of measurement methods. This system has been greatly contributing to the improvement of environmental measurement capability of private sector.

The "Certified Measurement Laboratory" is a private laboratory authorized by the governor of prefecture, and has certified environmental measurer(s) and required machinery and equipment for environmental measurement. Since the reports issued by the Certified Measurement Laboratory are approved for submission to the governmental organizations, many factories and

enterprises are entrusting sampling and analysis of effluent water to them. As a result of effective utilization of the outside laboratories, factories and enterprises have achieved to reduce the costs of measurement instruments, personnel in charge of analysis and their training. In addition, this system has been playing an important role for the effectuation of analytical works and for the improvement of accuracy and reliability of the measurements.

APPENDIX-3

IMPACT ON WATER IN LAGOON BY DISCHARGING THE TREATED WATER OF NEUTRALIZATION PLANT AT EIS

IMPACT ON WATER IN LAGOON BY DISCHARGING THE TREATED WATER OF NEUTRALIZATION PLANT AT EIS

1. PREAMBLE

This paper is presented to respond to the new and strong request made by Egyptian Side during the 4th Site Survey of JICA Study Team. The Study Team made the basic design of the neutralization facilities for the acid waste water out of pickling and rinsing processes of Egyptian Iron & Steel Co. (EIS). The outline of the requested study is as follows: in case that the treated water from the above-mentioned neutralization facilities be additionally discharged into the lagoon to which almost all the waste water(s) have been currently discharged, what effects or impacts on the water quality in the lagoon would be anticipated, since the water in the lagoon is recycled or re-used for certain purposes or processes for steel production.

Therefore, before JICA Study Team left Cairo, the Team requested EIS to make the following information and data available.

- current flow rates with the water quality into and out of the lagoon
- the purpose and processes where the water in the lagoon has been actually recycled and the guideline of required water quality for such recycle and service
- EIS's intention of control of water quality of discharged waste water out of EIS to the public domain such as River Nile and desert to satisfy the regulations at present and in future

Later, Egyptian Side duly provided only some information consisting of "flow rates into and out of the lagoon" with limited data of water quality. As discussed in the later part of this report, the data are insufficient and, in some points, dubious. Accordingly, it is infeasible to discuss the water quality of recycled water and its recommendable usage in detail and to propose some practical methods and means for the discharge of excess waste water to River Nile, the desert or public domain.

In this paper, by assuming the simple model, the impact on the recycle or re-use of water in the lagoon is discussed. Further, "the guideline of industrial water quality and monitoring" actually adopted in one of integrated steel mills in Japan is herein tabulated. It is highly expected for Egyptian Side to utilize it for reference.

2. CONDITIONS FOR STUDY

1. The neutralization facilities and its effluent (treated water) are described in Chapter 9.5.4 "Modified case"

2. The study utterly depends on the basic information and data provided by EIS which is attached in this report. The balance between total flow-in rate and total flow-out rate is assumes as the sum of evaporation loss and seepage loss into ground at the lagoon.
3. Total Dissolved Solids (TDS) in the treated water out of the neutralization facilities
   TDS is 3,280mg/litre: Ref. ITEM 3.(1) hereunder.
4. Total Hardness (TH) in the treated water out of the neutralization facilities
   TH is 2,190mg/litre as $CaCO_3$: Ref. ITEM 3.(2) hereunder. The hardness originally solved in the rinsing water and the hardness due to magnesium are not counted since they are estimated as less than 100ppm.
5. The concentration of TDS in water stored in the lagoon is homogeneous and constant. It is also estimated that the overall retention time at the lagoon is approximately one hour.
6. The overall hardness of all the flowing-in water to the lagoon is equal to TH of the water out of the lagoon to Sand Filters (W_o1), which is 170ppm as $CaCO_3$.
7. The specific gravity of each water is 1.
8. The discharge of waste waters (treated or non-treated) into the lagoon and the discharge of excess water out of the lagoon to desert do not infringe any laws nor regulations.

3. DISCUSSION

(1) TOTAL DISSOLVED SOLIDS IN THE TREATED WATED

Major chemical reactions at the neutralization facilities are:

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$$

$$2FeSO_4 + 2Ca(OH)_2 + 5H_2O + 1/2O_2 \rightarrow 2Fe(OH)_3 \downarrow + 2CaSO_4 \cdot 2H_2O \downarrow$$

Those chemical compounds are practically settled and removable.

However, calcium sulfate has such solubility:

in case of anhydrite: solubility 0.298 in 100 parts at 20deg.C

in case of gypsum: solubility 0.257 in 100 parts at 50deg.C

In this study solubility of calcium sulfate is 2,980mg/litre.

