

10. タウンサ堰道路橋改修にかかわる追加的検討

10.1. タウンサ堰道路橋の現状

タウンサ堰道路橋は、タウンサ堰の管理橋および地域交通の要として、1959年、堰工事の完成とともに供用を開始した。同橋は、車両通行幅員24ft(7.32m)、両側に6ft(1.83m)の歩道帯を有する鉄筋コンクリートゲルバー桁橋で、70ton設計荷重(Class AA Army Loading)で計画されている。建設後、約40年が経過している現在、スラブ下端の鉄筋の多くがむき出し状態にあり、スラブを支える5列の橋桁(高さ1.07m)には一部に変形・クラックが見られるが、普通車両の通行には支障はみられない。1995年12月には、灌漑電力局と土木交通局との橋梁耐久性に関する合同調査を実施した結果、現状では早急に破壊にいたる兆候は見られないが、今後の監視体制の強化と適切な保守・修理の実施が必要とし、以下の通行車両規制を提案している。

3軸トラック(10輪)	規制全重量40ton以下
4軸トレーラー(14輪)	規制全重量55ton以下
6軸トレーラー(22輪)	規制全重量65ton以下

タウンサ堰道路橋は、現在、車両分類にしたがって通行量を徴収している。これは、一般乗用車・トラクター3ルピー、ワゴン車5ルピー、バス・トラック15ルピー、トレーラー100ルピーとなっており、灌漑電力局が徴収管理を行っている。灌漑電力局は、一般公開入札方式で請負業者を選定し、委託徴収を行う。請負業者は徴収額と請負金額との差額分を国庫に納入している。年間の徴収額は、8~10百万ルピーと見積もられその半分以上は国庫に納額されている。

10.2. タウンサ堰道路橋改修の必要性

現在の通行量は、一日当たり1,348台(乗用車437台、バス・トラック508台、ワゴン車149台、トレーラー137台、トラクター119台)となっており、10年前の3倍に増加しているといわれている。また、下流のGhazi Ghat橋で20ton以上の車両通行規制を行っていることから、唯一兩岸通行が可能な同タウンサ堰橋に迂回する重量貨物車両通行が多く、今後さらに増加する傾向にある。加えて、現在工事中のインダスハイウェイが完成すれば(今後5年以内の開通の見通し)、同ハイウェイに最も近いアクセスルートにあたるタウンサ堰橋の交通量も急増するものと予想されている。

現在みとめられる橋桁の変形・クラックも今後進行するとみられとともに、現在の通行規制外の車両通行需要も増加するため、これに対処するための改修が必要と判断される。

10.3. タウンサ堰道路橋改修計画

道路橋の老朽化は、全体的に進行しているとみられるため、一部の補修、掛け替えではその目的を達せするには不十分で、全面にわたる改修が提案される。この道路橋の架橋では、盛り土上での施工によったため建設当時には大きな困難は見られなかったが、河道変換を行い現在水面上に位置する上部工の掛け替えにはかなりの困難がともなう。

改修計画としては、現在の床版、桁を順次撤去して、PC橋に置き換える。

10.4. タウンサ堰道路橋改修工事および工事費

(1) 改修方法

各橋脚間の吊り桁部から作業を進め、同部施工後、両橋桁の施工に移る。各工区では、片面通行を確保しつつ、片側より施工を進める。床版の施工では、下方よりの支持が難しいため、吊り型の支保工を採用する。

(2) 工事費

工事費は、現状のゲルバー橋撤去と、新たな鋼橋の建設を含めて、2,407 百万ルピーと見積もられる。ただし、鋼材については、所要の強度を有する鋼材のパキスタン国内での調達は難しいことから、輸入調達とする。

10.5. 事業評価および事業実施方法

(1) 経済評価

タウンサ堰道路橋の施設便益としては、道路橋を往来する通行車両、人的通行の輸送・交通便益と、タウンサ堰維持管理上の維持管理費用節減効果が挙げられる。

輸送・交通便益は、道路橋が無い場合に迂回を余儀なくされる燃料、車両損料等の節減額として算定する。現在の利用交通車両は、タウンサ堰がない場合には、下流の Ghazi Ghat 橋（タウンサより 80 km）か上流のチャシュマ堰橋（タウンサより 280 km）を利用することになる。交通量を現状なみの 1,300 台/日程度とすれば、同便益は 1,281 百万ルピー/年（経済価格）と見積もられる。

維持管理費節減便益としては、道路橋が無い場合に必要とされるタウンサ堰維持・管理費用のうちで、道路を活用することによって節減できる金額とする。維持管理作業要員、資材はすべてボートで移動するものと考え、道路橋はこの費用を節減できるものとする。このための費用としては、0.34 百万ルピー/年と見積もられる。これらを合計すれば、総合便益は 1,281.34 百万ルピー/年と見積もられる。

これに対して、改修工事費 2,407 百万ルピー（外備分 626 百万ルピー、内備分 1,781 百万ルピー）、維持管理費用としては軽微のコンクリート修理工事と清掃等で 0.13 百万ルピー/年と算出される。

プロジェクトライフを 50 年とした場合の EIRR は 25.5 % (NPV (12 %) : 3,680 百万ルピー、B/C : 3.19) と計算され、経済的にも十分妥当であると判断できる。

(2) 財務評価

年間の契約金額を差し引いた徴収収益は、5 百万ルピー以上と見積もられ、今後の交通量の増加にもなって徴収額の増大が期待される。

道路橋の現在の維持管理費は、軽微で年間数万 Rs. 程度で、管理を担当している灌漑電力局が負担している。仮に、独立の管理主体を想定して、現状に従った通行量の徴収と維持管理の実施を行うとすれば、十分財務的にも健全であることが確認される。

(3) 事業実施方法

事業実施時期としては、ゲート施設、水利構造物などの本件改修計画本格工事が全て完了した後、2 年間の工期で着手するものとする。

11. 結論および勧告

11.1. 結 論

本件調査では、パンジャブ州政府、とりわけ灌漑電力局の協力によって、タウンサ堰灌漑システムの改修計画を完成することができた。現地調査を通じて、調査対象地域では過酷な自然環境の中で活発な農業生産活動、活気ある社会生活が営まれており、それらの全てがタウンサ堰灌漑システムにより安定的に供給される「水」に依存していることが確認された。また、このような地域経済、社会の基礎を成しているタウンサ堰灌漑システムも、完成後、約40年を経過して顕著な損傷、機能障害が見られるようになってきたことも認められた。これらから、タウンサ堰灌漑システムはタウンサ堰を中心に放置できない状況で、適切な対処を早急に施さなければ、堰システムそのものが灰燼に帰すことも憂慮される深刻な事態にあることが明らかとなった。

本件調査では、このような現状把握に基づいて、各サブシステム、構成部分ごとに分析・診断して、問題点を明らかにし幾つかの改修方法を検討した。このような改修方法の中から、全体の改修目標を明確にしつつ、それぞれのサブシステムごとに最適な改修規模・方法を選定し全体改修計画を策定した。

本件改修計画は、経済、財務、環境等の各側面から事業評価を行った結果、実施優先度が極めて高いことが確かめられた。経済的内部収益率は50.2%と極めて高い投資効果を表しているとともに、現状を放置した場合の経済・社会的損失が如何に大きなものであることを示している。また、事業を実施した場合の環境面での顕著な負のインパクトも認められず、早急な事業実施が可能と判断された。

11.2. 改修事業実施にかかわる勧告

- 1) 本件改修計画は、経済、社会、財務、環境の各面から実施妥当と判断されており、早急な事業実施を強く勧告する。
- 2) 事業実施に向けて、国内における事業実施手続き、日本をはじめとする諸外国ドナーに対し資金調達のための準備・交渉を速やかに開始することを勧告する。
- 3) 事業実施に向けて、本件調査で提案された事業実施体制整備をすすめ、他関係機関との調整を行うことが望まれる。
- 4) 受益農民に対し、タウンサ堰システムの重要性と深刻な現状とともに、これを克服するための本件事業実施の必要性を広く啓蒙しておくべきである。また、この事業実施の概要を説明するとともに、時期によっては多少の利水面での不便が発生することを示し、協力を得るよう活動

することが望まれる。

- 5) 現在、相当な障害が発生しており改修工事の対象となっている各部分については、特に慎重な維持管理を行い、障害が予想外に悪化して改修工事に不都合が生じないように努力することが望まれる。
- 6) 堰道路橋の改修については、本件改修計画の中での単独フェーズとしての実施が提案されている。同フェーズの実施は、道路交通局、DGカーン郡庁などとの共同工事となるため、今後さらに詳細な共同調査を実施するとともに、その実施責任分担、実施の方法、時期、予算配分等の調整を図ることが必要である。
- 7) 本件計画は、タウンサ堰灌漑システムの改修計画と位置づけられる。この事業の実施によって、計画対象地域の第一段階の開発は回復される。しかし、同地域は高い開発ポテンシャルをなお有しており、今後さらに高い水準を目指した再開発が可能である。本件実施後、適当な時期に第二段階の開発計画の企画・推進が期待される。
- 8) 本件改修計画の実施によって、右岸土砂吐ゲートの機能性は格段に向上し、DGカーン水路の堆砂問題は大きく改善される。この場合、改修効果を十分に発揮するためには、適切な土砂吐ゲートの運用が前提であり、右岸ポケットの堆砂深のモニタリング成果を参考にした適時の土砂吐ゲート運用が不可欠である。また、本件改修計画では右岸ポケットへのシルトイクスクルーダーの設置を含めていないが、改修後の土砂吐ゲートの機能性向上をモニターしつつ、さらにシルトイクスクルーダーの設置が必要と判断される場合には、詳細な水理模型実験を経てその計画・設計・実施が望まれる。
- 9) バンジャブ州灌漑局においては、現在進行中の水利構造物安全性評価調査から明らかにされるバンジャブ州全水利堰の現状も参考にして、本件調査での改修対策などに関する成果を活用し、今後更に差し迫った他水利堰の具体的な改修計画企画を推進していくことを提案する。

11.3. 実施設計、工事実施にかかわる勧告

- 1) 実施設計作業の開始に先立ち、さらに詳細な堰体下流部、フリクションブロックなどの被害調査を行って詳細情報の蓄積に努め、効率の良い実施設計実施のための準備を進めるべきである。また、被害状況の変化を常に監視して実施設計に反映させることが望まれる。
- 2) 現在までの各モニタリング資料、管理記録、図面等の整理をすすめ、実施設計時の活用にも備えることが望まれる。

- 3) 工事实施に必要な用地の確保、人材の再訓練を実施すること。
- 4) 工事实施中の利水については、可能な利水量、利水配分を十分検討して、灌漑電力局本局、利水管理部とよく調整をはかっておくこと。
- 5) 実施設計にあたっては、以下の項目における水理模型実験が必要と判断される。予め実験実施準備を進めることが望まれる。
 - インダス川河川改修、洪水対策堤防計画のための、タウンサ堰周辺のインダス川河川流況に対するマクロスケールの水理模型実験
 - 堰体下流部跳水現象に関する水理模型実験
 - 堰体下流フリクションブロックの形状、配置に関する水理模型実験
 - 土砂吐ポケットの堆砂深と水路への堆砂流入関係に関する水理模型実験
 - タウンサ堰上流の河川堆砂形状と、適切なゲート運用形態に関する水理模型実験
 - 水路構造物の直下堤防洗堀に関する水理模型実験
- 6) タウンサ堰貯水池エリアは、野生生物保護区域に指定されており、本件改修事業計画を超えた自然環境の改変は行うべきではない。特に、インダス川イルカの生態保全には慎重であるべきで、場合によっては現在実施中のオックスフォード大学による調査最終成果を踏まえた堰魚道の形状変更も検討すること。

11.4. 維持管理および運用にかかわる勧告

- 1) 現在の維持管理体制の問題点を十分認識して、新しい改修事業施工後の維持管理体制への強化を進めること。
- 2) 維持管理規定を見直し、各維持管理担当者に徹底させること。
- 3) 各モニタリング機器、モニタリングデータ分析、保管のためのパーソナルコンピューターなどの導入を進め、担当人員には活用訓練を進めること。
- 4) 河川管理工事は、現在までの河川管理方針を尊重して、引き続き継続的に河道管理、堤防管理を進めること。
- 5) 各水路システムでは、定期的に適切な水路浚渫、ゲート等構造物の修理を遂行すること。
- 6) ワークショップは、今後の関連既存システムの維持管理作業量、内容に対応した規模、構成であるべく再構築することが望まれる。製品内容、価格によっては民間業者の積極的な導入が勧められることから、対象業者の育成、外注システムの整備を進めなければならない。

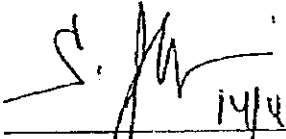
- 7) 本件改修工事に利用した6台の予備ゲートは、工事完了後、それぞれの利用計画に基づいて、工事や維持管理作業に機能的に活用すること。

添付資料

- 1 調査実施細則
- 2 協議議事録(インセプションレポート)
- 3 協議議事録(プロGRESSレポート1)
- 4 協議議事録(インテリムレポート)
- 5 協議議事録(プロGRESSレポート2)
- 6 協議議事録(ドラフトファイナルレポート)

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997


14/4/97

Mr. Suleman Ghani
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I . INTRODUCTION

In response to the request of the Government of The Islamic Republic of Pakistan(hereinafter referred to as "GOP"), The Government of Japan has decided to conduct the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation in Punjab of the Islamic Republic of Pakistan (hereinafter referred as "the Study") in accordance with the relevant laws and regulations in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with authorities concerned of GOP and the Government of Punjab (hereinafter referred to as "GOPunjab").

The present document sets forth the Scope of Work with regard to the Study.

II . OBJECTIVES OF THE STUDY

The objectives of the Study are;

- 1.to conduct a feasibility study on Taunsa Barrage Irrigation System Rehabilitation in Punjab, and
- 2.to carry out, in the course of the Study, technology transfer to the Pakistani counterpart personnel concerned through on-the-job training.

III . STUDY AREA

The study covers Taunsa Barrage and related facilities which are located at southwest of the Punjab Region,900km upstream from the mouth of the Indus River. .

On the course of the Study, Taunsa Barrage Irrigation System which has approximately 10,340km² of command area and the surrounding areas may be investigated and studied as technically required. (ANNEX 1)

IV . SCOPE OF THE STUDY

In order to achieve the above mentioned objectives, the Study consists of two(2) phases and will cover the following items.

1.Phase I

1.1 Review of the existing Taunsa Barrage Irrigation System.

1.2 Inspection and analysis on the condition of the Taunsa Barrage through the field survey.

(1)Mechanical works

- a)Gates
- b)Guides assemblies
- c)Hoisting mechanism
- d)Gate seals
- e)Others



石

- (2) Civil works
- a) Siltation and scouring around the Barrage
 - b) Piers
 - c) Sill concrete
 - d) Others

- (3) Operation and Maintenance
- a) Control system
 - b) Operation system
 - c) Maintenance system
 - d) Operation and maintenance organization
 - e) Others

1.3 Collection and analysis of the following data and information on the Taunsa Barrage Irrigation System through the field survey and interviewing the farmers;

(1) Natural conditions

- a) topography
- b) meteorology
- c) hydrology
- d) geology
- e) soil
- f) water quality
- g) others

(2) Socio-economic condition

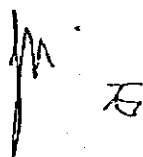
- a) population, birthrate, food situation, etc
- b) educational level (literacy rate), etc
- c) administrative organizations related to the projects
- d) social infrastructure
- e) regional and other donors' development plan
- f) others

(3) Agricultural and Agro-economic conditions

- a) land use
- b) land tenure
- c) cultivation technique
- d) cropping pattern and yield
- e) trend of supply and demand of crop
- f) farmer's economy
- g) agricultural credit system
- h) others

(4) Agricultural infrastructure

- a) major irrigation facilities
- b) construction materials
- c) others



- (5) Agricultural supporting service
 - a) government institutions
 - b) farmer's organizations
 - c) extension service
(extension worker, farmers' recognition level of irrigation)
 - d) supply of seed, fertilizer and chemicals
 - e) mechanization
 - f) others

- (6) Operation and maintenance
 - a) water management organizations
 - b) customs of water use, water right, water charge, etc.
 - c) others

- (7) Environmental aspects
 - a) natural environmental aspects
 - b) social environmental aspects

1.4 Initial Environmental Examination (IEE).

1.5 Identification of basic concept on rehabilitation plan for the Taunsa Barrage.

2. Phase 2

- 2.1 Field survey to collect supplementary data and information on the study area .
- 2.2 Formulation of an optimum rehabilitation plan for Taunsa Barrage Irrigation System;
 - (1) Taunsa Barrage
 - a) Mechanical works
 - b) Civil works
 - c) Gate operation and maintenance
 - (2) Operation and maintenance for irrigation system
- 2.3 Preliminary design for the major structure
- 2.4 Environmental Impact Assessment (EIA)
- 2.5 Preparation of implementation schedule
- 2.6 Estimation of the project costs and benefits
- 2.7 Overall evaluation of the project
- 2.8 Recommendations

V. STUDY SCHEDULE

The Study will be carried out in accordance with the attached tentative work schedule.(ANNEX 2)



AT

VI. REPORTS

JICA shall prepare and submit the following reports in English to GOP and GOPunjab.

1. Inception Report

Thirty (30) copies at the commencement of the Phase 1 field work.

2. Progress Report(1)

Thirty (30) copies at the end of the Phase 1 field work.

3. Interim Report

Thirty (30) copies at the end of the Phase 1 home office work.

4. Progress Report(2)

Thirty (30) copies at the end of the Phase 2 field work.

5. Draft Final Report

Thirty (30) copies after the Phase 2 home office work. GOPunjab shall provide its comments in the Draft Final Report to JICA within one (1) month after receiving the Draft Final Report.

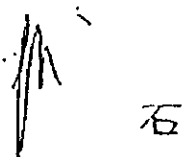
6. Final Report

Fifty (50) copies within one (1) months after the receipt of comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOP AND GOPUNJAB

1. To facilitate the smooth conduct of the Study, GOP shall take necessary measures;

- (1) to secure the safety of the Japanese study team,
- (2) to permit the members of the Japanese study team to enter, leave and sojourn in the Islamic Republic of Pakistan for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
- (3) to exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into and out of the Islamic Republic of Pakistan for the conduct of the Study,
- (4) to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
- (5) to provide necessary facilities to the Japanese study team for remittance as well as utilization of the funds introduced into the Islamic Republic of Pakistan from Japan in connection with the implementation of the Study,
- (6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,
- (7) to secure permission for the Japanese study team to take necessary data and documents (including photographs and maps) related to the Study out of the Islamic Republic of Pakistan to Japan, and
- (8) to provide medical services as needed. Its expenses will be chargeable to members of the Japanese study team.



2. GOPunjab shall bear claims, if any arises, against the members of the Japanese study team resulting from , occurring in the courses of , or otherwise connected with , the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.
3. GOPunjab has all responsibilities for the implementation of the Study and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
4. GOPunjab shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned:
 - (1) available maps, data and information (hydrological and meteorological etc.) related to the Study,
 - (2) counterpart personnel,
 - (3) credentials or identification cards, and
 - (4) Suitable office space with necessary equipment in Lahore and Taunsa.

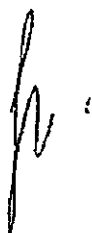
VIII. UNDERTAKING OF JICA

For the implementation of the Study , JICA shall take the following measures;

- (1) to dispatch at its own expense, the study team to the Islamic Republic of Pakistan, and
- (2) to pursue technology transfer to the Pakistani counterpart personnel in the course of the Study.

