## 4－2　建設費の概算

モデルスタディにおける施設の建設工事費は、主要な建設種目ごとの想定単価をもとに積算されている。

ここで用いられたすべての単価及び積算資料は、1980年12月現在の資材単価及び労務単価に準拠している。

特に土木躯体工事に関しては、その規模からして、チャンタブリ県内の地元業者にて十分施工可能と思われ又、工事に必要な原材料も県内の資材店で求められるため、県内一般価格を基礎としSanitation Division,Ministry of Healthによってモデル化されている貯水槽の価格を参考とした。

さく井工事に関しては、県内に本計画案を施工できる業者がいないために、バンコック市のさく井業者の単価をもとに地域特性を考慮して積算してある。

各単価及び積算に関する資料は現地調査期間中に収集されたものであり、アペンディックスに添付する。

タイ国においても、ここ1～2年の間に石油高沸等の影響で物価の上昇が激しく、昨年、一昨年と、前年比25％～30％上昇しており、1981年度においても、同等の物価上昇が予測されるが、本工事費にはコンティンジェンシーや物価上昇に係る値は含まれていない。

モデルスタディーについての概算工事費をTable 4－3.に、またその内訳詳細をTable 4－4.に示す。

Table 4－3　　建　設　費　の　概　要

| 項目 / モデルプラン | 建設費(%)(B) | 建設期間(日) | 給水対象人口(人) | 給水対象量(m³) | 建設費(Baht) | | |
|---|---|---|---|---|---|---|---|
| | | | | | 1人当り | ※1世帯当り | 1m³当り |
| モデルプランA | 1,090,000 (27) | 120 | 1,088 | 30 | 1,002 | 4,008 | 36,334 |
| 〃 B | 800,000 (19) | 90 | 564 | 15 | 1,419 | 5,676 | 53,334 |
| 〃 C | 700,000 (17) | 90 | 545 | 11 | 1,285 | 5,140 | 63,637 |
| 〃 D | 1,479,000 (37) | 120 | — | 20 | — | — | 73,950 |
| 合　計 | 4,069,000 (100) | 390 | 2,197 | 76 | 3,706 | 14,824 | 227,255 |
| 平　均 | 1,017,250 | 97.5 | 733 | 19 | 1,236 | 4,942 | 56,874 |

※ 1世帯4人として算定

Table 4 - 4 COST ESTIMATES FOR MODEL PLAN

| MODEL AREA | MODEL PLAN | CONSTRUCTION COST(฿) | CONSTRUCTION PERIOD (day) |
|---|---|---|---|
| Sai Kao (Ban Samrong) | Model Plan A | 1,090,000 | 120 |
| Tagad Ngao (Ban Nong Khan) | Model Plan B | 800,000 | 90 |
| Bo (Ban BO) | Model Plan C | 700,000 | 90 |
| Prapokklao Hospital | Model Plan D | 1,479,000 | 120 |
| Total | | 4,069,000 | 420 |

## 4 - 5 (a) CONSTRUCTION COST OF FACILITIES

MODEL PLAN - A

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (₱) | AMOUNT (₱) |
|---|---|---|---|---|---|
| 1. 0 | well Construction | | | | |
| 1 | Transportation and preparation | 1 | L.S. | | 35,000 |
| 2 | Drilling of well (Ø200 mm) | 80 | M | 5,500 | 440,000 |
| 3 | Furnish and install of well casing (Ø 100 mm) | 80 | M | 1,100 | 88,000 |
| 4 | Furnish and install of submersible pump complete with electric motor and accessories | 1 | L.S. | | - |
| 5 | Furnish and install of hand pump complete with necessary accessories | 1 | L.S. | | 20,000 |
| 6 | Furnish and install of well screen (Ø 100 mm) | 30 | M | 3,000 | 90,000 |
| 7 | Gravel packing and cement seal | 1 | L.S. | | 15,000 |
| 8 | Soil and water sampling | 1 | L.S. | | 10,000 |
| 9 | Well chamber construction | 1 | L.S. | | 5,000 |
| 10 | Pumping test and other miscellanious works | 1 | L.S. | | 155,000 |
| | Sub-Total | | | | 858,000 |
| 2. 0 | Construction of well platform | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 5,000 |
| 2 | Concrete work including reinforcement and plastering | 1 | L.S. | | 10,000 |
| | Sub-Total | | | | 15,000 |
| 3. 0 | Construction of pumping station | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | - |
| 2 | Brick masonry including cement motor works | | M2 | | - |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (Ø) | AMOUNT (Ø) |
|---|---|---|---|---|---|
| 3 | Concrete works | | M3 | | - |
| 4 | Reinforcement bar works | | kg | | - |
| 5 | Forming works | | M2 | | - |
| 6 | Plastering works | | M2 | | - |
| 7 | Plumbing works | 1 | L.S. | | - |
| 8 | Electrical works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 4. 0 | Construction of sand filter | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | - |
| 2 | Concrete works | | M3 | | - |
| 3 | Reinforcement bar works | | kg | | - |
| 4 | Forming works | | M2 | | - |
| 5 | Plastering works | | M2 | | - |
| 6 | Plumbing works | 1 | L.S. | | - |
| 7 | Furnish and install of gravel and sand | 1 | L.S. | | - |
| 8 | Miscellanious works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 5. 0 | Construction of elevated water tank | | | | |
| 1 | Basis work and leveling works | 1 | L.S. | | - |
| 2 | Furnish/install of water storage tank complete with necessary coating | 1 | L.S. | | - |
| 3 | Plumbing works | 1 | L.S. | | - |
| 4 | Miscellanious works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 6. 0 | Installation of water supply(transmission) pipes | | | | |
| 1 | Civil works for piping | 1 | L.S. | | - |
| 2 | Plumbing works | | M | | - |
| | Sub-Total | | | | - |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 7. 0 | Spare parts for two years operation | 1 | L.S. | | 10,000 |
| 8. 0 | Tools and Test kits | 1 | L.S. | | 7,000 |
| 9. 0 | Engineering supervision<br>Supervision shall be scheduled in twice when starting of construction and inspection/Hand over. | 1 | L.S. | | 200,000 |
| | Grand Total ---------- | | | | 1,090,000 |

## 4 - 5 (b) CONSTRUCTION COST OF FACILITIES

MODEL PLAN - B

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (₱) | AMOUNT (₱) |
|---|---|---|---|---|---|
| 1. 0 | well Construction | | | | |
| 1 | Transportation and preparation | 1 | L.S. | | 25,000 |
| 2 | Drilling of well (Ø 300 mm) | 35 | M | 4,000 | 140,000 |
| 3 | Furnish and install of well casing (Ø 200 mm) | 35 | M | 1,600 | 56,000 |
| 4 | Furnish and install of submersible pump complete with electric motor and accessories | 1 | L.S. | | - |
| 5 | Furnish and install of hand pump complete with necessary accessories | 1 | L.S. | | 15,000 |
| 6 | Furnish and install of well screen (Ø 200 mm) | 15 | M | 6,000 | 90,000 |
| 7 | Gravel packing and cement seal | 1 | L.S. | | 15,000 |
| 8 | Soil and water sampling | 1 | L.S. | | 10,000 |
| 9 | Well chamber construction | 1 | L.S. | | 5,000 |
| 10 | Pumping test and other miscellanious works | 1 | L.S. | | 155,000 |
| | Sub-Total | | | | 511,000 |
| 2. 0 | Construction of well platform | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 5,000 |
| 2 | Concrete work including reinforcement and plastering | 1 | L.S. | | 10,000 |
| | Sub-Total | | | | 15,000 |
| 3. 0 | Construction of pumping station | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | - |
| 2 | Brick masonry including cement motor works | | M2 | | - |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 3 | Concrete works | | M3 | | - |
| 4 | Reinforcement bar works | | kg | | - |
| 5 | Forming works | | M2 | | - |
| 6 | Plastering works | | M2 | | - |
| 7 | Plumbing works | 1 | L.S. | | - |
| 8 | Electrical works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 4. 0 | Construction of sand filter | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 15,000 |
| 2 | Concrete works | 5.8 | M3 | 1,500 | 8,700 |
| 3 | Reinforcement bar works | 185 | kg | 20 | 3,700 |
| 4 | Forming works | 35 | M2 | 250 | 8,750 |
| 5 | Plastering works | 45 | M2 | 150 | 6,750 |
| 6 | Plumbing works | 1 | L.S. | | 1,500 |
| 7 | Furnish and install of gravel and sand | 1 | L.S. | | 12,000 |
| 8 | Miscellanious works | 1 | L.S. | | 1,600 |
| | Sub-Total | | | | 58,000 |
| 5. 0 | Construction of elevated water tank | | | | |
| 1 | Basis work and leveling works | 1 | L.S. | | - |
| 2 | Furnish/install of water storage tank complete with necessary coating | 1 | L.S. | | - |
| 3 | Plumbing works | 1 | L.S. | | - |
| 4 | Miscellanious works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 6. 0 | Installation of water supply(transmission) pipes | | | | |
| 1 | Civil works for piping | 1 | L.S. | | - |
| 2 | Plumbing works | | M | | - |
| | Sub-Total | | | | - |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 3. 0 | Spare parts for two years operation | 1 | L.S. | | 10,000 |
| 4. 0 | Tools and Test kits | 1 | L.S. | | 6,000 |
| 5. 0 | Engineering supervison<br>Supervision shall be scheduled in twice when starting of construction and inspection/hand over | 1 | L.S. | | 200,000 |
| | Grand Total ---------- | | | | 800,000 |

## 4 - 5 (c) Construction costs of facilities

MODEL PLAN - C

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (¥) | AMOUNT (¥) |
|---|---|---|---|---|---|
| 1. 0 | Rain fall water storage tank | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 15,000 |
| 2 | Concrete works | 96 | M3 | 1,400 | 134,400 |
| 3 | Reinforcement bar works | 5680 | kg | 15 | 85,200 |
| 4 | Forming works | 735 | M2 | 210 | 154,350 |
| 5 | Plastering works | 420 | M2 | 120 | 50,400 |
| 6 | Plumbing works | 1 | L.S. | | 5,000 |
| 7 | Furnish and install of water collecting | 1 | L.S. | | 11,000 |
| 8 | Miscellanious works | 1 | L.S. | | 2,650 |
| | Sub-Total | | | | 458,000 |
| 2. 0 | Construction of sand filter | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 3,000 |
| 2 | Concrete works | 4.3 | M3 | 1,400 | 6,020 |
| 3 | Reinforcement works | 125 | kg | 15 | 1,875 |
| 4 | Forming works | 27 | M2 | 210 | 5,670 |
| 5 | Plastering works | 20 | M2 | 120 | 2,400 |
| 6 | Plumbing works | 1 | L.S. | | 5,000 |
| 7 | Furnish and install of gravel and sand | 1 | L.S. | | 7,000 |
| 8 | Miscellanious works | 1 | L.S. | | 1,035 |
| | Sub-Total | | | | 32,000 |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 3. 0 | Spare parts for two years operation | 1 | L.S. | | 5,000 |
| 4. 0 | Tools and Test kits | 1 | L.S. | | 5,000 |
| 5. 0 | Engineering supervison<br>Supervision shall be scheduled in twice when starting of construction and inspection/hand over | 1 | L.S. | | 200,000 |
| | Grand Total ---------- | | | | 700,000 |

## 4 - 5 (d) CONSTRUCTION COST OF FACILITIES

MODEL PLAN - D

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 1. 0 | well Construction | | | | |
| 1 | Transportation and pre-paration | 1 | L.S. | | 25,000 |
| 2 | Drilling of well (Ø 250 mm) | 70 | M | 4,000 | 280,000 |
| 3 | Furnish and install of well casing (Ø 150 mm) | 70 | M | 1,500 | 105,000 |
| 4 | Furnish and install of submersible pump complete with electric motor and accessories | 1 | L.S. | | 47,000 |
| 5 | Furnish and install of hand pump complete with necessary accessories | 1 | L.S. | | 110,000 |
| 6 | Furnish and install of well screen (Ø 150 mm) | 30 | M | 5,000 | 150,000 |
| 7 | Gravel packing and cement seal | 1 | L.S. | | 15,000 |
| 8 | Soil and water sampling | 1 | L.S. | | 10,000 |
| 9 | Well chamber construction | 1 | L.S. | | 5,000 |
| 10 | Pumping test and other miscellanious works | 1 | L.S. | | 155,000 |
| | Sub-Total | | | | 902,000 |
| 2. 0 | Construction of well platform | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 5,000 |
| 2 | Concrete work including reinforcement and plas-tering | 1 | L.S. | | 10,000 |
| | Sub-Total | | | | 15,000 |
| 3. 0 | Construction of pumping station | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | 20,000 |
| 2 | Brick masonry including cement motor works | 27 | M2 | 300 | 8,100 |

| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 3 | Concrete works | 5.8 | M3 | 1,500 | 8,700 |
| 4 | Reinforcement bar works | 265 | kg | 20 | 5,300 |
| 5 | Forming works | 38 | M2 | 250 | 9,500 |
| 6 | Plastering works | 42 | M2 | 150 | 6,300 |
| 7 | Plumbing works | 1 | L.S. | | 17,100 |
| 8 | Electrical works | 1 | L.S. | | 15,000 |
| | Sub-Total | | | | 90,000 |
| 4. 0 | Construction of sand filter | | | | |
| 1 | Earth work and leveling works | 1 | L.S. | | - |
| 2 | Concrete works | | M3 | | - |
| 3 | Reinforcement bar works | | kg | | - |
| 4 | Forming works | | M2 | | - |
| 5 | Plastering works | | M2 | | - |
| 6 | Plumbing works | 1 | L.S. | | - |
| 7 | Furnish and install of gravel and sand | 1 | L.S. | | - |
| 8 | Miscellanious works | 1 | L.S. | | - |
| | Sub-Total | | | | - |
| 5. 0 | Construction of elevated water tank | | | | |
| 1 | Basis work and leveling works | 1 | L.S. | | 4,500 |
| 2 | Furnish/install of water storage tank complete with necessary coating | 1 | L.S. | | 115,000 |
| 3 | Plumbing works | 1 | L.S. | | 10,000 |
| 4 | Miscellanious works | 1 | L.S. | | 1,500 |
| | Sub-Total | | | | 131,000 |
| 6. 0 | Installation of water supply(transmission) pipes | | | | |
| 1 | Civil works for piping | 1 | L.S. | | 42,000 |
| 2 | Plumbing works | 900 | M | 80 | 72,000 |
| | Sub-Total | | | | 114,000 |