While the solubility product of ferric hydroxide is: $Ksp=3.8\times10^{-38}$, the concentration of ferric ion of the solution at pH 8.0 is:

$$Fe^{+3} = 3.8 \times 10^{-38} \div (10^{-6}) \times 55.8 \times 10^{-3} \text{mg/litre}$$

$$= 2.12 \times 10^{-17} \text{ mg/litre}$$

Therefore, the concentration of ferric ion is regarded as "zero".

As mentioned above, the concentrations of calcium and ferric ions are saturated and in the treated water out of the neutralization facilities and practically constant regardless the flow rate through the neutralization facilities.

It is assumed that the concentration of TDS in the treated water consists of the saturated calcium sulfate (2,980 mg/litre) and of other TDS (300mg/litre) originally contained in the rinsing water and the sum of them is **3,280 mg/litre**.

(2) TOTAL HARDNESS IN THE TREATED WATER

Total hardness in the treated water out of the neutralization facilities is determined from the concentration of calcium sulfate (Molecular Weight 136). Its concentration is, as mentioned above, 2980 mg/litre.

TH = 2,980 mg/litre x 100/136 = **2,190 mg/litre as $CaCO_3$**.

Hardness due to magnesium ion and Hardness originally existing in the rinsing water are not counted since these hardness would be far less.

(3) WATERS FLOWING INTO LAGOON AND FLOWING OUT OF LAGOON

As the information given by Egyptian Side is limited, simplified cases are to be studied from the standpoint of flowing-in and –out with due consideration of TDS and TH.

Case 1 is based on the flow-in rates of the waters to the lagoon together with concentration of TDS and TH: so-called "flow-in type".

Case 2 is based on the flow-out rate from the lagoon together with concentration of TDS and TH: so-called "flow-out type".

Further, each type is divided into two in accordance of the normal flow rate of the neutralization facilities (960 m^3/day) and the maximum flow rate (2,160 m^3/day).

Therefore, Case 1(a) is of "flow-in type" with 960 m^3/day of treated water from the neutralization facilities while Case 1(b) is of "flow-in type" with 2,160 m^3/day of treated water.

Case 2(a) is of "flow-out type" with 960 m^3/day of treated water from the neutralization facilities while Case 2(b) is of "flow-out type" with 2,160 m^3/day of treated water.

TABLE 1(a), TABLE 1(b), TABLE 2(a) and TABLE 2(b) hereafter attached show the details.

It is noted that there is the difference in flow rate between flowing-in and flowing-out in data given by Egyptian Side. The balance is regarded as evaporation loss and the seepage into ground, though it is not sure that so much water is lost for approximately 1 day of retention time at the lagoon.

4. CONCLUSION

(1) TOTAL DISSOLVED SOLIDS (TDS)

In case that the treated water out of the neutralization facilities be newly discharged in the lagoon, TDS would be changed as follows:

Case 1(a): 1,117mg/litre to 1,148mg/litre, Increment: 31mg/litre (+2.7%)

Case 1(b): 1,117mg/litre to 1,186mg/litre, Increment: 69mg/litre (+6.1%)

Case 2(a): 582mg/litre to 622mg/litre, Increment: 40mg/litre (+6.9%)

Case 2(b): 582mg/litre to 670mg/litre, Increment: 88mg/litre (+15.1%)

Note;

According to the data given by Egyptian Side, there is a remarkable change between overall (composite) TDS (1,117mg/litre) of all streams flowing-in and that (582mg/litre) of stream(s) flowing out of the lagoon. It is very unlikely to decrease TDS in such a lagoon. The reason of such reduction of TDS cannot be discussed.

It is more understandable that evaporation would increase TDS to some extent in the lagoon.

Further, pH value is changed to 11 when water is fed to sand-filters from the lagoon. The reason of such change in pH is also unknown.

In Case 1(a) and (b), the increment of TDS due to the treated water from the neutralization facilities is less than 7% and the impact of the additional treated water is not significant to the present purpose or service of recycled water from the lagoon. However, many streams into the lagoon cannot be discharged to River Nile or to the desert since they cannot satisfy Law 48/82.

In case 2(a) and (b), the increment of TDS is higher than that of Case 1. However, the concentration of TDS, itself, is less than 700mg/litre. Therefore, it is judged that the water from the lagoon can be recycled to the same purpose and service as present.

According to the data given by Egyptian Side, the current concentration of TDS in effluent from the lagoon can satisfy the above-mentioned law for discharging to River Nile or to the desert. However, some treatment is required for adjustment of pH value before discharging it to any public domain.

(2) TOTAL HARDNESS (TH)

In Case 1(a) and (b) as the data are incomplete, the overall (composite) TH in waters flowing-in is assumed as same as TH of the water from the lagoon to sand filters. The highest TH (204 mg/ litre as $CaCO_3$) would be observed in Case 2(b). Though it is very "hard", any major impact due to additional flow-in of the treated water from the neutralization facilities is not foreseeable, so far as the water is recycles for the same purpose and service as present.