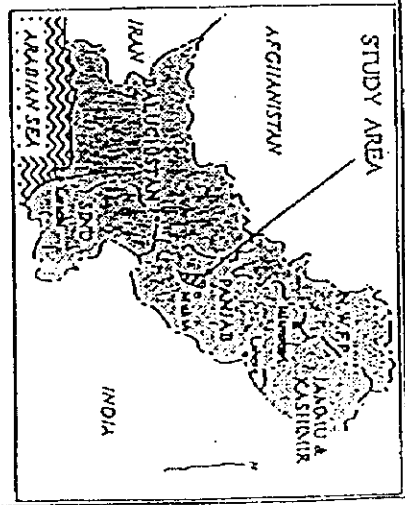
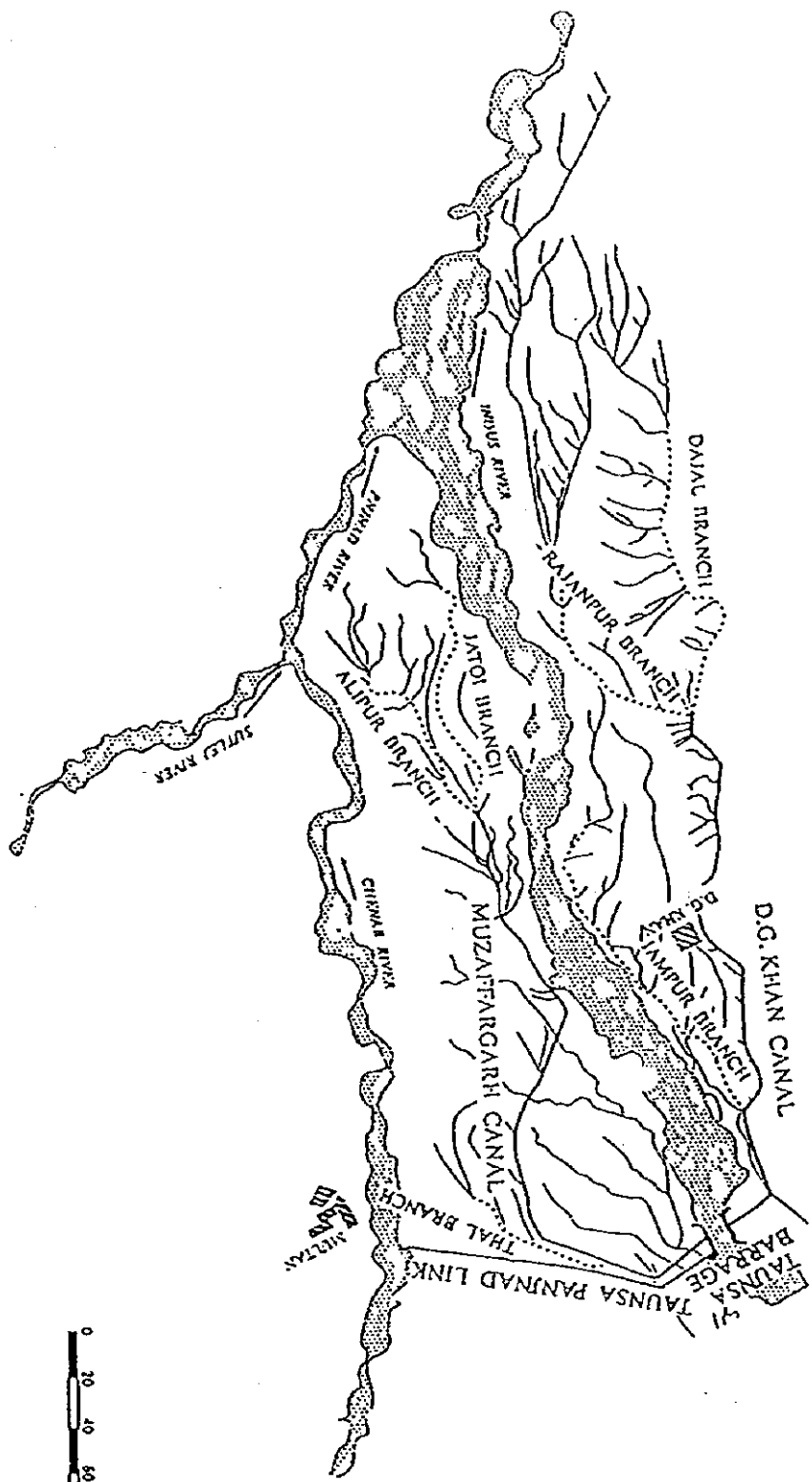
IX. CONSULTATION

GOP and JICA shall consult with each other in respect of any matter that may arise from or in connection with the Study.



ANNEX 1

STUDY AREA



ANNEX 2

TENTATIVE WORK SCHEDULE

7 8 9 10 11 12 1 2 3

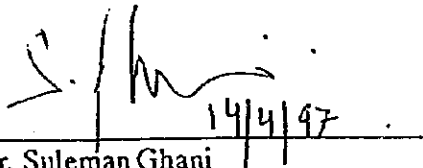
Months	1	2	3	4	5	6	7	8	9	10	11	17
Work in Pakistan										⊙		
Home office work in Japan												
Submission of reports	Δ		Δ		Δ		Δ	Δ	Δ/D/R			Δ
	Ic/R		P/R(1)		Iv/R		P/R(2)					F/R

- (Remarks)
- Ic/R : Inception Report
 - P/R(1) : Progress Report(1)
 - Iv/R : Interim Report
 - P/R(2) : Progress Report(2)
 - Df/R : Draft Final Report
 - F/R : Final Report
 - ⊙ : Comments on DF/R by the Pakistan side

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MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997


14/4/97

Mr. Suleman Ghani
Secretary,
Irrigation and Power Department,
Government of the Panjab

石坂邦美

Mr. Kuniyoshi Ishizaka
Leader,
Preparatory Study Team,
Japan International Cooperation Agency

The preparatory study team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Kuniyoshi Ishizaka, visited The Islamic Republic of Pakistan from April 6 to 17, 1997 for the purpose of discussing and confirming the Scope of Work for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study").

The Team had a series of discussions with the officials concerned of Irrigation and Power Department, Punjab Province (hereinafter referred to as "PID") and other organizations on the Scope of Work for the Study. The list of participants in the meetings is attached in the ANNEX 1.

As a result of the discussions, PID and the Team agreed on the Scope of Work for the Study.

The following are the main issues discussed and agreed on by both sides in relation to the Scope of Work for the Study:

1. The Study should be conducted on the physical rehabilitation of Taunsa barrage. The first priority of the Study should be given to the mechanical rehabilitation of gates, the second priority should be given to structural rehabilitation on the intake of D.G.Khan canal and third priority to the operation and maintenance, as a part of which was function of the workshop.
2. The siltation and scouring would be studied around the barrage in structural design as a integral part of the barrage rehabilitation. PID agreed on this point.
3. Both sides agreed that motor-mounted gate system would be suitable for the Taunsa barrage in operation.
4. PID requested the study for countermeasures of siltation at intake of D.G.Khan canal. The Team understood detail of the current situation which would be considered in the study.
5. PID requested reparation of one gate in the phase 2 study period on trial basis, utilizing the workshop for the smooth maintenance of the gates in the future. The Team promised to convey the request to the Government of Japan.
6. PID requested the study for keeping the designed water level at the barrage for irrigation. The Team proposed survey should be initiated to identify adequate measures. PID accepted the proposal.
7. Initial Environmental Examination (IEE) will be carried out in the phase 1 study by the Japanese study team in consultation with PID, mainly taking into account of the waterlogging and salinization. Environmental Impact Assessment (EIA), if necessary, will be carried out in the phase 2 study.
8. The Team requested that PID should assign the qualified and necessary number of counterpart personnel for the Study. PID ensured an arrangement to meet the request.
9. PID requested a counterpart training in the appropriate field in Japan. The Team promised to convey the request to the Government of Japan.

10. PID requested that the following equipment would be necessary for the study team to be arranged by JICA. The Team promised to convey the request to the Government of Japan.

- vehicle(s)(4WD)
- photocopier
- engine for testing gate operation
- survey equipment



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ANNEX 1

LIST OF PARTICIPANTS

1. Pakistan Side

Irrigation and Power Department

Mr.Suleman Ghani	Secretary
Mr.Tabir Ahmed Malik	Chief Engineer
Mr.Mian Yousaf Ali	Chief Engineer (Development)
Mr.Qazi Anwar Ali	S.E. Mechanical Circle
Mr.Muhammad Irfan	S.E. Muzaffargarh Canal Circle
Mr.Ch. Irshad-ul-Haque	Deputy Secretary

2. Japanese Side

JICA Preparatory Study Team

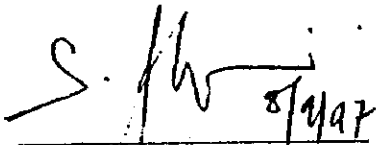
Mr.Kuniyoshi Ishizaki	Team Leader
Mr.Shigenori Nagashima	Construction Equipment Engineering
Mr.Naoto Tsunozumi	Irrigation Engineering
Mr.Tomoshi Noguchi	Agriculture
Mr.Makoto Kitanaka	Coordinator / Environment

JICA Pakistan Office

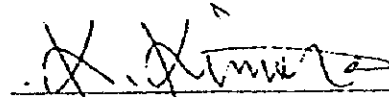
Mr.Noriaki Nagatomo
Mr.Sohail

MINUTES OF MEETING
ON
INCEPTION REPORT
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

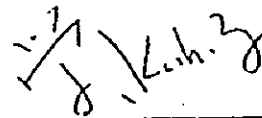
Lahore
8th September, 1997



Mr. Suleman Ghani
Secretary,
Irrigation and Power Department
Government of the Punjab



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team.



Mr. Manabu Kashiwabara
Advisor
Japan International
Cooperation
Agency.

MINUTES OF MEETING OF THE INCEPTION REPORT

Date 8th September, 1997.
Place Irrigation & Power Department.
Government of the Punjab, Lahore.
Participants See Annex.I.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on 14th April 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab. JICA sent to Pakistan a Feasibility Study Team (hereinafter referred to as "the Team") headed by Mr. Katsuhiko Kimura (Nippon Giken Inc.), Leader of the Team and Mr. Manabu Kashiwabara, as an advisor JICA Headquarters. The Team prepared and submitted thirty copies of the Inception Report to the IPD.

The meeting was held between the Team and the Government of the Punjab (hereinafter referred to as "the GOPunjab") on 8th September, 1997 for discussions on the Inception Report. Both parties agreed to the concept of the Inception Report and mutually confirmed the following:

1. The Team requested the GOPunjab to provide the available data related to the Study. The GOPunjab agreed to the request.
2. The GOPunjab agreed to assign necessary number of qualified counterpart personnel for the Study.
3. The Team explained that it was unable to undertake the restoration of one gate on a trial basis which was requested by the GOPunjab, since the restoration work would need several months and enormous preparation works same as the actual rehabilitation. The GOPunjab understood the Team's opinion and withdrew the request.
4. JICA will consider to accept counterpart training in Japan for one engineer who would be assigned in the prioritized field as a counterpart in the Study.

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PARTICIPANTS LIST

Date & Time 8th September, 9:00 A.M.
Place: Irrigation & Power Department.
Government of the Punjab, Lahore.
Subject: Taunsa Barrage Irrigation System Rehabilitation
Project, (Inception Report)

<u>Name</u>	<u>Present Designation, Office.</u>
1. Mr.Suleman Ghani.	Secretary Irrigation & Power Deptt.
2. Mr.Yousaf Ali Mian.	Chief Engineer (Dev.)
3. Mr.Tahir Ahmad Malik.	Chief Engineer (Research Zone).
4. Mr.Abdul Ali Sheikh.	Dy.Secretary (Dev.), I&P Deptt.
5. Mr.Qazi Anwar Ali.	S.E.Mechanical Circle, Lahore.
6. Mr.Rao M.Riaz.	Deputy Director, Design, Mechanical Circle.
7. Mr.Ghulam Sarwar.	Under Secretary (Evl.), I&P Deptt
8. Mr.Muhammad Bashir	Senior Research Officer, Incharge HRS Nandipur & Holding the office of PRO(H) at IRI, Lahore.

JICA STUDY TEAM

1. Mr.Katsuhiko Kimura.	Leader, JICA Study Team.
2. Mr.Yoichi Kishi.	Member, JICA Study Team.
3. Mr.Manabu Kashiwabara.	Advisor, JICA Headquarters.

JICA PAKISTAN OFFICE

1. Mr.Noriaki Nagatomo.	JICA Pakistan Office.
2. Mr.Sohail Ahmed.	JICA Pakistan Office.

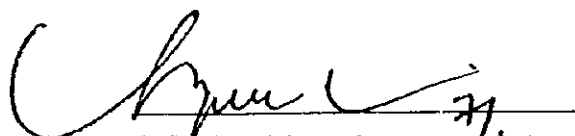
K.K.

M.K.

MINUTES OF MEETING
ON
PROGRESS REPORT (I)
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore

October 7th, 1997



Mr. Shafqat Masood
Additional Secretary
Irrigation and Power Department
Government of the Punjab



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team

MINUTES OF MEETING ON THE PROGRESS REPORT (I)
for
the Feasibility Study on TAUNSA Barrage Irrigation System Rehabilitation

Date: October 7th, 1997
Place: Irrigation and Power Department,
Government of the Punjab
Attendants: See Annex-I

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on April 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team commenced study on September 8th, 1997. The Study Team prepared Progress Report (I) which was described findings obtained during Phase I Field Work.

The meeting was held between the Study Team and the Government of the Punjab on October 7th, 1997 for the discussion on the Inception Report. Both parties have mutually confirmed the followings:

1. The Study Team submitted thirty five(35) copies of Progress Report (I) to the Government of the Punjab. The Reports are received by the IPD.
2. The Study Team explained that all findings and results obtained during field survey should be reflected into Interim Report to be prepared in Japan.
3. The Study Team requested IPD to conduct, if possible, dry works during the annual closure in Phase II field survey, which is to dry below and behind several bays by placing sandbags filled with sand.
4. The IPD requested the Study Team to inform the arrival date and schedule of the Team visiting Pakistan for conducting Phase II Study before more than 10 days of the arrival date.

Annex-1 List of Attendants

<u>Name</u>	<u>Present Designation, Office</u>
Mr. Shafqat Masood	Additional Secretary
Mr. Qazi Anwar Ali	S.E. Mechanical Circle, Lahore
Mr. Abdul Ali Sheikh	Deputy Secretary (Development), I&P Deptt.
Mr. Katsuhiko Kimura	Team Leader, JICA Study Team
Mr. Makoto Nashiro	Mechanics, JICA Study Team
Mr. Shoichi Maehara	Mechanics, JICA Study Team
Dr. Shuichi Matsushima	Hydraulic Structure, JICA Study Team
Mr. M. Qasim Saeed	Technical Coordinator

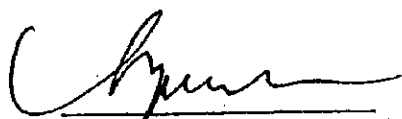
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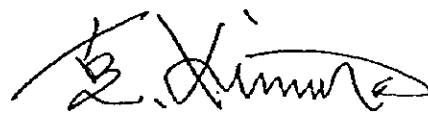
添付資料4 協議議事録 (インテリムレポート)

MINUTES OF MEETING
ON
INTERIM REPORT
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore
December 8th, 1997



Mr. Shafqat Masood, *7/12*
Additional Secretary (Technical),
Irrigation and Power Department,
Government of the Punjab.



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team

MEETING HELD ON 8.12.1997 IN THE COMMITTEE ROOM OF I&P
DEPARTMENT - FEASIBILITY STUDY ON TAUNSA BARRAGE,
IRRIGATION SYSTEM REHABILITATION - INTERIM REPORT.

List of participants is attached separately at Annex.I.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on April, 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team prepared and submitted thirty (30) copies of the Interim Report to the IPD on December 8th, 1997 prior to the commencement of the Phase-2 Study.

The meeting was held between the study Team and the Government of the Punjab on December 8th, 1997 for the discussion on the Interim Report. Both parties have mutually confirmed the following:

1. The Interim Report of the Study was accepted by the IPD of the Government of the Punjab after explanation and discussion on the report.
2. The IPD may submit comments on Interim Report to the Study Team, in writing within one month after. It should be reflected in preparation of Draft Final Report of the Study.
3. The IPD promised the Study Team to fully cooperate the team during Phase 2 Field Study, as same manner as Phase-1.

MEETING HELD ON 8.12.1997 IN THE COMMITTEE ROOM OF I&P
DEPARTMENT -FEASIBILITY STUDY ON TAUNSA BARRAGE,
IRRIGATION SYSTEM REHABILITATION - INTERIM REPORT.

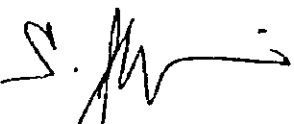
List of Participants

<u>Name</u>	<u>Position/Department</u>
1. Mr.Shafqat Masood	Additional Secretary (Tech.),IPD.
2. Mian Yousaf Ali	Chief Engineer(Development)IPD.
3. Qazi Anwar Ali.	S.E.Mechanical Circle, IPD.
4. Mr.Muhammad Ghufuran.	S.E.Muzaffargarh Canal Circle,IPD
5. Rao M.Riaz	Deputy Director Design, IPD
6. Mr.Abdul Ali Sheikh.	Deputy Secretary(Dev.) IPD.
7. Mr.Katushiko Kimura.	Team leader, JICA Study Team.
8. Dr.Shuichi Matsushima	Hydraulic Structure, JICA Study Team.
9. Mr.Qasim Saeed	Technical Coordinator,JICA StudyTeam
10. Mr.Noriaki Nagatomo	Representative, JICA Pakistan Office.

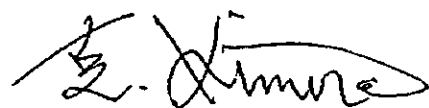
添付資料 5 協議議事録 (プロGRESSレポート 2)

MINUTES OF MEETING
ON
PROGRESS REPORT (2)
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore
January 24th, 1998



Mr. Saleman Ghani
Secretary
Irrigation and Power Department
Government of the Punjab



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team

MINUTES OF MEETING HELD ON 24.01.1998 IN THE COMMITTEE
ROOM OF IRRIGATION AND POWER DEPARTMENT - PROGRESS
REPORT (2)

List of Participants

<u>Name</u>	<u>Position/Department</u>
1. Mr.Suleman Ghani.	Secretary, IPD.
2. Mr.Usman Akram.	Additional Secy.(Tech.) IPD.
3. Mr.Tahir Ahmad Malik.	Chief Engineer, IRI, IPD.
4. Mr.Israr-ul-Haque.	Director (Floods), IPD.
5. Sh.Abdul Ali.	Deputy Secretary (Dev.) IPD.
6. Mr.Katsuhiko Kimura	Team Leader, JICA Study Team
7. Mr.Makoto Nashiro	Mechanics, JICA Study Team
8. Mr.Shoichi Maehara	Mechanics, JICA Study Team
9. Mr.Yoichi Kishi	Foundation, JICA Study Team
10. Dr.Shuichi Matsushima	Hydraulic Structure, JICA Study Team.
11. Mr.Hiroyasu Ohnuma	Agriculture/Environment, JICA Study Team.
12. Mr.Hiroei Ishihara	Construction Plan/Cost Estimate the Team.
13. Mr.Mitsuo Nishiya	Agro-Economy/Project Evaluation, the Team.
14. Mr.Muhammad Qasim Saeed	Technical Coordination, JICA Study Team.

JICANTS.

MINUTES OF MEETING HELD ON 24.01.1998 IN THE COMMITTEE
ROOM OF IRRIGATION AND POWER DEPARTMENT - PROGRESS
REPORT (2)

List of participants is attached separately.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (herein after referred as "the Study"), signed on April 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team prepared and submitted thirty (30) copies of the Progress Report (2) to the IPD on January 24th, 1998 at the termination of field survey of Phase-2 Study.

The meeting was held between the Study Team and the Government of the Punjab on January 24th, 1998 for the discussion on the Progress Report (2). Both parties have mutually confirmed the followings:-

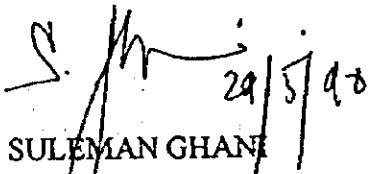
1. The Progress Report (2) of the Study was reviewed by the IPD of the Government of the Punjab after explanation and discussion on the report.
2. The need for review/analysis of the Barrage structure with reference both to surface and sub-surface flow considerations was emphasized.
3. The IPD may submit further comments on the Progress Report (2) to the Study Team through the JICA Pakistan Office, in writing within one month. It should be reflected in preparation of Draft Final Report of the Study.
4. The Study Team suggested that some serious damages as mentioned within the Progress Report (2) on the Taunsa Barrage should be urgently repaired without halting and waiting for the completion of final rehabilitation planning for the Taunsa Barrage to be formulated by the Study Team in Japan. The IPD replied the Study Team to take an adequate action on this matter.
5. The IPD requested the Study Team to donate the JICA's equipment utilized during the Study, for the purpose of strengthening of operation and maintenance of the Taunsa barrage system. The Study Team promised to convey their request to JICA Tokyo Office.