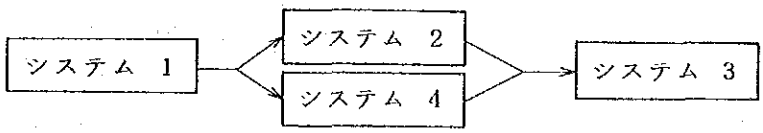
| ITEM NO. | WORK DESCRIPTION | Q'TY | UNIT | UNIT PRICE (฿) | AMOUNT (฿) |
|---|---|---|---|---|---|
| 7. 0 | Spare parts for two years operation | 1 | L.S. | | 20,000 |
| 8. 0 | Tools and Test kits | 1 | L.S. | | 7,000 |
| 9. 0 | Engineering supervision<br>Supervision shall be scheduled in twice when starting of construction and inspection/Hand over. | 1 | L.S. | | 200,000 |
| | Grand Total ---------- | | | | 1,479,000 |

## 4-3 実施計画スケジュール

すでに前節で述べられた如く、このプログラムは地域保健活動向上プロジェクト（Promotion of Provincial Health Services Project）の一部をなすものである。実施計画は当該プロジェクトに密接な関連をもたせ、且つモデル地域の特性を考慮して実施計画案を検討するものである。モデルスタディー及び実施計画を含めた本プログラムは、初期の緊急需要を充たそうとする一般的な指針を示すものであり、将来の変化に応じて必要とあれば変更及び修正がなされるべきものである。

Table 4－5.に各モデル・スタディーの施行期間を示す。プログラムの実施を確かなものにするために次の条件が考慮されるべきである。

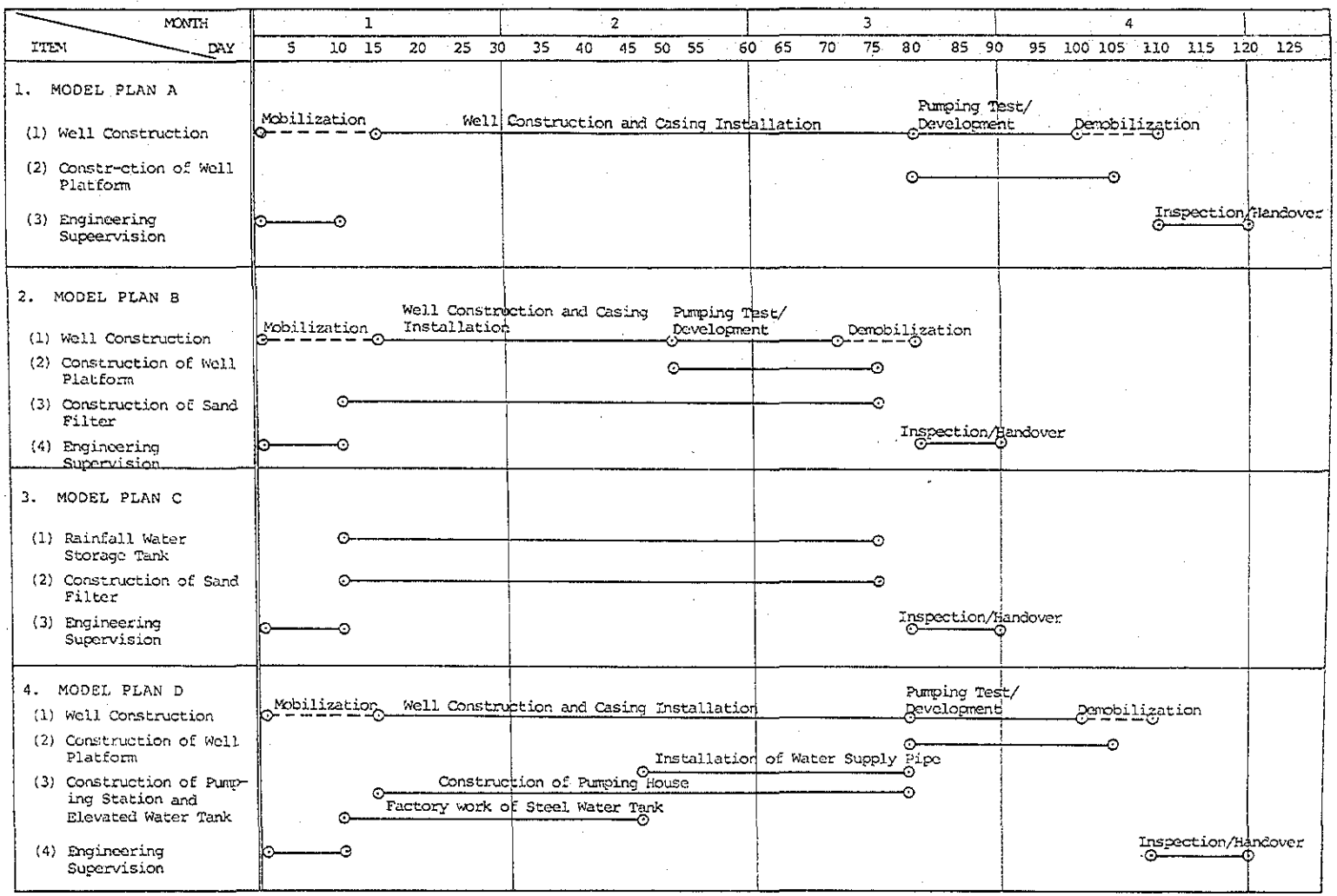
(1) モデル地域に施設を建設するに当り、次に示す順序でシステムを選ぶこと。




施設の選択にあたっては、水源事情，費用，効果分析及び将来の電力事情，需要増加等を考慮してある。

(2) 施行に当っては、業者打合せ建設地点の確認，工事の基本的指示及び竣工検査等を考へ、工事発註時及び竣工時（この時,次の物件の工事発註業務も含める）の２回につき現地にスーパーバイザー（プロジェクトエンジニア）を派遣するように計画した。

# Table 4-6 Estimated Execution Schedule of Facilities



## 4－4　維持管理計画

第３章“３－1.計画の基本方針”で、すでに述べられているとうり、本施設の運営は、地域の受益者たる当該村民からなる組織において、すなわち、彼らの責任のもとに実行されるべきである。

さらに、村の人々がこの計画で予定されている初期段階から参画するように強く望むものである。

1）維持管理とマネージメント

まず村単位で組織される委員会か、それに匹敵する地域での組織が構成されるべきである。地域レベル委員会の重要性は、それがモデル地域における維持管理の代表となること、また直接村のリーダー及び施設の日々の運営にかかわる村の主だった人々を加え、施設を利用する人々を教育し、計画に対する意識の向上を動機づけることである。

村の委員会は、特定の複数の村人を任命して彼らの施設の維持に関する全体トレーニングを受けさせる。特にハンドポンプについて、しかるのち事実上維持面でのすべての、責任を彼らに持たせる。彼らの働きに対しては、相応な報酬を支払うことを提案する。任命された村人は、施設の完成後、その維持管理に責任をもち、簡単な修理用部品を手元に置き、管理するものとする。もし、重大な故障が生じた場合は、地域のヘルスセンターへ行き、自らが修理するために必要な部品を入手したり、地域の水道技術者に修理を頼む。

また医療協力の面から、すでに活動しているVolunteer Comminucatorや Health Volunteerとの関連を考え、組織された運営委員会をこれらボランティアーが強く補佐すべきである。

さらにこのモデルスタディーが、保健対策プロジェクトの一環として発展し機能してゆくためには、中央レベルでの、これら維持管理に対する援助を行うと伴に、本プロジェクトの推進母体である公衆衛生省医科学局（Department of Medical Science）においても実施計画及び維持管理に関与する運営委員会を組織することが望ましいと考える。施設の規模，消耗交換部品，標準化の応用等を考慮すると、Sanitation Divisionで実施されている浅井戸改良プロジェクトと多くの共通点をもっており、これら実施中のプロジェクトの有効利用も検討する必要があろう。

2) 常時維持管理作業

a) 一般的故障

モデルスタディで計画されている施設のうちで、手押しポンプ施設がふだんの管理上最も故障しがちでめんどうである。ここでは、手押しポンプの維持管理作業について特に取りあげてみる。一般的な運用上の問題とその原因及び修理についてTable 4－7., 4－8.にまとめられている。

b) 製造業者の解説書

組立て，すえ付，注油そして維持管理について解説してある製造業者の指導書／マニュアルに忠実に従うこと。ポンプはすえ付の前に全体的に検査され、すべてが調整されること。

c) 訓　練

手押しポンプの維持管理に係る訓練計画では、すえ付，使用そして維持管理が強調されるべきである。製造業者や公的機関の指導書による、すえ付，使用・維持管理に関する訓練にあたっては、実際の現場での訓練がともなうべきである。実際にすえ付けられる手押しポンプの見本などを含めた、訓練用の小道具が用意されると良い。実地訓練としては破損したり摩耗した部品なども役立つであろう。

3) 維持管理費の概算と便益性

給水システムは前章3－3.飲料水供給施設計画に示されるように4つのモデルプランに分類されるが、設備単位としてはいくつかの基本的なユニットに分けられる。これら設備単位の使用耐用年数を下記のように推定する。

| | | |
|---|---|---|
| (1) | 井　　戸 | 15年 |
| (2) | ハンドポンプ | 10年 |
| (3) | 水中ポンプ | 10年 |
| (4) | コンクリート製水槽 | 30年 |
| (5) | 鋼製水槽 | 20年 |
| (6) | 給水ポンプ | 20年 |
| (7) | 給水栓及び各種バルブ | 20年 |
| (8) | ポンプハウス | 30年 |

給水施設のうち、機械設備の耐用年数を10年，パイプ類や貯水タンク等の比較的構

造の簡単で寿命の長い設備類は２０年とした。また、コンクリート構造物については、気候条件等を考慮して３０年としたが、この耐用年数は適正な運転と適格な整備が行われることを前提とする。

また維持管理に要する年間コストは大きく分けて、

(1) 施設の運転のための動力費

(2) 設備機器の消耗，交換部品

(3) 運転及び維持管理に要する一般経費

の３つに分類されるが、モデル地域のうちで電力の供給が与えられるのはPrapokklas Hospitolのみであり、機器の消耗，交換部品は施設の能力によって異ってくる。

また維持管理体制についても病院の管理下におかれるモデルプランDと他のモデルプランとは異るであろうし、さらに各モデルビレッジについても、それぞれ特色ある管理組織が考えられよう。

一般に維持管理に要する費用は施設の建設費に対して次のような見積りになる。

| | |
|---|---|
| 機械設備類 | 4 %～6 % |
| パイプ類及び水槽 | 0.5 %～2 % |
| その他の構造物 | 0.5 %～1 % |

Table 4－8.に維持管理に要する年間費用の概算を示す。費用の算定に当っては既存の施設の維持管理実績、例ば消耗部品の交換頻度や破損の程度（主として日本国内の実績）をもとにチャンタブリ県下で市販されているこれら部品の価格を参考とした。

動力費は、水中ポンプを運転するための電力代である。ポンプの能力と、給水量より、１日の平均運転時間を８時間として、年間の必要電力量を算出し、Table 4－7.に示す。地方電気料金をもとに算定した。

一般経費についての内訳は次の通りである。

○人件費 …… 5,760B/年

週２回２人が一組となって巡回管理を行う。

従って、

2人×2回/週×4回/月×12月/年＝192人/年

１人１回の管理業務につき、30バーツの日当を支払うとすると、

192人/年×30B/人 ＝ 5,760B/年

| | | |
|---|---|---|
| ○交通費，燃料費 | …… | 1,540₱年 |
| ○一般事務，組織運営費 | …… | 700₱年 |
| ○破損等による大口修理のための準備金等 | …… | 1,000₱年 |
| | 計 | 9,000₱年 |