Regarding TH there is no restrictive regulation against the discharge of "hard" water to any public domain.

5. SUMMARY

Egyptian Side has not inform for what purpose and service EIS currently recycle the water in the lagoon. However, it is judged that even after the treated water from the neutralization facilities is discharged in the lagoon, the water in the lagoon can be recycled without any significant impact to the same purpose and service as present.

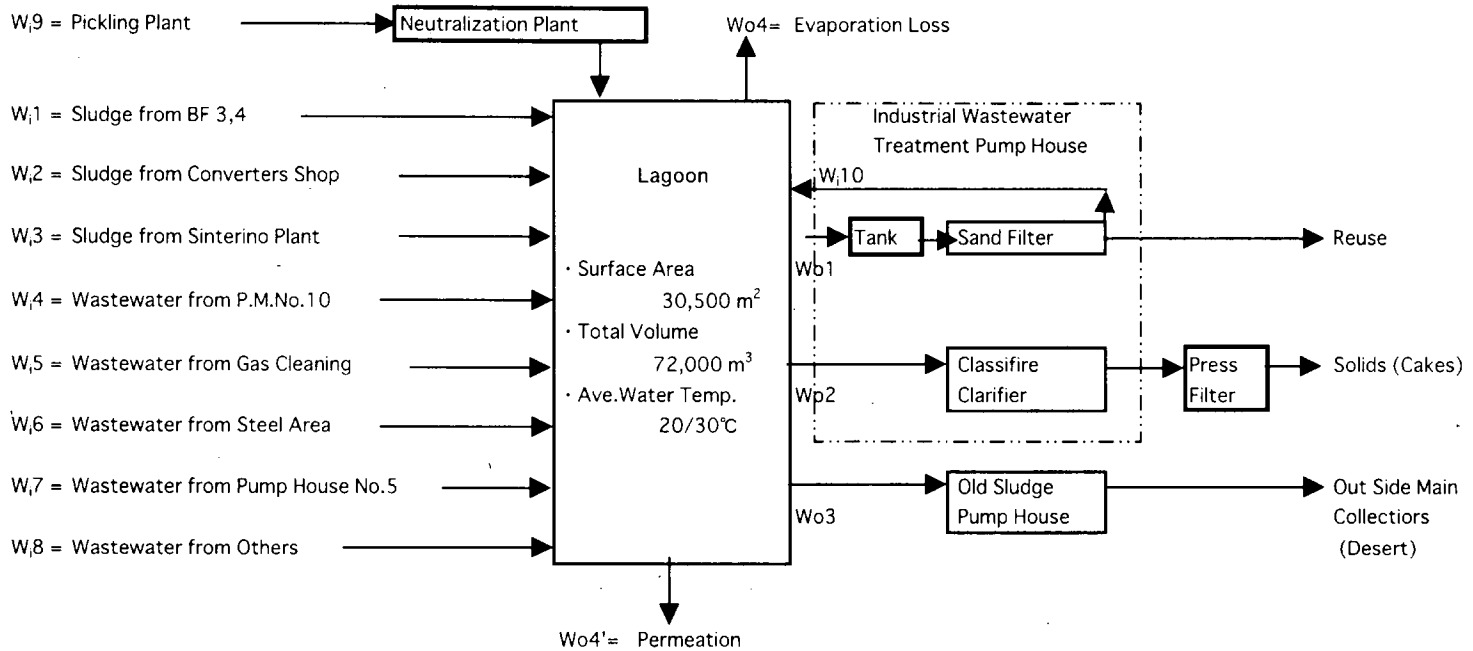
It is recommended that EIS shall monitor the flow rates of water(s) flowing-in and flowing-out together with water quality in future, especially when EIS intends to utilize the water in the lagoon for the new purpose and service or to implement any neutralization plant for rinsing water. Then, such dubious phenomena as the reduction of TDS and increase of pH value through the lagoon would be clarified. Further, the evaporation loss would be estimated.

The recycle or re-use of any water must be studied and surveyed with the water specialists and steel process/production engineers. Steel process/production engineers should be responsible for the quality of products and for the water demand in flow rate and quality. Such guideline or requirement should be documented and made available to the relevant engineers and operators. It is stressed that without good control of production it is infeasible to manage the industrial waste water properly.

Steel production is one of the typical industries demanding huge amount of water with different water quality. TABLE 5 ~ TABLE 8 hereunder attached are the guideline of water quality with monitoring intervals actually authorized and used in one of biggest steel complexes in Japan. Of course, the water quality, available amount and legislative requirements are different from Egypt. Nevertheless, the attached tables are useful as reference and Egyptian steel industries should establish the similar guidelines for steel production and for treatment of waste waters and their effective recycle or re-use.