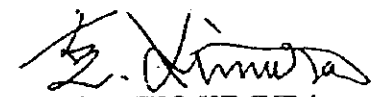
Meeting ending with a vote of thanks to and from the
chair.

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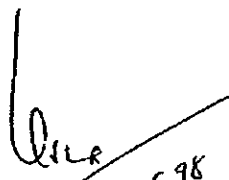
MINUTE OF MEETING ON DRAFT FINAL REPORT
FOR
FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
IRRIGATION AND POWER DEPARTMENT
GOVERNMENT OF THE PUNJAB
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

LAHORE,
29 MAY, 1998


SULEMAN GHANI
Secretary,
Irrigation and Power Department,
Government of the Punjab,
The Islamic Republic of Pakistan


KATSUHIKO KIMURA
Team Leader,
JICA Feasibility Study Team

In the presence of:


29.5.98

MINUTES OF THE MEETING ON DRAFT FINAL REPORT
for Feasibility Study on TAUNSA Barrage Irrigation System Rehabilitation
in the Islamic Republic of Pakistan

1. Date 29th May 1998
2. Place Irrigation and Power Department, Lahore.
3. Summary of Discussions:

Based upon the results of field survey and home office work, the Study Team submitted officially thirty (30) copies of Draft Final Report on the Study (herein-after referred as " the Report") and explained its contents to Irrigation and Power Department, Government of the Punjab in a meeting held on 29th May 1998 of which a list of participants is attached separately.

As a result of explanation and exchange of opinions on the Report, following points were agreed upon by the Japanese side (herein-after referred as "GOJ") and the Pakistan side (herein-after referred as "GOPunjab").

1. GOPunjab basically accepted the contents of the Report, with a strong desire to implement urgently the proposed rehabilitation project.
2. GOPunjab agreed with the recommendations described in the Report and would have to consider taking necessary actions. The comments of PID include the followings: -
 - a. Engineering Design of the Barrage shall take into account the engineering details of "Evaluation of Safety of Hydraulic Structures" which ^{has been} performed ^{conducted} by Punjab Irrigation Department for all the barrages in Punjab.
 - b. The planning and implementation arrangement required for Engineering Design of the project activities shall be made with the consultation of Punjab Irrigation Department.
3. GOPunjab agreed that more comments, if any, on the Report shall be sent to the JICA Headquarters by 15th July 1998 through the JICA Pakistan Office, Islamabad.

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4. GOJ promised that the Final Report should be compiled reflecting comments by GOPunjab within one month after receiving them, and the Final Report will be sent to GOPunjab immediately.
5. Treatment of the Report: JICA requested that GOPunjab would make the Final Report available to any person who is interested in the Study. GOPunjab agreed to this request.



MINUTES OF THE MEETING ON DRAFT FINAL REPORT

LIST OF PARTICIPANTS

1. Mr. Usman Akhram, In Chair
Additional Secretary (Technical), Irrigation & Power Department, Lahore.
2. Mr. Mian Yousaf Ali,
Chief Engineer, Irrigation, Development Zone, Lahore.
3. Mr. Mian Aslam Mahboob,
Chief Engineer, Irrigation, Coordination Zone, Lahore.
4. Mr. Tahir Ahmad Malik,
Chief Engineer (Research), Irrigation & Power Department.
5. Mr. Muhammad Aslam Qureshi,
Superintending Engineer, Mechanical Circle, Lahore.
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7. Mr. Qazi Anwar Ali,
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Director, Design, Irrigation & Power Department.
9. Mr. Rao Muhammad Riaz,
Deputy Director, Mechanical Circle, Lahore.
10. Mr. Abdul Rehman,
Director, Planning, Irrigation & Power Department.
11. Mr. Mumtaz Ahmad Khan,
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12. Mr. Nazir Ahmad Dugal,
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13. Mr. M. H. Siddiqi,
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16. Mr. Israr-ul-Haq,
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JICA

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3. Mr. Makoto NASHIRO, Mechanics (Gate Specialist).
4. Mr. Qasim Saeed, Technical Coordinator.

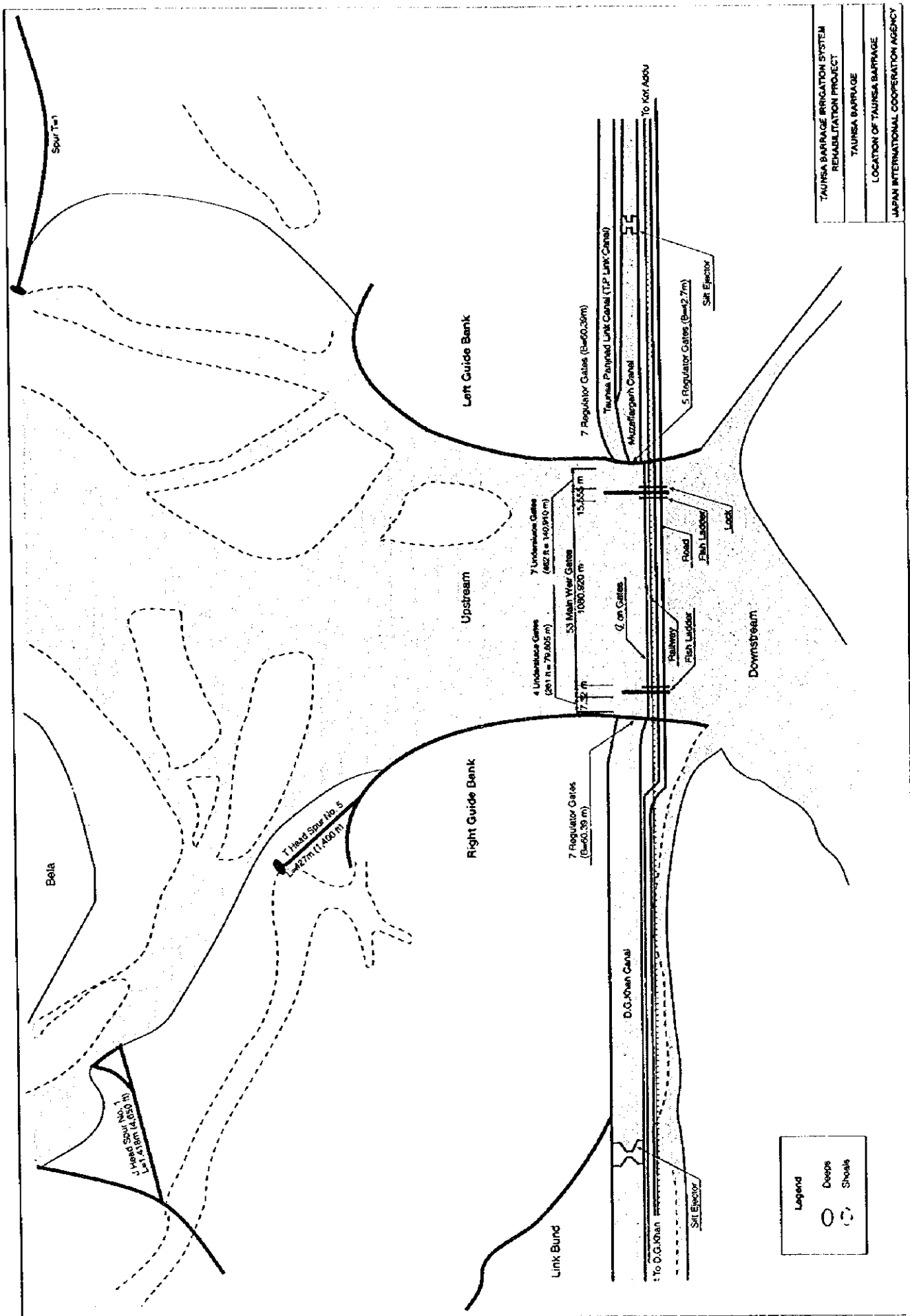


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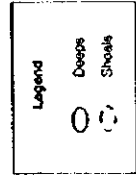


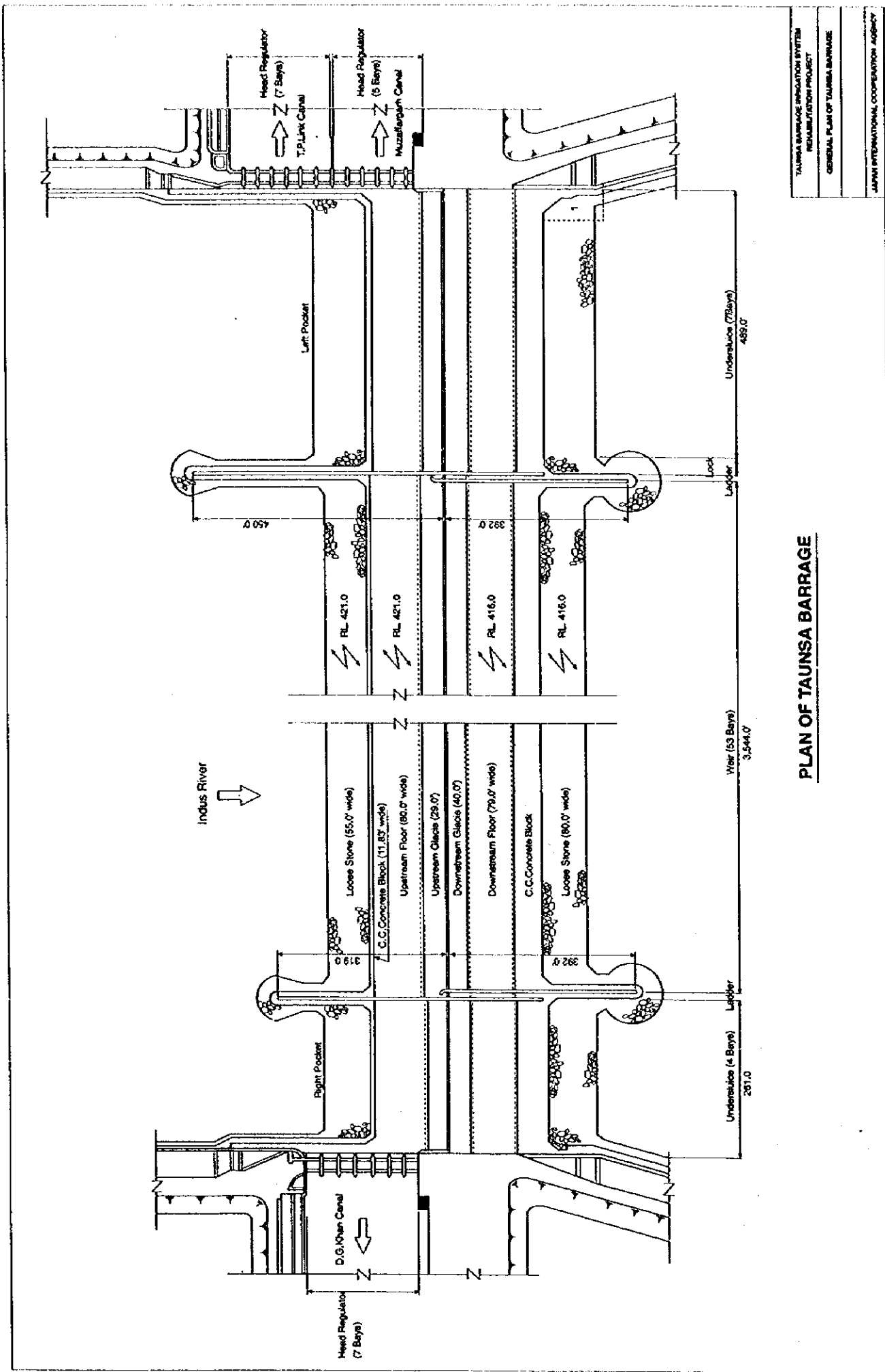
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

TAUNSA BARRAGE

LOCATION OF TAUNSA BARRAGE

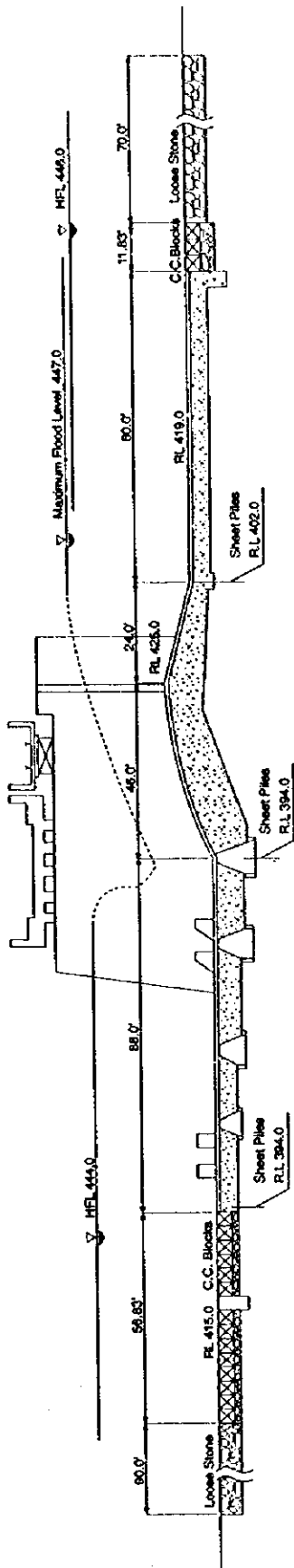
JAPAN INTERNATIONAL COOPERATION AGENCY



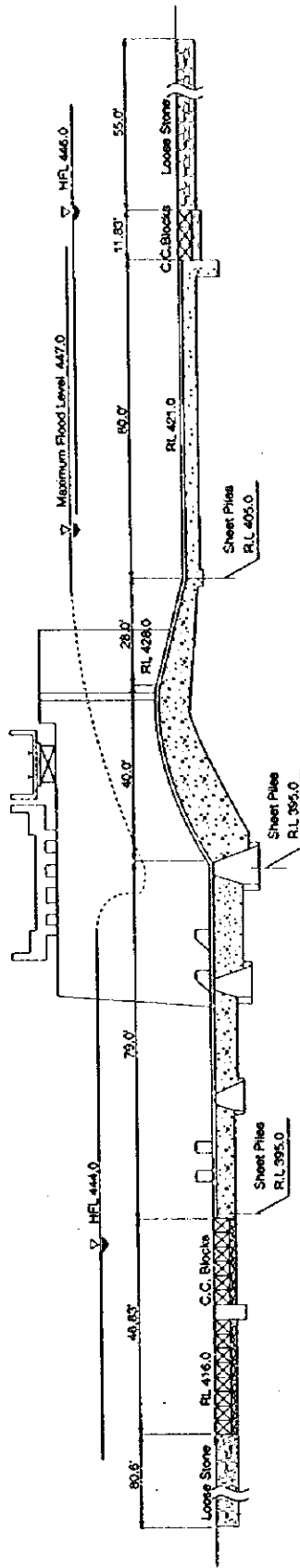


PLAN OF TAUNSA BARRAGE

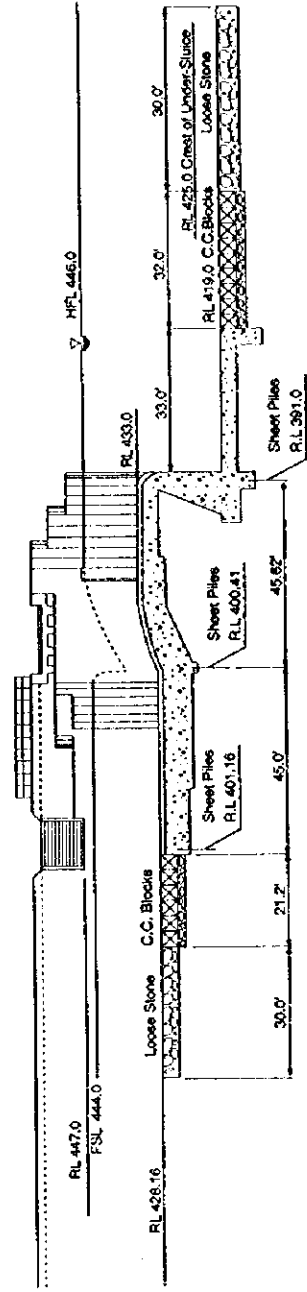
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
GENERAL PLAN OF TAUNSA BARRAGE
JAPAN INTERNATIONAL COOPERATION AGENCY



X-Section: through Undersluice



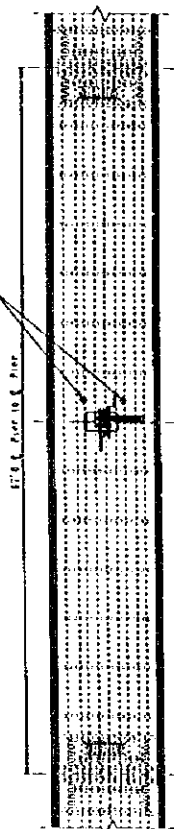
X-Section: through Weir



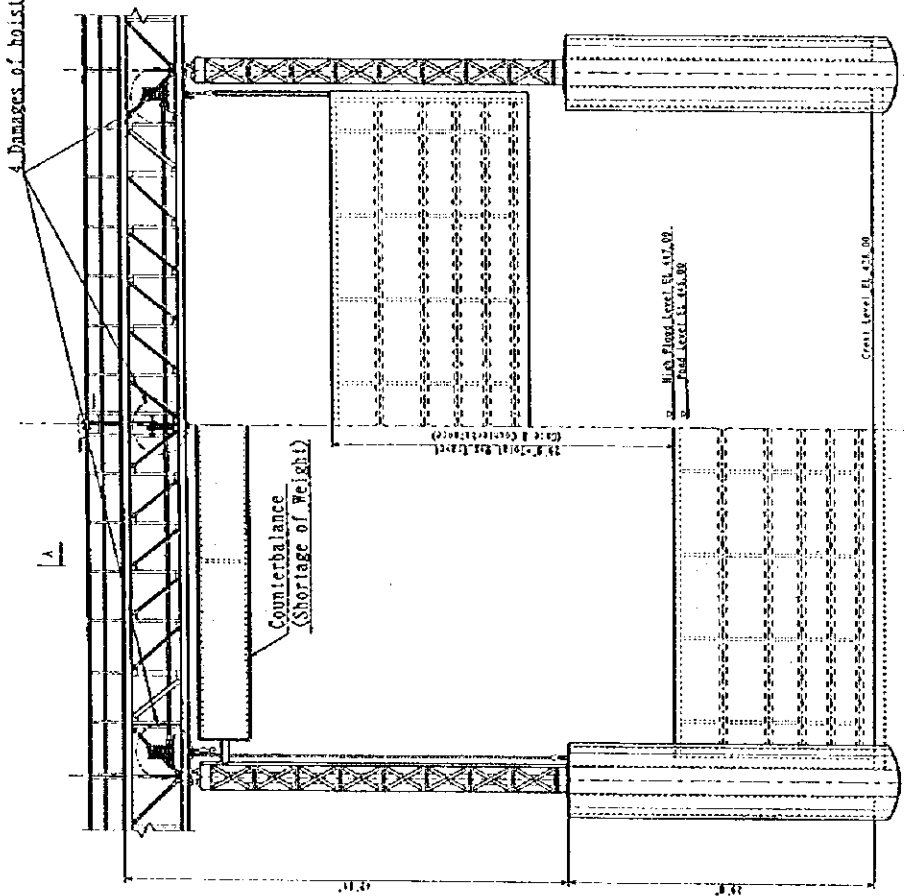
X-Section: Head Regulator of MGH and DGK Canal

TAJNEA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
CROSS SECTIONS
ORIGINAL DESIGN
JAPAN INTERNATIONAL COOPERATION AGENCY