また、本施設の便益性の問題について検討するに当っては、一般の水道事業とは異なった評価をする必要がある。

通常、水道事業は公営の独立採算制の事業とされているから、その便益は事業の採算性をもって判定する。

しかしながら、事業がこの原則によらない場合は、次のような便益を計測して事業のフィジビリティーを評価する必要がある。

(1) 消費者に対する効果

(2) 公衆衛生に対する効果

(3) 公益，産業に対する効果

(4) 以上の他、特記すべき効果

本水供給水施設の及ぼす効果として期待されるのは上記のうち、(1)と(2)であり、特に保健衛生上、水因性伝染病の発生を減少させる効果は大きいと云えよう。また乾期における飲料水の安全確保は地域住民の生活向上に大いに寄与すると考える。また、消費者としての水の価値を考えてみると、現在、水道事業による給水を受けている地域の住民は、P.W.W.A に対し、生産コストの約半分にあたる2パーツ／m³を支払っている。（実際生産コストは4.5パーツ／m³であり、このうち2.5パーツ／m³は政府負担となっている）水処理施設の規模と能力を別にすれば、本水供給施設の水の生産コストは、維持管理に要する費用とみなされる。従って、いま比較的管理負担の大きいタガンガオの場合を例にとると、

○年間の生産コスト　　14,000パーツ／年

○年間の給水量

15 m³／日 × 30日／月 × 12月／年 = 5,400 m³／年

○1 m³当りの生産コストは、

$$\frac{\text{年間生産コスト}}{\text{年間給水量}} = \frac{14{,}000₱}{5{,}400\ m^3} = 2.6₱/m^3$$

同様にしてそれぞれのモデル地域毎の生産コストは次のようになる。

○バンサムロン

$$\frac{14{,}000\text{₱}}{10{,}800\ m^3} = 1.3\text{₱}/m^3$$

○バンボー

$$\frac{11{,}500\text{₱}}{3{,}960\ m^3} = 2.9\text{₱}/m^3$$

○プラポックラオ病院

$$\frac{32{,}500\text{₱}}{7{,}200\ m^3} = 4.5\text{₱}/m^3$$

上記の結果を下記に示す。

Table4－7 飲料水の生産コスト概算

| モデル地域 | 給水人口（人） | 年間総給水量（$m^3$／年） | 年間生産コスト（₱年） | 1 $m^3$当りの飲料水生産コスト(₱/$m^3$) |
|---|---|---|---|---|
| バンサムロン | 1,088 | 10,800 | 14,000 | 1.3 |
| タガンガオ | 564 | 5,400 | 14,000 | 2.6 |
| バンボー | 545 | 3,960 | 11,500 | 2.9 |
| プラポックラオ病院 | 700 (*) | 7,200 | 32,500 | 4.5 |
| 合　　計 | 2,197 | 27,360 | 72,000 | 11.3 |
| 平　　均 | 733 | 6,840 | 1,800 | 2.9 |

従って、各モデル地域において、その受益者たる地域住民から飲料水の生産コストすなわち水道料金を徴収し、維持管理費の独立採算を行うとした場合、Table4－8に示すようにプラポックラオ病院を除いてP.W.W.A による水道事業の水道料金とそれほど変らないと云えよう。特に給水人口の比較的多いバンサムロン地域においては1.3パーツ／$m^3$となっており、村民レベルでの大きな経済負担とはならないと云えよう。

病院地域を除いた3つのモデル地域の平均を見ると2.3パーツ／$m^3$となる。

しかしながら、本実施計画の性格上、立案された水供給施設は保健衛生上の見地から現状を打開するための、いわば緊急措置であり、村民レベルでの経済的負担はでき得る限り軽減されることが望ましいと考える。

Table 4－8　モデルプランの年間維持管理費概算　(Baht)

| モデル地域 | プラン/項目 | 動力費 | 消耗部品 | 一般経費 | 合計 | 管理費負担 | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 1人当り | ※1 1世帯当り | ※2 1㎥当り |
| Sai Kao (Ban Samrong) | A | — | 5,000 | 9,000 | 14,000 | 14 | 56 | 467 |
| Tagad Ngao (Ban Nong Khan) | B | — | 5,000 | 9,000 | 14,000 | 25 | 100 | 934 |
| Bo (Ban Bo) | C | — | 2,500 | 9,000 | 11,500 | 22 | 88 | 1,046 |
| Prapokklao Hospital | D | 12,500 | 10,000 | 10,000 | 32,500 | — | — | 1,625 |
| 合計 | | 12,500 | 22,500 | 37,000 | 72,000 | 61 | 244 | 4,072 |
| 平均 | | 12,500 | 5,625 | 9,250 | 18,000 | 21 | 82 | 1,018 |

※1 1世帯4人とする

※2 ここでゆう1㎥とは計画給水量を示す。

Table 4 - 9 COMMON HAND PUMP TROUBLES AND REMEDIES

| TROUBLE | LIKELY CAUSE | REMEDY |
|---|---|---|
| 1. Pump handle works easily but no water delivered. | A. No Water at the source. Well dry. | Rehabilitate well, or develop a new source or sources of water. |
| | or | |
| | B. Level of water has dropped below suction distance of pump. | Can be checked with vacuum gauge or with weighted string. Reduce pumping rate or lower pump cylinder. |
| | or | |
| | C. Pump has lost its priming. | Prime the pump. If the pump repeatedly loses its priming it may be periodically pumping the well dry, the suction line may be leaking, or the suction valve or discharge check valve may be leaking. Repair line or valve. |
| | or | |
| | D. The cylinder cup seals ("leathers") may be worn out | Renew the cylinder cup seals ("leathers"). |
| | or | |
| | E. The valves or valve seats may be worn or corroded. | Renew valves and repair or renew seates. |
| | or | |
| | F. With a deep-well plunger pump the plunger rod may be broken. | This trouble would be indicated by the pump running freer and and probably quieter. Turn the pump over by hand and note if there is resistance on the upstroke. Broken rods must be renewed and this usually means pulling the drop pipe and cylinder out of the well. |
| | or | |
| | G. Shutoff valve may be closed (force pump). | Open valve |
| | or | |

Continued

| TROUBLE | LIKELY CAUSE | REMEDY |
|---|---|---|
| 1. Pump handle works easily but no water delivered (continued) | H. Hole in suction pipe.<br>or | Renew suction pipe. Cylinder may be lowered below water level in well. |
| | I. The suction pipe may be plugged with scale or iron bacterial growth or sediment.<br>or | Can be checked with vacuum gauge. Remove suction pipe and clean or renew. |
| | J. The pump cylinder may be cracked.<br>or | Renew the cylinder. |
| | K. Leak at base of cylinder.<br>or | Renew cylinder gasket. |
| | L. One or more check valves held open by trash or scale. | Remove valves and inspect for trouble. With deep-well plunger pumps this may mean pulling the pump cylinder or plunger and valves out of the well. |
| 2. Pump runs but delivers only | A. Plunger leathers badly worn (plunger and piston pumps).<br>or | Renew leathers. |
| | B. Well not yielding enough water.<br>or | Decrease demands or establish new sources of water. |
| | C. Cracked cylinder (plunger or piston pump).<br>or | Renew cylinder. |
| | D. Check valve(s) liaking.<br>or | Repair valve(s). |

Continued

| TROUBLE | LIKELY CAUSE | REMEDY |
|---|---|---|
| 2. Pump runs but delivers only a small amount of water, (continued) | E. Screen or suction valve may be obstructed, | Removed and clean |
| | or | |
| | F. Suction pipes are too small, | Can be checked with vacuum Gauge, Install pipe with larger diameter, or for deep well pump, lower pump cylinder below water level in well. |
| | or | |
| | G. Suction valve(s) may be out of order, | Repair valve(s). |
| | or | |
| | H. Cracked drop pipe or coupling, | Renew drop pipe or coupling. |
| 3. Pump needs too many strokes to start | A. Pump has lost its priming, | Prime the pump. If the pump repeatedly loses its priming, it may be periodically pumping the well dry, or the suction line or the suction valve may be leaking. Repair or renew line or valve. |
| | or | |
| | B. The cylinder cup seals ("leathers") may be worn out. | Renew the cylinder cup seals. |
| 4. Handle springs up after down stroke. | A. Suction pipe plugged up below pump cylinder, | Remove pump and clean out suction pipe. If well has filled with dirt up to suction pipe, the well should be cleaned out or the pipe cut off. |
| | or | |
| | B, Plunger check valve fails to open or to close, | Repair check valve. |
| | or | |

Continued

| TROUBLE | LIKELY CAUSE | REMEDY |
|---|---|---|
| 4. Handle springs up after down stroke (continued) | C. Suction pipe too small. | Replace with larger suction pipe. |
| | or | |
| | D. Water too far below pump (suction pipe too long) | Place cylinder nearer water. |
| 5. Leaks at suffing box | A. Packing worn out or loose. | Renew or tighten packing. Leave packing nut loose enough to allow a slow drip of water. The water serves as a lubricant. |
| | or | |
| | B. Plunger rod badly scored. | Renew plunger rod. |
| 6. Pump is noisy | A. Bearings or other working parts of the pump are loose. | Tighten or renew parts. |
| | or | |
| | B. Pump is loose on mountings. | Righten mountings. |
| | or | |
| | C. With deep-well plunger pumps having a steel plunger rod the rod may be slapping against the drop line. | Use a wooden rod or install guides for rod or straigten drop pipe if crooked. |

Table 4 - 10 SCHEDULE FOR MAINTENANCE OF HAND PUMP

| | | |
|---|---|---|
| daily | 1. | Clean the well-head and space for water-drawing. |
| Weekly | 1. | thorough clean-up of pump, well-head and surroundings. |
| | 2. | oil or grease all thing pins, bearings, and sliding parts, after checking that no rust has developed on them. |
| | 3. | inspect and take care of the drain ditch and the infiltration trench. |
| | 4. | record any comments from users about irregularities in working (tightness of parts, leaks from stuffing box, fall-off in water raised). Correct these when possible. |
| monthly | 1. | if necessary, adjust the stuffing box or gland. Usually this is done by tightening the packing nut. This should not be too tight-there should be a slight leak when the adjustment is correct. |
| | 2. | check that all nuts and bolts are tight, and check that there is no evidence of loose connections on the pump rods. |
| | 3. | check for symptoms of wear at the leathers, noting any comments from users about any falling off in the water raised. If the pump fails to raise water when worked slowly (e.g., at 10 strokes per minute), replace the leathers. |
| | 4. | carry out all weekly maintenance tasks. |
| annualy | 1. | paint all exposed parts to prevent development of rust. |
| | 2. | repair any cracked concrete in the well-head and surrounds. |
| | 3. | check wear at handle bearings and replace parts as necessary. On the Craelius pump, worn bushes can be replaced by short sections of pipe of suitable diameter. |
| | 4. | check plunger valve and foot valve; replace if found leaking. |
| | 5. | check the pump rod and replace any defective lengths or connectors. |
| | 6. | replace packing at the stuffing box or gland. |
| | 7. | carry out all monthly maintenance tasks. |