Table-1

Wastewater Flow & Qualities of The Lagoon at EIS Co.
Case 1(a) (Nor. Flow Case)

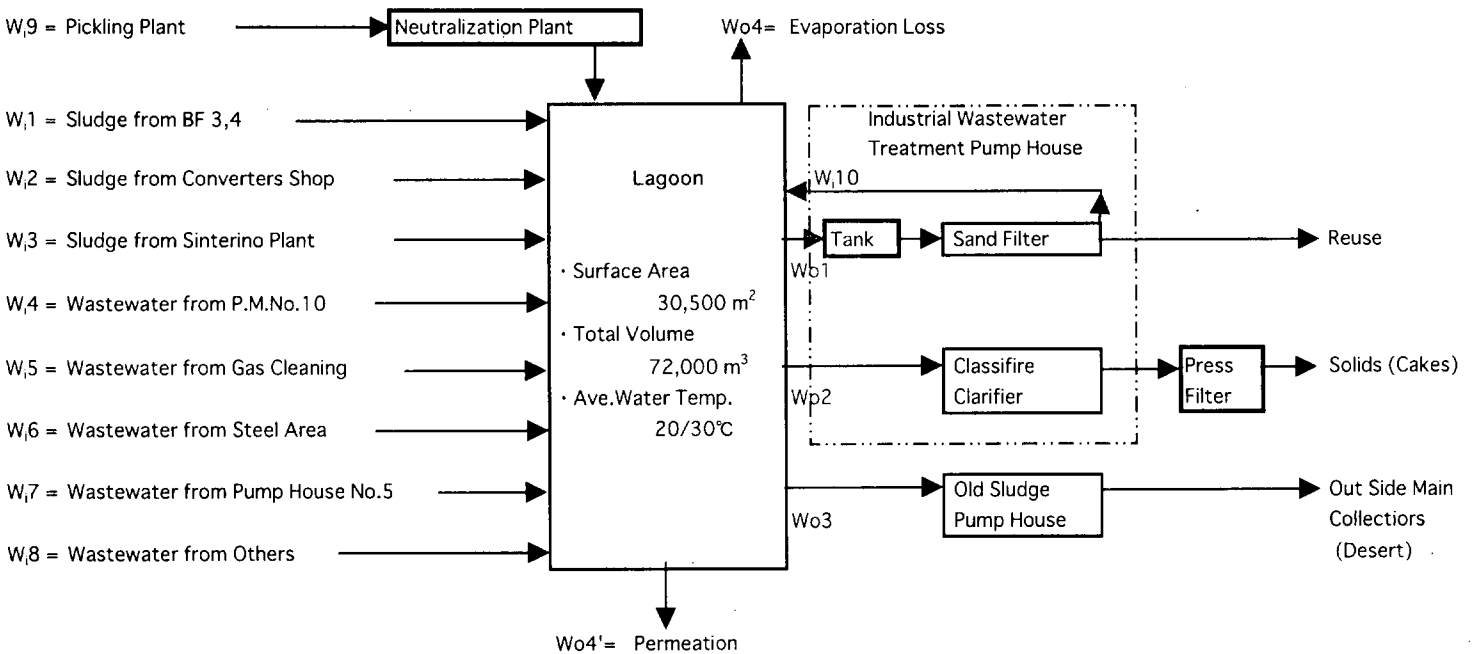


Items			Flow In											Flow Out				
Fluid No.			W_i1	W_i2	W_i3	W_i4	W_i5	W_i6	W_i7	W_i8	W_i9		Total	Total'	W_o1	W_o2	W_o3	Wo4+Wo4	Total
Flow Rate	Average	m^3/day	4,800	10,800	14,400	8,400	3,120	15,600	3,600	3,600	960		64,320	65,280	40,680	400	19,200	5,000	65,280
Qualities	pH	-	6.6	11.-12	8.3	8	6.6	8.3	7.8	8	6.-8				≒11	10.7-12	≒11	-	
	TSS	mg/L	4,600	28,893	350	254	62	120		40			111		111	275,112		-	
	TDS	mg/L	780	915	2,960	424	790	450	480	220	3,280		1,117	1,148	582	500-1,470		-	
	TA	mg/L	90		90	160	70			120			120		120	180		-	
	TH	mg/L	272		230	170	320			120	2,190		170	200	170	228		-	
	Temp.	℃	50-53	50						40			-	-	-	-	-	-	

Total : Current Operation condition (w/o Wi 9)
Total': Estimated Operation condition (w/ Wi 9, in future)
W_i10 : Not included in this water balance
NOTE 1:TH of "Total" is assumed as same as that of Wo1

Table-2

Wastewater Flow & Qualities of The Lagoon at EIS Co.
Case-1(b) (Max.Flow Case)