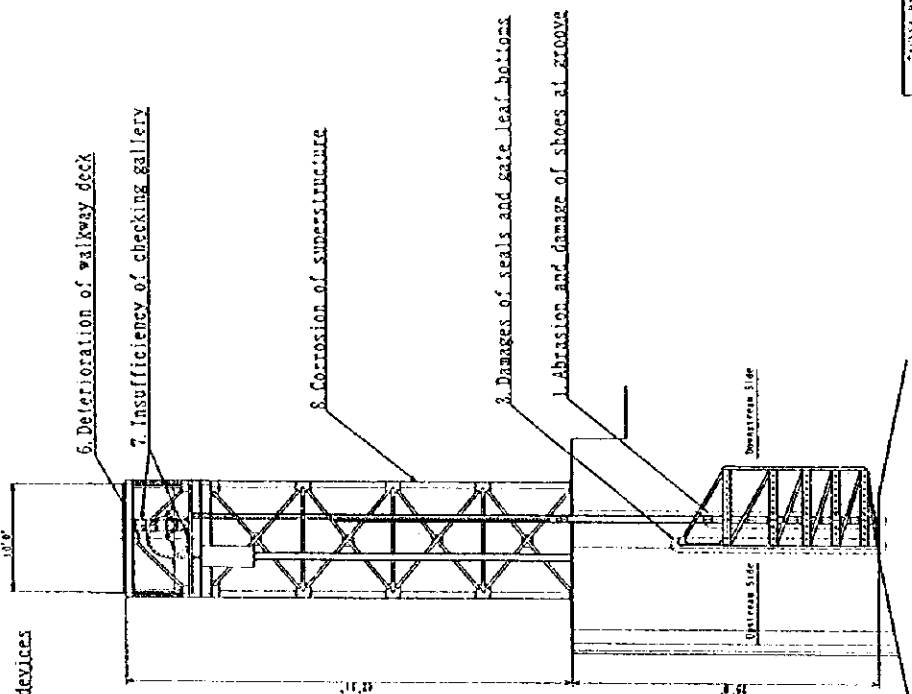
5. III. operational function of hoisting device



PLAN

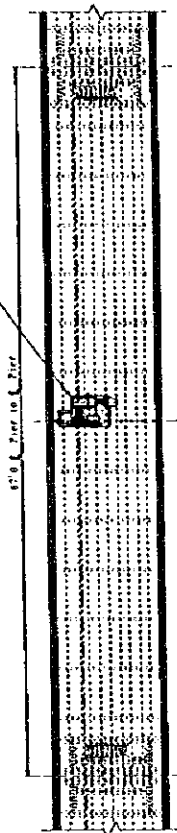


FRONT ELEVATION

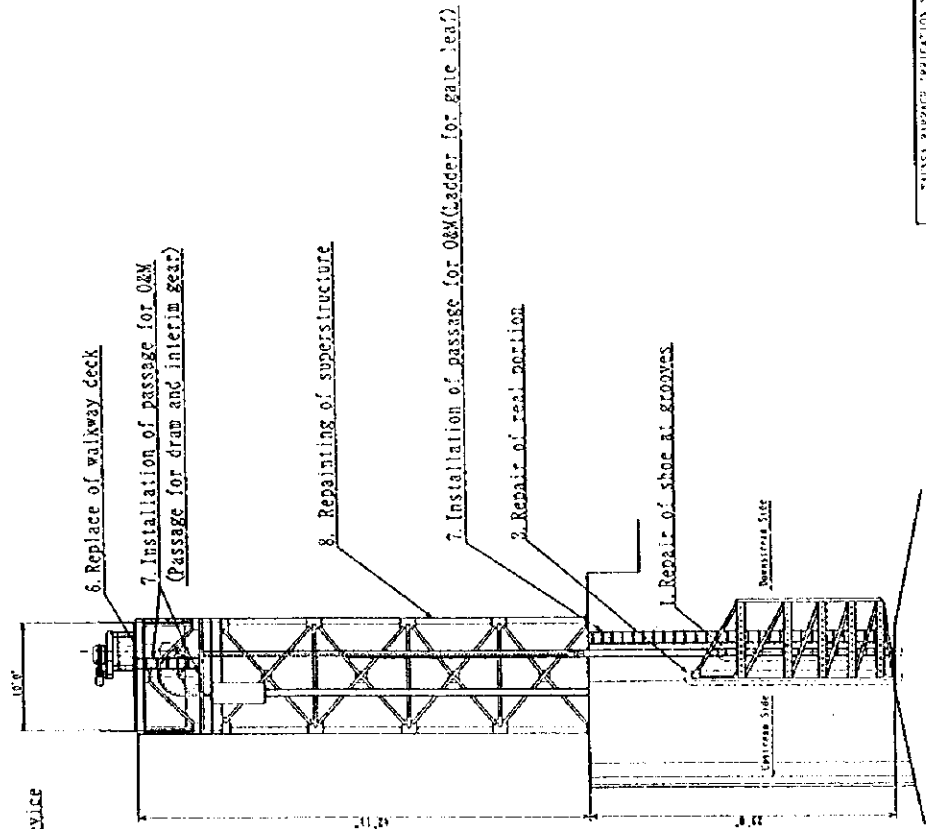
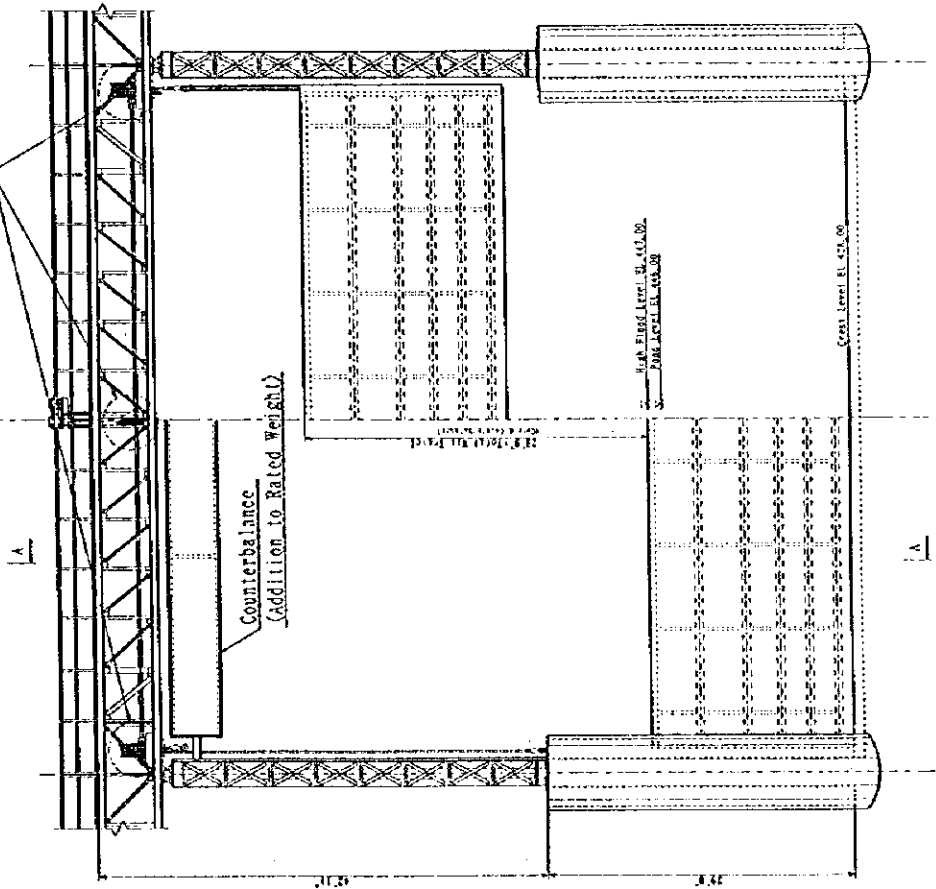


SECTION A-A

5. Improvement of hoisting function

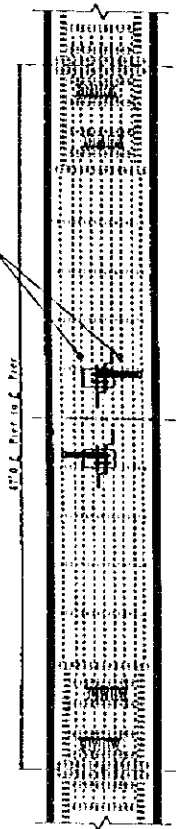


4. Repair of hoisting device

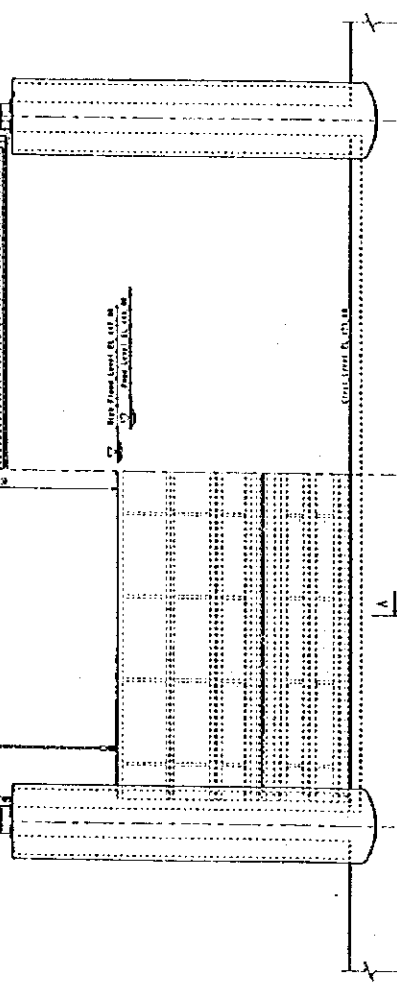
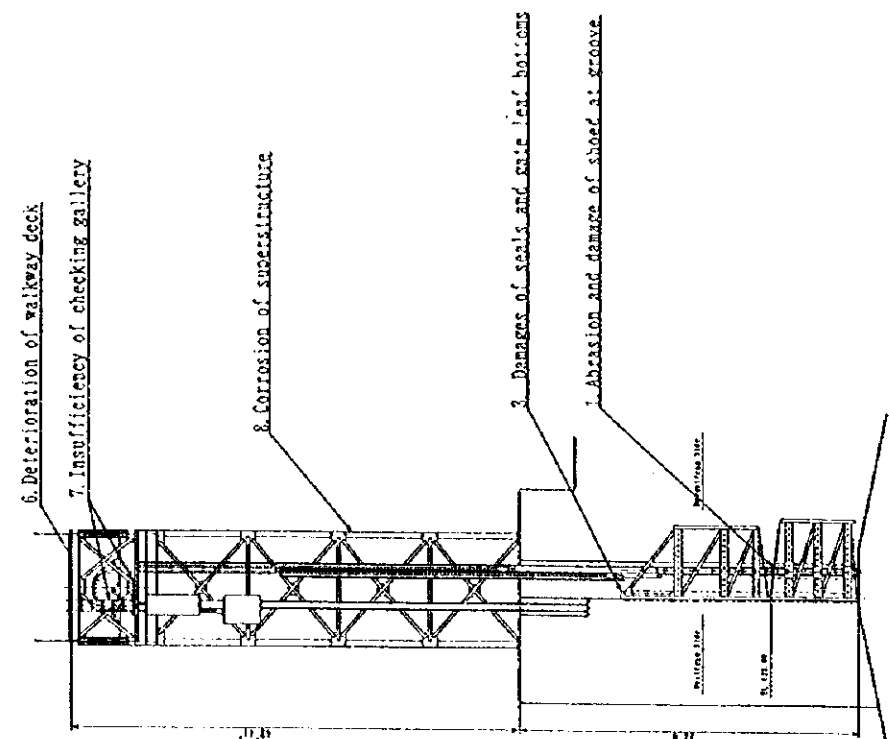
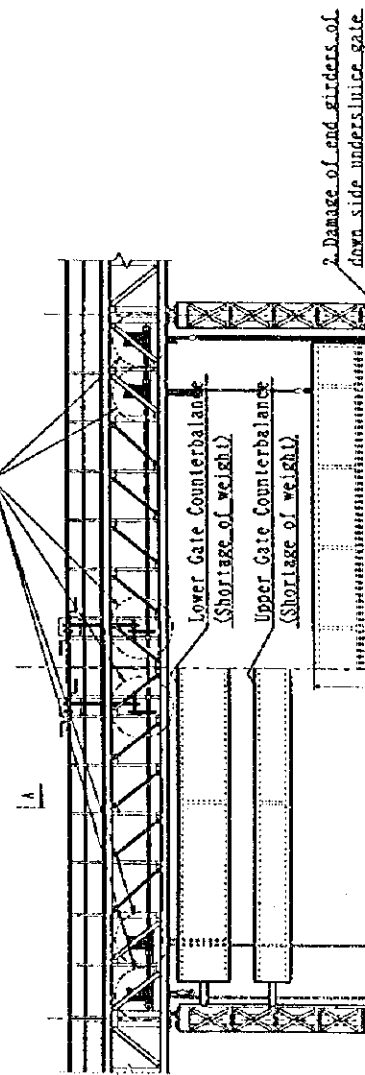


TAJIMA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
MAIN WEIR GATES—GENERAL
ASSEMBLY (AFTER REHABILITATION)
JAPAN INTERNATIONAL COOPERATION AGENCY

5. Ill operational function of hoisting device



1. Damages of hoisting devices

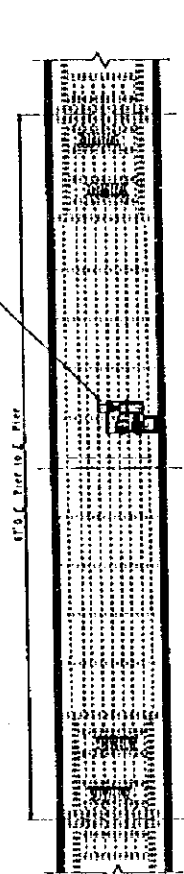


TANSA DAMMAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

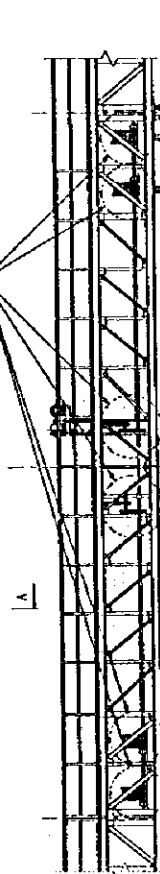
UNDERSLUICE GATES-GENERAL
ASSEMBLY (PRESENT CONDITION)

JAPAN INTERNATIONAL COOPERATION AGENCY

5. Improvement of hoisting function



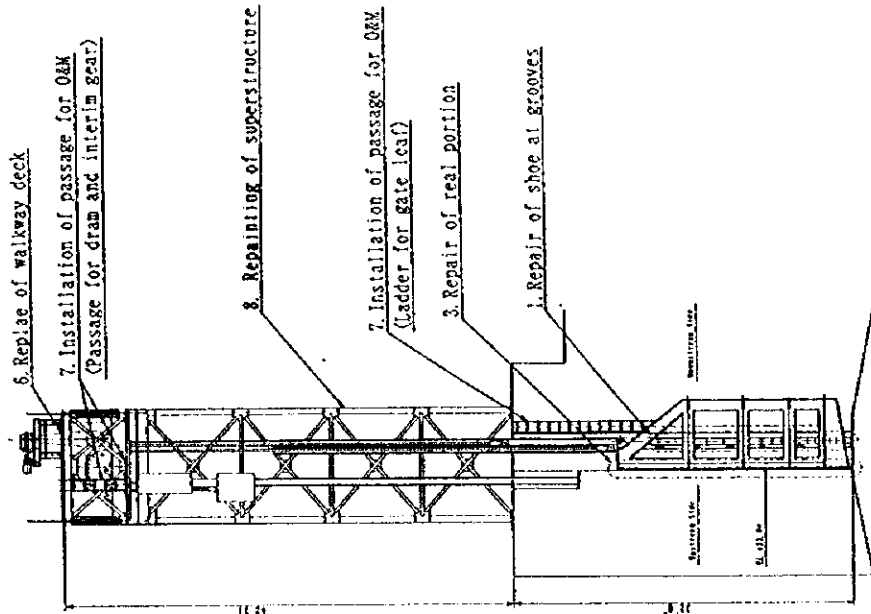
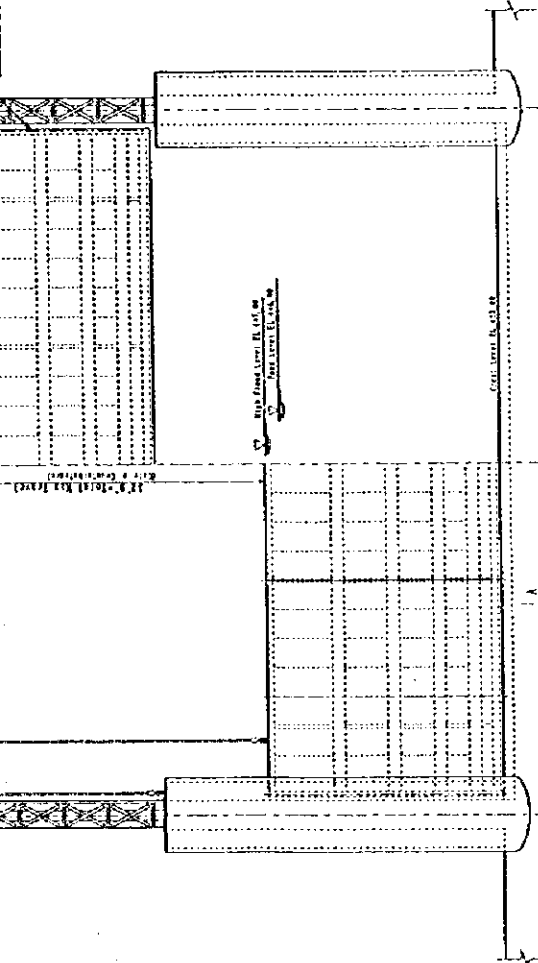
4. Repair on hoisting device



Lower Gate Counterbalance
(Addition to Rated Weight)

Upper Gate Counterbalance
(Addition to Rated Weight)

2. Rehabilitation of downside
undersluice Gate.



6. Replace of walkway deck

7. Installation of passage for O&M
(Passage for drum and interim gear)

8. Repairing of superstructure

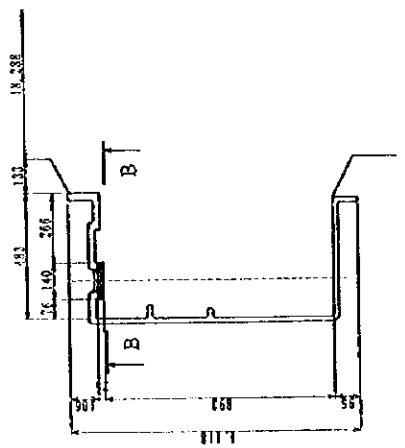
7. Installation of passage for O&M
(Ladder for gate leaf)

3. Repair of real portion

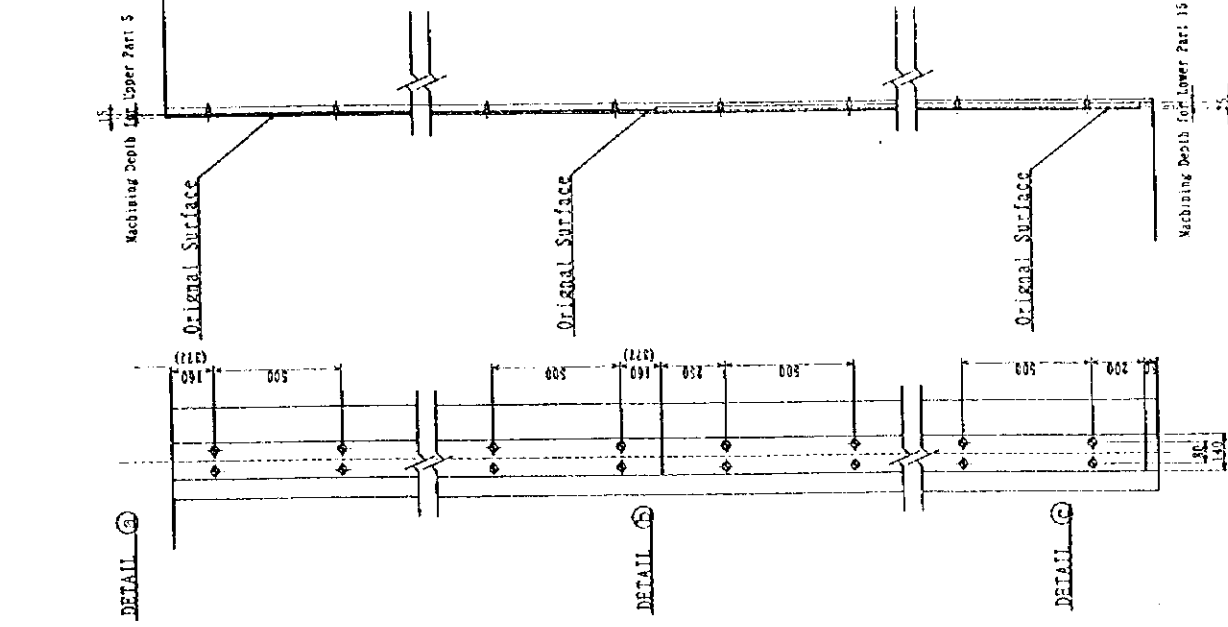
1. Repair of shoe at grooves

SECTION A-A

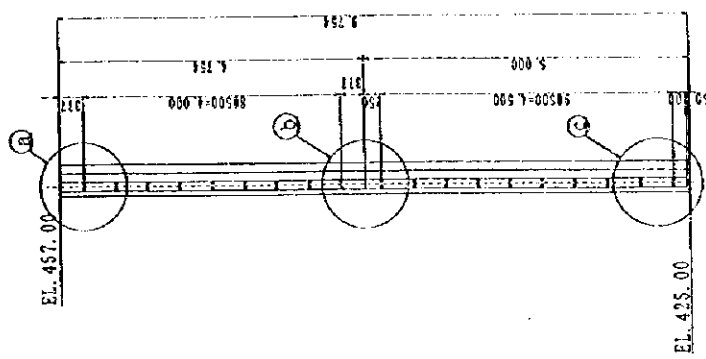
TAKENSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
UNDERSLUICE GATES-GENERAL
ASSEMBLY (AFTER REHABILITATION)
JAPAN INTERNATIONAL COOPERATION AGENCY