MODEL PLAN A

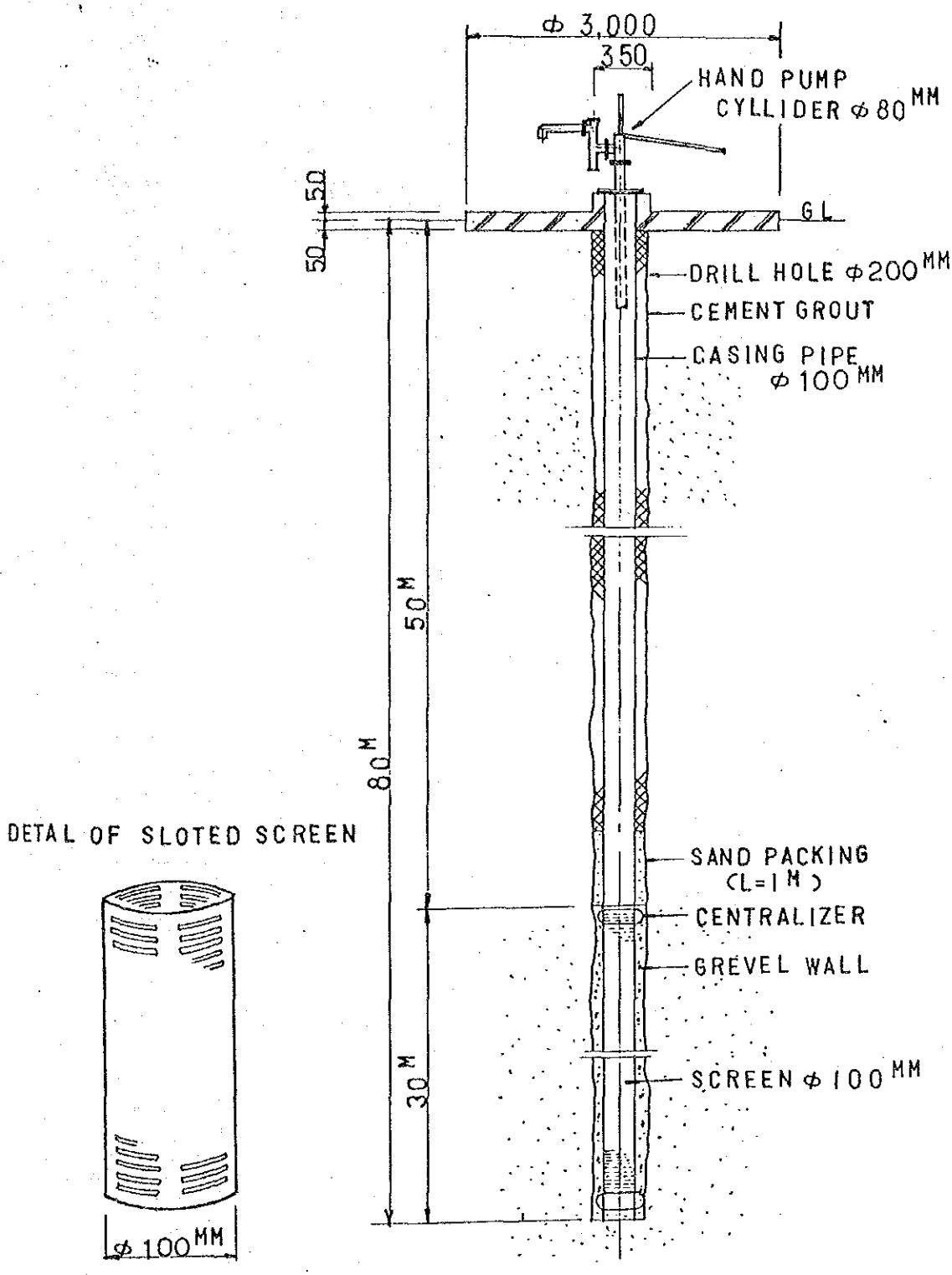



Fig4-1 STRUCTURE OF WELL

MODEL PLAN B

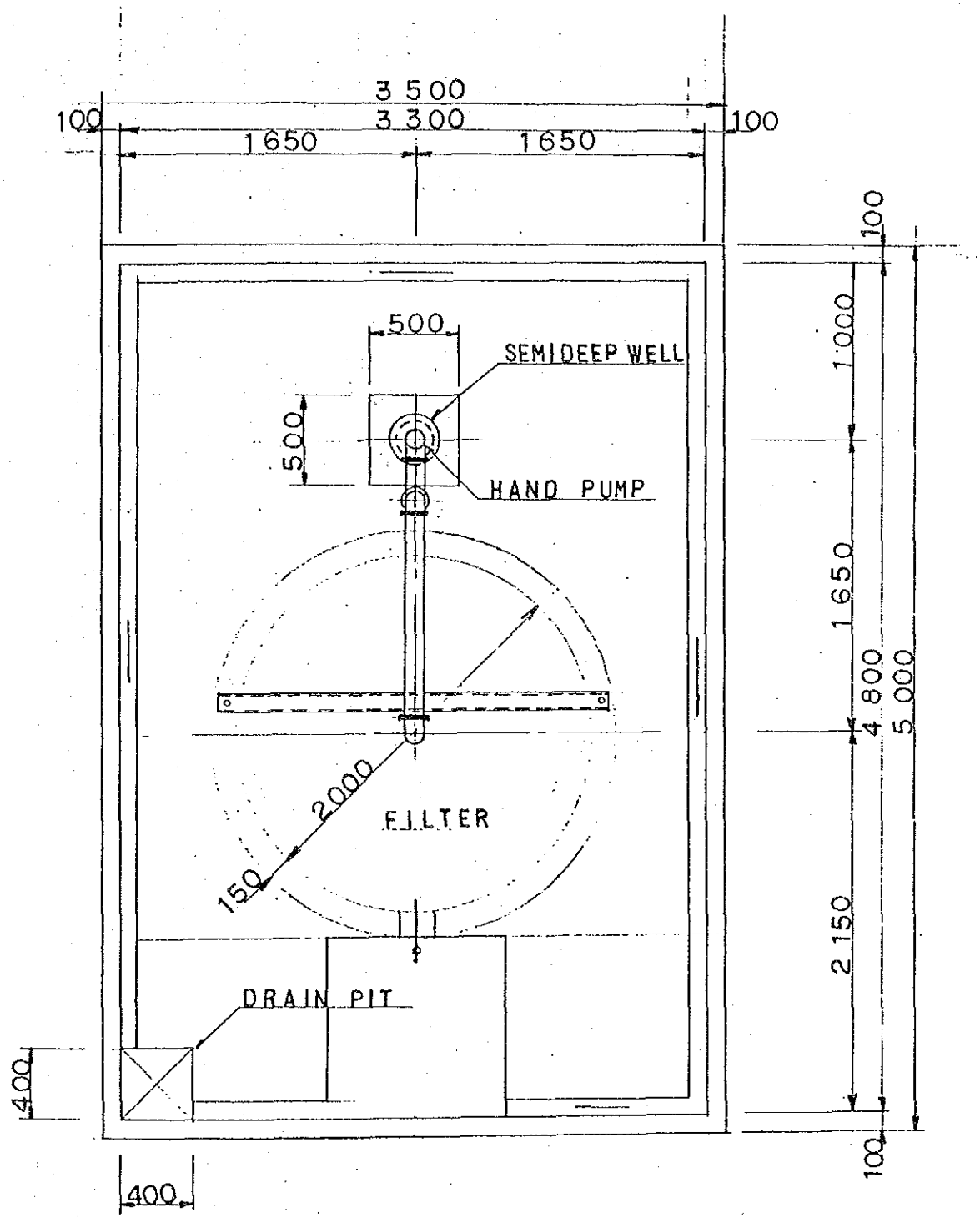



Fig4-2 PLAN 1 : 40

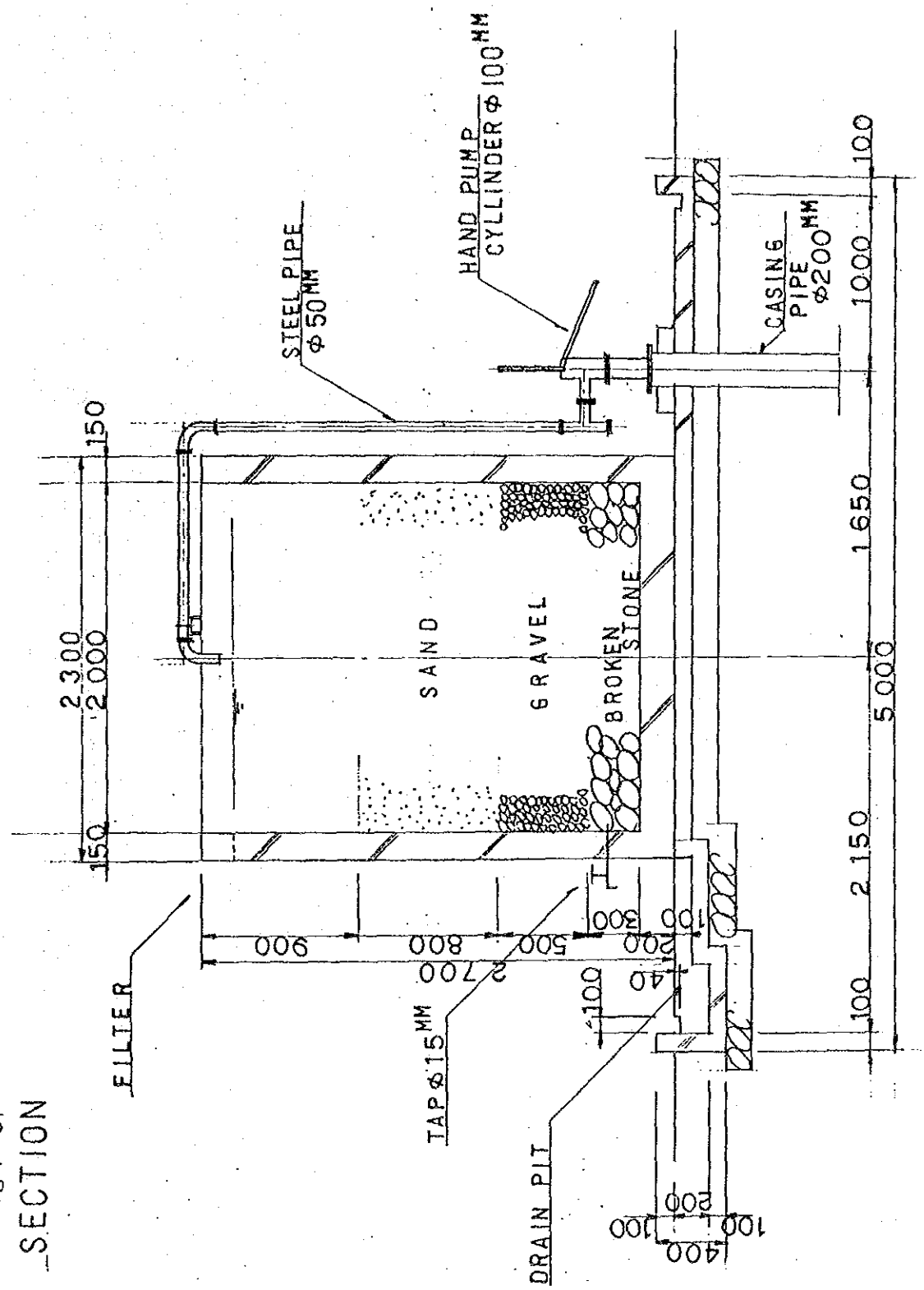



Fig 4-3;
SECTION

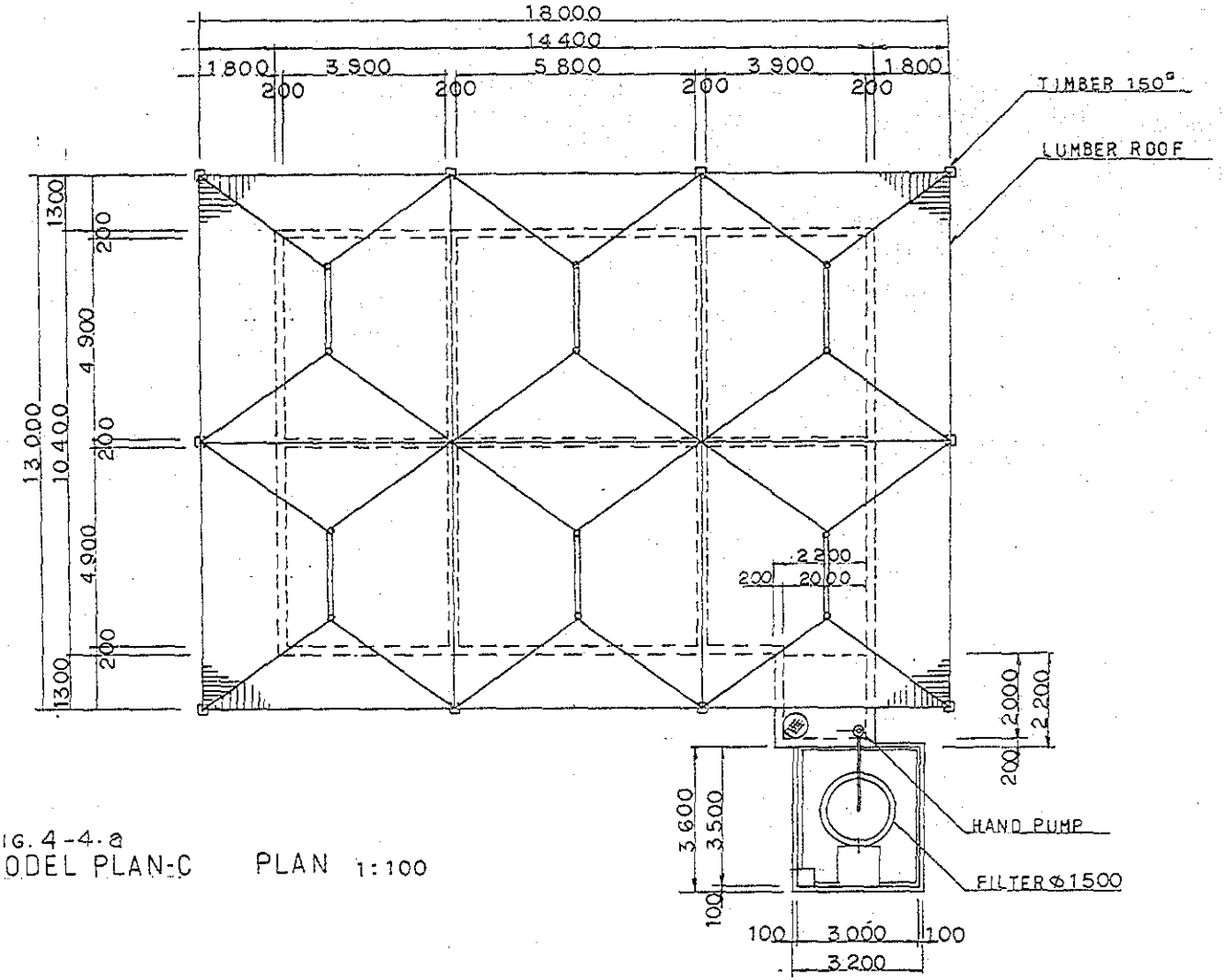



FIG. 4-4-a
MODEL PLAN-C PLAN 1:100