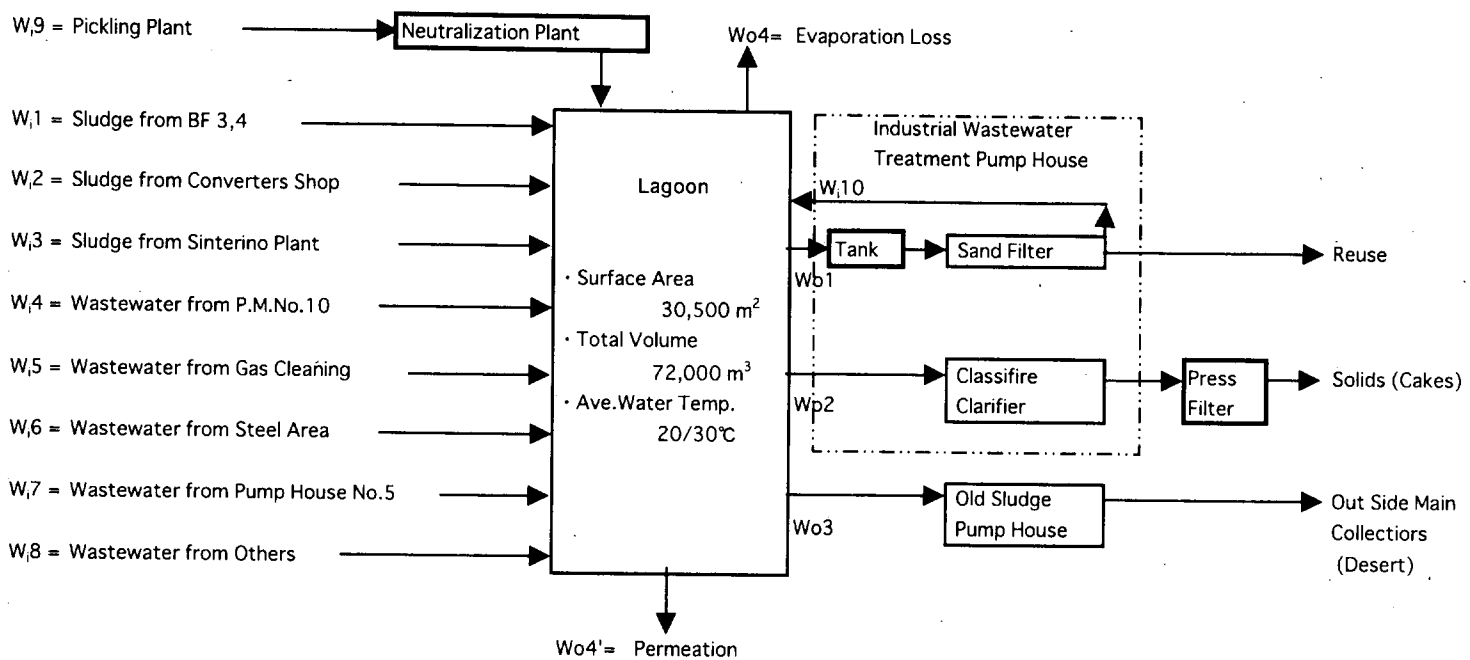


Items			Flow In											Flow Out				
Fluid No.			W_i1	W_i2	W_i3	W_i4	W_i5	W_i6	W_i7	W_i8	W_i9	Total	Total'	W_o1	W_o2	W_o3	Wo4+Wo4	Total
Flow Rate	Average	m^3/day	4,800	10,800	14,400	8,400	3,120	15,600	3,600	3,600	2,160	64,320	66,480	40,680	400	19,200	6,200	66,480
Qualities	pH	-	6.6	11.-12	8.3	8	6.6	8.3	7.8	8	6.-8			≒11	10.7-12	≒11	-	
	TSS	mg/L	4,600	28,893	350	254	62	120		40		111		111	275,112		-	
	TDS	mg/L	780	915	2,960	424	790	450	480	220	3,280	1,117	1,187	582	500-1,470		-	
	TA	mg/L	90		90	160	70			120		120		120	180		-	
	TH	mg/L	272		230	170	320			120	2,190	170	236	170	228		-	
	Temp.	℃	50-53	50						40		-	-	-	-	-	-	

Total : Current Operation condition (w/o Wi 9)
Total': Estimated Operation condition (w/ Wi 9, in future)
W_i10 : Not included in this water balance
NOTE 1:TH of "Total" is assumed as same as that of Wo1

Table-3

Wastewater Flow & Qualities of The Lagoon at EIS Co.
Case-2(a) (Nor. Flow Case-Wo1 Base)