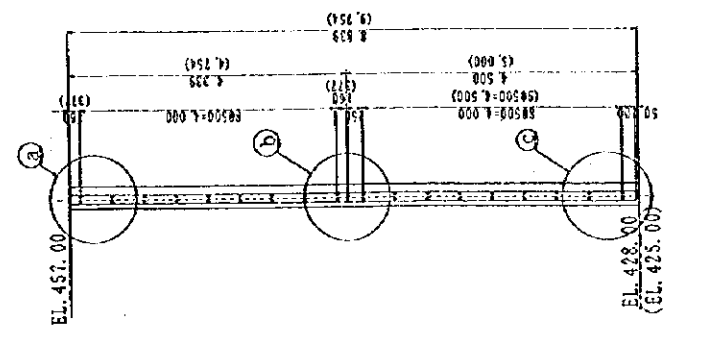
PLAN FOR MAIN WEIR GATES AND UPSTREAM LOCK GATE



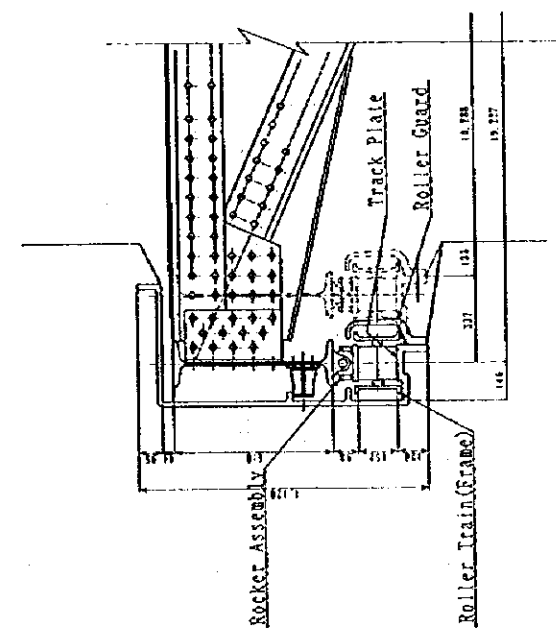
PLAN FOR UNDERSLUICE GATES



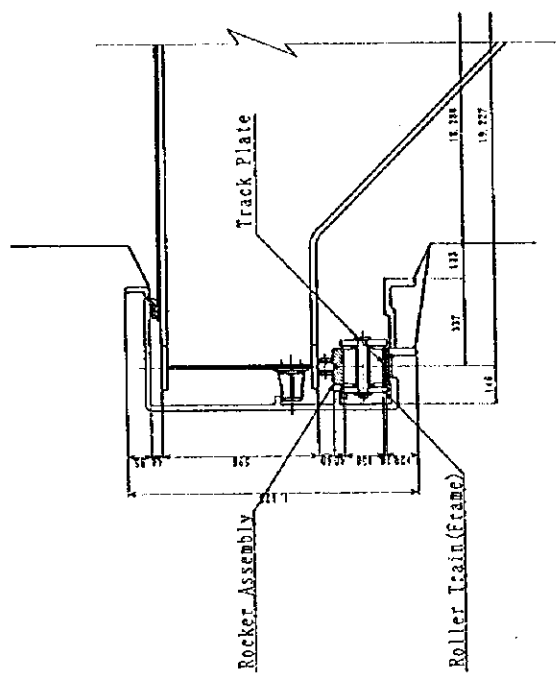
SECTION B-B



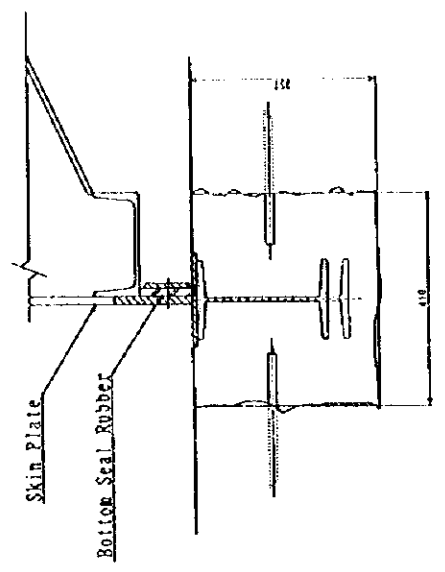
SECTION A-A
 SHOWS UPSTREAM LOCK GATE



DETAIL OF SIDE SEAL (PRESENT FIGURE)

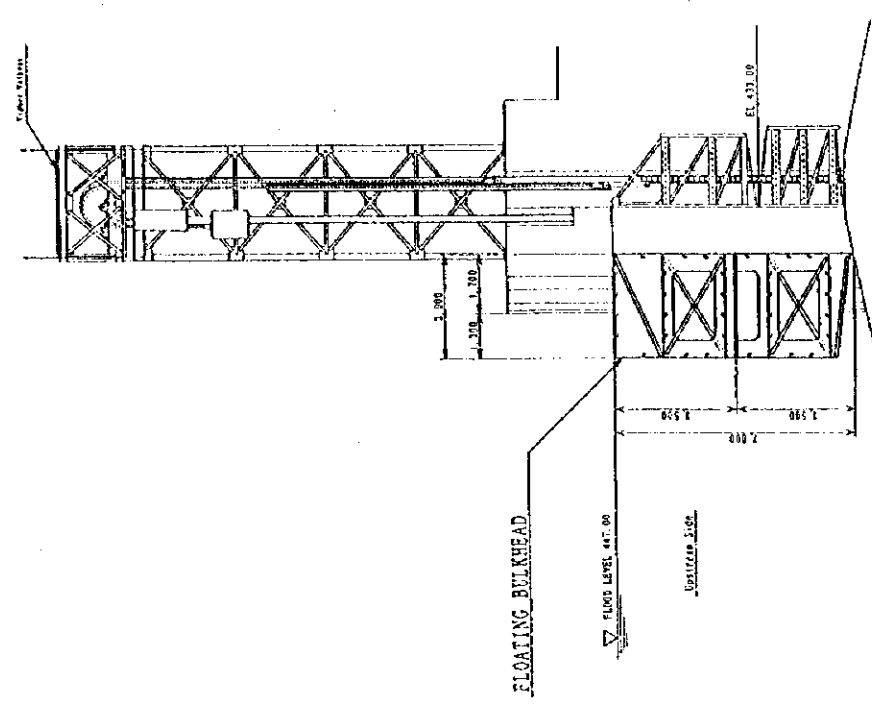
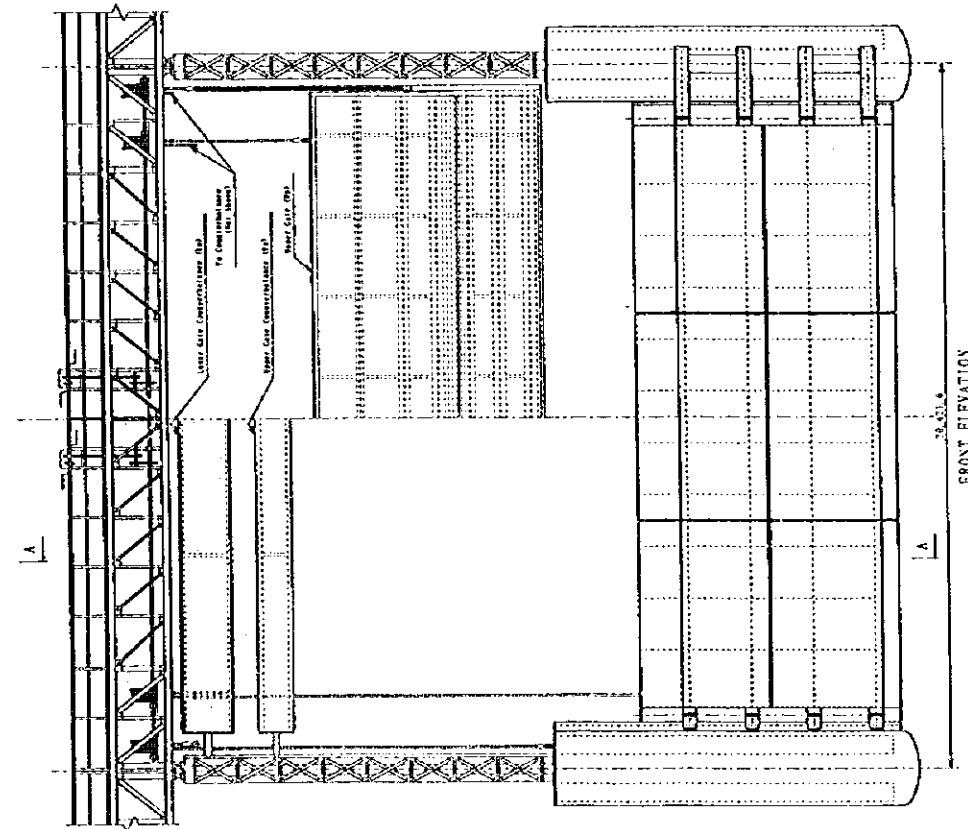
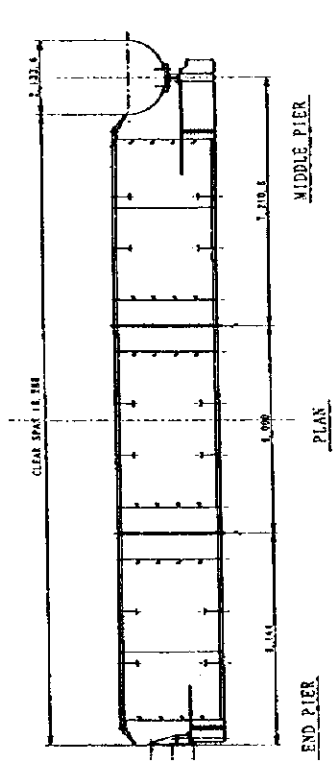


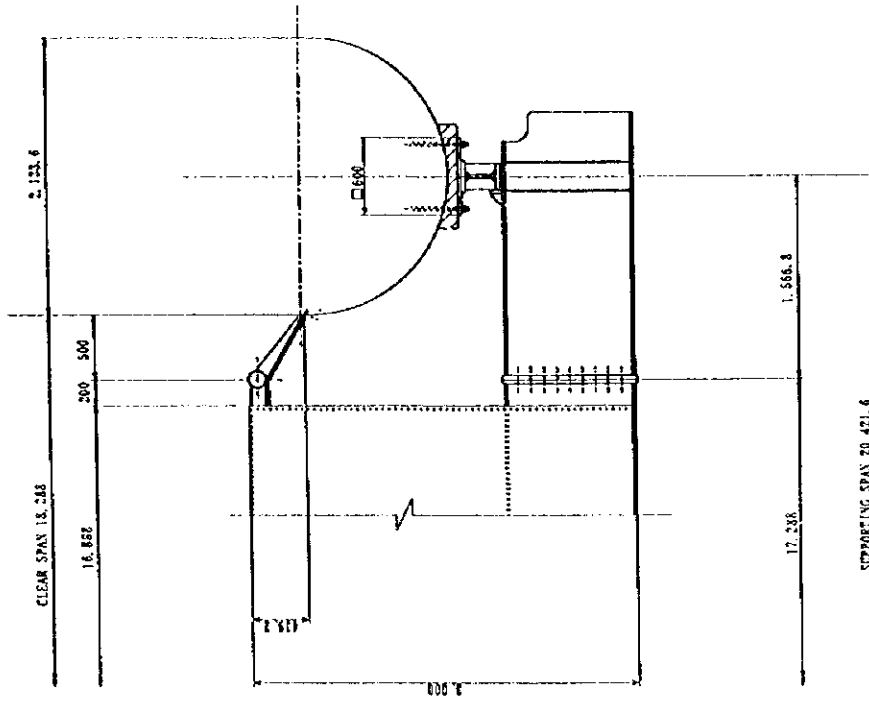
DETAIL OF SIDE SEAL (AFTER REHABILITATION)



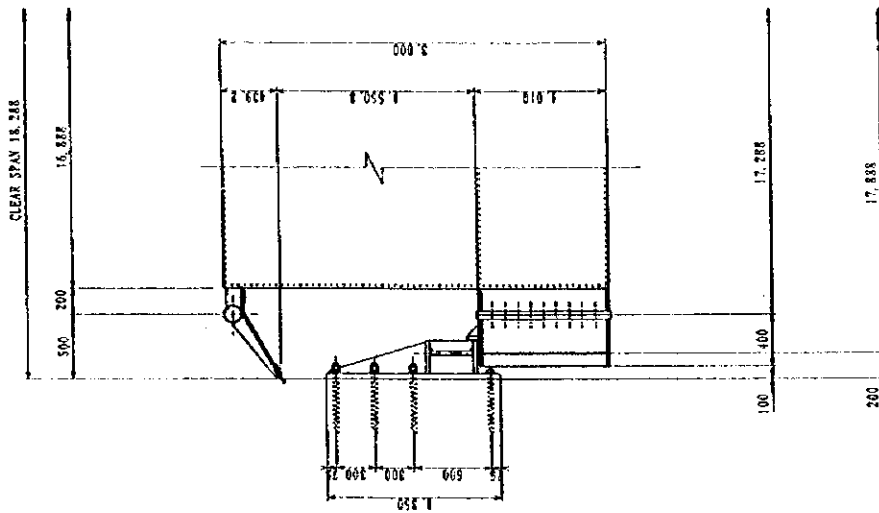
DETAIL OF BOTTOM SEAL (AFTER REHABILITATION)

TAJIMA IRRIGATION SYSTEM REHABILITATION PROJECT
UNDERSLICE GATES
DETAIL OF SIDE AND BOTTOM SEAL
JAPAN INTERNATIONAL COOPERATION AGENCY





DETAIL OF SIDE SEAL (FOR MIDDLE PIER)



DETAIL OF SIDE SEAL (FOR END PIER)

TANAKA IRRIGATION SYSTEM REHABILITATION PROJECT
FLOATING BULKHEAD
DETAIL OF SIDE SEAL
JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN