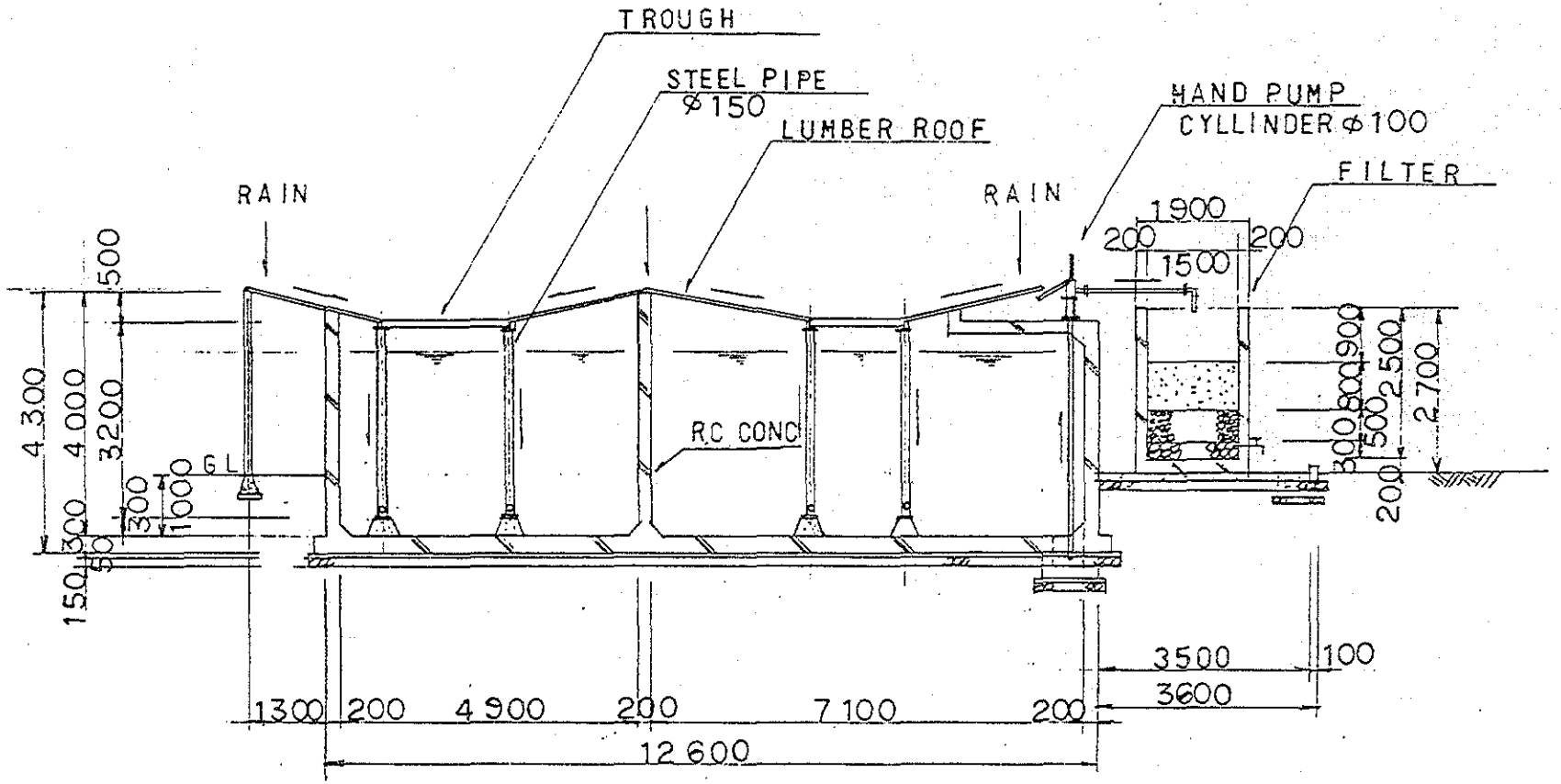



FIG. 4-4-b
SECTION

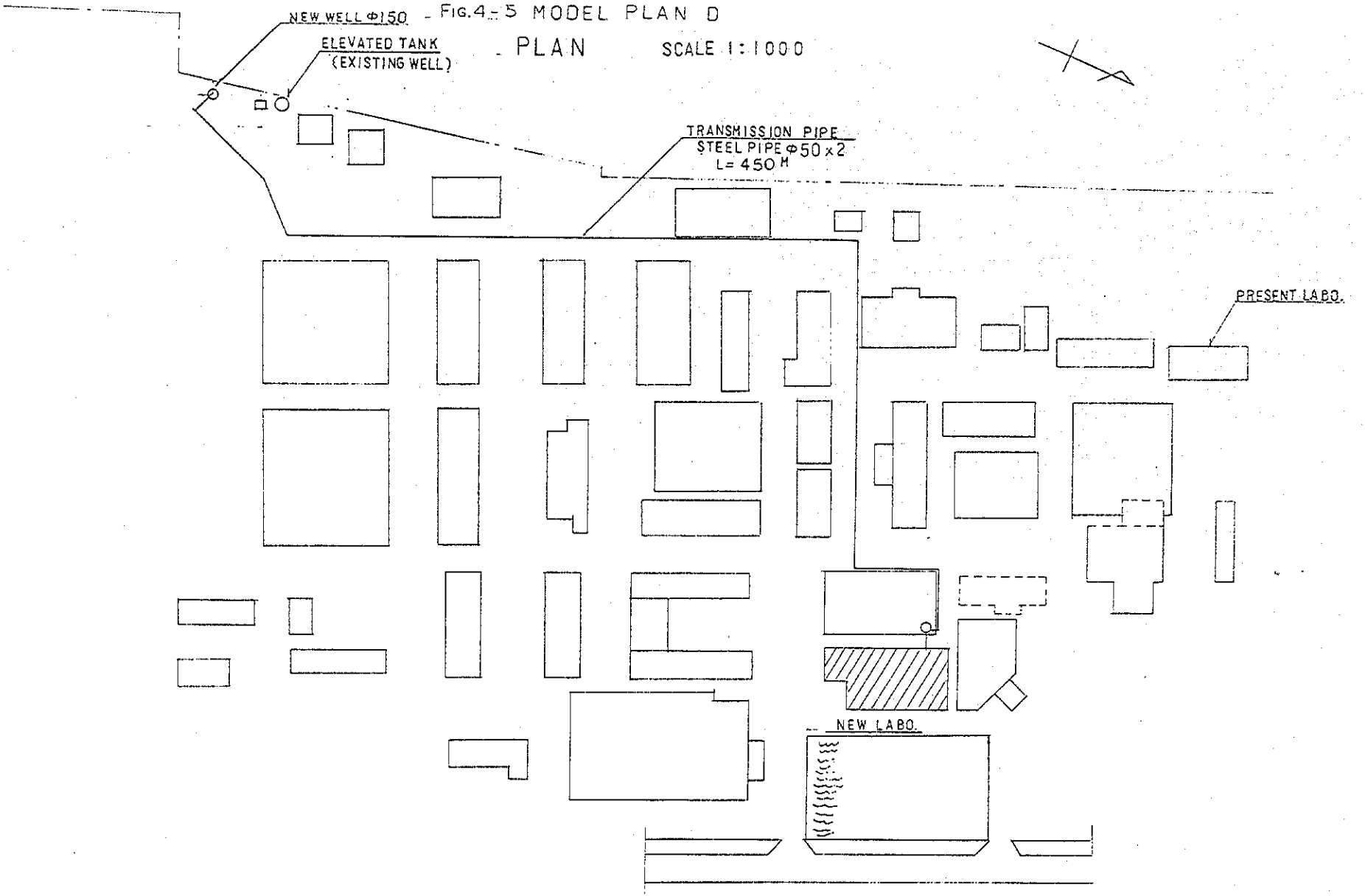
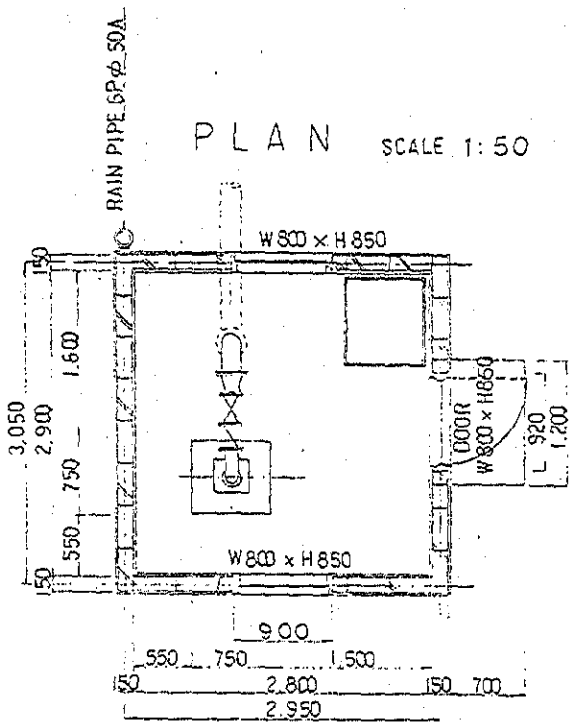



Fig.4-5 MODEL PLAN D

PLAN SCALE 1:1000



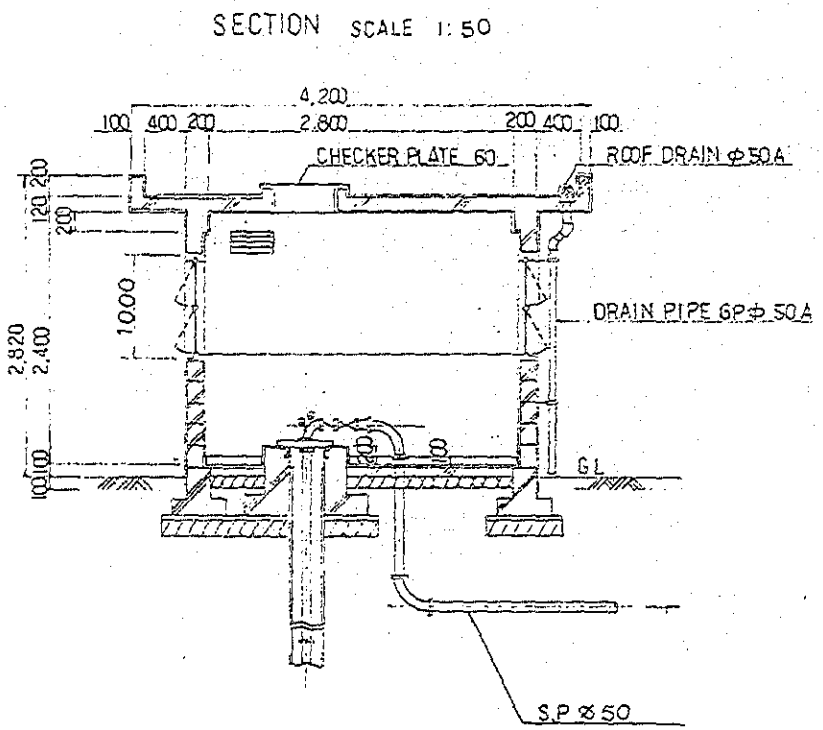
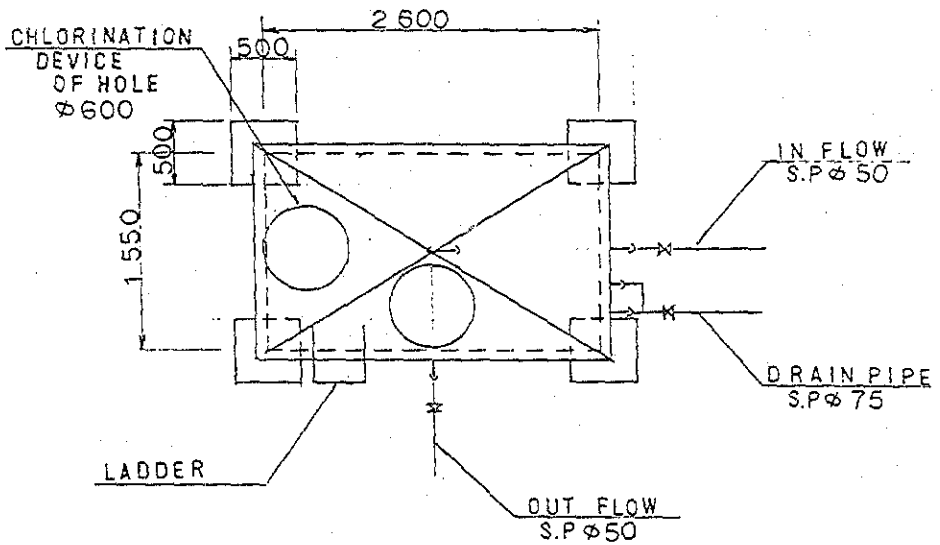
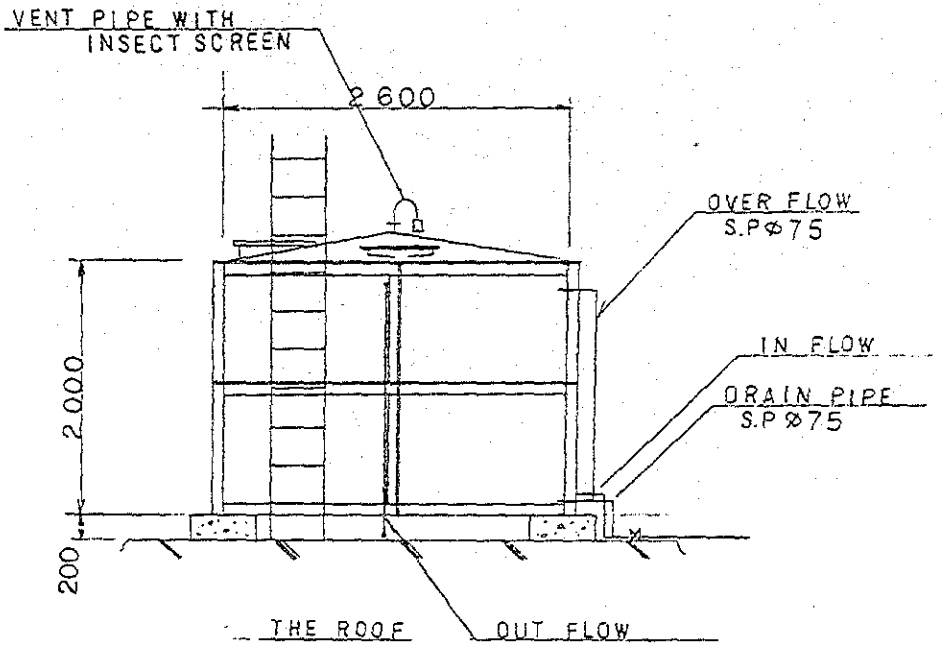