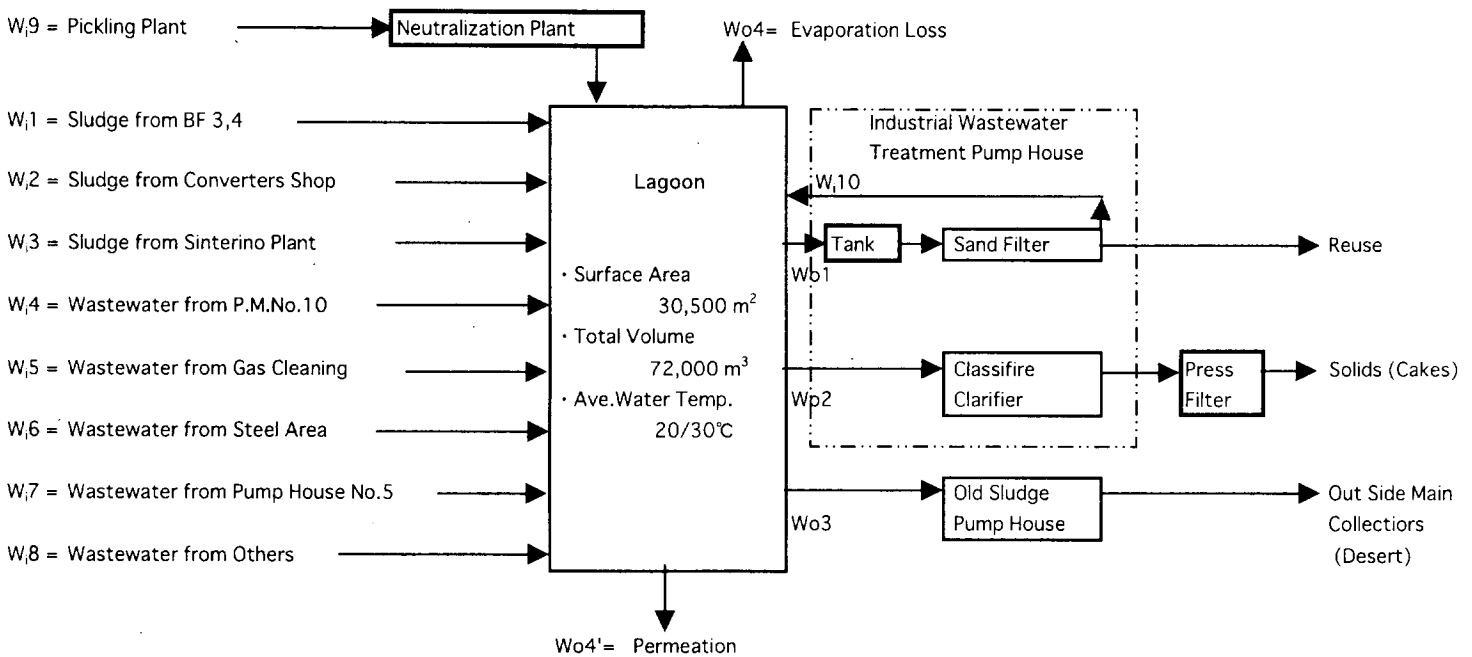


Items			Flow In											Flow Out				
Fluid No.			W_i1	W_i2	W_i3	W_i4	W_i5	W_i6	W_i7	W_i8	W_i9	Total	Total'	W_o1	W_o2	W_o3	Wo4+Wo4	Total
Flow Rate	Average	m^3/day	4,800	10,800	14,400	8,400	3,120	15,600	3,600	3,600	960	64,320	65,280	40,680	400	19,200	5,000	65,280
Qualities	pH	-	6.6	11.-12	8.3	8	6.6	8.3	7.8	8	6.-8			≒11	10.7-12	≒11	-	
	TSS	mg/L	4,600	28,893	350	254	62	120		40		111		111	275,112		-	
	TDS	mg/L	780	915	2,960	424	790	450	480	220	3,280	582	622	582	500-1,470		-	
	TA	mg/L	90		90	160	70			120		120		120	180		-	
	TH	mg/L	272		230	170	320			120	2,190	170	200	170	228		-	
	Temp.	℃	50-53	50						40		-	-	-	-	-	-	

Total : Current Operation condition (w/o Wi 9)
Total': Estimated Operation condition (w/ Wi 9, in future)
W_i10 : Not included in this water balance
NOTE 1:TH of "Total" is assumed as same as that of Wo1

Table-4

Wastewater Flow & Qualities of The Lagoon at EIS Co.
Case-2(b) (Max. Flow Case-Wo1 Base)



Items			Flow In											Flow Out				
Fluid No.			W_i1	W_i2	W_i3	W_i4	W_i5	W_i6	W_i7	W_i8	W_i9		Total	Total'	W_o1	W_o2	W_o3	Wo4+Wo4	Total
Flow Rate	Average	m^3/day	4,800	10,800	14,400	8,400	3,120	15,600	3,600	3,600	2,160		64,320	66,480	40,680	400	19,200	6,200	66,480
Qualities	pH	-	6.6	11.-12	8.3	8	6.6	8.3	7.8	8	6.-8				≒11	10.7-12	≒11	-	
	TSS	mg/L	4,600	28,893	350	254	62	120		40			111		111	275,112		-	
	TDS	mg/L	780	915	2,960	424	790	450	480	220	3,280		582	670	582	500-1,470		-	
	TA	mg/L	90		90	160	70			120			120		120	180		-	
	TH	mg/L	272		230	170	320			120	2,190		170	236	170	228		-	
	Temp.	℃	50-53	50						40			-	-	-	-	-	-	