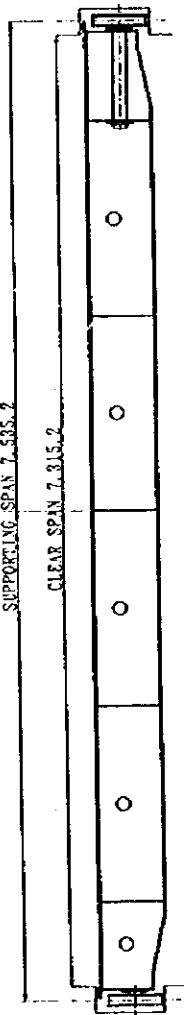
Scale

SECTION B-B

SECTION C-C

SUPPORTING SPAN 7.535.2

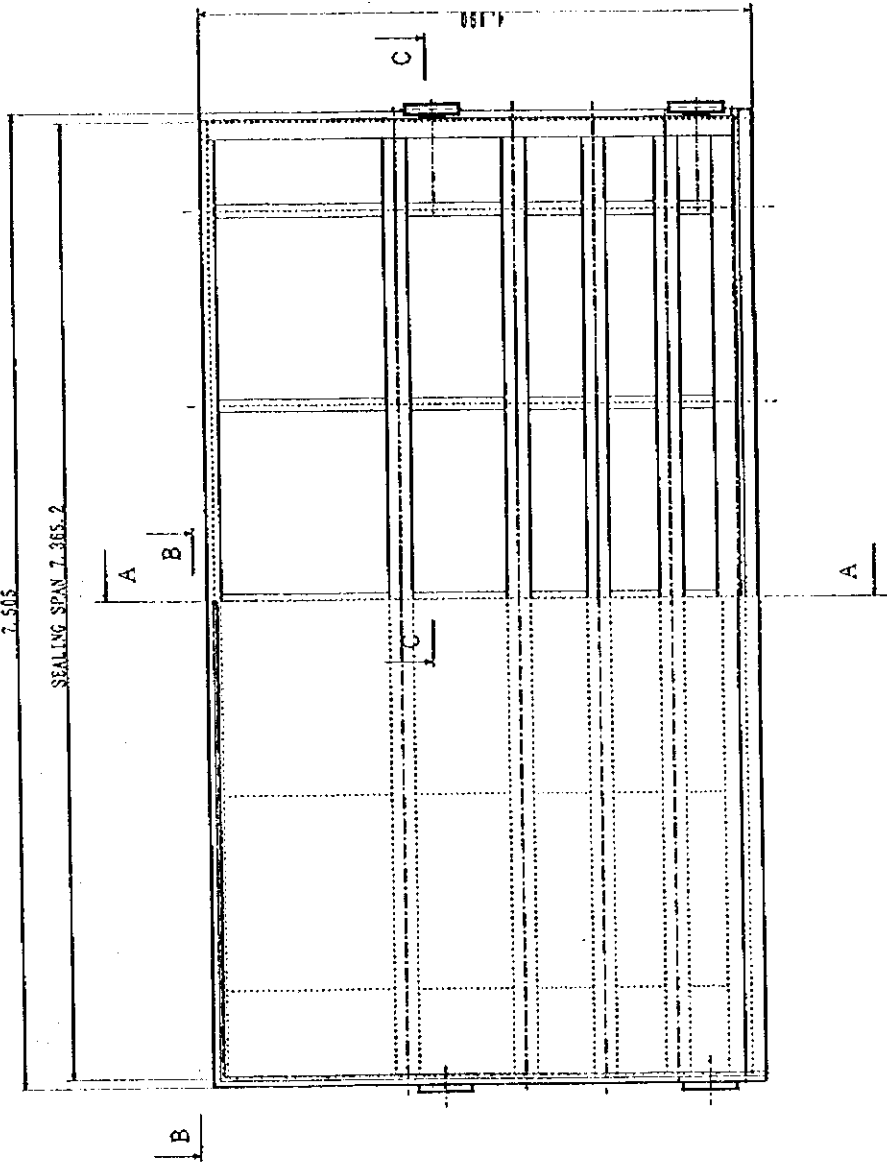
CLEAR SPAN 7.315.2



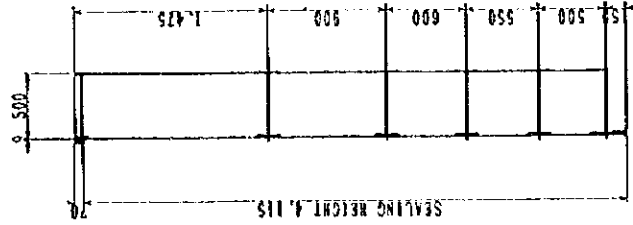
ELEVATION

7.505

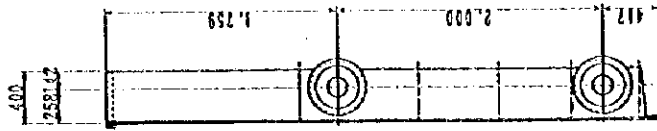
SEALING SPAN 7.365.2



SECTION A-A



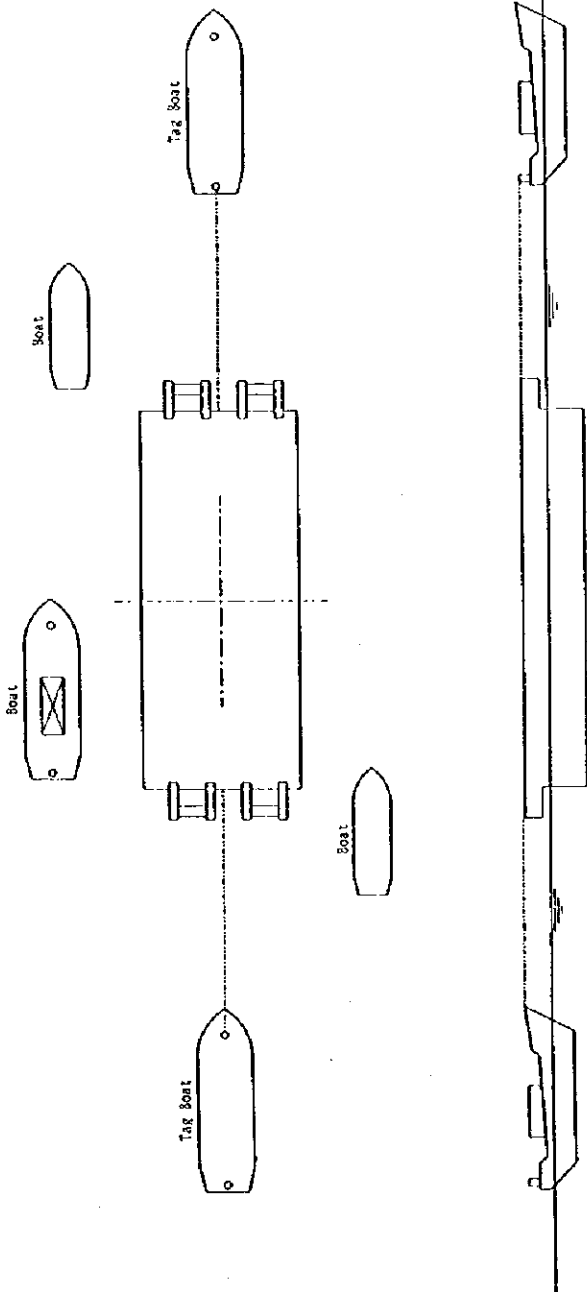
SIDE VIEW



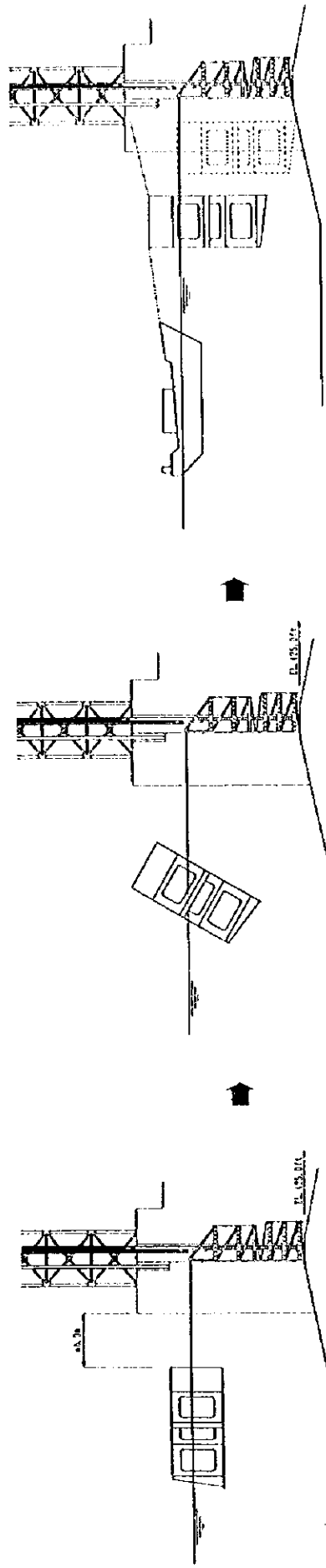
TAJNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

T. P. LINX CANAL REGULATOR GATES
ASSEMBLY OF GATE LEAF

JAPAN INTERNATIONAL COOPERATION AGENCY



TOWING OF FLOATING BULKHEAD

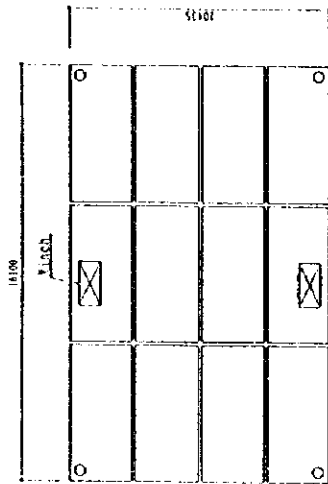
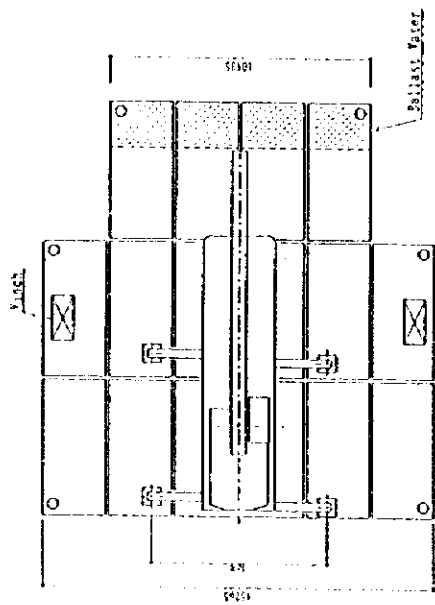


TAIWA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

INSTALLATION PROCEDURE

SETTING OF FLOATING BULKHEAD

JAPAN INTERNATIONAL COOPERATION AGENCY

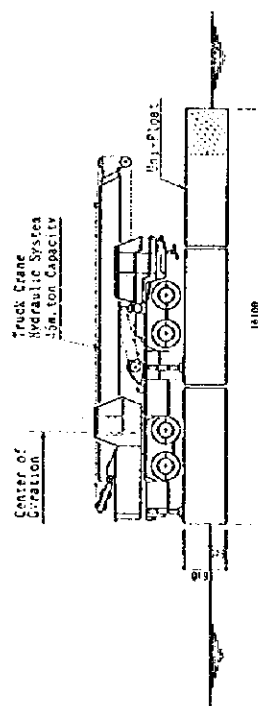


Main Weight(m. ton)

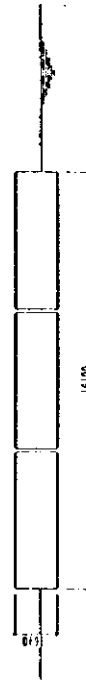
	Floating Crane	Barge
4500 T.C	37.4	—
Reinforcement	8.3	—
Finch	2.0	1.5
Attachment	3.0	1.0
Ballast Water	22.0	—
Uni-Float	59.2	44.4
Total	131.9	48.9

Specification of Uni-Float

Type	UF-E 3
Length	5,510 mm
Width	2,670 mm
Height	1,640 mm
Allowable Load	13.0 ton
Weight	3.7 ton
Ballast Capacity (4 Rooms)	16.5 m ³



FLOATING CRANE



BARGE

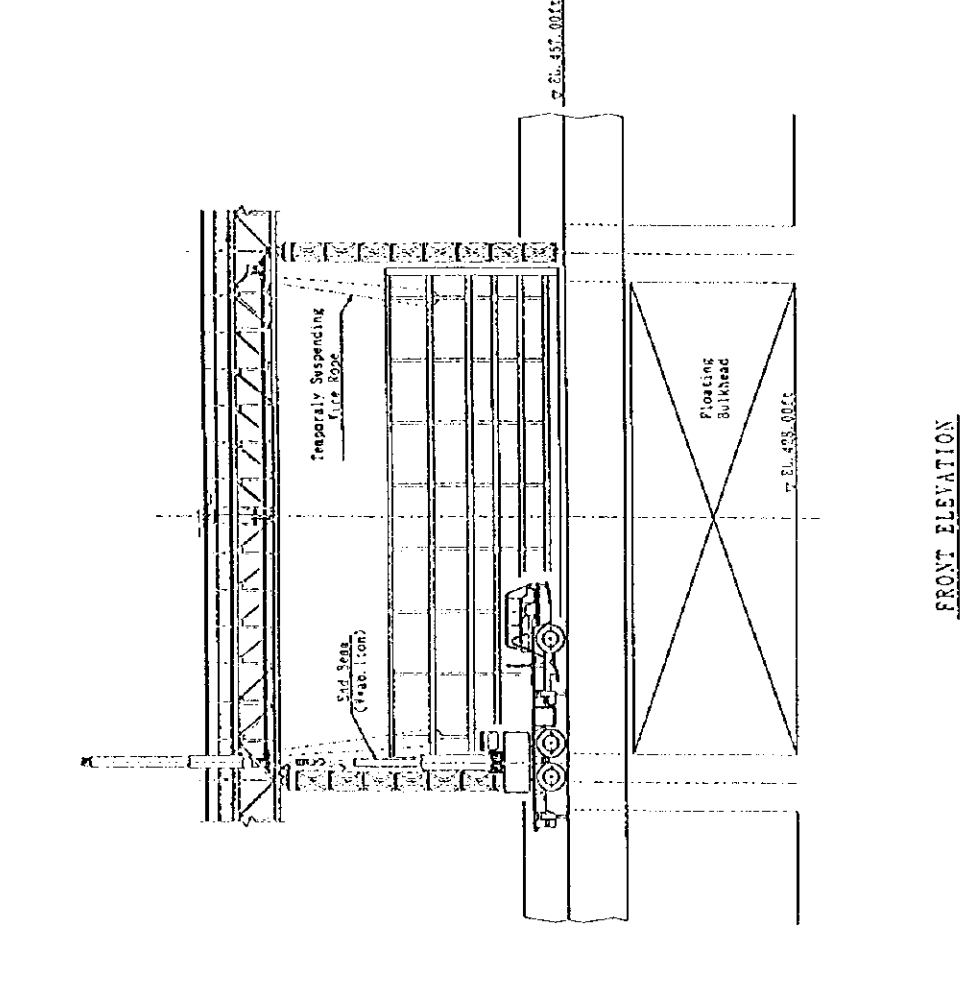
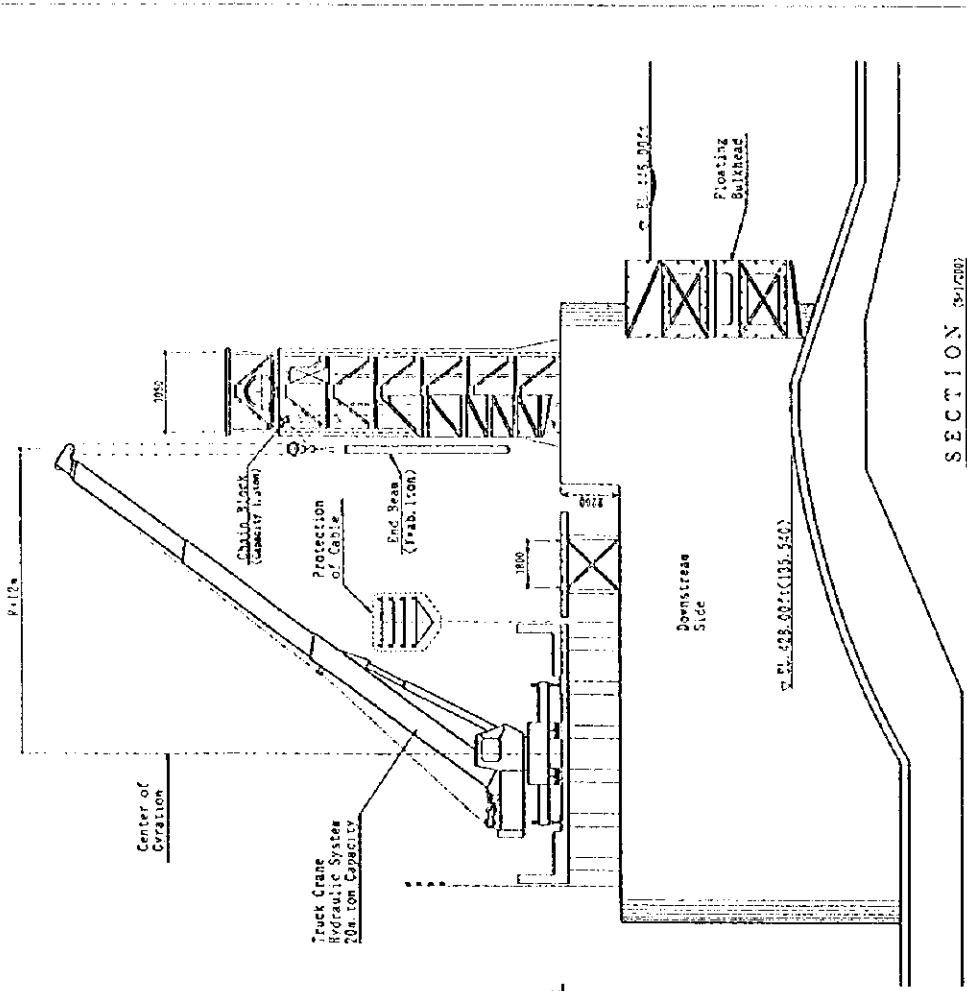
Unit in millimeters

TANSA BARGE IRRIGATION SYSTEM
REHABILITATION PROJECT

INSTALLATION PROCEDURE

FLOATING CRANE, BARGE

JAPAN INTERNATIONAL COOPERATION AGENCY



SECTION 03/15/00

FRONT ELEVATION

20m. Ton Truck Crane
Rated Lifting Capacity

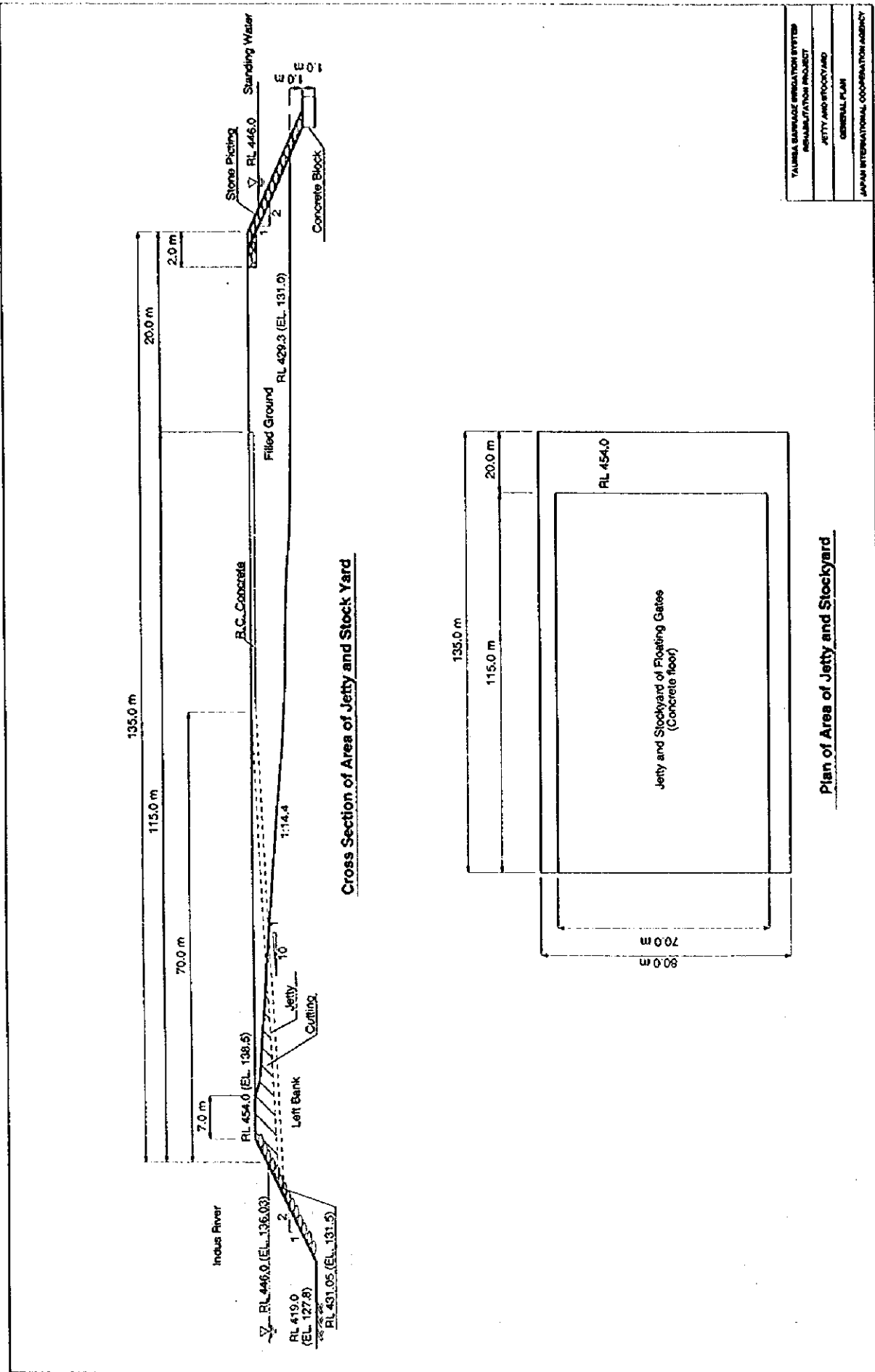
Torking Radius	Boom Length		
	17m	24m	31m
12.0m	3.90	4.30	3.80
13.0m	3.30	3.80	3.50
14.0m	2.85	3.30	3.20
15.0m	2.40	2.90	3.00
15.25m	2.30	2.85	2.95
16.0m	2.55	2.80	
17.0m	2.23	2.50	
18.0m	2.00	2.25	
19.0m	1.75	2.00	
20.0m	1.50	1.85	

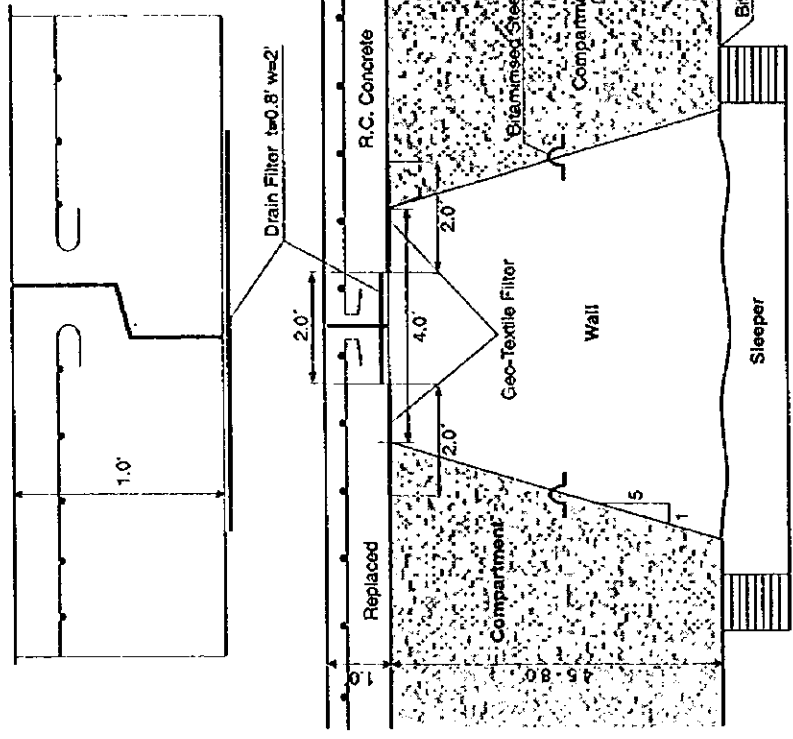
TAUNGA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