Fig. 4 - 6
DEEP WELL AND
PUMPING ROOM




PLAN 1:40




SECTION

FIG. 4-7
ELEVATED TANK

# APPENDIX A: DESIGN CRITERIA OF P.W.W.A.

## ESTABLISHMENT OF PROJECT CRITERIA OF P.W.W.A.

### Eligibility and Priority Criteria

Since the Community Potable Water Project was planned as a pilot project for the comprehensive National Potable Water Program, it was evident that program criteria had to be developed so that they could also be used for that program. Since the Royal Thai Government Department of Public Works, Ministry of Interior had already planned and partially implemented a program for communities with populations of over ten thousand, this number was established as the upper limit for communities to be considered for inclusion in the project. The lower limit was governed primarily by economic factors. Since per capita costs would have to be kept low to enable the broadest possible coverage with the limited funds available, the lower limit was set at a minimum population of 500 for any one system. (Communities with less than this number can normally be helped most economically by the Department of Community Development of the RTG Ministry of Interior.) In certain instances a group of small neighboring communities with less than 500 population each, but with an aggregate population exceeding 500 which can be served by a single system has been included in the project.

In order to qualify for inclusion in the project, communities are required to make formal requests in writing through the Changwad governor. The limited funds which have been made available for the project have necessitated a very careful review of community requests. Although during the early phases of the project the urgency of getting the program started affected the quality of review, this condition has long since been corrected and all requests now undergo an exhaustive review before approval is recommended.

Since the demand is much greater than the project can currently support, the size of the local community contribution becomes an important factor in determining project priorities. Every effort is made to obtain contributions of 50 percent or more of the cost where the system involves a sanitary district which has borrowing capability and up to 25 percent where the community does not have this capability. Non-economic factors do, of course, sometimes generate overriding priorities. In general, plant construction costs vary from 100 bahts ($5.00)/capita to 200 bahts/capita depending on the size of the population and the complexity of the installation.

During the early phases of the project, the scope of the program was limited primarily by the lack of qualified technical personnel. This condition has been substantially corrected and program limitations are now almost exclusively of a budgetary nature.

Technical Criteria

The development of appropriate technical criteria for the project was a matter of considerable concern to SED, USOM, and TAMS. The limited amount of funds dictated the lowest practicable criteria but good engineering practice dictated that the criteria be consistent with the requirements of the community. The situation was further complicated by the lack of reliable statistical data on the water habits of the residents to be served.

Studies were made of water usage in typical rural areas and the results compared with data from similar areas in other countries. SED, USOM and TAMS decided that consumption criteria should be developed for two different categories of communities, both of which were assumed to be constructed initially with 100 percent public taps. The designation of a community as category "A" or category "B" is dependent upon such factors as location, wealth, capacity of water source, village interest and extent of local contribution as well as the anticipated water habits of the community. It was assumed that at the end of ten years, category "A" communities would be 80 percent served by private house connections with an average overall per capita consumption of 80 liters per day, while category "B" communities would be only 40 percent served by private house connections with an average overall per capita consumption of 50 liters per day.

A plant life of ten years was utilized for design purposes, with a population growth figure of 3 percent annually, although plant structures with adequate maintenance should be usable well beyond this period. Some items of equipment such as pumps and engines may require replacement before the end of this period.

The maximum day demand was established as one-and-one-half times the average day demand and the peak hour demand was set at one-sixth of the average day demand. Since most of the communities do not have electricity and their budgets can only support one regular operator, the average pumping day was fixed at 10 hours to ensure that all normal pumping could be accomplished by one operator during daylight hours. To cover emergency situations, the maximum pumping day was set at 15 hours.

Total ground and elevated water storage was established at approximately 70 percent of the average day supply with the elevated portion a minimum of 20 percent of the average day supply. No provisions for the protection were incorporated in design criteria, although systems have in some instances been modified at the request of local authorities to include fire hydrants.

The design life for distribution systems was set at fifteen years. Asbestos cement and galvanized steel pipe were specified for plant piping and primary distribution mains, and PVC pipe for secondary distribution lines. A minimum pressure of 10 pounds per square inch at the curb was established for all distribution mains.

In general, the standard design criteria used as guidelines throughout the project were those of the American Water Works Association, with minor modifications as necessary to fit local conditions. To minimize the use of foreign exchange, locally manufactured products are utilized wherever practicable. Special attention has also been given to ensuring that proper emphasis is placed upon low initial cost and low oepration and maintenance costs in specifying various types of material and equipment.

Development of Standard Designs of P.W.W.A.

To get the project underway with a minimum of delay, existing SED plant designs were utilized for the first group of 17 plants. Modifications to these designs were made as necessary to fit local conditions during the spring and summer of 1966, and the plants were placed under contract for construction in September 1966.

The arrival of TAMS engineers prompted the decision to develop a group of new standard designs for the project based on the criteria outlined in Section V.* The basic principle employed in design development was to provide facilities which would yield a product meeting minimum U.S. Public Health Service standards and still the simple and economical to construct and easy to operate and maintain. The remote locations of most of the planned facilities, the inexperience of prospective operators and the absence of electrical power dictated simplicity, while budgetary limitations and the magnitude of the potable water problem made economical design particularly important.

The urgency of the project and the limited number of qualified TAMS and SED design personnel available made it necessary to restrict the various types of standard designs to a minimum. A series of standard treatment plants was designed with capacities of 10 cubic meters/hour, 20 cm/hr, 30 cm/hr and 50 cm/hr.** With these four capacities, it became possible to provide effective and economical systems for the entire population range (500 - 10,000) covered by the project.

* Standard design details are contained.

** Photographs of each size plant, as well as the Khon Kaen office and Warehouse Complex.

## Sources and Treatment

In addition to variations in system sizes, designs had to be developed to suit the various types and qualities of raw water. Ground water sources normally provide a good quality of water and treatment can often be limited to chlorination. In certain areas, however, an iron content of up to 10 ppm has necessitated more comprehensive treatment. Initial designs for ground water of this type provided for aeration, sedimentation, slow sand filtration and chlorination. Although a filtration rate about double the normally accepted rate has been used, the treatment has been completely satisfactory and has produced a very high quality water. Slow sand filters are not normally used for iron removal because they plug frequently, but this has not been a problem in Thailand because of the small size of the filters and the ready availability of labor for cleaning them.

Surface water is provided from a variety of sources including major rivers, such as the Mekong, the Mun, and the Chi, natural ponds and lakes, canals and irrigation reservoirs. In some areas, mountain streams or spring have supplied a good quality of water which requires only chlorination. In other instances, streams or rivers with sandy bottoms and low turbidity have allowed the use of infiltration galleries, supplemented by chlorination. In most instances, however, complete treatment of surface water, including coagulation, sedimentation, filtration and chlorination has been required.

Since it was originally assumed that it would be too difficult to train operators in the smaller communities to use rapid sand filters, initial designs for 10 cm/hr plants incorporated slow sand filters exclusively. However, the use of rapid sand filters proved not to be a problem and a corresponding design for this size plant has since been developed which allows substantial savings in construction costs.

## Facility Sizes and Design

Original designs provided for a 30 cm elevated steel tank with wood tower for the 10 cm/hr plant, a 45 cm elevated concrete tank with concrete columns for the 20 cm/hr plant, and a 60 cm elevated concrete tank with concrete columns for the 30 cm/hr plant. The elevated water storage was supplemented by ground water storage contained in concrete clear wells of 60 cm, 100 cm and 160 cm respectively for the 10 cm/hr, 20 cm/hr and 30 cm/hr plants. A separate concrete structure was provided for the treatment plant where required. Other plant facilities included raw and treated water pump houses, oil storage house, and a fenced enclosure for the plant area.

Initial construction costs have been a matter of considerable concern since the start of teh project and continuing attention has been given to providing more economical designs. The first step in this direction involved placing the treated water pump and the oil storage area under the flocculation

unit. Steel tanks and structures have been designed for use with the 10 cm/hr, 20 cm/hr and 30 cm/hr plants. A concrete standpipe was designed for the 30 cm/hr plant to replace the elevated tank and the clear well. Since the standpipe provided useful storage under pressure equivalent to the elevated tank and clear well storage at a substantially lower cost, a similar design was prepared for the 50 cm/hr plant which has proven equally satisfactory.

Pilot plant studies indicated that a spiral flow type flocculator could be substituted for the baffle type included in the original designs without appreciable loss of efficiency, and that considerable savings would result. Consequently, designs have been completed for 10 and 30 cm/hr compact plants with the new type flocculator and many other improvements for use in the FY 1969 construction program.

Power

Original designs did not usually contemplate the availability of electricity, and both centrifugal and deepwell turbine pumps were designed and procured with diesel power units. An administrative decision within USOM resulted in the delivery of nearly all of the deepwell turbine pumps with gasoline power units, creating a most unsatisfactory situation at a number of plants since different types of fuel are required for each unit. Steps are being taken to correct this condition by the procurement of replacement diesel drive units.

Early designs for plants along the Mekong River and in other areas where there are major seasonal variations in source water levels incorporated the use of floating pumphouses with diesel-driven pumping units. Since electric power is becoming increasingly available in all rural areas, electrically operated pumps are being planned for use in a growing number of installations. Electrically operated submersible pumps have proven particularly advantageous over floating pumphouses.

During the initial phases of design development all design was accomplished by TAMS and SED engineers working in the Khon Kaen office. As the field engineers gained more experience, those portions of the design which are peculiar to the individual installation, such as plant layouts, distribution systems, infiltration galleries and raw water intakes, have been assigned to the field offices. All designs are still reviewed in the Khon Kaen office, which also retains responsibility for development of new design concepts and modifications and improvements to existing standards.

## APPENDIX B: TECHNICAL SPECIFICATION (EXAMPLE)

### - Submersible Pump -

### General

The Supplier shall furnish and deliver to submersible vertical turbine type pumping unit(s) to the city of Chanthabri. Each pumping unit shall be close coupled to an electric motor designed for sustained and continuous operation under water.

### Performance and Dimensional Requirements

The pumping units shall meet the operating and dimensional requirements as shown in the following table.

| Description | Spec. |
|---|---|
| Number of Unit | 1 |
| Power (min nameplate ratings) | 3.7 |
| Min cap at design head (litter/min) | 70 |
| Design head -- TDH (meters) | 100 |
| Well casing diameter (mm) | 150 |
| Discharge diameter (mm) | 32 |

### Pump Construction

(a) General - Submersible pumping units shall conform to the requirements of JIS B8324 - Submersible Motor - Pump for Deep Well or "American Standards for Submersible Vertical Turbine Pumps" (AWWA Designation E101, Part B) and the following:

(b) Pump Bowl Assembly - The pump bowl assembly shall be equipped with cast-iron bowls and bronze impellers. The impellers shall be of cast bronze, smoothly finished and dynamically balanced. All bronze components shall conform to the requirements of ASTM Specification B62 or B145 or JIS H5111, BC-2 or BC-6. The bowls shall be of close grained cast-iron having a minimum tensile strength of 2,100 $kg/cm^2$, shall be free of blow holes, sand holes, and all other faults, and shall be accurately machined and fitted to close dimensions. The pump bowls shall be lined with porcelain enamel or epoxy. A pump bowl strainer of bronze shall be provided.

(c) Vertical Discharge Column - The column pipe shall conform to the "Specifications for Wrought-Steel and Wrought-Iron Pipe" (ASA Designation B36.10) schedule 30 steel pipe or JIS G3454, STPG38, schedule 40 pipe, with threaded sleeve couplings. The column pipe shall be sandblasted and coated internally and externally with coaltar epoxy or a 250 micron vinyl system.