Total : Current Operation condition (w/o Wi 9)
Total': Estimated Operation condition (w/ Wi 9, in future)
W_i10 : Not included in this water balance
NOTE 1:TH of "Total" is assumed as same as that of Wo1

Example of Criteria for Water Re-Use in Integrated Steel Plant in Japan

TABLE 5

For Dust Collection and De-Gassing at Basic Oxygen Furnace (BOF)

Classification	Direct Water			
Application	BOF Dust Collection		BOF Vacuum System	
	Criteria	Analysis Frequency	Criteria	Analysis Frequency
PH	7.0/9.5	2/M	6.5/8.5	2/M
SS(mg/l)	< 60	2/M	< 20	2/M
Hardness($CaCO_3$) (mg/l)	< 100	2/M	< 80	2/M
Cl^- (μ S/cm)	< 50	2/M	< 50	2/M
Oil (mg/l)	< 2	2/M	< 2	2/M
COD(mg/l)	< 3	2/M	< 3	2/M
M-Alkalinity(mg/l)				
Electric Conductivity (μ S/cm)	< 1000	2/M	< 600	2/M
Fe^{2+} (mg/l)				
MPN (/ml)				
Turbidity				

TABLE 6

For Direct Cooling Water in Rolling/Milling Process

Classification	Direct Cooling Water			
Application	Blooming Mill		Hot Strip Mill	
	Criteria	Analysis Frequency	Criteria	Analysis Frequency
PH	6.5/8.5	2/M	6.5/8.5	2/M
SS(mg/l)	< 10	2/M	< 20	2/M
Hardness($CaCO_3$) (mg/l)	< 80	2/M	< 80	2/M
Cl^- (μ S/cm)	< 600	2/M	< 50	2/M
Oil (mg/l)	< 2	2/M	< 2	2/M
COD(mg/l)	< 5	2/M	< 5	2/M
M-Alkalinity(mg/l)				
Conductivity (μ S/cm)	< 3000	2/M	< 600	2/M
Fe^{2+} (mg/l)				
MPN (/ml)				
Turbidity				

TABLE 7

Indirect Cooling Water in Steel Production Process

Classification	Indirect Cooling Water			
Application	Cooling Water for CCM		Cooling Water for LM Furnace	
	Criteria	Analysis Frequency	Criteria	Analysis Frequency
PH	6.5/8.5	2/M	6.5/8.5	2/M
Chemicals Concentration (mg/l)	10/15	2/M	80/110	2/M
Hardness($CaCO_3$) (mg/l)	< 80	2/M	< 120	2/M
Conductivity (μ S/cm)	< 450	2/M	< 600	2/M
Cl^- (mg/l)	< 50	2/M	< 100	2/M
COD(mg/l)				
M-alkalinity(mg/l)				
T-Fe (mg/l)				
MDD	20/50	1/M	20/50	1/M
MPN (/ml)	$< 10^3$	1/M	$< 10^3$	1/M
Turbidity				

Note : Re-use of Lagoon Water at EIS should be avoided.