INSTALLATION PROCEDURE

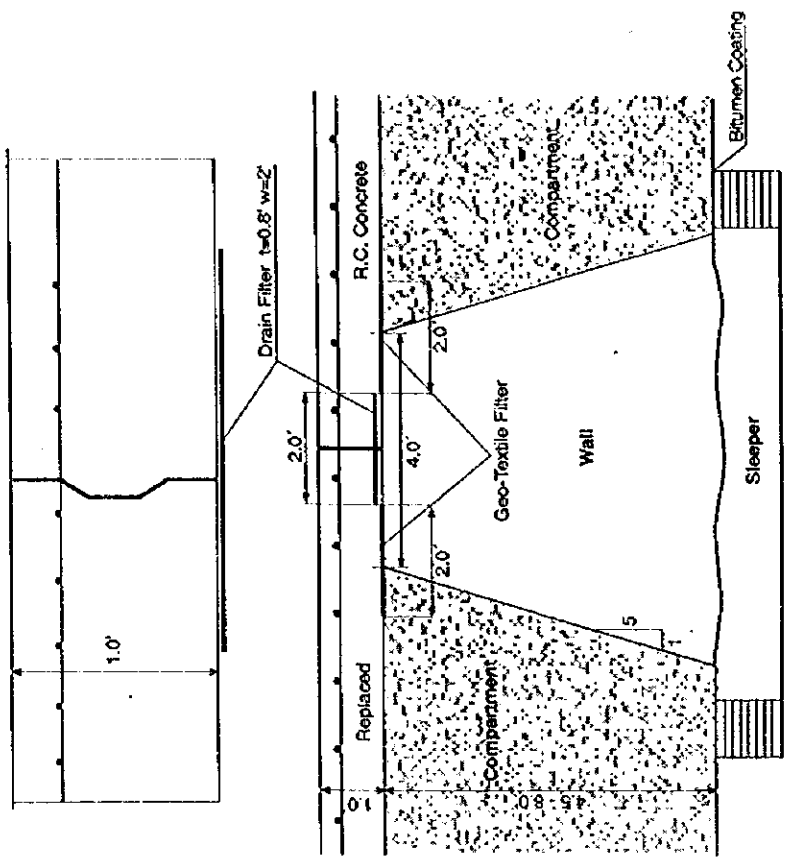
MAIN WEIR GATE

JAPAN INTERNATIONAL COOPERATION AGENCY





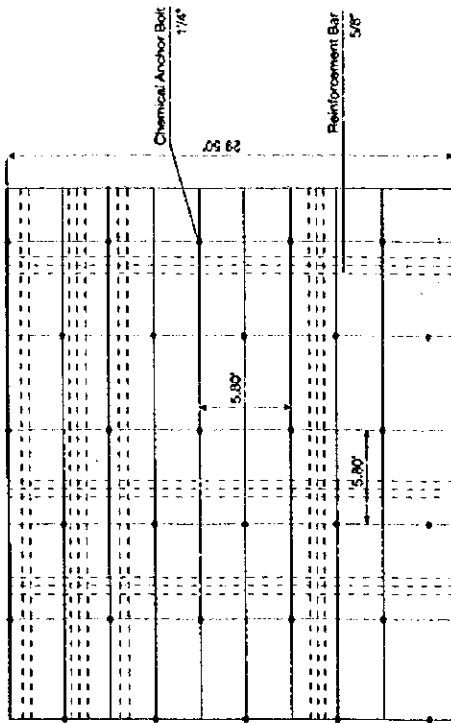
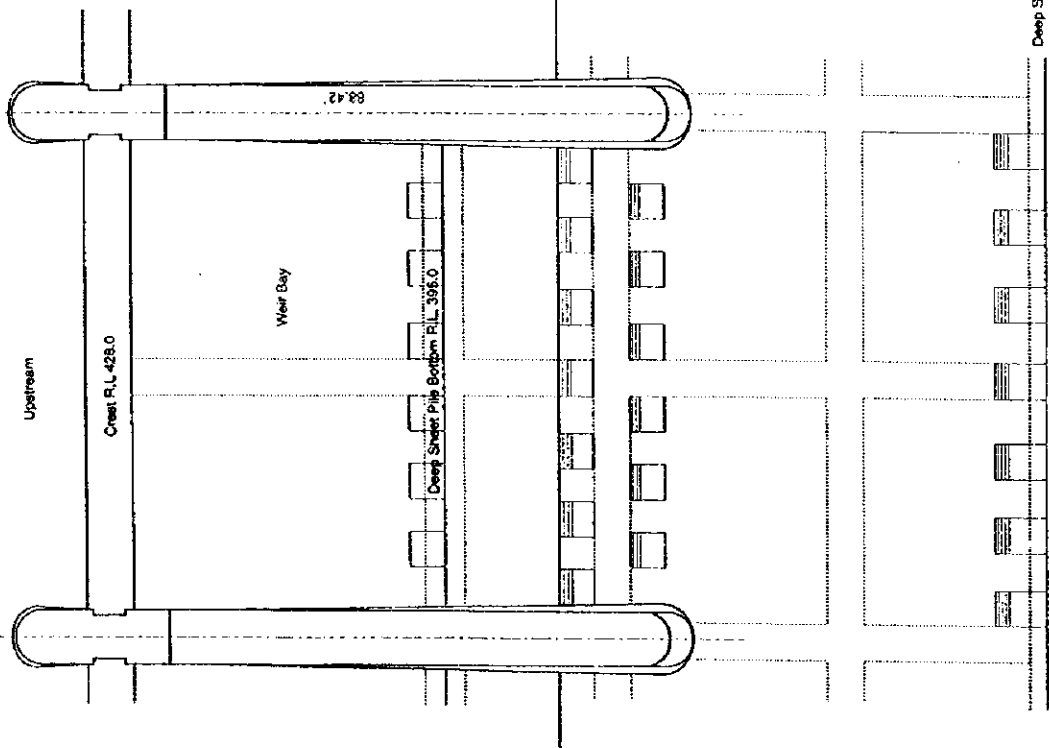
Expansion and Construction Joint with Waterstop



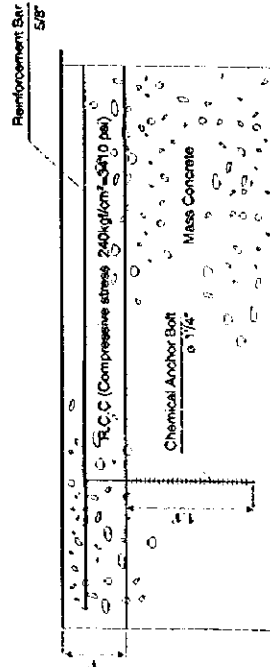
Construction Joint without Waterstop

TAJIMA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
JOINT OF SKIN CONCRETE AT DOWNSTREAM
SECTION OF FILTER ON THE JOINT
JAPAN INTERNATIONAL COOPERATION AGENCY

Detail of Reinforcement in Bay U/S Taunsa Barrage



Plan

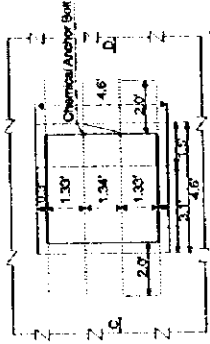


Cross Section

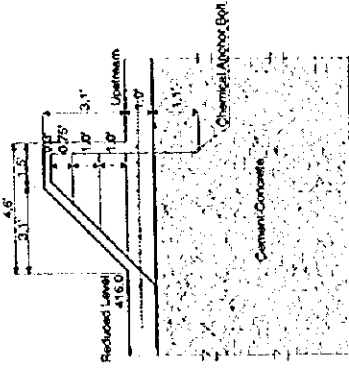
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
SKIN-CONCRETE
PROPOSED DESIGN OF REINFORCED SKIN CONCRETE
JAPAN INTERNATIONAL COOPERATION AGENCY

Deep Sheet Pile Bottom R.L. 395.0

Plan

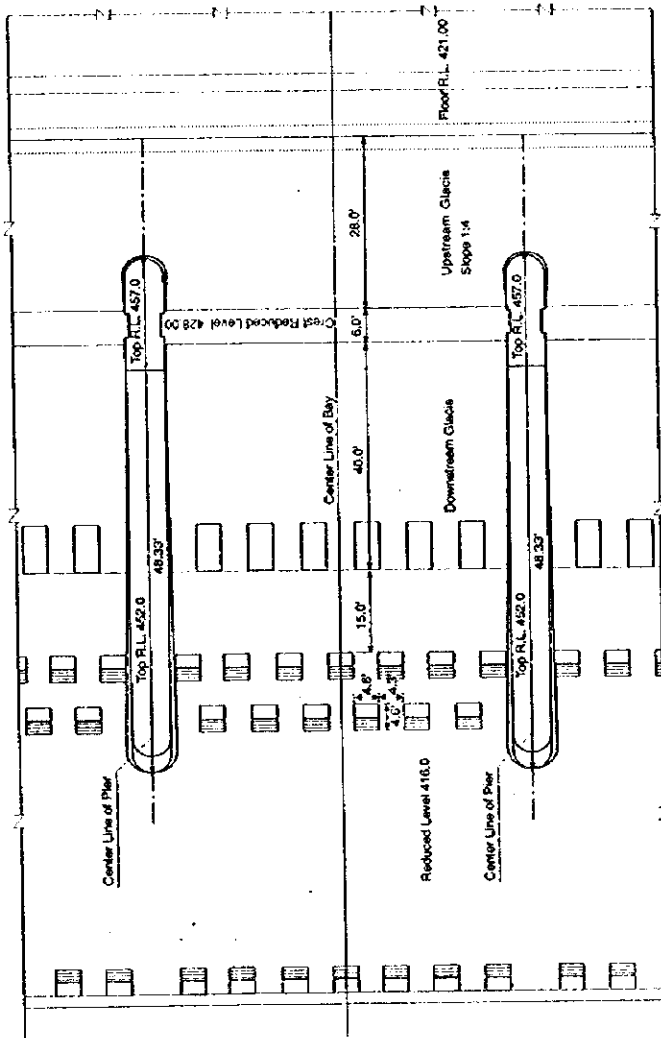


Friction Blocks Near Toe of Downstream Glacis

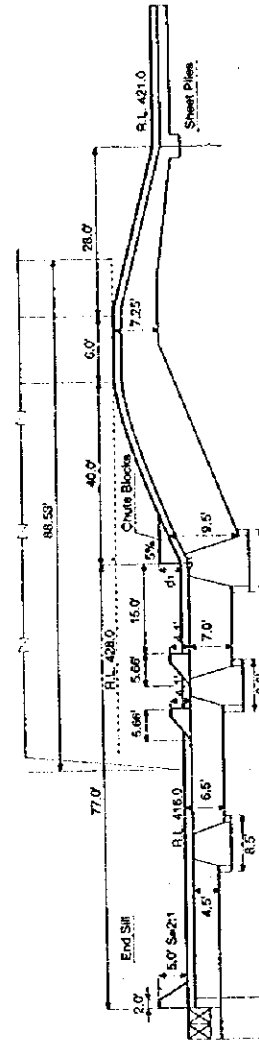


Section on C.D

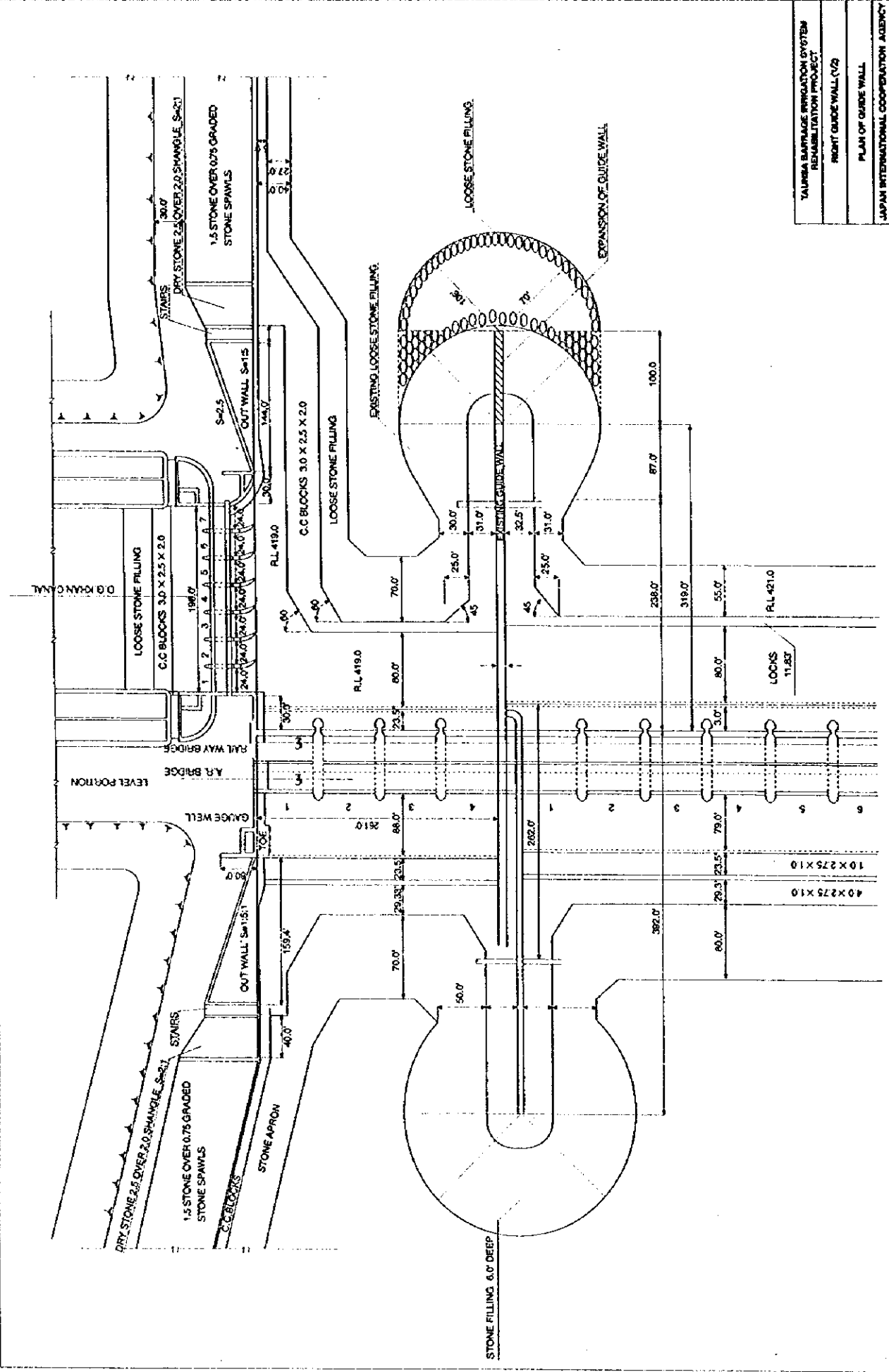
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
FRICION BLOCKS
PROPOSED DESIGN OF REINFORCED FRICION BLOCKS
JAPAN INTERNATIONAL COOPERATION AGENCY