(d) Submersible Cable - The electric cable shall be sized in accordance with AWWA E1-1. The cable shall be supported from the discharge column by non-magnetic stainless steel bands a minimum of every five (5) meters. A steel cable guard shall protect the cables where they pass the bowl assembly.

(e) Discharge Heads - The discharge head shall be of the surface plate type with flanged elbow, of cast iron and dimensions. The heads shall be designed to support the entire weight of the suspended parts. After fabrication the discharge heads shall be sandblasted and primed with one coat of red lead primer. The interior waterways shall be coated with epoxy or a 250-micron vinyl system. Anchor bolts shall also be furnished by the Supplier.

(f) Pump-Motor Coupling - The pump-motor coupling shall be of stainless steel and designed to transmit the total torque and thrust of the unit in either direction.

Motors

The motors shall be of the squirrel cage induction type, suitable for across-the-line starting and shall be capable of reduced-voltage starting. The motor shall be suitable for 220-volt, single-phase 50-hertz A.C. and capable of continuous operation under water. The motor temperature shall conform to the latest NEMA, JIS, JEC or JEM standards for submersible motors.

## APPENDIX C: SHOP DRAWINGS

Working or shop drawings prepared by the Contractor for any item shall consist of such detailed plans as may be required for the prosecution of the works. They shall include but not limited to shop details, installation methods, erection plans, exact layout diagrams and diagrams showing location, size, details and connections for all equipment and materials and must be approved by the Engineer before any work involving these shop drawings is performed. Shop drawings shall incorporate complete lists of spare parts, special tools, and other materials stocks to be furnished for proper maintenance and operation fo the equipment, as required by the Contract Documents. If no spare parts, special tools, or other items are to be furnished, the shop drawings shall specifically so state.

It is expressly understood that approval of the shop drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval shall not be construed as permitting departure from the Contract requirements. Approval of such shop drawings will not relieve the Contractor of the responsibility for only error which may exist, as the Contractor shall be responsible for the dimensions and detailing of adequate connections details of mutual agreement of dimensions and details and satisfactory construction of all works. It is mutually agreed that the Contractor shall be responsible for agreement and conformity of his working drawings with the Contract drawings and specifications.

The Contractor shall submit to the Engineer three (3) complete sets of all working and shop drawings. These working and shop drawings shall be completed and shall contain all required detailed information. If approved by the Engineer each copy of the working and shop drawings will be identified by the Engineer as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Engineer and resubmit six corrected copies for approval.

A title block shall be located in the lower right hand corner of each drawing. The title block shall display the following:

a. Number and title of drawing

b. Date of drawing or revision

c. Name of project structure of facility

d. Name of Contractor submitting drawing

e. Clear identify of contents and location of the works, specification, title and number

The size of working and shop drawings shall be the same size or half size

of the Contract drawings. The size of small drawings and schedules may be either letter size (21.5 cm by 28 cm)or legal size (21.5 m by 33 cm).

Drawings and schedules shall be checked and coordinated with the work of all descriptions involved before they are submitted for the approval to the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings submitted without this stamp of approval may be returned to the Contractor for resubmission.

The Contractor shall submit all drawings sufficiently in advance of construction requirements to permit no less than thirty (3) working days for checking and appropriate action. Additional time may be necessary for checking certain submittions and if necessary this is noted in the Supplemental Specifications. If the shop drawings are not approved then new submissions shall be prepared by the Contractor. The stated number of days for checking and action is required for each submission until approval is given.

If drawings show variations from the Contract requirements because of standard shop practice or for other reasons the Contractor shall describe such variations in his letter of transmittal. If acceptable the Engineer may approve any or all such variations subject to proper adjustment in the Contract requirements. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for execution of the work in accordance with the Contract, even though such drawings have been approved.

If the drawings or schedules as submitted show a departure from the Contract requirements which the Engineer finds to be in the interest of the Authority and to be so minor as not to involve change in the Contract Price or time for completion the Engineer may approve the drawings.

One set of approved working and shop drawings will be returned to the Contractor. If the Contractor desires more than one set the requirements of quantity submitted shall be increased accordingly.

Upon approval of shop drawings, the Contractor shall furnish three (3) prints of each drawing and one (1) reverse reading, reproducible tracing of each drawing to the Engineer for his use.

The Contract Price shall include the cost of furnishing all working, shop and As-Built drawings and the Contractor will be allowed no extra compensation for such drawings.

Before final payment is made the Contractor shall furnish to the Engineer on original set of As-Built working and shop drawings clearly revised, completed and brought up-to-date showing the permanent construction as actually made.

Appendix D COLLECTED DATA AND INFORMATION

I. Data on Natural Conditions

1) Meteorological data and information

(1) Yearly record of temperature for each month at Chanthaburi station for past 2 years. (1979 - 1980)

(2) Meteorological records in Chanthaburi Municipality. (1978 - 1980)

(3) Total water-fall for each month (1979 - 1980)

(4) Yearly record of wind conditions for each month at Chanthaburi station. (1976 - 1980)

(5) Mean annual rainfall. (1951 - 1970)

(6) Mean Maximum temperature. (1951 - 1970)

(7) Mean monthly rainfall. (1951 - 1970)

(8) Mean evaporation and mean relative humidity. (1951 - 1970)

(9) Table of monthly hydrometric data in Chanthaburi province. (1975 - 1979)

2) Geological map

(1) Hydrogeological map of the eastern part of Thailand. (1:250,000)

(2) Hydrogeological map of Western, lower central and eastern Thailand. (1:500,000)

3) Topographic map

(1) Topographic map of Changwat Chanthaburi, Changwat Rayong, Krong Khemarak Phoumin and Battambang at reduced scale of 1/250,000

(2) Topographic map of Ban Bung chanang Klang (Ban Samroong), Amphoe Khao Saming (Ban Boo), Ban Khot Hoi (Tagad Ngao I), changwat Chanthaburi (Tagad Ngao II), and Amphoe Laem Sing (Laem Sing) at reduced scale of 1/50,000.

(3) Topographic map of Khao Takrup, Khao Chamun, Ban Khun Song, Ban Noen Phun Sin and Ban Chan Khrem at reduced scale of 1/50,000.

4) Map of the model villages.

(1) Map of Toongbencha (village No.1)

(2) Map of Tagad-Ngao (village No.4)

(3) Map of Ban Bo (village No.5,6)

(4) Map of Ban Sam-Rong (village No.2)

(5) Map of Ban Sam-Rong (village No.8)

(6) Map of Ban Bo (village No.3)

5) Map of major land uses

6) Map of land use case studies

7) Map irrigation (1974) and extension of states scheme Irrigated Area in Thailand 1907 to 1976.

8) Topographic map of changwat Chanthaburi at reduced scale of 1/12,500.

2. Data on Planning and Designing

1) Plan of existing well facilities

(1) Plant layout of existing well facilities

(2) Plant layout of water intake facilities

2) Layout plan of water supply in Chanthaburi city area

3) Layout plan of Prapokklao Hospital Master plan

4) New laboratory layout plan of Prapokklao Hospital

5) Design criteria of Rural Water Supply

(1) The report of the community potable Water Project,

(2) Manual for small water supply facility

(3) Concrete Water Reserved-tank construction

6) Well logging maps in Chanthaburi province

7) Condition of ground water in Chanthaburi river area

8) Water supply development in Thailand

9) Memorandum of evaluation of well sites selected for A.D.B. Program.

10) Preliminary Country Report for international drinking water supply and sanitation decade.

11) Population Report of villages in Chanthaburi province (1978)

12) Table control and Field villages in Chanthaburi province (1980)

3. Data on Work Performance

1) Memorandum March 25, 1977 Evaluation of Well Sites Selected for A.D.B. Program. Appendix VI-1

2) Memorandum May 29, 1977 Well site suitability Contract IAW-5. Appendix VI-2.

3) Well Inspection Forms. Appendix VI-3

4) Specification on Supply Well construction. Appendix VI-4

4. Data on Construction Cost

1) Raw materials cost in Chanthaburi province

2) Labour cost and transportation cost

3) Mechanical equipment cost in Chanthaburi and Bangkok

4) Estimation of deep well at Chanthaburi

5. Data on Operational System

1) Data forms on Well Operation and Maintenance. Appendix VI-5

2) Information of past periodical maintenance work.

Appendix E COLLECTED DATA FOR COST ESTIMATES

I. Materials and labour cost collected from construction company and work shop in Chanthaburi Province.

Materials

| | | |
|---|---|---|
| Cement (diamond label) | | 70 ฿/50kg |
| " (tigar label) | | 60 ฿/50kg |
| Brick | 0.5 - | 1 ฿/pc |
| Gravel | | 210 ฿/m3 |
| Sand | | 80 ฿/m3 |
| Steel Bar | | |
| 2/8"(6.25mm) | | 20 ฿/10m |
| 3/8"(9.37mm) | | 42 ฿/10m |
| 4/8"(12.5mm) | | 75 ฿/10m |
| 5/8"(15.6mm) | | 120 ฿/10m |
| 6/8"(18.75mm) | | 185 ฿/10m |
| Piping Materials | | |
| PVC.1/2" | | 35 ฿/4m |
| 1" | | 50 ฿/4m |
| 2" | | 80 ฿/4m |
| 3" | | 180 ฿/4m |
| 4" | | 370 ฿/4m |
| Steel Pipe | | |
| 1/2" | | 100 ฿/6m |
| 1" | | 160 ฿/6m |
| 2" | | 310 ฿/6m |
| 3" | | 500 ฿/6m |
| 4" | | 720 ฿/6m |
| Gate Valve | | |
| 1" | | 60 ฿/pc |
| 2" | | 120 ฿/pc |
| 3" | | 350 ฿/pc |
| 4" | | 600 ฿/pc |

Labour Cost

| | |
|---|---|
| Steel Work(Ave.dgree) | 0.85 ฿/kg |
| Carpenter(Local labour) | 50 ฿/day |
| (Ave. " ) | 70 ฿/day |
| (Chief " ) | 200 ฿/day |
| Civil Work(Local labour) | 50 ฿/day |
| (Chief " ) | 200 ฿/day |

II. General Estimates for water well construction quoted by Drillwng Company in Bangkok, December, 1980.

Cost of Drilling for 4" well, max.depth 100m
1,000฿/m for soft formation
3,000 - 5,500 ฿/m for very hard formation

Cost of Materials

| | |
|---|---|
| 8" x 20' API casing | 6,000 ฿/pc |
| 4" x 20' API casing | 3,000 ฿/pc |
| 4" x 20' API steel slot | 4,100 ฿/pc |
| 4" x 10' API stainless | 11,000 ฿/pc |

## III. Cost of Electric Power, Water Supply and Telecommunication

### 1. Metropolitan Electricity Authority

The Metropolitan Electricity Authority is generating and distributing agen of electricity for Bangkok, Nonthaburi and Samut Prakarn :

Monthly Power Rate

1.1 Power service for any business with a demand of 30 - 499 kilowatts.

A. Demand Charge :

Baht 98.00 per kw of billing demand

B. Energy Charge :

| | |
|---|---|
| First 50 kwhr | 0.9861 Bht/kwhr |
| Next 150 kwhr | 0.9761 Bht/kwhr |
| Next 200 kwhr | 0.9661 BHt/kwhr |
| Over 400 kwhr | 0.9561 Bht/kwhr |

1.2 Power service for any business with a demand of 500 kilowatts or over :

A. Demand Charge :

Baht 90.00 per kw of billing demand

B. Energy Charge :

| | |
|---|---|
| First 200 kwhr | 0.9761 Bht/kwhr |
| Next 280 kwhr | 0.9661 Bht/kwhr |
| Over 480 kwhr | 0.9461 Bht/kwhr |

1.3 For those plants which require more than 1000 kilowatts of power, the applicant may apply for Off-Peak service. This service is available to those plants which either suspended or reduced their power load during the On-Peak hours (between 6.30 pm. and 8.30 pm.)

A. Off-Peak Period :

| Demand Charge (billed per kilowatt) | Energy Charge (billed per kilowatt) |
|---|---|
| 65.00 Bht/kw | 0.9361 Bht/kwhr |

B. On-Peak Period :

| Demand Charge (billed per kilowatt) | Energy Charge (billed per kilowatt) |
|---|---|
| 115.00 Bht/kw | 0.9361 Bht/kwhr |

1.4 Stand-by Service :

A. In case the stand-by is not used during any billing month, the stand-by demand charged shall be :

Baht 30.00 per kw of stand-by demand

B. In case the stand-by is used during any billing month the charge shall be of either the regular schedule applicable or the stand-by charge, whichever is higher.