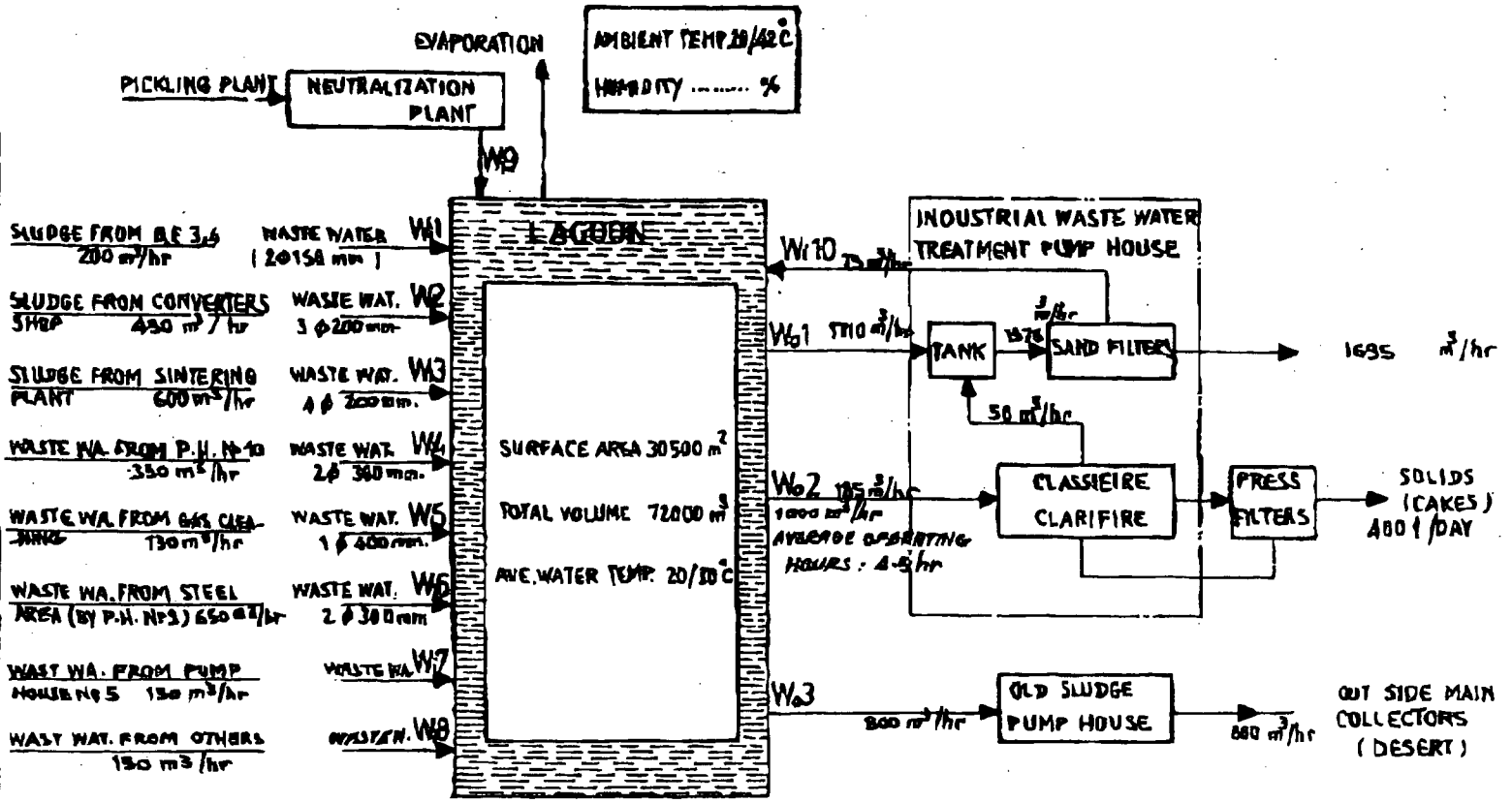
Note: MDD is a kind of parameters to express the corrosiveness.

TABLE 8

For Sprinkling Water against Dust in Material Yard

Classification	Direct Water			
Application	Sprinkling Water in Material Yard Case-1: Probable Discharge to (outside) Public Domain		Dust Proof Water Case-2:No discharge to (outside) Public Domain	
	Criteria	Analysis Frequency	Criteria	Analysis Frequency
PH	6.0/8.5	Const.	pH value must be controlled within 6~8.5. Other criteria may not be essential. In case that waste water recovered at the yard is discharged to outside public domain, the waste water shall be treated to meet the relevant regulations.	
SS(mg/l)	< 20	2/M		
Hardness($CaCO_3$) (mg/l)	< 100	2/M		
Cl^- (μ S/cm)	< 50	2/M		
Oil(mg/l)	< 2	2/M		
COD(mg/l)	< 7	2/M		
M-Alkalinity(mg/l)				
Conductivity (μ S/cm)				
Fe^{2+} (mg/l)	< 10	2/M		
Zn(mg/l)	< 5	2/M		
N-He(mg/l)	< 0.5	2/M		

WASTE WATER FLOW & QUALITY OF THE LAGOON AT EIS. CO.



			FLUID INTO										FLUID OUT			
FLUID NO			Wi 1	Wi 2	Wi 3	Wi 4	Wi 5	Wi 6	Wi 7	Wi 8	Wi 9	Wi 10	Wo 1	Wo 2	Wo 3	
IN-FLOW RATE	AVERAGE	m³/d	4800	10800	12600	8400	3120	15600	3600	3600		900	41040	4500		3700
QUALITY	P-H.	—	6-6	10-5÷12	8-3	8	6-6	8-3	7-8	8		10-5÷11	10-6÷11	10-7÷12		10-5
	TSS	mg/l.	4600	28853	350	254	62	120		40		250	111	275112		27
	TDS	mg/l.	780	915	2960	424	790	450	480	220		582	582	500÷1470		
	TA	mg/l.	90		90	160	70			120		120	120	180		
	TH	mg/l.	272		230	170	320			120		170	170	228		
	TEMP.	C°	50÷53	50						40						

(WO1) 24 hr/d CONTINUOUS STEPPING
(WO2) 4 hr/d OPERATING (DAYTIME)