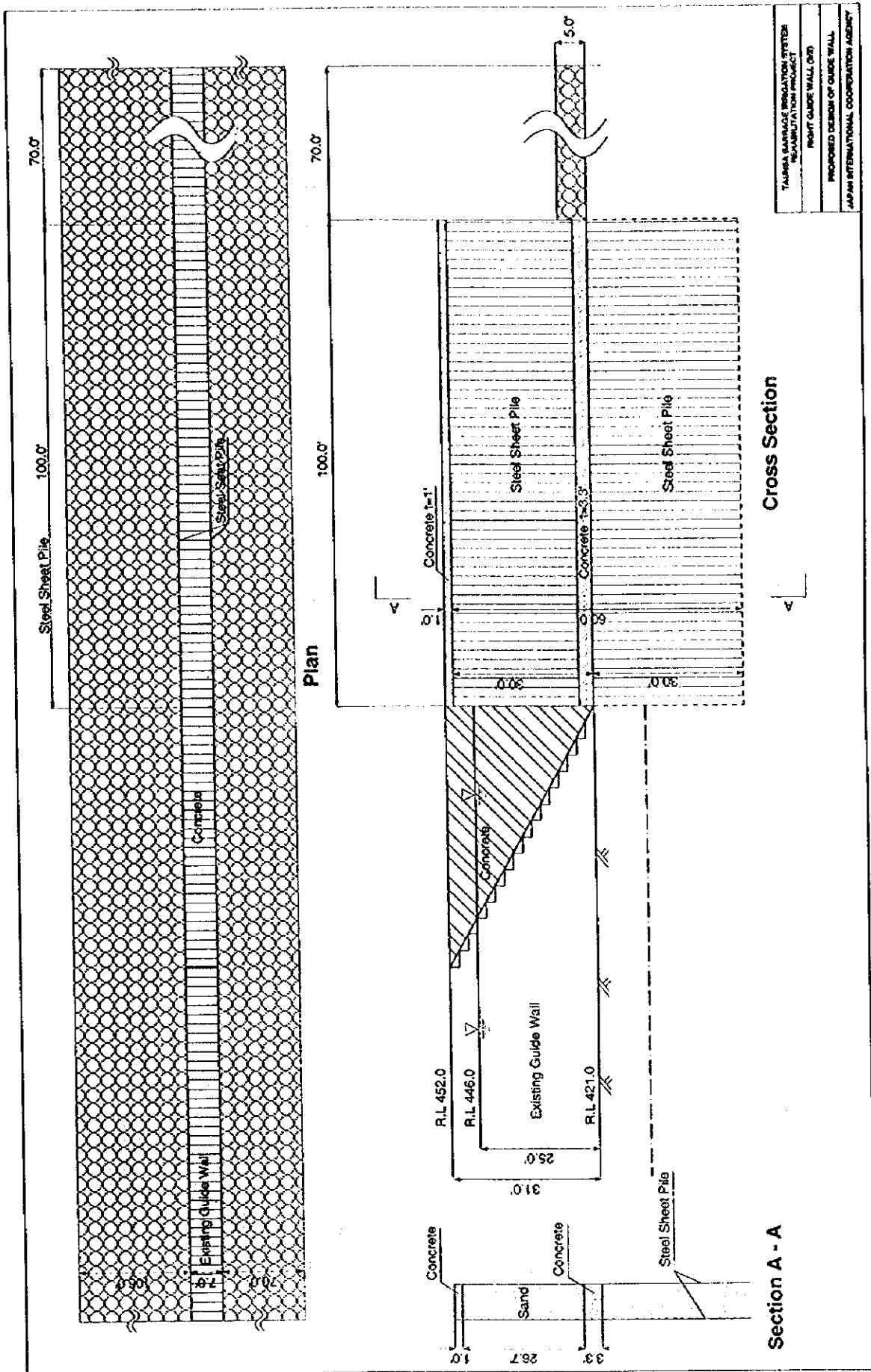
Plan

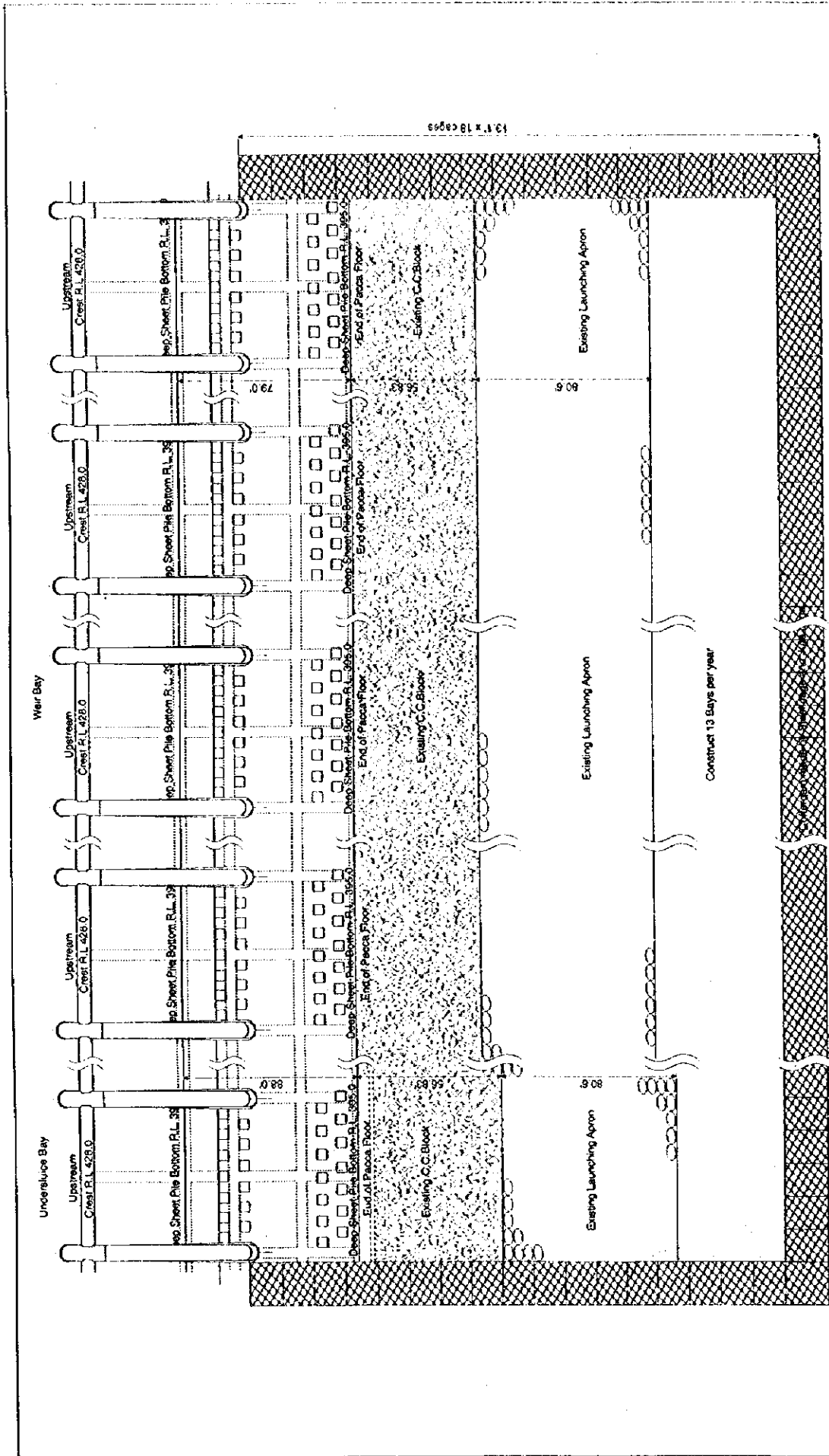


Section on A.B

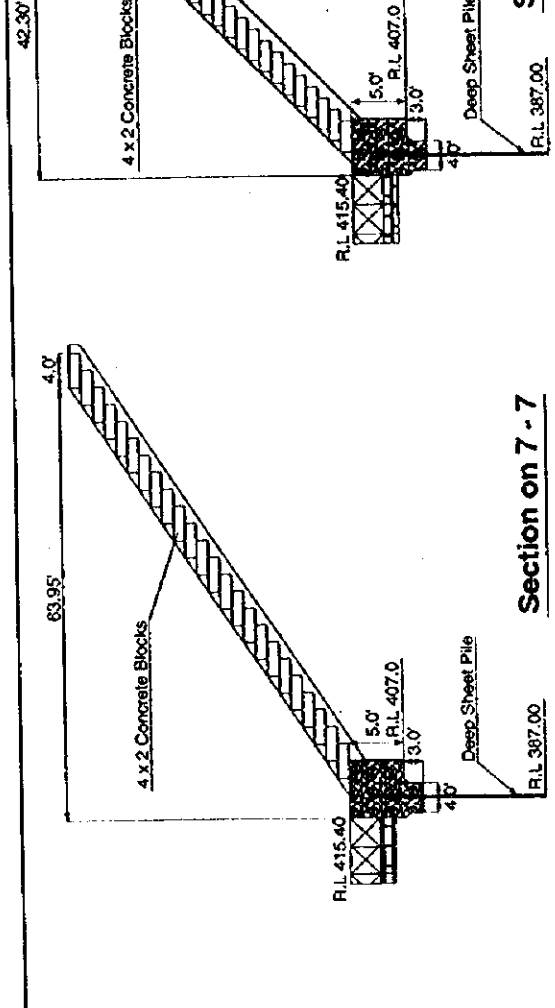
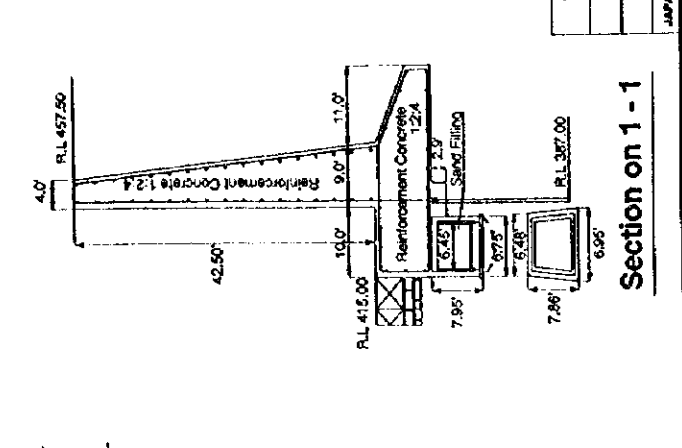
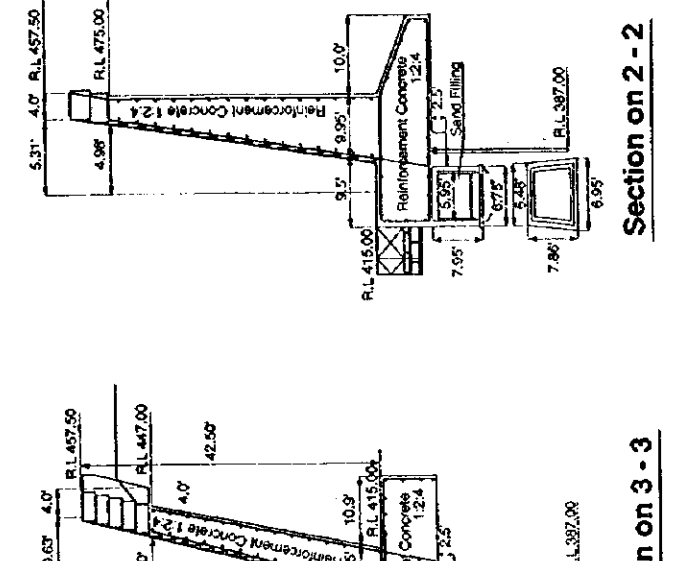
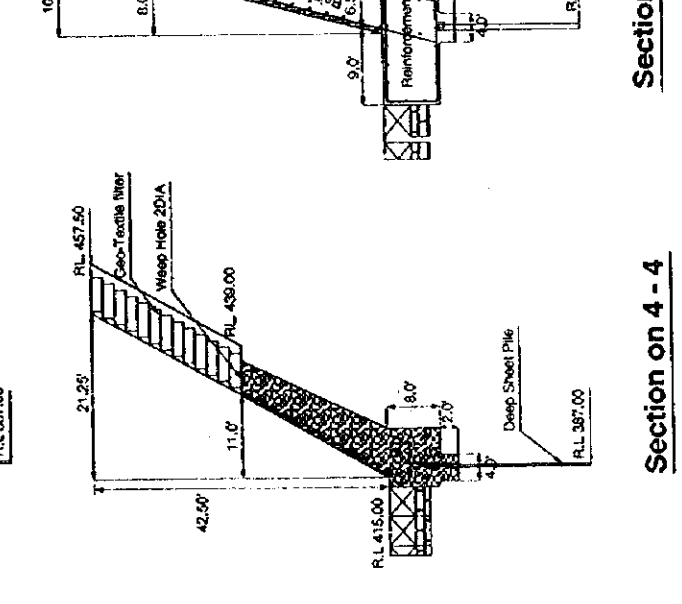
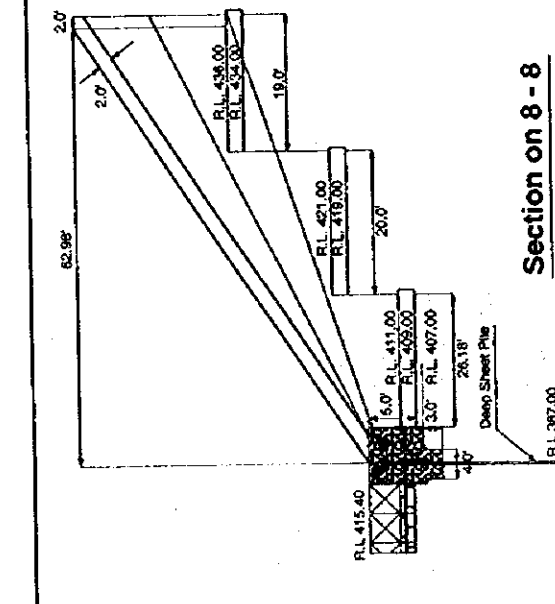
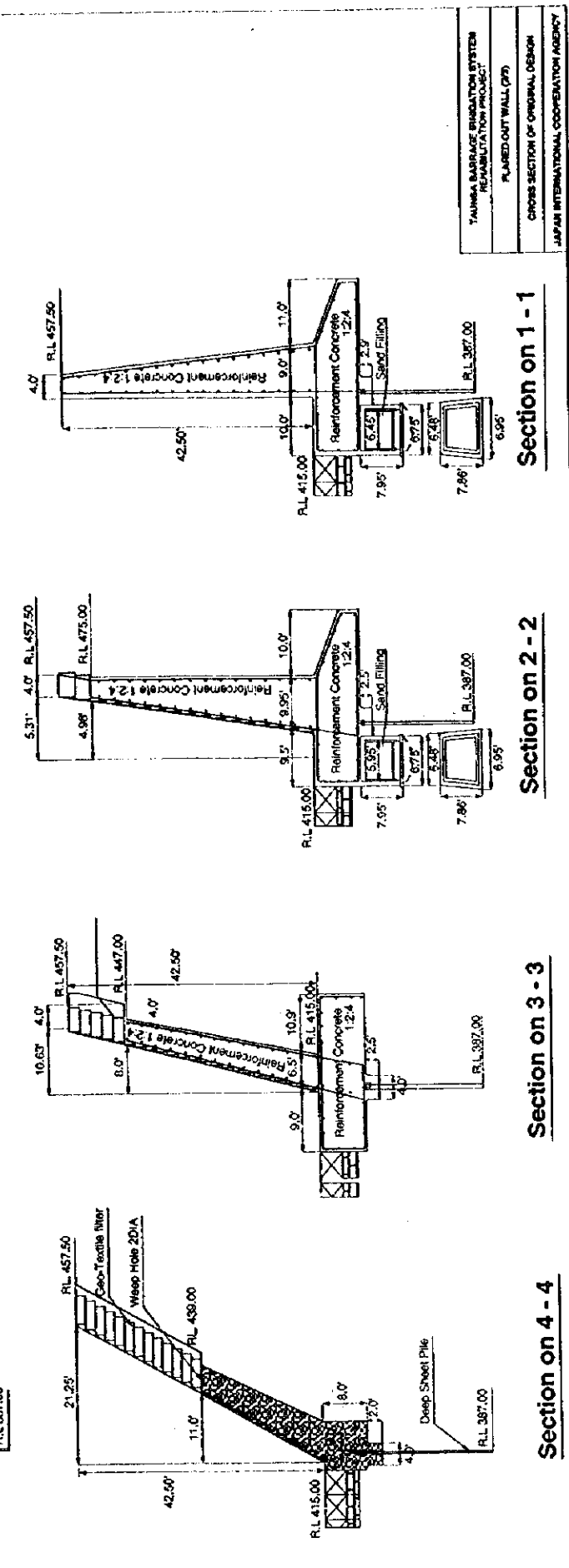
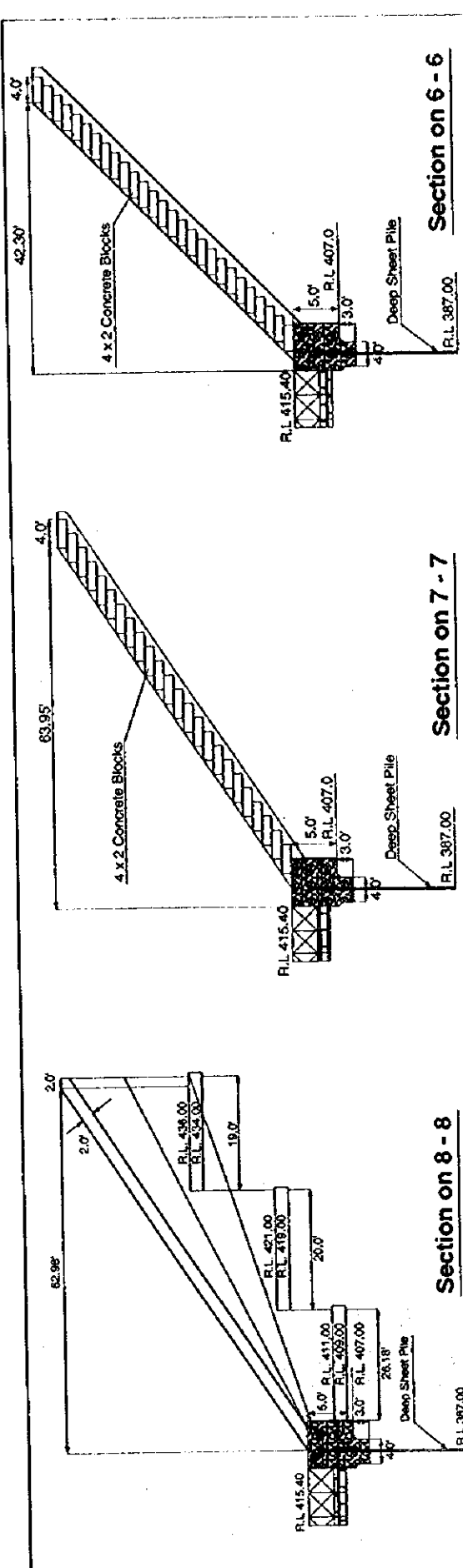


TAUMSA BARRAGE IRRIGATION SYSTEM
 REMEDIATION PROJECT
 RIGHT GUIDE WALL (7/9)
 PLAN OF GUIDE WALL
 JAPAN INTERNATIONAL COOPERATION AGENCY





TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
TEMPORARY WORK (1/2)
PLAN OF COFFERDAM
JAPAN INTERNATIONAL COOPERATION AGENCY

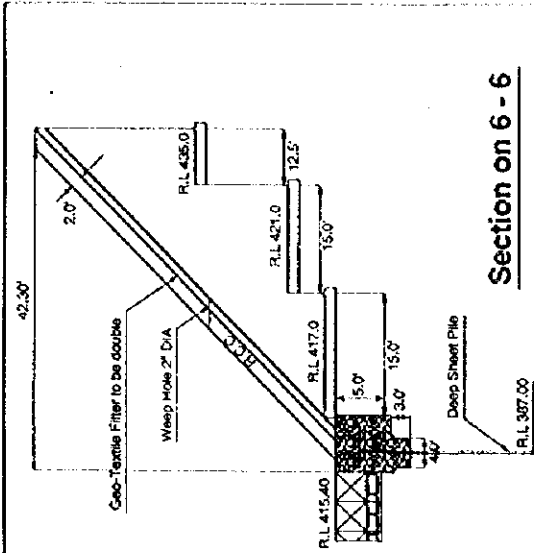


TAIWA BARRAGE BRIDGATION SYSTEM
REHABILITATION PROJECT

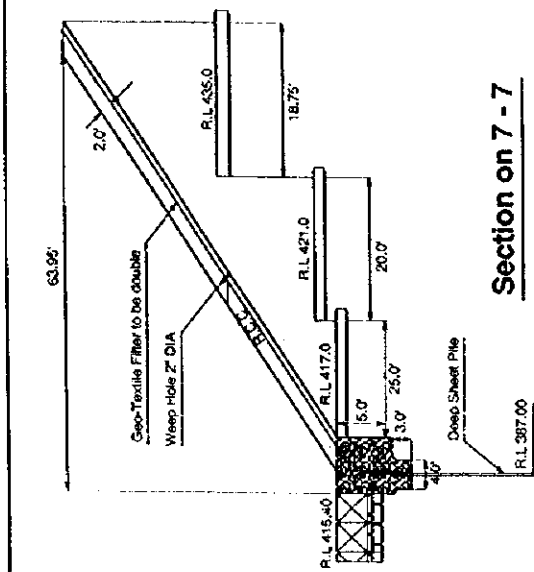
PLUMED-OUT WALL (P)

CROSS SECTION OF ORIGINAL DESIGN

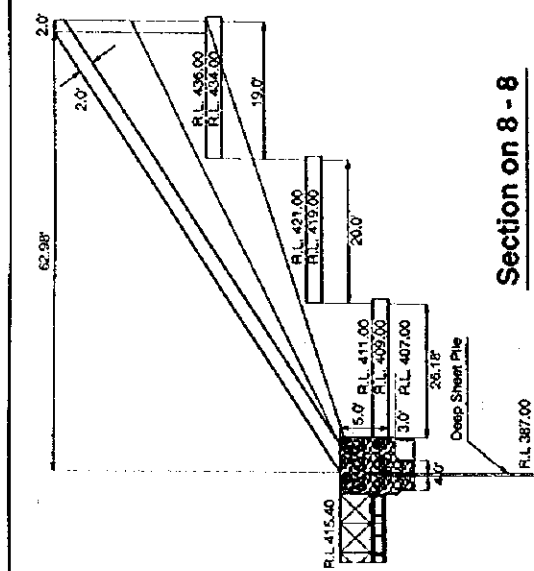
JAPAN INTERNATIONAL COOPERATION AGENCY



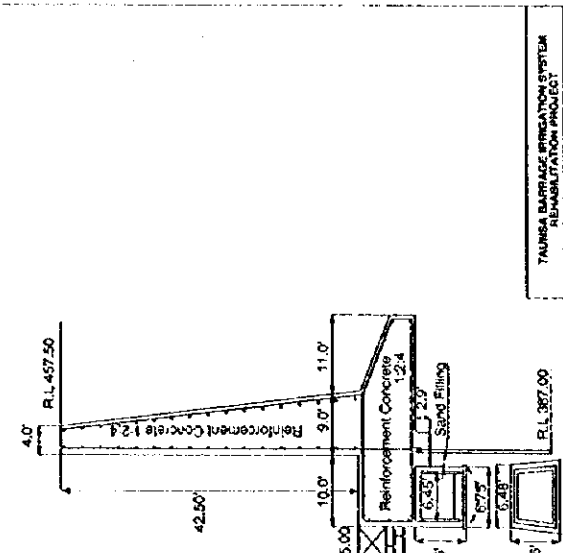
Section on 6 - 6



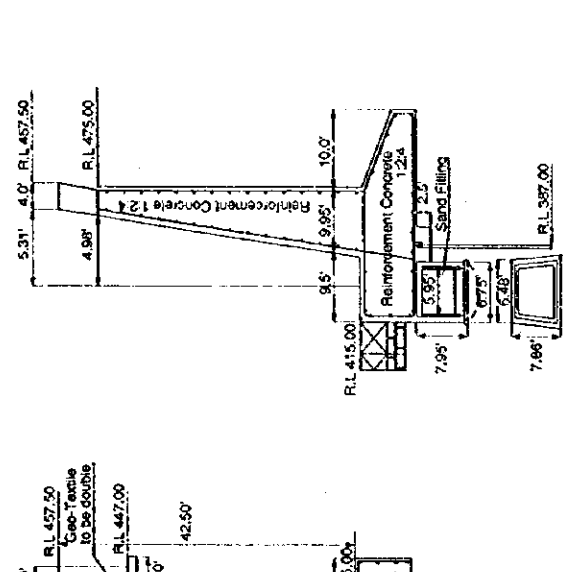
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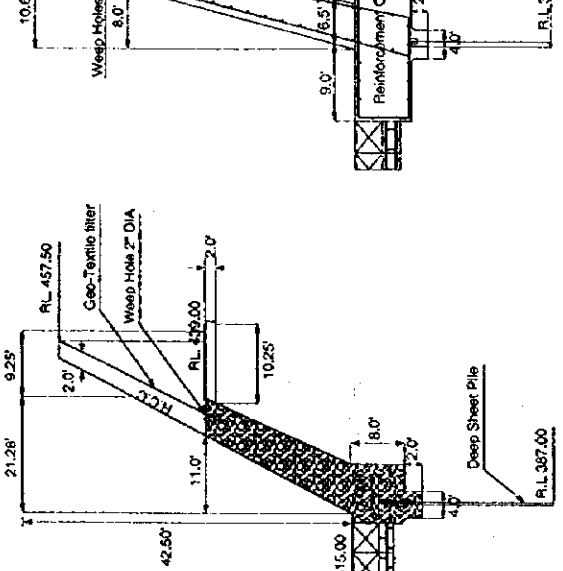
Section on 8 - 8



Section on 1 - 1



Section on 2 - 2



Section on 3 - 3



Section on 4 - 4

TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
FLARED OUT WALL (R/R)
CROSS SECTION OF PROPOSED DESIGN
JAPAN INTERNATIONAL COOPERATION AGENCY

JICA