2. Provincial Electricity Authority

Monthly Power Rate

2.1 For business of a maximum demand of 30 - 499 kilowatts

A. Demand Charge

Fixed rate of 92.00 Bht/kw

B. Energy Charge (billed per kilowatt)

| | |
|---|---|
| First 50kwhr | 1.1353 Bht/kwhr |
| Next 150kwhr | 1.1053 Bht/kwhr |
| Next 200kwhr | 1.0253 Bht/kwhr |
| Over 400kwhr | 1.0453 Bht/kwhr |

2.2 For business of a maximum demand of 500-999 kilowatts.

A. Demand Charge

Fixed rate of 88.00 Bht/kw

B. Energy Charge (billed per kilowatt)

| | |
|---|---|
| First 50 kwhr | 1.1153 Bht/kwhr |
| Next 150 kwhr | 1.0753 Bht/kwhr |
| Next 200 kwhr | 1.0353 Bht/kwhr |
| Over 400 kwhr | 0.9953 Bht/kwhr |

2.3 For business of a maximum demand of 400 kilowatts and over.

A. Demand Charge

| | |
|---|---|
| Fixed rate of | 87.00 Bht/kwhr |

B. Energy Charge

| | |
|---|---|
| First 100 kwhr | 1.0353 Bht/kwhr |
| Next 300 kwhr | 1.0153 Bht/kwhr |
| Over 400 kwhr | 0.9853 Bht/kwhr |

## 3. The Metropolitan Water Works Authority

The metropolitan supply area consists of the three provinces of Bangkok, Nontaburi and Samut Prakarn.

### 3.1 Monthly Water Rates

| Cubic meters of Water Used Per Month | Rate Per Cubic Meter |
|---|---|
| 0 - 6 cubic meters | No Charge |
| 6 - 12 " | ฿ 0.50 |
| 12 - 25 " | ฿ 1.00 |
| 25 - 50 " | ฿ 1.50 |
| 50 - 200 " | ฿ 2.00 |
| Over 200 " | ฿ 2.50 |

### 3.2 Demand Charge

The minimum charge of water rates even though the water does not reach the amount as shown in the following table :

| Meter Size | Demand Charge (Baht) |
|---|---|
| 1" | 54 |
| $1\frac{1}{2}$" | 120 |
| 2" | 215 |
| $2\frac{1}{2}$" | 335 |
| 3" | 480 |
| 4" | 850 |
| 6" | 1900 |

4. The Provincial Water Works Division

Monthly Water Rates

4.1 The charge is fixed at 2 Baht per cubic meter. This is for water supply under the controll of PWWA. In case the customer contacts with concessionaires, the charge varies with locality and is generally higher than installation in the municipal area. However, the charge for this service is regulated and supervised by PWWA.

5. Telecommunication

5.1 Request for Installation

Anyone wishing to install a telephone should file an application in person at the Commercial Section of the Telephone Organization of Thailand or at one of the Metropolitan Telephone Area offices. The application is required to buy the subscription bounds of the T.O.T. :

- at the rate of 30,000 Baht if the installation is to be done within three months
- at the rate of 10,000 Baht if the installation is to be done within one year

This excludes the telephone installation and deposit.

5.2 Monthly Telephone Rates in the Metropolitan Areas

Business and residence subscribers pay the same rate at the minimum charged of 50 Baht and 2 Baht for each call.

5.3 Monthly Telephone Rates in the Provincial Areas

The rent rate for the automatic type is the same as the telephone rate in the metropolitan areas.
As for the telephones in the areas when the operator-connecting the lines system is used, the rent rate is 50 Baht.

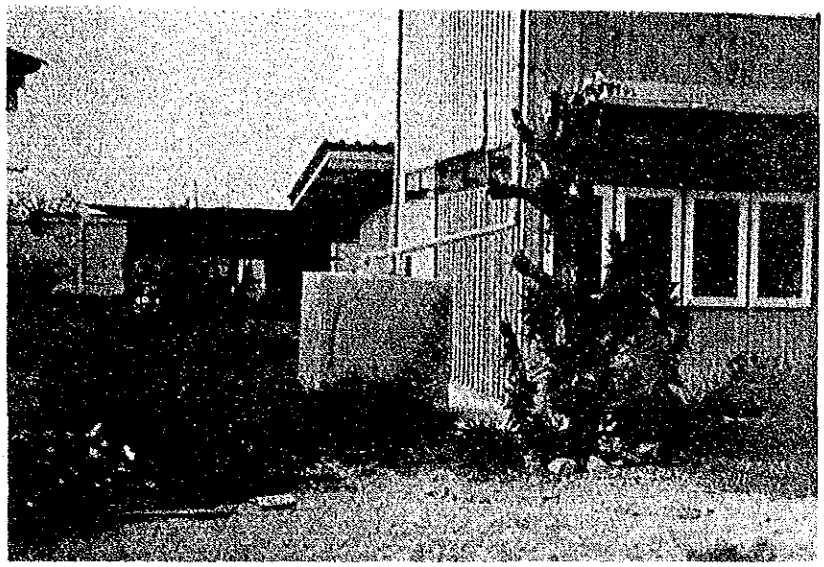
## 5.4 Long Distance Rates from Greater Bangkok Metropolitan Area

Long distance rates are dependent on the length of call and the distance. The minimum rate of the first 3 minute rate is 6 Baht and every next minute is 2 Baht. The highest charges of the first 3 minute rate is 36 Baht and every next minute is 12 Baht.

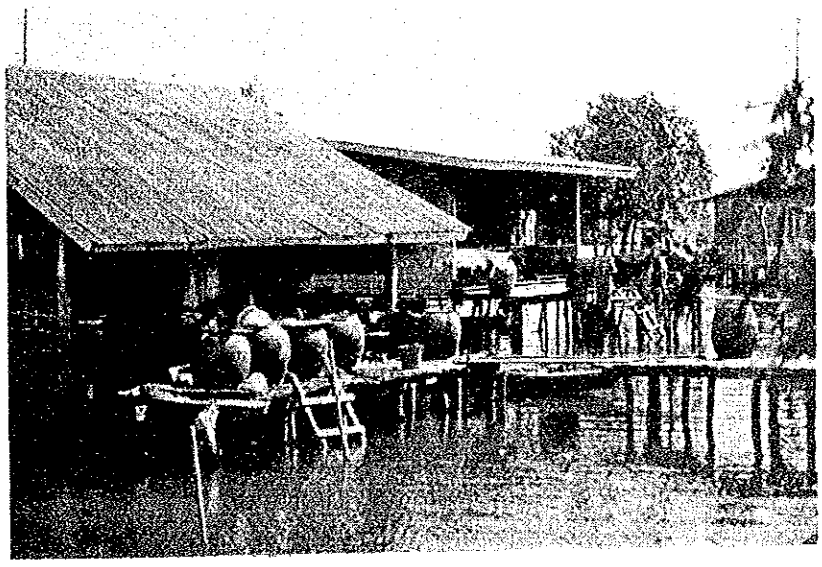
## 5.5 Overseas Long Distance Rates

The charges are dependent on the length of call and the distance. The minimum charge of the first 3 minute rate is 90 Baht and for every next minute is 30 Baht. The maximum rate of the first 3 minute rate is 375 Baht and every next minute is 125 Baht.

# 資　　料

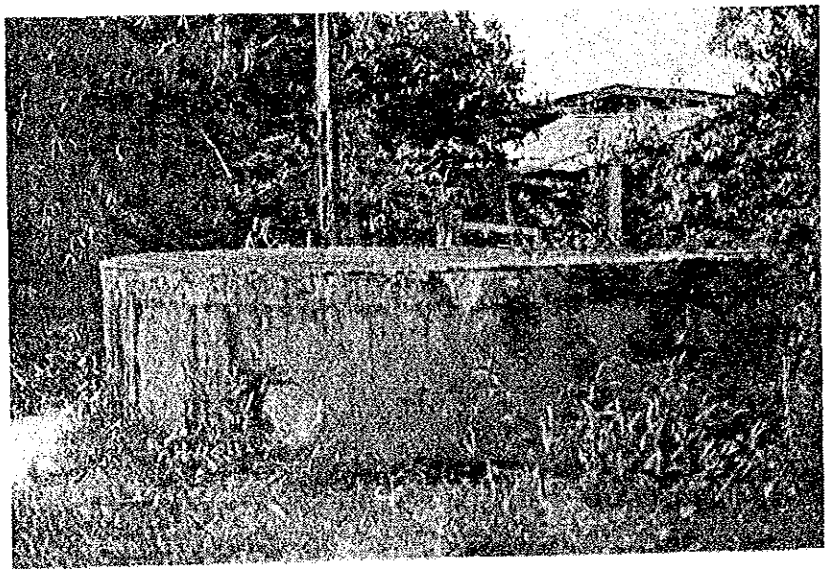


Rainfall Water Tank in Prapokklao Hospital



Rainfall Water Tank in Ban Bo

Hand Pump the Semi-deep Well in Ban Bo



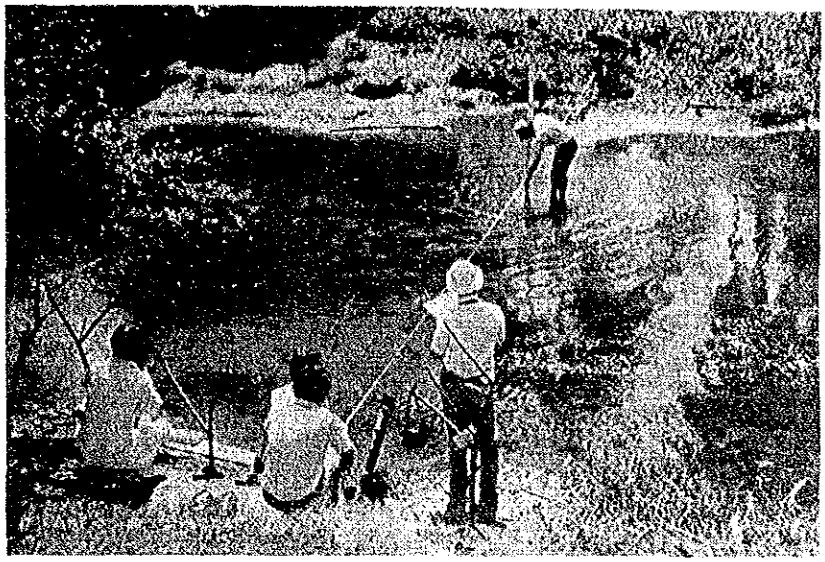
Existing well in Prapokklao Hospital

Geoelectric Prospecting in Prapokklao Hospital

Geoelectric Prospecting in Tagad Ngao

Preperation for Water Analysis at Site

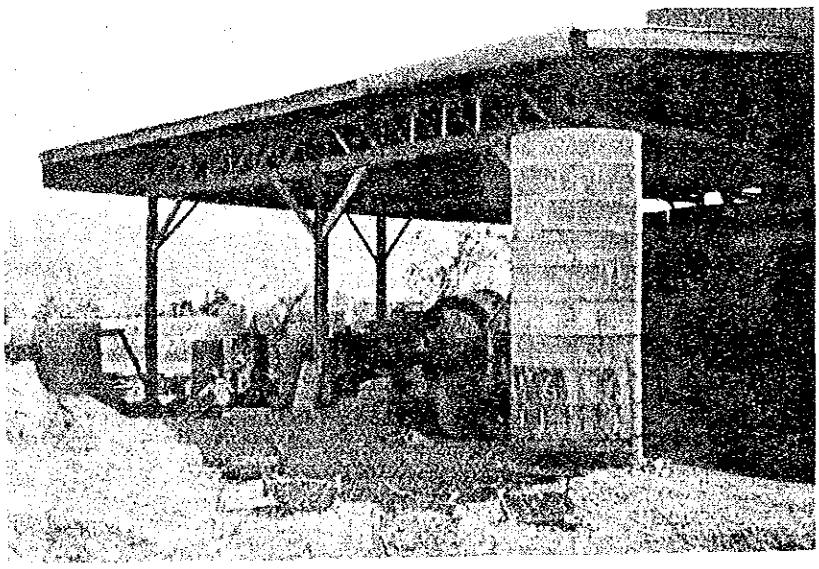
Water Sampling from Existing Well



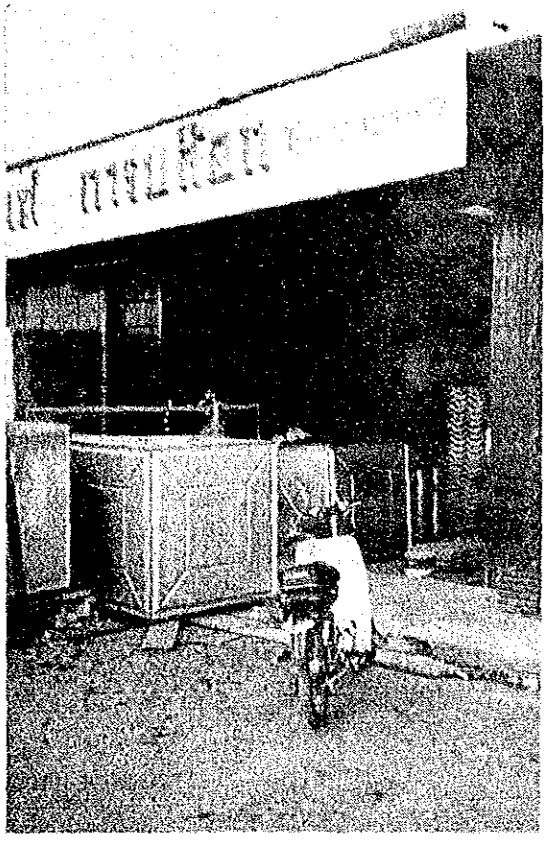
Field Survey in Ban Samroong

Field Survey in Ban Samroon

Public Well in Tagad Ngao



Local Factory of Well Construction Materials



New Type of Water Tank on Market
(at Chanthaburi City)

Bottoled Drinking Water on Market